University of Alberta

Grounding Global Seeds: A Contextual Comparison of the Politico-Ecological Implications of Genetically Modified Crops for Farming Communities in Alberta (Canada) and Andhra Pradesh (India)

by

Ashok Kumbamu

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Examining Committee

Dr. Gordon Laxer, Sociology (Supervisor)

Dr. Michael Gismondi, Integrated Studies, Athabasca University (Co-supervisor)

Dr. Satoshi Ikeda, Sociology, Concordia University

Dr. Roger Epp, Political Science, Augustana Faculty

Dr. Karen Hughes, Sociology

Dr. Gerardo Otero, Sociology, Simon Fraser University

Dedication

To my parents (Bharathamma & Satyanarayana), Sunitha and Saahas

Abstract

The main objective of my dissertation is to analyze and compare the socio-ecological implications of the adoption of genetically modified (GM) seeds and alternative agroecological farming methods for farming communities in Alberta, Canada and Andhra Pradesh, India – localities situated in contrasting geopolitical, socio-cultural, and structural-institutional contexts in the global economy. For this research, the adoption of GM canola in Alberta and GM cotton in Andhra Pradesh are used as comparative case studies to explore the qualitative impact of agricultural biotechnology on farming communities.

Many studies have examined the potential impact of GM crops, but few have looked beyond economic cost-benefit analysis. In this dissertation, I examine social and cultural aspects of farmer decision-making in the adoption of the new seed technology, farmer receptivity to new cropping methods, knowledge translation between laboratory and farmer, and the impact of global knowledge-based technology on local knowledge systems, socio-cultural practices, the nature-society relationship, and gender relations. I use a global ethnography methodology and draw on a series of field interviews with farmers to provide sociological insight into how global processes of the "Gene Revolution" impact different farming communities in different localities in the world-economy.

In this dissertation I argue that the debate about the new agricultural technologies (e.g. GM seeds), the environment and agrarian crises should not be narrowed to the question of new technologies *per se.* Rather it should be

understood from an *agrarian political ecology* perspective articulating political economy (neoliberal governance at global, national and provincial levels, and the processes of dispossession of primary agricultural producers from their means and conditions of production), socio-cultural systems (the construction of hegemonic discourse about genetically modified organisms, agricultural deskilling, gender relations), and ecosystems (a process of mastering nature, monoculturization, environmental risks, metabolic rift) in the context of neoliberal globalization.

My fieldwork study of the "Gene Revolution" provides closer, more fine-grained research and analysis of its impacts with sensitivity to local class and status, gender and cultural issues, and the ways in which farmers' technology adoption decisions can dramatically alter overall quality of life, local knowledge systems, community development, the sustainability of agriculture and the ecosystem itself.

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In the process of completing my doctoral dissertation, I am indebted to many people and institutions for their contribution to my research and writing. I am glad that I have now the opportunity to thank them all. First of all, I sincerely thank the ‘organic intellectuals’ behind this project, farmers in India and Canada, who shaped my sociological imagination and contributed their immense knowledge to my understanding of farm life in socio-ecological crises. Throughout my doctoral program, I received very generous support from many institutions and programs: the Department of Sociology and the Faculty of Graduate Studies and Research at the University of Alberta, the Killam Trusts, and the International Development Research Centre. I thank them all for their great help without which I would not have successfully completed my PhD.

I have been so privileged and honored to work with three great mentors and friends: Gordon Laxer, Michael Gismondi, and Satoshi Ikeda. Because of these three individuals, who never tried to impose their institutional or epistemological power upon me, my journey through a PhD program has become a pleasurable one. My work with them transcends the average teacher-student relationship. While providing constructive criticism, they gave me tremendous intellectual freedom to develop my own ideas and analysis to make a genuine contribution to the political ecology of biotechnology.

Even before I applied for an admission into a PhD program in the Department of Sociology at the University of Alberta, I contacted Satoshi Ikeda with my research proposal to know whether he would be willing and available to supervise my research project. He immediately said yes, and also suggested that I should compare the adoption process of genetically modified crops in Canada and India. At that time, I was not really interested in studying Canadian agriculture, because I did not know anything about Canada and its agricultural system, and also thought that such a comparative study would delay completion of my PhD. But, soon after my arrival in Edmonton, Satoshi and I started discussing the comparative aspect and how it contributes to understanding the implications of genetically modified organisms under neoliberalism. Intense discussions with Satoshi and other graduate students in the historical sociology reading group about comparative methods made me decide on a comparative study. Satoshi also invited me to go with him to many informal meetings and brainstorming sessions with farmers in the Viking area, Alberta, and this helped me build rapport with community leaders and farmers. Until he moved to Concordia University in 2007, he acted as my thesis supervisor, and later continued as a committee member. I really thank him for his strong support and encouragement throughout the program.

When Satoshi left for Concordia, I started working with Gordon Laxer (thesis supervisor) and Mike Gismondi (co-supervisor). Gordon's critical remarks on comparative methodology, broader political economy questions pertaining to the global food crisis in the context of the peak oil crisis, Canadian political economy, and alternative sustainable initiatives and farmers' protests always cautioned me to think through these issues thoroughly. His comments and suggestions on every chapter helped me through several revisions. Thank you, Gordon.

In 2005, I took an independent course in environmental sociology with Mike Gismondi at Athabasca University. I am so delighted to say that this course and thereafter numerous discussions with Mike have been instrumental in crafting my "green lenses" and broadening my world outlook about many socio-ecological aspects. He introduced me to many interesting scholarly works and we read together many important debates from a multidisciplinary perspective to better understand the society-nature relationship. A steady series of reading and discussion sessions with him over the last 5 years have been very fruitful and enriching. Each interaction helped build my confidence in my ability to engage with complex subject matters and facilitated my growth as an independent critical thinker. He has made invaluable comments and suggestions on several drafts of this thesis and has helped me to fine-tune the content as well as the prose. Above all, the friendship we developed over the years is a great asset in my life. Mike, I really thank you for your mentorship and comradeship.

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In Alberta, I sincerely thank all the farmers, who generously offered their time and knowledge for this project. Social activist friends Linda Cheu and Ken Larsen helped me find some farmers for the interviews in Alberta. I thank them for their help. I also thank Marian Pinsky at Concordia University, who has been reading my published work and making encouraging comments. Somaiah Kasani and his family members have been very supportive since my wife and I arrived in Edmonton. I sincerely thank them for their help and encouragement.

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Most of my gratitude, however, goes to my wife, Sunitha Anmangandla. Without her immense support and companionship, I would not have successfully completed this project and many others. The birth of our son, Saahas, when I was halfway through this thesis writing, gave me new energy and motivation to complete the project in the stipulated timeframe. I thank my parents, Bharathamma and Satyanarayana, who worked so hard on and off farm throughout their life and sacrificed many things to provide better education for all of their five children. I guess they achieved their dreams! I also thank all my siblings, relatives and friends for their gracious encouragement over the years.

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List of Abbreviations and Acronyms

Bt	*Bacillus thuringiensis*
CGIAR	Consultative Group on International Agricultural Research
CSA	Community Supported Agriculture
CSOs	Civil Society Organizations
DDS	Deccan Development Society
DNA	Deoxyribonucleic acid
FAO	Food and Agriculture Organization
GM	Genetically Modified
GMOs	Genetically Modified Organisms
HYVs	High Yielding Varieties
IARCs	International Agricultural Research Centers
IPRs	Intellectual Property Rights
MNCs	Multinational Corporations
NAFTA	North American Free Trade Agreement
NARS	National Agricultural Research System
NFM	New Farmer Movement
NGOs	Non-Governmental Organizations
PBRA	Plant Breeders' Rights Act
PCF	Parkland Conservation Farm
Rs.	(Indian) rupees
The US	The United States of America
TRIPS	Trade Related Aspects of Intellectual Property Rights
TUA	Technology Use Agreement
UFA	United Farmers of Alberta
UNDP	United Nations Development Program
UPOV	International Union for the Protection of New Varieties of Plants (French acronym, *Union pour la protection des obtentions vegetales*)
WTO	World Trade Organization

Chapter 1

A Global Ethnography of the "Gene Revolution": An Introduction

Introduction

My doctoral dissertation analyzes and compares the politico-ecological implications of genetically modified (GM) crops for farming communities in Alberta, Canada, and Andhra Pradesh, India – localities situated in contrasting geopolitical, socio-cultural, and structural-institutional contexts in the global economy.

Particularly, this thesis explores and analyses the sociological, politico-ecological, and cultural aspects of farmers' decision-making in the adoption, non-adoption and abandonment of GM seeds, and their receptivity to new cropping methods, the information gap between laboratory and farmer, and the impact of global knowledge-based technology on local knowledge systems. Also, my dissertation critically examines the implications of the adoption and improper adoption of GM seeds for the social relations of production, nature-society relations, gender relations, and alternative sustainable farming initiatives. For this research project, the adoption of GM canola in North Central Alberta, and GM cotton in Warangal district in Andhra Pradesh are used as comparative cases to explore the qualitative impact of agricultural biotechnology on farming communities.

Technological revolutions in agriculture in the 20th century can be categorized into three phases. The first "Green Revolution"[1] began with the

[1] The term "Green Revolution" was first used by Dr. William Gaud, then Director of the United States Agency for International Development (USAID), in a speech entitled "The Green Revolution: Accomplishments and Apprehensions" delivered at the meeting of the Society for International Development in 1968 (Parayil 2003:975, 980) . He used the term "to stress that the changes occurring in the wheat and rice fields of Asia was revolutionary, not just evolutionary, progress." (Swaminathan 2004:4) According to Lester R. Brown, the term "revolution" was thoroughly "abused", but, he concludes that, there is "no other

development of hybrid crops using plant breeding techniques and helped increased food production in the developed countries between the 1930s and 1950s. The second "Green Revolution" aimed at the dissemination of the same technology to the Third World[2] between the 1960s and 1970s. The third "Green Revolution," which is also called the "Gene Revolution,"[3] advanced the application of biotechnology techniques in crop development from the 1990s onwards. (Bernauer 2003:3-4; Parayil 1992: 741-744) Some proponents often claim that the "Gene Revolution" is nothing but the "Doubly Green Revolution,"[4] (Conway 1998; Serageldin 1999:387) or the "Evergreen Revolution."[5] (Swaminathan 1996, 2000, 2001)

Biotechnology is many things to many people. Some proponents suggest that genetic modification is not a new phenomenon and has been used in plant breeding techniques for more than 10,000 years. Particularly, in the last century

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term [that] adequately describes the effects of the new seeds on the poor countries where they are being used" (Brown 1970:6).

[2] In this paper I frequently use the geopolitical terms "North" and "South" and "Third World". When I refer to global North, it includes industrial countries of Europe and North America and two countries south of the equator, Australia and New Zealand. Similarly, the global South includes a group of the less-developed or underdeveloped countries of Asia, Africa, and Latin America, which are also collectively called the Third World. In critical development studies, the term "Third World" (a Cold war term) often refers to the diversified collection of colonies, semi-colonies, and neo-colonies that are part of the world capitalist system (Berberoglu 1992: 169-170; Petras 1981). Currently, in critical globalization studies, the "global South" and the "Third World" are considered as "largely equivalent" terms (see, Dirlik 2004). I also use these two terms interchangeably.

[3] The usage of the term "Gene Revolution" is more frequent since the 1990s, but it is difficult to trace the authentic source for the naming of the term itself (Parayil 2003:975, 980). It should be noted that some skeptics question the usage of the terms "revolution" and "epoch making" to refer to the rapid developments of biotechnology. For the discussion on whether biotechnology is a "revolutionary sociotechnical form," see Buttel 1989; Buttel 1991; Otero 1991.

[4] The term "doubly green revolution" was coined by Gordon Conway, president of the Rockefeller Foundation. He used the term to refer to increase in production and productivity while conserving the environment (Conway 1998; Serageldin 1999:387).

[5] M S Swaminathan coined the term "evergreen revolution" referring to "sustainable advances in crop productivity per unit of land, water and time without associated ecological harm." (Swaminathan 2001:949)

many "successful" crop varieties have been developed using genetic modification (GM) techniques. "In light of these successive genetic modifications of crops, the use of the term *genetically modified organism* (GMO) to designate GE [genetically engineered] crops is a definite misnomer since it implies that before GE there were no genetic modifications…*Genetically engineered or transgenic* would be more appropriate terms" (Gepts 2001:1780-1781, italics original).

Other proponents suggest that biotechnology came of age with the advent of recombinant deoxyribonucleic acid (DNA) technologies (Ratledge 1992:1). But, biotechnology is not a single technology; it is a cluster of new knowledge drawn from various scientific disciplines as well as diverse technology systems (Roobeck 1990; Buttel, Kenney, and Kloppenburg 1985: 33, 53). The magnitude and scope of recent scientific developments bear no comparison with "traditional" or "old" biotechnology. Rather "modern" or "new" biotechnology is based on new techniques in: (1) recombinant DNA technology; (2) monoclonal antibody production; and (3) cell tissue culture. It is the combination of these three processes that forms the basis of what is called genetic engineering (Persley 1990). In this dissertation, for the sake of convenience, I use the terms "genetically modified," "genetically engineered" and "transgenic" interchangeably to refer to the products that have been developed using genetic engineering or recombinant DNA technology.

The "Green Revolution" of the 1960s aimed to avert food crises and famines through a package[6] combining miracle seeds, controlled irrigation,

[6] The "Green Revolution" technology has been called "package technology" because high yielding varieties (HYVs) give substantial yields only under certain conditions where the farmer can apply heavy fertilizers, pesticides and supply controlled water, otherwise they do not give more than the traditional varieties and some times even less than the traditional varieties (Griffin 1979:209-210). For example, in the absence of application of fertilizers, Sonara-64 (a high yielding variety of wheat) gives the yield of 2232 kilograms per hectare compared to 2355 kilograms per hectare yield of C-306 (a indigenous variety). However, when 100 kg of fertilizers applied the yield of the Sonara-64 rises to 4600 kg. while that of C-360 rises to only 3689 kg. Similar kind of substantial difference between the yield of local and high yielding varieties of rice with and without fertilizers application was noticed in India (Griffin 1979:209-210). Apart from fertilizers, water is very essential input because "the

fertilizers, pesticides, and related farm management skills. It was introduced into post-colonial societies with the objective of averting the Malthusian spectre of famine (Brown 1970:16; Farmer 1986:175-176; Persley and Serageldin 2003:7; Ross 1998). Since the inception of the "Green Revolution," some argued that the diffusion of "modern" agricultural technologies would solve the problems in "traditional" agriculture in the "Third World." Further they advocate that poverty and hunger in the "Third World" can only be solved through the new agricultural technological interventions (Conway 2003: 29-53; Serageldin 2003: 19-27).

As proponents of the "Green Revolution" anticipated, the new agricultural technologies have helped boost global food production by 270% from 1960 to 2000 with only a 7% increase in land under food grain crop cultivation. For instance, global maize production increased from 205 million metric tons (MMT) in 1961 to 785 MMT in 2007. Similarly, global rice and wheat production increased from 216 MMT and 222 MMT in 1961 to 652 MMT and 607 MMT in 2007, respectively.[7]

Despite this tremendous increase in food grain production, however, measurements of global food insecurity clearly indicate that the "Green Revolution" did not completely solve the problem of feeding the world's rapidly growing population. As the Food and Agriculture Organization (FAO) 2001-2003 estimates, over 854 million people continue to suffer from permanent or intermittent hunger, and more than 60 percent of them are women. About 820 million of chronically hungry people live in developing countries.[8] More than

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response of seeds to fertilizers cannot occur in the absence of water." Under these circumstances, the 'package' technology altogether compelled huge capital investments in industries related to fertilizers, pesticides, and irrigation equipments (Griffin 1979:210). Agricultural scientist William C. Paddock writes, "where the Green Revolution is said to exist, it would die tomorrow without any one of its three legs: subsidies, irrigation, and fertilizer. The economies of the developing world make all three legs fragile support." (1970:900)

[7] FAOSTAT Statistics Database, updated 11 June 2008.

[8] Food and Agriculture Organization (FAO), *The State of Food Insecurity in the World* (Rome: FAO, 2006)

150 million children under the age of 5 years are underweight and about 10 million children die each year due to malnourishment in the global South.[9]

The population projections show that by the year 2025 the world's population will most likely be 8 billion people, increasing at the rate of nearly 100 million per year. If the gap between production and population is not balanced, then there may still be 600 million poor people suffering from hunger by 2025. To bridge the gap, global food grain production has to be increased by 40% (500 millions extra tons in the global South and 200 million extra tons in the global North) (Chrispeels 2000:3-6).

More importantly, the industrial agricultural system has created a fossil-fuel dependent agricultural system. Although high yielding varieties (HYVs) played a vital role in generating global food surpluses, fossil fuels provided required direct and indirect energy for production, processing, preservation, and transportation. Direct energy use in agriculture is primarily petroleum-based fuels to operate farm machinery and equipments, and indirect energy use is in the form of Nitrogen-Phosphate-Potash (NPK)-based fertilizers and pesticides (insecticides, herbicides and fungicides). Since the advent of the "Green Revolution," the use of energy in conventional agriculture has increased by an average of 50 fold. Considering the enormous increase in fossil fuel energy use in agriculture and the gradual decline of its efficiency in creating proportionate food energy, Peak Oil theorists forecast that agriculture will eventually collapse as global petroleum extractions, after reaching a peak point in the very near future, are terminally depleted; this will lead to a "Malthusian catastrophe." (Pfeiffer 2006; Heinberg 2004)

Given this critical situation, proponents of the new agricultural technologies argue that a new "war on hunger" has to be waged using Gene Revolution technologies (Conway 2003: 32; Dodds 2003: 149; Serageldin 2003:19). They celebrate the virtues and acclaim the possibilities of biotechnology drawing upon the Malthusian logic (i.e. hunger is due to a gap

[9] United Nations Children's Fund (UNICEF), The State of the World's Children. The Double Dividend of Gender Equality (New York: UNICEF, 2007)

between food production and human population growth rate) used by proponents of the "Green Revolution." Their arguments draw on scare tactics, using statistics of the estimated gap between population growth and food production, to justify the need for biotechnology to overcome food and nutritional insecurity, and thus avert future famines in the global South (See Conway 1998, 2003; Serageldin 1999, 2003; Leisinger 2001; Dodds 2003; Johnston 2003; MaGloughlin 1999; Alam 1994; Abelson and Hines 1999; Potrykus 1999; Qaim 2001; Traxler and Falck-Zepeda 1999; Pinstrup-Andersen and Cohen 2000).

Critics of the "Green Revolution" categorically reject the Malthusian thesis upon which the "Green Revolution" seems to have been built; they suggest that there is no direct relationship between the prevalence of hunger in a given country and the size of its population. Instead, they suggest that there is sufficient food in the system, but food distribution is uneven, so many people are too poor to buy food. Furthermore, hunger is not caused by food availability, but by a range of social, political and economic inequalities that affect market access and purchasing power of individuals and groups in society.[10]

For example, as social histories of the Indian Green Revolution show, food insecurity in the country widened while food production substantially increased. In fact, after adoption of the "Green Revolution," food grain production in India has increased from 50.8 million tons in 1950-51 fiscal year to 227.3 million tons in 2007-08 fiscal year. With increase in food grain production, sufficient food has entered into the food system but it has not reached the household level across all sections of society. Arunachalam and Umarani mention that "the storehouses of the Food Corporation of India are overflowing with unsold grain, estimated between 45 and 60 million tons (in June 2001), a third of which is rotting in the open, and yet 250-300 million people do not have enough to eat." (Arunachalam and Umarani 2001: 896; see also Patnaik 2009) This paradox of "the co-existence of mountains of grains and millions of hungry"

[10] For the issues related to poverty, food insecurity and famine see Sen 1981, Mukherjee 2002 and Swaminathan 2000: 17-25, and for a greater discussion about the relevance of biotechnology to world hunger and poverty, see Lappe and Britt 1995 and Lappe et al 1998.

reflects the existing social inequalities, and issues related to farmers' access to and control over the means of production and consumption, and their purchasing power in the market (Swaminathan 2001:948; Arunachalam and Umarani 2001:896).

Critics contend that the introduction of the "Green Revolution" has intensified the processes of commercialization of agriculture,[11] and the new technologies used and benefited the "resourceful" big farmers in the more favored regions (i.e. regions with land suitable to the new crops, availability of better irrigation facilities, electricity, etc)[12] (Byres 1977, 1981; Bhaduri 1986; Cleaver 1972; Chambers 1984; Dasgupta 1977; Griffin 1979; Patnaik 1999; Pearse 1980).

As pointed out by Griffin (1979:209), the HYVs introduced in the initial phase of the "Green Revolution" were more delicate compared to local varieties and demand more care from the cultivators. Apart from this, the new seeds were less tolerant to drought and floods. Moreover, the "package" characteristic of the technology allowed the critics of the "Green Revolution" to assert that "the new technology is not very suitable for subsistence, non-market farming because it is intensive in cash inputs and in some cases requires fairly elaborate production and marketing facilities." (Griffin 1979:213) Therefore, it has been concluded that the "Green Revolution" technology was, theoretically, "scale-neutral," but not "resource neutral."[13] Similar views are expressed even in the debate about

[11] Griffin (1979:212) in his land mark study on the "Green Revolution" concludes that "the 'green revolution', from a technical point of view, is largely a biological and chemical revolution, but from a socio-economic point of view it has largely become transformed into a commercial revolution".

[12] It has been well documented that the governments which adopted the "Green Revolution" package put more efforts to first introduce the new technology in the regions where irrigation facility was relatively well developed, and in the areas where large commercial farms were dominant. For example, wide spread of rice varieties in Central Luzon in Philippines, introduction of the new wheat varieties in the irrigated zones of the Indus basin in Pakistan, Punjab and Haryana in India (Griffin 1979:211).

[13] Theoretically "Green Revolution" technology has been considered "scale-neutral" because no economies of scale are involved in it – that is, there is no decline in the cost of production per acre with increased acreage. Therefore, it

GM crops. For a few similarities between the "Green Revolution" and the "Gene Revolution" debate, see Box 1.1.

Critics further argue that, with the advent of GM technology and the new patent system, there has been a growing trend of the commodification of both agricultural inputs and outputs, the consolidation of the seed industry, and the monopolization of research and development. Thus the new technologies have been used as an instrument to reproduce inequalities in a society and dependency relations between the countries that develop and the countries that adopt them. Also, they warn that biological, ecological, economic and social dangers posed by biotechnology far outweigh potential benefits (Altieri and Rosset 1999:155-162; Buttel 1990: 113-145; Deo and Swanson 1990: 583-612; Falcon 2001: 41-60; Fowler and Mooney 1990; Friedland et al 1998; Goodman and Redclift 1991; Jasanoff 2006; Magdoff, Foster and Buttel 2000; Kloppenburg 1988; Lappe, Collins and Rosset 1998; Otero 2008; Pistorius and Van Wijk 1999; Ross 1998; Shiva 1991; 2000).

Amidst fierce criticism, the first GM crop was released for commercial cultivation in 1994. But it was not until 1996 that the GM crops were cultivated in significant area, some 1.7 million hectares in 6 countries. Since then, it has increased 74-fold. In 2008, 125 million hectares of GM crops were planted by 13.3 million farmers in 25 countries. Corporate technological elites and pro-industry organizations such as the International Service for the Acquisition of Agri-biotech Applications (ISAAA) continuously estimate the global diffusion of GM crops, and assert that the spread of GM crops represent the fastest agricultural technology diffusion in recent history.[14]

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appears to benefit both small and large farmers alike. But, as critics argue, it was certainly not "resource-neutral" because the farmers who have better access to physical as well as capital resources gained more profit and they were in a better position to deal with the risks pertaining to the new technology (Harriss 1987:321).

[14]http://www.isaaa.org/resources/publications/briefs/37/executivesummary/default.html Accessed on: 08 March, 2008.

In 2008, the US was the largest grower of GM crops with 62.5 million hectares (50% of global GM crop area), followed by Argentina with 21 million hectares (17% of global GM crop area), Brazil with 15.8 million hectares (13% of global GM crop area), India with 7.6 million hectares (6% of global GM crop area), Canada with 7.6 million hectares (6% of global GM crop area), China with 3.8 million hectares (3% of global GM crop area), Paraguay with 2.7 million hectares (2 % of global GM crop area), South Africa with 1.8 million hectares (1% of global GM crop area), and the rest of seventeen GM crop growing countries with less than one percent of global GM crop area. In 2007, 57% of global GM crops (69.4 million hectares) were grown in industrialized countries and 43% (49.4 million hectares) in developing countries. Between 2006 and 2007 the absolute growth in GM crop area in developing countries was 8.1 million hectares, whereas in developed countries 3.8 million hectares were cultivated (James 2007). From the year 2004, the absolute growth in total biotech crop area in developing countries has been higher than developed countries.

There is a vast literature on the diffusion of GM crops and the market strategies of seed companies in promoting the new seeds all over the world. But little emphasis is placed on the process of the adoption and cultivation of GM seeds. Although social scientists are increasingly engaged in studying the impacts of GM crops, few studies examine the differential socio-economic impact of GM crops in localities that are situated in different and contrasting politico-economic contexts. Thus my research uses a global ethnography methodology to provide a sociological insight into how global processes of the "Gene Revolution" impact different farming communities in different localities in the world-economy.

Box 1.1: Views of Proponents and Opponents of Technology

Views of Proponents of Technology
▪ Poverty and food insecurity are the results of traditional farming methods, and lack of knowledge about the new agricultural technologies. ▪ Malthusian logic to explain world's hunger. ▪ New agricultural technologies are both scale neutral as well as resource neutral. ▪ New technologies promote, directly or indirectly, employment opportunities in farm, off-farm and non-farm sectors. ▪ New technologies increase land use (that is why they are considered as "land-augmenting" technologies) and productivity, which enable export of food grains to earn foreign exchange. ▪ Development of new technologies is not just profit-driven project, but need-driven project. ▪ If the problems of food insecurity and environmental destruction are not solved in the "Green Revolution," they will be solved by the "Gene Revolution."
View of Opponents of Technology
▪ Poverty, inequality and lack of access to and control over the means of production are the real causes of world's hunger. ▪ New technologies are, theoretically, "scale-neutral", but not "resource-neutral." ▪ New seeds demand for mechanization to cope with the shorter time intervals between harvesting of one crop and plant other crop. ▪ New technologies aim at the promotion of industrial agriculture and the capitalist mode of production, which eventually results in the differentiation of farming community and creates new social classes in the countryside. ▪ New technologies promote monoculture and erode biodiversity. ▪ New technologies endanger the environment, farm health, and rural livelihoods of the poor. ▪ New technologies enhance attrition of the indigenous knowledge system. ▪ New technologies may increase plant productive capacity, but terminates reproductive capacity, which is essential for agricultural sustainability. ▪ Developers of new technologies do not consider socio-cultural and ethical values associated with subsistence agricultural systems. ▪ New technologies sharpen the existing socio-ecological contradictions in the countryside. ▪ Multinational corporations use new technologies as instrument of domination over farming communities across the globe.

The Research Questions

My research project aims to investigate and analyze these pressing issues through the following six research questions, which are equally relevant to both the Alberta and Andhra Pradesh cases.

1. How do socio-economic factors (such as social class, social status, social identity, kinship, merchant-farmer relationship, community relations, gender relations) and cultural factors (such as media advertisements, billboards, and field demonstrations) influence farmers to adopt, not adopt or abandon GM seeds?
2. What are the socio-economic impacts of GM and non-GM crops on farmers from different socio-economic categories (defined based on the size and ownership of land holding and caste in Andhra Pradesh, and gross farm revenues in Alberta)?
3. Do differences in socio-economic status affect farmers' perceptions and understandings of the socio-ecological implications of the adoption of new technologies in general, and GM crops in particular?
4. Does the knowledge transfer gap between the laboratory and the field impact productivity and the conditions of production? Does the rapid spread of GM crops affect the process of agricultural skilling or deskilling?
5. Why do some primary producers resist the introduction of GM crops while a majority of farming communities adopt these new seeds? What are their different strategies or mechanisms of resistance? Do farmers' everyday life experiences and cultural meanings of agriculture, and understandings of nature influence their visions or local struggles for reclaiming sustainability?
6. How do the state and non-governmental organizations (NGOs) influence the adoption of GM crops and alternative initiatives of farming communities?

Methodology: Global Ethnography

Since the inception of the "Green Revolution," a global phenomenon of agricultural restructuring has been happening through various mechanisms of transnational politico-economic processes and national politico-economic reforms (see Box 2.2). This phenomenon has two objectives: the *deepening* of the capitalist logic of production by intensifying the commodification and the industrialization of agriculture on the one hand; the *widening* of the capitalist system and corporate domination over agricultural producers and consumers across the globe on the other. Although this phenomenon is global in scale, its implications (economic, environmental, political, socio-cultural) are different for different locales.

According to sociologist Reinhard Bendix, "comparative sociological studies … increase the 'visibility' of one structure by contrasting it with another." (Bendix 1977:16) In a similar way sociologist Gordon Laxer says:

> Comparative research allows us to analyze why certain things happened in one society and not in another. Without comparison we are left to unearth and interpret only those events pertaining to the society under study; we cannot address the question of why certain alternatives were debated and implemented in one society and not even conceived in another (Laxer 1989: vii).

Global ethnography offers us a useful methodological framework to better understand how the remote and invisible global forces (such as the World Bank, the World Trade Organization, multinational corporations, etc) operate and affect localities in different national politico-economic, socio-cultural and ecological contexts. According to Marxist sociologist Michael Burawoy, global ethnography "shows that time-space compression or time-space distanciation are not as universal as the cosmopolites would claim. It shows globalization to be a very uneven process and, most important, an artifact manufactured and received in the local." (Burawoy 2001:148) He further says it "speaks, first and foremost, to those left behind on the ground," (Burawoy 2001:148) and it aims "to replace abstract globalization with a grounded globalization that tries to understand not only the experience of globalization but also how that experience is produced in specific localities and how the productive process is a contested and thus a political accomplishment." (Burawoy 2001:158) Furthermore, global ethnographies "reveal not just the impact of an impersonal force but also how localities are made penetrable by forces, how localities assimilate these forces into their own socioscapes, and how forces are resisted, accommodated to, and fled from." (Gille and Riain 2002: 275)

Global ethnographers reject approaches that reify *flows, scapes, networks, and mobilities* in defining and analyzing globalization's impacts, because in such approaches, "places disappear entirely." Moreover, "these approaches neglect the agency of actors and their sense-making activities as forces in shaping the flows of themselves." (Gille and Riain 2002: 275) Global ethnography focuses on how "the space of flows" and "the space of places" constitutes one another, rather than seeing them as binary oppositions (Gille and Riain 2002: 275, see also Castells 1997). As Burawoy writes:

> Globalization is produced and consumed not in thin air, not in some virtual reality but in real organizations, institutions, communities, etc. From this point of view *the global becomes ethnographic*…As entry into Third World 'postcolonial' terrains became more problematic, anthropologists, at least those still interested in doing ethnography, were driven towards global ethnography, examining the world from the standpoint of participants located at the intersections of the most remote forces, connections and imaginations. *The ethnography becomes global.* (Burawoy 2001:150, emphasis original)

Proponents of global ethnography clearly recognize the influence of the nation state in shaping global forces and global connections. They also argue that any countermovement of globalization has significant effect only when they are rooted in "national soils" on the one hand (Burawoy et al. 2000:35); and when they have global imagination, that is, the construction of a global vision by the local in actively participating in the public discourses of globalization, on the other (Gille and Riain 2002:283-284). But, it "does not balkanize the world into developing and developed countries. It implies that we can and must study the

United States from the standpoint of globalization no less than Burkina Faso." (Burawoy 2001:157) In other words, global ethnography gives equal weight to all cases or sites selected for an ethnographic research irrespective of their location and particularities. It not only allows us to understand the broader implications of globalization from the perspectives of people whose everyday lives influenced by it (see, for example, Webster, Lambert and Bezuidenhout 2008), but also the production process of the forces of globalization such as the World Bank's neoliberal policies (Goldman 2005, Moore 1999, Ferguson 1994).

How does global ethnography methodology help us understand the adoption of GM crops and implications for farming communities in Canada and India? The overall development process of Canada and India is neither spatially nor temporally uniform, but they are *relationally* connected with each other through different mechanisms of the world economy such as global financial flows, international trade, trade agreements, technological diffusion, and the operations of multinational corporations. This relationality has different effects on the social relations of productions as well as the natural conditions of production at the local or community level. Particularly, the cases in Canada and India have different socio-historical trajectories and experiences in the adoption of new agricultural technologies and rural development. But, in the age of neoliberal globalization, the two cases face a common historical conjuncture (i.e. the "Gene Revolution"), where they share more similar agricultural situations than ever before. Similarities include the deepening integration of farmers into the global agri-food systems, increasing dependency on a few multinational corporations for farm inputs (e.g. Monsanto) and the marketing of outputs (e.g. Cargill), the increasing process of industrialization of agriculture, the aging of farmers, deepening socio-ecological and economic crises, the adoption of GM seeds, and farmers' initiatives to reclaim agricultural sustainability. All these global processes are present in both the cases, but the degree of their manifestations varies.

Box 2.2: Agricultural Restructurings at Global, National and Local Levels from the "Green Revolution" to the "Gene Revolution"

<table>
<tr><th colspan="2">Global Level: political and economic processes</th></tr>
<tr><td colspan="2">▪ Expansion of trade agreements – bilateral and multilateral – into agricultural sector.
▪ Strong advocacy for neo-liberal policies around the world.
▪ Establishment of monopoly of a few of multinational corporations in seed research, development and distribution.
▪ A paradigm shift in the Consultative Group on International Agricultural Research (CGIAR) approach towards biotechnology.
▪ Acceleration of "gene-drain" from the global South to North.
▪ Strengthening of the university-industry complex
▪ Expansion of a stringent patent regime across the globe.
▪ Other</td></tr>
<tr><th colspan="2">National Level: political and economic adjustments</th></tr>
<tr><td colspan="2">▪ Wide-spread adoption of trade liberalization policies in the agricultural and rural development sectors (Particularly, reforms in national seed policies).
▪ Implementation of structural adjustment policies.
▪ Privatization of seed research, development and distribution.
▪ Entry of multinational corporations through mergers, acquisitions and other strategic alliance with domestic seed companies.
▪ Decline in government support to agriculture and rural development programs.
▪ Withdrawal or reduction of subsidies to farmers.
▪ No proper functioning of input quality regulatory mechanisms.
▪ No transparency and democratic accountability in the approval process of GM crops.
▪ Other</td></tr>
<tr><th colspan="2">Local or Farm Level: agro-ecological restructuring</th></tr>
<tr><th>Socio-economic and Institutional Changes</th><th>Socio-Ecological Changes</th></tr>
<tr><td>▪ Commodification of inputs and outputs.
▪ Increase of the cost of inputs and the lack of sufficient institutional support.
▪ Inadequate extension support for farmers.
▪ No special public awareness programs about the new technology.
▪ Decreased staple food production and increased food insecurity.
▪ Deskilling of farmers.
▪ Other</td><td>▪ Increase of monoculturization and loss of biodiversity.
▪ Decline of grazing fields and livestock.
▪ Decline of mixed and rotation cropping.
▪ Increase of application of petro-chemicals.
▪ Soil exhaustion.
▪ Depletion of water table and pollution of water.
▪ Other</td></tr>
</table>

Despite these similarities, the two cases also have significant differences in terms of the social organization of production (farm size, access to farm inputs such as land, labor, capital and technology), infrastructure (transportation, produce storage and marketing facilities), public institutional support to farmers (farm subsidies, credit facility, minimum crop supporting price, crop insurance, etc.), risk management and mitigation mechanisms, policy and regulatory environment, the level and quality of information flow from the laboratory to the field, farmers' literacy levels and their receptivity to the new technologies, gender and community relations, agricultural biodiversity, and socio-cultural conditions.

My research project does not compare all the features mentioned above, rather considers a few similarities and differences that are useful to address the research questions. Between the two cases the following similarities are compared: (a) the adoption process and impact of GM crops, (b) the socio-ecological crisis, (c) farmer deskilling and dispossession, and (d) farmers' alternative initiatives. Relevant differences in (a) policy environment and its implications, (b) the social organization of production, and (c) socio-cultural practices are also compared.

I consider this comparison a "contextual comparison," which "encourage[s] comparison between different challenges across different countries." (Webster, Lambert and Bezuidenhout 2008:20) To explain contextual comparison metaphorically, this involves "comparing apples with oranges" rather than "apples with apples" as in "matched comparison." (See Locke and Thelen 1995:338) In contextual comparison, the cases are examined and analyzed placing them in their specific social histories and national contexts. Global ethnography allows contextual comparison to better understand "*place-making projects* that seek to redefine connections, scales, borders, and character of particular places and particular social orders. These projects are the critical sites through which global ethnographers can interrogate social relations in an era of globalization." (Gille and Riain 2002:277, emphasis added)

Considering similarities and differences between the two cases, this contextual comparative study provides sociological insight into: (a) How the "Gene Revolution" affects the sustainability of agriculture and the resilience of farm communities situated in different localities of a globalizing world; (b) how the farming communities are connected through mechanisms of global capitalism, socio-ecological crises, and farmers' alternative initiatives; (c) why and how socio-cultural aspects of ecological crises help us understand local sustainable farming practices; and (d) whether the position of a nation state in the world-economy alters the adoption of the new seed technology and risk management practices by farmers.

Data Collection Methods

Contextual comparison approach allows us to use different methods of data collection based on the context of cases under study. Alberta, Canada and Andhra Pradesh, India have contrasting politico-economic and socio-cultural contexts. Furthermore, the case of Andhra Pradesh is more complex than the case of Alberta. Thus I used different data collection method according to the context of each case.

Data Collection in Andhra Pradesh, India

The study was conducted in two villages (Kadavendi and Enabavi) in Warangal district. The villages were selected based on contrasting characteristics to control for comparison of the factors that influence the farmer to adopt or not adopt Bt cotton and the impact of the new seeds on the socio-economic conditions of the farmers and the environment.

The village of Kadavendi was selected based on the following indicators: (a) majority of farmers adopted Bt cotton cultivation, (b) the village is not too close or too far to town and the activities of NGOs are not predominant, and (c) sizable population of *dalits* (so-called untouchables) and *adivasis* (tribals). Whereas in Enabavi (a) no farmer cultivating Bt cotton, (b) relatively small and homogenous farming community in terms of class and caste, (c) relatively closer to town and NGOs are actively working with farm community and promoting “chemical-free” agriculture. Apart from these indicators, the selection of villages was done based on: (i) secondary data (from the department of agriculture, Warangal district) on land use change, land quality, topographic maps, rainfall, distribution of tribal population; (ii) baseline surveys conducted by local research organizations; (iii) preliminary discussions with district agricultural offices, local non-governmental organizations, farmers organizations, and local researchers at Osmania University and Kakatiya University.

Personal contacts with individuals and farmers organizations from my previous research work in the district also helped me identify the villages for the study. I have also sought help from organizations such as the Centre for Rural Operations and Programs Society (CROPS), which has been actively promoting "chemical free" and "GM free" agriculture in Enabavi village.

I conducted a household survey in the two villages to prepare a sampling frame as well as to better understand the existing agrarian structure. In-depth interview method was used to collect data about the socio-economic and cultural factors influencing the adoption process of GM crops, farmers' understanding of production procedures and problems associated with the implementation of "refuge mechanism," and their perception of the new technology and its impact on farm economy and the environment.

Stratified random sampling was used to collect data from the farmers. The sample was drawn from the two categories of the farmers: one, farmers who adopted Bt cotton; second, farmers who did not adopt or those using traditional varieties or High Yielding Varieties. Within these two broad categories, farmers were divided into sub-strata based on variables such as farm size, caste group, educational level and sex, and then simple random sample method was used to select household members for individual interviews within each stratum. Sample size was 110 (100 households in Kadavendi and 10 in Enabavi), and an equal percentage of sample was drawn from each category of the farmers.

In addition to in-depth interviews, focus group discussions were conducted in both the villages. Considering busy farming activities of farmers, focus group discussions were organized in two rounds in each village. To ensure the equal participation of farmers from different social groups, village *panchayat* (council) buildings were selected as a venue for meetings. The aim was not to analyze the groups, rather to gain more and diversified information in a short period of time. The participants in the groups were selected from the different categories of farmers (big farmers, middle farmers, and small/marginal farmers), tenants/sharecroppers, agricultural laborers, women, activists from local farmer organizations, and representatives of local NGOs and local government bodies. The selection of the participants was through preliminary survey and through the key informants such as village president, village administrative officer, and local school teachers. Eight to ten participants were recruited into each group. The total number of groups was four. The group discussions were semi-structured with low level of moderation. The entire discussion was tape-recorded.

Apart from these in-depth interviews and focus group discussions, I also conducted 12 life-history interviews (10 in Kadavendi and 2 in Enabavi), with farmers to gather insights into the self-perception of social and ecological changes over a period of time, which is often not readily discovered by the use of questionnaires. This method enabled me to gather qualitative data (in a chronological order) about how the adoption of technologies influences farmers' capabilities/skills and any repercussions on the community, and intergenerational or gender relations. I conducted life-history interviews with the farmers who experienced different technological interventions, and also with the farmers from younger generations to examine the impact of the new technologies on the process of farmer enskilling or deskilling.

The participants for life-history interviews were selected by the preliminary survey and through key informants such as village president/village administrative officer. The participants for interviews were selected in such a way that farmers from all major categories such as big farmers, middle farmers, and small/marginal farmers, tenants/sharecroppers, agricultural laborers, and women farmers were included. Interviews were conducted using an open-ended questionnaire. A semi-structured questionnaire was used for in-depth interviews and a list of questions used for life history interviews. All are attached as Appendix 5, 6, and 7.

Besides life history interviews, I collected folklore, songs, and stories of the farmers to understand the channels of local knowledge transmission from one generation to other. I also discussed issues with local seed merchants, money lenders, and representatives of local NGOs. Secondary data was collected from various sources such as directorate of statistics, the Ministry of Agriculture, Directorate of Agriculture of Warangal district, and available reports and surveys from various agricultural organizations and individuals.

Data Collection in Alberta, Canada

The study is based on primary and secondary research. Primary research includes in-depth interviews with farmers. I collected secondary data from the Alberta Agriculture and Rural Development, Statistics Canada, reports from several farmers' organizations, civil society groups, farm magazines, and secondary literature on Alberta context.

For primary data collection, snowball sampling, a nonprobability sampling procedure that involves using members of the group of interest to identify other members of group, was used to draw a sample for interviews. This sampling procedure is also called network or chain referral sampling because the sample is drawn from the networks of people or organizations. This is a multistage procedure. It began with a few people and spread out on the basis of initial contacts. I conducted interviews with farmers in North Central Alberta. I used this sampling procedure because it was difficult to get a complete list of farmers in the study area to use any of probability sampling procedures such as random sampling, stratified sampling, cluster sampling etc.

A friend of mine who has contacts with farmers in the surroundings of Edmonton put me in contact with many farmers. Also, I attended farmers' brainstorming meetings in the Town of Viking, where I had an opportunity to interact with a network of farmers and green activists whom I interviewed later. Teaching a Sociology course at Augustana Faculty in Camrose also put me in contact with farmers through students in my class who personally knew some farmers in that area. Members of a civil society group, Biofreedom, also connected me with some farmers in the Greater Edmonton region. I began my field research with initial contacts, and at the end of each interview I asked the farmers to suggest another farmer of same social or different social group who might be willing to share their agricultural experiences. Overall, I conducted interviews with 20 farmers from various locations in North Central Alberta: Leduc, Tofield, Vegreville, Viking, Beaver County, Hay Lakes, Camrose, Eckville, and New Norway.

For in-depth interviews, I contextualized the questionnaire that I used in the case of Warangal district (see Appendix 9). Since my sample size was very small to conduct further life history interviews, I added few questions to in-depth interview questionnaire about the implications of inter-generational relations for farm activities. Also, I made appropriate changes based on my initial interviews in Alberta. For better understanding of the Alberta context, besides in-depth interviews, I also discussed with the representatives of non-profit organizations such as Biofreedom in Edmonton and the Parkland Conservation Farm in Vegreville, and communicated with government officials at Alberta Agriculture and Rural Development and Agriculture and Agri-Food of Canada.

Data Analysis

A checklist was used to make sure required data to answer my research questions were collected. In this research project, quantitative secondary data were used to show patterns or changes over time. For example, trends or patterns in the adoption of GM crops, land use change, productivity, farm net income, etc. Quantitative primary data were sorted out according to study population (e.g. small-big farmer, upper-lower caste). Codes were assigned to every interview form and the data was tabulated according to categories of farmers. For the analysis of quantitative data I do not apply any statistical tests. Data were presented as tables or graphs with simple mathematical calculations.

Field research involves simultaneous collection and analysis of qualitative data. Throughout the fieldwork I addressed questions such as: When did an event occur? What was involved? Who was involved? Where did it occur? Such a list of questions helped me make notes on places, events, activities, people and conversations. However, it was not my intention to collect every datum I encounter, but only relevant information. All interviews were tape recorded, translated and transcribed. Transcribing is a time consuming process; on average, it took three to four hours to transcribe a one-hour interview. I transcribed the tapes during the field research itself because it allowed me to check the quality of data and take appropriate measures if I found the collected data were not enough or not relevant to answer my questions. After the transcription of data, I double checked the transcribed information just to make sure that the spirit and “voice” of interviewee was properly captured. Throughout the field research I simultaneously took notes (analytic memo) while taping the conversation. At the end of every interview, an identification (ID) number was given to each questionnaire or respondent.

Once required data were collected, based on the existing literature, a few themes (ideas, concepts, terminology or phrases) were identified. For each theme an abbreviated code was assigned (e.g. landlord (L), large farmer (LF)). Using these themes, data were organized into coherent categories. This process was done in three stages. In the first stage, I used an “open coding” method, in which themes are located and an initial code is assigned to condense the data into categories. Data was reread and reread to create new codes and changed initial codes wherever needed. In this first phase of coding process, I brought themes to the surface from deep inside the data. In the second phase, (“axial coding”) emphasis was placed on identifying patterns and connections within and between categories. By doing this I moved forward from the level of raw data to categories or themes, which play an important role in analysis. During this coding phase causes and consequences, conditions and interactions, strategies and processes were identified. The final phase is “selective coding”. This involves scanning data and previous codes. In this phase a few cases, which illustrate themes and make comparison and contrasts, were organized to come up with new interpretations (Corbin and Strauss 1990).

The analysis of my field research is presented as both descriptive and analytic. In descriptive accounts emphasis is placed on providing details informed by theoretical themes. Complementary to this, in analytic accounts new conceptual themes are developed on the basis of data obtained. By combining these two methods, my research contributes to a grounded understanding of the global GM phenomenon.

Summary of Chapters

This thesis consists of seven chapters including this introductory chapter. *Chapter two* critically explores and analyzes the strategies and mechanisms of neoliberal globalization that enabled the restructuring of the global agri-food systems, and the dispossession of small farmers across the globe from their means of production. Particularly, I examine three important mechanisms: (i) technological mechanisms (the technological paradigm shift from the "Green Revolution" to the "Gene Revolution"), (ii) institutional mechanisms (the restructuring of international agricultural research and development institutions), and (iii) legal mechanisms (the imposition of a stringent patent regime).

Chapter three reviews the critical sociology of agriculture and rural development, environmental sociology, and science and technology studies. In this chapter I elaborate a grounded framework of agrarian political ecology based on my empirical understanding of the dialectical interaction of political economy, ecosystems and socio-cultural systems, and the implications of this dialectical process for the sustainability of agriculture in the Indian and Canadian contexts.

Chapter four presents my fieldwork research and analysis in Andhra Pradesh, India. In this chapter I critically examine agrarian transitions in Kadavendi village and its relevance for our understanding of the adoption and abandonment of GM crops. The ethnographic account of GM crops provides critical insights into the process of the adoption of the new seed and its implications for local knowledge systems, the social relations of production (including gender relations), and the nature-society relations. Also provides how farmers of different socio-economic backgrounds and life experiences perceive GM crops and socio-ecological crises.

Chapter five provides a sociological account of the factors that influence farmers in adopting GM crops and the socio-ecological implications of the new technology for farming communities in Alberta, Canada. In this chapter I analyze the causes and consequences of agrarian crisis and its implications for "political deskilling." Furthermore, this chapter explores and analyzes the implications of GM technologies for the dispossession of farmers from their means of production and local knowledge systems.

Chapter six examines and analyzes movements that challenge the industrial agri-food system and GM crops in the Greater Edmonton region in Alberta, and in the villages of the Deccan Development Society and Enabavi in Andhra Pradesh. It also explores various strategies of farmers and non-governmental organizations in building autonomous and subsistence communities, and reclaiming sustainability in the context of neoliberal globalization. To better understand these political dynamics, I use Karl Polanyi's concept of "double movement" and examine the building of alternative movements and its implications for nature-society relationships.

In *chapter seven*, I summarize the major findings drawing insights from the contextual comparison of the politico-ecological and socio-cultural implications of GM crops for farming communities in Alberta and Andhra Pradesh.

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Chapter 2

Neoliberal Seeds and the Sustainability of Agriculture: A Socio-historical Analysis of the Transition from the "Green Revolution" to the "Gene Revolution"

You take my life
When you do take the means whereby I live.[15]
(Shakespeare, *The Merchant of Venice*, Act 4, Scene 1)

Introduction

The objective of this chapter is to explore and analyze the strategies and mechanisms of global capitalism that enable the restructuring of the global agri-food system, and the dispossession of millions of peasant-farmers across the globe from their means of production. Particularly, I examine three important mechanisms of global capitalism in agriculture, and their implications for primary agricultural producers and the sustainability of agriculture. They are: (i) technological mechanisms (the technological paradigm shift from the "Green Revolution" to the "Gene Revolution"), (ii) institutional mechanisms (the restructuring of international agricultural research and development institutions), and (iii) legal mechanisms (the imposition of a stringent patent regime).

Technological Mechanisms and Its Implications

Technological Paradigm Shift: From the Green Revolution to the Gene Revolution

In conventional plant breeding (the "Green Revolution" technology), genes could only be transferred within related species. But, with biotechnology, genes of an organism can be mapped, isolated and transferred to: (1) another organism of the same species (e.g. pest resistant gene of a tomato variety can be transferred into

[15] Quoted in Karl Marx, *Capital*. Volume.1 (London: Penguin Books, 1976), 618.

another tomato variety) or (2) an organism of a different species (e.g. a tomato gene can be transferred into rice) or (3) an organism belonging to different kingdom (e.g. a firefly gene has been transferred into a tobacco plant and a gene from a salt-water fish has been transferred into a soybean plant in order to produce a cold weather tolerant soybean variety) (Fowler and Mooney 1990:141). In effect, biotechnology has reached a stage where genetic engineers can separate genetic code that contains required information from the deoxyribonucleic acid (DNA) in cells and the separated information can be manipulated according to the target product, and recombined with genes of another living organism to produce a new and desired product.

Proponents of biotechnology claim that biotechnology allows us to create plants that are able to tolerate both abiotic stresses (drought, heat, floods, salinity) and biotic stresses (pests, weeds, diseases), attributes that promise to alleviate the problems of agricultural development in the regions where soils are salinated, water is scarce and temperatures are higher. They also assert that biotechnology can be used to alter plant characteristics to produce crops that mature earlier, are easier to transport, and have fewer post-harvest losses, and, which have increased nutritional quality (for example, the so-called "Golden Rice"- is a variety genetically fortified with a relatively large amount of Vitamin A). Biotechnology researchers have also developed breakthrough varieties which are herbicide-tolerant (for example, Roundup Ready canola) and insect resistant crops (for example, Bt cotton[16]) which produces toxic substances to kill target insect pests.

[16] Bt (*Bacillus thuringiensis*, a soil bacterium) act as a pesticide, when inserted into a seed by releasing highly toxic crystals through leaves and stems of the plant to kill specific target insects. Using Bt as pest controller is not entirely a new phenomenon. It was isolated from soil in 1911 and since 1930 it has been available for the farmers to use it as an organic pesticide (Shiva 2000:106). Particularly in organic farming, farmers have been using dried mixtures of fermented live Bt formulations as an important pest management tool for generations, but increasingly since the 1980s. This kind of usage is considered as a relatively environmentally benign method. [GM crops with the "genetic pesticide" mechanism released for commercial cultivation since 1995 (Scrinis 1998:37)]. The companies' rationale for promoting Bt crops as opposed to Bt sprays is: "Bt transgenic technology in cotton helps in overcoming certain limitations of Bt sprays such as the need for repeated applications, sensitivity to

Hybrid seed (key to the "Green Revolution"), at least theoretically, does not produce sterile seeds. Although second generation hybrid seed does not perform as well as parent seed, it can be planted the following season.[17] The second (F2) generation of hybrid, "*if not biologically sterile*, is economically unusable as seed, producing anywhere from 20 percent to 40 percent less than the first hybrid. *For all practical purposes, such a loss of yield amounts to biological sterility.*"[18] In contrast, critics express a fear that biotechnology can be used to terminate the capacity of the seed as means of production (seed) while only retaining its utility as product (grain).[19] Thus it prevents farmers from collecting and saving seeds from their crop harvest for planting the following season. This creates a situation where farmers inevitably depend on the market for seeds and other inputs. Moreover, "as crops incorporating the "terminator technology" are most likely to be genetically homogenous, genetic homogeneity in crops could become more widespread, enhancing genetic vulnerability to pests and diseases." (Swaminathan 1998:8; see also Bharathan 2000: 1070)

Contrary to critics, seed companies consider this technology as a type of Technology Protection System (TPS) or Genetic Use Restriction Technology (GURT). The rationale of companies behind developing and selling the technology is that it could be used:

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solar radiations, wash off due to rain, etc." (Barwale 2001:326) For the socio-economic and environmental implications of Bt cotton, see Kumbamu 2006.

[17] De la Perriere, Robert and Seuret 2000:27; ETC Group 2002, 'Terminate Terminator', http://www.etcgroup.org/documents/terminatorbrochure02.pdf

[18] Berlan and Lewontin (1986) quoted in David Goodman and Michael Redclift, *Refashioning Nature: Food, Ecology and Culture* (London: Routledge, 1991), 104, emphasis added.

[19] Critics call this technology "Terminator technology" (also called "suicide technology"). Canada based international non-governmental organization, the Action Group on Erosion, Technology, and Concentration (ETC Group) – formerly RAFI, the Rural Advancement Foundation International – labeled this technological method as "Terminator technology" when a Patent right (U.S. Patent Number 5,723,765: Control of Plant Gene Expression) was awarded in March 1998 to a multinational seed company, Delta and Pine Land Company, which was later purchased by a giant seed company Monsanto, in collaboration with the United States Department of Agriculture (Steinbrecher and Mooney 1998).

> [t]o prevent transgenes from spreading to closely related wild plants [i.e., "gene flow"] by preventing germination of any crossbred seeds. Furthermore, this technology could potentially eliminate the problems of "volunteer" plants that appear from seed left in the fields after harvest. Volunteer plants must be eliminated before the next crop is planted because they are hosts for pest and pathogens and can nullify the benefits of crop rotation.[20]

The Action Group on Erosion, Technology, and Concentration (ETC Group) calls GURT a "Traitor Technology", because this "allows a plant's genetic traits to be turned 'on or off' when a chemical is applied to the plant or seed". In the case of "Terminator technology", chemical application is used to induce sterility in seeds. According to ETC Group, applications of biotechnology for developing such unethical technologies "lead to 'bioserfdom' – they are technologies that threatens to hold farmers hostage to multinational agrochemical corporations – either through sterile seeds or chemically – dependent plants."[21]

Soon after Monsanto acquired patents for "Terminator technology," many civil society organizations (CSOs), farmers' organizations, international development agencies[22] and environmentalists registered their protest in different forms and condemned the technology as "both dangerous and reprehensible." (De La Perrier and Seuret 2000:31) With anti-terminator technology campaigns and protests, Robert Shapiro, the president of Monsanto, on 4 October, 1999, announced: "We are making a public commitment not to commercialize sterile

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[20] Quoted in RAFI Communiqué, *Suicide Seeds*, *RAFI Communiqué*, Issue 8, January/Febravary 2001.

[21] See, ETC Group 2002, "Terminate Terminator in 2002: Defend Food Sovereignty," http://www.etcgroup.org/documents/terminatorbrochure02.pdf. Accessed on: 10 February 2004.

[22] International agencies and foundations that condemned the "Terminator technology" include FAO, CGIAR, United Nations Conference on Environment and Development (popularly called The Earth Summit), and the Rockefeller Foundation. (For the comments of various international development organizations, see http://www.etcgroup.org/upload/publication/216/01/etcnewsrel.05april02.pdf. Accessed on: 10 March 2009.)

seed technologies, such as the one dubbed 'Terminator'."[23] However, terminator technology remains a subject of controversy, because, as ETC Group argues, the "gene giants" are rigorously working on developing similar kinds of technology under different names. As well these companies are applying for, and some have already acquired, patents for the "Terminator technology." In this context, critics of the technology are demanding for the surrender of the patents for the "Terminator technology" to organizations such as FAO in order to prove that private companies or institutions have no intention to commercialize the technology.[24] While some civil society organizations trust the FAO, several hundreds of civil society organizations, and agricultural research organizations around the world have expressed their disagreement with the FAO report released on May 17, 2004: *Agricultural Biotechnology: Meeting the Needs of the Poor?* Registering their strong opposition to the report, they wrote an open letter to Jacques Diouf, the Director General of FAO:

> This report has been used in a politically-motivated public relation exercise to support the biotechnology industry… The report turns FAO away from food sovereignty and the real needs of the world's farmers, and is a stab in the back to the farmers and the rural poor FAO is meant to support. We are deeply disappointed that FAO has breached its commitment…[25]

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[23] Monsanto announced its commitment not to commercialize "terminator technology" in an open letter wrote to Gordon Conway, President of the Rockefeller Foundation. For full text of the letter, see http://www.biotech-info.net/monsanto_letter.pdf. Accessed on: 5 February 2009.

[24] ETC Group, "Terminator Technology – Five Years Later," *ETC Group Communiqué* 79 (May/June 2003), 9-10.

[25] See, http://www.grain.org/front_files/fao-open-letter-june-2004-final-en.pdf. Accessed: 16 December, 2005.

Institutional Mechanisms and the Concentration of Gene Capital

The "Green Revolution" and the CGIAR System

The story of the "Green Revolution" began when the Rockefeller Foundation sent four young American agricultural scientists – George J. Harrar, plant pathologist; Norman Borlaug, plant pathologist and geneticist; William Colwell, agronomist; and Edward Wellhausen, corn breeder – to Mexico late in 1944 to develop an agricultural research program that could improve food production, and could "rescue" the country from the famine conditions. The research team was headed by Dr. George J. Harrar (who later became the President of the Rockefeller Foundation in 1961), and Norman Borlaug was appointed as the head of the wheat-breeding program – Cooperative Wheat Research and Production Program – in 1945.

Within a short span of time, Dr. Harrar's team succeeded in developing a new Mexican high yielding variety (HYV) of wheat in 1955. As a result of their continuous research and experimentation, the team was able to develop the first Mexican semi-dwarf wheat varieties, Pitic 62 and Penjamo 62, and released them for commercial cultivation to Mexican farmers in 1962. Soon after, these new wheat varieties were widely adapted to different agro-climatic conditions in the tropical and sub-tropical countries. These semi-dwarf wheat varieties were first adopted extensively by the farmers in India and Pakistan in 1967. This led to a rapid increase in productivity under favorable conditions such as proper crop management and supply of sufficient water and fertilizer etc. The increase in productivity, together with an increase in area of production, resulted in a remarkable increase in total wheat production throughout the 1960s (Brown 1970). For example, Indian wheat production increased from 10 million tonnes in 1964 to 17 million tonnes in 1968 (Swaminathan 2004). Similarly, Mexico, which had been one of the prime wheat importers of Latin America before the introduction of "Green Revolution" technology, turned out to be "self-sufficient" by the early 1960s and later it achieved the position of exporting a portion of her crop (Cleaver 1972).

While advocates of the “Green Revolution” used the increase of food grain production to reiterate their rationale for the advent of the new technology, and that the new technology was introduced to rescue the Third World from famine conditions, (Brown 1970:16) critics contended that the “Green Revolution” was introduced to prevent the possible “red revolutions” in those countries. Political economist Harry Cleaver argues that at the time of the inception of the “Green Revolution,” the “capitalist world” (meaning most northern industrial countries) was facing a major problem in the expansion of its market operations to most parts of Asia and Latin America (Cleaver 1972:178). At the same time, a socialist state was established in China under the leadership of Chairman Mao Zedong, and was spreading communist ideology in other countries of the Third World. In that historical conjuncture, Maoist China abandoned many western development projects including several projects of the Rockefeller Foundation. British were fighting with the communists on the Malay Peninsula. French were facing a tough time in Indochina. In the Philippines, the Communist Party of the Philippines was reborn in the context of worldwide revolutionary upsurge of the 1960s. In India, the Naxalbari peasant uprising was gaining momentum and spreading across the country. In Korea and Vietnam rural guerrillas were intensifying their struggle against the U.S.-backed governments and the U.S. (Cleaver 1972: 178; Fowler and Mooney 1990:56; Busch and Lacy 1990: 588-589).

In such a political turmoil, the “capitalist world” had recognized that all these rural guerrilla wars had a common basic cause – “rural discontent” that “stemmed from hunger.” Therefore, “hunger was the ally of the communists.” Then the “capitalist world” had realized that if hunger is a major ally of Communists, then food can be a weapon to fight them (Fowler and Mooney 1990:56). With this political motivation, along with the economic strategy of the disposal of post-war surplus food stocks, the U.S government adopted the Agricultural Trade Development and Assistance Act of 1954 [Public Law 480

Program (PL-480)], which, after a few amendments, was titled "Food for Peace Program."[26]

In fact, the U.S. government used food aid as an instrument to transfer Green Revolution technology to third world countries. For example, the US president, Lyndon Johnson, used the food dependency situation of India in 1966, and enforced the Indian government to adopt the new technology in order to provide food aid to India (Shiva, 1991: 31-32). However, the main goal of the industrial countries in the late 1960s was to silence the political opposition in the countryside in the Third world, and to bring these rural areas under the operations of market forces.[27]

However, the successful results of the new wheat varieties in Mexico encouraged the Rockefeller Foundation to join with the Ford Foundation to further research and development activities in Asia and other parts of the world (Cleaver 1972; Shiva 1991). Subsequently, the International Rice Research Institute (IRRI) was established by these Foundations in Los Baños, Philippines, in 1960. Research activities of the IRRI began in 1962 with an aim of developing new rice varieties equivalent to the Mexican wheat. The IRRI, within a time span

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[26] Initially, this program was instituted to dispose abundant surplus food stocks resulting from technological support and farm subsidies in the US in the post-war period. The three major components of this program are: (i) concessional sales program (Title I), commodity aid donation program for emergency and non-emergency purposes such as famine, (ii) disastrous relief programs (Title II), and (iii) bilateral food aid for development programmes (Title III). But, the stated goal of the Food for Peace Program was "to increase the consumption of U.S. agricultural commodities in foreign courtiers, to improve the foreign relations of the U.S. and for other purposes." (Cited in McMichael 2004: 54-55) For a detailed account on how the US used food aid programs as part of its strategic foreign policy, and created a food dependency condition in the "Third World," see, for example, Friedmann 1993.

[27] The intentions of the "capitalist world" in designing food aid programs and, later, the "Green Revolution" can also be deduced from awarding the Nobel Prize for Peace in 1970 to the so-called "father of the Green Revolution", Dr. Norman Borlaug, a plant breeder, who invented the "miracle" dwarf wheat in Mexico in 1954. He was awarded the Nobel Prize for Peace, but not for Physiology, because his work was considered as peaceful means to transform rural societies, and to clamp-down on the rural uprisings in the countryside, and to prevent the possible "Red Revolutions" in the Third World. See, for example, Kloppenburg 1988a; Shiva 1991: 19; Fowler and Mooney 1990: 57.

of four years, developed a prolific dwarf rice variety, IR-8, which is popularly called “miraculous rice” variety (Brown 1970)

After successful development of the new rice varieties, the IRRI noticed the need for agricultural technicians who could work efficiently along with the economists and managers being trained under the Rockefeller and Ford Foundations, the Agricultural Development Council (ADC) and United States Agency for International Development (USAID). To fulfill that need, the IRRI focused on training agricultural technicians for Asia. As well, the Mexican research project had increased its research activities and research personnel, and had grown to form the International Center for the Improvement of Corn and Wheat (*Centro Internacional de Mejoramiento de Maíz y Trigo*, CIMMYT) in 1963 (Cleaver 1972). This was followed by the establishment of the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, and the International Center for Tropical Agriculture (CIAT) Colombia, in 1967.

In 1971, at the initiative of Robert McNamara, (who was a former board member of the Ford Foundation and then the president of the World Bank), the Ford and Rockefeller Foundations, the Food and Agriculture Organization (FAO), the United Nations Development Programme (UNDP), the World Bank, and several bilateral donor agencies established a Consultative Group on International Agricultural Research (CGIAR) to support the network of the international agricultural research centers (IARCs) known as “Future Harvest Centers.” The number of IARCs has increased from four to eighteen then decreased to fifteen, and the scope of their research activities has gradually widened.

Initially, in the early 1970s, the IARCs concentrated their research on the major food crops grown in the Third World – rice, wheat, and maize. But in the late 1970s, the IARCs expanded their research to include roots and tubers, legumes, livestock, and genetic resources in tropical areas. In the 1980s, the IARCs further evolved to include research in the areas of institution building and food policy. In the 1990s, in response to ecological criticism of the “Green Revolution” and to the United Nations’s Brundtland Report of 1987, the centers included sustainable natural resource management, agroforesty, forestry, and gender equity in their research agenda. In 2000s, to address the problem of enduring world hunger in general, and food insecurity in sub-Saharan Africa and South Asia in particular, and to help implementing the United Nations Millennium Development Goals, the CGIAR included sustainable food security, poverty reduction, new partnerships with the corporate sector and biotechnology into its research agenda.

The "Gene Revolution" and the CGIAR System Reforms

Since the inception of CGIAR, its membership has been increased from eighteen members (11 industrialized countries, 2 private foundations, 5 international organizations) to sixty four members (26 Third World countries, 21 developed countries, 13 regional and international organizations, and 4 foundations including the Ford Foundation, Rockefeller Foundation, Kellogg Foundation and Syngenta Foundation for Sustainable Agriculture[28]). Each of these members traditionally contributes minimum of US$ 500,000 annually. But, CGIAR's funding mainly comes from European Commission (about 50 percent), the World Bank (about 13.5 percent), the United States (about 12 percent), Japan (about 10 percent), and the Rockefeller and Ford foundations (less than 2 percent). Australia, Canada and Colombia also make considerable contributions.

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[28] Syngenta Foundation for Sustainable Agriculture joined as a member of the CGIAR in 2002. It should be noted that Syngenta is based in Switzerland and is the world's second largest pesticide corporation (with US$ 7,285 million sales in 2007 i.e., 19 percent of global market share) and third largest seed corporation (with US$ 2,018 million seed sales in 2007 i.e., 9 percent of global proprietary seed market) (See, ETC Group 2008: 11, 15). It holds the highest number of patents for the "Terminator technology," more than any other private firm (See, ETC Group 2003: 6-7). Two US based corporations, Monsanto and DuPont are the first and the second largest seed companies with 23 percent (US$ 4,964 million seed sales in 2007) and 15 percent (US$ 3,300 million seed sales in 2007) of global proprietary seed market, respectively. In the pesticide sector, Bayer (German) is the largest corporation with US$ 7,458 million sales in 2007 i.e., 19 percent of global market share; BASF (Germany) is the third largest corporation with US$ 4, 297 million sales in 2007 i.e., 11 percent of global market share (ETC Group 2008:11, 15).

When the CGIAR system was established, funding was not a big problem. In fact, funding to the system has gradually increased over the years: the total funding allocated to the first four centers was US$14.8 million in 1971, and increased to US$141 million by 1980, and to US$305 million by 1990 (Shah and Strong 1999:59). But, donor attitudes towards the system have been changed since 1991 because CGIAR mainly focuses on plant breeding technologies, while its major donors readily embrace genetic engineering. Although the number of research centers and members of the CGIAR has increased, overall funding of CGIAR slightly increased by an average annual rate of 0.7 percent in nominal terms and decreased by 1.8 percent per year in real terms between 1992 and 2000.

With flattening support, financial crisis resulted in budget cuts to research programs, personnel and staff (Manicad and Lehmann 1997). For instance, according to Ronald Cantrel, director of the International Rice Research Institute (IRRI), one of the CGIAR's largest centers, located in Philippines, was forced to reduce their staff by 25 percent in 2002 because the donors cut funds to the centre from about US$30 million in 2001 to US$ 25 million in 2002.[29] The centre had already reduced its staff by 40 percent in 1996. Around the world the CGIAR laid off about 110 of its international senior scientists (about 10 percent) and about 2000 locally recruited staff. It also cut back some of its existing programs and deferred new programs that it had planned to implement (Manicad and Lehmann 1997).[30]

During the “Green Revolution,” the CGIAR system, while supported by government and non-governmental funds, played a more public role in disseminating new technological innovations around the world. But in the era of the “Gene Revolution” with the monopoly of private firms in research and development, the CGIAR system, with its financial constraints, has become

[29] See, “Patents Worry in Rice Research,” *New Straits Times*, 08 December 2003.

[30] See also *Nature*, “Concerns as Germany Cuts Funds to Agricultural Research Centers,” *Nature*, 402 (1999):845-846; *Nature*, “A Chance for Change in France,” *Nature* 423 (2003):1.

dependent on a few multinational corporations (Qaim 2001:3068). In this context, not only the CGIAR system but also the National Agricultural Research Systems (which are under the public sector in most of Third World countries) are restricted to basic research, while the fruits of the basic research are appropriated by the private sector, which uses the basic research to develop applied (commercial) technologies (Goodman and Redclift 1991:175-180; Lewontin and Berlan 1986: 22-23; Kloppenburg 1988:12-14).

Under these difficult conditions, CGIAR commissioned a "Third System Review" in 1997 to examine:

> (1) CGIAR's future role in fulfilling its aim; (2) the role, strategic advantage and the position of the CGIAR within a rapidly changing global scientific, communicational and institutional settings and arrangements; and (3) CGIAR's strengths and past achievements in terms of science, strategy, finance and governance structure." (Manicad and Lehmann 1997:1217)

The review report was submitted for discussion at the International Centers Week (ICW) meeting in October 1998. As a result of the review, CGIAR endorsed a shift in its focus in two major areas: First, from crop-specific research, which was successful in the "Green Revolution" period, to the integration of crop research by adopting the concepts of "sustainability" and "eco-regionality." (Serageldin 1999) Second, a shift in the scientific approach from conventional plant breeding to biotechnology (Serageldin, 1999; Manicad and Lehmann 1997).

These changes in CGIAR encouraged new partnerships with the private sector. With this strategic move, not only the CGIAR system but also National Agricultural Research Systems (NARSs), which are under the public sector in most of Third World countries, were severely affected. To attract private sector investments, CGIAR allowed corporations recently to study and utilize the germplasm previously collected through its network of research collaborators including the National Agricultural Research Systems (NARSs) around the world (Manicad 1999). For example, the International Center for the Improvement of Maize and Wheat (CIMMYT) is conducting research in Kenya and Zimbabwe in partnership with the Syngenta Foundation to develop Bt maize. Similarly, a CGIAR center is conducting research in Mexico with the support of Monsanto and the Rockefeller Foundation to develop virus resistant GM potatoes (Orton 2003).

Germplasm is stored in “gene libraries”[31] or “genebanks” under CGIAR's custody. A “genebank” is an insulated room where the collected seed samples are stored at low temperature and controlled humidity (Fowler and Mooney 1990). The central premise of the “genebanking” is to preserve genetic resources of wild varieties and landrace[32] of crop varieties before they become extinct. Thus, these centers are considered ‘storehouses’ of “the seeds of the future.” (Wilkes 1988) But, in the “genebanks,” where plant genetic resources are collected, they have very limited information such as where the sample collected, when, and by whom (Wilkes 1988). Therefore, at the period of collection and “banking,” there is no possibility to know whether the collected sample will have any useful genes. The key characteristics of the sample become apparent only after “expensive and time consuming evaluation.” (Kloppenburg and Kleinman 1988) Therefore, the vast genetic resources remain in the “genebanks” “inaccessible to most of plant breeders” (Wilkes 1988:80) until fuller evaluation processes are over and their “latent utility” is revealed, which may take decades (Kloppenburg and Kleinman 1988:189).

The eleven CGIAR centers around the world play a vital role in collection, characterization and conservation of plant genetic resources. The International Board for Plant Genetic Resources (IBPGR) established in 1974 coordinates the network of global germplasm collection. Indeed, two-thirds of these “genebanks” are located in the Third World and hold about 85 percent of

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[31] “Gene libraries are collection of DNA fragments” that represent “the entire genome of an organism.” These DNA fragments can be used as “raw material for genetically engineering a particular crop” as they are created by breaking a genome into fragments and then “multiplied by inserting each fragment into a single bacterium.” (Nottingham 2003: 24)

[32] Landrace are the locally developed varieties by the indigenous farmers through the process of selection over generations (Ruttan 2001: 370).

the world's collected germplasm. CGIAR invests US$ 6 million every year to maintain the "genebanks". Over 600,000 samples of genetic resources have been collected and stored. About 533,000 of total samples are "designated in-trust for the world community" as per the agreement between CGIAR and FAO. This means that the germplasm "within the in-trust collections will be made available without restriction to researchers around the world, on the understanding that no intellectual property protection can be applied to the material."[33] In practice, it is less clear. There is evidence of struggles over ownership with access to the private sector to CGIAR's genebanks.

Another concern is contamination of indigenous varieties with GM traits. For instance, a study in Mexico revealed that "of 2,000 maize plants tested, samples from 33 communities in nine Mexican states tested positive for contamination. In some cases as many as four GM traits, all patented by multinational "Gene Giants", were found in a single plant."[34] Many civil society organizations (CSOs) and peasant organizations expressed concern, as well, the Government officials acknowledged the contamination of local maize varieties by GM genes at the maize center of genetic diversity in Mexico. But the Mexican government insisted that such contamination would harm neither indigenous maize biodiversity nor public health.[35] Ironically, despite the government's recognition of the GM contamination, CGIAR has declined to acknowledge it.[36] Overall, critics have become suspicious of CGIAR's approach and its commitment to its mandate: alleviating world hunger and poverty through the dissemination of science and technology.

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[33] See http://www.cgiar.org/research/res_genebanks.html. Accessed on 23 February, 2004.

[34] See "Maize Rage in Mexico, GM Maize Contamination in Mexico – 2 Years Later" http://www.etcgroup.org/documents/maizerage.pdf. Accessed on: 03 January, 2005.

[35] See "Maize Rage in Mexico, GM Maize Contamination in Mexico – 2 Years Later" http://www.etcgroup.org/documents/maizerage.pdf. Accessed on: 03 January, 2005. P.2.

[36] See "Trouble in Paradise" http://www.etcgroup.org/documents/paradisefinalNR.pdf. Accessed on: 03 January, 2005.

Privatization of Research and Consolidation of the Seed Industry

In the initial phase of the "Green Revolution", a clear division of labor existed between the international agricultural research centers (IARCs) and the national agricultural research systems (NARSs). The IARCs conducted research and developed the new varieties and supplied them to the NARSs in the Third World. The NARSs then planted these new varieties in nurseries or field stations and produced the seed quantities required for distribution within their jurisdiction (Deo and Swanson 1990). Since the involvement of multilateral institutions, university research centers, governments, non-profit organizations, financial institutions such as banks, and others in promoting "Green Revolution" technology, the demand for new varieties became overwhelming for the public sector (World Bank 1999). The public sector alone could not cope with the demand, and this led to a "black market" (i.e. illegal activities) in seed distribution of public seeds. As well, the increasing popularity of these new varieties encouraged private companies to invest in seed production and marketing (Deo and Swanson 1990). To allow these private companies control over the lucrative seed market, the first privatization initiative of seed development and distribution occurred in the United States. The American government enacted the Plant Varieties Protection Act of 1970, and within a short span of time, MNCs (including non-traditional seed companies) entered into the global seed market, bought out many small seed companies and established their hegemony in the seed sector (Deo and Swanson 1990).

Recent developments in biotechnology changed the business strategies of the "gene giants" such as Monsanto and Syngenta, who are busily engaged in searching for new markets for their agricultural input commodities (seed, pesticides, herbicides etc). The multinational corporations (MNCs) are merging with or acquiring smaller biotech firms in the North, especially seed companies that already have established market links/channels in the Third World. Small firms in the Third World are selling off or merging with MNCs because they do not have capacity to obtain patent rights or the required resources and expertise for research and development of new varieties.

Proving that there are no sectoral boundaries for profit-driven private firms, many non-seed companies entered into the seed sector, after seeing its profitability. Today, most seed companies are controlled by a handful of large multinational chemical and pharmaceutical firms. As of 2007, 67 percent of the total proprietary seed market was controlled by the world's top 10 corporations. The world's top three companies – Monsanto (US), DuPont (US), and Syngenta (Switzerland) – account for 47 percent of global proprietary seed market. Similarly, the world's top 10 corporations control 89 percent of the global agrochemical market. Moreover, the world's six biggest agrochemicals are also big players in the global seed sector (ETC Group 2008:11, 15, see Table 2.1)

Table 2.1: Corporate Concentration in Seed and Agrochemical Industry, 2007

Seed Sector		**Agrochemical Sector**	
Company	Seed sales (US$ millions) (% of global market share)	Company	Agrochemical sales (US$ millions) (% of global market share)
Monsanto (US)	4964 (23%)	Bayer (Germany)	7458 (19%)
DuPont (US)	3300 (15%)	Syngenta (Switzerland)	7285 (19%)
Syngenta (Switzerland)	2018 (9%)	BASF (Germany)	4297 (11%)
Groupe Limagrain (France)	1226 (6%)	Dow AgroSciences (USA)	3779 (10%)
Land O' Lakes (US)	917 (4%)	Monsanto (USA)	3599 (9%)
KWS AG (Germany)	702 (3%)	DuPont (USA)	2369 (6%)
Bayer Crop Science (Germany)	524(2%)	Makhteshim (Israel)	1895 (5%)
Sakata (Japan)	396 (<2%)	Nufarm (Australia)	1470 (4%)
DLF - Trifolium (Denmark)	391 (<2%)	Sumitomo Chemical (Japan)	1209 (3%)
Takii (Japan)	347 (<2%)	Arysta Lifescience (Japan)	1035 (3%)
Total	14785 (67%)	Total	34396 (89%)

Source: ETC Group 2008:11, 15.

As well, collaboration between biotech industries and universities has been growing, particularly in the US, since the adoption of Bayh-Dole Act in 1980. The Act encouraged universities to become involved in developing commercial products and permitted them to hold exclusive licenses and patents to bring "innovations" into the market "for the public good." In the same year, the Supreme Court of the US, in the landmark case of *Diamond Vs. Chakrabarty*, held that genetically modified organisms could be patented.[37] This enabled biotech firms to partner with biotechnology research centers in the universities, giving the private firms access to the resources of publicly funded universities and an opportunity to actively shape or direct research agendas.[38]

What is the nature of research guided by biotech firms and whose interests does it serve? The question of control over research agendas has become crucial as public funding of universities declines and they depend more and more on private funding. For instance, in the US, the public funding for universities declined from $3.54 billion in 1992 to 3.48 billion in 1999, whereas industry funding as a share of total university research and development gradually increased from 2.6 percent in 1970, to 3.9 percent in 1980, 6.9 percent in 1990, and 7.7 percent in 2000.[39]

What are the implications of the privatization of seed research and development and the increasing concentration of MNCs in the seed sector for domestic research, and farmers around the world? As the private companies

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[37] Pew Initiative on Food and Biotechnology, *University – Industry Relationships: Framing the Issues for Academic Research in Agricultural Biotechnology* (Washington, D.C: Pew Initiative on Food and Biotechnology, 2003), 21. http://www.pewtrusts.org/our_work_report_detail.aspx?id=33362. Recently visited on: 1 March 2009.

[38] Indeed "firms whose scientists collaborate with top university scientists tend to earn more patents and more highly cited patents than do other firms." (Pew Initiative on Food and Biotechnology 2003:11) It is not surprising to learn that many of the earliest genetic engineering companies were established by university professors. For instance, Genentech, the first private firm that ventured into commercial exploitation of rDNA technology, was founded by Herbert Boyer, a bacteriologist at the University of California, in 1976 (See Busch, Lacy and Burkhardt 1991:14-17).

[39] Pew Initiative on Food and Biotechnology 2003:19, 21.

pump money into research and development of "high quality" seeds, critics predict that they will sell their seeds at a higher price in a monopolistic market situation. Moreover, the concentration of patents on new seeds and the "enabling technology" in the hands of a few MNCs, hampers public research and development in the Third World. It will be impossible for any third world research institution, public or private, to use either the seeds or "enabling technology" for research purposes, unless and until they enter into commercial relationship with the patent holders of the technology (Falcon 2001). In effect, the patent system reinforces the concentration of the market through the mechanism of merger and acquisition.

Similarly, increasing privatization of research and development concentrates power in the hands of a few MNCs, and gives them control by pushing the Third World to the receiving end. This will eventually marginalize public research in the Third World, reducing it to a supporting research body for the private sector. Whoever controls and manipulates the seed development programme in the context of Trade Related Aspects of Intellectual Property Rights (TRIPS) sets the agenda for researchers (Bhattacharjee 1988; Goodman and Redclift 1991; Kloppenburg 1988).

Critics argue that seed production control eventually leads to control over food production and threatens food security for millions of poor people (Mukherjee 2002). Robert Fraley, now Executive Vice President of Monsanto, admits as much when discussing the consolidation of seed companies: "What you're seeing is not just a consolidation of seed companies, it's really a consolidation of the entire food chain. Companies like ours, who want to continue to be in the food and feed production business, are all trying to secure our spot along that chain."[40] His comments raise the further question of the sovereignty of the state. As Indian scientist-activist, Suman Sahai puts it, "a nation that does not produce its own seed and its own food cannot be a secure nation." (Sahai 2001:3339)

[40] Quoted in James Flint, "Agrocultural Industry Giants Moving Towards Genetic Monopolism," Telepolis, Heise Online (1988), http://www.heise.de/tp/r4/artikel/2/2385/1.html. Accessed on: 12 January, 2005.

To further tighten their grip, MNCs aim at innovations that can generate inter-linked sales of seeds and chemicals. This engineered inter-linkage provides companies a monopoly over complementary inputs. For example, Roundup Ready corn and soybeans were developed by Monsanto in such a way that they will respond to only Monsanto's major herbicides. Therefore, peasants and farmers will be left with no chance to escape from the control of the MNCs. The monopoly of a few MNCs in the seed market has been promoting monoculture of a few patented varieties. This will eventually lead to attrition of rich biodiversity that has been eroded to a great extent by the "Green Revolution."[41]

As mentioned by Busch, Lacy and Burkhardt (1991:16), "the scientific community could become desensitized to the social impacts of biotechnology research. Some research that lacks commercial application could be neglected entirely." This has created so-called "orphan crops," that are neglected and unprofitable for public and private sectors to research and develop their new varieties (Falcon 2001). Research on tropical crops such as bajra, jowar, sorghum, tropical rice, tropical maize and chickpeas has been neglected or marginalized as a consequence of the "Green Revolution," and current research focuses more on the crops that fetch foreign earnings. Many orphan crops were dietary staples of the poor classes. So, shift in scientific research directly affects poor and marginalized populations. Other critics argue:

> Poor subsistence farmers used to grow and consume largely the cheaper but more nutritious coarse cereals, but in the wake of the "Green Revolution" they have no option but to shift their cereal consumption in favor of costlier cereals. This has increased their

[41] A few decades ago, Chinese farmers were growing some 10,000 varieties of wheat but the number had been reduced to only 1,000 by the 1970s. In India, more than 200,000 varieties of rice were grown but the monoculture of the "Green Revolution" destroyed many species and the number has come down to 17,000; and today, the majority grow just a few dozen varieties. Also, Indian farmers lost many varieties of wheat and are restricted to only a few varieties. In Mexico, only 20 percent of maize diversity exists today. In the Philippines, rich diversity of rice varieties had been eroded by the "Green Revolution," and by the mid-1980s, only two varieties of Green Revolution seed occupied 98 percent of the entire rice-growing area (Shiva 2000: 80, 84).

> market dependency on the costlier rice and wheat (Suryanarayana 2002:623).

In contrast to claims by seed companies that the new GM crops like Golden Rice are super crops that will solve the dietary problem of Vitamin A deficiency, as agroecologist Miguel Altieri argues:

> People exhibit Vitamin A deficiency not because of rice contains too little Vitamin A but because their diet has been virtually reduced to rice. "Golden Rice" is another one-dimensional attempt to solve a problem created by the "Green Revolution"-diminishing crop and dietary diversity-and is unlikely to make any lasting contribution to well-being (Altieri 2002:620).

Legal Mechanisms and Patents on Life

Traditionally there were no intellectual property rights mechanisms to protect plant varieties, or for that matter any living organism (Khor 2002; Orton 2003). For the first time in history, with the efforts of the 1956 Congress of the International Association of Plant Breeders for the Protection of Plant Varieties, plant breeders rights (PBRs), a form of intellectual property rights to safeguard new crop varieties, was established. Though the PBRs protected against the resale of seeds, it permitted farmers to store and resow seeds from the protected crops. In 1961, after four years of negotiations, the PBRs further developed into the UPOV system, the International Union for the Protection of New Varieties of Plants [popularly known by its French acronym *Union pour la protection des obtentions vegetales* (UPOV)], which was initially signed by the Western European countries in Paris at the first International Convention for the Protection of New Plant Varieties, and came into effect in 1968. Similarly, the Plant Variety Protection Act was enacted in the US in 1970 (Kuyek 2004: 15-17). According to this Act, private seed companies have exclusive market rights for the varieties they develop.

Since its adoption, the UPOV convention has undergone three amendments in 1972, 1978 and 1991. The 1978 version of UPOV strengthened farmers' rights and provided:

> [t]wo important exemptions to breeders' rights: (i) breeders' exemption (allowing breeders to use protected varieties for breeding purposes and developing new varieties, including the freedom to exploit these new varieties commercially); and (ii) farmers' privilege (which allows farmers to save protected seeds for sowing in subsequent years) (Khor 2002: 77-78).

But the 1991 version of UPOV convention, curtailed farmers' rights, restricting re-use of seeds they harvest in their fields, and extending extensive rights to plant breeders. Critics argue that the UPOV system, by restricting re-use of farm-saved seeds, was aimed at promoting commoditization of seeds. (Khor 2002:78; Orton 2003: 25).

Once restricted to a few western countries, membership in UPOV has extended globally since all member countries of the World Trade Organization (WTO) are obliged to adopt minimum standards of intellectual property rights (IPRs). They may fulfill this criterion by either obeying the patent system or an "effective *sui generis* system,"[42] otherwise referred to Plant Variety Protection (PVP system), or a combination of both. (Orton 2003:25; Khor 2002: 76; Asian Development Bank 2001:179-181). IPRs provide the patent holder a claim to worldwide ownership on the new life form for 20 years. But, WTO's enforcement of Trade Related Aspects of Intellectual Property Rights (TRIPS) makes, as Nottingham argues, "national patent laws around the world…subservient to the patent laws in the countries where multinational companies were awarded their patents." (Nottingham 2003: 115; see also Shiva 2000:89)

[42] *Sui generis* is a Latin term which means "of its own kind." "Effective *Sui generis* system" means that every country could develop its own version of an intellectual property rights system "that best suits for their agricultural system and the needs of breeders and farmers." (Orton 2003: 25) However, the interpretation of the term "effective" is still a problematic since there is no proper definition of the term given in the Trade Related Intellectual Property Rights (TRIPS) agreement.

The "Gene-Drain" from the Global South to North

The major changes in the CGIAR system outlined earlier in this chapter raise basic questions pertaining to the implications of Intellectual Property Rights (IPRs) for germplasm exchange, development of the new varieties, and farmers' rights. Appropriation of genetic resources from the global South takes place by using the "common heritage principle," which considers agricultural germplasm a "gift of nature" and a common resource of all humankind. Germplasm could be collected and used without permission from, and payment to, its country of origin. But, critics reject the notion of "gift of nature" and argue that "most plant genetic resources are not simply the gift of nature. Landraces and primitive cultivars have been developed by peasant farmers; [therefore] they are the product of human labour." (Kloppenburg and Kleinman 1988:190; see also Gomez and Torres 2001:286; Pistorius and Van Wijk 1999:3) However, the CGIAR, through its international agricultural research centers (IARCs) around the world, collect and transfer germplasm from the "genetically-rich South" to the "genetically-poor North." (Kloppenburg and Kleinman 1988)

The "gene-drain" is not entirely a new phenomenon. It is well documented that, to develop new varieties in the global North, colonial powers (and later imperialist powers) collected the seeds of landraces and wild varieties from the global South driven by scientific developments, ethnocentric methods and curiosity (Pistorius and Van Wijk 1999). What is new in the contemporary "gene-drain" is that once the original germplasm (so-called "primitive" germplasm) from the South reached the North, they were hoarded in botanical gardens or, more recently, in "genebanks" that are controlled by corporations (Pistorius and Van Wijk 1999), and largely used by the private sector to develop new varieties (so called "elite" germplasm) in the North (Kloppenburg 1988). In turn, increasingly, new varieties are protected from free usage by intellectual property rights, provided to the developer of the new variety, and not to the country of origin of the germplasm (Kloppenburg 1988, see also Gomez and Torres 2001).

According to Kloppenburg, "plant genetic resources leave the periphery as the common – and costless – heritage of mankind, and return as a commodity –

private property with exchange value." (Kloppenburg 1988:169) This asymmetry in germplasm flow has become one of the important issues in the debate about biotechnology. As the international agricultural research centers around the world have access to and collect the seeds of landraces and wild varieties, and given CGIAR's shift towards private sector research and development, the issue of transfer of germplasm is much more relevant. Critics argue that CGIAR may help the private sector convert the common resource of germplasm into commodities, purchasable on the market. Given MNCs domination in seed development, and stringent patent regimes, world food production may become controlled by a few corporations that acquired patents on the crops they developed (Pistorius and Van Wijk 1999).

The "appropriation of plant genetic resources" by a few MNCs in developed countries also endangers Third World countries' export earnings. Using the germplasm of tropical plant varieties, corporations from advanced countries are trying to develop tropical products such as sugar, cocoa, and coffee by genetic manipulation. Many important export crops of the Third World may have to compete against similar crops produced in developed countries. This threatens the advantage tropical regions have based on land suitability and climate conditions for certain crops, and threatens to decrease foreign earnings of agro-export dependent Third World countries (Kloppenburg and Kleinman 1998; Nottingham 2003).

Conclusion

The acceleration of the transformation of peasant or family farming into industrial agriculture and agribusiness with the aid of biotechnology tools is increasingly controversial. In the process of restructuring of farming system, technology has been used as an instrument to convert the farm inputs and outputs into essential commodities, and enabled the penetration of capital into agriculture in the Third World (Buttel 1990:117-118; Kloppenburg 1988:31-37). This process started with the development of "miracle seeds" of the "Green Revolution" in the 1960s, and accelerated with the advent of GM seeds in the

1990s. As skeptics argue, the two agricultural revolutions of the twentieth century have tightened global capital's grip over agriculture and food security and threatened the livelihoods of millions of poor people across the globe. As well, a few MNCs have established hegemony in the research, development and marketing of new seeds.

Introduction of new technologies into highly stratified societies induce qualitative changes in the social relations of production and create new socio-economic contradictions. Evidence show that the "Green Revolution" sharpened the contradictions in third world agrarian societies and created new social classes: the bourgeois, the semi-proletariat, and the proletariat. Today, the "Gene Revolution" has the capacity to exacerbate the disastrous effects of the "Green Revolution." GM techniques embed a new technocratic formula into seeds, which increasingly brings the entire agricultural system into the operations of the capitalist world system. The consolidation of the seed industry in the core, and the enforced integration of third world farmer-peasants into the capitalist world economy perpetuates the existing unequal power relations and technological dependency between the periphery and the core.

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Chapter 3

Agrarian Political Ecology: Dispossession, Metabolic Rift, and Hegemony

Introduction

In this chapter, I critically review select writings on the implications of new agricultural technologies for farmers and peasants drawing from debates in development studies, political economy, environmental studies, and ecological feminism. I use the critical literature review to develop an analytical framework for my understanding of the adoption of genetically modified crops and it's politico-economic, socio-cultural and environmental implications for farming communities in Warangal district in India and North Central Alberta in Canada.

Development and Post-Development Approaches

Modernization theorists claim that "traditional" (Third World) societies can be transformed into "modern" (advanced industrialized) societies only on the one hand by changing the forces of production (technology) (Moore 1963: 89), and thereby the relations of production in society; on the other hand by "transforming and remolding archaic social structure that resist technological change in these societies." (Parayil 2002:117) They unequivocally suggest that 'developing countries' should welcome the diffusion of western knowledge, skills, institutions, values, technology and capital, which they argue has made the West economically successful. Anthropologist Elizabeth Bird (1984: 23) describes the assumptions of western architects of development:

> First, that these development planners know what "the people" in the "developing countries" want; second, that what they want is what "we" have; third, that "they" are not yet advanced enough to be able to fully indulge themselves with repercussions; and fourth, that discipline, prudence and forbearance are some of the qualities necessary to success.

The fundamental assumption of proponents of the global diffusion of "technical knowledge" is that Third World people are incapable of innovating and developing new technologies needed to solve their problems. This assumption is very explicit in the World Bank's understanding of knowledge production, transfer and utilization for development in the global South. For example, the Bank's *World Development Report 1998/99* states: "Poor countries — and poor people — differ from rich ones not only because they have less capital but because they have less knowledge. Knowledge is often costly to create, and that is why much of it is created in industrial countries." (World Bank 1999:3) According to World Bank pundits, "knowledge is like light. Weightless and intangible, it can easily travel the world, enlighten the lives of people everywhere." (World Bank 1999:3)

In the field of agricultural and rural development, particularly since the inception of "Green Revolution" technology, proponents advocate that technological change in an agrarian society can promote social change, altering the farmers' material conditions of life by changing the socio-cultural and institutional frameworks of society in which the technology operates (see Parayil 2002:123-129). Others advocate that poverty and hunger in the Third World can only be solved through new technological interventions in agriculture (Conway 2003; Serageldin 2003). The adoption of Green Revolution technology has been presented as a "rational choice" for farmers, and farmers who adopted the new technological package were viewed as active agents of change towards 'development' in the countryside (Parayil 2002:143). This process is described as the diffusionist approach.

A diffusionist approach to modernization offers a technological "solution" to underdeveloped countries to help them catch up to developed countries. Proponents believe that the widespread adoption and diffusion of new technologies in farming is a decisive factor in development process. Development should increase because of the process of "diffusion" and "acculturation." But, in underdeveloped countries, there are many constraints to diffusion (Frank 1972:357). The modernization theories assume that underdeveloped countries will welcome the diffusion of Western knowledge, skills, institutions, values, technology and capital, which made the West economically successful. The "Green Revolution" in 1960s is the best example for the diffusionist approach. However, the international diffusion of agricultural knowledge was not entirely a new phenomenon. For example, sugarcane and art of sugar making were diffused from India to China, to Arabia, and to the Mediterranean region by merchants and traders by around 400 BC (Ruttan 2001: 184-186). What is new in contemporary periods is the institutionalization of knowledge systems for diffusion such as the restructuring of the Consultative Group on International Agricultural Research (CGIAR), the domination of a few multinational corporations (MNCs) in seed research and development, and the expansion of a stringent patent system across the globe (see chapter two).

According to sociologists Deo and Swanson (1990:584-585), the implicit assumptions of the advocates of modernization approach (see, for example, Rostow 1960; Eisenstadt 1963; Moore 1963; Levy 1966; Nash 1984) were: (1) new technologies would solve the socio-economic and political problems in a given society; (2) once the new technologies were developed, then the development process would take off the social and economic needs; (3) the core reason for poverty and hunger was insufficient production, not unequal distribution of resources and wealth; (4) "diffusion of innovations" (such as the "Green Revolution" package technology) would lead to elimination or reduction of the "knowledge gap" between the laboratory scientists and farmers; and (5) science and technology were neutral and benefited all users in a similar way.

Such assumptions about the diffusion of technical knowledge led post-developmentalist critics to label technological diffusion "monocultural" and "Eurocentric," a project that aims at homogenization that ignored socio-cultural diversities in the non-western societies[43] (Naderveen Pieterse 2001:98; So 1990:33; Escobar 1995). According to Escobar (1995: 12) stereotypical and

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[43] Sociologist Marion Levy Jr. writes "as time goes on, they and we will increasingly resemble one another … because the patterns of modernization are such that the more highly modernized societies become, the more they resemble one another." (quoted in So 1990:33)

ahistorical views about Third World peoples' inability to innovate and create the new knowledge systems, depoliticized the real problems, and obscured the root causes of underdevelopment such as colonial and neo-colonial exploitation, the domination of multinational corporations (MNCs), unequal international trade relations, and a stringent patent system controlled by powerful northern countries. (See So 1990: 58)

For Escobar, the diffusion of western knowledge in the form of development projects notably marginalizes and disqualifies non-western knowledge systems, but also promotes "cultural violence on the Third World." (1995:13; see 1992) Along similar lines, Indian eco-feminist and fierce critic of technology Vandana Shiva argues that Western science and technology are the results of Enlightenment thinking and positivism, which promote the mastery of nature and destroy any harmonic relationship between nature and society (Shiva 1991)

Post-developmentalist approach offers a political and cultural critique of modernity, techno-scientific progress, and development. Post-developmentalists reject Western science and development models, considering them as the instruments of imposition of power, cultural Westernization and homogenization, and environmental destruction (Naderveen Pieterse: 2001:98; Nandy 1989). For them, science is seen as power (Nandy 1988) and questionable output of Enlightenment thinking and positivism. According to Vandana Shiva, technology enables the people who control it to get mastery over nature (Shiva 1991). But, the "critique of science" and "anti-science" are not the same. Critics of science acknowledge the limitation of science and technology in solving socio-economic and political problems. They criticize the use of scientific knowledge for expansion of political power by the developed countries. Many dissident intellectuals, green parties, popular organizations and other non-governmental organization who oppose modern development expertise and policies are not anti-science per se. However, those who hold the views of anti-science often suggest the traditional methods of production as an alternative to western technologies.

In most development projects, the transfer of technology and knowledge became an important component and it is often considered as neutral and inevitably beneficial to all in the Third World. But Escobar argues it creates a new cultural and social order or disorder in the Third World (Escobar 1995:36). He finds that development programs restructure the social relations, deepen western modernization influence and often depoliticize problems in the Third World (Escobar 1995:12). Therefore, as post-development scholars argue, the concept of Eurocentric development should be "deconstructed" and endogenous development, where "the goals and values of development generate from within, should be pursued." (Naderveen Pieterse 2001:86) Contrary to the modernization project, which considers 'state' as a unit of development, the post-developmentalist approach considers different sites such as people, community, local, and grassroots as the units of development. Moreover, it focuses on endogenous development and "the revalorization and adaptation of existing social and cultural capital." (Naderveen Pieterse 2001:86)

It is very important to consider post-development approach in the context of the "Gene Revolution" because the adoption of the new seeds may have serious socio-cultural implications for the entire society. Although the post-development approach offers a well-articulated critique of GM crops, they do not offer alternative means for a systemic transformation. Rather they focus on autonomous community building, local knowledge systems, and local governance and community empowerment through the decentralization of politics. But, they neglect global political economy aspects of technology transfer and its implications for community based autonomy. Knowledge or technology transfer from developed to developing countries is not entirely a benign development process. Rather it is a politico-economic process whereby a few MNCs with patents on new technologies appropriate local research and development activities, legal rights, and perpetuate dependency for technological inputs, services, knowledge, and training in the Third World. Therefore, any alternative development model must analyze technology transfer or in this case transfer of patented GM seeds from a few developed countries to the Third World, by analyzing the full range of politico-economic, socio-cultural and legal dependencies. For such an analysis, the political economy of development and underdevelopment approaches provide the most suitable framework.

Political Economy Approaches

Dependency and world-system approaches emerged as a major challenge to modernization theory, and offered alternative interpretations of the causes and consequences of "development" and "underdevelopment" within the world-system. These approaches rose to prominence in the late 1960s and in the early 1970s in the political context of the anti-systemic movements. The central premise of these approaches is that for deeper understanding of the causes and consequences of development and underdevelopment processes, it is essential to place these global processes within the socio-historical context of the origin and development of the capitalist world-system and the incorporation of the global South through the process of colonialism and imperialism (Frank et al 1972; Wallerstein 1974; Kay 1993; Abbott 2003). Proponents of these approaches also argue that the capitalist world-system (particularly imperial states and MNCs) strategically developed its own structures and processes to reproduce the zonal structure of the core – semi-periphery – periphery. The core countries are developed because they have exploited and expropriated economic surplus from the peripheral countries. The peripheral countries are underdeveloped because of the manner of their insertion into the capitalist world- system (Koo 1984:35).

In the sphere of technological transfers, political economist Andre Gunder Frank argues that the diffusion of technology from the developed countries to the underdeveloped countries became problematic, because it operated within the framework of "monopoly structure of [the core] economic system." (Frank et al 1972:365) The increased diffusion of important technology from the developed countries to the underdeveloped countries "serves as the basis of the capitalist metropolis' control over its underdeveloped economic colonies." (Frank et al 1972:366) Monopoly included control over human expertise, engineering, planning, decision making, local research and development, tools (also spare parts, services, designs), local firms, and the flow of capital (unequal or uneven) back to corporate headquarters in developed countries.

Like Frank, British sociologist Steven Yearley (1988:145-180) argues that in the process of the development and transfer of technologies Third World research centers became the extension of First World research centers contributing basic research back to the centre and even experimenting with "inappropriate" technologies prohibited in developed countries. This process served the best interests of the First World. It undermined the research capabilities of the Third World. Further it resulted in the adoption of inappropriate and unsuitable technologies that hindered the modernization path of the poor countries. The "Green Revolution" of the 1960s is a classic example of a technology transfer that evolved out of the dependent relationship between the core and the periphery at the peak of modernization theory. Many analysts of the "Green Revolution" argue that new agricultural technology package increased inequalities in third world societies and increased dependency between the corporations in countries that developed and those who adopted the new technologies.

Similarly, critical studies of the new agricultural technologies show that a few multinational corporations (MNCs) have established domination in the research, development and marketing of the new seeds. The three important attributes of MNCs – "concentration, centralization and internationalization of capital," (Menon 1986:62) help them in the expansion of their activities in agriculture across the globe by a series of corporate mergers and by making use of the new trade and patent regimes under the control of the World Trade Organization. By utilizing patent mechanisms and through strategic market alliances and mergers, a few MNCs create an oligopolistic market situation where the small and medium-sized firms are effectively blocked from entering into the seed sector. This enables the concentration of economic and political power in the hands of a few MNCs in a few developed countries. This process has many implications for seed research and development in the Third World, and for small and marginal farmers across the globe (Magdoff, Foster and Buttel 2000).

Studies on the "Green Revolution" clearly demonstrated that the introduction of new agricultural technology entailed the "forced commercialization" of agriculture, and eventually resulted in commodification of the major agricultural inputs such as land, labor and technology (Buttel 1990:116-117). This in turn resulted in acceleration of the process of "production for the market" and intensification of capitalist relations of production. In the context of the "Gene Revolution," since the 1990s genetic engineering technology not only commodifies the inputs (particularly seeds) but also the outputs – its primary focus is on crops that are tradable in the international market. In these circumstances, a high level of what Krishna Bharadwaj called "compulsive involvement" in the market or what Amit Bhaduri referred to as "forced commerce" is occurring (see Bharadwaj 1985; Bhaduri 1986).

But market participation and interaction of various classes in the market is not a "neutral" process, rather it is determined by an individual agent's socio-economic position (class, caste, ethnicity, gender, etc) in a particular society. Particularly for small and marginal farmers, the process of commodification of the means of production exerts pressure on cash needs which in turn pushes them towards financial institutions, local money lenders and merchants for credit. In certain third world politico-economic contexts, this borrowing or credit lays a first step for their dependency, and leads to a "credit-product interlocked market relationship" that works as the prime mechanism of the differentiation of the peasantry (Banaji 1977; Bhaduri 1983).

Political economy approaches provide a macro analytical framework to better understand how the development of new agricultural technologies play an important role in perpetuating the dependency relationship between developed and developing countries. But, they often neglect socio-cultural and environmental repercussions of new technologies at the micro-level of the community and household farm. To consider the implications of capitalist technology transfers for the nature-society relations, and gender relations, we turn to critical environmental sociology.

Socio-Ecological Approaches

In this section, I discuss three major approaches in environmental sociology that are relevant to our understanding of the implications of GM crops for society and the environment: Ecological modernization perspective, Marxist ecology, and ecofeminist approaches.

Ecological Modernization Perspective[44]

In recent years ecological modernization has emerged as one of the dominant perspectives in the field of "environmental social sciences." (Buttel 2000: 57) A central premise of ecological modernization perspective[45] (EMP) acknowledges that the environmental problems of this century have been caused by modernization and rapid change in the forces of production, and that these problems "can be overcome by technical and procedural innovations." (Hajer 1996: 249) For EMP proponents, technological innovation is part of the solution. They further assert that even when environmental problems are caused by technology, they can best be solved by more advanced technologies. Critics disagree. Some argue that "capitalist technology is in reality a force of oppression, exploitation, and destruction."(O'Connor 1998: 200) Others consider EMP a perspective of "(Northern) Eurocentricity," its metatheoretical and normative assumptions formulated on studies conducted in West European (the Netherlands and Germany) political and economic contexts (Buttel 2000: 64). In response to such criticisms, proponents have encouraged application of EMP by scholars around the globe to examine its relevance for the industrial sectors of newly industrializing countries (e.g. Malaysia, Indonesia), countries in "transition"(e.g. Lithuania, Hungary, China), and the so-called developing countries (e.g. Vietnam, Kenya, Thailand) (See, for example, Mol 2001; Mol and Sonnenfeld 2000; Spaargaren, Mol and Buttel 2000; Zhang 2002). EMP in the

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[44] This section is a part of my paper published in the journal *Capitalism Nature Socialism*, see Kumbamu 2006.

[45] I agree with Frederick F. Buttel who prefers to "use the expression ecological-modernizationist "thought" or "perspective", rather than theory …because of the fact that, at least as far as the literature in English is concerned, ecological modernization is not yet a clearly-codified theory." (Buttel 2000:58)

agrarian sector and its environments in the global South remains less studied. (Jepson and Brannstrom 2005: 297; Kumbamu, 2006).

According to one analyst, the Ecological Modernization perspective has modernized modernization theory (Zhang 2002:25). One of its leading theorists, Arthur Mol, argues that "the basic, most fundamental, idea of the ecological modernization theory has been formulated as the 'emancipation', 'differentiation' or growing independence of an ecological sphere and rationality with respect to the economic sphere and rationality, in particular." (Mol 2001:222) Whereas modernization theory places more emphasis on economic rationality neglecting ecological rationality, EMP considers that the conflict between economy and ecology can be mitigated within the framework of capitalist mode of production (Buttel 2000:60; Mol and Spaargaren 2000: 36).

To bring harmony between economy and ecology, Joseph Huber, "the founding father of ecological modernization," (Mol 2000:48) suggests two complementary processes: "ecologization of economy" and "economization of ecology."

> The 'ecologization of economy' refers to the physical and organizational changes in production and consumption processes. The 'economization of ecology' refers to the economic valuation of environment and nature, which are recognized to be the third force of production (apart from labor and capital) (Leroy and Van Tatenhove 2000:195)

To enhance economic growth and resolve environmental problems, a synthesis between the sphere of economy and ecology can be achieved through innovations and advancements in technology. Some proponents of EMP call this "scientification of ecology" and consider it the heart of the perspective (Spaargaren 2000: 51). For them, in the contemporary Western industrial mode of production and consumption, ecological rationality can no longer be subset of economic rationality. Ecological rationality is emerging as an autonomous and independent factor from the economic sphere, intertwined rather than mutually exclusive (Spaargaren 2000: 53).

According to Mol and Sonnenfeld the central aim of EMP "has been to analyze how contemporary industrialized societies deal with environmental crises."(Mol and Sonnenfeld 2000:5) To achieve this aim, EMP, breaking from "demodernization" and "counter-productivity theory", relies on "the proposition that the environmental crisis can and should be overcome by a further modernization of the existing institutions of modern society." (Spaargaren 2000: 56; Buttel 2000:61) Policy prescriptions of EMP to "safeguard the societies' sustenance bases" emphasize environmental reforms that as the advocates of EPM believe, not only bring improvements in physical environments but also in social and institutional environments (Mol and Sonnenfeld 2000:6).

In many empirical studies of EMP, the case study methodology was used to trace the historical development of technological innovations, state policies and regulatory institutions vis-à-vis environmental reforms in specific industries. Most were conducted in northern and northwestern Europe. Based on their structural and institutional circumstances, some analysts conclude that EMP was:

> … applicable primarily for advanced industrial countries, due to prerequisites for green industrial restructuring, e.g. the existence of a welfare state, advanced technological development …a state regulated market economy …and…widespread environmental consciousness. (Sonnenfeld 2000:236)

For them, EMP offered less relevance to "developing" countries because it is "a Northern (Western) - oriented discourse rooted in a particular stage of economic development where high material living standards have been achieved among the majority of people." (Toke 2001:289) Other proponents of EMP disagree and argue that EMP has relevance to the newly industrializing countries, countries in transition, and "developing" countries (Mol and Sonnenfeld 2000, Mol 2001). For them, EMP is not a simple process of transferring ideas from the West to the rest of the world, as was evident in the Modernization Project. Rather, as Arthur Mol argues, "major adaptations would have to be made before these environmental reform ideas, institutional designs and strategies are transferred successfully." (Mol 2001:68-69)

GM crops provide an important lens through which to assess EMP for two reasons: First, GM crops are presented as a solution (if not the only solution) to the economic and environmental problems created by the conventional crops of the "Green Revolution" in the 1960s, 1970s and 1980s itself a strategy for development or progress through technological advancement at the heart of modernization theory. Second, debates about GM crops raise many ethical and political questions about the environmental problems associated with the adoption of new technologies (Toke 2002: 145). But, what is important is whether the contemporary transfer of ecological modernization prescriptions and technologies will avoid the ecological, social and political problems of the Green Revolution of the 1960s and 1970s, or these new technologies will create additional socio-ecological contradictions and crises.

Marxist Ecology and Ecological Marxism

Some scholars have pointed out that "traditional Marxism" has been preoccupied "with a productivist paradigm that endorsees unlimited economic growth and ignores environmental degradization." (Goldman and Schurman 2000:565; see also Benton 1989; Grundmann 1991)[46] Other Marxist scholars believe that "Marx

[46] Critics who consider Marxism as "technological determinism" often quote the following statements from Marx's writings: "The handmill gives you society with the feudal lords; the steam-mill, society with the industrial capitalist." (Marx 1971:109) "Technology discloses man's mode of dealing with Nature, the process of production by which he sustains his life, and thereby also lays bare the mode of formation of his social relations, and of the mental conceptions that flow from them." (Marx 1906:406) "The bourgeoisie cannot exist without constantly revolutionizing the instruments of production, and thereby the relations of production, and with them the whole relations of society." (Marx and Engels 1967:83)

But, according to sociologist Donald Mackenzie, "interpretations of Marxism as technological determinism" are primarily based on a simple "equation 'forces of production = technology'." (Mackenzie 1984: 477) As social theorist William Shaw (1979:158) argues:

> Technological determinism is a slight misnomer since Marx speaks, in effect, of productive-force determinism … for Marx the productive forces include more than machines or technology in a narrow sense. In fact, labor-power, the skills, knowledge, experience, and so on which enable labor to produce, would seem to

hinted at, but did not develop, the idea that there may exist a contradiction of capitalism that leads to an 'ecological' theory of crisis and social transformation." (O'Connor 1998:160) Challenging the limitations of "traditional Marxist" theories of economic crisis ("the first contradiction of capitalism"), James O'Connor has developed an "ecological Marxist theory of economic crisis" (what he calls "the second contradiction of capitalism") to explain the ecological foundation of capitalist crises. In his theory of "second contradiction," O'Connor has introduced nature, natural limits, the exhaustion of ecological systems, and ecological services like corbon sinks, in conjunction with labor and capital, as a fundamental aspect of contradictions in capitalism.

According to O'Connor, "traditional Marxist" theories explain economic crises in capitalism in terms of the contradiction between the forces of production and the relations of production, whereas "ecological Marxism" explains economic crisis in terms of "the contradiction between capitalist production relations and productive forces, on the one hand, and conditions of production[47], on the other." (O'Connor 1998:164) In "traditional Marxist" theory, crisis in the capitalist system occurs when "producible commodities cannot be sold profitably, thus preventing the realization of profits and their transmission into additional capital." (Mattick 1969:186; see also O'Connor 1981:109) In other words, economic crisis manifests on the *demand side* in the form of a "realization crisis," or "overproduction of capital." (O'Connor 1998:161)

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be most important of the productive forces. The forces of production are, for Marx, thoroughly human."

[47] James O'Connor writes:

> Conditions of production are things that are not produced as commodities in accordance with the law of the market (law of value) but which are treated as if they are commodities, in other words, they are "fictitious commodities" with "fictitious prices." According to Marx, there are three conditions of production: first, human labor-power, or what Marx called the "personal conditions of production"; second, environment, or what Marx called "natural or external conditions of production"; third, urban infrastructure (we can add "space"), or what Marx called "general, communal conditions of production. (O'Connor 1998:243)

In “ecological Marxism”, contrary to “traditional Marxism”, the capitalist mode of production impairs or destroys rather than reproduces its own conditions of production, which in turn undermines overall productivity and production. This eventually leads to an economic crisis, which manifests on the *supply side* in the form of a “liquidity crisis,” or “underproduction of capital.” (O’Connor 1998:161) In sum, in the course of further development of capitalism, conditions of production would eventually turn out to be the limiting factor to capitalism. In other words, nature becomes the “gravedigger of capitalism.”

Critics of O’Connor argue that the theory of “second contradiction” underestimates the capacity of capital to accumulate even in the degraded conditions of production. Capital exploits nature to an extent where it does not create any value for profit (Burkett 2003: 454,455; Foster 2002:11). In fact, capital has been revolutionizing the forces of production, and has been trying to cope with nature’s limits and be less dependent on nature. Development of fiber-optic cables, satellite communications, use of solar energy, wireless electronic equipments, etc., are a few examples to show how the capitalist system develops and uses the newer technologies (such as nanotechnology and synthetic biology) to create conditions where human society is less dependent on natural resources (Dickens 2002:54). In a similar vein, Michael Hardt and Antonio Negri (2000:272) argue that in the age of Empire, capital has reached a stage where it does not need to look for non-capitalist environments to rob or exploit raw materials. They further contend that the passage from imperialism to Empire[48]:

> … centers on a qualitative leap in the technological organization of capital. Previous stages of the industrial revolution introduced machine-made consumer goods and then machine-made machines but now we find ourselves confronted with machine-made raw materials and foodstuffs – in short, *machine-made nature* and machine-made culture. (Hardt and Negri 2000:272; emphasis added).

[48] For a critical discussion on how Hardt and Negri’s conceptualization of Empire differs from classical theories of imperialism, see Kumbamu 2010.

However, the views of Marx and Engels on science and technology have been controversial because of their strong conviction that technology is "a fundamental factor accounting for the growth in resource productivity and man's enlarged capacity to manipulate his natural environment for the attainment of human purposes." (Rosenberg 1976:127) Critics of Marx within the Marxist tradition rejected these views as "productivist," "anti-ecological" and "promethean" (Benton 1989; Grundmann 1991). Over emphasis on the forces of production, as ecological Marxists point out, undermines the sustainability of nature because technology damages the actual "conditions of production" in the process of increasing productivity and "mastering nature."

Contrary to the "ecological Marxist" criticism, Marx explicitly mentions the ecological consequences of capitalist agriculture:

> All progress in capitalist agriculture is a progress in the art, not only of robbing the laborer, but of robbing the soil; all progress in increasing the fertility of the soil for a given time, is a progress towards ruining the lasting source of that fertility…Capitalist production, therefore, develops technology, and the combining together of various processes into a social whole, only by sapping the original sources of all wealth – the soil and the laborer. (Marx 1906:555-556)

Marx explained that it is impossible for human beings to sustain the necessary conditions required for a metabolic harmony between nature and society under the capitalist mode of production, because the capitalist greed of profit sees nature as a gift or an obstacle to its expansion of economic operations. He explicitly states that "rational agriculture" is impossible under modern capitalist conditions. But, to overcome nature's limits, capital continuously revolutionizes the forces of production. In the course of mastering nature by new forces of production, the capitalist system further deepens the rift between society and nature (see Foster 2009).

Against the criticisms of "traditional Marxism," John Bellamy Foster, Paul Burkett and others, following "both the spirit and the letter of Marx"[49] (Burkett 2003:454), have taken up the task of defending or "sustaining Marx." (Salleh 2001)[50] Through their project of reinterpretation of Marx's historical materialism, they rediscovered the concept of socio-ecological metabolism in Marx's writings. Foster boldly states: "Marx's social thought…is inextricably bound to an ecological world-view." (Foster 2000:20)

The concept of metabolic rift developed by Marx and elaborated by Foster (1999, 2000) provides a useful framework to understand nature-society relations. Marx used the concept of "metabolism" to explain the relationship between nature and society in general, and to underscore the potential socio-ecological crises that emerge as a result of the capitalist mode of production in agriculture in particular.

The gist of Marx's ecological thought is that the development of capitalism in agrarian societies creates an "irreparable rift"[51] in metabolism[52] at

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[49] Contrary to the claims of Foster and Burkett, Kovel argues:

> Foster and Burkett consider the original Marxian canon as the true and sufficient guide to save nature from capitalism…However superior it might be, Marx's thought, being a human product, remains time-bound and incomplete. For this reason it becomes most realized when most free, or to use his own expression, 'ruthlessly critical of everything existing.' This would include, needless to say, being critical of itself. Therefore Marxism today can have no greater goal than the criticism of Marx in the light of that history to which he had not been exposed, namely, of the ecological crisis (Kovel 2002: 211).

[50] For critical discussion on Foster's *Marx's Ecology* see Rudy 2001; Panayotakis 2001; Kovel 2001. For defenders of Foster, see Moore 2001, 2001a; Burkett 2001. Although the debate over "Marx's ecology or Ecological Marxism," (the title of symposium hosted by C*apitalism Nature Socialism,* the flagship journal of socialist ecology), contributed to Marxist ecology, it has led to a "kind of academic sectarianism…in the struggle to establish the legitimacy of one or another perspective." (Moore 2001:134)

[51] According to Paul Burkett, Marx used the concept of "rift" "to reveal the alienation of both labor and nature built into capitalism, *as the basis for* an

different scales and levels: (a) between the means of production and primary producers, (b) between society and nature, (c) between town and country, and (d) between colonizer and colonized (Foster 2000:164).

Sociologist Alan Rudy contends that the concept of metabolic rift is useful to understand socio-ecological crises in precapitalist societies only. For Rudy, metabolic rift theory fails "to explore the complexity and unevenness of capitalist agricultural intensification." (Rudy 2001: 57) Rudy's contention indirectly suggests that "metabolic rift" is a concept that could only be applicable to analyze the socio-ecological crises of the "primitive accumulation" phase of capitalism. This assumption raises a related question whether "primitive accumulation" is a particular historical phase/event, or a continuous process.

Karl Marx analyzed the expropriation of the agricultural population in England in the sixteenth century as a ramification of the historical process of the "the so-called primitive accumulation of capital."[53] Marx developed the concept

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adequate materialist *and* class analysis of this system and its crises tendencies." (Burkett 2001:129, italics original)

[52] According to one of the leading biochemists in the early 20th century Lawrence Joseph Henderson (1913), "metabolism is the term applied to the flow of matter and energy and their intermediary transformations within the organism" (quoted in Bing 1971:178). In other words, as Fischer-Kowalski and Haberl (1998:573-574) wrote:

> Metabolism is a biological concept which refers to the internal processes of a living organism. Organisms maintaining a continuous flow of materials and energy with their environment to provide for their functioning, for growth and reproduction. In an analogous way, social systems convert raw materials into manufactured products, services and, finally, into wastes.

Marx was influenced by German chemist and agricultural scientist Justus von Liebig, who first introduced the term "metabolism" in his book "Organic Chemistry and its applications to Physiology and Pathology", published in 1842 (Bing 1971:161).

[53] The three terms in the concept of the "so-called primitive accumulation" have different connotations. Political economist Michael Perelman writes: "The word 'primitive,' first of all, suggests a brutality lacking in the subtleties of more modern form of exploitation…The second term, *accumulation*, reminds us that the primary focus of the process was the accumulation of capital and wealth by a small sector of society." (Perelman 2000:2, emphasis original).

of "primitive accumulation" critiquing Adam Smith's mythical concept of "previous accumulation"[54] and his theorization of the origin of capitalism or commercial society as the result of "the voluntary acts of the participants," which "scrupulously avoided any analysis of social relations." (Perelman 2002:26) Contrary to such assumptions of classical political economy, Marx brilliantly delineated the relationship between the historical processes of the development of the capitalist relations of production and the expropriation of agricultural producers from their means of production (Perelman 2002:26). He argued that the process of primitive accumulation has transformed "on the one hand, the means of subsistence and of production into capital, on the other, the immediate producer into wage labor." (Marx 1965:714) Indeed, it is "nothing less than the historical process of divorcing the producer from the means of production." (Marx 1965:714)

Primitive accumulation of capital is, in essence, not an accumulation of previously created surplus capital, but a process of the creation of the capitalist relations of production and necessary capitalist institutions (Millar 1978:386). This process, however, takes place in different forms at different historical time periods. For instance, in the case of England:

Marx himself mentioned that accumulation in the sixteenth century in England "appears as primitive, because it forms the pre-historic stage of capital and of the mode of production corresponding with it." (Marx 1965:715-715) According to political theorist Ellen Wood (2002:36), Marx prefixed the pejorative term "so-called" to primitive accumulation because:

> Capital, as Marx defines it, is a social relation and not just any kind of wealth or profit, and accumulation as such is not what brings about capitalism. While the accumulation of wealth was obviously a necessary condition of capitalism, it was far from being sufficient or decisive. What transforms wealth into capital was a transformation of social property relations.

[54] Marx used the word "previous" to refer to Smith's word "*ursprunglich*," but Marx translators modified it as "primitive." (Perelman 2000:25) By rejecting the concept of previous accumulation of Smith, Marx cautioned that "this primitive accumulation plays in Political Economy about the same part as original sin in theology." (Marx 1965:713)

> The spoliation of church's property, the fraudulent alienation of the State domains, the robbery of the common lands, the usurpation of feudal and clan property, and its transformation into modern private property under circumstances of reckless terrorism, were just so many idyllic methods of primitive accumulation. They conquered the field for capitalist agriculture, made the soil part and parcel of capital, and created for the town industries the necessary supply of a "free" and outlawed proletariat. (Marx 1965:732-733)

The historical experiences of England suggest that the basic mechanisms of the primitive accumulation of capital are: one, the *commodification* of everything including nature; two, the *privatization* or the enclosure of communal property; three, the *alienation* of labor; and four, the creation of the *social division of labor* between primary producers and capitalist land owners, and between town and country. The underlying aspects of all these mechanisms are: *rift* and *dispossession*. The process of dispossession, according to Marx, is only possible by active support of the state, "by the action of the immanent laws of capitalist production itself, [and] by the centralization of capital." (Marx 1965: 734-737, 762-763)

However, the important issue is whether the concept of primitive accumulation has any relevance for our understanding of the enduring process of the dispossession of primary agricultural producers from their means of production in the age of the "Gene Revolution" and neoliberal globalization? According to Michael Perelman "primitive accumulation is a historical process rather than a mythical event" and it "remains a key concept for understanding capitalism – and not just the particular phase of capitalism associated with the transition from feudalism to capitalism, but capitalism proper. Primitive accumulation is a process that continues to this day." (Perelman 2000:27, 33, 34, 37; Miller 1978:387) Marxist geographer David Harvey agrees with Perelman's proposition (Harvey 2003: 233, n5), and replaces the concept of "primitive accumulation" with the concept of "accumulation by dispossession."[55]

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[55] Harvey writes: "Since it seems peculiar to call an ongoing process 'primitive' or 'original' I shall, in what follows, substitute these terms by the concept of 'accumulation by dispossession'." (Harvey 2003:144)

Harvey proposes "a general reevaluation of the continuous role and persistence of the predatory practices of 'primitive' or 'original' accumulation within the long historical geography of capital accumulation." (Harvey 2003:144) He emphasizes that the mechanisms of the processes of primitive accumulation and accumulation by dispossession are more or less similar; but in the age of neoliberal globalization, the old methods of dispossession have been modified, and a few ones have been invented in order "to play even stronger role now than in the past." (Harvey 2003:147, 148) The new mechanisms have been created "in the name of neo-liberal orthodoxy" under the tutelage of international financial institutions such as the World Bank, the International Monitory Fund, and the World Trade Organization (Harvey 2003: 147, 148). Harvey identifies four major mechanisms of accumulation by dispossession: privitization, financilization, the management and manipulation of crises, and state redistributions (Harvey 2003, 2006, 2007). These cutting-edge mechanisms have intensified and broadened the scope of the process of the endless accumulation of capital in the era of neoliberal globalization.

Harvey argues that the capitalist system can overcome the problem of underconsumption (as Rosa Luxemburg first theorized) "by reinvestment which generates its own demand for capital goods and other inputs." (Harvey 2003:139) For Harvey, in the present capitalist system, the "overaccumulation of capital" and "the lack of opportunities for profitable investment" are the key problems. In order to resolve these major problems, global capitalism searches for, or creates, new avenues not only for trade to solve the problem of underconsumption, but also for capital investments to solve the crisis of overaccumulation. By using various mechanisms at its disposal, global capitalism as represented by imperial states and multinational corporations creates new profitable avenues, which provide cheaper inputs – natural as well as human resources – and a flexible regulatory environment. In this process, imperial states use their economic as well as extra-economic power (i.e. military power) to indirectly govern the new avenues through a comprador bourgeois class and a subordinate state system (Harvey 2003:139; 2006).

In this age of "new imperialism," the process of dispossession occurs at a variety of social avenues and geographical scales. This happens both in the "inside" (i.e. the core) as well as the "outside" (i.e., the periphery) of the capitalist world system. But the scale and degree of the manifestation of dispossession may vary based on the position of a nation-state in the global economy. According to Giovanni Arrighi (2004:531), "the more developed capitalistically a state is…the greater the difficulties involved in practicing it [dispossession] at home, and the greater the incentives and the capabilities to practice it abroad." Therefore, "it is certainly the case that some of its most vicious and inhuman manifestations are in the most vulnerable and degraded regions within uneven geographical development." (Harvey 2003:173)

While highlighting the analytical importance of the concept of primitive accumulation, Harvey criticizes Marx for limiting its scope in constructing the general theory of capital accumulation. He argues that Marx shares "certain crucial initial assumptions" with classical political economy, which "relegate accumulation based upon predation, fraud, and violence to an 'original stage' that is considered no longer relevant or, as with Luxemburg, as being somehow 'outside of' capitalism as a closed system." (Harvey 2003:144). But Ellen Wood (2006:21) disagrees with Harvey and argues:

> The point is not that he [Marx] relegated 'accumulation based upon predation, fraud, and violence' to an 'original stage' but that this kind of accumulation, to the extent that it remains an essential feature of capitalist imperialism, has a new logic, which is a consequence and not a cause of a dynamic specific to capitalism.

Wood (2006:21) further argues that accumulation by dispossession is "not simply a matter of repeated exercises in the seizure and concentration of wealth but, more fundamentally, of the continuing imposition, maintenance and intensification of market imperatives." She criticizes Harvey's conception of accumulation by dispossession because it does not emphasize the transformation of social-property relations, which, in fact, create market imperatives. Harvey rather focuses on different functional mechanisms of the process of capital overaccumulation (Wood 2006:23). Thus, accumulation by dispossession creates favorable conditions for endless accumulation of capital, but does not become a dominant form of accumulation compared to expanded production (Brenner 2006:102; Fen 2006).

Political scientist Nancy Hartsock (2006) while generally agreeing with Harvey on reviving the concept of primitive accumulation, criticizes that the gender dimension of the accumulation of capital has been neglected in the theorization of accumulation by dispossession. She further argues that either primitive accumulation or accumulation by dispossession "is not gender neutral but is built on the backs of women." (2006:187) Therefore, gender dimension must be included in the analysis of accumulation of capital at any historical moment. In fact, the process of accumulation by dispossession is not restricted to the sphere of material production, but it also happens in the sphere of socio-cultural production and reproduction, which includes gender, ethnicity, aboriginality, racism, subalternities, identities, and local knowledge systems. Acknowledging these epistemological limitations of Harvey's concept of accumulation by dispossession, I use this concept in my thesis to examine how the forces and mechanisms of the new imperialism reach and operate in local agricultural systems, create a metabolic rift, and dispossess millions of agricultural producers from their means of production.

In addition to the differences among Marxists on the ecology question, ecofeminists fiercely attack ecological Marxism for its sole emphasis on class and nature contradictions neglecting the role of gender in ecological politics (Salleh 2003). A topic I will return to discuss in my analysis of the adoption of GM crops and its implications for the dispossession of women knowledge and bargaining power in Indian context.

Ecofeminism and Feminist Environmentalism

Many feminist scholars have conceptualized the relationship between woman and nature in various ways. Ecofeminists argue that in terms of exploitation woman and nature are identical, and by innate qualities of women they have special relationship with nature; but "capitalist patriarchy" destroys the sacred relationship between them (Shiva 1993:164; Also see Philip 2001; Merchant 1981, 1989; Plumwood 1993; King 1989). According to Vandana Shiva, western development models rely only on modern western knowledge systems, which marginalize and disqualify non-western knowledge systems. Based on this assumption, Shiva creates a "magic identity": "development = modernization = Westernization." (Shiva 1991:233) She further argues, "reductionist science", which is the foundation for western development models, "is a source of violence against nature and women, in so far as it subjugates and dispossesses them of their full productivity, power and potential." (1993:24). In other words, for Shiva, "anything that is violent to nature causes violence to women, and vice versa." (Nanda 2003:226) A few other ecofeminists also share similar views: the origins of domination of women and nature are rooted in "the Enlightenment and the (Western) scientization of society…" (Goldman and Schurman 2000:571; see Shiva 1993a; Mies & Shiva 1993; Merchant 1980, 1992).

According to Shiva (1993:168, emphasis added):

> In most cultures women have been the *custodians of biodiversity*… [which] is ecologically and culturally embedded. Diversity is reproduced and conserved through the reproduction and *conservation of culture*, in festivals and rituals which not only celebrate the renewal of life, but also provide a platform for subtle tests for seed selection and propagation.

In an essentialist and functionalist manner, Shiva further contends: "when women conserve seed, they conserve biodiversity and therefore conserve balance and harmony." (Shiva 1993:168-169) There are several problems with this kind of generalizations about women-nature relationships. First, Shiva considers women as a homogenous category; she does not pay attention to caste and class dynamics in women-nature relationship. Particularly, in Indian context, women of *dalit* (oppressed castes or so-called 'untouchables'), *adivasis* (aboriginal or indigenous people), and *bahujans* or *sudras* (so-called 'backward castes') social categories constitute a major portion of the total agricultural labor force (Da Corta and Venkateswarlu 1999). Predominantly, women belonging to these subaltern sections engage with nature everyday as part of the gendered division of labor in a household environment. Indeed, they are the "custodians of biodiversity."

On Shiva's suggestion for the "conservation of culture," whose culture has to be conserved in order to preserve biodiversity? For example in India, whether dominant *brahmanical*[56] culture or subaltern *dalitbahujan* culture has to be conserved. I would argue that the conservation of dominant *brahmanical* culture will not help the conservation of biodiversity because *brahmanical* culture appreciates the ideological and aesthetic dimensions of *prakriti* (or nature), but not its materialist dimension. A simple explanation for this is that *brahmanical* culture does not value labor interactions with land or nature, and labels *dalits*, who work with soil and nature every day, as "untouchables." She does not explain why and how do women have special relationship with nature? Is it women's innate nature to conserve and celebrate biodiversity, or protect the environment in which they live? Or, is it because of socio-cultural conditions that shape the relationship between men, women and nature? Neither Shiva, nor her intellectual collaborators in ecofeminist perspective, consider these questions in the critique.

In contrast to Shiva and her followers, Sinha et al (1997:79) based on their fieldwork in Himalayan forests argue: "Not nature per se, but women's sense of 'need' and 'responsibilities' , and the property institutions that regulate their fulfillment, are important in determining the way in which they approach the

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[56] *Brahmin* is priest caste group, which stands at the apex of the hierarchal caste system. They keep their traditional authority by imposing dominant cultural values on the rest of society in order to keep hierarchy and inequality intact. Critical *dalitbahujan* scholars consider *brahmanical* culture a culture of domination and exploitation (See, for example, Ilaiah 2005).

issue of their rights, responsibilities and relationships towards nature." In their study they conclude that "women in 'traditional' societies are not only 'embedded in nature', but also embedded in social and gender relations that were and are, firstly, relations of dominance and subordination." (Sinha et al 1997:79; see also Cochrane 2007)

Contrary to the populist and spiritualist notions of ecofeminism, feminist environmentalists argue that "women's and men's relationship with nature needs to be understood as rooted in their material reality, in their specific forms of interaction with the environment." (Agarwal 1992:126; see Seager 2003) Feminist environmentalist Bina Agarwal (1992:146) argues that feminist environmentalism provides a theoretical framework that "locates the symbolic and material links between people and the environment in their specific forms of interaction with it, and traces gender and class differentiation in these links to a given gender and class division of labor, property and power." She further argues:

> The link between women and the environment can be seen as structured by a given gender and class (/caste/race) organization of production, reproduction, and distribution. Ideological constructions such as of gender, of nature, and of the relationship between the two, may be seen as (interactively) a part of this structuring but not the whole of it. (Agarwal 1992: 127)

Feminist environmentalists reject the equations: "women = nature" and "men = culture," and argue that the nature-society relations, environmental knowledge and the knowledge of agroecological system are gendered and stratified among women by class and caste. Gender, caste and class relations are vital in understanding access to resources, institutional support for better use of resources, and vulnerability in cases of ecological risks (Agarwal 1992, 1994; Leach 1991, 1994).

Analytical Framework of the Thesis: Agrarian Political Ecology

In this thesis I argue that the debate about the new agricultural technologies (e.g. GM seeds), the environment and agrarian crises should not be narrowed to the question of new technologies *per se.* Rather it should be understood from an agrarian political ecology perspective articulating *political economy* (neoliberal governance at global, national and provincial levels, and the processes of dispossession of primary agricultural producers from their means and conditions of production), *socio-cultural* systems (the construction of hegemonic discourse about GMOs, agricultural deskilling, gender relations), and *ecosystems* (a process of mastering nature, monoculturization, environmental risks, metabolic rift) in the context of neoliberal globalization.

Biotechnology as Neoliberal Governance and Dispossession

I agree with the premise that science and technology do not function as independent variables, rather function as dependent variables in the capitalist system, "which creates enormous incentives for the generation of technological change" in order to intensify capital accumulation and to maintain the political status quo (Rosenberg 1976:127). In fact, science and technology operate in a given economic, socio-cultural, political, and physical environment, and, their consequences are never neutral. Science and technology "reflect the class [and socio-cultural] relations of society in which they originate or are employed." (Deo and Swanson 1990:607) Thus, the technological choices are always political choices (Altieri 2002: 619), and, the understanding of technological changes depends on the political-ideological lenses through which one perceives them.

From the "Green Revolution" to the "Gene Revolution," the proponents of new agricultural technologies advocate that new technologies are "need-driven," "sustainable," "humane," and "neutral" – beneficial for the small and big farmers alike. But the diffusion of new technologies commodified farm inputs that led to dependency of farmers on the market for capital, information, and inputs. Therefore, the ultimate aim of the developers of the new agricultural technologies in promoting them on a colossal scale is to replace the household-based farming system with the market-dependent agricultural system. To achieve this aim, new technology is used as an instrument to control the most important means of production in farming – seed. As long as small and peasant-farmers collect and save seeds from their own fields for future use, there is little chance for capital to commodify the seed once and for all. The natural characteristics of "the seed constitute a biological barrier to its commodification." (Goodman and Redclift 1991:92) For global capital, it is essential to commodify farm input as well as output in order to penetrate in and control Third World agriculture (Buttel 1990:115). To this end, biotechnology has been chosen to make the means of production (seeds) into essential commodities on the one hand; and the patent system has been adapted to safeguard corporate profits on the other. In other words, the corporate sector has been using both biological as well as judicial mechanisms to tighten its grip over global agriculture (see Goodman and Redclift 1991: 90-93). Commodification of seed and control over its reproductive capacity through technological intervention has severe implications for the nature-society relations on the one hand; local or practical knowledge embedded in the socio-cultural systems on the other. Moreover, control over seed allows the seed industry to decide what the farmer has to grow, how to grow, when and how to harvest, where to sell, and finally what to eat. Therefore, it is not just that the technology is packaged into the seed, but the whole 'technocratic formula' is packaged into the seed.

As I argued in chapter two, with the advent of GM seeds, there has been a growing trend of the commodification of both agricultural inputs and outputs, the consolidation of the seed industry, and the monopolization of research and development. New technocratic mechanisms have been used as an instrument to perpetuate the commodification of agricultural inputs and outputs. Research and development of new seeds has been privatized and the global germplasm commons have been appropriated. All these processes have deepened socio-ecological contradictions, accelerated the dispossession of primary producers from their means of production in the global South as well as North (see chapter four and five), increased inequalities in an agrarian society, and reinforced dependency relations between the countries that develop the new technologies and the countries that adopt them.

In the context of asymmetrical global power relations, a few MNCs now decide the fate of global agricultural primary producers and the sustainability of agriculture. Particularly, in the age of the "Gene Revolution," biotechnology has become a new tool in the hands of imperial forces to have more control over one of the important means of production of the farmers, the seed, and thereby control over agriculture and millions of farmers across the globe. Thus I see the GM phenomenon as a continuing pattern of corporate control and governance over the agri-food production and consumption systems. This approach explores how corporate GM discourses reduce deeper politico-economic, socio-ecological and ethical problems to technological issues and solutions, and how larger neoliberal processes have legitimated the penetration of GM products by restructuring global and national agricultural institutions, legal systems and public discourses. In this thesis I analyzed how all these methods of dispossession in the age of the "Gene Revolution" have further deepened the separation between nature and society.

Biotechnology as a Metabolic Rift

For Foster (2000), the metabolic rift process started with the Industrial Revolution in the nineteenth century, but Moore (2000) disagrees and argues that it started in the transition from feudalism to capitalism in the sixteenth century (See also Schneider and McMichael 2010). Rather than focusing on an abstract analysis of the origin of the metabolic rift process, I examine and analyze whether it has any relevance for our understanding of socio-ecological crises in agriculture in the age of the "Gene Revolution." I also analyze how the metabolic rift operates in different forms in different modes of production – a capitalist agricultural system in Canada and a semi-feudal agrarian system in India – and how the rift process at the local level is connected to the global process of accumulation by dispossession.

Sociologists Mindi Schneider and Philip McMichael (2010:474) challenge Marx's analysis of materials and mechanisms involved in the metabolic rift. They argue that "Marx built his theory on a specific source of nutrients (humanure) and a specific nutrient pathway (soil-grain-human-soil) that are of only limited use ecologically." They further argue that "in farming, there are a number of practices that enhance soil structure, build soil organic matter (SOM), and maintain soil fertility. Marx's myopic focus on the role of a single practice – incorporating human waste into crop fields – is inadequate as an explanation of the overall decline in soil fertility as observed in his time." (Schneider and McMichael 2010:471). I agree that this limitation is applicable to the original formulation of the concept, but many environmental sociologists have further developed it and extended the scope of its application (see, for example, Foster 2000, Moore 2000, Clark and York 2005). In this thesis, I explored and analyzed various forms of metabolic rifts caused by the commercialization of agriculture from the "Green Revolution" to the "Gene Revolution": the destruction of the process of the recirculation of natural nutrients, such as nitrogen, phosphorus and potassium, by introducing fossil fuel based fertilizers and pesticides; the erosion of biodiversity by promoting monoculturization; the creation of market dependency for human and farm animal survival by undermining ecological goods and services such as the availability of groundwater, local food supply, fresh air, fodder, waste absorption, and soil conservation practices; and the attrition of local knowledge systems by imposing global scientific knowledge systems. In this thesis, based on my empirical analysis, I argue that the "Gene Revolution" has intensified all these rift processes.

Although the metabolic rift analysis provides a useful analytical framework for the analysis of the socio-ecological implications of the "Gene Revolution," it neglects non-economic factors such as socio-cultural systems, local knowledge, gender, and ethnicity.[57] As Marx observed, humans interact

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[57] Schneider and McMichael (2010:477) also point out that "by focusing solely on the material aspects of human-nature relations, the metabolic rift concept ignores a rift in the production and reproduction of knowledges."

with nature through labor (Foster 2000:155-157). But labor interacts with nature through local knowledge systems, which are embedded in everyday socio-cultural practices of people. Thus I incorporate socio-cultural systems into my analytical framework to better understand the implications of the "Gene Revolution" for gender relations, local knowledge systems, and socio-cultural meanings of nature and agriculture.

Biotechnology as Hegemony and New Episteme

In the debate about GMOs, the social construction of legitimacy of GM science and technology as an efficient tool of sustainable development and societal wellbeing plays very important role. For proponents, the major purpose of this discourse construction is to make GM technology commonsensical to farmers and consumers in order to build societal consent and acquire legitimacy on the one hand; to "reinforce dominant framings of issues" in the debate on the other (see Newell 2009). Political economist Adam Morton (2007:113) argues that hegemony "appears as an expression of broadly based consent, manifested in the acceptance of ideas and supported by material resources and institutions which is initially established by social-class forces occupying a leading role within a state but is then projected outwards on a world scale." (See also Newell 2009:40) Although the global forces of GM technologies produce and diffuse a global discourse to construct consensus at global level, they contextualize it according to local politico-economic and socio-cultural settings, and use local agents, institutions and resources to implement hegemony at farm and community level. In other words, the state and corporate technological elites reproduce "bio-hegemony" using different socio-legal institutions, administrative systems, and information and communication technologies at every stage of the journey of GM products from the laboratory to the point of consumption. As I show in this thesis, the imposition of global hegemonic knowledge on local knowledge results in skill restructuring – deskilling, reskilling and enskilling – and the dispossession of farmer control over agricultural production.

According to Vandana Shiva (2001:69), for the farmer, the seed "is not just merely a source of future plants/food; it is the storage place of culture, of history." The seed is the storehouse of local farming knowledge systems. Local knowledge systems in peasant agriculture include knowledge of the physical environment, biological folk taxonomies (or classification systems), best farming practices, and the experimental nature of all this knowledge (Altieri 1990: 553). The selection, collection and preservation of seeds, and their use according to geo-physical or agro-climatic conditions, is an accumulated knowledge source passed on through generations (Sillitoe 1998:229).

Acquiring, retaining, and sharing of the local knowledge of nature and production processes constitutes the nub of agricultural skilling. In agriculture, the process of agricultural skilling is one of the key aspects in socio-ecological sustainability. Moreover, such local knowledge systems are not owned by any private individual or company, but are developed as a collective knowledge system. The sharing of collective knowledge promotes interdependency among the farmers and binds them together and fortifies their social relations. Furthermore, preserving local knowledge through socio-cultural practices reproduces and enhances the intimate interaction between the primary producer and nature. Indeed, one's expertise in the practical knowledge of agriculture boosts one's self-esteem, enhances one's social status and improves one's bargaining power within the locality, because this knowledge is embedded in everyday socio-cultural practices that provide social status.

In a community where the farmers save and share the seed, the interdependent community relations act as "social channels for moving the information" in the "skilling" process of future generations (Stone 2002: 619). But when the seed becomes a commodity in the external relations of a community, it also becomes, by extension, a commodity in the internal life of the community. Commodification makes the "skilling" process obsolete, and could eventually lead to the weakening of community relations. For that matter, commodification of anything in a community dismantles the existing social relations around it, and creates new social relations that reinforce further commodification of other things in the community. But this is not an irreversible process. There are lots of instances where communities challenge the process of commodification and build social economies in the community (see chapter 6).[58]

Seed commodification makes the farmer a passive recipient of knowledge because where farmers cannot use their collective knowledge system to develop new seed, the attrition of local varieties leads to the deskilling of the farmers (Stone 2002: 619). Because they are the keepers of biodiversity, the experts on local landscapes and waterscapes, the everyday interactants with nature, and the organic environmentalists, who know the art of living by maintaining sustainable relationships with nature, the process of dispossessing farmers of their agricultural knowledge is an unsustainable one, according to some critics, with severe socio-ecological implications. Thus the diffusion of global knowledge systems such as biotechnology is neither neutral nor banal. It dispossesses local knowledge systems and widens the rift between primary agricultural producers and nature. As I discuss in chapters four and five, it also affects social status and bargaining power in intra and extra-household environment because local knowledge embeds in everyday socio-cultural practices which provide value system to social status.

Political scientist and anthropologist James Scott uses the term "métis" to refer to "local knowledge" or "practical knowledge,"[59] and explains why we should protect it against the imposition of "imperial knowledge"— "epistemic knowledge"/ scientific knowledge. For him:

> Métis, as far from being rigid and monolithic, is plastic, local, and divergent. It is in fact the idiosyncrasies of métis, its contextualness, and its fragmentation that makes it so permeable,

[58] For several examples of community-led and state-initiated decommodification processes, see Laxer and Soron 2006.

[59] James Scott carefully avoids the terms "indigenous" or "traditional" knowledge because they carry negative connotations. Scott argues "'local knowledge' and 'practical knowledge' are better, but both terms seem too circumscribed and static to capture the constantly changing, dynamic aspect of métis." (Scott 1998:424)

> so open to new ideas. Métis has no doctrine or centralized training; each practitioner has his or her own angle.

He further argues that the "elimination of métis" or "de-skilling" is a precondition to disciplining workers and primary producers, and for making profits (Scott 1998:335-336). I agree with Scott, however, the issue of farmer deskilling must be understood in the context of a wider debate about "accumulation by dispossession" and the metabolic rift.

Conclusion

In this chapter I developed an analytical framework of *agrarian political ecology* by way of a critical review of major theoretical positions in development studies, environmental sociology, and globalization studies pertaining to science and technology transfers. The three major components of my framework (i.e. dispossession, metabolic rift, and hegemony) allow us to ground the global process of GM seed production and distribution, and its socio-ecological implications for farmers in different local contexts.

In the case of the diffusion of new agricultural technologies, various actors, institutions, states and corporations are involved at different levels. To better understand the implications of these new technologies for the socio-ecological crises in different localities (the cases in Alberta and Andhra Pradesh) of the global economy, we should examine the relationship between: (1) global forces and processes (supranational institutions and their imposition of neoliberal polices, imperial states and their role in restructuring the global agri-food system, MNCs, and the patent system); (2) the role of state (implementation of regulations, policy reforms, providing infrastructure and security for foreign capital, and engaging in trade agreements and international treaties) and comprador bourgeoisie at the national level; and (3) the factors that influence farmers to adopt or resist new technologies, and the role of non-governmental and civil society groups in building countermovements at local and regional levels. Agrarian political ecology allows us to address these politico-economic, socio-cultural and environmental issues at different levels. With this framework, I argue that the materialist understanding of socio-ecological crises is incomplete if we do not incorporate everyday socio-cultural experiences of nature into our analysis. The understanding of the socio-cultural meanings of nature along with global political economy helps us “translating distant particularities into shared experiences,” (Gismondi 2006:153) and thereby provides new avenues for struggles against global capitalism.

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Chapter 4

Dispossession and Metabolic Rift in Indian Agriculture: The Dynamics of Adoption and Abandonment of Genetically Modified Cotton in Kadavendi, a South Indian Village

Introduction[60]

Critical scholars of Indian agriculture argue that the introduction of the "Green Revolution" in the mid-1960s created a "commercial revolution" in the countryside by making agricultural inputs (such as land, labor, and technology) as well as outputs into essential commodities (Griffin, 1979; Patnaik, 1990). Consequently, this process of commodification created a market-dependent farming community, and sharpened both socio-ecological and regional contradictions, accelerating differentiation in the peasantry. In a treadmill fashion, the changing agrarian structure and associated asymmetrical power relations widened the spread of the new technologies (Byres, 1981; Cleaver, 1972; Dasgupta, 1977; Griffin, 1979; Harriss, 1982).

Until the late 1980s, the Indian state actively supported the diffusion of the new technology package by subsidizing fertilizers, seeds, power, and irrigation. Since embarking on the path of economic liberalization in the early 1990s, however, revenue expenditure on agriculture and rural development by the Indian state has declined. Investments in public agricultural research and extension, spending on irrigation and infrastructure development, the public distribution system of foodgrains, and farmer credit facilities have all gradually waned. Import and export restrictions on almost all agricultural commodities have been removed. Neoliberal economic policies facilitated the deeper integration of farm communities into the global economy, and have gradually withdrawn the state from effective regulation of the agricultural input sector and commodity prices. Deregulation has resulted in rising input costs and a price collapse in agricultural commodities. A major agrarian crisis is occurring. In its

[60] This section is a part of my paper published in the journal *Capitalism Nature Socialism*, see Kumbamu 2006.

extreme form, the crisis reveals itself in mounting farmer suicides (Rao, 2005, Shiva, 2005). As official data show, one hundred fifty thousand farmers committed suicide across the country between 1997 and 2005. On average, one farmer committed suicide every 32 minutes, and 45 farmers every day for 9 years! (Sainath, 2007) Unfortunately, this sad phenomenon has been continuing.

Agricultural policies and institutions in general, and seed policies in particular, have been gradually restructured as part of neoliberal economic reforms according to changing global dynamics. Table 4.1 presents the gradual policy reforms in the Indian seed sector from 1966 to the present day. The objective of these reforms was to provide better quality seed to farmers in order to increase production at the national level. However, the policy reforms also removed hurdles that prevented multinational agribusiness corporations from entering the Indian seed sector and facilitated the growth of the private sector in research, development and distribution. They also made seed-saving and exchange by farmers illegal and replaced indigenous seed varieties with corporate seeds.

The private sector share of the seed industry jumped from 20 percent in 1981 to 76 percent in 2001. Similarly, the value of the seed market more than doubled from Rs.10 billion in 1994-95 to Rs. 22 billion in 1998-99. While the share of the organized seed supply by private firms increased from 35 percent to 60 percent, the public sector seed supply fell from 40 percent to 25 percent. During that same time, the share of the unorganized/informal seed sector dropped from 25 percent to 15 percent (Chaturvedi 2002:16-17).

Biotechnology boosted the already lucrative agricultural input industry, and mergers, acquisitions and other strategic alliances have been increasing. Almost all of the major Indian seed companies have collaborated with foreign partners to get access to the new patented technologies (Pray, Ramaswami and Kelley 2001:596). As private companies pump money into research and development of "high quality" seeds, it is expected that they will sell their seeds at a higher price in a monopolistic market situation. Already there are glimpses of this at work. In India, Mahyco-Monsanto currently selling Bt cotton for Rs. 750

(it was Rs.1, 600-1,800 until 2006) per packet compared to Rs. 350-500 for non-GM hybrid cotton.

Besides increasing the presence of private firms in the seed sector, the new seed policies resulted in the development of commercial non-food crops in place of traditional food crops that, along with an emphasis on high yielding varieties, meant greater use of fertilizers and pesticides (Rao 2001:3455-3458; Ramaswami 2002:417-429; Choudhary and Laroia 2001:925-927). Against this background, Bt cotton was introduced into India in 2002 with claims that it would reduce consumption of pesticides and insecticides as well as the environmental problems associated with these biocides, because the plant itself acts against the "bollworm complex." Bt cotton became championed as one solution to the growing number of cotton farmer suicides in India.

Introduction of Bt Cotton

Cotton is one of the ancient and principal crops in India and considered the "King of Crops" and the "White Gold". India, the third biggest cotton growing country in the world, cultivates around 8-9 million hectares per year. India is the second biggest cotton consumer in the world, but occupies the third position in terms of production. More than 60 million people, directly or indirectly, depend on cotton for their livelihood. Revenues from cotton constitute around 30 percent of the gross domestic product of Indian agriculture (Barwale et al 2004:23). Considered spatially, the total area grown under cotton in India accounts for approximately 25 percent of the world's total cotton area, while India's total cotton production accounts for 14 percent of the world's output. But in terms of yield, India remains the lowest averaging only 52 percent (300 kg/ha) of the world average yield of 580 kg/ha (Bennett et al 2004:96). Pest menace is one of the main reasons for the low productivity. Major pests that heavily damage cotton are insects (particularly *Helicoverpa armigera*, commonly called American bollworm) and sucking pests such as aphids, whiteflies and jassids. As Monsanto-Mahyco Biotech (MMB) claims, Bt cotton was developed specifically to target American bollworm and reduce crop damage. Bt cotton was commercially released in India in 2002.

Table 4.1: Seed Policy Reforms in India: An Outline

Seed Policy	Objective
The Seed Act (1966)	Provided a statutory body that regulates the release of new varieties, seed certification, and seed testing.
Seed Control Order (1983)	Placed seeds of all food crops, fruits, vegetables, cattle fodder and jute on the essential commodities list, and regulated the quality of seed production and distribution.
New Policy on Seed Development (1988)	Liberalized the seed sector and facilitated the entry of local and foreign private sector companies into seed research, development and marketing. Also, relaxed constraints on seed imports.
Plants, Fruits and Seeds Order (1989)	Permitted unlicensed imports of seeds and planting material, including vegetables, flowers and ornamental plants.
Protection of Plant Varieties and Farmer's Rights Bill (2001)	Provided a right to farmers to sell, use, and exchange, their farm produce including seeds from varieties protected under this Act in the same manner as they were entitled to before the enactment of this Act. However, it prohibited farmers from selling branded seed of a variety protected under this Act.
National Seed Policy (2002)	Allowed imports and exports of seeds from all crops. Opened the seed supply to agribusiness giants.
The Seed Bill (2004)	Made seed registration mandatory for farmers wanting to exchange or sell their saved seed for agricultural purposes. Thus, this bill made the historical practice of seed saving and exchange by farmers illegal. This Bill also enlarged the scope of agriculture by including horticulture, forestry and the cultivation of plantation, medicinal and aromatic plants. Under the 1966 Seed Act, "agriculture" included only horticulture.

Source: Compiled by the author

The earliest efforts to introduce Bt cotton into India began in 1990 when Monsanto approached the Indian government through the Department of Biotechnology (DBT) for permission to test the new variety. In 1993, the Indian government rejected Monsanto's proposal on two grounds: (a) the technology transfer fee was very high, and (b) Bt cotton seeds containing the *Cry1Ac* gene were not yet approved in the U.S. Indian agricultural officials did not feel that there was enough field experience with the new genetically engineered American variety to anticipate the results of backcrossing it into a local variety (Scoones 2003: 7; Bharathan 2000:1068; Ghose 2001:323).

Two years later, however, the government of India decided to allow Bt cotton seeds into the country by permitting a business deal between Mahyco (Maharastra Hybrid Seed Company) and Monsanto, an arrangement that avoided enormous public expenditures for the technology transfer fee (Bhatia 2001:321-322; Ghose 2001:323). In 1996, Mahyco imported 100 grams of transgenic Cocker-312 cottonseed, which contains the *Cry1Ac* gene from Bt. Between 1996 and 1998, Mahyco developed three Bt cotton seed varieties from the imported transgenic seeds: MECH -12, MECH-162, and MECH-184.

Monsanto considered Mahyco, one of the oldest and largest seed companies in India, a "good vehicle" to enter the Indian seed market,[61] and in May 1998, they bought a 26 percent share of the firm by paying 24 times the market rate. The two companies formed a 50:50 joint venture in 1998 establishing Mahyco-Monsanto Biotech Limited to produce and market genetically modified Bt cotton in India (Shiva 2001:81). That same year Mahyco-Monsanto received permission from the Review Committee on Genetic Manipulations (RCGM) in the Department of Biotechnology to conduct field trials in 40 plots covering 5.164 hectares in nine states (Barwale 2001: 325).

In response to the growing opposition to GM crops, in 1998 the Indian government banned Terminator technology (Barwale 2001:325; Cohen 2004: 1567). Both the Indian government and the company repeatedly asserted that Bt cotton did not contain Terminator genes (Bharathan 2000:1070). However, farmers' organizations alleged that seed tested in field trials contained Terminator

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[61] Commenting on the partnership with Mahyco, Jack Kennedy (Monsanto's director of Product Development and Applied Genetics) said: "We propose to penetrate the Indian agriculture sector in a big way. Mahyco is a good vehicle." (Quoted in Shiva 1999: 601)

technology (De la Perriere and Seuret 2000:63). Reviewing the results of the first trials, the RCGM suggested another eleven field trials in 1999. During these field trials, the company had conducted biosafety assessments that included studies on pollen escape, also known as gene flow or "out-crossing," the effects on non-target organism, toxicity, allerginicity, aggressiveness and wildness, and confirmation of the absence of Terminator genes.

Based on "totally confidential" data from the field trials, in July 2000, the Genetic Engineering Approval Committee (GEAC), constituted and chaired by the Ministry of Environment and Forests, permitted Mahyco-Monsanto to conduct seed production on 150 hectares, and large-scale field trials on 82 hectares at 395 locations in seven central and southern states (Barwale 2001:325; Qaim 2003: 2117). After reviewing the results of these field trials, on March 26, 2002 GEAC announced that the performance of Mahyco-Monsanto's Bt cotton was "satisfactory" and formally approved commercial release and cultivation for three years in six states: Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, and Tamil Nadu (Barwale 2001; Dhar 2001:19-21; Newell 2003; Orton 2003; Scoones 2003).

With the commercial release of Bt cotton, in May 2003, the Indian Government set up the Task Force on Application of Biotechnology in Agriculture, headed by M.S. Swaminathan, to formulate a draft policy framework governing the use of agro-biotechnology. In its May 2004 report to the Ministry of Agriculture, the taskforce recommended replacing the existing three-tier approval process for GM crops[62] with a one-step approval process to speed the commercial release of subsequent GM crops. The report recommended the establishment of an autonomous regulatory body, the Agricultural Biotechnology

[62] In the first tier, the Institutional Biosafety Committee assesses the research proposals and decides whether to approve or reject it. In the second tier, the Review Committee on Genetic Manipulation (RCGM) permits limited field trials and assesses them for farm health and environmental safety. In the third tier, the Genetic Engineering Approval Committee (GEAC) conducts a more detailed environmental impact assessment, recommends multi-location field trials, and then decides whether the variety will be approved for commercial release.

Regulatory Authority, to separately handle biosafety issues pertaining to GM crops (Bagla 2004:1579).

Even though the state created regulatory institutions, it is doubtful whether they functioned effectively and transparently. For example, in June 2001, representatives from Monsanto and the Ministry of Environment met with a number of independent scientists and farmers organized by Greenpeace (a New Delhi based NGO affiliated with Greenpeace International), to discuss the implications of Bt cotton. Neither Monsanto nor the government provided any scientific evidence to questions raised by Greenpeace. Similarly, in November 2002, Gene Campaign, a New Delhi based NGO headed by Suman Sahai, filed a lawsuit in the Delhi High Court charging that the field trials conducted by Monsanto were "unscientific." They argued that the company did not follow appropriate monitoring, evaluation and precautionary procedures. The government rejected these claims and insisted that Bt cotton was safe, but drew its conclusions from confidential data.[63] The state ignored civil society organizations' demands that the state and Monsanto be democratic and transparent in conducting the field trials. The closed approval processes that Bt cotton underwent in India reflects a global process identified by scholars of neoliberal globalization of how the bourgeoisie state apparatus operates within the logic of global capital, especially how the state restructures its institutions and reforms its policies, and even peer reviewed process of science to facilitate the expansion of markets.

In India, seed companies and their agents commonly sell seeds, fertilizers and pesticides that are not what they claim to be. For example, not all Bt cotton seeds are labeled as such; or the seeds might be an unapproved variety. Pesticides and fertilizers are considered "spurious" if their quality is diluted and fake brand names are used. In the Warangal district as well as in the state of Punjab and Haryana, the pesticides that cotton farmers were spraying were also found to be spurious. A series of studies linked the spraying of substandard pesticides to crop

[63] See http://www.makingindiagreen.org/btcotton.htm. Accessed on April 02, 2005.

failure and subsequent cotton farmer suicides (See, for example, Qayam and Sakkahari 2004)

Spurious Bt cotton seeds were sold in Gujarat by an Ahmedebad based seed company, Navbharat Seed Pvt. Ltd, that surreptitiously introduced unapproved Bt cotton seeds under a pseudo-brand name Navbharat 151 had been registered with the Department of Agriculture of Gujarat in 1998. It was discovered that around 500 farmers planted this unapproved variety of Bt cotton on approximately 10,000 acres after several adjoining fields with conventional hybrid cotton were devastated by a major bollworm attack (Cohen 2004:1567; Jayaraman 2001:555; Scoones 2003:9). The same unapproved variety had been planted in Gujarat and other states for two years and is believed to have devastated large tracts of crops. Following the discovery of the Navbharat 151 plantings, the GEAC directed the State Biotechnology Coordination Committee of Gujarat to destroy the standing crop. However, a rich farmers' lobby succeeded in stopping the State government of Gujarat from destroying the crop. Such class pressure to overlook the illegal selling of Bt cotton raises doubts about the effectiveness of regulatory mechanisms and the government's capacity and commitment to control the selling of spurious seeds, fertilizers and pesticides.

Such contradictions in the "Gene Revolution" as it is occurring in India, make it important to review the "Green Revolution" since 1960s and the socio-economic and political implications of the spread of agricultural technologies for livelihood and wellbeing of millions of farmers, and for the agrarian transitions[64] in the countryside. In the next section I revisit the debate about the agrarian transitions to better understand the potential implications of new gene technologies for the social relations of production and the environment.

New Agricultural Technologies and the Mode of Production Debate

In the Green Revolution literature, an important debate occurred over whether the introduction of new agricultural technologies would resolve the "agrarian

[64] The concept of "transition" connotes "a qualitative shift, from one social system with its own 'law of motion', to a very different one with a very different dynamic and very different conditions of existence." (Wood 2002:36)

question," by developing capitalist relations of production in the Indian countryside. According to Byres, the debate about the development of capitalist mode of production[65] in Indian agriculture has been the "most sophisticated,

[65] A mode of production, according to Hindess and Hirst (1975:9), is "an articulated combination of relations and forces of production structured by the dominance of the relations of production." Although many Marxist scholars agree with this definition, a few disagree and ask: "why one should posit relations of production or forces of production as dominant." (Byres 1985:6) As Byres (1985:6) observes, the noted examples for the separation of the two aspects of a mode of production are: Robert Brenner (1976, 1977) who awards primacy to the relations of production and Gerald Allan Cohen (1978) who argues for the primacy of the forces of production. In support of Hindess and Hirst, Byres argues that "an articulated combination of relations and forces of production" in their definition does not mean that "in a particular mode of production coherence requires that a *single* set of productive forces articulates with a *single* set of relations of production." (Byres 1985:5, italics original) But, Alavi rejects the concept of mode of production altogether because he considers it a "theoretical concept of structure that does not denote societies in all their particularities but rather connotes structural properties of societies or social formations." (Alavi 1980:359)

The use of the concept of the mode of production becomes more difficult if many modes of production coexist in a society, which has regional as well as geographical diversities. A few Marxist scholars prefer the concept of "social formation" to "mode of production." According to Perry Anderson, social formation is a "concrete combination of different modes of production, organized under the *dominance* of one of them." (Anderson 1996:22, italics original) He further says "the purport of the concept of social formation is precisely to underline the plurality and *heterogeneity* of possible modes of production within any given historical and social totality." (Anderson 1996:22, italics original) Marx used the term "social formation" to refer to a society (Byres 1985:7).

Jairus Banaji (1990:120) argues, "[t]o most Marxist relations of production and relations or forms of exploitation have been synonymous terms, conceptually identical or almost so." But, he considers this as a conceptual error. He then distinguishes between the relation of production and relations of exploitation:

> We may define relations of exploitation as the particular form in which surplus is appropriated from the direct producers, not the specific form, e g, labor rent, rent in kind, but the general form, eg, serfdom, where the direct producers are tied to the means of production through some form of extra-economic coercion. Relations of production, on the other hand, are the specific historically determined form which particular reasons of exploitation assume due to a certain level of development of the

extensively argued and passionate debate among Indian Marxists" in the recent past (Byres 1985:11).

The mode of production debate in India has raised very important questions pertaining to the nature of agrarian transition in the countryside, and the methods of investigation of the changing social relations of production in transition societies. In fact, the entire debate has revolved around a few important epistemological, methodological, empirical, and normative issues. Rather than providing yet another critical review of the mode of production debate,[66] I highlight a few key contending issues in the debate, and critically re-examine them from an agrarian political ecology perspective to better understand the socio-ecological implications of the new agricultural technologies for primary producers and the environment.

The debate about the mode of production in Indian agriculture was initiated by Sulekh Chandra Gupta in 1962. But, it gained momentum with a publication of a research report based on a survey of big farmers in the state of Punjab by Ashok Rudra (along with his colleagues Majid and Talib) published in India's premier journal for social science research, *Economic Political Weekly* in 1969. The main aim of their research was to find out whether capitalist farming was emerging in the Indian countryside in general, and in the Punjab region in particular. In their "search for the capitalist farmer," they characterized the capitalist farmer as one who: (a) cultivates land himself/herself rather than leasing out, (b) uses wage labor in a much greater proportion than family labor, (c) adopts new agricultural technologies as quickly as they are introduced, and (d) produces for the market rather than family consumption, in other words, focuses on profit rather than subsistence (Rudra et al 1990:27). Based on these criteria, they could not find even a single capitalist farmer. This led them to conclude that a class of capitalist farmers did not emerge in the Indian countryside.

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productive forces, to the predominance of property forms (feudal landed property, etc) and so on. (Banaji 1990:120)

[66] For an excellent review of the debate, see, for example, Thorner 1982, 1982a; Harriss 1979; McEachern 1976.

Political economist Usta Patnaik, based on her research in 10 villages in Punjab in 1969 critiqued Rudra's methodology and conclusions. Contrary to Rudra's conclusion, she argued that "a new class of capitalist farmers *is* emerging: this is a phenomenon common to every region, insofar as every area has been subjected to the same factors – albeit operating with varying intensity – of an expanding market and enhanced profitability of agricultural production." (Patnaik 1990:39, emphasis original) Later, Patnaik changed her position on this, and argued that the internal class contradictions in the countryside did not allow the complete development of capitalism in agriculture. She further argued that the presence of wage labor and the production for the market are only necessary, but "not sufficient" for the development of capitalism. Following Marx[67], Patnaik (1990:44, emphasis added) asserted that the crucial "characteristic of the capitalist is not merely appropriation of surplus value generated by the wage-labor he employs, but also *accumulation* and *reinvestment* of surplus value in order to generate more surplus value."

Critiquing Patnaik's emphasis on accumulation and reinvestment, Paresh Chattopadhyay, citing Lenin's definition of capitalism, contends that generalized commodity production – the transformation of labor power into a commodity – is the key characteristic of capitalism. He further argues that it is unnecessary to highlight accumulation and reinvestment, because the process of generalised commodity production in "its ultimate form generates the process of surplus

[67] Marx wrote:

Two characteristic traits mark the capitalist mode of production right from the start. *Firstly*. It produces its products as commodities. The fact that it produces commodities does not in itself distinguish it from other modes of production; but that the dominant and determining character of its product is that it is a commodity certainly does so. This means, first of all, that the worker himself appears only as a seller of commodities, and hence as a free wage-labourer – i.e. labour generally appears as wage-labour… The *second* thing that particularly marks the capitalist mode of production is the production of surplus-value as the direct object and decisive motive of production. Capital essentially produces capital, and it does this only as it produces surplus-value (Marx 1991: 1019-20) value and its reinvestment though at a relatively *low* stage of capitalist development, this may be very slow and may not be quite clear to the superficial observer." (Chattopadhyay 1990:82; italics original)

Andre Gunder Frank intervened in the debate and supported the position taken by Chattopadhyay, and problematised Patnaik's "far out definitions of 'capitalism' in agriculture." He argued that "if the UP [Usta Patnaik] method is to 'extend' the criterion of extended reproduction, accumulation and reinvestment of them in each of the impoverished farms in India, no wonder, that she is hard put to recognise the capitalist mode of production when she sees it." (Frank 1990: 109) The implicit assumption of Frank was that imperialism directly or indirectly brings all countries into the circuit of the world capitalist systems and imposes the capitalist relations of production. Thus, in terms of exchange relations of productions, all farmers in India, for that matter farmers anywhere in the world, are essentially capitalist in nature.

Patnaik argued back. She asserted that generalized commodity production in India did not emerge as a result of internal contradictions, but rather by external imposition of capitalism as part of imperialist exploitation. She further argues that the enforced integration into the world capitalist exchange relations, in fact, "led to an inordinate development of capital in the sphere of *exchange*," destroyed the pre-capitalist modes of production, but did not reconstruct them "on a capitalist basis." (Patnaik 1990a: 94, emphasis original) Patnaik concluded that though there is "limited capitalist development" in agriculture, the dominant and prevailing mode of production in Indian agriculture is "semi-feudalism." (Patnaik 1990: 55) For her the essential feature of semi-feudal relations of production is the "direct extraction of surplus in the form of labor or produce, without the intermediation of the market and with monopoly of landed property." (Patnaik 1999:230) As we shall see this finding will be helpful to understand contemporary class relations and the "Gene Revolution." As Brass (2002:457) points out:

> One important consequence of classifying a social formation as "semi-feudal"…is that the principal contradiction is located not between capital and labor but between on the one hand an external imperialism coupled with its internal ally, the "feudal" landlord class, and on the other an anti-imperialist alliance composed of peasants, workers, and a "progressive"/nationalist bourgeoisie, in which the peasantry constitutes the dominant element.

Although the hybrid concept "semi-feudal" already existed in the literature, Amit Bhaduri gave it prominence when he characterized the relations of production in Indian agriculture as "semi-feudalism" as opposed to capitalist because the dominant features of production relations "have more in common with classical feudalism of the master-serf type than with industrial capitalism." (Bhaduri 1973:120) According to Bhaduri, the basic features of semi-feudalism are: (a) non-legalised sharecropping system, (b) perpetual indebtedness of small tenants, (c) the use of two modes of exploitation — usury and landownership — by land proprietary class, and (d) market inaccessibility for tenants, and small and marginal peasantry (1973:120-121). Based on empirical analysis of village surveys in eastern Bihar, economist Pradhan Prasad supported Bhaduri's semi-feudalism thesis (see Prasad, 1973, 1974). Both argued that in the semi-feudal mode of production the big landlords are reluctant to adopt new agricultural technologies because of a fear that the tenants might escape from or find ways to resist the bondage.

Another proponent of the semi-feudalism thesis, Nirmal Chandra, argues that semi-feudalism would not obstruct the adoption of new agricultural technologies. Chandra argued that even when new agricultural technologies were adopted, the semi-feudal relations were perpetuated "by lowering the tenant's share, the landowner can keep him as poor as he always was." (Chandra 1974: 1326, see also Sau 1975) He further added that the presence of massive unemployment or underemployment in the countryside was another important factor that sustained semi-feudalism. Not everyone agreed. Tom Brass, in his critique, argues that this framework "denies that accumulation based on unfree labour is possible, debt bondage is regarded as an obstacle to 'pure' capitalist development.” (2002:458) He found proponents of semi-feudal thesis “epistemologically unable to make a connection between unfree labour and capitalist development, they mistakenly conclude that, as the Indian countryside is still characterized by archaic relational forms, agriculture continues to be in a pre-capitalist stage.” (2002:458) Critiquing such theorization of the peasantry in pre-capitalist societies as armchair expertise, prominent public intellectual and civil rights activist from Andhra Pradesh, K. Balagopal wrote:

> [A]cademics have gone wherever capital has gone. Not only that, wherever they have gone they have hunted out capital, weighted it, measured it, labelled it, and all but cultured it, and convinced themselves and each other that they have understood the world. Much of the confusion arises from the implicit belief that pre-capitalist societies and social relations have no internal dynamics capable of leading to a rupture, but only the penetration of capital can achieve change (Balagopal 1983:711).

This debate in its initial stages mainly focused on the differentiation of the peasantry and new political class formations in the countryside. Later, this debate emphasized the role of the caste system and the state in agrarian transition. But, a majority of participants in this major Indian debate neglected the implications of the adoption of new agricultural technologies for the ecological conditions of production and nature-peasant relations, the agrarian eco-system, and socio-cultural practices of everyday life. The debate was also dominated by empirical studies including statistical/mathematical analysis of data from field surveys and official sample surveys, or historical and theoretical contexts. Ethnographic accounts of agrarian transformations were limited or trivial. And, the voice of the peasantry is not heard in the debate. Surprisingly, participants of the mode of production debate are also silent about the implications of the current “Gene Revolution” for agrarian transformations.

In the next section, I draw on field studies to shed new light, from a peasant perspective, on the “Gene Revolution” and agrarian transformations. My research focuses on the adoption and abandonment of Bt cotton in Kadavendi village in the Telangana region[68], and explores politico-ecological implications of the new seed for agrarian relations in the village.

The Agrarian Transformations in the Kadavendi Village of Telangana

The Agrarian History of Telangana: A Brief Introduction

In pre-independent India, there were 565-odd princely states, also called native states, outside the British Raj but under its suzerainty. The British Government controlled external affairs, defense and communication matters leaving internal administration to local rulers (Chandra, Mukherjee and Mukherjee 2000). But, when the Indian Independence Act went into force in 1947, most of these princely states accepted to join either the Indian Union or Pakistan. Five states – Hyderabad, Kashmir, Junagadh, Manavadar and Mangral – remain independent. The latter three states joined the Indian Union peacefully, but Kashmir and Hyderabad did not. As of 1947, Hyderabad was the second largest and most populous Princely state (with 86% Hindus, 12.5% Mulsims and 1.5% Christians and others) with three different linguistic areas: Telugu speaking Telangna area (8 districts), Marati speaking Maratwadi area (5 districts) and Kanada speaking area (3 districts) (Chandra, Mukherjee and Mukherjee 2000). The Indian Union noticed that the Hyderabad state issue was more complex than Kashmir for two reasons. First, Mir Osman Ali Khan Bahadur – the 7th Nizam, the muslim ruler of the Princely state of Hyderabad between 1911 and 1948 – reluctance to join India, second, the uprising of the Telangana peoples' armed struggle from 1946.

On October 15, 1947, the Indian state offered the Nizam a "Standstill Agreement," which he accepted on November 29, 1947 after considerable

[68] The state of Andhra Pradesh consists of three distinct regions: Coastal Andhra, Rayalaseema, and Telangana. Among these regions, there are variations with regard to the landholding patterns, soil fertility, irrigation, rainfall, cropping patterns, and the levels of development. While Telangana and Rayalaseema are considered as underdeveloped regions, Coastal Andhra is an affluent region. Prior to the Independence, Coastal Andhra and Rayalaseema were under British rule, whereas Telangana was under the Nizam's feudal rule (Venkateswarlu 2003). My study village, Kadavendi, is in the Warangal district of Telangana.

modifications. According to this Agreement, the Indian state support for Hyderabad state in crucial external matters such as foreign affairs, defense and communications would continue as it was under the paramount power of the British Raj. But the Indian state had no right to send in military troops in the event of internal matters except in the times of war (Eagleton 1950:288). At that moment, the Indian state hoped that the Nizam would eventually agree to integrate Hyderabad state into India before the Agreement expired on November 29, 1948. But, at this critical conjuncture, the uprising of *Razakhars*[69] and their atrocities on the majority non-Muslim community in Hyderabad state created a situation of anomie. Observing lawlessness and "systemic gun-running," the Indian state believed that Hyderabad state had no capacity to protect its people and repeatedly announced its intention to take over the territory and "democratize" the society (Das 1949:71). In response, Hyderabad state complained to the United Nations Security Council that the Indian state imposed an "economic blockade," which the Nizam considered as the violation of the Agreement (Eagleton 1950: 290).

At the same time that Nizam's administration was negotiating with the Indian government for the status of independent state, the people of Telangana initiated an armed struggle against the feudal oppression of the Nizam state system. The land tenure system of the Nizam, for example, was divided into three categories: the *Khalsa or Diwani* system in which 60 percent of the total area was

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[69] In 1927, a cultural association named the Majlis-i-Ittihad-ul-Muslimin (Council of the Union of Muslims), popularly called "the Ittihad," was formed with an aim to keep the supremacy of Mulsim culture in the state of Hyderabad. But, in 1940, under the leadership of an Islamic fundamentalist, Kasim Razvi, an armed wing of the Ittihad know as *Razakhars* (literally meaning of this Urdu word is "volunteers") was created. The Nizam completely supported the Razakhars, although he denied this right from its inception. The ideology of Razhakars attracted many Muslim youth, and it grew rapidly within a short period of time. And, eventually, it started influencing the Nizam rule. In fact, Razvi "elaborated the doctrine that Hyderabad was an Islamic state, the Nizam being representative and symbol of a sovereignty that pertained in fact to the Muslim community, and which he exercised on their behalf." (Smith 1950:33-34)

under Government Revenue System, *jagirdari* system[70] in which 30 percent of the total area was given to the loyalists of the Nizam who provided him military support and other services, and Sarf-e-Khas system in which 10 percent of the total area was under the direct control of the Nizam and his family and revenue directed to palace maintenance and administrative expenses.

In the Khalsa system, the cultivators did not acquire ownership of land, only the right to cultivate as long as they were allowed to do so. To collect revenue taxes over such lands, intermediary agents, *Deshmukhs*,[71] were appointed. In compensation, they were given some government lands, a salary as a percentage of revenue they collected, and also a pension. In some areas, *akbari* (excise) contracts were also given to them. Apart from all these benefits, "most of them availed of the opportunity to seize as much of the best land as they could." (Pavier 1974:1413) Pavier analyses that the global capitalist crisis in 1930s severely affected the peasantry of Telangana, because they were connected to the international market through export-oriented cash crops such as groundnut and castor. When the prices of agricultural commodities declined during the Great Depression, the peasantry incurred heavy losses and they were left with no surplus to pay their taxes and fines imposed by the landlords. Thus, the landlords grabbed the lands of the peasantry. In this way, landlords and *Deshmukhs* encroached the lands of the peasantry.

Balagopal rejects Pavier's functionalistic argument of "the cash crops-international capitalist crisis-indebtedness-alienation syndrome." He argues that while economic crises made the peasantry more vulnerable to dispossession from

[70] The literal meaning of the term 'jagir' means a gift or grant. During the Nizam rule, the right to collect revenue for the government in some areas was granted to his loyalists who provided him military and other services. Those who possess the jagirs were called Jagirdars. They operated as a sub-state system under the Nizam. Some Jagirdars had their own police and revenue collection system. They used to pay little loyalties to the Nizam, but collect taxes from peasants and tenants 10 times higher than in Khalsa (Government) areas (Sundarayya 1972:10).

[71] For the origin and the growth of Deshmukhs see, for example, Tirumali 1992, Balagopal 1983, Pavier 1974.

the means of production, the crisis was not the root cause of land alienation. He argues that landlords grabbed land from the peasantry to perpetuate their monopoly over land, irrespective of whether they produced cash crops or not, and whether there was a capitalist crisis or not. He notes that "the landlords grabbed cultivable land to extract rent (cash, kind, and labor rent) from the peasantry; they grabbed forest and bush land to extract grazing rent (pullari in Telugu); and they grabbed marginally cultivable land to prevent the landless from acquiring land – a prerequisite for feudal social domination." (Balagopal 1983: 711) Regardless, drawing on all methods of feudal domination, every *Deshmukh* and landlord in Telangana seized land (between 2,000 acres and 160,000 acres in about 20-60 villages). For instance, Janareddy *Deshmukh* possessed 160,000 acres, Baba Saheb *Deshmukh* possessed 150, 000 acres, Visunoor *Deshmukhs* possessed 40,000 acres, and Suryapet *Deshmukh* possessed 20,000 acres (Pavier 1974, Ramesh 1998, Tirumali 1992).[72] Visunoor *Deshmukh,* Rapaka Ramachandra Reddy, possessed land in about 60 villages in Janagam area, and Kadavendi village was one of them. He constructed a *gadi*[73] in Kadavendi and sent his

[72] While feudal mode of production and exploitation was very much evident in regions such as Telangana, a few historians wonder: "*Was There Feudalism in Indian History?*" (Mukhia 1985) By comparing the ecological conditions and social organization of production of medieval India and medieval Europe, Harbans Mukhia argues that the concept of feudalism (which originated in a specific socio-historical context of Europe) cannot be applied to characterize pre-colonial India. Critiquing RS Sharma's (1965) premier work on feudalism in India, Mukhia (1985:268) argues that in Indian history there was no serfdom because the "conditions of production in India did not require serf-labor." He further argues that unlike European feudalism, which was characterized by "the structured dependence of the entire peasant population on the lords," (Mukhia 1985:258) "Indian agrarian history has been characterized predominantly by free peasantry." (Mukhia 1985:268) The path-breaking article, "Was There Feudalism in Indian History?" in the *Journal of Peasant Studies* in 1981 has initiated another round of debate on the mode of production. The contributions to this debate were later published in a volume "*Feudalism and Non-European Societies.*" (see Byres 1985)

[73] The landlord was popularly called "*dora,*" his wife or mother was called as "*dorasani,*" and their fort-like bungalow was called "*gadi*." (Tirumal 1992)

mother Janamma to live there to supervise tax collection and agricultural activities.

Deshmukhs were not only big landlords but also moneylenders in the villages. It was a common practice that they 'distribute' surplus grains and money to the peasantry and recollect them with a huge interest. In some cases, they forcefully lent grains (i.e. "involuntary credit") to the peasantry to collect them back with higher interest, or to seize whatever property they had. For instance, when Janamma entered Kadavendi village, Visnoor *Deshmukh* possessed only 32 acres of land, but shortly after her arrival the size of their landholding increased to 450 acres (Ramesh 1998). As Tirumali noted, "Janamma used to distribute her surplus grain to each door even in the absence of occupants and collected later with interest." (Tirumali 1992:482; See also Ramesh 1998) If the peasantry failed to repay the loan, their land would be grabbed and they would become bonded labor (*jeethagallu*) by use of their extra-economic power (i.e. private armed gangs). Landlordism and usurious moneylending was overwhelmingly strengthened when the magisterial and judiciary authority were given to *Deshmukhs* along with revenue collection. With vested economic and extra-economic power, *Deshmukhs* became local *sarkar* or government. And, they were supported by local administrators and assistants such as *Patwari/Karanam* (revenue collector, always a *Brahman*), Police Patel and Mal Patel (village police officers, always a person belonging to Reddy or Velma caste), and *Maskoor* (village assistant, always a *dalit*). The landlords and their administrative agents controlled major portion of village land. Table 4.2 provides evidence of the feudal concentration of land in Kadavendi in the 1940s.

In addition to these kinds of economic exploitation, *vetti* (forced extraction of labor services and products) was one of the common social phenomena in Telangana, and it was imposed on all peasant sections in varying degree (Kannabiran and Lalitha 1990:201). As Balagopal (1983: 713) describes:

> Vetti is not bonded labour; its sanction lies not in usurious debt, as in the case of debt-bondage, but in custom and brute force. It is not even corvee as understood in European feudalism, where

the peasant had to perform labor service on the landlord's fields. Vetti included that, but went well beyond it. All the toiling castes of the village had to supply free of charge to the landlord whatever products or services they produced…In addition the landlord would sit in judgement over village disputes and collect fines from the offending party (often from both parties). He would demand gifts from the villagers on special occasions, and contributions to the cost of ceremonial functions in his family. More generally, anything in the village that attracted the landlord's eyes had to be handed over to him.

Table 4.2: Land Concentration in Kadavendi, 1930-1946.

S. No	Name of Landlord	Dry land (in acres)	Wet land (in acres)	Total land (in acres)
1	Janamma (Mother of Visnoor Deshmukh)	150	300	450
2	Eturu China Dharma Rao (Police Patel)	20	130	150
3	Eturi Narasimha Rao Panthulu (Patwari)	60	100	160
4	Ponugoti Sitarama Rao (Mali Patel)	40	60	100
5	Asanala Yellaji	50	100	150
6	Dukkidi Veeramma	50	100	150
7	Varikela Ramoji	30	100	130
8	Kasumandla Mallaji	25	75	100
9	Dharagani Kondaji	40	60	100
10	Vennamaneni Venkataramana Rao	40	40	80
		505	1065	1570

Source: Adapted from Ramesh 1998: 76.

But, the atrocities and exploitation of *deshmukhs* and the landlords did not go unchallenged. People in Telangana under the leadership of Communists and *Andhra Mahasabha* (Congress-minded Hindu organization, which adopted radical ideology and corresponding praxis later) had begun militant struggles challenging the economic and extra-economic coercion of *Deshmukhs* and the landlords in the early 1940s. By the mid 1940s, the struggle had metamorphosized into armed struggle drawing people from different peasant sections and the landless of various castes (Benichou 2000). The main aim of the movement had become the abolition of *vetti*, illegal exactions, and evictions by feudal landlords, as well as ending the oppression of the Nizam and his army.

At its peak, the movement under the leadership of the Communist Party of India and the *Andhra Mahasabha* (with 2,000 *dalams* or armed guerrilla squads and 20,000 people militia) liberated 3000 villages with about three million people in an area of 16,000 square miles from the clutches of feudalism. The landlords were driven away from their *gadis* and their lands were repossessed, and one million acres of land were redistributed among the landless labourers and small peasants (Banerjee 1984:19). "*Gram-raj*" (what some communists described as the system of "village soviets") was established in about 3000 villages, mostly in three districts of Telangana – Nalgonda, Warangal and Khammam. Peasant committees conducted village governance for about 12-18 months (Sundarayya 1972).

Faced with this political turmoil, on September 13, 1948 the Indian Union government declared a state of emergency and sent 50,000 military troops, a code name "Operation Polo" (euphemistically called "Hyderabad police action") into Hyderabad state. The mission was two-fold: (i) to overthrow the Nizam's rule, and (ii) to suppress the people's revolt. Within five days of the "police action," the Nizam surrendered to the Indian Union Government on September 18, 1948. After the success of "hundred-hour war" and the takeover of the Nizam's administration, the Indian Union focused on crushing the peasant revolution. A hunt for communists was started, and military camps were established in the movement areas. Subsequently, *Deshmukhs* and the landlords, who had run away to cities to save their lives from the armed guerrilla squads, reentered villages with the help of the military to re-confiscate the land distributed to the landless by the communists. The landlords became informers for the military, identifying communist activists, their hide-outs and shelter places, and the people who supported them. The military arrested and tortured thousands of guerrilla squad members, activists and sympathizers, and killed thousands of cadre members who resisted them. It should be noted that "Sardar" Vallabhbhai Patel, Deputy Prime Minister of Union Government, and popularly called the "iron man of India," was reported to have told a meeting at Hyderabad in 1950 that he “would not allow a single Communist to be alive in Telangana.” (Banerjee 1984:23)

The Indian police and military applied heinous methods to wipeout the guerrilla squads and their mass base: burning alive, burying alive, raping women in front of their partners and children, even raping and molesting girls age between 10 and 15 years etc. (Sundarayya 1972). In about 2000 villages of Telangana, more than 4,000 communists and peasant activists were killed, more than 10,000 sympathizers were imprisoned for years, more than 50,000 were inhumanly tortured in police detention and army camps, and hundreds of thousands were terrorized initially by the mercenaries of the Nizam and later the brutal military force of Nehru’s government (Sundarayya 1972, Surjeet 1992). After the “police action” of the Indian state, the Communist Party of India and the *Andhra Mahasabha* announced the withdrawal of armed struggle on October 21, 1951. However, the Telangana Peoples’ Armed Struggle “had set a revolutionary tradition among the Telugu people.” (Kannabiran and Lalitha 1990:203)

Hyderabad joined the Indian Union, and the first general elections were held in 1952. Congress party won a majority in Hyderabad state assembly and formed the government. In 1953, the Andhra State (NOT Andhra Pradesh) was formed on linguistic basis by separating Telugu speaking regions of Madras state (i.e. Rayalseema and Coastal Andhra). Later, in 1955, the Indian government constituted a States Reorganization Commission (SRC), which proposed to merge the Hyderabad state with the Andhra state to form the State of Andhra Pradesh. Although the people of Telangana resisted the merger, finally, on November 1, 1956 the State of Andhra Pradesh (with three regions – Telangana, Rayalseema and Coastal Andhra) was declared.[74]

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[74] Among the three regions, Coastal Andhra has emerged as the economically affluent and politically powerful region. In the new State, majority of political and policy decisions regarding the distribution of natural and public assets (irrigation, industries, universities etc) have been taken in favour of Coastal Andhra since the formation of the state of Andhra Pradesh. This has resulted in the underdevelopment of Telangana and Rayalseema regions. People in Telangana see this as “internal colonization,” and want to end this by forming

The new government implemented land reforms to pacify peasant resistance. Even the Communist party considered the reforms “progressive” and “radical.” But, land reform in Telangana, in fact, “gave the concessions which the small landlords and rich peasants wanted.” (Banerjee 1984:22) And, “the new class of landlords that emerged in the post-Independence period resorted to old feudal modes of exploitation and oppression.”[75] (Srinivasulu 2002: 16) The people of Telangana once again resorted to armed struggle in the early 1970s inspired by *adivasi* struggles in Srikakulam district of Coastal Andhra[76] and the “spring thunder of Naxalbari”[77] to abolish all kinds of exploitation of feudal

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the separate state of Telangana, and have been fighting for this political demand (see, for example, Simhadri and Rao 1997).

[75] Putchalapalli Sundarayya (1972: 328), one of the prominent communist leaders of the Telangana armed struggle admits:

> The landlords who ran away or were driven out of the villages during that movement, had trekked back and reconsolidated their position in the rural areas. They seized back most of their so-called *seri* lands, and sold most of the “*anyakrantalu*” and lands under the old tenants to other rich cultivators and some protected peasants, who got the right of the first purchase under the land laws enacted in 1950 … The drive to deprive the peasants and agricultural labourers of the waste lands they have been cultivating is going on.

[76] Srikakulam movement was born of out of an incident of killing of two tribal peasants by landlords on 31 October 1967 in the Parvathipuram Agency area situated on the north-eastern tip of Andhra Pradesh. The incident was the culmination of a long history of struggles by the Jatapu and Savara *adivasis*. A group of revolutionary teachers (Vempatapu Satyanarayana, Adibhatla Kailasham, Panchadri Krishnamurthi and others) began to work among the Savaras and Jatapus from the 1950s. They mobilized these adivasis against the landlords’ exploitation and atrocities and for better wages. By 1967, the landlords were forced to increase the wages for the laborers, and concede two-third share of crops to the sharecroppers. These achievements strengthened the adivasis’s faith in political organization. The strength and influence of the Srikakulam movement can be understood by reading into what Charu Majumdar, the founding leader of the Naxalite movement, wonders, “Srikakulam – Will it be the Yenan of India?” (quoted in Banerjee 1984:100)

[77] The Naxalite movement takes its name from a peasant uprising which took place in May 1967 at Naxalbari – a small village in Siliguri subdivision in Darjeeling district in the state of West Bengal. It was led by armed Communist

landlords and the state apparatus. It is important to note that, historically, the peasantry of Telanagna resisted systemic oppression and violence with real weapons, rather than resorting to the "weapons of the weak." (Scott 1985) Understanding this complex history and the underdevelopment of Telangana, helps clarify the response to contemporary development initiatives such as the introduction of GM crops in the region, and Kadavendi village in particular.

Kadavendi: A Village of Revolutions

Kadavendi is located 30 kilometres south of Janagam, a town situated half-way between Hyderabad and Warangal. This is not a road-side village, but distanced 4 km away from the main road that connects Janagam and Suryapet. To enter the

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revolutionaries who later officially announced the Communist Party of India (Marxist-Leninist) [CPI (ML)] on 22 April 1969 – Lenin's birth anniversary. It was formed by a group of Communists who denounced the programmes adopted by the Communist Party of India (Marxist) [CPI (M)] at the Calcutta Congress. CPI (ML) declared that the objective of the new party is to seize political power through an agrarian revolution. It upholds Maoism as the Marxism of the current era. Despite many setbacks, it has spread to many new areas (now it operates in 200 districts in 16 states out of 400 districts in 28 Indian states) and is still striving towards achieving its objective. Since its inception, based on differences in strategies and tactics in waging revolutionary struggle, the Naxalite movement has been divided into several parties and groups. But genuine revolutionary parties in India have been trying to merge and form a unified party. Consequently, the CPI (ML) Party Unit, another Maoist party that had very strong presence in Bihar and parts of Madhya Pradesh, merged with the Peoples' War party in 2002. And, in 2004, the Maoist Communist Centre also merged with the People's War party and formed the Communist Party of India (Maoist). According to Dr. Manmohan Singh, the current Prime Minister of India, the country's biggest internal security problem comes from the "Naxalite menace." The statement of Mr. Singh also indicates the influence of the Maoist movement in the Indian countryside.

Eminent Indian sociologist, A.R Desai (1986: xxiii) says: "the various CPI (ML) parties and groups popularly known as Naxalites, should be credited with elevating the movements of the rural poor from being bogged down in pure economism and reformism to a new heightened political level (whether one agrees with them over their overall perspective and strategy or not)." Even in the academic world, as Chibber (2006:379) observes, "naxalbari served to not only renew Left culture, but to unleash a torrent of debate on everything from political strategy to the more abstruse questions regarding the conceptualization of Indian history and culture. In doing so, it opened entirely new vistas in scholarship."

village, one has to cross a muddy bridge over *vaagu* (stream) that flows south and ends in Musi river. The bridge, which is in very poor condition, often collapses whenever there are heavy rains and strong downstream flows in the *vaagu*. In fact, the bridge collapsed and washed away two times during my field research in 2006 (see picture 4.1). About 200 meters, after crossing the *vaagu*, at the entrance of the village, a visitor encounters an array of *amaraveerula sthupalu* (martyr columns) of the heroic people of Kadavendi, who participated in the Telangana peoples' armed struggle (see picture 4.2).

Picture 4.1: The washed away muddy bridge over the stream in Kadavendi.

Source: Picture was taken by the author, September 10th, 2006.

Picture 4.2: A Row of Martyrs Columns at the Entrance of the Village.

Source: Picture was taken by the author, August 9th, 2006.

Picture 4.3: The Shrine of Gadi Maisamma under the Tree and the Martyr Column of Doddi Komaraiah behind it.

Source: Picture was taken by the author, August 19th, 2006.

The oral histories of elderly people of Kadavendi tell us that the people of this village originally belonged to a hamlet situated in a deep forest area on the borders of Visnooru and Madhapuram. But, about 350 years ago, they shifted their habitat about 7 kilometres away from their original place towards the *vaagu*, due to lack of water for cultivation. During the construction of the new village, in the excavations in the middle of the village for a shrine of Gadi Maisamma (see picture 4.3) – a goddess believed to protect the houses and habitants within the boundaries of the village – they found an earthen pot (*Kadava*) filled with silver (*vendi*) coins. The villagers felt that it was an auspicious sign for their prosperity. Since then, they call their village "Kadavendi" as a short form for Kadava-Vendi (see Ramesh 1998).

In the history of people's movements in Telangana, Kadavendi is considered as a village of revolutions because its people have made an enormous contribution to the two great peasant struggles: the Telangana peoples' armed struggle and the ongoing Maoist revolution. In fact, for both movements, the martyrdom of Kadavendi revolutionaries became a milestone in further expansion and intensification of struggle. The murder of Doddi Komaraiah[78], the first martyr of the Telangana armed struggle, in Kadavendi on July 4, 1946, by the *goondas* (thugs) of Vishunur Deshmukh ignited the revolutionary spirit of the people and spread the movement to other areas.[79]

In the Naxalite movement, Erramreddy Santhoshi Reddy, alias Mahesh, of Kadavendi, worked for more than two decades in the erstwhile CPI (Marxist-Leninist) Peoples' War party and was elected as State Secretary and Central

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[78] For a detailed account of the historical events that led to the killing of Doddi Komaraiah by the thugs of Visunooru *Deshmukh* in Kadavendi, and its impact on the growth of the anti-feudal and anti-Nizam movement, see Ramesh 1998. It should be noted that the martyrdom of Komaraiah became a chronological reference point for most of the elderly people in the village. When I asked any details of the historical events of the village (for example, the year of severe famine) or personal details (such as the date of birth), elderly people in the village say that a particular event happened X years before or after Komaraiah's murder, or I was X years old when Komaraiah was killed.

[79] For a detail account of the role of Kadavendi in Telangana armed struggle see, for example, Ramesh 1998.

Committee Member. He was killed (along with two other Central Committee members and a shepherd) in a fake "encounter" in the Koyyuru forest of Karimnagar district on December 2^{nd}, 1999 by "greyhound" police force.[80] After these state killings, the People's War party further intensified armed struggle, formed the Peoples' Guerrilla Army, and initiated efforts to unite the major Maoist parties in the country.[81] Given the history of revolutionaries and the movement in Kadavendi, it has been considered as a politically "sensitive" village.[82]

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[80] 'Greyhounds' is a breed of racing dogs in North America. But, this name was given to a newly formed anti-Naxalite police force (by the Chief Minister NT Rama Rao in 1998) that was exclusively created and specially trained to hunt and wipe out the Maoist revolutionaries and sympathizers in the state of Andhra Pradesh (see, for example, Balagopal 1988).

[81] It should be noted that not only Santhosh Reddy but many youth of Kadavendi worked in various revolutionary parties, and a few of them have been killed so far in various "encounters."

[82] During my field research in Kadavendi, two local police constables, who came to the village as part of their regular patrolling, enquired about me and my research assistants, who happened to be local educated *dalit* youth. The police ordered us to stop conducting research in the village, because, according to them, any research by "outsiders" in a politically "sensitive" village should not be allowed if the researcher did not get prior police permission. And, they suggested that I go to their higher officials and get permission if I wanted to continue research in Kadavendi. Following their order, we temporarily stopped the household survey and in-depth interviews with the farmers. Then, the next day I went to the local police station in Devaruppala to discuss with the higher officials, and to seek permission from them to complete my research. I met with a police inspector and explained him about my research, and asked him to give an explanation why the constables interrupted my work. After knowing the objectives of my research, the very first question the police officer asked me was: "Why did you choose this village out of thousands of villages in the State? At that moment, I was not interested in explaining my methodological justification to a police officer, who has nothing to do with my work, and I replied him, "why not this village." But, he answered back rudely: "I think you don't know the history of this village. It's very sensitive area. You can't do research there without taking prior permission from the police." He repeated the same opinion as his constables. Considering the civil rights violation record of Warangal police and the wellbeing of my research assistants, I have shown him my research proposal, the Ethics Review approval certificate as well as a letter that I got from the Department of Sociology, University of Alberta, anticipating such a problem during field research in Warangal district. After an hour long discussion, I finally convinced him why I had selected Kadavendi as my study village, and got

While going through the "Red Revolution" in the 1970s and 80s, the people of Kadavendi also welcomed Green Revolution technologies. Kadavendi was traditionally a rice growing village. Farmers had been using several varieties of local seeds for generations. But, for the first time, they adopted hybrid rice varieties in the mid-1970s. As well, Guntur Reddies (Andhra settlers), the people of *reddy* caste who emigrated from the Rentachintala village of Guntur district of the coastal Andhra region more than 100 years ago, introduced cotton cultivation into the village in the late 1970s. In the early years, these settler farmers cultivated indigenous (*desi*) seed varieties, but adopted hybrid cotton seeds such as Hybrid-4 (H-4) and Varalaxmi in the early 1980s, when cotton cultivation began to emerge as a cash crop in the district. By the-mid 1980s, all local cotton varieties in the village had been replaced by a few hybrid varieties. Another commercial crop in the early 1970s that was predominantly grown in this village was tobacco. Tobacco was widely adopted, promoted by Vazir Sultan Tobacco company (now VST industries) that produces Charminar cigarettes, the India's oldest brand. The company provided all required inputs to the farmers on the condition that the produce was sold to them at farm gate prices. Later the company stopped providing input support to the farmers. Without this economic incentive to cultivate the crop, tobacco cultivation disappeared in the village.

The next section outlines continuous introduction of the new forces of production (Table 4.3) that gradually changed the social organization of production and the natural conditions of production in Kadavendi. To better understand the socio-ecological crises for the peasantry and the implications of new technologies in general, and GM seeds in particular, it is important to examine and analyse the contemporary agrarian structure and social relations of production in Kadavendi.

"permission" to conduct further research. But, at the end, he warned me that I should inform and get permission from the local police if I ever wanted to conduct research in this village. This indicates a potential threat to academic freedom and civil rights in the areas of the Naxalite movement from the agents of the state apparatus.

Table 4.3: Introduction of various new technologies into Kadavendi

New Technology	First introduced into the village
Electricity	Late 1960s
Pesticide spray pump	Late 1970s
Green revolution rice varieties	Early 1980s
Electric water pump	Early 1980s
Borewell for irrigation	Mid 1980s
Iron ploughs	Mid 1990s
Tractor	Late 1990s
TV	Late 1980s
Phone	Early 1990s
GM cotton varieties	2003

Source: Field research

Agrarian Structure of Kadavendi

The current population (September 2006) of Kadavendi *gram panchayat* (village council) including three attached *thandas* (tribal hamlets) – Chipparala Banda, Pottigutta, Dubbathanda – is 5676 people divided among 1406 households. Of the total households, 1138 households (81 percent) are farmers and 268 households (19 percent) are landless. Based on caste and tribe in constitutional parlance, the population of the village is divided into four broader categories: Other Castes (OCs)/"upper" castes (162 households, 12 percent of the total population), backward castes (BCs)/*bahujans* (768 households, 55 percent of the total population), scheduled caste (SCs)/ the so-called "untouchables"/*dalits* (220 households, 16 percent of the total population), and scheduled tribes(STs)/ *adivasis* (256 households, 18 percent of the total population) (see Table 4.4). For sub-castes under these broader categories see Table 4.5.

Table 4.4: Differentiation of Households by the Size of Landholding and Caste Categories (2006)

Caste / Land size	OC	BC	SC	ST	Total	Percent of the total households
Less than 0.1-2.5	15 (5)	152 (48)	98 (31)	51 (16)	316	22.5
Between 2.6-5.0	36 (8)	237 (54)	63 (14)	107 (24)	443	31.5
Between 5.1-10	29 (10)	157 (53)	15 (5)	95 (32)	296	21.1
Between 10.1-25	58 (73)	22 (27)	0	0	80	5.7
Between 25.1-50	3 (100)	0	0	0	3	0.2
Landless	21 (8)	200 (75)	44 (16)	3 (1)	268	19.1
Total	162	768	220	256	1406	100
Percent of the total households	12	55	16	18	100	

Note: Figures in parenthesis are row percentages.
Source: Field research

The Distribution of Landholdings

Based on the size of operational landholding, the farming households are divided into five major categories: marginal farmers with land size less than 2.5 acres (316 households or 22.5 percent of the total farming households), small farmers with land size between 2.6 and 5 acres (443 households or 31.5 percent of the total farming households), semi-medium farmers with land size between 5.1 and 10 acres (296 households or 21.1 percent of the total farming households), medium farmers with land size 10.1 and 25 acres (80 households or 5.7 percent of the total farming households), and large farmers with land size 25.1 and 50 acres (3 households or 0.2 percent of the total farming households).

Table 4.5: Sub-castes in Kadavendi

Caste Category	**Caste**
Upper Caste	Brahmin/bapani (priest caste) Vaishya/komati (merchant caste) Reddy Christian Reddy (converted Christians) Velama Karanam Arey
Backward Caste [*Bahujans*]	Golla/Yadava (Shepherd) Kuruma (Shepherd) Goundla/goud (Taddy Tappers) Chakali (Washermen) Mangali (Barber) Kummari (Pottery) Mudiraj (Fishermen) Munnuru Kapu/Telaga/ Balija (Cultivators) Vadla (Carpenter) Kamsali (Blacksmith) Ovusali (Goldsmith) Poosala Padmashali (Weavers) Medara Vaddera (stone cutters) Dudekula and Muslims[83]
Scheduled Caste [*Dalits*]	Maadiga ("Untouchable" leather worker and agrarian labor caste)
	Maala ("Untouchable" agrarian labor caste)
Scheduled Tribe [*Adivasis*]	Lambada

Source: Field research

Although the operational holding of land alone is not an accurate indicator of the socio-economic position of a farmer (Patnaik 1990), land remains the most important factor in determining the position of a household in a village economy where livelihood of a majority of people still depends on agricultural activities. Moreover, the possession and the size of land determine the households' bargaining position in the stratified rural structure as well as in the

[83] Based on the constitutional and reservation status of dudekula and economically backward mulsims, I categorized them into Backward Castes, but I ackwnoledge their specific socio-cultural and religious identity within this category.

markets. Loss of land is considered a great misfortune, and gaining additional land is considered a great success by the other members of the village community. Access to other factors of production (such as inputs, institutional credit and subsidies, information about new technologies, etc.) is largely determined by the size of landholding. The size of landholding, thus, plays a vital role in the agricultural land use change as well.

By the year 2006, the total number of farmer households and the area of operational holdings significantly decreased. For instance, the total number of farm households decreased from 1211 in 1994 to 1138 in 2006, and the area of operational holdings decreased from 6193 acres in 1994 to 3743 acres in 2006 (Table 4.6). This indicates that the farmers are moving out of agriculture and down sizing their area of agricultural operations. Of the farmers moving out of agriculture, the majority are marginal farmers (their percentage of landholdings decreased from 43.8% in 1994 to 27.8% in 2006), followed by medium (from 8.8% in 1994 to 7% in 2006) and large farmers (from 0.7% in 1994 to 0.3% in 2006). In contrast, the percentage of small farmers and semi-medium farmers increased from 27.7% to 38.9% and from 19% to 26%, respectively, between 1994 and 2006. And, except for small farmers, for all other categories the percentage area of holdings decreased between 1994 and 2006. As well, there has been a significant decrease in the average area of operational holdings across the five categories between 1994 and 2006. Average size of operational holding of marginal, small, semi-medium, medium, and large farmers was 1.3 acres, 3.6 acres, 8 acres, 15.8 acres, and 37.1 acres, respectively, in 1994; this has decreased to 1.1 acres, 2.2 acres, 5.7 acres, 8.4 acres, and 25 acres, respectively, in 2006 (Table 4.7).

Table 4.6: Number and Area of Operational Holdings in Kadavendi

	1994		2000		2006	
Size class category	No. farmers	Area (acres)	No. Farmers	Area (acres)	No. Farmers	Area (acres)
Marginal farmers (Less than 0.1-2.5)	530 (43.8)	704 (11.4)	584 (41.8)	851 (16)	316 (27.8)	337 (9)
Small farmers (Between 2.6-5.0)	335 (27.7)	1614 (26.1)	434 (31.1)	1551 (29)	443 (38.9)	973 (26)
Semi-medium farmers (Between 5.1-10)	230 (19)	1848 (29.8)	296 (21.2)	1779 (33)	296 (26)	1684 (45)
Medium farmers (Between 10.1-25)	107 (8.8)	1693 (27.3)	80 (5.7)	1090 (20)	80 (7)	674 (18)
Large farmers (Between 25.1-50)	9 (0.7)	334 (5.4)	3 (0.2)	75 (1)	3 (0.3)	84 (2)
Total farmers	1211 (100)	6193 (100)	1397 (100)	5346 (100)	1138 (100)	3752 (100)

Note: Figures in parenthesis are column percentages.

Source: Data for 2006 were collected by household survey during my field research, but for 1994 and 2000 data were collected from Mandal Revenue Office, Devaruppala.

Table 4.7: Average Area of Operational Landholdings

	1994	2000	2006
Size class	Acres	Acres	Acres
Marginal Farmers	1.3	1.5	1.1
Small Farmers	3.6	3.6	2.2
Semi-medium	8.0	6.0	5.7
Medium Farmers	15.8	13.6	8.4
Large Farmers	37.1	25.0	25.0

Source: Field research

Change in the size and area of operational holdings in Kadavendi clearly indicates that there is no increase in the concentration of land in the hands of a few large farmers. Rather there is increase in the number of small and semi-medium farmers and a significant number of farmers are moving out of agriculture and taking up other occupations. These processes beg further questions: What other livelihood options are available and are chosen by the farmers? Who completely abandoned cultivation? What are the politico-economic and legal factors that have obstructed the process of land concentration? What happened to the erstwhile landlords and their socio-economic and political power in the village?

Land reforms in Andhra Pradesh (AP) have followed the India-wide pattern.[84] These reforms were implemented to eliminate intermediaries (such as *deshmukhs*, *jagirdars*, and *zamindars*), to put a ceiling on landholding and recover excess land from big landlords, to protect the rights of tenants, and to distribute surplus land to the landless. The AP government adopted a phase-wise implementation of land legislation through a gradual lowering of the ceiling on land holdings. This gradual process provided ample time for the big landlords to do *binami* (proxy) transactions,[85] for example, to transfer land ownership to temples, where the landlords act as the custodian of the so-called "temple lands." This helped the landlords to decrease the size of landholding in their name in official records below the ceiling levels. Such practices of the landlords were encouraged by the loopholes in land reform legislations and corrupt bureaucracy.

In fact, with the implementation of land ceiling laws very little surplus land was acquired, and much less was distributed to the landless. Moreover, whatever land the state had distributed was mostly unirrigated or uncultivated land, which required high capital investments and labor power to turn it into cultivable land. Although a significant waste land is reported to have been

[84] In the initial phase of land reforms in the 1950s and the early 1960s, Andhra Pradesh (AP) followed all-India pattern, but it was governed by three different legislations. They were: (1) The Andhra Pradesh (Telangana Area) Tenancy and Agricultural Lands Act, 1950, which was applicable only to Telangana regions, (2) The Andhra Tenancy Act, 1956, which was applicable to the Andhra region that constitutes the coastal Andhra and Rayalaseema, and (3) The Andhra Pradesh Ceiling on Agricultural Holdings Act, 1961, which was applicable to all regions of the united Andhra Pradesh.

[85] It was a common phenomenon during the early days of land reforms in India that the landlords transferred their land to their loyal tenants, servants, and relatives in order to bring their size of landholding down in the eyes of law, but in reality the landlords maintained total control over the land.

distributed, there is no information about the status of such lands (Parthasarathy 1996:70).

In Kadavendi, during the Telangana people's armed struggle of 1946-51 about 1200 acres of land was occupied by the Communist party and distributed to the landless of all castes (for the land concentration during that time see Table 4.2). But, after the withdrawal of the armed struggle, the new government ordered that the land occupied and distributed by the communists should not be cultivated because forceful encroachment of land was illegal. The landless followed government orders. They hoped that government would implement land reforms and the excess land above ceilings would be taken over and distributed to them. But, their dreams never came true. Instead, landlords gradually sold land to erstwhile tenants and the landless. In this way, the land reform legislation played an important role not in the redistribution of surplus land to the landless, but in checking any further concentration of land in the hands of a few landlords or rich peasants (Suri and Raghavulu 1996: 46-47). Later in the mid 1980s, the Naxalite movement entered the village with a slogan, "Land to the Tiller," and occupied the excess land (about 40 acres) of a landlord by planting red flags in his field. But, the Naxalites could not distribute the occupied land due to severe state repression, although they managed to distribute some land of a landlord to the landless for housing purposes. However, with the threat of the Naxalite movement, the landlords and rich farmers were reluctant to expand their size of landholding. Instead, they invested their agrarian surplus into real estate business, civil contracts, agricultural input business, money lending business, commission agent system, and small-scale industries.

Tenancy is not a predominant form of cultivation in Kadavendi. After years of peasant struggles, and the enactment of tenancy laws and the introduction of "Green Revolution" technology, the number of tenants in Kadavendi has been reduced to 1% of the total cultivators. The tenants pay their rent in cash based on the quality of soil. The annual cash rent for *regadi* (red soil), which is good for cotton crop, is Rs. 2000 per acre, and for *madikattu* (wet land) is Rs. 1500 per acre. However, it should be noted that almost all tenant agreements in this village are oral, and are not recorded in the village revenue accounts. Therefore it is very unlikely that the Tenancy Act would affect either the leased out landowner or leased in tenants.

Farmer Education and Age Distribution

Not surprisingly, 65 percent of the heads of farm households, who make critical decisions regarding agricultural practices, are illiterates. Among the educated farmers, 21 percent studied up to primary school level (i.e. up to 5th standard), 10 percent up to secondary school level (i.e. up to 10th standard), 3 percent up to intermediate level (i.e. up to 12th standard), and only 1 percent up to undergraduate level (Table 4.8). In terms of age distribution of the heads of farm households, only 14.9 percent are in the age group of 21-30 years, the majority (45.4 percent) of them are aged between 31 and 50 years, 6 percent of them are between 60 and 70 years, and only 0.3 percent of them are above 70 years. This demonstrates that younger generation across all size classes are not taking up agriculture as a vocation (Table 4.9). Particularly, no upper caste household aged between 21 and 30 is in agriculture (Table 4.10). And, in terms of gender, except for less than 1 percent of widow farmers, the rest of the heads of farm households are males. But, it should be noted that women are not considered farmers by local culture even if they are the *pattedars* (registered landowners) and contribute labor power as equal as their male counterparts in agricultural activities.

Table 4.8: Education Level of Heads of Farm Households, 2006

Level of Education	Illiterate	1-5th class	6-10th class	11-12th class	Undergraduate degree	Total
Marginal	231 (73)	69 (22)	13 (4)	3 (1)	0	316
Small	310 (70)	89 (20)	36 (8)	4 (1)	4 (1)	443
Semi-medium	192 (65)	59 (20)	30 (10)	12 (4)	3 (1)	296
Medium	12 (15)	17 (22)	36 (45)	10 (12)	5 (6)	80
Large	0	0	2 (67)	1 (33)	0	3
Total	745 (65)	234 (21)	117 (10)	30 (3)	12 (1)	1138 (100)

Note: Figures in parenthesis are row percentages.
Source: Field research

Table 4.9: Age Distribution of Heads of Farm Household by Farm-size Classification, 2006

Size Class	21-30	31-40	41-50	51-60	61-70	71-80	Total
Marginal	63 (20)	82 (26)	98 (31)	57 (18)	16 (5)	0	316 (100)
Small	62 (14)	142 (32)	142 (32)	75 (17)	22 (5)	0	443 (100)
Semi-medium	41(14)	83 (28)	92 (31)	56 (19)	24 (8)	0	296 (100)
Medium	3 (4)	10 (13)	38 (48)	18 (22)	7 (9)	3 (4)	80 (100)
Large	0	0	2 (67)	1 (33)	0		3 (100)
Total	170 (14.9)	317 (27.9)	372 (32.7)	207 (18.2)	69 (6)	3 (0.3)	1138 (100)

Note: Figures in parenthesis are row percentages.
Source: Field research

Table 4.10: Age of the Head of Farm Household by Caste Category, 2006

Caste Category	21-30	31-40	41-50	51-60	61-70	71-80	Total
OC	0	28 (20)	54 (38)	32 (23)	24 (17)	3 (3)	141 (100)
BC	85 (15)	159 (28)	199 (35)	102 (18)	23 (4)	0	568 (100)
SC	32 (18)	49 (28)	56 (32)	32 (18)	7 (4)	0	176 (100)
ST	53 (21)	81 (32)	63 (25)	40 (16)	15 (6)	0	253 (100)
Total	170 (14.9)	317 (27.9)	372 (32.7)	207 (18.2)	69 (6)	3 (0.3)	1138 (100)

Note: Figures in parenthesis are row percentages.
Source: Field research

Differentiation of Agricultural Producers

From a "peasant essentialist" perspective of agrarian populism, the peasantry is characterised by farm household that undertake petty production with the objective of meeting subsistence needs rather than making profits, that hold community solidarity and egalitarianism, that value community norms, kinship relationships and reciprocities, and that keep a harmonic relationship with nature. The characterization of the undifferentiated peasantry and petty production are common features of agrarian populism (Bernstein 2003:1, 7). But, with the penetration of capital into agriculture, the *petty producers* of the peasant societies have become *petty commodity producers* "[w]hen they are unable to reproduce themselves outside the relations and processes of capitalist commodity production, when those relations and processes become conditions of existence of peasant farming and are internalized in its organization and activity." (Bernstein 2003:4) Indeed, petty commodity production is a form (rather than a "mode") of production that prevails in the agrarian economies in the transition from feudalism to capitalism.

In Kadavendi, the categorization of farming community based on their occupation and relations of production is a complex matter because a majority of households are involved in two or more occupations in order to cope with the increasing gap between their farm income and household expenditure. For the majority of farmers, working in two or more occupations is a matter of mere survival, rather than accumulation. Based on the primary and subsidiary sources of income, the farming community of Kadavendi is divided into nine major categories. They are the following:

1. Households that solely depend on agriculture – 392 (34.4 percent)
2. Households that completely abandoned cultivation because of the rising cost of production and the debt burden, and became wage labourers – 58 (5 percent)
3. Households that completely abandoned cultivation and depend only on caste occupations – 8 (0.7 percent)
4. Households that primarily depend on agriculture and also practice caste occupation for supplementary income – 61 (5.4 percent)
5. Households that primarily depend on farming but supplement their income by working as wage labourers – 387 (34 percent)
6. Households that mainly depend on wage labor but also cultivate their farm to get some additional income – 160 (14.1 percent)

7. Households that derive major portion of household income from their jobs in private sector but they also depend on farming for subsidiary income – 35 (3.1 percent)
8. Households that work in public sector but depend on farming for subsidiary income – 12 (1.1 percent)
9. Households that primarily depend on local entrepreneurship but depend on agriculture for additional support to household – 25 (2.2 percent)

While 13 percent of marginal farmers and 28 percent of small farmers depend on agriculture as their sole source of income, the majority of semi-medium (54 percent), medium (83 percent), and large (66 percent) farmers completely depend on agriculture. Moreover, 16 percent of the marginal farmers and 2 percent of the small farmers have abandoned cultivation and become wage laborers. And, another 6 percent of marginal and 2 percent of small farmers abandoned agriculture and depend only on caste occupations. No farmer from other size classes has abandoned cultivation (see Appendix 1).

Table 4.11: Farmers' Occupations after the Abandonment of Own Cultivation, 2006.

Caste category / Occupation	BC	SC	ST	Total
Bonded labor (*Jeetham)*	3	4	0	7
Land leased-out and casual agricultural labor	4	4	0	8
Land leased-out and migrant labor	4	2	1	7
Non-cultivating and agricultural labor	11	14	2	27
Non-cultivating and migrant labor	5	0	0	5
Non-cultivating and non-agricultural labor	2	2	0	4
Total	29	26	3	58

Source: Field research

After the abandonment of work for themselves on their own farm, the farmers have become bonded labor (*jeethagaallu*), casual agricultural labourers, migrated to urban centres to work in factories and the construction industry, and wage labor in non-farm sector in the village (see Table 4.11). Apart from these farmers who abandoned agriculture, there is a pool of landless (268 people) who work in various occupations. Among the landless, 21 households are OCs (8 percent), 200 households are BCs 200 (75 percent), 44 households are SCs (16 percent), and 3 households are STs (1 percent). (See Appendix 2)

Bonded Labor in Kadavendi

In 2006, there were 13 bonded laborers in Kadavendi. The reasons for the presence of bonded labour are: unequal or no access to land and other productive assets, generational indebtedness, no access to common property resources, no institutional mechanism to support existing livelihood or provide new livelihood opportunities, lack of education, and no institutional credit support. In bonded labor, the number of hours worked is not important, but whether work is completed or not matters. (For a typical day activities of bonded labor see Table 4.12). There is no basic rule to calculate the remuneration of the bonded labor, but it depends on years of experience in agriculture, previous work record, physical strength, loyalty, and bargaining skills at the time of contract. Generally, the bonded labor contracts last one year, and workers are not allowed to do any other work for wages for another.

Table 4.12: A Typical Day in the Life of a Bonded Labor in Kadavendi

Timing	Activity
4:30 – 5:00 am	Wakes up
5:00 – 6:00	Cleans animal shed and takes them to the fields
6:00 – 11:00	Ploughs or levels land
11:00 – 11:30	Eats lunch brought by wife or mother
11:30 – 2:00	Feeds animals
2:00 – 5:30 pm	Continues work
5:30 – 6:30	Collects grass for livestock and gathers animals to shed
6:30 – 7:00	Returns home after work
7:00 – 10:00	At home
10:00 – 11:00	Goes back to the field to look after water supply to crops. If there is intermittent power supply, he sleeps at the site of water pump or electric motor in the field to switch on the motor whenever power comes.

Source: Field research

In Kadavendi, an average remuneration for an adult bonded laborer is Rs.13,500 per annum and for child bonded laborer is Rs.3500 per annum. They also take *baaki* or *appu* (credit) from the landlord to clear off some previous debts or for consumption expenses with an interest rate between 24% and 36% per annum. In some cases, the debt as well as bonded labor is intergenerational, that is, if father failed to repay the debt, then the son works as a bonded labor for the landlord. Apart from money, the landlord has to give them a pair of *cheppulu* (sandals), two pairs of cloths, one *cheddaru* (blanket), and regularly *beedies* (filterless tiny Indian cigarettes made of tobacco wrapped in a tendu leaf) if he smokes. Depending on the landlord, they also regularly get food (usually left over food). The existence of bonded labor and child labor are peculiar features of feudalism, and they operate through informal mechanisms because both forms of labor have been prohibited by the law. But, astonishingly, the bonded laborers in Kadavendi also have a *Jeethagaalla Sangham* (an Association of Bonded Laborers) to collectively bargain for hike in their remuneration and other facilities.

Agricultural Implements

Although the farmers in Kadavendi quickly adopted the biological (i.e. new seeds) and chemical (new synthetic fertilizers and pesticides) technologies of the "Green Revolution," their adoption of mechanical technologies is very minimal and slow. Overall, only 39 percent of the total farmers have pesticide spraying pumps, 49 percent of farmers are still using wooden ploughs pulled by oxen and cows (see Picture 4.4), 30 percent of farmers have bullock carts, 7 percent of farmers have iron ploughs, and only less than 1 percent of farmers have tractors. Astonishingly, 22 percent of the total farmers have no implements at all. All of them are marginal and small farmers, and for services they must pay people who have agricultural implements. Landholding size as well as caste also play an important role in the possession of agricultural implements. For differences in the possession of implements according to land size class and caste category see Table 4.13 and Table 4.14.

Table 4.13: Possession of Agricultural Implements by Land Size Class, 2006

Land size class	**Pesticide pumps**	**Wooden ploughs**	**Bullock carts**	**Tractors**	**Iron ploughs**	**No implements**
Marginal	19	46	22	0	0	240
Small	142	222	93	0	18	6
Semi-medium	195	204	160	1	24	0
Medium	80	80	69	6	37	0
Large	3	3	2	3	3	0
Total	439	555	346	10	81	246
Percent of the total farmers	39	49	30	1	7	22

Source: Field research.

Table 4.14: Possession of Agricultural Implements by Caste Category, 2006

Caste category	Pesticide pumps	Wooden ploughs	Bullock carts	Tractors	Iron ploughs	No implements
OC	72	82	63	7	32	16
BC	222	256	136	3	40	119
SC	42	69	35		4	86
ST	104	149	111		5	25
Total	439	555	346	10	81	246

Source: Field research.

Picture 4.4: Ploughing to Remove Weeds in Bt Cotton Crop with Wooden Plough Pulled by Oxen.

Source: Picture taken by the author in Kadavendi, September 9th, 2006.

Perpetual Indebtedness and Vulnerability

Indebtedness has become a common feature of farming community in the region of Telangana. The main reasons for indebtedness are: high agricultural input costs, increase in consumption costs, increase in expenses on health problems, poor crop yield, poor market price for produce, limited or no access to institutional credit, high interest rates, and expenses on other socio-economic events such as marriage, dowry system, etc. (see Parthasarthy and Shameem 1998) Contrary to the claims of proponents of new technologies, even after adoption of Bt cotton, the farmers cannot escape the debt trap. In Kadavendi, as of 2006, 73.4 percent of farmers are in debts ranging from below Rs.10,000 to above Rs. 140,000. In fact, 97 percent of marginal farmers, 95 percent of small farmers, 94 percent of semi-medium farmers and 75 percent of medium farmers are indebted (For detailed figures of indebtedness based on size class see Table 4.15). It should be noted that the current debt is not debt of previous year rather it is the accumulation of debt from the past 20 years or so. But, the debt burden has increased in the past 5 years. For 69 percent of the farmers the current debt has been accumulating for the past 5 years, for 26 percent of the farmers for 5- 10 years, for 4 percent of the farmers for 11-15 years, and for 2 percent of the farmers for 16-20 years (Table 4.16). For the years of indebtedness based on caste category see Table 4.17. For a majority of farmers, the amount of debt is much higher than their asset value. This vulnerable condition is one of the main reasons for farmer suicides (see Figure 4.1). In Kadavendi, between 2000 and 2006, three farmers committed suicide by consuming pesticide.

Sources of Credit

Since the adoption of cotton cultivation in general, and Bt cotton in particular, input costs have increased. These require money capital, which is not readily available for the majority of farmers. And, due to a cumbersome process, lack of collateral property and the prevalence of corruption in institutional credit outlets, farmers have to resort to usurious money lenders, input dealers and sub-dealers, local merchants, *aadthi* agents (the commission agents), and private sources

(Table 4.18). Since tenant-farmers are not eligible for institutional credit, they completely depend on such informal credit sources. All these informal moneylenders charge interest between 24 percent and 36 percent per annum. Credit analysis of the farmers shows that 41 percent received loans from input (seed and pesticide) dealers, 15 percent of farmers received credit from commission agents (*Aadthidar*), 15 percent from rich farmers and relatives in the village, and the rest from other sources.

Informal moneylenders such as input dealers, sub-dealers, and local merchants generally provide credit in kind (seeds, fertilizers, and pesticides) rather than in cash, and they start collecting their dues from the farmers' second and third harvest of produce onwards. Some local merchants and sub-dealers demand that farmers repay their loans with produce rather than money. This kind of mechanism is called "credit-product interlocked market relationship," where the farmer borrows money from the local moneylender and pays back to him/her by produce. In this relationship, usually the moneylender keeps advancing input credit to indebted farmer by taking his/her land as collateral. This provides an opportunity to the moneylender to claim the farmer's land if he/she fail to repay the loan. The credit-product interlock also prevents the farmer selling their produce in the open market where he/she can get relatively higher returns for his/her produce. This kind of relationship has been viewed as "a mechanism of differentiation [of the peasantry] and primitive accumulation" by some and as "a form of capitalist development" by others (Adnan 1985:PE59; see Banaji 1977; Bhaduri 1983; Bharadwaj 1994).

In the commission agent system (locally called *Aadthi* system), the commission agents act as middlemen between the farmer and the buyer in the market yard (officially designated market place) in determining the quality of produce, and grading and fixing a rate to it. In the Warangal market yard alone about 350 aadthi agents are conducting their business. Each *aadthi* maintains a network of farmers and local agents, and he (usually a man) advances loans to the farmers to meet production costs. In return, farmers who take loan from these agents have to sell their produce in the market through them only. And, for acting as intermediaries and facilitating the sale, these agents get some commission over the value of produce from the farmer as well as the buyer. If a farmer demands payment for his or her produce on the spot of the sale, then the commission agent takes a commission of 3 percent, and if he or she accepts to wait for at least 10 days for the payment then the agent charge only 2 percent. After selling the produce, the commission agent recovers his loan amount with interest from the money the farmer receives.

The majority farmers of Kadavendi complain that often the *aadthis* and the buyer collaborate, and cheat farmers by downgrading the quality of produce and thereby lowering the price of produce. They also say that the buyer-commission agent group cheats farmers by wrongly measuring the produce, and by not counting any extra weight of cotton below 500 grams when measuring a cotton bag. Also, they take 1-2 kilograms of cotton from the farmer as a sample without any payment. In this *aadthi* system the farmer has no opportunity to participate in deciding either the quality or the price of the produce. And, there is no proper government regulation to ensure at least the Minimum Support Price for the produce.

A majority of the farmers in Kadavendi sell their produce to input dealers, local merchants, and outside traders (*beragaallu*) at farm-gate prices in the village because of economic compulsions to pay off their debts, to meet household consumption and other expenses, and to avoid transportation risks to the regularized markets. Other reasons for the distress sale of cotton are lack of storage capacity, long waiting time and exploitation at the sale points in the markets, and poor information systems about the prices of produce. Thus, the adoption of new technologies alone cannot solve the problem of indebtedness, if farmers do not have access to regulated market mechanisms or other alternatives such as farmer cooperative systems.

Table 4.15: Indebtedness of Farm Households in Kadavendi by Size Class, 2006

	Zero	10,000	11-20,000	21-30,000	31-40,000	41-50,000	51-60,000	61-70,000	71-80,000	81-90,000	91-100,000	101-110	111-120	121-130	131-140	141-150	Total
Marginal	11 (3)	130 (41)	63 (20)	36 (11)	24 (8)	42 (13)	3 (1)	0 (0)	3 (1)	0 (0)	3 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	316 (100)
Small	23 (5)	85 (19)	78 (18)	72 (16)	55 (12)	56 (13)	21 (5)	19 (4)	18 (4)	0 (0)	13 (3)	0 (0)	0 (0)	0 (0)	0 (0)	3 (1)	443 (100)
Semi-medium	18 (6)	12 (4)	57 (19)	35 (12)	27 (9)	50 (17)	25 (8)	22 (8)	7 (3)	0 (0)	32 (11)	0 (0)	7 (3)	0 (0)	0 (0)	2 (1)	296 (100)
Medium	20 (25)	10 (13)	3 (4)	9 (11)	2 (3)	3 (4)	3 (4)	7 (9)	7 (9)	0 (0)	7 (9)	3 (4)	3 (4)	0 (0)	0 (0)	3 (4)	80 (100)
Large	3 (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 (100)
Total	75 (6.6)	238 (20.9)	201 (17.7)	152 (13.4)	108 (9.5)	152 (13.4)	52 (4.6)	48 (4.2)	36 (3.2)	0 (0)	55 (4.8)	3 (0.3)	10 (0.9)	0 (0)	0 (0)	8 (0.7)	1138 (100)

Note: Figures in parenthesis are row percentages. Source: Field research.

Table 4.18: Credit Source by Size Class, 2006

Size class	Banks	Balavikas Cooperative Society	Banks and cooperatives	Commission agents (Aadthi)	Input dealers and sub-dealers	Rich farmers and relatives in the village	Relatives from other villages and towns	Self-help Groups	Local merchants	Total
Marginal	6 (2)	0 (0)	0 (0)	40 (13)	114 (37)	66 (22)	31 (10)	3 (1)	45 (15)	305 (100)
Small	7 (2)		9 (2)	42 (10)	213 (52)	65 (16)	21 (5)	4 (1)	49 (12)	410 (100)
Semi-medium	9 (3)	3 (1)	3 (1)	64 (23)	103 (37)	26 (9)	29 (10)	15 (5)	28 (10)	278 (100)
Medium	6 (9)	8 (11)	17 (24)	12 (17)	6 (9)	2 (3)	12 (17)	4 (6)	3 (4)	70 (100)
Total	28 (3)	11 (1)	29 (3)	157 (15)	436 (41)	159 (15)	92 (9)	26 (2)	125 (12)	1063 (100)

Note: Figures in parenthesis are row percentages.
Source: Field research.

Table 4.16: Years of Indebtedness by Size Class, 2006.

Size Class	1-5 yrs	6-10 yr	11-15 yr	16-20yrs	Total
Marginal	227 (74)	69 (23)	6 (2)	3 (1)	305 (100)
Small	290 (71)	103 (25)	14 (3)	4 (1)	410 (100)
Semi-Medium	181 (65)	76 (27)	13 (5)	8 (3)	278 (100)
Medium	32 (45)	25 (36)	11 (16)	2 (3)	70 (100)
Total	729 (69)	274 (26)	44 (4)	17 (2)	1063 (100)

Note: Figures in parenthesis are row percentages

Source: Field research.

Table 4.17: Years of Indebtedness by Caste Category, 2006.

Caste Category	1-5 yrs	6-10 yr	11-15 yr	16-20yrs	Total
OC	64 (60)	33 (31)	9 (8)	1 (1)	107 (100)
BC	353 (66)	150 (28)	21 (4)	11 (2)	535 (100)
SC	120 (70)	41 (24)	9 (5)	2 (1)	171 (100)
ST	192 (77)	50 (20)	5 (2)	3 (1)	250 (100)
TOTAL	729 (69)	274 (26)	44 (4)	16 (2)	1063 (100)

Note: Figures in parenthesis are row percentages.

Source: Field research.

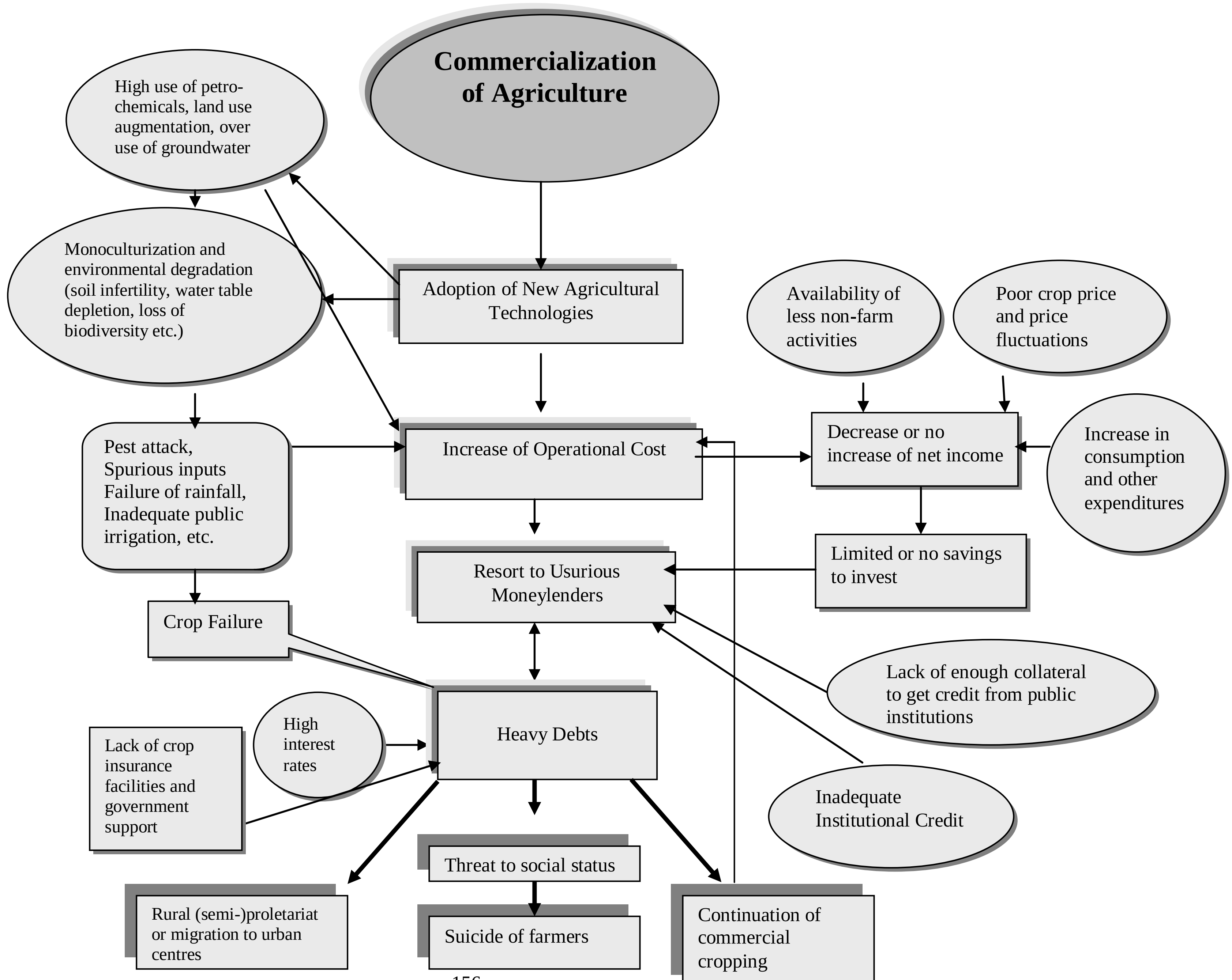

Figure 4.1: Risks involved in commercial agriculture with new agricultural technologies

Apart from all these local political economy conditions, cotton commodity price fluctuations in the international market also severely affect the price of produce. All these local and global market forces impact the realization of profits by the majority of farmers and perpetuate indebtedness and vulnerability.

The above discussion about the agrarian conditions of Kadavendi clearly indicates that the semi-feudal mode of production (i.e. both the feudal mode of production and the capitalist mode of production are present, but the feudal mode of production is dominant) (see Table 4.19), still prevails and the agrarian question remains intact. Although there is a transfer of surplus through high interest rates, high prices for inputs and low prices for outputs to industrial and commercial capitalist economy, the operations of surplus generation and transfer is based on the conditions created by the semi-feudal relations of production. In the following section, I analyze how the semi-feudal relations of production help the diffusion of Bt cotton seeds and other agricultural inputs, which generates surplus for industrial and capitalist class.

Table 4.19: Aspects of the Semi-feudal Mode of Production in Kadavendi

Elements of the Feudal Mode of Production	Elements of the Capitalist Mode of Production
• Primitive forces of production • Perpetual indebtedness, and limited accumulation and reinvestment • Sharecropping • Bonded labor • Credit-product interlocked mechanisms • Limited market accessibility • Significant number of the landless • Patriarchal property rights • Caste ideological hegemony	• Presence of wage labor • Production for the market • Commodification of agricultural input and output • Displacement of artisan caste occupations and the disintegration of *jajmani* system (patron-client relationship within the caste system) • Patriarchal property rights

The Political Ecology of Bt Cotton[86]

Bt cotton seeds were first introduced into Kadavendi by Mahyco-Monsanto in 2003 with an assertion that Bt cotton would increase productivity and reduce dependency on pesticides, thereby alleviating economic and environmental problems. The adoption rate of Bt cotton in the village has been astonishing. In 2003, only 14 farmers adopted it, but the number has gone up to 892 in just four years. By 2006, of all cotton farmers (964), 892 farmers (93%) cultivated Bt cotton and only 72 farmers (7%) cultivated non-Bt cottonThough there are different rates of adoption based on the size of landholding, by 2006 the majority of farmers in all categories adopted Bt cotton: 84% of marginal farmers, 91% of small farmers, 99% of semi-medium and medium farmers, and 100% of large farmers adopted Bt cotton (see Table 4.20).

Factors Influencing the Adoption of Bt Cotton

To introduce new seed and to convince farmers to adopt them, companies use various marketing strategies. The major factors that influenced farmers to adopt Bt cotton in Kadavendi were seed company mobile campaigns, field demonstrations, farmers' advocacy and social networks and seed merchant–farmer networks. (For the profile of the farmers interviewed in Kadavendi, see Appendix 3)

When asked about the factors that most influenced them to adopt Bt cotton, the most common answer was their mounting burden of debt and their desperate situation which led them to try a new product. When asked for more specific reasons for their initial adoption, only 7 percent of the farmers reported that they had adopted Bt cotton because of the influence of company advertisements and mobile campaigns. My research found that the major influencing factors (for 43 percent of the adopters) were field demonstrations and the perceived success of big farmers in the village. Other factors such as farmers' advocacy and social networks influenced 29 percent of the adopters and the seed

[86] A version of this section has been published in the *International Social Science Journal*. See Kumbamu 2009.

merchants and dealers influenced 21 percent of the adopters. We will examine each factor in turn (see Table 4.21).

Seed Company Advertisements and Mobile Campaigns

Every year, well before sowing season starts (that is, between May and June), seed company campaigners regularly go from village to village in jeeps or vans to introduce the new seed. In Kadavendi the farmers came to know about Bt cotton for the first time through company mobile campaigns in 2003. In the campaigns special emphasis is placed on the agronomic benefits of Bt cotton vis-à-vis non-Bt cotton varieties. In fact, Bt cotton was projected as a solution to the problems associated with non-Bt cotton, such as heavy bollworm attacks, a huge application of pesticides and poor yields.

Table 4.20: Adoption of Bt cotton in Kadavendi, 2003-2006

Farmer category based on landholding size	Total farmers in the village, 2006	No. of farmers adopted Bt cotton, 2003	No. of farmers adopted Bt cotton, 2004	No. of farmers adopted Bt cotton, 2005	No. of farmers adopted Bt cotton, 2006	Percentage of Bt cotton adopters of the total cotton cultivators in 2006	No. of non-Bt cotton farmers, 2006	Percentage of non-Bt cotton farmers of the total cotton cultivators in 2006	Total cotton farmers in 2006	Percentage of cotton cultivators of the total farmers in 2006
Marginal farmers	316	0	3	71	167	84	32	16	199	63
Small farmers	443	0	11	181	351	91	35	9	386	87
Semi-medium farmers	296	3	16	149	292	99	4	1	296	100
Medium farmers	80	9	19	52	79	99	1	1	80	100
Large farmers	3	2	3	3	3	100	0	0	3	100
Total farmers	1138	14	52	456	892	93	72	7	964	85

Source: Field research

Table 4.21: Factors of Influence in the Initial Adoption of Bt cotton

S. No	Factors of Influence	Percentage of Bt cotton Farmers
Common factor: Debt burden		
1	Company mobile campaigns and media advertisements	7
2	Field demonstrations and perceived success of big farmers	43
3	Farmers' advocacy and social networks	29
4	Seed merchants and dealers	21

Source: Field research.

The basic tools of mobile campaigns are pamphlets, posters, billboards and live speeches by trained campaigners. In addition, companies regularly broadcast commercial advertisements of the new seed on local television and radio. Although the seed campaigns were not entirely new to the farmers they are always tempted to attend such events because company campaigns and advertisements lead them to believe that each new seed is somewhat technically improved and gives better yields than the existing ones. Moreover, since the farmers have been thoroughly vexed with the negative externalities of non-Bt cotton varieties, they look forward to any new seed that could diminish their vulnerability. As one farmer mentioned, "we have no alternative but to adopt the new seed because non-Bt cotton cultivation has created a very fragile economic condition, and a life and death situation." In fact, this desperate situation of the farmers provides companies with an added advantage in the spread of GM seed. Well-trained campaigners with their effective communication skills always try to give a good first impression of GM crops and present these new seed as a savior.

Field Demonstrations and the Social Construction of GM Crops

Field demonstrations are one of the most influential marketing strategies in new seed promotion. Seed companies or their agents first select suitable villages for field demonstration, then select suitable farmers who are willing to plant GM crops in their fields. Companies usually select demonstration fields in villages that are along the main road for good visibility, and make the task of mobilizing farmers easy. Furthermore, companies give preference to villages where farmers have already been cultivating commercial crops such as cotton, chilli and tobacco rather than villages growing noncommercial crops such as food for household consumption, because it is easier to make farmers in those villages understand the economic advantages of the new seed.

The seed companies select one or two resourceful farmers in about 10 villages, farmers with adequate resources such as suitable land, an abundant supply of water, implements, basic formal education, ready access to public institutions and previous experience with commercial crops. They also tend to choose farmers from powerful socioeconomic groups (that is, from the “upper” castes and upper classes). Since Kadavendi has been one of a few predominantly cotton-cultivating villages, the agricultural land of a large farmer belonging to an “upper” caste (Reddy) has been selected for the field demonstration. The seed companies provide the demonstration farmer free seed and sometimes even fertilizers and pesticides. They then closely monitor the entire production process, suggesting new risk management techniques to get higher yields. Under such favourable conditions, Bt cotton in the demonstration fields gave higher yields than non-Bt cotton. The farmer who owned the demonstration field in Kadavendi reported that he had produced 10 quintals of Bt cotton per acre with just four sprays of pesticide (compared to 6-8 quintals of cotton with 10-15 sprays on a more traditional cotton farm).

The seed company agents select the best fields for demonstration in order to ensure the proper assessment of the growth of crops and the agronomic value of the produce. This is because the seed companies want to demonstrate in the “model” fields how the new seed will increase productivity and decrease production costs (by decreasing the number of sprays of pesticide). The local seed company agents then organize 10-15 relatively well-off farmers in a group from nearby villages and bring them in a jeep or van to the demonstration site to explain how the new seed could benefit them. For the farmers, simply being selected for the field tours is a source of social prestige. They are considered gentlemen farmers and become agents of information dissemination in the village.

During the field tours the seed agents also arrange for the farmers to interact with the owner of the demonstration field. This is because it is more effective if the farmer of a "successful" crop, rather than a company agent, talks about the advantages of the new seed. In many interesting sociological ways, field demonstrations not only serve to spread GM crops, but also work for consensus building in the farm community, and for the social construction of the image of GM crops and scientific knowledge about them. Also, field demonstrations have been used as a means of social learning, a process by which farmers come to know about the benefits of GM crops and spread the word in their social networks. In a nutshell, the main purpose of field demonstrations is social construction of the belief that embracing GM crops is a rational act.

Farmers' Advocacy and the Exploitation of Social Networks

As the adoption of GM cotton has accelerated, a few demonstration field farmers as well as other rich farmers have taken up the seed business in the village. These farmer-cum-informal seed dealers have become the front-end sellers for GM seed companies as well as "resource persons" for novice Bt cotton farmers. When I asked a local seed dealer about his "side-business," he said: ''I do not make much money out of this side-business. I hardly get 10 to 15 rupees commission per bag or free seed for my farm from the company's seed distributors. The seed merchants in town get real profits, not us''. It is uncertain whether they make much money or not, but what is very obvious in Kadavendi is that the farmers place more trust in the local farmer-cum-informal-seed dealer than in the local seed merchants. Farmers are familiar with the attitudes of seed merchants and in recent years have found them unreliable. Another important factor that influences farmers to buy the seed from the local seed dealer is their proximity to their field, which enhances small and marginal farmers' access to the new technology and decreases their transportation costs.

The caste system also influences farmers. Though there are several farmer-cum-informal-seed dealers belonging to various castes, the farmers prefer to go to the seed dealer of their own caste because they place high trust in them and there is a stronger socio-economic bond between them. Table 4.22 shows that, in the year 2006, 55 percent of Bt cotton farmers purchased their seed in Kadavendi and the rest (45 percent) purchased their seed from the nearby town, Janagam. The majority of the farmers belonging to BC and SC caste categories purchased their seed in Kadavendi from seed dealers of their caste, and the majority OC and ST farmers purchased seed from seed merchants in Janagam because of past relationship with them. However, 7.2 percent of the total Bt cotton adopters (65 farmers) sowed spurious seeds in 2006, which did not germinate at all in most of the fields (Picture 4.5) and resulted in poor crop growth in some fields. And, 29 percent of *dalit* Bt cotton farmers and 10.5 percent ST farmers sowed spurious seeds in Kadavendi (Table 4.23).

Table 4.22: Place of Purchase of Bt Cotton by Caste Category, 2006

Place of Purchase	**OC**	**BC**	**SC**	**ST**	**Total**
Kadavendi	60 (44)	300 (65)	75 (87)	52 (25)	487 (55)
Janagam	75 (56)	162 (35)	11 (13)	157 (75)	405 (45)
Total	135 (100)	462 (100)	86 (100)	209 (100)	892 (100)

Note: Figures in parenthesis are column percentages.
Source: Field research.

Table 4.23: Number of Farmers Sowed Spurious Bt Cotton Seeds in 2006

Size class	**OC**	**BC**	**SC**	**ST**	**Total**
Marginal	2	5	8	12	27
Small	1	7	11	4	23
Semi-Medium	0	3	6	6	15
Total	3	15	25	22	65
Percent of the total Bt cotton Farmers	2.2	3.2	29	10.5	7.2

Source: Field research.

Seed Merchant-Farmer Networks

By the early 1990s hybrid cotton seed spread throughout Warangal district, and farmers overwhelmingly planted cotton because of attractive prices, the government advocacy of export-oriented cash crops and trade liberalization polices (Stone 2007:74). This has commodified all agricultural inputs (such as land, labor and technology) and outputs into essential commodities. This process of commodification has increased farmers' dependency on the market for agricultural inputs and has also promoted production exclusively for the market.

Taking advantage of the capital-intensive agricultural system and the market-dependent farming community in the district, some erstwhile landlords and rich farmers have invested a part of their accumulated capital, or the money they earned from selling their land, in the agricultural input business. They consider entering the seed business a rational choice because it is very lucrative. Moreover, selling off lands in the countryside and moving into town is considered safer. This is because the Maoist revolutionary movement (the main political program of which revolve around the socio-economic issues of agrarian transformations and the Land-to-the-Tiller slogan), has been growing and is an influential political force in the region (Srinivasulu 2002). This process of landlords and rich farmers venturing into business enterprises started in the mid-1980s and gained momentum in the 1990s. It still continues today.

Picture 4.5: A *Dalit* and Marginal Farmer Preparing Land for Another Crop After the Failure of Bt Cotton Seed Germination in 2006.

Source: Picture was taken by the author in Kadavendi, October 4th, 2006.

Erstwhile big farmers are well established in the agricultural input business because they used their socio-cultural, economic and political networks in the villages. Though most of them live in towns, they still exercise significant socioeconomic and political power over the peasant farmers in the countryside, through their agent networks in villages. Moreover, the commodification of the means of production increases the need for cash, which pushes the small and marginal farmers, lacking access to formal and reliable institutional credit facilities, towards usurious local moneylenders for cash credit, or to seed merchants and dealers for input credit. The advancement of input credit allows seed merchants to sell inputs to the peasant farmers at higher prices and to charge higher interest rates on their input loan because farmers usually pay off their loans, completely or partially, only after selling their crop in the market.

In the Warangal district, there are about a thousand agricultural input merchants, and their social networks cover almost all 1,015 *Gram Panchayats* (village councils). These seed merchant-farmer networks and the semi-feudal relations of production serve as market channels to help the seed companies spread the new seed. This informal nexus between the semi-feudal class and the capitalist class helps us to understand how the locally dominant agrarian classes assist the penetration of global capital as well as global agricultural knowledge.

Economic Costs and Benefits of Bt and non-Bt Cotton

Comparison of the agro-economics of Bt and non-Bt cotton clearly shows that with the adoption of Bt cotton, the expenditure on pesticide and the labour cost associated with its application has significantly decreased. But, since there is no proper information for farmers about the physical characteristics of Bt cotton crop, they increased the application of synthetic fertilizer considering the shorter size of the Bt crop. Moreover, some farmers strongly believe that their soils would not respond to the new seed if they did not apply fertilizers and pesticides. A medium farmer with 20 years of farming experience strongly asserts that “if we want to continue to use the new seed, we must use chemical fertilizers and pesticides, because our soils are habituated to chemicals, and we are also accustomed to use them.” However, with the high use of fertilizers, weeds have increased; thereby labor costs for weeding have increased. This has no significant impact on the total labor cost of production because the labor cost for pesticide application has decreased.

Although with the intervention of the government of Andhra Pradesh in 2006, the seed companies have decreased the cost of Bt cotton seed from Rs.1800 to Rs.750, it remains costlier than any non-Bt varieties. Thus, with the increase in the expenditure on seed and fertilizers, the total cost of production has increased. Although there is an increase in yield, contrary to the claims of proponents of technology, it is not uniform across different size classes. In fact, the yield of Bt cotton has significantly increased only for medium and large farmers, because they have access to required inputs (water facility, capital availability etc.) and information regarding proper crop management practices (application of required fertilizers, timely identification of pest and application of pesticides, timely weeding, etc.) However, for marginal, small, and semi-medium farmers, there is no big difference in their total net income with the adoption of Bt cotton (see Table 4.24 and Table 4.25). A marginal farmer lamentingly says:

> When we were using local cotton seed [non-Bt], insects used to eat our money. But, since the adoption of Bt cotton, seed and chemical dealers are eating our money. Whether it is Bt or non-Bt, with cotton crop cultivation we never benefited yet. For us nothing has changed. Before and after the adoption of Bt cotton, our financial situation remains the same. Returns from agriculture are not even compensating our family labor cost. (Interview with a farmer in Kadavendi, July 3rd, 2006)

As the farmer clearly pointed out for marginal and small farmers the net income is not even equal to their family labor power invested in the entire production process. But it is very rare that a farmer calculates his or her family labor cost in the net income. Many are satisfied even if they get marginal returns (excluding their labor costs) from all their crops. As a small farmer mentions: "We take money from profits of rice cultivation and invest them in cotton cultivation, and vice versa. We are not so greedy. If we get an average of Rs. 2,000 per acre [about CAN $50] from all our crops, we live like kings! " (Interview with a farmer in Kadavendi, August 2nd, 2006)

Table 4.24: Average Costs and Benefits of Bt Cotton in Kadavendi, 2006-07 (All Values in Rupees).

Items	Marginal	Small	Semi-medium	Medium	Large
Land Development expenses	1540	1650	2000	2400	2400
Seed cost	750	750	750	750	750
Fertilizer cost	1750	1850	2100	2240	2570
Pesticide cost	2150	2225	2420	2600	2700
Pre-land development activities and the labor cost of fertilizer application	130	130	165	200	235
Sowing	70	70	70	70	70
Weeding	525	525	630	735	840
Pesticide application	665	665	570	475	570
Harvesting	700	788	1225	1785	1750
Total family labour cost	1740	1718	1460	1465	0
Total wage labor cost	350	460	1200	1800	3465
Total labour cost	2090	2178	2660	3265	3465
Transportation cost	150	260	320	425	500
Other costs	150	200	270	290	368
Interest on working capital	785	832	1087	1261	1530
Yield (in quintals)	5.0	5.5	6.8	8.5	10.0
Price per quintal	1650	1740	1750	1820	1840
Total expenditure	9365	10445	11337	13676	13915
Gross income	8250	9570	11900	15470	18400
Net income including family labor cost	-1265	-1075	293	1504	4117
Net income excluding family labor cost	475	643	1753	2969	4117

Source: Field research

Table 4.25: Average Costs and Benefits of non-Bt Cotton in Kadavendi, 2006-07 (All values in Rupees).

Items	Marginal	Small	Semi-medium	Medium
Land Development expenses	1500	1550	1850	2100
Seed cost	470	450	480	475
Fertilizer cost	1000	1100	1200	1325
Pesticide cost	3400	3600	3800	3900
Pre-land development activities and the labor cost of fertiliser application	135	130	170	200
Sowing	70	70	70	70
Weeding	380	420	540	580
Pesticide application	720	720	720	1235
Harvesting	700	840	1050	1225
Total family labour cost	1645	1760	1280	1560
Total wage labor cost	360	420	1270	1750
Total labour cost	2005	2180	2550	3310
Transportation cost	0	0	300	375
Other costs	140	160	180	170
Interest on working capital	807.6	854	1032	1146
Total expenditure	9323	9894	11092	12426
Yield in quintals	5	5.2	6.5	7
Price per quintal	1650	1680	1760	1840
Gross income	8250	8736	11440	12880
Net income including family labor cost	-1073	-1158	348	454
Net income excluding family labor cost	572	602	1628	2014

Source: Field research.

Erosion of Biodiversity, Food Security, and Commons

In the process of production for the market, farmers totally neglected cultivating many staple foods, oil seed and other crops, which have eventually disappeared from the regional rural landscape. In Kadavendi, as of 2006, 65.2 percent of cultivated land is planted to cotton (of which 61.9 percent is to Bt cotton and 3.4 percent is to non-Bt cotton). Only 12.2 percent of cultivable land is under rice cultivation, 6.5 percent is groundnut, 4.2 percent is chillies, 4.1 percent is redgram, 3.2 percent is sesame, and the rest is other minor millets, vegetables and fruits (see Table 4.26). In the process of shifting towards commercial crops, several varieties of crops mentioned in Table 4.27 have totally disappeared within the last twenty years, and crops such as sesame (*nuvvulu*), groundnut (*pallikaya*), redgram (*kandulu*) and other pulses are on the edge of disappearing. This is not just an erosion of biodiversity, but the dispossession of farmers' control over agriculture, livelihood, food security, and the local knowledge and cultural values associated with cultivating these crops.

Table 4.26: Agricultural Land Use (in acres) in Kadavendi, 2006.

Crop	Marginal farmers	Small farmers	Semi-medium farmers	Medium farmers	Large farmers	Total land use in acres	Percent of the total cultivated land
Bt Cotton	194	648	886	360	65	2153	61.9
Non-Bt	40	60	10	7	0	117	3.4
Rice	40	99	194	86	4	424	12.2
Chillies	0	19	55	69	3	146	4.2
Sorhghum	3	4	21	0	0	28	0.8
Maize	0	0	5	10	0	15	0.4
Redgram	14	43	67	16	3	143	4.1
Ground nut	25	42	142	9	9	228	6.5
Fruit trees	0		30	13	0	43	1.2
Coriander	0	4	5	10	0	18	0.5
Vegetables	0	0	30	15	0	45	1.3
Seasame	1	20	60	30	0	111	3.2
Greengram	0	0	10	0	0	10	0.3
Total cultivated	317	939	1515	625	84	3481	100.0
Total irrigated	99	218	436	178	59	991	28.5

Source: Field research

Table 4.27: Crops that Are Disappearing and Have Disappeared in Kadavendi Within the Last 20 Years.

	English	**Telugu**
Cereals and Millets		
	Pearl millet/jowar	*Sajjalu*
	Foxtail millet	*Korralu*
	Sorghum/bajra	*Jonnalu/pacha jonnalu*
	Finger millet	*Taidalu/ragulu*
	Maize	*Mokka jonna*
	Proso millet	*Varigalu*
	Rice varieties	
	---	*Sambalu*
	---	*Bankodlu*
	---	*Palasannalu*
	---	*Pottimolakalu*
Oil seeds		
	Castor	*Amdalu*
	Safflower	*Kusumalu*
	Sunflower	*Podduthirugudu*
	Sesame	*Nuvvulu*
	Groundnut	*Pallikaya/verushanaga*
Pulses		
	Soybean	*Soyabean*
	Greengram	*Pesarlu*
	Horsegram	*Ulavalu*
	Cowpea	*Bebbarlu*
	Field bean	*Anumulu*
	Blackgram	*Minumulu*
	Redgram	*Kandulu*
Other	Tobacco	*Pogaku*

Source: Field research

Until the introduction of Green Revolution rice cultivation into Kadavendi only about 10-15 percent of upper caste and upper class used to eat rice and the rest were eating millets such as *jonnalu, sajjalu, taidalu, korralu,* and *varigalu.* But, gradually, every household in the village shifted their staple food preference towards rice. Moreover, the social construction of millets as the staple food of "uncivilized" lower castes and rice as the staple food of "civilized" upper castes also influenced people to adopt rice eating habits. The influence of such hegemonic discourse on eating preferences and eating styles has to be understood in the framework of the modernization of society. Farmers I interviewed informed that nowadays nobody eats millet food in Kadavendi. When I ask elderly people, they complain that food in the past was tastier, healthier, cheaper, and locally available for everybody. Now the situation is changed. As a *dalit* small farmer in his 60s says:

> In the past we used to eat bajra, jowar, some roots, leaves and other edible products from our own fields. When we were eating food from our fields, we lived healthy. We used to eat rice only on some special occasions such as festivals and marriages. But we started eating rice regularly since everybody began producing rice in the village … Now nobody is eating millets. Younger generations don't even like the taste of them. But, now food is no good. Younger generation people are not as strong as the older generations… We are spending money on *mandula koodu* [food grains produced by heavy application of fertilizers and pesticides] and buying *rogalu* (diseases)… We are growing cotton for the market and buying rice from *shavukaru* [local merchant] because the farmers in this village have reduced rice growing area. So if we don't have enough money, we don't get enough food for all family members…*Sarkar* (government) not only introduced rice into our lives but also hunger and new diseases along with it. (Interview with a farmer in Kadavendi, July 17th, 2006)

Not only the food crisis, but also the water crisis has been augmenting in Kadavendi. Since the public irrigation system was not well developed and maintained in this region, the farmers have started digging bore wells to acquire more water. This initiated the privatization of groundwater, which led to an unhealthy competition among the farmers to dig deeper bore wells and tap more underground water. In Kadavendi, as a result of this competition, the number of tube bore wells remarkably increased over years. In fact, many farmers invested huge amounts of money in digging and maintaining bore wells, and, consequently, became heavily indebted. Moreover, the rapid increase of bore wells has gradually resulted in the depletion of the water table, and has pushed farmers to dig even deeper (at least 200 feet) to extract the water. The depletion of the water table in the region has created a water scarcity situation not only for agriculture but also for human and animal consumption. Moreover, water from all sources has been fluorinated, with serious health implications for the majority, who cannot afford to buy water everyday.

As well, the increase of the net area under non-food crop cultivation has gradually decreased the scale of grazing land, with a resultant decrease of the number of livestock in the village. The decrease in domestic animals has serious implications for subsistence farmers. It has reduced the use of livestock manure and has increased dependency on chemical fertilizers. It has also increased the use of tractors in the place of bullock-carts and cattle ploughs. Since all agricultural inputs (such as seeds, fertilizers, pesticides, labor power, fuel, water, and machinery) are commodified, farmers need money (capital) to buy them. To meet farm as well as household expenses, farmers have to cultivate commercial crops for the market. They find themselves caught on the treadmill of commodification of everything in the village.

Imposition of Global Knowledge and the Attrition of Local Knowledge

As I discussed earlier, seed commodification makes the farmer a passive recipient of knowledge because where farmers cannot use their collective knowledge system to develop new seed, the attrition of local varieties leads to the deskilling of the farmers (Stone 2002: 619). But it is important to understand how the process of deskilling operates in agriculture with GM crops. For example, critics have argued that GM crops can generate negative socio-ecological externalities if farmers do not understand and follow the specific cropping practices such as the "refuge strategy." For this reason, it is crucial to ask whether the farmers receive correct information about the new seed and the specific insect resistance management practices, and whether they properly understand the information and follow it, are crucial questions to examine. As with any other crop, insects that are exposed to Bt crops will eventually develop resistance to the poisonous substance, Bt toxin, that the crop produces. Considering this, a proactive insect resistance management system was put together by seed companies to delay or prevent the development of Bt resistance in insects. The resistance management plan suggests a "refuge strategy" of planting non-Bt cotton in at least five rows surrounding the Bt cotton field, or 20 percent of the total sown area, whichever is greater. The logic is that when non-Bt cotton is planted within or around a Bt cotton field, the non-Bt cotton acts as a "refuge" for Bt-susceptible insects that will mate with Bt-resistant insects, and produce Bt-susceptible offspring, thereby minimizing or delaying the development of Bt-resistant insects.

In India, and other countries where GM crops have been adopted, it is mandatory to practice refuge strategy to mitigate as yet unknown socio-ecological and economic risks with the development of Bt resistant insects (Manjunath 2005). All Bt cotton companies sell seed packages with two packets: a 450-gram packet of Bt cotton and a 120-gram packet of non-Bt cotton for the refuge. However, there is considerable doubt whether the implementation of the refuge strategy is feasible in India, where marginal and small farmers predominate, and whether these small agricultural producers understand the importance of this unique practice.

When asked about the practice of the refuge strategy, no farmer in Kadavendi responded positively. In the first year of adoption of Bt cotton, most of the farmers practiced a refuge strategy according to instructions given by seed merchants; but few practiced it in the second year and from the third year onwards almost all farmers had abandoned it. One farmer explains how he adopted and abandoned the refuge strategy:

> When I purchased Bt cotton seed, the seed merchant advised me to plant non-Bt cotton seed if I could. He told me that non-Bt would work as a border against insects entering into the Bt field. In the first year I followed the merchant's advice, but from the second year onwards I did not, because I do not see any specific benefit with this practice. What we have clearly noticed in the first year was that insects attacked only non-Bt plants but not Bt plants, and about 200-300 non-Bt plants per acre were totally damaged. We were afraid that these insects would also attack Bt cotton plants if we continue to grow non-Bt around it. Thus we stopped using non-Bt around Bt. Moreover, we found this new practice was merely a waste of land, as non-Bt cotton plants do not yield anything. A few farmers, those who mechanically follow the advice of companies,

> are still planting non-Bt cotton around the Bt cotton field, but those who do agriculture technically and creatively have stopped practicing this system. (Interview with a farmer in Kadavendi, September 4th, 2006)

Many farmers believe that the seed merchants advised them to plant non-Bt cotton around Bt cotton because they wanted the farmers to compare how effective the new seeds can be in increasing productivity and decreasing pest problems. The farmers who do not care about comparing their Bt crop with non-Bt gave all non-Bt seed packets to their relatives or neighbours who cannot afford to buy cotton seed. Furthermore, some farmers just ignored the advice of merchants because they heard their neighbours and other farmers in the village complain that planting non-Bt seeds around Bt field provides no special benefit.

Though the farmers may ignore the advice of merchants on risk management plans, they remain totally dependent on them for other information regarding seed varieties and pesticide application. If farmers find a pest on their crop, they will go and describe the problem to the merchant in town, or local seed dealer, sometimes bringing the infested leaves, fallen flowers and bolls and even insects. The dealer or merchant will then give them a pesticide based on his understanding and knowledge or whichever brand gives him a higher profit margin.[87] Sometimes farmers ask the merchant to give them a similar pesticide to the one that he gave to one of his or her neighbours. Since they do not have any other source of information, they believe the merchants and apply pesticides indiscriminately. Admittedly, a farmer says:

> We spray whatever the pesticide merchant recommends to us. Though his recommendations do not work effectively all the time, we have to believe him blindly because we have no other source of information. He is like a God to us as our fate is in his hands since he sells us both seeds as well as chemicals (*mandulu*). (Interview with a farmer in Kadavendi, October 3rd, 2006)

[87] I collected this information from an informal discussion with a seed and pesticide merchant in the town of Janagam.

In every seed packet, the seed companies do provide an information leaflet describing the characteristics of GM cotton. But, few farmers can read or understand the information on the leaflets. In Kadavendi, about 65 percent of farmers are illiterate. The rest of them read basic information but have never been exposed to information leaflets. Thus, the information leaflets are merely symbolic. In addition, public extension services are underfunded and inefficient. In Devaruppala *mandal*, there are only one agricultural officer and two agricultural extension officers, who are supposed to provide services to 7,664 farmers in 13 villages. Moreover, even the local agricultural officers do not have a clear understanding of GM seed.[88] In fact, the local agricultural officers work as if Bt cotton does not come under their purview of extension support. This is because the predominance of private companies in Bt cotton seed research, development and marketing, leaving little for public agricultural researchers and extension workers to do.

Given this ineffective public extension system, the local seed and pesticide dealers have become the main source of information. They influence the farmers on what seeds to sow, and what fertilizers and pesticides to apply. Indeed, the general knowledge of dealers about the new seed and insect ecology has become a determining factor regarding crops. A farmer laments:

> In the past, we used to do agriculture based on our own knowledge (*sontha thelivi*) and understanding of nature. But now we do agriculture based on knowledge and suggestions of the seed and pesticide merchants, because we do not know how the new seed works. Moreover, we cannot make experiments with these new seeds using our knowledge, because we are not in a position to bear the cost if something goes wrong. (Interview with a farmer in Kadavendi, September 17th, 2006)

In the process of agricultural deskilling, firstly, farmers' knowledge and skills are made obsolete, then, a farming community that is dependent on scientific knowledge and has lost the ability to experiment and adapt is created. Apart from

[88] I collected this information from an informal discussion with an agricultural officer in Devaruppala.

farmer deskilling, the new technology has also created new agents of local power, domination and governance – the agricultural input merchants – in addition to the landlord class.

Anthropologist Glenn Stone (2006), based on his study on the implications of the rapid spread of GM cotton in Warangal district for the deskilling and enskilling of farmers, claims that the new seed has hampered the individual and social learning important to the agricultural skilling process.[89] His use of the concept of agricultural deskilling is intellectually fascinating. However, he does not provide adequate and apt empirical data to support his claims. Astonishingly, Stone's ethnographic research does not consider as I have in my fieldwork the existing agrarian structure such as caste, class, gender, political representation, age and educational levels of farmers, etc. He treats farmers as a homogenous category. But, it is difficult to accept Stone's approach to understand agricultural skilling or deskilling, without engaging the socio-economic and political environment into which GM seeds have been sown. In fact, Stone does not really offer us a sociology of who those farmers are that have adopted or not adopted Bt cotton; their socio-economic status; or even whose skills and what skills have been deskilled.

Even if we ignore these structural and sociological questions, all three aspects of deskilling that Stone has proposed – inconsistency, unrecognizability, and rapid change of technology – are not peculiar to Bt cotton alone, but are equally relevant to all hybrid varieties. Stone does not explain how Bt cotton is unique or different from non-Bt hybrid cotton varieties in terms of agricultural deskilling. Likewise, deskilling can occur in each and every stage of a peasant's agricultural operations – from pre-production and production, to marketing the final product – yet again Stone focuses merely on the adoption of seeds. Taking a modernist perspective, Stone (2006:97) asserts that the "loss of an obsolete skill set does not constitute agricultural deskilling" which begs the question of who decides 'whose skills' and 'what skills' are either productive or obsolete? And,

[89] The following four paragraphs are adapted and modified from my critical discussion piece that has been published in *Current Anthropology*. For my critique and Stone's response, see Kumbamu 2007; Stone 2007.

how does a productive skill become an obsolete skill? From a neo-liberal modernization point of view, any skill set of a farmer or a worker that hinders the expansion of the market is considered obsolete, and must be destroyed. But this is assertion, not analysis.

I am not suggesting that no agricultural deskilling is happening at all in Warangal; what I am arguing is that, unlike industrial deskilling (see, Braverman 1974), agricultural deskilling does not happen in a short period of time. Rather, it takes generations to manifest itself. Therefore, to document agricultural deskilling one should study the knowledge gap between the consecutive generations of farmers. Stone also makes a ridiculous claim that the farmers of Warangal do not make substantial experimental trials on their fields – the basis of environmental learning – to discover whether adopting Bt cotton is good, bad or simply a cotton fad. Here I find his method unsound. To determine whether farmers were making any experiments or not, in my field work I interviewed the farmers, and looked at the year to year farming profiles of Bt cotton farmers to contrast how many acres of land they planted to Bt cotton in the first year of adoption, and whether farmers increased or decreased Bt cotton planting in consecutive years. This allowed me to determine whether there was an empirical basis for "perceived advantage" or disadvantage.

In Kadavendi, although the rate of the adoption of Bt cotton has been increasing every year, several farmers had abandoned Bt cotton in the second or third year of adoption based precisely on learning of its negative agro-economic impacts. For instance, in 2006, 30 farmers belonging to marginal (10 farmers), small (14 farmers), and semi-medium (6 farmers) farmer categories abandoned Bt cotton based on their individual learning from Bt cotton cultivation in previous years (see Table 4.28). The main reasons for their abandonment of Bt cotton are: high seed cost, new seed demands high dose of fertilizers, failure of seed germination, no change in productivity, total crop failure and debt doubled for a few farmers. Similarly, all farmers in Enabavi, a small village in the same district, totally abandoned Bt cotton based on their social learning. Stone's study does not provide such data about the non-adoption and abandonment of Bt cotton, or discuss why some farmers react negatively against the so-called “cotton fads.” He assumes no experimentation is occurring.

Table 4.28: Number of Farmers Abandoned Bt Cotton in Kadavendi in 2006.

Size Class	BC	SC	ST	Total
Marginal	4	4	2	10
Small	7	4	4	14
Semi-Medium	3	1	1	6
Total (30)	14	9	7	30

Source: Field research

In the midst of global controversy about GM crops, some rich farmers in Kadavendi strongly believe that without the adoption of new technologies it would be difficult to do agriculture in the future, because of increased pest attacks, soil degradation, depletion of water table, increasing weeds, and increasing labor scarcity and wages. One rich farmer enthusiastically reported: “We heard that next year we are going to get Bt-II and year after Bt III to wipe off all kinds of crop damaging insects. If we could get such seeds, then we go to the fields only two times: one at the time of sowing and another at the time of harvesting.” Although some farmers place great hope in technology, a few farmers fear the impending socio-ecological dangers of the new seed. When I interviewed them about the externalities of Bt cotton, one farmer responded furiously:

> If Bt cotton is a problematic seed, why scientists should develop this, and why the Indian government should allow this? It is too late for anybody to stop this because we don't have any other alternative. Our soils have been totally damaged due to a huge application of chemicals. Now we cannot grow traditional crops in our fields. Moreover, we can’t even get local seed varieties in the market. How we would survive if the new seed is not good for our health, our soils and livestock? … Government is responsible if something goes wrong with this seed ... But, unfortunately, irrespective of political parties, no government takes responsibility

> for farmer welfare. (Interview with a farmer in Kadavendi, October 12th, 2006)

New Technologies and the Ecological Embeddedness of *Dalitbahujans*

The adoption of new agricultural technologies and consequent changes in the social organization of production have greatly influenced the way the peasant farmer in Kadavendi interacts with, values, and understands nature. Before the introduction of modern technologies, farmers used to maintain a sustainable relationship with nature, and their economic and socio-cultural activities were deeply embedded in it. In particular, the primary agricultural producers belonging to *Dalitbahujan* (an umbrella social category that includes the so-called "untouchable" castes/*dalits* and "backward" castes/*bahujans*) and *Adivasi* (tribal) social groups, see themselves as an integral part of nature as it plays a predominant role in their everyday socio-cultural, religious, and economic life.

Completely dependent on nature for everyday survival, farmers used to consider nature as a mother who nurtures her children with love and care, or as a goddess who blesses her worshipers. Furthermore, farmers position themselves as the responsible sons and daughters of the soil, who consciously protect it out of reverence. When farmers were totally dependent on local seed, they had more control over their agriculture because their participation in the market was limited, and for majority of farmers their primary purpose of production was subsistence rather than accumulation. Indeed, the farmers never had a narrow productivistic conception of agriculture in which agriculture is seen as a purely economic activity. Rather, they had a broader ecological view that focused not only on the immediate needs of human beings but also on the sustainability of such things as the quality of the soil and of bodies of water, biodiversity, socio-cultural wellbeing and agricultural animals. This *ecological thinking* was part of their everyday life and was continuously reproduced through various socio-cultural forms to be passed along from one generation to another.

Seed is the heart of agriculture. It is often considered as a storehouse of culture and history (Shiva 2001). Thus, seed saving was one of the core activities of farmers in India, involving four vital activities: firstly, the identification, separation and collection of good quality produce from the harvest for reuse as seed in the next season; secondly, properly cleaning the seed before preserving them in earthen pots; thirdly, checking them regularly and properly sun-drying them on the floor at appropriate intervals (usually once a month or so) to avoid infections and to kill insects if any had entered into the seed storage pots and fourthly, cleaning them well again before the sowing season starts.

All these activities were carried out by women who possessed special knowledge and skills for selecting, collecting and preserving good quality seed. Except for the collection of seed, all other seed activities would take place in the domestic sphere of production, where women remain responsible for activities such as cleaning, nurturing and cooking. When asking farmers how and why women possessed special knowledge about seed, the most common response was that protecting seed was an important female responsibility because it consisted of female activities such as cleaning and caring. Moreover, men were always busy with other on-farm activities (such as ploughing, land development and watering crops) as well as off-farm ones, such as going to the market. Thus, the patriarchal relations of production reproduced the gendered division of labor in household and agricultural activities. But the interesting point to note is that the gender division is not just of labor but also of local knowledge. Hence, women possessed the multigenerational knowledge of seed, which provided them with intra-household bargaining power and social recognition as custodians and providers of local seed. But, since 'women' is not a homogeneous category, the immediate question that follows is: Which women? When I ask this question the majority of male and female members of farm households replied that the women of *dalitbahujan* castes possess more knowledge about seeds and agriculture. A female farmer even sarcastically questions: "What upper caste women know about seeds? They don't know anything about seeds and agricultural activities. They would know if they ever go and work in the field." But, another female member of *dalit* household disputes this and says: "it's not the question of caste but women who work on the field everyday and who deeply involve in agriculture know more about seed development and preservation."

Since the introduction of hybrid seed that produce less productive or sterile seed, and the rise of production for the market, farmers tend to buy the seed from the market for every season. With the commodification of seed, women's role as the protector of seed has diminished and their knowledge about seed has become obsolete. When asked about the changing role of women as seed developers, a male cotton farmer explained:

> When we were using the seed from our fields, women had more knowledge about the old seed than men because they were responsible for collection and preservation of good quality seed. But now we have stopped saving seed from our fields because we are no longer using them. If we notice anybody in our village gets a good crop, we go and enquire about the seed that the farmer has used and the place of purchase; then we go and buy the same seed from the market. Since we started buying the new seed from the market, men have more knowledge about the seed, because they are the only ones who go to the market and discuss with the seed merchants and other farmers about the performance of the new seed and buy them. (Interview with a farmer in Kadavendi, September 28th, 2006)

This farmer's explanation shows how women possessed special knowledge and power when the farmers were using the old seed collected from the field; but since the introduction of the new seed women's knowledge has been devalued and dispossessed. In fact, the new seeds from the market have enhanced opportunities for men to participate in the agricultural input as well as output market, and have reinforced patriarchal power relations in households in general, together with the male domination of decision-making throughout the agricultural production process. Indeed, this lends some support to the construction of a simple binary opposition between matriarchal nature and the patriarchal market.

Conclusion

My research findings demonstrate that social and cultural factors are crucial in the adoption of GM seeds, that issues such as trust and caste allegiance play a part, that aggressive marketing strategies such as demonstration plots are not neutral, simple experiments in the field, but interwoven with power relations and social relations, and this reinforces inequities in the rural society. And, the unintended consequences of the adoption of new seeds are unsustainable and inequitable – the narrowing of food stuffs produced, the loss of local knowledge, the further social devaluing of women and the reinforcement of patriarchy and market.

Overall, the adoption of the new agricultural technologies has facilitated four major interrelated agrarian transformations in Kadavendi:

1. From the nature-dependent and subsistence-oriented agriculture and food system to the market-dependent agriculture and food system.
2. From active local knowledge producing and reproducing farmers (seed breeders) to passive consumers of global scientific knowledge (seed purchasers)
3. From the socio-ecological sustainability of agro-biodiversity to genetic vulnerability and the monoculturization of agriculture.
4. From the ‘visible’ oppression of the (semi-) feudal landlords to the ‘invisible’ exploitation by the local merchant class as well as the global capitalist class.

In a treadmill fashion, the first three transformations have further deepened the rift between the farmer and nature, and have created new socio-ecological crises. But, the fourth transformation has facilitated the emergence of the new agents of power and domination in the village. Historically, the people of Kadavendi have the bitter experiences of feudal oppression as well as the great memories of heroic peoples’ struggles against the exploitation of the landlords. During the Telangana peoples’ armed struggle in the late 1940s and later in the Naxalite movement, it was not difficult for people to identify and apprehend the agents of exploitation. The landlords were obvious enemies of the majority of the oppressed people, and anger against them was very expressive in the peoples' movements. For example, a stanza from a popular song written by radical poet Guda Anjaiah in the wake of the Naxalite movement reads: "The village is ours / so are the environs / what is this Lordship / what is this overlording." (Quoted in Rao 1995:115) But, the political situation in the countryside has changed as the economic and extra-economic domination of the landlords diminished. Now the agents of market forces have established their hegemony, which is very difficult to perceive, understand and fight against directly. This condition is very well articulated in a famous song by *dalit* balladeer, Gorati Venkanna. The song starts with a stanza, "The village is weeping in pain inflicted by invisible conspiracies" of an invisible hand, and it ends with a line "imperialist venom is slowly seeping into the village."[90]

As Brockway puts it, "there is no way to draw the line between science, commerce and imperialism." (Quoted in Deo and Swanson 1990:586) Therefore, the debate about GM seeds and its socio-ecological implications for the farming community should be understood from an agrarian political ecology perspective that articulates the wider framework of the "agrarian question" in the context of neoliberal globalization. The process of dispossession and the metabolic rift in Kadavendi clearly indicates that even if the "agrarian question" is resolved by further revolutionizing the forces of production, consequently, the peasantry will have to face the 'nature questions' about ecological exhaustion and the second contradiction of nature (see Connor 1998). Furthermore, my fieldwork study of the "Gene Revolution" provides closer, more fine-grained research and analysis of its impacts with sensitivity to local class and status, gender and cultural issues, and the ways in which farmers' technology adoption decisions can dramatically alter overall quality of life, local knowledge systems, community development, the sustainability of agriculture and the ecosystem itself.

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Chapter 5

Seeds of Hope or Risk? The Politico-Ecological Implications of the Adoption of Genetically Modified Canola in Alberta, Canada.

Introduction

I first encountered Canadian farmers at the 35th Annual Convention of the National Farmers Union in Saskatoon in November 2004. At the convention, for the first time in my life, I saw farmers in formal suits. To my surprise, I also saw farm couples in their 50s and 60s dancing on the floor on the final day of the convention. This was a stunning cultural shock for me because my sociological imagination of farmers that comes from an Indian context was incomparable to their counterparts in Canada. Based on this primary impression, I naively assumed that all Canadian farmers were well-off. But, later I had an opportunity to attend a series of meetings organized by farmers in the Viking area (about 100 kilometers southeast of Edmonton, Alberta) to discuss the possibilities of alternative sustainable initiatives in agriculture.

At one of those meetings, in an informal conversation with a farmer, I shared my views on farming conditions and the spate of farmer suicides in neoliberalized India. He empathetically listened to my account of the Indian farming situation, and later said: “Although we don’t have farmer suicides, we have suicidal problems for farmers in Canada.” This statement hit me so strongly, and it totally shattered my naïve perception of Canadian farming. Then, I started researching and learning from farmers about the ongoing farm crisis in Canada. As part of that endeavor, I developed this research to further understand the causes and consequences of the “suicidal problems” faced by many farmers in Alberta, in the context of the adoption of genetically modified (GM) seeds and neoliberal globalization.

The adoption of innovative agricultural technologies is not a new phenomenon in Canada. Particularly, in Western Canada, farmers adopted new mechanical technologies as quickly as they started the cultivation of specialized, export oriented crop (wheat) in the early 1880s (see Adelman 1994; Ward 1994). According to rural sociologist Robert Welch Murchie (1936:68, 70) the striking patterns of farm investment in mechanization occurred between 1901 and 1931. Particularly, in the prairies, the total farm investment devoted to livestock declined from 23.5 percent in 1901 to 7.2 percent in 1931. This indicates a rapid transformation from the use of animal power agriculture, to machine power dependent agriculture beginning in the early decades of 20th century. (See picture 5.1 and 5.2 for farm machinery used in the early 1930s. See also picture 5.3, 5.4 and 5.5 for gradual changes in grain storage facilities in the early 1930s, '60s and '90s).

Murchie (1936:122; see also Fowke 1957:81) noted that this transition had been "instrumental in increasing farm capitalization both through its effect in increasing the size of farm and through substituting machinery, for the purchase of which capital is required, for human labor."[91] In Canada, the mechanization of agriculture in the early 20th century significantly increased agricultural productivity. Growth for the period 1887-1921 was less than 1 percent, but increased to more than 2 percent per annum for the period 1935-1964 (Lew 2000:181). Along with the diffusion of machinery technology, railway construction on the prairies, and the arrival of millions of immigrants from European countries also significantly influenced agrarian development in Canada (see, for example, Adelman 1992, 1994; Solberg 1982; Lewis and Robinson 1984).

Overall, in Canadian agricultural growth, prairie agriculture played a pivotal role because of the high diffusion rate of agricultural machinery in the region over other regions in Canada. The high diffusion rate of new technologies became possible in the prairies because the mechanization of agriculture suited the flat landscape and the extensive cultivation of wheat.

In the area of seed development technologies, important efforts began with the establishment of the first agricultural college at Guelph, Ontario, in 1874 to

[91] For deeper insights into the early capitalization and mechanization of agriculture between 1900 and 1930, see also Mackinotosh 1935.

develop training programs in agricultural science. Another important development initiative was the appointment of William Saunders by the Canadian Parliament in 1885 to study the experimental farm system in the United States. In 1886, based on his recommendations, Parliament passed an act to establish the system of federal experimental farms. The first farm was established at Ottawa in 1886, four more farms were established by 1889, and another twenty were developed between 1905 and 1916 (Kuyek 2007; Slinkard and Knott 1995). Researchers in these experimental stations collected seeds from around the world and developed new seeds using plant breeding techniques. In all seed development activities, farmers played an important role in experimenting and adapting new varieties to their local conditions.

Picture 5.1: A Plow Used in the 1930s.

Source: Photo was taken by the author at the Parkland Conservation Farm, Vegreville, Alberta, September 25th, 2008.

Picture 5.2: A Seeder Used in the 1930s.

Source: Photo was taken by the author at the Parkland Conservation Farm, Vegreville, Alberta, September 25th, 2008.

Picture 5.3: The Barn Used to Store Grain the 1930s.

Source: Photo was taken by the author at the Parkland Conservation Farm, Vegreville, Alberta, September 25th, 2008.

Picture 5.4: Grain Stores in the 1960s and '70s.

Source: Photo was taken by the author at the Parkland Conservation Farm, Vegreville, Alberta, September 25th, 2008.

Picture 5.5: Grain Stores in the 1990s.

Source: Photo was taken by the author at the Parkland Conservation Farm, Vegreville, Alberta, September 25th, 2008.

For instance, adapting wheat varieties to Canadian cold weather conditions became a big issue for immigrant farmers, who brought seeds with them from their countries of origin. One popular wheat variety, Red Fife was developed by David Fife and his wife Jane Fife, a Scottish farming couple in Ontario. The development of this seed had international and gender dimensions:

> In 1841 they [David and Jane Fife] received a sample of wheat from a friend in Glasgow, Scotland. The sample had come to Scotland in a shipment of wheat originating in Danzig, Poland. Believing that the seed was spring wheat, the Fifes planted it in the spring. Because it was winter wheat, it did not head out except for one plant that produced three heads. The seed from that one plant was multiplied and named Red Fife. Jane Fife was the daughter of a farmer and seedman. She probably knew about selection from her family. (DePauw, Boughton and Knott 1995:6)

Red Fife, with its good resistance to rust and early maturity characteristics, rapidly spread across North America. This new variety helped increase wheat production in the prairies and turned Canada's prairies into the "grain elevator of the British empire." (Quoted in Kuyck 2007:35) As productivity increased, wheat became the "king" of the crops. Moreover, Canadian economic and political development became closely tied to the cultivation of wheat, which was considered "the keystone" in Sir John Macdonald's National Policy of 1879 (Skogstad 2007:27).

To further increase wheat productivity, farmers and researchers felt that improvements of new varieties were still needed, particularly in terms of maturity time. At this juncture, William Saunders and his research team concluded that rather than searching for new varieties all over the world, it would be wise to further develop Red Fife (Kuyck 2007: 35). In 1909, after years of trials, he and his son Charles Saunders developed the Marquis wheat variety by crossing Red Fife with a variety from India called Hard Red Calcutta. Marquis displayed the quality of early maturity and increased resistance to disease better than Red Fife. By 1920 in the prairies, about 90 percent of land was sown to Marquis wheat (White 1995: 4). But, the overwhelming adoption led to a wheat monoculture and this created problems of soil erosion, and massive crop failures. The farm crisis was compounded with the dramatic decline of global wheat prices in the Great Depression of 1930s (Britnell 1937).

During the Great Depression and the postwar years, the Canadian state's intervention in agricultural sector increased to improve research and development. In this process, the state centralized and standardized agricultural research in Canada. Given this initiative, "the farmer-to-farmer model of agricultural exchange was quickly replaced by the one-way technology model (scientist to farmer) and diversity gave way to uniformity." (Kuyck 2007: 37) Along with the standardization of agricultural research, the state also took two important initiatives: 1) restoring the Canadian Wheat Board in 1935 and granting it monopoly rights in 1943 to sell the prairie farmers' wheat; 2) the price stabilization program that covers eleven farm commodities (Skogstad 2007:28). These developments in the 1940s, and other policy changes in the 1950s and '60s, restructured the rural landscape and set conditions for further industrialization of agriculture: mechanization created surplus labor in agriculture that caused a rural population migration to urban centres. Mechanization also increased off-farm activities, decreased total number of farms, and increased intensification and concentration of farm activities (Anderson 1958. For empirical studies on rural restructuring in Canada in the 1960s and 1970s, see Parson 1990, 1999; Beesley and Russwurm 1981; Bryant and Johnston 1992; Pierce 1994; Tremblay and Anderson 1966). For example, in Alberta, the average area per farm in 1920 was 353 acres. This increased to 1055 acres in 2006 and demonstrates the tremendous concentration of land in the hands of large farmers (See Table 5.1).

Until the early 1980s, the public sector supported and controlled about 95 percent of overall plant breeding research, and 100 percent of plant breeding activities in cereal and oilseed sectors in Canada (Kuyck 2007:37). Moreover, until 1990, Canada was the only country among the major agricultural countries of the world that did not have a system of Plant Breeders' Rights (PBR). Although foreign ownership and capital investment in Canada has a long history (see, for example, Laxer 1989; Levitt 1970; Teichman 1982), transnational corporations did not show interest in investing in seed research and development, because of unconducive seed regulations, the Canadian state emphasis on "standardized export commodities," and diversified climatic conditions (Kuyek 2007:38).

Table 5.1: Total Number of Farms, Total Area of Farms and Average Area Per Farm in Canada and in Alberta, 1921to 2006.

Canada				**Alberta**		
Year	Total Number of Farms	Total Area of Farms (in acres)	Average area per farm (in acres)	Total Number of Farms	Total Area of Farms (in acres)	Average area per farm (in acres)
1921	711,090	140,887,903	198	82,954	29,293,053	353
1931	728,623	163,114,034	224	97,408	38,977,457	400
1941	732,832	173,563,282	237	99,732	43,277,295	434
1951	623,087	174,046,222	279	84,315	44,459,632	527
1956	574,993	173,919,214	302	79,424	45,970,395	579
1961	480,877	172,542,461	359	73,212	47,228,653	645
1966	430,503	174,120,560	404	69,411	48,982,875	706
1971	366,110	169,664,166	463	62,702	49,506,287	790
1976	338,552	169,082,181	499	61,130	49,928,771	817
1981	318,361	162,815,073	511	58,056	47,218,170	813
1986	293,089	167,601,113	572	57,777	51,040,463	883
1991	280,043	167,423,057	598	57,245	51,425,111	898
1996	276,548	168,167,475	608	59,007	51,964,360	881
2001	246,923	166,802,197	676	53,652	52,058,898	970
2006	229,373	167,010,491	728	49,431	52,127,857	1,055

Source: Adapted from Statistics Canada, Census of Agriculture. http://www.statcan.gc.ca/pub/95-632-x/2007000/t/4185570-eng.htm. Accessed: November 10th, 2009.

But with the influence of the global rise of neoliberal economic policies in the 1980s, the Canadian state started withdrawing its support for public research and the farming community (Qualman and Wiebe 2002; Roppel, Desmarais and

Martz 2006). By the early 1990s, with some exceptions, Canadian agriculture was well integrated into global agriculture in general, and North American agriculture in particular (Hertel 2001). Canada adjusted all its agricultural policies (including the *Canada Seed Act* of 1923 that protected farmers customary rights in seeds) according to the mandates of the Canada-US Free Trade Agreement (FTA 1989), later the North American Free Trade Agreement (NAFTA 1994), and the United Nation's General Agreement on Tariffs and Trade (GATT), which became the World Trade Organization (WTO) in 1995. In 1990, the Canadian Parliament passed the *Plant Breeders' Rights Act* (PBRA) and ratified the UPOV Convention as adopted in 1961 and revised in 1978. (See chapter two for a detailed account of the origin and transformation of the UPOV Convention from 1961 to 1991.) Although the *Plant Breeders' Rights Act* gives exclusive ownership rights to plant breeders over the varieties they develop, it allows the farmer to "sell the grown plant for profit and, more importantly, can retain seed and grow it in future seasons, all without infringing on the breeder's rights." (Derzko 1994:166; see also Carew 2000) As Kuyek (2007:44) observes:

> The Act was sold to the public as a way to increase investment in research without compromising the interests of farmers and public research, since the Act only covers the unauthorized commercial propagation of protected plant varieties, leaving farmer seed-saving and further breeding with protected varieties outside of the scope of the Act.

But, the Canadian government has twice tried to amend the Act in favor of the rights of industrial breeders and limiting "farmer's privilege." Finally, in 2002, Canada signed (or agreed in principle to) the 1991 UPOV Convention to indicate its intention to ratify (or to become a State Party to) it in the future. But, farmers' organizations, civil society groups and think tanks opposed Canada's direction to ratify the Convention because:

> Article 14(1) of the 1991 [UPOV Convention] provides that, in respect of the propagating material of a protected variety, any production, reproduction (multiplication), conditioning for the

> purpose of propagation, offering for sale, selling or other marketing, exporting, importing, or stocking for any of these purposes, shall require the authorization of the breeder. Accordingly, the basic scope of the production extends to *all* production or reproduction (multiplication) without reference to its purpose and, unlike the 1978 [UPOV Convention), does not have the effect of creating, by implication, a 'farmer's privilege'." (Greengrass 1991:469; see also Derzko 1994:168, emphasis original)

Stewart Wells, a farmer in Saskatchewan and the President of the National Farmers Union, argues that the big seed corporations are pushing the agenda to change the Canadian seed laws according to the 1991 UPOV Convention. He argues:

> These changes are criminalizing the age-old, customary practices of farmers…If we, as a nation, continue to withdraw from plant breeding, then foreign transnationals will own and control all new seed…If Canada amends its seed laws based on recommendations from seed companies, farmers will lose their right to save, reuse and sell their seeds. Farmers would essentially lose ownership of their seeds and become renters of corporate seeds. (Wells 2004, *The Western Producer*, October 28, 2004)

In 1995, the first GM crops were introduced into Canada, in a policy environment that has favored corporate seed breeders and agri-chemical industry. Since then, a total of 12 GM crops were registered with the Canadian Food Inspection Agency. But only four GM crops (canola, corn, soy, and sugar beet) were approved for commercial cultivation in Canada, and the rest of them (Alfalfa, cotton, flax, papaya, potato, rice, squash, and tomato) cannot be grown in Canada. Before we examine the adoption and implications of GM crops in Alberta, we need to look more closely at transformations in agrarian political and economic conditions.

Agricultural Restructuring, Dispossession, and the Disappearance of Family Farm

Small and medium farms defined by gross farm revenues in Alberta are disappearing. Between 1981 to 2006, small farms declined from 69.7 percent of total farms to 51.9 percent. Medium farms declined from 17.2 percent to 15.1 percent. During the same period, large and very large farms increased from 12.1 percent of total farms to 26.6 percent, and from 1.2 percent to 6.4 percent (see Table 5.2 and note below Table).

Table 5.2: Farms Classified by Total Gross Farm Receipts at 2005 Constant Dollars, Alberta, Census Years 1981 to 2006.

	Alberta	**1981**	**1986**	**1991**	**1996**	**2001**	**2006**
Farm Categories*	**Total gross farm receipts at 2005 constant dollars (percentage of total)**						
Small farms	Under $10,000	17552 (30.2)	15490 (26.8)	11433 (20)	14078 (23.9)	10787 (20.1)	9791 (19.8)
	$10,000 to $24,999	11969 (20.6)	10009 (17.3)	10973 (19.2)	10509 (17.8)	9397 (17.5)	8720 (17.6)
	$25,000 to $49,999	10944 (18.9)	9807 (17)	9811 (17.1)	9165 (15.5)	8352 (15.6)	7170 (14.5)
	Sub-total	40465 (69.7)	35306 (61.1)	32217 (56.3)	33752 (57.2)	28536 (53.2)	25681 (51.9)
Medium Farms	$50,000 to $99,999	10003 (17.2)	10563 (18.3)	10702 (18.7)	9707 (16.5)	8584 (16)	7448 (15.1)
Large Farms	$100,000 to $249,999	5811 (10)	8904 (15.4)	10160 (17.7)	10515 (17.8)	9853 (18.4)	8805 (17.8)
	$250,000 to $499,999	1204 (2.1)	2040 (3.5)	2756 (4.8)	3307 (5.6)	4081 (7.6)	4333 (8.8)
	Sub-total	7015 (12.1)	10944 (18.9)	12916 (22.5)	13822 (23.4)	13934 (26)	13138 (26.6)
Very Large Farms	$500,000 to $999,999	355 (0.6)	620 (1.1)	881 (1.5)	1035 (1.8)	1514 (2.8)	1871 (3.8)
	$1,000,000 to $1,999,999	157 (0.3)	224 (0.4)	328 (0.6)	368 (0.6)	589 (1.1)	688 (1.4)
	$2,000,000 and over	61 (0.1)	120 (0.2)	201 (0.4)	323 (0.5)	495 (0.9)	605 (1.2)
	Sub-total	573 (1)	964 (1.7)	1410 (2.5)	1726 (2.9)	2598 (4.8)	3164 (6.4)
	Total	58,056	57,777	57,245	59,007	53,652	49,431

Source: Adapted from Statistics Canada, Census of Agriculture.

http://www.statcan.gc.ca/pub/95-632-x/2007000/t/4129747-eng.htm. Accessed: November 10th, 2009.

* Agriculture and Agri-Food Canada classifies business-focused farms into the following categories based on gross farm revenues:

a) Small Farms: Farms are those with gross farm revenues between $10,000 and $49,999.
b) Medium farms: Farms with gross farm revenues between $50,000 and $99,999.
c) Large Farms: Farms with gross farm revenues between $100,000 and $499,999.
d) Very large Farms: Farms with gross farm revenues of $500,000 or more.

Similarly, concentration of land is increasing in Alberta. Defined by land base, the number of small and medium size farms is decreasing, and the number of large size farms is increasing. For instance, the number of farms with land size between 400-559 acres decreased from 7947 (13 percent of total farms) in 1976 to 4209 (8.5 percent of total farms) in 2006. Whereas the number of farms with land size 3,500 acres and more increased from 1502 (2.5 percent of total farms) in 1976 to 2673 (5.4 percent of total farms) (See Table 5.3). Reflecting on the disappearance of small and medium farms, a small farmer commented:

> Small farms are becoming extinct. That's kind of a bad thing… The government wants to have rural revitalization. If they want to rebuild rural community, how do you do that? If you have smaller farming, you have more people and you have more things going on in rural. But if you have big farming, you don't need those little guys. (Interview with a GM farmer in New Norway, February 7th, 2008)

This raises the pertinent question: Why do farmers abandon farming? What are the real causes of the farm crisis? "Is it a crisis?" or is it something else, more structural? As freelance journalist and author Ingeborg Boyens (2001:18) argues: "Well, the word "crisis" implies a situation that may improve. Sadly, this is a fundamental, structural change in agriculture that is dimming the lights on a way of life that defined Canada's very nature throughout the past century."

From the late nineteenth century into the twentieth, the state actively supported export-oriented agriculture by providing and regulating grain elevators, storage facilities, and railway freight rates. But, as part of neoliberal structural adjustment starting in the mid 1980s, (McBride 2005) the state's support to infrastructure facilities decreased or terminated. For instance, in the prairies, there were 3,117 primary grain elevators in 1981 but the number declined to only 367 by 2009. And, the average elevator facility has increased in capacity from 2,707 tons to over 20,100 tons.[92] This contraction and concentration has serious implications for farmers. As a GM canola farmer laments:

> I usually sell my produce to Agricore. That's the only one now that is left. We used to have quite a few different elevators in our community. But, they all closed down, they all were bought by Agricore. There are a few other places where we can sell, but not that many. In the past, we had probably in our town here 3-4 different places you could deliver to, and there were probably anywhere between 2-3 different companies in each town, who you could sell to. Now they have a monopoly. They decide the price. (Interview with a GM farmer in Beaver County, December 22nd, 2007)

Another farmer explains that the dismantling of infrastructure had wider social implications for community relations:

> The new technologies serve to make farmers much more independent of each other…The removal of the branch rail line system and the demise of the cooperatives, these served as a common meeting ground, which has now been lost. So the loss of community has been a function, not only of the decline in farm numbers, but the loss of these institutional supports. (Interview with a non-GM farmer in Eckville, December 22nd, 2007)

Critical scholars and farmers' organizations also identify structural adjustment in Canadian agriculture according to NAFTA and WTO agreements, and the concentration of transnational corporate power in agriculture, as the major causes of the perpetuation of farm "crisis." The structural adjustments involve export oriented production, budget cuts to spending on agriculture, deregulation of input and output markets, termination of government programs that supported farmers

[92] Canadian Grain Commission. 2009. Grain Elevators in Canada: Crop Year 2009-2010. http://www.grainscanada.gc.ca/statistics-statistiques/geic-sgc/2009-12-30.pdf. Accessed: December 15th, 2009. See also Weatherald, Patrick. 2007. Grain elevators getting bigger but fewer. http://www.statcan.gc.ca/pub/96-328-m/2004013/4193989-eng.pdf. Accessed: December 15th, 2009.

(see Table 5.4), creation of conducive policy environment for foreign direct investments, and privatization of public sector industries and facilities (Qualman and Wiebe 2002; Qualman 2003; Roppel, Desmarais and Martz 2006).

Table 5.3: Farms Classified by Size of Farm in Alberta, 1976 to 2006.

Size of farm	1976	1981	1986	1991	1996	2001	2006
Under 10 acres	730 (1.2)	910 (1.6)	1031 (1.8)	1008 (1.8)	1511 (2.6)	1118 (2.1)	1063 (2.2)
10 to 69 acres	3548 (5.8)	3352 (5.8)	3365 (5.8)	3420 (6)	4458 (7.6)	4098 (7.6)	4593 (9.3)
70 to 129 acres	1930 (3.2)	2353 (4.1)	2624 (4.5)	2728 (4.8)	3196 (5.4)	3041 (5.7)	3262 (6.6)
130 to 179 acres	8586 (14)	9023 (15.5)	8853 (15.3)	9309 (16.3)	10167 (17.2)	8945 (16.7)	7315 (14.8)
180 to 239 acres	1056 (1.7)	1050 (1.8)	1111 (1.9)	1231 (2.2)	1361 (2.3)	1388 (2.6)	1463 (3)
240 to 399 acres	10877 (17.8)	9383 (16.2)	8726 (15.1)	8536 (14.9)	8420 (14.3)	7299 (13.6)	6386 (12.9)
400 to 559 acres	7947 (13)	6844 (11.8)	6267 (10.8)	5911 (10.3)	5594 (9.5)	4986 (9.3)	4209 (8.5)
560 to 759 acres	7269 (11.9)	6404 (11)	6103 (10.6)	5672 (9.9)	5363 (9.1)	4600 (8.6)	3979 (8)
760 to 1,119 acres	8172 (13.4)	7600 (13.1)	7341 (12.7)	6825 (11.9)	6424 (10.9)	5625 (10.5)	4807 (9.7)
1,120 to 1,599 acres	5038 (8.2)	4978 (8.6)	5164 (8.9)	5188 (9.1)	4845 (8.2)	4382 (8.2)	3924 (7.9)
1,600 to 2,239 acres	2634 (4.3)	2849 (4.9)	3154 (5.5)	3232 (5.6)	3244 (5.5)	3297 (6.1)	3012 (6.1)
2,240 to 2,879 acres	1201 (2)	1222 (2.1)	1477 (2.6)	1512 (2.6)	1590 (2.7)	1594 (3)	1681 (3.4)
2,880 to 3,519 acres	640 (1)	675 (1.2)	784 (1.4)	859 (1.5)	898 (1.5)	971 (1.8)	1064 (2.2)
3,520 acres and over	1502 (2.5)	1413 (2.4)	1777 (3.1)	1814 (3.2)	1936 (3.3)	2308 (4.3)	2673 (5.4)
Total	61,130	58,056	57,777	57,245	59,007	53,652	49,431

Source: Adapted from Statistics Canada, Census of Canada. http://www.statcan.gc.ca/pub/95-632-x/2007000/t/4129741-eng.htm#48. Accessed: Novemebr 14th, 2009.

All these reforms have increased the financial burden on farmers and decreased net returns although gross revenue from farming is continuously increasing. For instance, from 1985 to 2008, the sale value of farmers' produce in Canada was $802 billion, but farmers have realized only $3 billion net farm income from the markets in 24 years (that means $125 million per year on average). In fact, in 1985, market net income dropped to zero for the first time since the Great Depression, and since 2001 it has remained below zero (National Farmers Union 2009). This clearly explains why farm debt in Canada in general, and in Alberta in particular, has been increasing. According to Statistics Canada, farm debt in Alberta increased from $4 billion in 1981, to $13.5 billion in 2009. A similar situation prevails in all provinces, and overall farm debt outstanding in Canada increased from $18 billion in 1981 to $63 billion in 2009.[93]

Table 5.4: Termination of Some Major Farm Related Programs by the Canadian Government in the late 1980s and the 1990s.

Government Program	Objective of the Program	Year of Termination
1) Two-Price Wheat Program	To stabilize domestic wheat price and increase net farm income	1988
2) Special Canadian Grain Program	To protect farmers from low prices caused by trade competition between the US and Europe.	1988
3) Western Grain Stabilization Program	To stabilize grain price and increase net farm income.	1991
4) Tripartite Stabilization	To stabilize the prices for livestock (such as hogs, cattle), other agricultural produce like honey, and some crops.	1994
5) The Feed Freight Assistance Program	To support the costs of shipping feed grains to Maritimes and British Columbia.	1995
6) The Crow Benefit	To cover some transportation costs that resulted from the federal government termination of the Crow Rate in 1984.	1995

Source: Qualman and Wiebe 2002:7-8.

[93] See Statistics Canada. 2010. "Farm Debt Outstanding." Catalogue no. 21-014-X, Vol.9, No.1. http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=21-014-XIE&lang=eng#formatdisp. Accessed: August 14, 2010.

In this indebted farming condition, for the majority of farm families, working in the non-farm sector to earn wages and to retain their farms has become an inevitable phenomenon. This process of semi-proletarianization has been increasing. For instance, in Alberta, 40.1 percent of total farmers in 1991 used to work in the non-farm sector while engaging in farm activities, but it has increased to 54.6 percent by 2006 (Table 5.5). In this context of the farm crisis, younger generations are reluctant to take up farming. In Alberta, the percentage of farmers under the age of 35 years decreased from 20.5 percent in 1991 to 8.8 percent in 2006. Correspondingly, between 1991 and 2006, the percentage of farmers from 35 to 54 years and 55 years and over increased from 47.7 to 50.1 and 31.8 to 41.1. As a result, the average age of farm operators increased from 47.3 years in 1991 to 52.2 years in 2006 (see Table 5.6).

Together these agrarian changes suggest the nature and intensity of crisis that the farming community in Alberta is going through. Political scientist Roger Epp (2009: 146-147) analyses the ongoing process of dispossession in rural communities:

> The farm crisis is about rural communities where rural rail-lines are abandoned and grain elevators come down, where tax bases shrink, where retail stores and government services like hospitals, schools, and post offices are consolidated in large centres. Populations age and decline. People who have given volunteer energy to the work of building community wear out, retreat into the isolation of hard work, or move away. The farm crisis is about the lack of leadership that can speak for a fractured agricultural community to a wider audience…The farm crisis is about fears for the future of what is good work – work that feeds people, engages parents meaningfully with their children and grandchildren, and requires multiple skills…the crisis is about the immense psychological burden of keeping a third-or fourth-generation family farm that is not merely a business, but a physical, historical anchor of home and identity. The farm crisis, finally, is about an acute sense of abandonment by governments, which are no longer willing – or perhaps able – to play the role of balancer on behalf of disadvantaged regions or economic sectors.

Into these “fractured agricultural communities,” GM seeds were introduced to address some of the aspects of the farm crisis. But, it is sociologically important to understand how this new technology was introduced and its socio-ecological and economic implications for the farming community. Whether GM technology is a hope or another risk imposed by industrialized corporate agricultural system is an open question. To explore and analyze this important issue I conducted in-depth interviews with 20 farmers (18 GM canola farmers and 2 non-GM canola farmers) in North Central Alberta, Canada (see Appendix 8 for the profile of participants).

Table 5.5: Number and Percentage of Farm Operators Involved in Non-farm Work for Living in Alberta from 1991 to 2006.

	1991	**1996**	**2001**	**2006**
Farm operators, paid non-farm work	**Number of operators (Percentage of operators)**			
No	48775 (59.9)	41540 (50.4)	38720 (50.8)	32555 (45.4)
Yes	32645 (40.1)	40915 (49.6)	37470 (49.2)	39105 (54.6)
Total	81420 (100)	82455 (100)	76190 (100)	71660 (100)

Source: Adapted from Statistics Canada, Cenusus of Agriculture. http://www.statcan.gc.ca/pub/95-632-x/2007000/t/4129760-eng.htm. Accessed: November 14th, 2009.

Table 5.6: Number and Percentage Distribution of Farm Operators by Age, Alberta, Census Years 1991 to 2006.

	1991	1996	2001	2006
Age of farm operators	**Number of operators (Percentage of operators)**			
Under 35 years	16660 (20.5)	13485 (16.4)	8900 (11.7)	6290 (8.8)
35 to 54 years	38845 (47.7)	42315 (51.3)	40425 (53.1)	35935 (50.1)
55 years and over	25910 (31.8)	26655 (32.3)	26875 (35.3)	29440 (41.1)
Total	81,415	82,455	76,200	71,665
Average age of farm operators	47.3	48.2	49.9	52.2

Source: Adapted from Statistics Canada, Cenusus of Agriculture. http://www.statcan.gc.ca/pub/95-632-x/2007000/t/4185586-eng.htm. Accessed: November 15th, 2009.

The Commercial Mission: Factors that Influence Farmers to Adopt GM Canola in Alberta

> We all share the same planet - and the *same needs.* In agriculture, many of our needs have *an ally* in biotechnology and the promising advances it offers for *our future.* Biotechnology is the science of changing the genetic makeup of seeds that grow our food to add new benefits. *Healthier, more abundant yields. Reduced reliance on pesticides and fossil fuels. A cleaner environment*.
>
> ("Let the Harvest Begins" campaign started by Monsanto on the World Food Day (October 16th) in 1998. Emphasis added.)

As the Monsanto campaign indicates, genetically modified seeds have been introduced into farming communities in Alberta by constructing a hope that agro-economic and agro-ecological problems can be solved with the adoption of GM crops. Particularly, the seed companies promise that new seed will effectively control weeds, reduce the cost of fertilizer and herbicide applications, decrease labor time, increase yield and thereby increase net profit per acre. These are some of the factors that convinced farmers to adopt the new seed. For example, Monsanto introduced Roundup Ready canola claiming that the new crop does not require much time and energy for weed management, because weeds can be controlled by spraying Roundup, a selective herbicide that does not harm crops. Moreover, GM canola grows well in low or no-tilling conditions, and gives high yields. By emphasizing these agronomic factors, GM crops have been presented as a time-and-energy-saver and farm economy booster, in the age of socio-ecological and economic crises.

The Alberta Financial Services Corporation (AFSC) estimates that the adoption of herbicide tolerant canola in 1996 was only 6 percent of the total seeded canola, but it has increased to 99 percent in 2007, and continues to be the same until 2009.[94] Moreover, only two varieties, Roundup Ready (52 percent) and Liberty Link (41 percent), constitute 93 percent of seeded canola acreage in Alberta. The seeding of conventional canola has drastically decreased from 94 percent of total canola seeded area in 1996, to 1 percent in 2009 (Table 5.7).

My field research data also confirms a similar trend in the adoption of GM canola in Alberta. In 1996, only 2 farmers (5 percent of total farmers interviewed) adopted GM canola, but, by 2007, 18 farmers (90 percent of my sample) adopted it (Table 5.8). In the context of the overwhelming adoption of GM crops in Alberta, it is important to get deeper insights into how seed and agro-chemical companies use strategies to convince farmers to accept their claims and adopt the new seed.

Multinational seed corporations use various public relation strategies. Some influential methods that I noticed in Alberta were: (a) Seed and agro-chemical commercials on television and local radios, billboards on highways, and

[94] The Alberta Financial Services Corporation (AFSC) has estimated the total area seeded to GM canola and non GM canola crop in the province based on 4.2 million insured acres (84% of estimated total seeded acres of canola/rapeseed in Alberta in 2009).

the testimonials of ‘successful’ farmers in farm magazines; (b) field demonstrations by seed and agro-chemical companies; (c) bringing farmers to meetings where they inform farmers of new technology and its benefits; and (d) the concerns about legal actions in a pro-corporate politico-legal environment. In my field research I found that all these factors have significant influence on the rapid diffusion of GM crops in Alberta.

As indicated in Table 5.9, examining major factors that influenced farmers I interviewed, 39 percent of farmers who adopted GM canola were influenced by company commercials, 22 percent by field demonstrations organized by seed companies, 22 percent by induction meetings for novice farmers, and 17 percent by fears about a pro-corporate politico-legal environment. In turn I will discuss all these factors in detail.

Table 5.7: Percentage of Seeded Canola Acres by Herbicide System in Alberta.

Year	Percentage of Seeded Canola Acres by variety in Alberta					
	Conventional*	Roundup Ready	Liberty Link	Navigator	Clearfield[95]	Total
1996	94	<1	1	0	5	100
1997	70	2	11	0	17	100
1998	41	22	10	0	27	100
1999	31	24	14	0	31	100
2000	24	44	11	<1	21	100
2001	14	53	13	<1	20	100
2002	14	53	19	<1	14	100
2003	10	59	18	<1	13	100
2004	6	57	24	<1	13	100
2005**	-	-	-	-	-	-
2006	4	49	37	0	10	100
2007	1	53	36	0	10	100
2008	1	52	38	0	9	100
2009	1	52	41	0	6	100

*Conventional canola includes non-herbicide tolerant varieties such as *Brassica napus* or Argentine canola, *Brassica rapa* or Polish canola, and *Brassica juncea*. Polish canola was <1%, but this is probably underestimated since less Polish canola is insured.
** There is no data for 2005 since the producers were not asked to name their crop variety in that year.

Source: Based on the Agriculture Financial Services Corporation (AFSC) Crop Insurance Records, Agriculture and Rural Development, Government of Alberta.[96]

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[95] Clearfield types were developed with tolerance to Group 2 herbicides via mutagenesis, not recombinant DNA (rDNA, also called transgenic) technology. Mutagenesis is a common plant breeding tool used throughout the world and it is not regarded as genetic engineering. However, in Canada, any new trait is regarded as a plant with novel trait (PNT) no matter how it was developed. Thus, in Canada, crops with new traits developed through mutagenesis since 1995 must go through the same regulatory process as those developed by rDNA (recombinant deoxyribonucleic acid) techniques.

[96] The data was calculated by Murray Hartman, oilseed specialist at Agriculture and Rural Development, Government of Alberta.

Table 5.8: The Number and Percentage of Farmers Interviewed Who Adopted GM and non-GM Canola.

Year	Number of Farmers Adopted GM Canola	Percentage of total farmers	Number of Farmers Adopted non-GM Canola	Percentage of total farmers
1996	1	5	19	95
1997	4	20	16	80
1998	5	25	15	75
1999	7	35	13	65
2000	10	50	10	50
2001	12	60	8	40
2002	14	70	6	30
2003	16	80	4	20
2004	17	85	3	15
2005	17	85	3	15
2006	18	90	2	10
2007	18	90	2	10
2008	18	90	2	10
2009	18	90	2	10

Source: Field research

Table 5.9: Major Factor that Influenced Farmers to Adopt GM Crops as Drawn from my Interviews.

Factors Influenced Farmers in the Adoption of GM Crops	Number of Farmers Adopted GM Canola	Percentage of farmers adopted GM Canola
Company commercials	7	39
Field demonstrations	4	22
Induction meetings	4	22
Pro-corporate politico-legal environment	3	17
Total	18	100

Source: Field research

Advertisements, Billboards and Testimonials

As part of market strategies, companies use various communication methods to 'reach-out' and influence farmers to adopt GM seeds. Seed and agro-chemical corporations are spending millions of dollars for their public relation campaigns. For example, Monsanto alone spends $50 million per year for advertisements throughout the world.[97] They have been using several strategies: Mesmerizing television commercials, pro-GM technology radio discussion programs, appealing billboards on highways, and trust-building testimonials with dazzling pictures of GM crops in farm magazines from farmers who claimed to be have financially benefited from the new seed. Although some of these methods were used in the past, the intensity of corporate advertisements and public relation campaigns has increased with the advent of GM crops. This is because of the growing anti-GM campaigns that advocate the harmful effects of GMOs on the socio-ecological and health conditions of producers and consumers. The intensified corporate advertizing mission is clearly evident in rural Alberta. As Roger Epp (1997:8) aptly observes "the newest feature of the rural landscape is signboards for corporate seed, fertilizer, and herbicide products."

While a majority of farmers were convinced by the corporate advertisements, a few farmers were very critical about them. A non-GM canola farmer strongly argues:

> Farmers have been brainwashed into believing that they [GM crops] are good… I have seen TV programs over a period of year; it's absolutely incredible, the amount of high pressure sales that are been conducted on TV and radio commercials. It would be interesting to see how much money these companies spend, and who they actually hire them to create these commercials. We don't know where they are growing crops, but they show us glorious fields… Are they computer generated or are they real? Those are very good questions. Then, they get testimonials from people that this is the best thing that they have ever done. I think this is a serious matter of brainwashing (Interview with a non-GM farmer in Tofield, March 2nd, 2008).

[97]See "Who Benefits from GM Crops," http://www.foe.co.uk/resource/reports/who_benefits_from_gm_crops.pdf. Accessed: December 30, 2009.

As shown in picture 5.6, some seed companies create images to give an impression that continuous growth in yields is inevitable with the adoption of GM crops. Such images only focus on continuous growth year after year, but do not provide any clue about the conditions under which the crop was produced. The highlighted slogan in the image, “my farm, my choice,” tries to present a view that farmers always have a choice and that they are choosing GM crops because they work best for them. Companies also use popular cultural images to advertize their products. For example, Pioneer seed company uses images of hockey players (hockey is the national sport of Canada and source of national identity and pride) in their advertisements in farm magazines. As indicated in picture 5.7, the company advertizes that “Pioneer brand 45H28 with the Roundup Ready gene is a hot new player in the Pioneer Hi-Bred lineup this year. It’s changing the way the canola game is played!” By using cultural metaphors, images, icons and everyday language in advertisements, the companies try to create a cultural medium to which farmers could easily connect to, one that lends legitimacy to corporate claims. Primarily these images give a strong message that the new seeds will bring revolutionary changes in crop management and productivity.

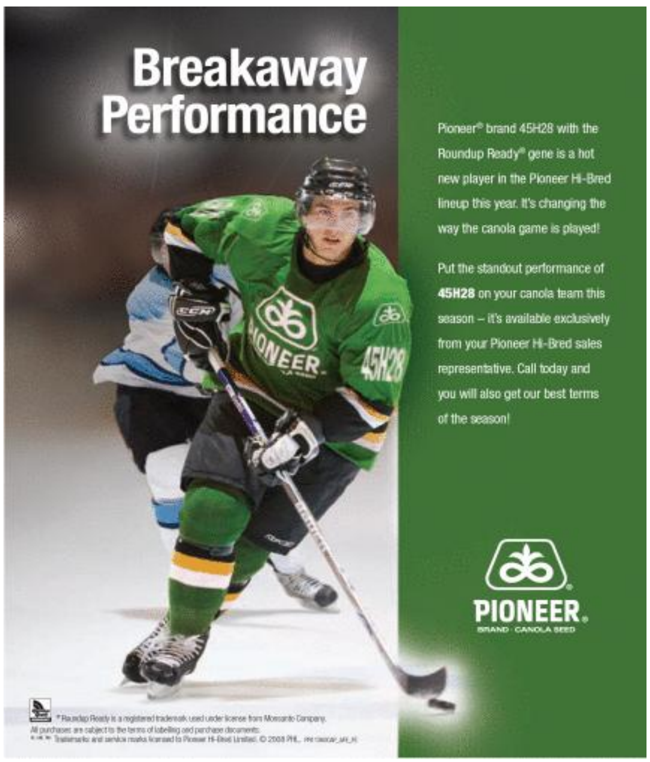
Field Demonstrations

Field demonstrations are one of the important strategies that seed and agro-chemical companies have been using to promote GM crops. Companies rent a small piece of land (generally 2 or 3 acres) mostly from small farmers, and cultivate GM crop for demonstration purposes. They rent land alongside highways and place a signboard on the plot to get the attention of farmers who pass by on that route. Moreover, this is more convenient for farmers who would like to visit these fields. When the crop is ready for demonstration, the company agents advertize about the field demonstration in local farm newspapers, broadcast on local radio and also inform the management of local grain elevators, who can spread the word among local farmers.

Picture 5.6: GM Canola Advertisement in a Farm Magazine

Source: *Alberta Farmer*, November 23, 2009, p. 6.

Picture 5.7: GM Canola Advertisement in a Farm Magazine



Source: *Alberta Farmer*, Nov 17, 2009, p. 6.

Field demonstration is a model that has been duplicated from public agricultural research stations. But since the early 1990s, the influence of agricultural experimental stations on farm operations has been reduced. Commercial seed and agro-chemical company field demonstrations have been increased. Some farmers consider the decrease of public agricultural experimental stations as a major loss, because these stations played very important role in introducing hybrid varieties and acted as impartial channels of new knowledge transfer related to new crops. As one non-GM farmer said:

> This is a major loss to me. I always used to go to the university research farm or down to the federally run experimental farm, and talk to scientists. I knew those guys were on the public payroll, and they were not pushing any particular technology. They were impartial. I can trust what they said. I can't trust what these guys [corporate funded scientists] say because they are sales men now. They are not scientists any more in my view; they are just sales men because they have vested interests. They are in the conflict of interest situation. So, in my opinion, there is no legitimacy in them, and they are totally null and void. These guys are impaired by their commercial interests. Their information is useless for me (Interview with a non-GM farmer in Eckville, December 22nd, 2007).

Field demonstrations seem to have a great influence on farmers in adopting GM crops in Alberta. A large farmer, who has been using GM seeds since their introduction, told me:

> I have been to probably a dozen or more…This is all set up through the local grain elevators. You know, Monsanto, when they want to set up a field day, they contact grain elevator, the grain elevator contact some local farmers in the area… They tell you mostly about different characteristics of genetically modified crops. They set up in the middle of summer. Usually it set up on a private farm. And Monsanto or whoever is putting on it, they rent 2 or 3 acres and hold a seed plot there. They are right beside the highways; they are all over in the province (Interview with a GM farmer in Camrose, January 20th, 2008).

Induction Meetings

Another important factor that influences farmers in the adoption of GM crops is induction meetings organized by seed companies with the cooperation of government agricultural departments and local grain elevators. In these meetings, the seed company marketing representatives give the best first impression of new varieties. Some farmers believe that induction meetings are "brainwashing" workshops where corporate marketing representatives present a rosy future for farmers with the adoption of GM crops, and where they do not even mention socio-economic, environmental and health externalities. But, others consider them as knowledge translation channels since they provide very precise information about the development of GM seeds and how they will benefit farmers with their agronomic efficiency and easy crop management. One farmer who adopted GM canola after his first induction meeting, told me:

> You know what happened they advertise the meetings in the newspapers. I probably heard about at the local grain elevator, you know, and they were talking it would be so good. It certainly sounded like. Before Roundup Ready canola, it was such a trouble controlling weed… That's why I went to the first meeting that was organized by Monsanto in a conference room in Leduc. It was fairly big size meeting; there were over 100 farmers there... There were some area reps [representatives] and some kind of marketing guys. They have meetings going on across the province. So I am just imaging they had an area already, you know… You better believe it they were very straight forward. They described how the system works, how you can spray up, and how they thought it was better. They also told about TUA [technology use agreement], and the license fee – $15 per acre. You can take it or leave it. They were very honest! (Interview with a GM farmer in Viking, April 17th, 2008)

Because farmers must pay a license fee and sign an agreement to use GM seeds, this is an important topic at induction meetings. The Supreme Court of Canada describes the functioning of a TUA in its ruling in the case of *Monsanto Canada Inc. v. Percy Schmeiser* (which I will discuss in the following section):

> Monsanto requires a farmer who wishes to grow Roundup Ready Canola to enter into a licensing arrangement called a Technology Use Agreement ("TUA"). The licensed farmers must attend a Grower Enrollment Meeting at which Monsanto describes the technology and its licensing terms. By signing the TUA, the farmer becomes entitled to purchase Roundup Ready Canola from an authorized seed agent. They must, however, undertake to use the seed for planting a single crop and to sell that crop for consumption to a commercial purchaser authorized by Monsanto. The licensed farmers may not sell or give the seed to any third party, or save seed for replanting or inventory. The TUA gives Monsanto the right to inspect the fields of the contracting farmer and to take samples to verify compliance with the TUA. The farmer must also pay a licensing fee for each acre planted with Roundup Ready Canola (Schmeiser 2004). [98]

The Gene Policing in the Pro-Corporate Politico-Legal Environment

As discussed in chapter 2, all GM seeds are patented and farmers cannot save and re-plant them in the next season or clean them and sell to other farmers. To prohibit farmers re-planting GM seeds, companies have introduced the TUA system. This is a new contract system that came into farmers' life along with GM crops. When I asked a canola farmer what the TUA system is and how it operates on the ground, he explained:

> Technology use agreement, what it is, Oh man, when you first sign up, it's quite a long document. It says you have to buy certified seed every year. You can't grow your own common seed and clean it. The agreement gives them right to enter into your field. Monsanto can come and inspect your field whenever they want. You know that type of thing. You pay $15 per acre first, then you can buy your seed. If you don't pay that $15 per acre you can't buy the seed (Interview with a GM farmer in Leduc, May 3rd, 2008).

To determine whether farmers growing GM crops have paid adequate TUA fees for all seeded acres, seed companies hire field inspectors (the so-called crop cops) to go around in the countryside and inspect the fields of GM farmers. For

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98 http://scc.lexum.umontreal.ca/en/2004/2004scc34/2004scc34.html. Accessed: December 24, 2009.

instance, Monsanto hired a private investigation agency, Robinson Investigation Canada Ltd, which recruited a team of retired Royal Canadian Mounted Police (RCMP), to conduct GM field inspections. As one of my farmers mentioned:

> I think they [company inspectors] do come every now and then. But, I don't know. They don't inform. I mean they can drive by a field and see what is growing there, you know…Well, the thing is that there is no non-GM canola growing. It's all GM Canola... I think what they are looking for mostly is, you know, they want to make sure you are buying enough acres of technology agreement. I mean if you only buy 100 acres of TUA, and you are seeding 1000 acres; that's what they are looking for. They want to make sure that you are paying for the technology (Interview with a GM farmer in Hay Lakes, February 10th, 2008).

The issues of private property, intrusion, and sovereignty over your own farm have become controversial. As expressed in the now famous legal case of Percy Schmeiser:

> They [the crop cops] will go into any farmer's field that they choose and take away either seeds or plants in whatever state they happen to be – even against the farmer's will. In other words, they steal them. If a farmer catches one of them in his field and says, 'you are trespassing: you are stealing some of my crops,' they will just laugh at him and say, 'if you take us to court, we will drag you through the court system and you won't have a farm left'… Alternatively, Monsanto will fly in a small plane over a farmer's canola fields and drop one of their Monsanto Round-Up Ready (Monsanto's pesticide) spray balls. It will then come back in about 10 days, and if the canola field has died Monsanto knows that the farmer wasn't using its canola; if it hasn't died, it knows he was. The fact that it is illegal to spray from the air in Canada does not worry Monsanto in any way (Schmeiser 2004). [99]

Some farmers informed that these crop cops also provide a toll-free number to farmers to spy on their neighbors if they grow GM crops without signing a TUA.

[99] From an interview with Percy Schmeiser, a farmer in Saskaschewan. See http://www.grain.org/research/contamination.cfm?id=103. Accessed: November 10th, 2009.

Moreover, when they visit GM fields, they also inquire about neighboring farmers' crop information, and collect some crop samples if they suspect that the farmers are growing GM crops "illegally." They conduct further laboratory investigations, and if they find that the suspected farmers are growing GM crops, then the seed company initiates legal proceedings against them. One such controversial and globally debated case is *Monsanto Canada Inc. v. Percy Schmeiser*. Schmeiser, a canola farmer in Saskatchewan who has been actively farming more than 50 years, bought conventional canola seed in 1993 and saved a portion of crop to re-use them as seed in the next years. But in 1997, he noticed that some area of his canola crop developed resistance to Roundup herbicide when he sprayed it on weeds and he found stray (volunteer) canola plants growing around his field. At that moment, he realized that his field was contaminated by GM canola from neighboring fields. But, he did not inform either Monsanto or any government agency, because he had never purchased and planted GM crops. Instead, he harvested the crop and, as he does every year, saved a portion of it and replanted in the following year. (See, for example, Pechlaner 2007 for a detailed account of this case and the politico-economic implication of legal actions against farmers in Canada).

In 1998, acting on a tip off that Percy Schmeiser was illegally growing Monsanto's patent-protected roundup ready canola, the company's crop cops, as Schmeiser claims, stealthily collected crop samples from his field for further investigation. When the test results came positive, Monsanto filed a legal action against Schmeiser accusing him of infringing its patent rights. But, Schmeiser challenged Monsanto, and his legal battle became a source of inspiration for anti-GM activists and organizations across the globe. In fact, this case was touted in the media as "'David' versus the biotech 'Goliath'." (Pechlaner 2007:208) The case went all the way to the Supreme Court of Canada because of Schmeiser's strong determination to challenge the power of the corporation and to prove that he was not a "patent infringer." Contrary to Monsanto's accusation, Schmeiser (2001:32)[100] contended:

> In Canada there is no law against carrying rapeseed in open trucks or leaving cut rapeseed in the field. This makes it easy for the small seeds to spread. It is also impossible to contain pollen flows. The gene responsible for glyphosphate resistance is a dominant gene and rapeseed an open-pollinated plant. When a GM plant crosses with conventional rapeseed, resistance will be carried into the following generation. In my fields the GM variety was thickest along the roadway. There was little in the field itself. When I received the court summons I wondered why anyone would think I had deliberately mixed GM rapeseed with my own seed. The only advantage of growing GM rapeseed is its resistance to Roundup. If farmers spray Roundup on a mixed GM and non-GM crop they can expect big losses

Schmeiser (2001:31) argued that "the seed and plant are the farmer's property. GM rapeseed has the ability to intrude where it was not planted. It has unique ability to replicate itself. I believe Monsanto lost its right to exclusivity when it lost control of its invention. How can farmers avoid GM rapeseed getting into their crops and becoming a contaminating weed?" But this argument did not convince the Canadian Federal Court Judge, Andrew MacKay, who ruled that:

> A farmer whose field contains seed or plants originating from seed spilled into them, or blown as seed, in swaths from a neighbor's land or even growing from germination by pollen carried into his field from elsewhere by insects, birds, or by the wind, may own the seed or plants on his land even if he did not set about to plant them. He does not, however, own the right to the use of the patented gene, or of the seed or plant containing the patented gene or cell.[101]
>
> The trial judge found the patent to be valid. He found that it did not offend the *Plant Breeders' Rights Act*, S.C. 1990, c. 20, and held that the difficulty of distinguishing canola plants containing the patented gene and cell from those without it did not preclude

[100] Schmeiser, Percy. 2001. Genetic Contamination and Farmers' Rights. *Biotechnology and Development Monitor*. 44/45:32.

[101] http://decisions.fct-cf.gc.ca/en/2001/2001fct256/2001fct256.html. Accessed: December 24, 2009.

> patenting the gene. The trial judge also rejected the argument that the gene and cell are unpatentable because they can be replicated without human intervention or control.[102]

Schmeiser lost the case in the Federal Court Trial Division in 2001. He appealed to the Canadian Federal Court of Appeals. But, he lost it there as well. Finally, he appealed to the Supreme Court of Canada. In the final ruling in May 2004, the Supreme Court also rejected his legal grounds of appeal, and ordered him to pay the court fees about $150,000 and to abandon all the seed he and his wife had saved all these years. His case sheds light on important critical issues involved in the enforcement of the TUA. In light of his case, critical scholars and environmental activists around the globe have exposed the implications of the patenting of life forms for farmers' rights and the sustainability of agriculture (See, for example, Oguamanam 2007). But, Monsanto counters: "the truth is Percy Schmeiser is not a hero. He's simply a patent infringer who knows how to tell a good story."[103] (Later in this chapter, I will return to the issues related to gene contaminations and its socio-ecological and political implications for farmers.) However, since the 'victory' of Monsanto in this case, GM seed companies have been actively enforcing the TUA strategy by often referring to the court order against "gene infringers." Monsanto strongly defends its TUA strategy and legal actions against farmers who do not sign up or violate the agreement:

> We pursue these matters for three main reasons. First, no business can survive without being paid for its product. Second, the loss of this revenue would hinder our ability to invest in research and development to create new products to help farmers. We currently invest over $2.6 million per day to develop and bring new products to market. Third, it would be unfair to the farmers that honor their agreements to let others get away with getting it for free. Farming,

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[102] http://scc.lexum.umontreal.ca/en/2004/2004scc34/2004scc34.html. Accessed: December 24, 2009.

[103] http://www.monsanto.com/monsanto_today/for_the_record/percy_schmeiser.asp. Accessed: November 26, 2009.

> like any other business, is competitive and farmers need a level playing field.[104]

Although the patent holders of ("biological") terminator technology imposed a self-moratorium on their commercial deployement (see chapter 2 for discussion about terminator technology), the enforcement of a TUA for GM crops acts as "legal" terminator. The corporations prohibit farmers to replant their seed from the field in the next season by enforcing a licensing system. Thus the TUA system legally undermines the biological capacity of the seed to germinate. Moreover, heritage rights of farmers to save seeds, their skills to propagate new seeds as well as community relations around seed sharing also affected by these "legal" terminator seeds. This raises social and ethical issues greater than the corporate rights in a TUA. In addition, this system cultivates mistrust and fear among farmers that they will be sued by seed companies if GM crops were found on their fields through gene contamination. With the Monsanto-Schmeiser case now farmers not only suspect their neighbors but also their own crop, because the Court insisted that it is the "liability" of a farmer to know whether his or her crop is contaminated by GM gene irrespective of the means by which it enters (Pechlaner 2007, see also Oguamanam 2007; Cullet 2005). In this way, the corporations are sowing the seeds of fear, mistrust and risk in the countryside.

Farmers fear not only legal action but also the humiliation associated with it. When a seed company sues a farmer it publishes his or her name in farm magazines. In some cases, seed companies also impose a lifetime ban on farmers who violate or do not sign a TUA, from buying GM seeds with their genetic traits. For instance, in November 2009, Monsanto used its "Violator Exclusion Policy" to impose a lifetime ban on four Ontario farmers for "stealing" its Roundup Ready soybean technology. Defending the ban, Trish Jordon, Monsanto Canada's public affair director, says, "it's our technology…we can choose who we wish to sell to and who we don't. It's not an automatic that you have access to our

[104] "Why Does Monsanto Sue Farmers Who Save Seeds?", http://www.monsanto.com/monsanto_today/for_the_record/monsanto_saved_seed_lawsuits.asp. Accessed: December 29, 2009.

technology."[105] Some farmers consider this action as a major threat to the farming community, and argue that "they [seed companies] want to dictate the market and what we grow and how we grow it."[106] Not all farmers denounce a lifetime ban on buying GM seeds for the violation of company's regulations. A leader of a farmer association in the prairies considers it as justifiable act: "I am a guy that likes the (Monsanto) technology and pays for it… I don't like free riders going in and taking advantage of this stuff. Under these circumstances I think it's justified to have a lifetime ban."[107]

Yet, labeling farmers as patent infringers and humiliating them as burglars devalues farmers' social status and creates a communal socio-psychological crisis in the countryside. This has serious implications for social harmony and community relations. Moreover, this condition hinders possibilities for non-GM and organic farming alternatives. In my study some farmers adopted GM crops when their neighbors adopted them to avoid having them spying on their farm operations and the threat of legal actions. In this way, the pro-corporate legal environment influences farmers to adopt GM crops. As a farmer mentions: "I am not one hundred percent happy with GM canola. But, there is no other way to go. Well, I don't like the control over the farmer when you buy the seed." (Interview with a GM farmer in Vegreville, April 9th, 2008) In Alberta, 99 percent of canola farmers are now growing GM varieties. Nevertheless, it is important to examine the socio-economic and ecological implications of the new seed for these farmers.

The Political Ecology of GM Canola

The Economic Impact of GM Canola

In my research, I collected mixed responses on the impact of GM canola from farmers. While a few farmers were still suspicious of the GM companies' claims about the benefits, some farmers were very positive about the economic impact of GM canola. A large farmer who benefited with GM canola told me: "The new

[105] www.albertafarmexpress.ca, November 23, 2009, p.9
[106] www.albertafarmexpress.ca, November 23, 2009, p.9
[107] www.albertafarmexpress.ca, November 23, 2009, p.9

seed is a profit generator. It is very safe and has tremendous benefits for farmers." (Interview with a GM farmer in Leduc, May 3rd, 2008)

When I compared the economics of GM canola with conventional canola, the herbicide and tillage costs for the GM crop were 25 percent and 23.3 percent less than non-GM crop herbicide and tillage costs. But, the average total expenses per acre were 5.4 percent higher for GM crops, because seed cost increased by 26.1 percent, and additionally a TUA fee was added. It should be noted that there is no significant change in fertilizer and harvest costs. But, the GM canola crop gave 5.9 percent higher yield and 6.6 percent higher profit than conventional canola crop (see Table 5.10). As indicated in Table 5.10, the cost of tillage for GM canola farmers was less than for conventional farmers, because of the adoption of reduced or no tillage practices.[108]

Proponents of GM technologies claim that the adoption of GM crops promotes reduced-or no-tillage system with their effective weed control mechanism (Brookes and Barfoot, 2006). It is evident in my research that 78 percent of GM farmers shifted their tillage practices after the adoption of GM canola, because they believe that it grows well in the no-tillage system. But 28 percent of farmers did not change their tillage practices because they do not believe that no-till has any significant impact on yield (see Table 5.12). Although a majority of GM farmers adopted the reduced- or no-tillage system, changes in tillage practices in Alberta started well before the introduction of GM crops (see Table 5.11).

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> No-till technologies are very effective in minimizing soil and crop residue disturbance, controlling soil evaporation, minimizing erosion losses, sequestering C [carbon] in soil and reducing energy needs. However, no-till is effective only with the use of crop residue as mulch, which has numerous competing uses. No-till farming can reduce yield in poorly drained, clayey soils when springtime is cold and wet (Lal, Reicosky and Hanson 2007:1)

Reduced-or no-tillage system increases the amount of organic carbon in the form of crop residue stored in the soil (a process called "carbon sequestration") and reduces carbon dioxide emissions into the environment.

Table 5.10: Average Economic Costs and Benefits of GM Canola and Conventional Canola Per Acre in 2008.

	Conventional Canola (n=2)	GM Canola (n=18)	Percentage of change
Tillage (cultivator and seeding cost)	25	20	-25.0
Seed cost	13.25	20.75	36.1
TUA fee	0	15	100.0
Fertilizers	35.2	34.5	-2.0
Herbicide	37	30	-23.3
Harvesting	35	35	0.0
Local transportation	6	6	0.0
Land tax	5	5	0.0
Crop insurance	15	15	0.0
Total expenses	171.45	181.25	5.4
Yield (bu/acre)	32	34	5.9
Commodity price ($/bu)	9	9	0.0
Gross revenue	288	306	5.9
Gross margin	116.55	124.75	6.6

Source: Field research

In the late 1980s, government agencies, agribusiness companies and farmers organizations started the discourse of conservation tillage considering tillage as one of the major causes of soil erosion. In the early 1990s, the practice of conservation tillage was aggressively promoted with the claim that the new tillage practices would reduce cost related to equipment, energy and labor. Promoters also claimed that soil depletion and chemical pollution problems could be solved by conservation tillage, without making significant changes in high chemical input based conventional agriculture, or initiating alternative sustainable agricultural practices (Hall 1998). These claims convinced many farmers to shift their conventional tillage practices, to conservation tillage or no-tillage. As indicated in Table 5.11, by 1996, 10.3 percent of total farms in Alberta already shifted to the no-tillage system, and the shifting process has further increased to 47.8 percent by 2006. Thus there is no direct relationship between adopting GM crops and the no-tillage system. It had already occurred with conventional (non-GM) farmers and continued among organic farmers. Some GM farmers continue to resist it. Some critical scholars remark that conservation tillage may help restore soil quality, but they point out that this practice perpetuates an idea that problems created by the industrial agricultural system can be solved through new technologies:

> Ideologically, conservation tillage had reduced the problems of soil fertility and erosion to limited technical issues that could be addressed through new technologies and modifications such as the use of no-till, without interfering with the primary agribusiness goals of high levels of productivity and capital accumulation. (Hall 1998:232-233, see also Buttel 1993)

Table 5.11: Tillage Practices Used to Prepare Land for Seeding in Alberta, Census Years 1991 to 2006.

	1991	**1996**	**2001**	**2006**
Total land prepared for seeding				
Farms reporting	44,322	39,107	35,006	30,725
Area in acres	19,685,388	18,761,116	18,465,784	18,726,144
Percentage of total land prepared for seeding	100	100	100	100
Tillage incorporating most of the crop residue into the soil				
Farms reporting	36,838	29,123	22,041	15,930
Area in acres	14,291,324	10,657,824	6,847,096	4,589,714
Area in hectares	5,783,493	4,313,068	2,770,921	1,857,391
Percentage of total land prepared for seeding	72.6	56.8	37.1	24.5
Tillage retaining most of the crop residue on the surface				
Farms reporting	9,249	11,804	10,863	8,956
Area in acres	4,779,955	6,166,922	6,550,489	5,185,594
Area in hectares	1,934,379	2,495,665	2,650,889	2,098,535
Percentage of total land prepared for seeding	24.3	32.9	35.5	27.7
No-till seeding or zero-till seeding				
Farms reporting	1,976	3,455	6,490	9,121
Area in acres	614,109	1,936,370	5,068,199	8,950,836
Area in hectares	248,521	783,621	2,051,027	3,622,274
Percentage of total land prepared for seeding	3.1	10.3	27.4	47.8

Source: Statistics Canada, Census of Agriculture. http://www.statcan.gc.ca/pub/95-632-x/2007000/t/4129758-eng.htm. Accessed: November 17th, 2009.

The Socio-Ecological Implications of GM Canola: Farmers' Perceptions

In this section, I analyze the politico-ecological implications of GM canola based on farmers' perceptions and understandings of the new technology. In my field research, 78 percent of GM farmers reported that GM canola effectively and easily controls weeds, while 11 percent of farmers noticed that weeds are gradually becoming resistant to herbicides and another 11 percent of farmer found herbicide tolerant canola 'volunteers' (crops growing in other crops)[109] increased after the adoption of the new seed. For 56 percent of the GM farmers interviewed, GM canola decreased the use of agro-chemicals, but for 44 percent of them there was no big change in their chemical applications. Contrary to the claims of proponents of GM seeds, 67 percent of farmers did not find any significant change in their labor time for crop management, while for 33 percent of farmers the new seed saved their labor time to some extent (see Table 5.12). A non-GM farmer based on his observations explained:

> The GM seeds are specific to various herbicides. [For example, Roundup Ready, Liberty Link and Clearfield varieties are tolerant to glyphosate, glofosinate, and imidazolinone herbicides, respectively.[110]] This has encouraged their overuse and ultimate redundancy due to weed resistance. From my observations, they do not in any way lessen the amount of tillage or trips over the field as compared to an organic rotation in my area. I'm told by my neighbours that some weeds are developing a resistance already to the herbicide and so they are having to make multiple applications compared to just a few years ago. Also fungal diseases are becoming an increasing problem in our area, which

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"A volunteer is essentially a crop growing in another crop, which competes for nutrients and other resources, making it a weed that some farmers choose to control. Volunteers may arise from harvest losses in a previous year or seed movement from wind, transportation, etc. HT [herbicide tolerant] canola volunteers are resistant to specific chemicals and, depending on the agronomic context, may require additional management (e.g., herbicides, tilling, etc.)." (Mauro and McLachlan 2008:473)

110 See, for example, Mauro and McLachlan 2008:465

> was largely unheard of before continuous cropping became the norm (Interview with a non-GM farmer in Eckville, December 22nd, 2007).

In terms of yield, for 67 percent of GM farmers interviewed, GM canola increased yield. But, 22 percent of GM farmers reported that the new seed did not significantly change yield, while for 11 percent of farmers yield decreased. All agreed that their seed cost increased and they consider the TUA an extra economic burden. Pertinent to the TUA, a majority of farmers worry about lawsuits in the context of gene contamination beyond their control. But farmers who agree with the company's logic of the TUA, argue that there is no need to worry about legal actions as long as the farmer adherers to the agreement. Moreover, a majority of the farmers interviewed (89 percent) believe that with the adoption of GM crops dependency on a few transnational corporations for seeds and agro-chemicals has increased. They are concerned but they cannot control the issue. For a non-GM farmer, this is one of the major reasons for not adopting the new seed.

Explaining the politico-economic implications of GM crops, one non-GM farmer responded:

> On balance very negative, not because of any intrinsic problems with GMOs [genetically modified organisms], although it looks like there are many. But because they are not developed in the public interest by impartial bodies, as has been the case with conventionally bred seeds until recently. The best alternative is what we have now: publically funded plant breeding, in the public interest with the results put into the public domain. This keeps control with the community and does not cede it to a few trans-national oligopolies (Interview with a non-GM farmer in Eckville, December 22nd, 2007).

But, only a few farmers (11 percent) consider that there is no significant change in the input market situation. All farmers expressed a view that the number of varieties available in the market has decreased since the introduction of GM crops. A majority of GM farmers (61 percent) also felt that they lost their right to save their farm seed with the adoption of the patented GM seed. But, some farmers (39 percent) were not concerned about saving seed because they believe that any new seed developed in the laboratory is far better than their farm seed (see Table 5.12).

A large farmer clearly indicates this: “I try new seeds every year. There are certain types of seeds that work better in this area and on my farm. Oh boy, you know what really, the seed that developed off the farm is head and shoulder better than anything that I could develop here.” (Interview with a GM farmer in New Norway, May 15th, 2008) It is also evident in my research that a majority of GM farmers (72 percent) worry about the volatile export market situation for GM crops with increasing negative consumer perceptions of GM products in European and some Asian countries. But, 28 percent of farmers do not consider this as a big issue because GM technology produces value added products and it always creates new markets within the country and beyond the borders.

While cultivating hope among farmers in terms of increasing yield, GM crops also create fear and uncertainty about gene contamination, and health and environmental implications. Gene contamination is the greatest fear for 50 percent of farmers. Even non-GM farmers fear gene contamination because they believe that it is very difficult to maintain segregation between GM and non-GM crops. As a non-GM farmer mentions:

> It tells me that seed travels… In this particular farming situation, we wouldn’t be able to grow canola and certify it as organic. There has to be, ohh, I don’t know how many mile barrier it is. It is just not possible. If you go to the testing, the contamination level has to be less than 0.5%. That’s very difficult. There is no seed segregation. As far as I am concerned, any canola has GMO contamination or it is GMO, one or the other. (Interview with a non-GM farmer in Tofield, March 2nd, 2008)

Table 5.12: Perceived Advantages and Disadvantages of GM Canola Crop of Farmers Interviewed.

	Perceived Advantages and Disadvantages of the Adoption of GM Canola	Number of Farmers Responded (N=18)	Percentage of the Total Farmers Adopted GM Canola
Weed control	Effectively and easily controls weed	14	78
	Weeds are getting resistance to herbicides	2	11
	Volunteer canola increased	2	11
Tillage	Promotes low or zero tillage conditions because GM crops grow well in such tillage systems	13	72
	GM crops have no impact on tillage practices	5	28
Yield	Increased yield	12	67
	No significant change	4	22
	Decreased yield	2	11
Seed price	Seed price increased	18	100
Seed varieties	Dependency on few seed varieties	18	100
Seed saving	Lost the right to save seed	11	61
	Do not care about saving seed because companies are producing superior varieties	7	39
Agro-chemical cost	Costs on agro-chemicals decreased	10	56
	No significant change	8	44
Crop management time	Labor time decreased to some extent	6	33
	Did not change	12	67
Technology Use Agreement	Technology User Agreement has become an extra economic burden	18	100
Legal actions by seed companies	Worry about lawsuits because gene contamination is beyond the control of farmers	13	72
	Do not need to worry about it as long as farmers adhere to the TUA	5	28
Access and Dependency	Increased dependency on few companies for seeds and agro-chemicals	16	89
	No change	2	11
GM Market	Created volatile export market for GM produce because of negative consumer opinion about GM products	13	72
	Created value added products and new markets	5	28
Risks	Developed a fear of gene contamination in other fields and with other crops in storage bins	9	50
	Lack of credible scientific information about the technology	4	22
	Fear of health and environmental problems	3	17
	No risks involved	2	11

Source: Field research

A recent GM flaxseed contamination issue in Canada is one of the best examples to illustrate the economic implications of gene contamination for farmers. GM flaxseed was developed by a molecular geneticist, Alan McHughen, when he was at the University of Saskatchewan in the 1990s. He gave a catchy brand name "Triffid" (the name that he got it from John Wyndam's 1951 novel *The Day of the Triffids)* to the new variety, and registered it with the Canadian Food Inspection Agency (CFIA) in 1998. It is important to note that GM flaxseed only received regulatory authorization, not approval for large-scale commercial production in Canada. Dr. MaHughen, who later moved to the University of California, gave away some packets of seed to farmers for "educational purposes." Farmers cultivated them in small areas between 1998 and 2001. Later, considering serious objections to GM flaxseed from the Flax Council of Canada and concerned about European market access, the CFIA cancelled its registration in 2001 and made it illegal to grow GM flaxseed in Canada.

In September 2009, GM flax material appeared in Europe and Japan in Canadian flaxseed shipments. The outbreak of GM contamination news devastated flax growers because all major Canadian flax importers (Europe, which imports about 70 percent of total Canadian flax, Japan and China) suspended flax shipments immediately. As a result, the value of flax collapsed from $11 a bushel (25Kg) to $2 to $3. Overall losses for farmers are estimated at more than $300 million. Moreover, all Canadian flax growers now have to undergo a costly testing process to ensure that their crops and fields are GM contamination-free. [111] But, there is no clue so far about who cultivated the "illegal" flax and how the contamination occurred. The Canadian regulatory agencies are now investigating the matter. However, the case of GM flax contamination clearly points out the inefficient regulatory and monitoring system in Canada. Weak government control poses a serious threat not only to access to

[111] "Attack of the Triffids has flax farmers baffled" *The Globe and Mail.* http://www.theglobeandmail.com/news/national/attack-of-the-triffids-has-flax-farmers-baffled/article1340838/. Accessed: October 27th, 2009. See also"Flax farmers worried about future." http://www.cbc.ca/canada/calgary/story/2009/11/04/calgary-flax-farmers-genetically-modified.html. Accessed: November 10, 2009.

the export market, but also to the country's food and seed sovereignty, public health and the environment.

Amidst a huge global controversy about the implications of GM technology, 22 percent of GM farmers I interviewed consider it risky because of the lack of credible information about the implications of the new technology, and because of poor knowledge translation mechanisms from the scientific community to the farming community. Some farmers I interviewed (11 percent) also fear impending health and environmental problems with GM cropping. As a GM farmer says:

> I see the introduction of GM seeds as a negative overall impact, not only on the agricultural systems but on our society in general, because the procedures for testing and verification and the long term effects haven't been properly investigated. The long term effects determine exactly what's gonna happen environmentally, socially and economically. The economic stand point is totally based on the premise that there will be decrease in fertilizer and pesticide requirement, and the new technology is an answer to world's problems with food production. But, none of these things have been completely substantiated. There is no reduction in fertilizer and pesticide use (Interview with a GM farmer in Vegreville, May 23rd , 2008).

Another GM farmer, who believes that GM seeds will further accelerate the treadmill of production that deepens the socio-ecological crises in agriculture, told me: "The cost of GM crops is increasing, so is dependency on higher yields. This is risky." A younger GM farmer offered an intergenerational comparative perspective:

> Compared to my father's generation, there are certainly a lot of differences. I can say there are more tools that we can use now. Even as far as better seeds like herbicide resistant varieties, better machinery, better fertility, and better weed control. The only big difference now is the economics are much tighter…there is less of profit margin because the cost of production has increased (Interview with a GM farmer in Camrose, March 20th, 2008).

A majority of farmers are still growing GM crops although they do not believe in the claims of technological proponents. They are doing this because they see no viable alternative to GM farming in the current politico-economic conditions in Canada. A small percentage of farmers I spoke with do believe that there are no risks involved in growing GM crops.

Epistemological Shift and Ecological Rift

For information about the new crop management practices, many Canadian farmers noted that since the introduction of GM crops they rely more on workshops sponsored by seed and agro-chemical companies, information in farm magazines and on local radio provided by corporate-funded research scientists, and information leaflets that come along with the purchased agricultural inputs. In this process of technological change, there is a shift from the collective knowledge about production and reproduction systems to the collection of information from corporate public relations departments. Indeed, GM crops make farming a perfunctory activity that does not require much knowledge and experience of agriculture. As one GM farmer explained:

> In the context of GM crops, the farmer doesn't have to have a lot of knowledge. You know why…because you can spray Roundup at any time. You don't even know what stage the weed is, and you don't even have to know what weed it is. Oh my God with this technology, anybody can grow canola. Before we had GMOs, you actually had to know something about agriculture. Since the introduction of GMOs, you don't need to know anymore. All you do is: sow seed and spray roundup. And, all you have to know is: crop stands and weed dies. That is why farmers also love it. With less knowledge and experience you can actually still accomplish great things. That is why farmers really like the new technology (Interview with a GM farmer in Sylvane Lake, June 13th, 2008).

GM crops not only create an epistemological shift, but also deepen the metabolic rift by further intensifying industrial agricultural practices, making farming an appendage of an agri-business driven by profits. As sociologist Philip McMichael explains:

> The metabolic rift expresses the subordination of agriculture to capitalist production relations, that is, the progressive transformation of agricultural inputs (organic resources to inorganic commodities), reducing nutrient recycling in and through the soil and water, and introducing new agronomic methods dependent upon chemicals and bioengineered seeds and genetic materials produced under industrial conditions (McMichael, 2009:255; see also Foster 2009).

The industrialized agricultural system has created a chemical culture as well as a monoculture that has deepened a rift between the social relations of production and the natural biological conditions of production. It fundamentally shifted the emphasis from the quality of food to the quantity of food production to meet growing population demands. Pertinent to these, it also perpetuated a powerful idea that it is difficult to get higher yields without adding inorganic fertilizers to the soil. This idea undermines alternative agro-ecological practices that could mend the metabolic rift. As one farmer explained:

> In terms of the environment, an agro-ecosystem is not a natural system. Nature loves diversity, complexity, and succession, things like that. Farmers don't like that. We want a monoculture, that's uniform. And, nothing else there. So that's the agro-ecosystems we try to create. There are only two ways to do that. One way is to beat the hell out of it with petrochemicals. The other way to do is the natural rotation system that I am attempting to do. But most of farmers use a chemical approach (Interview with a non-GM farmer in Eckville, December 22nd, 2007).

Still, some farmers strongly believe that the use of organic fertilizers is not economically viable. As one large farmer says:

> I strictly use just these dry, commercial fertilizers… It's kind of a waste of time using organic fertilizers. I mean, once that fertilizer is in the soil, it is indistinguishable from either commercial fertilizer or organic fertilizer. Anyway, you can't really get enough fertilizer on unless you are putting a pile of hard manure or something on. My dad started using commercial fertilizers in 1960s. Since then, we have been using them every year (Interview with a GM farmer in Camrose, March 25th, 2008).

However, in contrast to what many urban dwellers believe, the farm crisis in Canada is not just restricted to the farming community. It manifests in different forms in various aspects of life such as health, the food system, and the environment. As one farmer from Tofield elaborately explained:

> Right now, the farming situation in Canada is a national crisis…Everybody in the agricultural chain, we call value chain, making money except the producer…If the guys at the bottom who are producing all this food is failing to make any money, they gonna quit. Then, what happens to the rest of the value chain if you have nobody producing? It leads to a crisis… I think everybody has to accept some of the blame. The worst, may be, the biggest, culprit has been the cheap food policy that has been promoted in Canada and the United States. As far as I am concerned, the Canadian system is not significantly different, you know our cultures are very very close. Its cheap food policy, by creating all this cheap food, it has become a problem more than one way if you look at it from a health perspective… The costs of health are soaring out, there is no control and more and more people getting sick. Why? … If you are not putting in quality inputs, different things are gonna start manifesting. The agricultural crisis is directly related to a health crisis. There is no money in healthy people; there is no money in healthy animals. From that point of view, I see it a crisis that overlaps many different areas, that's why I call it a national crisis. It not only impacts our agriculture, but also impacts our health, health care system and our quality of life. That's how I see it… If you have highly nutritious food, your food should be your medicine. *Food is a medicine*. If people would look at food from that perspective, when taking medicine, would they want cheap medicine that may or may not work? (Interview with a non-GM farmer in Tofield, March 2nd, 2008).

Conclusion

In this chapter, I argue that the current farm crisis in western Canada is a systemic crisis created by the Canadian state's adoption of neoliberal economic policies in the context of globalization. As part of agricultural restructuring, the state has rolled back programs that helped stimulate the farm economy and help mitigate the farm crisis. Instead, it created very conducive policy environment for foreign direct investments and allowed transnational corporations to "legally" take over all farm operations in all stages from pre-production to post-production. Moreover, the corporations have reduced the socio-cultural and politico-ecological values of agriculture to business values that focus on exchange value.

Particularly, in the context of GM crops, farmers have become "bio-serfs" to the seed and agro-chemical corporations. They lost control over their agricultural activities. They lost the infrastructure that sustains community relations. They lost their identity and pride when corporations suspect them being criminals. They are losing their heritage as many small and medium farms are disappearing. Their knowledge is becoming obsolete in the context of GMOs or lost. They have lost their voice in the process of "political deskilling," (see, Epp 2001) and finally they lost their future because they are sowing seeds of uncertainty. These processes of dispossession, hastened by neoliberal globalization, pose a serious threat to the sustainability of agriculture and the farming community itself. They promote not personal suicide but perhaps suicidal conditions for a way of life and living.

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Chapter 6

Sustainability Matters: Alternative Initiatives and Resistance to Genetically Modified Organisms and the Corporatization of Agriculture in Alberta and Andhra Pradesh

Introduction

In this chapter, I explore and analyze the building of a movement that challenges the process of neoliberal globalization in general and the commodification of agriculture and food in particular, drawing examples from Alberta, Canada and Andhra Pradesh, India. As illustrative cases from Andhra Pradesh, I use the socio-political and organizational dynamics of peasant mobilization in the villages of the Deccan Development Society *sanghams* (grassroot associations of the poor) network in Medak district and in the village of Enabavi in Warangal district. In the context of Alberta, I examine producer-consumer efforts in the Greater Edmonton region to build an alternative local food movement against the corporatization of the agri-food system.

The major objective of each movement is to build self-protective and subsistence communities, to mend the metabolic rift between nature and society, and to reconstruct the social fabric of their communities. I use social historian Karl Polanyi's concept of "double movement" as an analytical framework[112] to explain alternatives being explored in Canadian and Indian agriculture, and their socio-political implications for farming communities.

Polanyi argues that as it evolves the market system transforms "isolated markets into a market economy, regulated markets into a self-regulated market"

[112] Karl Polanyi wrote *The Great Transformation* in 1944 and it has been "recognised as one of the major works of twentieth-century social science." (Block 2003:275) In this "canonical work," Polanyi provides a new interpretation of the political and economic origins of the rise and fall of nineteenth century civilization and the entailed "great transformation." Polanyi's main argument is that the nineteenth century civilization stood on four basic institutions: the balance-of-power system, the international gold standard, the self-regulatory market, and the liberal state, but the primary cause of the great transformation is the self-regulating market.

(Polanyi 157:57) and that in a self-regulating market economy "instead of economy being embedded in social relations, social relations are embedded in the economic system." (Polanyi 1957:57) This transformation in the relationship between society and economy essentializes the commodification of all non-commodities and makes "society as an adjunct to the market." Moreover, a "disembedded" economy creates a new "insecurity and social anxiety," (Munck 2002:18) because it destroys the basic "forms of integration" — namely "*reciprocity*" and "*redistribution*"— which constitute the fundamental social relations of society (Polanyi 1957: 46-53).

Contrary to liberal theory, Polanyi considered the idea of the self-regulating market a "stark utopia" and argued that "such an institution could not exist for any length of time without annihilating the human and natural substance of society; it would have physically destroyed man and transformed his surroundings into a wilderness." (Polanyi 1957:3) He further argued that it would be impossible to develop and sustain a society "controlled, regulated, and directed by markets alone," because social relations and political institutions could not be totally embedded in the autonomous market economy (Polanyi 1957:68). Further, the total subordination of "fictitious commodities" (such as land, labour, and money) to the market forces would be pernicious to society. In fact, the organization of production of any commodity has to be embedded in social relations, and the state apparatus is required to manage supply and demand for all commodities. Some critics argue that it is nonsense to speak of the logic of an autonomous and self-regulating market (Block 2003:282).

According to Polanyi, the expansion of the self-regulating market to fictitious commodities inexorably spurred society to take self-protecting measures against "the intrusion of market." This countermovement was "more than the usual defensive behaviour of a society faced with change," but in fact, it was a reaction against a market-controlled economy which would destroy the "fabric of society" and social organization of production. Polanyi termed the clash between these two contradictory trends — self-regulating market and self-protecting societies — as a double movement, and he argued this double movement governed the dynamics of modern civilization (Polanyi 1957:76):

> [Double movement] can be personified as the action of two organizing principles in society, each of them setting itself specific institutional aims, having the support of definite social forces and using its own distinctive methods. The one was the principle of economic liberalism, aiming at the establishment of a self-regulating market, relying on the support of the trading classes, and using largely *laissez-faire* and free trade as its methods; the other was the principle of social protection aiming at the conservation of man and nature as well as productive organization, relying on the varying support of those most immediately affected by the deleterious actions of the market – primarily, but not exclusively, the working and the landed class – and using protective legislation, restrictive associations, and other instruments of intervention as its methods. (Polanyi 1957: 132)

Although there are several ambiguities in Polanyi's conceptualization of the "market economy," "embeddedness," "disembeddedness," "fictitious commodities," and in his assumptions about the character of the state and its role in redistribution, his concept of double movement is still relevant for understanding the spread of the self-regulating markets, on the one hand, and the rise of the self-protecting communities, on the other, especially in the politics of (anti-) globalization. Neoliberal economic policies have extended the free trade system across the globe and commodified many things in the social as well as natural world. This tendency has been challenged by de-globalization and decommodification movement(s) with an aim of "reclaiming 'everyday life' (the life world) from 'big business' (the system)." (Crossley 2003: 297) However, it is important to examine whether it is possible to build sustainable self-protecting communities in a globalizing world. Particularly, in the context of the "Gene Revolution," it is crucial to understand the operational strategies, for example, of the decommodification of food movements, and its socio-ecological implications for rural communities.

It is not clear in Polanyi's writings what constitutes subjective forces of self-protecting mechanisms and how do they initiate counterhegemonic movements (For a critical exposition of Polanyi's work for study of globalization, see, for example, Burawoy 2003; Halperin 2004; Webster, Lambert and Bezuidenhout 2008).

Sowing the Seeds of Hope in India[113]

While the Indian state enthusiastically pursues the neoliberal economic agenda in all socio-economic and public sectors, countermovements in various forms have been gaining momentum and challenging the intrusion of the market system into social and community life, and protesting the dispossession of people from their customary livelihoods and the destruction of the environment. In India, since independence in 1947, myriad social movements have arisen across the country, including peasant, women's, *adivasi* (tribal people), *dalit* (so-called untouchables), civil rights, and nationalist movements. These movements formed in a response to failures of the developmentalist state. As geographer Paul Routledge observes, "they represent struggles for cultural, ecological and economic survival, confronted as they are by a seemingly inexorable process beyond their control and accompanied by the apparatus of exploitation, domination and repression." (Routledge 1993:16)

Historically, social movements in India have been associated with political parties that purposively manipulated or co-opted them for their own benefit of electoral politics, and did not allow them to operate independently (Routledge 1992). New grassroots social movements have arisen, however, in an attempt to redefine political place, agency, and actions that are often autonomous of political parties, though sometimes they form alliances with 'like-minded' non-governmental organizations (NGOs) and other civil society groups. New social movements tend to engage in local and issue-based struggles and attempt to create political alternatives by 'empowering' and 'sensitizing' different social groups in civil society (Routledge 1993:17; 1992).

[113] A version of this section has been published in the *Community Development Journal*. See Kumbamu 2009.

As environmental historian Ramachandra Guha (1989:12) argues, the new social movements (NSMs) in India are struggling on two levels: (i) at the "defensive level," in protecting "civil society from the tentacles of the centralizing state" and market forces, and (ii) at the "assertive level," in changing civil society from within and proposing an alternative conception of "good life," which rests on the notion of sustainability, local knowledge system, and cultural identities. The assertive dimension of the NSMs often involves "constructive resistance":

> That is, not only do these movements articulate dissent (and often noncompliance) with central and state government policies, but they also actively seek to articulate and implement alternative development practices. Viewing the state-directed development process as inimical to local tradition and livelihood, many social movements actively affirm local identity, culture and systems of knowledge as an integral part of their resistance. (Routledge 1993:17)

In the realm of agriculture, the so-called new farmers' movements (NFMs) began in the 1970s and operate under different names in specific contexts throughout the country (Brass 1994: 4). Scholars writing on NFMs in India generally agree that these farmer movements are part of the NSMs that have emerged globally as a new phenomenon from the late 1960s onwards (Brass 1994: 6). As discussed in chapter 4, the commodification of agriculture hastened by the "Green Revolution" has made the peasantry more vulnerable to the price fluctuations in regard to both input and output. NFMs mobilized farmers around the issues of "index-linked agricultural output prices, lower input prices, crop insurance schemes, the ending of bureaucratic corruption, and the imposition of rural quotas for entry into higher education and government employment." (Brass 1994:7) While the "Green Revolution" created objective conditions for the rise of the "new" farmers' movements, it is the "Gene Revolution" in the era of neoliberal globalization that has facilitated the mushrooming of urban-based NGOs and environmental group movements (Scoones 2008).

Apart from these "new" farmer and NGO movements, the "old-style" peasant-based revolutionary parties and organizations that follow the Naxalbari path have been waging protracted armed and militant struggles with a goal to end all kinds of oppression and exploitation of semi-feudal and semi-colonial social formations. They reject the idea of building the peasant movement based on “economism” or “economistic reductionism,” (Banerjee 1984: 26) which is a basic characteristic of the NFM.

The “newness” in these farmers’ movements when compared with “old-style” peasant movements is identified by agrarian political economist Terence Byres (1994:2) as:

> Agency has passed from ‘peasant’ to ‘farmers’; the central focus of rural agitation had shifted from land to prices; the essential agitational form was a non-party one; and distinctive, novel methods of agitation were employed ... broadening of agenda and ideology, to include the environment and women's issues.

The mobilization dynamics and political actions of all these countermovements depend on their political programs, strategies, and tactics. Evaluation and value judgment of these movements is not relevant to this research project. Thus, this chapter is limited to the examination of peoples’ “constructive resistance” in reclaiming a range of autonomies in agricultural and rural life: autonomy over natural resources including seeds, food production, markets, media, and the socio-ecological sustainability of their communities.

Building Discursive and Constructive Resistance: The Case of the Deccan Development Society and the “GM-free” Village Project in Enabavi

In 1983, a group of urban-based professionals from development studies, communication technologies, and social sciences set up the Deccan Development Society (DDS) and began working with dalit women, the most marginalized and excluded section of Indian society, in the Zaheerabad *mandal* (sub-district) of Medak district, with its field station in Pastapur village, and its headquarter in Hyderabad, the capital city of Andhra Pradesh. Over two decades, DDS activities have spread to 75 villages in five *mandals* (sub-district level) in Medak district. In the initial phase, the vision of DDS was "to give a leadership to the community groups from outside and facilitate a humane transfer of technology." But, after learning from past experiences and seeing the intensified farm crisis in the post-reform phase (i.e. after 1990), DDS realized that "it is crucial for local communities to take over certain spheres of autonomies to protect themselves from being trampled over by invisible globalizing forces."[114] Then, it expanded its vision to include autonomous community building to challenge the consequences of market mechanisms as well as the policies of failed developmentalist state by reclaiming control over natural resources and local socio-political institutions.

The terms such as "autonomy," "sovereignty," "democracy," "indigenity," and "participation" have become integral of DDS strategic planning as well as day to day activities. Although mobilizing women and organizing them into sanghams is a typical NGO practice, DDS's special focus on dalits and its alternative development model are unique. The Organization has 5000 dalit women members and "has a vision of consolidating these village groups into vibrant organs of primary local governance and federate them into a strong pressure lobby for women, the poor and dalits."[115] Dalit farmers in the project area are organized into sanghams and form a network in implementing development projects under the guidance of DDS development workers. The sangham network follows egalitarian guiding principles such as democratic participation, decentralized decisions, equity, and sustainability, and takes an alternative approach to that of conventional project formulation, implementation, and evaluation.

The strategies of DDS in building autonomous communities divide into two broad categories: (1) place-based strategies of community development and (2) network-based solidarity movement. These two strategies and associated activities aim to avert the risks and crises of the market economy and develop and defend autonomous communities (For a summary of DDS activities, see Table 6.1).

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[114] http://www.ddsindia.com/www/default.asp. Accessed: January 10, 2008.

[115] http://www.ddsindia.com/www/default.asp. Accessed: January 10, 2008.

Place-based Strategies

As developmental critic Arthur Escobar suggests, place-based strategies "rely on the attachment to territory and culture," whereas network-based strategies "enable social movements to engage in the production of locality by enacting a politics of scale from below." (Escobar 2001:161) In fact, networks act as instruments for "the production of discourses and practices that connect nodes in a discontinuous space." (Escobar 2001:169) These two strategies are complementary rather than contradictory. For Escobar, place-based strategies "derive greatly from the modes of operation of the networks that are becoming central to the strategies of localization advanced by social movements (and, of course, by capital in different ways)." (Escobar 2001:169) Particularly in the politics of liveability, "reclaiming sustainability," as political ecologist Michael Gismondi writes, "means struggling to define local places and local ecosystems within a network of global system, and starting to build alternatives from the bottom up." (Gismondi 2006: 153)

In response to the negative implications of market-oriented agriculture and food policies, DDS takes up (place-based) community development activities to address the issues of the erosion of biodiversity, livelihoods, indigenous knowledge systems, local food grains, and food security. The sangham network also takes up socio-cultural issues such as child marriage, sexual harassment, child labour, and atrocities against women. The sangham network has implemented the following programmes in their pursuit of autonomy over food, land, seeds, and the commons:

- *Community Grain Fund Program* (Alternative Public Distribution System): Brought marginalized lands of dalits into dryland cultivation by collectively using natural resource management methods – "eco-employment." In this program, the sangham women and landless laborers took land on lease from farmers who are not cultivating and worked collectively in order to acquire extra food grains for their families. Through this collective effort, the sangham network has significantly increased food grain production at the village level. For instance, the sangham network brought over 1000 hectares of fallow land under cultivation and remarkably produced extra 800,000 kg of sorghum in the first year itself of the program. To encourage the production of traditional crops, to eliminate middlemen in the marketing of produce and to provide a fair price to the producers, the Organization also established the Deccan Development Society Mutually Aided Credit Cooperative Society Ltd. This Co-op works as a safe avenue for the marketing of organic produce. All these efforts are directed towards reaching the main aim of the program: "local food production, local food storage, and local distribution."

- *Community Gene Fund Program* (Traditional Seed Banking Program): Examining market–nature relations, Polanyi wrote that "land is an element of nature inextricably interwoven with man's institutions. To isolate it and form a market out of it was perhaps the weirdest of all undertakings of our ancestors." (Polanyi 1957:178) This is doubly true to all elements of nature, including seeds. To counter the "weirdest" phenomenon of seed commodification, the sangham network has been consciously working to decommodify seeds and to keep them as a precious bounty of nature for a sustainable future through community-owned and managed seed banks. Over 500 sangham women participated in this program and recovered 50 traditional crop varieties in two years and established community seed banks in 30 villages. To encourage farmers to conserve traditional varieties, since 1999, the sangham network has been annually organizing a month-long cultural campaign called the Mobile Biodiversity Festival, which begins on the local harvest festival of *Sankranthi* (usually 14 January) and ends on 12 or 13 February.
- Dalit Watershed Program: Built using the indigenous technical knowledge and exclusively targeted at the development of Dalit farmers' marginalized lands to grow the neglected dry land crops such as millets.

Table 6.1: DDS Sangham Network Activities in Building Self-Protecting Autonomous Communities

Neo-liberalized Indian State Programs and Market Economy Mechanisms	**Crises and Risks**	**Self-Protecting Activities of the Sangham Network**	**Resulting Autonomies and Resistance**
Spread of industrial agricultural and food system; improper targeting of beneficiaries and inadequate and inefficient food distribution; subsidy cut	Food insecurity; endangered food of "lower" castes	Alternative Public Distribution System through the Community Grain Fund; Café Ethic (Organic Millet Restaurant); revival of subaltern food culture	Food sovereignty
Diffusion of new agricultural technologies (seeds, fertilizers, pesticides etc.) from the "Green Revolution" to the "Gene Revolution"	Monoculturization; commodification of seeds and other inputs; socio-ecological crises	Agro-biodiversity conservation through the Community Gene Fund; mobile biodiversity festival to bring awareness among farming communities	Seed sovereignty and control over natural resources
Deregulation of the agricultural input sector and subsidy cut to crucial inputs; deregulation of markets and withdrawal of the state from effective price regulation of agricultural commodities	Increased cost of production; poor price for the produce; indebted farming community	Ecological agriculture; dalit watershed; organic cooperative market; eco-enterprise (e.g. vermicompost project)	Autonomy over market, sustaining agriculture and livelihoods
Commodification of land	Disappearance of commons	Preserving commons and pastures	Control over commons
Imposition of global scientific/ epistemic knowledge	Dispossession of indigenous knowledge	Indigenous knowledge documentation and dissemination through the Community Media Trust and Community FM Radio for community awareness; green education	Sustaining local knowledge and autonomy over media
Privatization of public services	Privatization of education and healthcare	Village Medicinal Commons; community supported *balwadies* (kindergartens)	Building autonomous social service systems
Spread of GM crops	Socio-ecological risks and negative externalities	Anti-GM campaigns, networking, and solidarity movement; policy lobbying; organic movement	Assertive resistance
Pro-technology and pro-market studies conducted by epistemic professionals and corporate consultants	Hype over technology and gloss over its negative externalities; uncertainties	Research conducted by civil society members and public intellectuals; video documentation by the Community Media Trust to show the socio-ecological and health implications of GM crops.	Discursive resistance

With all these dedicated efforts, the sangham women have significantly increased the cultivation of traditional food crops (mainly millets). These initiatives have revitalized the food culture of the marginalized section (dalits, adivasis, and most "backward" castes) in the villages of the sangham network, whose main source of food had been various millets until the introduction of the Green Revolution food grains such as rice and wheat into their lives. In order to deconstruct the social construction of millets as the food of "lower" castes and to bring back this "forgotten food" into urban people's diet, the sangham network has opened a Café Ethnic, an organic millet restaurant, in the town of Zaheerabad. Moreover, with the traditional seed banking programme, the sangham women have become seed producers and shares not only to their co-members of the network, but also to the farmers of dominant castes such as *reddy* and *velma*. This has enhanced their intra-household, as well as extra-household bargaining position. More importantly, the local seed production activity has decreased small farmer dependency on external inputs and enhanced the "internal cycle of inputs," which helps healing the metabolic rift between nature and farm community, and restore the social fabric of society.

Network-based Strategies

With its network-based strategies, DDS has emerged, in the state of Andhra Pradesh, as one of the major advocates of an organic movement, fierce critics of the techno-industrial agricultural production systems in general, and GM farming in particular. DDS is a member of several regional, national, and international network-based coalition movements. These include the Andhra Pradesh Coalition in Defence of Diversity, a coalition of over 142 civil society organizations in Andhra Pradesh, the Organic Farming Association of India, the South Asian Network for Food, Ecology and Culture (SANFEC), South Against Genetic Engineering (SAGE), GRAIN, and Biodiversity Action for Sustainable Agriculture – Asia (BASA – Asia). DDS also works as the Regional Resource Agency, networking over 500 environmental and civil society organizations, for the government's Ministry of Environment and Forests. In 2007, DDS initiated the All India Millet Network to encourage production of millet, known as “God’s own crop,” and “to ensure not only the food security of the country but also multiple securities such as fodder security, health and nutritional security, livelihood security and ecological security.” (www.ddsindia.com, accessed on April 28, 2008)

DDS regularly commissions studies on the socio-ecological implications of ecological agriculture, biodiversity conservation, and the adoption of GM crops. Since the introduction in 2002 of Bt cotton into Andhra Pradesh, DDS has been conducting studies each year on the socio-economic and ecological implications of the new seed. These have facilitated and stimulated intense discussion about GM crops and their implications for the sustainability of agriculture and farm community.

Sangham women have started making a difference in reclaiming sustainability by demanding that, “their unrecognised voices are heard and acknowledged by the world outside.” In 2001, in order to create an autonomous media, a team of 10 dalit women farmers trained in video production and formed a Community Media Trust (CMT). Over a six-year period, the CMT has produced 75 short films on various agricultural and rural issues such as biodiversity, local health care, women and agriculture, and GM crops. Recently, they produced three important films to capture farmers’ experiences with Bt cotton in Andhra Pradesh and other places: *Why are Warangal Farmers Angry With Bt Cotton?* (2003), *Bt Cotton in AP: A Three Year Fraud* (2005), and *A Disaster in Search of Success: Bt Cotton in Global South* (2006), shot in South Africa, Indonesia, Thailand, Mali, and India. These films won the prestigious UGC–CEC (University Grants Commission–Consortium of Educational Communication) National Award for the Best Educational Video out of 246 nation-wide entries from big-named short-film producers and academia from various Indian universities. The latest multimedia publication of DDS-CMT, *Affirming Life and Diversity: Rural Images and Voices on Food Sovereignty in South India*, a collection of 12 videos and text on various issues of development in South India, was globally launched in Bonn, Germany, as part of the United Nations Convention on Biodiversity, and subsequently launched in India and Canada in 2008. The video production of DDS-CMT not only helps in building space-based network of solidarity movement at the national and global level, but also encourages farming communities in adopting organic food production methods at local and regional levels. To learn more about the process of subaltern production and distribution of community videos at DDS-CMT and its impact on local farming communities, see Mookerjea 2009.

Enabavi: A Chemical-free and GM-free Village

While DDS is making significant contributions to sustainable agriculture in Medak district, another Hyderabad-based NGO, the Centre for World Solidarity (CWS) has been working to build a countermovement to the diffusion of GM seeds in Andhra Pradesh. Particularly, in Warangal district, CWS in association with the Centre for Rural Operations and Programmes Society (CROPS) that operates from Janagam, helped transform a chemical intensive agriculture village, Enabavi in Lingala Ghanapuram manadal, into a "chemical-free" and "GM-free" village (see picture 6.1 and 6.2). In Enabavi, the majority of farmers adopted Bt cotton in 2003 and 2004, but completely abandoned it from 2005 onwards. In this village, there are only 51 farm households and the majority of them are small farmers belonging to "backward castes." This somewhat homogeneous socio-economic condition provided very conducive circumstances for CROPS to intervene into their agricultural practices and transform them towards sustainable agriculture (see Appendix 4). The regional media touted this as a "new revolution" and proclaimed that: "Enabavi farmers create history." (*The Hindu*, October 12, 2006) Some governmental and non-governmental organizations also consider Enabavi as a model, and bring farmer leaders from this village to other villages in other districts in the State and even to other States to explain the process of their agricultural transformation and its benefits to their community. It should be noted that although CROPS is instrumental in the "chemical-free" village project, the intellectual input of CWS and funding from *Aide à l'enfance de l'Inde* (AEI), Luxembourg, is also very crucial.

Picture 6.1: The "Chemical-free" Village Sign Board at the Entrance of Enabavi.

Picture 6.2: Writing on a Water Tank by CROPS in Enabavi to Advocate Sustainable Agriculture Principles.

Source: Pictures 1 and 2 were taken by the author, October 3rd, 2006.

Although all these activities of the *sangham* network in the DDS project and the farmers of "chemical-free" village have been challenging the intrusion of the self-regulated market system into agriculture, it is difficult to imagine their functioning without the material support and intellectual guidance of urban-based professionals. Moreover, considering the dependency of DDS and CWS on external (international as well as national) funding sources[116] to support the alternative community initiatives, it is difficult to believe that the "chemical-free" or "GM-free" villages would grow further and build an effective countermovement locally against the forces of neoliberal globalization. In fact, it is naïve to believe that building autonomous and subsistence communities alone would counter globalization process without militantly challenging political and economic forces that have vested interests in promoting the new "great transformation" and in perpetuating oppression and exploitation of subaltern peasantry.

Here, I constructed two ideal types (neoliberalism and subsistencism) and explored to some extent the implications of them for subaltern peasantry. This will be taken further in future research to examine how the activities of organizations such as DDS and CWS fall short of the ideal type, and how they pacify militant social mobilization in the region that have been demanding radical transformation in the social relations of production and distribution.

Legal and Militant Resistance

While organizations such as DDS and CWS are building discursive and constructive resistance to the introduction of GM seed, a few farmer organizations are challenging this by legal and militant actions. Although many farmers organizations affiliated to parliamentary political parties oppose GM seeds on ideological basis, they do not build a strong movement against or assiduously protest the state policies on biotechnology. But, since the field trials, farmers'

[116] The DDS receives funding from various international development agencies in Germany, Norway, Sweden, Canada, UK, the Netherlands and Switzerland, and also from various state and central government agencies. See http://www.ddsindia.com/www/default.asp. Accessed: January 22, 2010.

groups organized by NGOs and civil society organizations have been protesting the introduction of Bt cotton into the country. Ironically, the Karnataka Rajya Raitha Sangha (Karnataka State Farmers' Association), a Gandhian organization in the state of Karnataka, attacked and destroyed the field trial stations as part of a campaign called "Cremate Monsanto!" The protestors warned biotech investors and shareholders: "You should rather take your money out before we reduce it to ashes."[117] In 1999, the Research Foundation for Science, Technology and Ecology, headed by Vandana Shiva, filed a public interest lawsuit in the Supreme Court challenging the legality of the field trials on the grounds that no data were made public.

After the commercial release of Bt cotton, the anger of farmers who incurred heavy losses turned to violent street protests; they burned down Monsanto's seed outlets in the town of Warangal, imprisoned Mahyco-Monsanto representatives in the villages, and demanded the company compensate them for the crop failure.[118] Considering the growing wrath of the farmers and pressure from civil society organizations, the state government of Andhra Pradesh recommended the central government not renew Mahyco-Monsanto's license to sell its three varieties of Bt cotton. In response, on May 3, 2005 the Genetic Engineering Approval Committee banned Mahyco-Monsanto's Bt cotton in Andhra Pradesh. However, this was seen as a "tokenistic" response to the farmers' agitation against Bt cotton, because, in the same year, the committee continued to allow it to be sold and grown in the five other Indian states where it was already approved. The committee also approved five new Bt cotton varieties: RCH-144 Bt and RCH-188 Bt developed by Rasi Seed company, MRC- 6301 Bt developed by Mahyco, and Ankur-681 and Ankur-09 developed by Ankur Seeds. The approval of these new Bt cotton varieties clearly demonstrates the strong commitment of the Indian state to the corporate-control Gene Revolution, whatever the results.

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117 See http://home.ica.net/_ fresch/ndp/monsant3.htm. Accessed on April 19, 2005.

118 See ''Bt Cotton Fails Yet Again in India Farmers Go On Rampage,'' http://www.gmwatch.org/archive2.asp?arcid_ 4557. Accessed on April 28, 2004.

Building Sustainability Initiatives: The Localization of the Agri-Food System in Alberta

Farmers in Alberta have a great historical legacy of agrarian movements. In the late 19th century and the early 20th century, farmers in Alberta created a "movement culture," cultivated a deeper sense of community, and built sustainable co-operative systems (Rennie 2000; Sacouman1979). Initially, for economic purposes, farmers were mobilized and organized into different producer associations (such as the Territorial Grain Growers' Movement in 1901). But, later these associations evolved as a political force by forming the United Farmers of Alberta (UFA) in 1909, United Farm Women of Alberta (UFWA) in 1915, and the Non-Partisan League in 1916. Finally, the farmer led political parties achieved electoral success, formed the government in 1921, and continued its rule until 1935 (see Macpherson 1953). During this period, as the Editor of *The UFA* (1926) proudly claims they "gained a quiet confidence in their own ability to carry on their own affairs in their own way … learned much in their own schools of democracy, [and] obtained a deeper insight into the methods and possibilities of democratic political action." (Quoted in Epp: 2001:307) However, political radicalism among Alberta farmers has gradually diminished since the petit-bourgeois reformist rule of Social Credit party from 1935 to until 1971 (see, for example, Irving 1959; Bell 1989; Sinclair 1989) and the pro-corporate governments of the Progressive Conservative party from 1971 onwards (Barrie 2006).

In the contemporary context of neoliberal globalization and the "Gene Revolution," although there is no collective mobilization and resistance to corporate domination over agriculture, many farmers organizations in Canada have been opposing GM technologies and a small percentage of farmers have been pursing alternative initiatives to reclaim their communities. In fact, in the Canadian Wheat Board annual survey in 2009, the majority of farmers (69 percent) opposed the introduction of GM wheat, 19 percent indicated that the seed should be allowed if it benefits the farmer, only 9 percent wanted to grow as soon as possible, and 3 percent expressed that they did not know about it.[119]

As political scientist Roger Epp (2001:308) says:

> There is no useful purpose in attempting to freeze a changing historical reality at some idealized point in the past, and from it either lamenting the present or imagining a more desirable future that glosses over contemporary problems. There is precious little sentimentality left in rural Alberta anyway. There are intimations of loss, however, and confusions about rural identity that present crucial opportunities and perhaps political possibilities.

To revive "precious little sentimentality" and create alternative political possibilities, farmers in Alberta have been building a discursive resistance to neoliberal globalism by organizing brainstorming meetings, conferences, educational tours, and demonstration fields. With a ray of hope, they are relearning about their community transformation to promote sustainable initiatives. For instance, in a "relearning community" initiative in the Town of Viking, in which I also participated briefly, attempted to understand the forces behind the rural transformation and its implications for rural sustainability. In this program, the farmers of the Viking community state:

> We will be taking a fresh look at community in our changing world including how communities were formed, how politics evolved through the years and where we are now. We will ask how globalization has affected community and consider the importance of our environment to our communities. We will also conduct an exploration of examples of healthy communities as well as a look at how some communities are choosing to evolve in directions that enhance the quality of the lives of their citizens.[120]

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119 http://www.cwb.ca/public/en/farmers/surveys/producer/pdf/survey_full_061809.pdf. Accessed: January 29, 2010.

120 http://www.augustana.ualberta.ca/files/group/514/Relearning%20Community%20Brochure.pdf. Accessed: December 17, 2009.

Organic Farming

In the midst of overwhelming adoption of GM crops, a small percentage of farmers with dedication and passion are attempting to rebuild their communities based on sustainability principles. As part of this, they clearly denounce GM technologies. As Canadian Organic Growers clearly state: "In our view, genetic engineering (GE) runs contrary to the principles of caring for and protecting people and the ecosystems on which they depend. GE is a short-term, ill-conceived and oversimplified approach to agriculture; it does not respect natural systems."[121] Considering nature-dependent organic agriculture as one of the alternatives to corporate-dependent GM agriculture, some small farmers in Alberta have been cultivating with organic methods. In recent years, although there is no drastic increase in the number of certified organic producers, the acreage under organic production and the number of processors and distributors has been increasing (see Table 6.2 for information about certified organic producers and processors in Alberta between 1999 and 2008). One of the main reasons for farmers to grow organic food is, as the Canadian Organic Growers state:

> Organic practices respect the complex web of plant and animal relationships on which we all depend. These webs of life naturally build resilience and security into the ecosystem and consequently into our food system. Organic agriculture conserves genetic diversity, the benefits of which have been widely acknowledged. It encourages regional self-reliance in the production of high quality food, financial security for farmers and rural dwellers, and food security for us all.[122]

[121]"COG's Position on Biotechnology." http://www.cog.ca/our-work/consumer-awareness/cog-s-position-on-biotechnoloy/. Accessed: January 10th, 2010.

[122] COG's Position on Biotechnology." http://www.cog.ca/our-work/consumer-awareness/cog-s-position-on-biotechnoloy/. Accessed: January 10th, 2010.

Table 6.2: Number of Certified Organic Producers and Processors in Alberta from 1999 to 2007.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Farms Certified Organic	210	325	330	254	245	254	238	231	231	259
Percentage of Total Farms	0.4	--	--	--	0.4	0.4	0.5	0.5	0.5	0.5
Number of Farms in Transition	11	--	--	--	8	12	7	2	--	4
Acreage of Production (acres)	227800	--	--	--	188306	235677	322414	375605	397244	346005
Number of Processors and Handlers	27	--	--	--	54	53	58	48	64	70

Source: Canadian Organic Growers (Compiled by the author). http://www.cog.ca/our-work/organic-statistics/. Accessed: January 26, 2010.

With increasing consumer consciousness about the socio-ecological and health implications of the industrial agri-food system, the consumption of organic products in Canada in general, and Alberta in particular, has been growing slowly. In Canada, in 2006, a conservative estimation of the total value of certified organic products (excluding organic but not certified) was about $1 billion, and it was expected to grow in the near future. In Alberta, as of 2007, 1,491 organic certified food items were available in grocery stores. Indeed, the value of organic products has been increasing every year (Government of Alberta 2007).

With increasing consumer preference for organic food, market opportunities for organic producers have extended from niche market to the mainstream. Organic producers in Alberta sell their products through different market channels: 23 percent of total products sell directly to consumers, 26 percent to processors, 26 percent to specialty stores, 7 percent to retail grocery, 5 percent to feed sector, and the rest to other (see Table 6.3).

Table 6.3: The Market Channels of Alberta Organic Producers

Market Channel	Percentage of Total
Processor	26
Specialty food stores	26
Directly to consumers	23
Retail Grocery	7
Feed	5
Canadian Wheat Board	4
Food service	2
Conventional retail	2
Seed	2
Other	3
Total	100

Source: Government of Alberta. 2007. "Farm to Fork: Organics in Alberta," p.4.

But, with the involvement of various market agents, organic food is also leaving the locality of production for the purpose of global consumption. If an organic product travels equal distance of a conventional or GM product, then the ecological value embedded in that product will be diminished. Thus it is important to examine where Alberta organic products are going. Farmers sell 17 percent of products in the local (defined as within 100 kilometers of the farm) by using the producer-consumer networks, 23 percent in other areas of Alberta, 25 percent in other provinces of Canada, 32 percent in USA, and the rest in other parts of the World (see Table 6.4).

Although a total of 40 percent of Alberta organic products are sold within the province, the majority percentage is exported to other provinces and USA. This raises a pertinent question that whether organic farming will help reduce our ecological footprint and greenhouse gas emissions. A study conducted by agricultural economist Sean Cash and his team at the University of Alberta calculated the "food miles" of organic and conventional food consumed in Edmonton and their environmental cost of greenhouse gas emissions. They calculated that "the annual environmental costs for a city the size of Edmonton were \$135,000 to \$183,000 (5492-7526 tonnes CO2) for conventional produce and \$156,000 to \$175,000 (6348-7124 tonnes CO2) for organic produce."[123] They also found that some organic products (such as mangos, bananas) travel more distance than conventional products. This raises important issues related to the ecological counter-productivity of organic products. One of the main reasons for such ecological issues is the corporatization of organic food production, distribution and processing. In fact, the institutionalization of organic certification, price premium for organic produce, and growing consumer demand facilitated the emergence of "corporate organics." (Johnston, Biro and MacKendrick 2009; see also Raynolds 2004) The globalization of corporate organics is going against the spirit of the localization of the organic agri-food system. However, a few rural and urban communities have been attempting to localize food production and consumption through various market arrangements such as farmers' markets, 100 mile diet, community supported agriculture, urban gardening, food box projects, consumer clubs, and green restaurants.

Table 6.4: Place of Marketing of Alberta Organic Products

Place of Marketing	Percentage of Total
Local (within 100 kilometers of the farm	17
Other areas of Alberta	23
Other Provinces in Canada	25
USA	32
Asia	1
Other	2
Total	100

Source: Government of Alberta 2007. "Farm to Fork: Organics in Alberta," p.5

Farmers' Markets

In Alberta, over 100 farmers' markets are marketing locally produced food products. The majority of farmers' markets are approved by Alberta Agriculture and Rural Development, and they also use the trademark or logo, the Sunnygirl (see picture 6.3), to indicate that they received approval to sell products from the

[123] University of Alberta. "Organic Food Miles Take Toll On Environment." ScienceDaily 7 June 2007. <http://www.sciencedaily.com /releases/2007/06/070606113311.htm>. Accessed: Jan 5th, 2010.

community. The total estimated market value of farmers' markets is about $380 million in 2008, and it is expected to grow in the future. A study conducted by Alberta Agriculture and Rural Development on alternative agricultural markets indicates that local community members prefer buying food products from farmers' market because: they want to support local economy and local farmers, they believe that they are fresher (not processed as food in superstores) and grown with fewer chemicals, they believe the food is safer because they trust local farmers' production practices, and they consider it is economically and environmentally viable as the food is available closer to home. In addition to these, for consumers, it is great pleasure to talk to the person that produced the food that reflects the culture of the community (Alberta Agriculture and Rural Development 2008).

Picture 6.3: Sunnygirl Logo for the Alberta Agriculture and Rural Development Approved Farmers' Markets.

Source: http://www.albertafarmfresh.com/info.htm. Accessed: January 10, 2010.

Community Supported Agriculture, Food Box Projects, and Community Gardens

Community supported agriculture (CSA), also known as community shared agriculture, is "an arrangement whereby a group of people, one of whom is a farmer, agree to share the costs and products of a seasonal vegetable garden." (Fieldhouse 1996:43) CSA operates with mutual trust and cooperation among the members who participate in it. In principle, all group members buy shares in farm products in advance from CSA farmer. Members are allowed to volunteer in all activities from pre-production to harvesting. They also get an option to receive farm produce either by door delivery service or by directly participating in harvesting throughout the season. For instance, the farmer of a growing CSA in Edmonton, Sparrow's Nest Organics, mentions that "a typical weekly Share could include: bunched carrots and beets; potatoes; broccoli or cauliflower; kale or Swiss chard; onion or leek; lettuces; herbs (parsley, oregano, marjoram, basil, thyme); peas or beans; radish; summer squash; tomato; pepper."[124]

The CSA system allows urban consumers to directly participate in food production and brings them closer to nature. This process shortens food chain from the field to the plate by eliminating middleperson and agencies. More than building direct producer and consumer relationship, it promotes the values of sustainability, community development and local food security. It also cultivates the values of sharing (costs, planning, labour, local knowledge, local food culture, harvest, risks and celebration) (Fieldhouse 1996) and caring (nature, community relations, and biodiversity). Above all, CSA presents an idea that food is not just a thing that we can buy at any grocery or fast-food centre, but it is an object of relationship that binds us to nature and the community. Sharing experiences with a CSA project, Edmonton Journal's food columnist, Liane Faulder, writes:

> Overall, I was pleased with the CSA experience. I really liked the convenience of picking up my fresh vegetables close to home (the south-side drop off point was just a few blocks from my house) because sometimes it's not easy to get to the farmers market. I also

[124] http://www.sparroworganics.com/what_we_do.html. Accessed: January 23, 2010.

> liked being exposed to different vegetables, and the challenge of figuring out new recipes with them. I had rarely eaten kale before this summer. Now I love kale, particularly when prepared in a Portuguese Green Soup, a recipe given to me by the chef at Sabor Divino.[125]

Comparing the socio-economic implications of farmers' markets and CSA, rural sociologist Clare Hinrichs (2000:300-301) writes.

> CSA – in its vision, and possibly also in its evolving practice – suggests more readily than farmers' markets an economic form where marketness and instrumentalism might be creatively reconciled with social embeddedness. CSA moves toward decommodifying food through the special transaction of the share and through its explicit emphasis on community. Farmers' markets involve less deliberate proximate ties and personal connections. They remain firmly rooted in conventional exchange relations, where asparagus and sweet corn can be purchased when available for the going price that day. With CSA, in contrast, the precise correspondence of the share fee to the produce one will actually receive cannot be known until the growing season is over. Entering a relationship based on such indeterminacy requires some measure of trust.

Although the coordination of volunteers is a big challenge in the CSA projects, the community support for this initiative has been increasing in the Edmonton region. Another local food movement initiative recently started in Edmonton is the Good Food Box project, which aims at making 'local' easy in the context of the global agri-food business. This is a non-profit project that acts as a medium between urban consumers and CSA farmers.[126] The organizers of this project collect food stuff from the network of local CSAs within 100 kilometer radius, and distribute mixed produce in a box to consumers at their home, business or office. This project has been gaining momentum because it provides market

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125 http://www.edmontonjournal.com/life/food/Farming+city/1783650/Local+food+nourishing+relationships/2182637/story.html. Accessed: January 23, 2010.

126 The Good Food Box project was initiated in Edmonton with the partnership of the Canadian Center for Community Renewal, Healthy Alberta Communities, Greater Edmonton Alliance, Alberta Hospital, and Eat Local First.

opportunities for farmers and fresh food for consumers who cannot directly participate in CSA.

Apart from CSA, there are also about 40 community gardens in and around Edmonton, and they formed as a network to educate and spread the value of local community gardens in the neighborhood. (For more information about the Community Garden Network of Edmonton and Area, see http://www.edmcommunitygardens.org.) Another non-profit initiative in local food democracy is "Slow Food Edmonton" movement that denounces the standardization of food and taste by the industrial agri-food system, and "believes that pleasure and quality in everyday life can be achieved by slowing down, respecting the convivial traditions of the table and celebrating the diversity of the earth's bounty."[127] This organization primarily focuses on building discursive resistance at grassroots level by promoting educational programs in schools and communities in Edmonton. However, some critical scholars of local food movements argue that:

> Conceptions of farmers' markets or CSAs that see participants as individual clients or consumers (particularly in urbanized settings, where these can operate as a boutique mode of food procurement), work to reproduce a mode of political engagement grounded in individual consumer choice and favoring elite social classes, rather than aiming for the conscious re-constitution of more equitable, democratic, and sustainable socioecological relations in the food system. (Johnston, Biro and MacKendrick 2009:526)

Sustainable Agriculture Demonstration Farms

While corporations are vehemently pursuing various market strategies (including demonstration plots as discussed in chapter five) to spread GM seed in Alberta, a few farmer organizations are attempting build counter-hegemonic discourse by demonstrating the socio-ecological and economic merits of sustainable agricultural methods. One of such organizations is the Parkland Conservation Farm (PCF) that is located near Vegreville about 90 kilometers east of Edmonton.

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[127] http://www.slowfoodedmonton.ca/?page_id=5. Accessed: January 23, 2010.

This farm operates on 600 acres of land that was leased out to PCF by the Basilian Fathers who homesteaded on this property in 1903. Initially, it was started as the PARI (Parkland Agricultural Research Initiative) Conservation Farm in 1993 and successfully operated until 1996. But in 1997 it evolved as PCF to further continue not-for-profit activities for the promotion of sustainable agriculture.

The mission statement of PCF clearly states that it is "committed to increasing awareness and adoption of sustainable agriculture practices that conserve soil, water and wildlife habitat. We achieve these goals through demonstration, discovery and education of youth, farm managers and the general public."[128] (see picture 6.4 and 6.5) Consistent with the mission statement, they have been conducting field demonstrations and producer education workshops in the field of integrated crop management, pasture management, manure management, livestock management, holistic farm management, low or zero tillage, rotational grazing, winter wheat, and greenhouse gas mitigation methods. They also conduct agro-environmental programs for children between ages 3-18 to educate them on the relationship between food, agriculture and nature. PCF's activities are shaped by its five basic strategic pillars: a) sustainable farming, b) affordable rural living, c) local food security, d) learning from the past (from pioneering traditions of aboriginal people and the early immigrants), and e) farm energy alternatives. PCF publicizes all its major activities through local radio, local news papers, personal contacts, and the newsletters of organic general stores in Edmonton. According to the program coordinators at PCF, the number of farmers and other people attending their activities has been increasing to learn about sustainable agricultural practices.

[128] http://www.parklandconservationfarm.com/info/mission.html. Accessed: January 22, 2010.

Picture 6.4: The Sign Board of the Parkland Conservation Farm on Highway 16 near Vegreville.

Source: Picture was taken by the author, September 25th, 2008.

Picture 6.5: Signs Boards on the Parkland Conservation Farm.

Source: Picture was taken by the author, September 25th, 2008.

Conclusion

In this chapter, I examined the process and strategies of countermovements to the corporatization of agriculture and food and its potential implications for the revitalization of sustainable rural communities in Alberta and Andhra Pradesh. I also analyzed the role of post-developmentalist organizations in the creation of a discursive, as well as constructive, resistance against agricultural globalization and in the cultivation of 'hope' amidst agrarian distress. These organizations have adopted both place-based as well as network-based strategies to build and defend self-protective and subsistence farming communities, to mend the metabolic rift between nature and society, to promote the decommodification of nature, to revitalize local knowledge systems, and to re-reconstruct social fabric within communities. Place-based activities and space-based network movements complement each other in empowering people and building a ‘counter-hegemonic bloc’ against neoliberal globalization.

Sociologist Sourayan Mookerjea (unpublished work) argues that:

> If we re-orient the concept of empowerment ‘positively’ away from its connection to a militant struggle against oppression, not only does ‘empowerment’ lose all meaning, but we have admitted to ourselves only the vaguest conception of the social organization of oppression.

Thus, in order to sustain people’s empowerment and sovereignty over local resources and socio-political institutions, the organizations challenging the self-regulating market through “constructive resistance” and militant struggles have to dissolve their contradictions and form a united force against the political and economic mechanisms of the new “great transformation.”

Environmental historian, Colin Duncan (1996:181-182) argues, and I agree, that “agriculture should be returned to its rightful, central place in agriculture, but on both a new ecological basis and a new socioeconomic basis. The institutionalization of ecologically sound agriculture will facilitate the return of agriculture to culture, and of culture to agriculture.” But, this is a difficult political task in the current model of the corporate agri-food system and the political space of neoliberalism. Thus, to sustain agriculture and the farm community, it is important to build pressure on the state to reorient its policies towards revitalizing rural communities on sustainability principles and participate in political activities that challenge the corporations, while building social economies around local food movement strategies such as farmers’ markets, CSA, 100 mile diet or community gardens.

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Chapter 7
Comparison and Conclusion

Many studies have examined the potential impact of genetically modified (GM) crops, but few have looked beyond economic cost-benefit analysis. In this dissertation, I have examined the sociological and cultural aspects of farmer decision-making in the adoption of the new seed technology, farmer receptivity to new cropping methods, knowledge translation between laboratory and farmer, and the impact of global knowledge-based technology on local knowledge systems, socio-cultural practices, the nature-society relationship, and gender relations. I used global ethnography methodology to better understand the global process of the "Gene Revolution," and its implications for farming communities in localities in Canada and India.

Canada and India followed different trajectories in terms of the adoption of new agricultural technologies, agrarian transformation, and farmers' response to these developments. While farmers in Canada adopted hybrid seeds and fuel-based mechanical implements in the early twentieth century, farmers in India completely depended on local seed varieties and animal-based traditional implements until the Green Revolution package was introduced in the 1960s. In Canada, new seeds developed in public research institutions by using plant breeding techniques have helped increase the production of high quality food products and overall agricultural production, and expanded the area of agricultural operations.

The "Green Revolution" was introduced into the global South with a major claim that the new technology package would bring revolutionary changes in the countryside in a similar way how the steam engine revolutionized the social organization of production in early industrial Europe (Brown 1970:10). Proponents of the "Green Revolution" claim that changes in the farm sector resulting from the new technology spilled over into other sectors of society and human life, increasing not only farm incomes but also off-farm and non-farm employment opportunities for the landless rural households, which raised the purchasing power of rural people (Brown 1970; Glaeser 1987). Agricultural economist Matin Qaim (2001: 3065) estimated that through the "income multiplier effect," one dollar of direct benefit in agriculture generated by the "Green Revolution" resulted in an additional dollar of benefits in other sectors. In other words, the "Green Revolution" emphasized that rural development could be achieved by intensifying agricultural production using modern technology without resorting to any radical political reforms such as a land redistribution program (Atkins and Bowler 2001; Harriss 1987; Ross 1998). Indeed, the discourse of "Green Revolution" suggests that "technical change is an alternative to political change." (Griffin 1979:2)

However, Green Revolution detractors point out that the resulting intensification of the commercialization of agriculture that accompanied the introduction of the new agricultural technology had serious problems. The package character of the technology means that it does not work well with subsistence, non-market farming, because it requires large amounts of money and, in some cases, substantial production and marketing facilities. Therefore, while Green Revolution technology was, theoretically, "scale-neutral," it was not "resource-neutral" (Harriss 1987; Byres 1981). Environmentalists and green activists argue that the "Green Revolution" eroded rich biodiversity in the global South and promoted the "monoculturization" of agriculture, which destroyed ecosystems and resulted in unsustainable agricultural practices (Shiva 1991, 1993).

At this conjuncture, two contradictory trends in world agriculture have been gaining momentum: one, the spread of GM seeds based on the premise that new seeds can minimize fertilizer and pesticide consumption, and solve or reduce the socio-ecological negative externalities of the "Green Revolution" (Conway 1998; Serageldin 2003; Swaminathan 1996); two, the agroecological [or commonly referred to as organic (Badgley et al. 2007; Magdoff 2007)] movement, which aims at mending the metabolic rift between the farmer and nature, and building environmentally sound and socially just alternative agricultural systems (Carroll et al 1990; Altieri 1987; Shiva and Bedi 2002).

As I discussed in chapter two, these technological developments are not occurring in a politico-economic vacuum. In fact, neoliberal states that operate in synergy with their multinational corporations (see Petras 2002) readily accepted agricultural biotechnology and promoted the diffusion of new seeds on a global scale. Imperial states effectively used the supranational institutional mechanisms (such as the Bretton Woods institutions) to impose neoliberal economic policies that eased the entry of multinational agribusiness corporations into the global agri-food system, restructured global agricultural research and development and promoted the commodification and patentification of seeds. This makes perfect sense from the point of corporate agriculture, since the input trade, what farmers buy to produce their crop, is more profitable than the output trade – what farmers sell (Parayil, 2003:984). For critical scholar of science and technology studies Sheila Jasanoff, biotechnology is one of the important "tools of imperial construction."

Anthropologist James Scott argues, and I agree, that agricultural technological innovations based on imperial scientific views are ''not just strategies of production, but also strategies of control and appropriation (Scott 1998:311). Sheila Jasanoff expresses a similar view on biotechnology:

> Biotechnology is a discourse: to some, of progress and improvement, beneficence and utility; to others, of risk, invasiveness, and domination from afar. Proponents of agricultural biotechnology tell particular stories about a world in which plant genetic modification is possible, and these stories carry political and cultural weight…Biotechnology is an institution of governance; it shapes forms of social life by influencing how people choose to, or are able to, live with the products of bio-industry (Jasanoff 2006:283-284).

Critics of the "Gene Revolution" argue that the new technology (by commodifying the inputs and outputs) accelerates the process of capitalist penetration into the countryside, alters the social organization of agricultural production, and differentiates farmers into antagonistic social classes. Although a vast literature on this aspect in the "Green Revolution" debate exists, little attention has been given to agrarian transitions in the “Gene Revolution” debate. My dissertation discussed the impact of GM seeds in the age of new imperialism on the social organization of production as well as on the nature-society relationship in the countryside, and the direction of such agrarian transitions.

Some proponents of GM crops with ecological modernization perspective strongly argue that the advancement of technology in agriculture along with “political modernization” can solve the economic and environmental problems by boosting productivity and reducing dependency on agro-chemical inputs. But ecological Marxists disagree with this, and argue that “it is not technology that is the primary issue, but rather the nature and logic of capitalism as a specific mode of production.” (Foster 2009:144) Although ecological Marxism and Marxist ecology provide powerful conceptual tools for analyzing the dialectical relationship between nature and society and socio-ecological crises, it mainly focuses on economic factors – for example, how the capitalist mode of production and the process of the accumulation of capital create a rift between nature and society (Foster 2000, Burkett 1999), and destroy the mere “conditions of production” (O’Connor 1998) – and neglects non-economic factors such as socio-cultural beliefs and values, gender, ethnicity, caste, and local knowledge system. It is important to consider the non-economic factors of nature-society relationship because the socio-cultural practices of everyday life provide a foundational basis in the interaction between society and nature. Thus, in this dissertation, I developed an agrarian political ecology framework drawing analytical concepts from political economy, ecosystem, and the socio-cultural system.

Embracing neoliberal economic policies, both Canadian and Indian states have restructured their agricultural policies to enable the entry of multinational seed and agro-chemical corporations. Furthermore, government funding for agricultural research and development and extension services for farmers in the two countries has gradually declined since the early 1990s. Seed corporations and government agencies in both countries used a similar claim to promote the new technology that the super seeds of the “Gene Revolution” can solve the major problems associated with conventional and organic farming methods, and can mitigate farmers' "suicidal problems" in Canada and farmer suicides in India.

Although there are significant differences between farm communities in Alberta and Andhra Pradesh, these two communities are relationally connected through *global forces* such as multinational corporations, the patent system, and biotechnology products. Proponents of global ethnography argue that "in studies of global forces the social actors and places being studied are caught up in a *place-making project* constituted well beyond their influence that can hardly be shaped by them – although they may develop complex forms of adaptation, avoidance, and survival." (Gille and Riain 2002: 280; see also Burawoy et al 2000, emphasis added)

In both places seed companies use similar methods to sell their GM seeds to farmers: field demonstrations; social construction of the new seed as "growth engine" through various cultural mechanisms and commercials; and farmer sensitization programs such as farmer induction meetings and conferences. In addition to these public relations strategies, the introduction of the Technology Use Agreement (TUA) system with GM seeds has become another major factor that influences farmers to adopt GM crops in Canada. As I discussed in chapter 5, the "gene flow" and the TUA system in a pro-corporate politico-legal environment have created conditions that have enforced farmers to adopt GM crops in order to escape from legal actions by seed companies. Considering the socio-economic and political conditions of the Indian farming community, seed companies are not insisting on signing up an agreement such as a TUA but they are collecting technology license fee as part of seed cost.

Contrary to the claims of GM technology proponents, the new seeds did not bring any revolutionary change in either productivity or economic profit to farmers I interviewed in Alberta and Andhra Pradesh. In both cases, I found that the cost of production has increased, but there is a little decrease in pesticide application. Furthermore, a majority of farmers in both cases expressed their concerns about ecological (such as gene contamination, weed and insect resistant crops, soil damage) and implications of GM products for human and animal health. Because of overwhelming domination of private sector in seed research and development, and the lack of democratic and transparent mechanisms in field trials, there is a lot uncertainty about the implications of GM crops. Anything uncertain is a risk (see Beck 1992), so GM crop cultivation and GM product consumption is a potential risk.

Although farmers in Alberta and Andhra Pradesh have different socio-cultural systems, a majority of them attribute a similar value to agriculture and nature. Contrary to the corporation's view of agriculture that focuses only on growth and economic value, farmer's holistic perspective incorporates socio-cultural and heritage values, ecological values, communal values, and the value of sustainability and wellbeing. But in the age of neoliberal globalization and the "Gene Revolution," the majority of farmers lost their freedom to choose their agricultural practices and pushed to make decisions under the circumstances imposed by monopoly corporations. However, big farmers in Alberta and Andhra Pradesh perceive GM seed as enabling technology to sustain agricultural growth and farm operations. This reflects that the socio-economic implications of the new technology depend on the scale of operations, availability of resources, and access to input market.

For some farmers in Alberta and Andhra Pradesh new technologies in general and GM seeds in particular are efficient tools that can help them overcome some of nature's limitations and threats, and empower them with new knowledge. But others believe that these new technologies developed with corporate profit motive endanger the harmonious relation between nature and the farmer by eroding biodiversity, destroying the nutrient cycle and attritioning local knowledge systems. These processes have several gender implications as well. As I discussed in chapter 4, my findings in Kadavendi show that GM crops accelerated the processes of the dispossession of women from their knowledge systems of seed selection, collection, saving and propagation. In Alberta, although I did not find any specific implications of GM crops for women's knowledge, farm women are becoming more vulnerable because they are working on farm and off-farm under strain and stress in the process of increased semi-proletarianization with the intensification of agrarian crisis (See also Roppel, Desmarais and Martz 2006).

To challenge the global hegemonic discourse of biotechnology and the strategies of neoliberal governance of society and nature, farmers in Andhra Pradesh are building a counterhegemonic movement in various struggle forms (discursive, constructive and assertive). Farmers in Alberta also initiated a movement that challenges the corporate domination over family farms and local food system by revitalizing holistic farm management practices and strengthening producer-consumer dynamism. Many farmers I interviewed in Alberta and Andhra Pradesh informed me that they did not like to adopt GM seeds when they first introduced them because they considered these new seeds as another means of dispossession and unstainability. But later they adopted them because they believed that resisting GM phenomenon was beyond their capacities. While many farmers do not see any possibility of resistance or alternatives to GM crops, some farmers with great hope built a sustainable agricultural movement and demonstrated that there are many ways to resist GM crops and promote alternatives to reclaim sustainability. But, it requires further research to understand why only some farmers adopt oraginic farming methods, and how these local food production practices can address the global food crisis.

My dissertation research suggests that a study of the “Gene Revolution” requires fieldwork with sensitivity to local class and status, gender and cultural issues, and to ways in which farmers’ technology adoption decisions can dramatically alter the overall quality of life, local knowledge systems, community development, the sustainability of agriculture and, ultimately, the survival of the ecosystem itself.

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APPENDIX

Appendix 1: Differentiation of Agricultural Population based on the Source of Livelihood, Labor Use, and Caste Category.

Source of Livelihood	Landholding size (Total no. of households)	No. of Households (% of the total of the Category)	Percentage of respective land size class	Use of labour in main agricultural activities	Farm households by caste category
Category I: Agriculture only	Marginal (316)	41 (10)	13	Mainly family labor, occasionally exchange labor, and rarely hired labor	107 (27% of the total farmers in this category) OCs; 186 (47%) BCs; 10 (3%) SCs; 89 (23%) STs
	Small (443)	124 (32)	28	Mainly family labor, occasionally exchange labor, and rarely hired labor	
	Semi-Medium (296)	159 (40)	54	Mainly hired labor, occasionally family labor	
	Medium (80)	66 (17)	83	Predominantly hired labor and farm servants	76% of the total OC farmers, 33% of BCs, 10% of SCs, 35% of STs
	Large (3)	2 (1)	67	Predominantly hired labor and farm servants	
	Total (1138)	392 (100)	34.4		
Category II: Abandoned own cultivation and became wage labor	Marginal (316)	49 (84)	16	Work as farm servants, agricultural labor, migrant labor, and construction labor	30 (52%) BCs; 25 (43%) SCs; 3 (5%) STs
	Small (443)	9 (16)	2	Work as agricultural labor, migrant labor, leased-out land	5% of BCs; 14% of SCs; 1% of STs
	Total (1138)	58 (100)	5		
Category III: Abandoned own cultivation and depend only on caste occupation	Marginal (316)	6 (75)	2	Taddy tapping, sheep rearing, weaving, hair cutting, carpentry, leather work	6 (75%) BCs; 2 (25%) SCs
	Small (443)	2 (25)	0.5		1% of BCs; 1% of SCs
	Total (1138)	8 (100)	0.7		

Group IV: 1. Agriculture* 2. Caste occupation	Marginal (316)	20 (33)	6.0	Mainly family labor, occasionally exchange/hired labor	61 (100%) BCs
	Small (443)	29 (48)	6.5	Mainly family labor, occasionally exchange/hired labor	11% of BCs
	Semi-Medium (296)	9 (15)	3.0	Mainly family labor, occasionally exchange/hired labor	
	Medium (80)	3 (5)	4.0	Mainly hired labor, supplementary family labor	
	Total (1138)	61 (100)	5.4		
Category V: 1. Agriculture 2. Wage labor	Marginal (316)	70 (18)	22	Mainly family labor, occasionally exchange labor, and rarely hired labor	6 (2%) OCs; 203 (52%) BCs; 67 (17%) SCs; 111 (29%) STs
	Small (443)	222 (57)	50	Mainly family labor, occasionally exchange labor, and rarely hired labor	4% of OCs; 36% of BCs; 38% STs;44% of STs
	Semi-Medium (296)	95 (25)	32	Mainly family labor, occasionally exchange/hired labor	
	Total (1138)	387 (100)	34		
Category VI: 1. Wage labor 2. Agriculture	Marginal (316)	107 (67)	34	Mainly family labor, occasionally exchange labor, and rarely hired labor	45 (28%) BCs; 72 (45%) SCs; 43(27%) STs
	Small (443)	44 (28)	10	Mainly family labor, occasionally exchange labor, and rarely hired labor	8 % of BCs; 41% of SCs; 17% of STs
	Semi-Medium (296)	9 (6)	3	Mainly family labor, occasionally exchange labor,	

				and rarely hired labor	
	Total (1138)	160 (100)	14.1		
Category VII: 1. Private sector job 2. Agriculture	Marginal (316)	13 (37)	4	Predominantly hired labor, occasionally family labor	15 (43%) OC; 12 (34%) BCs; 8 (22%)STs
	Small (443)	9 (26)	2	Predominantly hired labor, occasionally family labor	10% of OCs; 2% of BCs; 3% of STs
	Semi-Medium (296)	9 (26)	3	Hired labor	
	Medium	4 (11)	5	Hired labor	
	Total (1138)	35 (100)	3.1		
Category VIII: 1. Public sector job 2. Agriculture	Marginal (316)	6 (50)	2.0	Predominantly hired labor, occasionally family labor	6 (50%) OCs; 6 (50%) BCs
	Semi-Medium (296)	3 (25)	1.0	Hired labor	5 % of OC; 1% of BC
	Medium	3 (24)	4.0	Hired labor	
	Total (1138)	12 (100)	1.1		
Category XI: 1. Local entrepreneur ship 2. Agriculture	Marginal (316)	4 (16)	1.0	Predominantly hired labor, occasionally family labor	6 (24%) OCs; 19 (76%) BCs
	Small (443)	4 (16)	1.0	Predominantly hired labor, occasionally family labor	5 % of OCs; 3% of BCs
	Semi-Medium (296)	12 (48)	4.0	Hired labor	
	Medium	4 (16)	5.0	Hired labor	
	Large	1 (4)	33.0	Predominantly hired labor and farm servants	
	Total (1138)	25 (100)	2.2		

* 1. Principle source; 2. Subsidiary Source
Source: Field research

Appendix 2: Livelihoods of the Landless in Kadavendi (Total=268).

"Upper" Caste		**"Backward" Caste**		**Scheduled Caste**		**Scheduled Tribe**	
Occupation	**No.**	**Occupation**	**No.**	**Occupation**	**No.**	**Occupation**	**No.**
Agricultural Input and Output Business	7	Tailoring	8	Bonded labor	5	Private job	1
Private and Public jobs	7	Kiranam	3	Private and public jobs	4	Tailor	1
Kiranam (small grocery store)	3	Auto Rickshaw drivers	5	Kiranam	1	Migrant labor	1
Agri. Labor	2	Rural Medical Practitioners (RMPs) (4) and medical shop (3)	7	Auto Rickshaw drivers	1		3
Old-age dependent	2	Tractor cleaner	1	Leather work	1		
		Tutor	1	Exclusively wage labor	32		
		Mobile vegetable vendor *(Kooragayala gampa)*	1				
		Tea stall (*chai dukanam)*	1				
		Old-age dependents	9				
		Exclusively wage labor	82				
		Migration					
		Work in companies	2				
		Construction labor	11				
		Caste occupation (goldsmith)	1				
		Car driver	1				
		Private tutor	1				
		Job in private and public sector	6				
		Caste artisan labor					
		Vaddera (Stone cutters)	14				
		Vadrangi (Carpenter)	6				
		Kamsali (Blacksmith)	1				

		and *Kiranam*					
		Avusali (Goldsmith)	3				
		Mangali (Barber)	1				
		Chakali (Washermen)	1				
		Gouds (Taddy tappers)	3				
		Kuruma (Shepard)	1				
		Padmashali (Weavers)	30				
Total	21		200		44		3

Source: Field research.

Appendix 3: Profile of the Farmers Interviewed in Kadavendi.

3.1 Farmers Interviewed in Kadavendi by Land Size Class, 2006

Land Size Class	Bt Cotton Farmers	Non-Bt Cotton Farmers
	Number	Number
Marginal (Less than 2.5 acres)	12	22
Small (2.5 - 5.0 acres)	21	25
Semi-medium (5.1 - 10.00 acres)	11	2
Medium (10.1 - 25.00)	6	1
TOTAL (100)	50	50

Source: Field research

3.2 Farmers Interviewed in Kadavendi by Caste Category, 2006

Caste Category	Bt Cotton Farmers	Non-Bt Cotton Farmers
	Number	Number
"Upper" or Other Caste (OC)	8	0
"Backward" Caste (BC)	24	20
Scheduled Caste (SC)	10	27
Scheduled Tribe (ST)	8	3
TOTAL (100)	50	50

Source: Field research

3.3 Education Levels of the Farmers Interviewed in Kadavendi, 2006

Level of Education	Bt Cotton Farmers	Non-Bt Cotton Farmers
	Number	Number
Illiterate	32	42
Up to Primary school (< 5 th standard)	4	6
Up to Secondary school (6-10th standard)	8	2
Up to College (11-12th standard)	4	0
Undergraduate education	2	0
TOTAL (100)	50	50

Source: Field research

3.4 Farmers Interviewed in Kadavendi by Age Group, 2006

Age Group	**Bt Cotton Farmers**	**Non-Bt Cotton Farmers**
	Number	Number
20-30	6	7
31-40	18	21
41-50	20	19
51-60	5	3
61-70	1	0
TOTAL (100)	50	50

Source: Field research

Appendix 4: Profile of the Farmers Interviewed in Enabavi.

4.1 Farmers Interviewed in Enabavi by Land Size Class, 2006

Land Size Class	**Non-Bt Cotton Farmers**
	Number
Marginal (Less than 2.5 acres)	2
Small (2.5 - 5.0 acres)	4
Semi-medium (5.1 - 10.00 acres)	4
TOTAL (10)	10

Source: Field research

4.2 Farmers Interviewed in Enabavi by Caste Category, 2006

Caste Category	**Non-Bt Cotton Farmers**
	Number
"Backward" Caste (BC)	10
TOTAL (10)	10

Source: Field research

4.3 Education Levels of the Farmers Interviewed in Enabavi, 2006

Level of Education	**Non-Bt Cotton Farmers**
	Number
Illiterate	6
Up to Primary school (< 5 th standard)	1
Up to Secondary school (6-10th standard)	2
Up to College (11-12th standard)	1
Undergraduate education	0
TOTAL (10)	10

Source: Field research

4.4 Farmers Interviewed in Enabavi by Age Group, 2006

Age Group	**Non-Bt Cotton Farmers**
	Number
20-30	2
31-40	1
41-50	2
51-60	4
61-70	1
TOTAL (10)	10

Source: Field research

Appendix 5: In-depth Interviews: Semi-structured Interview Questionnaire (Field Research in Andhra Pradesh, India)

Interview No:

1. General Information

Date: ---

Name of the informant: ----------------------------------

Ward number: -------------; House number: ---------------; Village/hamlet: -----------

2. Household Data

Name of the head of household ----------------

Social category/caste ----------------------------

No. of households	Sex	Age	Education	Occupation

Source of income: a) Primary/main: ---------------------, b) Secondary: ---------------

3. Land Information

Total land at hand: ---------------- acres

How many plots do you have? -------------

Plot No.	No. of acres per plot	Owned land	Land taken on rent	Land given out on rent	Land taken on share cropping	Land given out on share cropping
1.						
2.						
3.						

Cultivated land	Uncult -ivated land	No. of crops produced in cultivated land	Purpose of uncultiv ated land	Irrigated land	Non-irrigated land	Source of irrigation

4. Data on land use and the adoption of High Yielding Varieties (HYVs)

i) Since how long you have been working on farm? --------------------

When did you adopt HYVs for the first time?---------- Which crop(s)? -------

ii) Land use before the adoption of HYVs

Plot No.	Soil type	Land use in acres	Local seed	Are there any specific problems or benefits with local seed?
		1.		
		2.		
		3.		
		4.		
		5.		
		6.		
		7.		

iii) Present land use and the adoption of HYVs:

Plot No.	Soil type	Land use in acres	Local seeds	HYVs (variety and company name)	Place of purchase
		1. Cotton -			
		3. Chili -			
		4. Rice -			
		5. Jowar -			
		6. Bajra -			
		7.			
		8.			

5. Agro- biodiversity

i) What were the major crops in your early farming life? -------------------

ii) What are the crops that disappeared?

Crop varieties lost	When did disappear and what might be the reason?	Implications of the disappearance of these varieties for the environment and livelihood?

6. Data on land use and GM crop adoption

i) Did you adopt Bt cotton? Yes/No

If No, is there any specific reason for not adopting?

If Yes, when did you adopt Bt cotton for the first time? ------------

ii) Give reasons for selecting this particular crop? (Explanation)

----

iii) Present and past Bt cotton land use:

Plot No.	Year	Bt cotton land use in acres	Place of purchase of seeds
	2002		
	2003		
	2004		
	2005		
	2006		

iv) Do you think your land is suitable for this particular crop? Yes/ No

If No, what do you do to improve the soil quality? ---------------

7. Economic Cost and Benefits of Non-Bt and Bt Cotton

Cost of Production	**Non-Bt Cotton in Year: ------**	**Bt Cotton in Year: -----------**
Land development		
Seeds and seed treatment if any		
Fertilizers (what, how much quantity, how many times, how much it costs) How do you know the application procedures	organic synthetic	organic synthetic
Pesticides (what, how much quantity, how many times, how much it costs) How do you know the application procedures		
Implements		
Labor (Own and hired) 1. Land development 2. Sowing 3. Weeding 4. Pesticide application 5. Harvesting		
Credit (Total amount, purpose, source, interest rate)		
Electricity		
Local value addition if any		
Marketing and transportation costs (place of sale, market information)		
Other expenditures:		
Total expenditure		
Yield in quintals		
Price per quintal		
Gross income		
Net profit		

8. Crop Management Information

i) What was the source of knowledge or information about new seeds, pest and weed management practices in the past?

ii) Is there any change in the sources of such information? If yes, what are the new sources?

iii) Did you receive any specific information about the new cropping method of Bt cotton (eg. Refuge mechanism)? Yes/ No

If yes, who provided the information? ----------------

What kind of information you received? --

iv) Did you understand the information provided? Yes/no

If yes, did you follow the refuge method? Yes/ no

- If yes, do you think those specific methods have any advantage in terms of fertilizer and pesticide consumption, labor requirement, weed management, productivity.

If no, why did not you follow the refuge method? ----------------

- If you didn't follow the refuge method, why do you think the company provided non-Bt cotton seed along with Bt cotton seed?
- What did you do non-Bt cotton seed that come along with Bt cotton seed?

v) Did you enter into any agreement with the seed company? Yes or no

If yes, do you know the terms and conditions before you inter into an agreement?

vi) Have you ever received information about government agricultural programs, subsides, and market prices for crops?

9. Cropping practices

i) No of cropping cycle in a year ---------------------------------

ii) Do you practice crop rotation?

If yes, what crops you rotate? --------------

What do you think the benefits of crop rotation? -------------------------------

Where did you learn of crop rotation practices? -------------------------------

If no, have you ever practiced crop rotation in the past? Yes/no ------------

If yes, why did you stop doing such practice now? ------------------

If no, is there any reason for not adopting crop rotation? ------------

iii) Do you practice intercropping? Yes/no

If yes, what crop you grow as main crop ------------------ and as intercrop -
----

- Is there any specific reason for using these crops? -------------------
- What do you think the benefits of intercropping? --------------------
- Where did you learn of intercropping practices? ----------------------

If no, have you ever practiced intercropping in the past? Yes/no -----------

- If yes, why did you drop such practice now? -------------------
- If no, is there any reason for not adopting intercropping? ---------------

10. Data on Soil and Water Management

Soil

i) What do you do to keep and improve soil quality? -----------------------

ii) How do you identify the condition and nature of soil quality?

iii) Did/do you use any biofertilizers for soil development? Yes/no

If yes, what is the purpose and the cost involved?

- Who involves in biofertilizers development and application?
- What do you think the benefits of indigenous soil conservation practices?

If no, why biofertilizers are not using? ------------------------------------

iv) Did you notice any change in land quality after adopting Bt cotton seed?

If yes, what kind of change you noticed? ---------------------------------

What do you think the reason might be for such change? ---------------

Water

i) What kind of water conservation practices you used to do? --------------

ii) What do you think the benefits of indigenous water conservation practices? --

How does the change in soil and water management practices affect overall farm activities?

11. Implements

i) What kind of change you notice in the use of farm implements over the years?

ii) Do you see any relationship between the use of new seeds and the use of new implements?

iii) Are there any implications of new implements for soil, water, labor, and livestock?

12. Indigenous Knowledge System

i) How did the new technology affect your knowledge about seed development, land and water management?

ii) Who involves in selection, collection and preservation of local seeds?

iii) Do women have any specific knowledge about seed development?

If yes, women of what social category, and why do they possess this special knowledge?

How does the adoption of the new seed affect women status as seed conservators and developers, and their bargaining power in household environment and the community?

iv) What kind of socio-cultural mechanisms you adopt to transmit local knowledge systems of nature and crops to next generations?

13. Food

i) What kind of food you used to eat in the past? --------------------------------

a. Morning:

b. Afternoon:

c. Evening:

d. Night:

ii) What was your main source of food? How accessible it was?

iii) How did the new seed change your food and consumption patterns?

iv) What is your staple food now?

a. Morning:

b. Afternoon:

c. Evening:

d. Night:

v) What is your main source of food? How accessible it is?

14. Culture and Nature

i) What is your everyday like?

ii) Do you participate in any group or community celebrations in your village? If yes, why do you participate in them? If no, why?

iii) Do you see any relationship between nature, spirituality, and culture?

iv) How do you perceive the changing conditions of production (i.e. nature) and its impact on the way of living (i.e. culture)?

v) Did new agricultural technologies change your way of life? If yes, how?

vi) How do new technologies affect your relationship with nature and the community? Is there any other change in the community that you can attribute to the new technologies?

15. Livestock

i) How many animals do you have presently ----------

Type of animals	No. of animals	Purpose
1. Bullocks 2. Cows 3. Buffalos 4. Goats and sheeps 5. Other		

ii) Have you had more or less animals in earlier years? Yes/no

What are the reasons for the increase or decrease of the number farm animals?

iii) If bought,

What are they? When did you buy? How many and where? What was the purpose? How much money invested?

iv) If sold out,

What are they? When did you sell? How many and where? Why did you sell? How much money you received?

v) Did you notice any impact of Bt cotton on farm animals?

16. Labor Force

i) How many members from your family fully participate on the farm activities

ii) Male------, Female----------

iii) Does your family labor power satisfy labor need? Yes/no

iv) If no, do you hire labor from outside? Yes/no

If yes, for which crop and what activities?

v) d) How did the new agricultural technologies impact labor conditions?

- hours/days of labor requirement
- quality of labor

- remuneration/wages
- health
- ecological and political consciousness.

17. Data on credit

i) Do you have any debts? Yes/no

 a. If yes, the amount of debts-------------

ii) What was the purpose you borrowed money for? --------

What is the source of credit? -----------

What is the interest rate? ----------------

What are the terms of repayment? -------------

iii) Have you able to repay as per the agreement? Yes/no

 a. If no, why? ----------------------------------

iv) What happened when you failed to repay your loan/credit?

viii) How frequent do you borrow? Every year or every cropping season?

ix) Is there any change in your overall financial condition after the adoption of Bt cotton? If yes, how; if no, why?

x) What was your credit condition before and after the adoption of Bt cotton?

Before the adoption of GM crop	After the adoption of GM crop
Amount:	Amount:

18. Government support

i) Have you ever received any of government subsidies/extension services/advice /training? Yes/no

 a. If no, why?

 b. If yes, what kind of subsidy you have received and in what form?

 c. What is your opinion on such subsidy programs?

19. Marketing

How is your current marketing of crops different from the past?

In terms of:

a. Crops
b. Place of sale
c. Price
d. Transportation to the market
e. Middlemen or brokers
f. Cheating practices in the market place

20. Cotton crop and gender based farm activities

	Male		**Female**		**Both**	
	Activity	No. of working days	Activity	No. of working days	Activity	No. of working days
Land development						
Sowing						
Weeding						
Pesticide application						
Harvesting						
Local value addition						
Other works: ---------------						

21. Gender relations before and after the adoption of the new seed

Inputs	**Pre-production**	**Production**	**Harvesting**	**Post-harvesting**	**Local value addition**	***Marketing***
1. Who enters into the market to borrow money and to purchase other inputs (seeds, fertilizers, and pesticides)?	1. Role of men and women in land development and seed treatment activities	1. Who does what?	1. Number of men and women participate and kind of work.	1. The role of women and men in transporting, cleaning, and storing the produce.	1. What are the existing practices of local value addition and the role of men and women in those practices?	1. Who takes decision on place and quantity of selling produce?
2. Is there any change in terms and conditions of payments (cash or credit), if woman enters into the market?	2. Who takes decision on agricultural land use, cropping pattern or mixed cropping?	2. Number of person days available for men and women in the production processes.	2. Wages for women and men.	2. Number of laborers (women and men) participated and wages for them.	2. Who takes decision in the following activities: grading, retention for later use, packing, and farmgate sales?	2. Who enter into the (local and outside) market?
3. If it is man who enters into the market all the time, then what are the factors that restrict woman to enter into the market?	3. If there are agricultural extension services or training, who in the household is considered?	3. Number of women and men participate.	3. Number of person days available for women and men		3. Number of person days available for women and men	3. What are the specific constraints/problems for women to participate in marketing affairs?
4. Is there any impact on women participation in market transactions in case they have entitlements over assets like land, house etc.	4. Who makes required implements ready for cropping season?	4. Wages for women and men	4. What are the problems in the current practice?		4. Wages for men and women and the method of payment.	4. Who takes decision on money management in a household after selling the produce?
		5. To whom technology is accessible or whose work burden is reduced due to technological intervention.	5. In case the farmers are using machines, then who is having ownership (women or men)			5. Does entry into the market makes any difference in the bargaining power of women?
		6. What are the problems/risks in the existing practices?	6. Who is being displaced or whose person days reduced due to introduction of machines.			

22. Migration

Does or did anybody of your family members migrate to elsewhere?

If yes, how many? ---------; when? --------; why? -------; to where? ---------; and what kind of work they do? -------

23. Peasant movements

i) What kind of social movements have seen in the past?

ii) According to you what was the agenda of the past movements?

iii) What were the implications of the past movements for your village transformation?

iv) How do you understand or perceive the farmers and laborers movements in the 1980s, and their continuity till date?

v) Who do you think is responsible for the existing socio-economic and ecological problems in your village? Do you propose any alternative to the current socio-ecological crises?

Appendix 6: Life History Interviews: Open-ended Questions (Field Research in Andhra Pradesh, India).

Interview No: -----------------------------

Date: ---

Informant: ----------------------------------

House number: ----------------------------

1. Where and when were you born? Where were you raised?
2. When did you start working on farm? How did you learn the methods of farming?
3. What was your experience in the early days of farming? Did you have farm animals and livestock? What did you grow?
4. Describe a typical day farming in your youth?
5. How did you learn reasoning seasons, estimating land quality, selecting, collecting and preserving seed, land development procedures etc.?
6. How did you do your land development?
7. How did you share information about your crop, pests, and weeds with other farmers?
8. What were local festivals related to nature and agriculture like when you were growing? How did you celebrate them? Were there any community festivals? How did you participate in them?
9. How was your social relationship with other farmers in the community? What change did you see now? What do you think the reason might be?
10. What instruments did you use from the pre-production stage to harvestation? When did you first get your iron plough or tractor?
11. What kinds of seeds you sowed first? What was the output like?
12. When did you first get electricity? How did it change your life?
13. When was the best harvest (output) that you can still remember? What was the crop? How much was the produce?
14. What were the best seed varieties that you used and still remembered?

15. When did you first hear about high yielding varieties (HYVs)? From who? When did you first adopt them? Where did you get them?
16. Who did the selection, collection and preservation of seeds before you adopted the new seeds? If it was women, then why women were assigned to this task of seed collection?
17. How did new agricultural technologies change your way of life? How does this change affect your relationship with your nature/agricultural field and the community? Is there any other change in the community that you can attribute to the new technologies?
18. When did you first cultivate cotton in your field? Why? What was the crop like? What was the initial phase of production like? Did you notice any change in your agricultural practices after the adoption of new crop? (Soil development methods/crop rotation/mixed cropping/irrigation/seed collection).
19. Did you notice any change in the soil after the adoption of the new seed? What do you think the cause might be? If soil quality is damaged, do you think it is possible to restore your land quality? How?
20. What was your staple food when you were growing? Was there any change in your diet? What was the change? How did you feel about "new" food and where did you get it? Why did not you go back to your "traditional" food? Do your children like the food that you used to eat?
21. When did you first apply synthetic fertilizer and agro-chemicals (pesticides/insecticides/herbicides) on your field? What do you think of the affects agro-chemicals to land, water, and farmer health?
22. Can you list a few crops that are totally disappeared from the scene of rural landscape? How did the disappearance of crops affect you or community? How do you feel about it?
23. Do you feel empowered with the adoption of new technologies? If yes, how? If no, why?
24. How do you consider the overall change that took place since the adoption of new agricultural technologies? Do you think the new technologies are good

for farmers and the environment? If yes, in what ways? If no, why? What alternatives you think would be good for farmers?

Appendix 7: Household Survey Questionnaire (Field Research in Andhra Pradesh, India).

Interview No:

1. General Information

Date: ---

Name of the informant: ----------------------------------

Ward number: ------------- ; House number: -----------------; Village/hamlet: -------

2. Household Information

Name of the head of household ----------------

Social category/caste ----------------------------

No. of households	Sex	Age	Education	Occupation

Source of income: a) Primary/main: ---------------------, b) Secondary: ---------------

3. Land Information

Total land at hand: ---------------- acres

How many plots do you have? -------------

Plot No.	No. of acres per plot	Owned land	Land taken on rent	Land given out on rent	Land taken on share cropping	Land given out on share cropping
1.						
2.						
3.						

Cultivated land	Uncult-ivated land	No. of crops produced in cultivated land	Purpose of uncultivated land	Irrigated land	Non-irrigated land	Source of irrigation

4. Present Land Use

Plot No.	Soil type	Land use in acres	Local seeds (variety name if any)	HYVs (variety and company name)	Place of purchase
		1. Non-Cotton -			
		2. Bt Cotton			
		3. Chili -			
		4. Rice -			
		5. Jowar -			
		6. Bajra -			
		7. Other			

5. Adoption of Bt Cotton

Plot No.	Year	Non-Bt cotton land use in acres	Price of non-Bt cotton seed	Place of purchase of non-Bt cotton seed	Bt cotton land use in acres	Price of Bt cotton seed	Place of purchase of Bt cotton seed
	2002						
	2003						
	2004						
	2005						
	2006						

6. Livestock

How many animals do you have presently: -- ----------

Type of animals	No. of animals	Purpose
1. Bullocks 2. Cows 3. Buffalos 4. Goats and sheeps 5. Other		

7. Agricultural Implements

Implements	Number	When did you buy?	Where did you purchase?
Pesticide pumps			
Wooden ploughs			
Iron ploughs			
Bullock carts			
Tractors			
Electric motor			
Other:			
No implements			

8. Government Support

i) Have you ever received any of the following from government agencies:

Subsidized seed Yes/No

Subsidized fertilizer Yes/No

Subsidized pumpsets Yes/No

Extension services Yes/No

Training Yes/No

Bank Loan Yes/No

ii) Have you ever received information or guidance on crop management from agricultural extension officer? Yes/No

If yes, for which crop? ---------

iii) Do you know about crop insurance policies? Yes/No

If yes, do you have crop insurance? Yes/No

If yes, for which crop? -----------------

9. Data on credit

v) Do you have any debts? Yes/no

a. If yes, the amount of debts -------------

vi) What was the purpose you borrowed money for? --------

What is the source of credit? -----------

What is the interest rate? ----------------

What are the terms of repayment? -------------

vii) Since how long you have been indebted? -----------

10. Migration

Does or did anybody of your family members migrate to elsewhere?

If yes, how many? ---------

When? --------

Why? ---------

Where? --------

What kind of work they do? --------

Appendix 8: Profile of the Farmers Interviewed in Alberta

8.1 Education Levels of the Farmers Interviewed in Alberta, 2007-2008.

Level of Education	**GM Canola Farmers**	**Non-GM Canola Farmers**
	Number	Number
High School	5	0
Diploma/Certificate	7	1
Bachelors Degree	5	0
Masters Degree	1	1
TOTAL (20)	18	2

Source: Field research

8.2 Farmers Interviewed in Alberta by Age Group, 2007-2008.

Age Group	**GM Canola Farmers**	**Non-GM Canola Farmers**
	Number	Number
20-30	2	0
31-40	3	0
41-50	5	1
51-60	5	1
61-70	3	0
TOTAL (20)	18	2

Source: Field research

8.3 Farmers Interviewed in Alberta by Active Farming Experience, 2007-2008.

Years of Experience	**GM Canola Farmers**	**Non-GM Canola Farmers**
	Number	Number
1-5 years	2	0
6-10 years	3	0
11-15 years	4	1
16-20 years	4	1
More than 20 years	5	0
	18	2

Source: Field research

Appendix 9: In-depth Interview: Semi-structured Interview Questionnaire (Field Research in Alberta, Canada).

Interview No:

1. General Information

Date: ---

Name of the informant: ----------------------------------

Address: --

Phone number: ------------------------------; Email: --------------------------

2. Household Data

No. of households	Sex	Age	Education	Occupation

Source of income: a) Primary/main: --------------------, b) Secondary: -------------

3. Land Information

Total land at hand: --------------- acres; or ---------------- hectares

How many plots do you have? -------------

Plot No.	No. of hectares per plot	Owned land	Land taken on rent	Land given out on rent	Cultivated land	Uncultivated land
1.						
2.						
3.						

4. Data on land use

i) Since how long you have been working on farm? --------------------

ii) When did you adopt HYVs for the first time? ---------- Which crop(s)? ----

iii) Adoption of HYVs:

Plot No.	Soil type	Land use in acres (Crop Name)	Non-GM HYVs (Variety Name)	Brand/ Company Name	Place of purchase
		1.			
		2.			
		3.			

5. Data on land use and the adoption of GM seeds

i) Did you adopt GM seeds? Yes/No
If no, is there any specific reason for not adopting?

ii) If Yes, when did you adopt GM seeds for the first time? ----------------;
Which crop? ------

iii) Are there any factors that influenced you to adopt this particular GM crop? (Explanation)

iv) Present and past GM crop land use:

Plot No.	Year	GM crop land use in acres	Place of purchase of seeds
	1996		
	1997		
	1998		
	1999		
	2000		
	2001		
	2002		
	2003		
	2004		
	2005		
	2006		
	2007		
	2008		
	2009		

6. Economic Cost and Benefits of GM Canola per acre.

Production Process	Value	Particulars
Tillage (cultivator and seeding cost)		
Seed costs		
TUA fee		
Fertilizers costs (plus the cost of application)		What fertilizers, how much quantity, how many times Application procedure and costs
Herbicides costs (plus the cost of application)		What herbicides, how much quantity, how many times Application procedures and costs
Harvesting		
Crop insurance		
Local transportation		
Land tax		
Other expenditures		
Total costs		
Yield (bu/acre)		
Commodity price ($/bu)		
Gross revenue		

6.1 Economic Cost and Benefits of non-GM canola per acre

Production Process	Value	Particulars
Tillage (cultivator and seeding cost)		
Seed costs		
Fertilizers costs (plus the cost of application)		What fertilizers, how much quantity, how many times Application procedure and costs
Herbicides costs (plus the cost of application)		What herbicides, how much quantity, how many times Application procedures and costs
Harvesting		
Crop insurance		
Local transportation		
Land tax		
Other expenditures		
Total costs		
Yield (bu/acre)		
Commodity price ($/bu)		
Gross revenue		

7. Crop Management Information

i) How did you get information about new crops, pests, and weed management in the past (before the adoption of GM seeds)?

ii) Who provides such information now (after the adoption of GM) about the use of seeds, the identification of weeds and pests, and proper application of fertilizers, and pesticides?

iii) Do you notice any change in the quality of information you receive in the past and now?

   a. If yes, in what ways?

iv) Did you receive any training or specific information about the cropping method of GM crops? Yes/ No

   a. If yes, who provided the information? ----------------
   b. What kind of information you received? --------------------------------

v) Did you understand the information provided? Yes/no

   a. If yes, did you follow the suggested cropping methods? Yes/ no
   b. If yes, do you think the specific methods have any advantage in terms of fertilizer and pesticide use, crop produce, and weed management.

   If no, what was the reason for not following the specific cropping methods?

vi) Did you enter into any agreement with the seed company? Yes or no.
If yes, did you understand the terms and conditions before you inter into the agreement?
If yes, what are they?---
How do you feel about the Technology Use Agreement (TUA)?

vii) Do you regularly receive information about government agricultural programs, farm subsides, and commodity prices, etc.? If yes, what is the source of information?

8. Diversity of cropping practices

i) No of cropping cycle in a year ---------------------------------

ii) Do you practice crop rotation?

If yes, what crops you rotate? -------------

What do you think the benefits of crop rotation? ------------------------------

Where did you learn of crop rotation practices? -------------------------------

If no, have you ever practiced crop rotation in the past? Yes/no ------------

If yes, why did you drop such practice? -------------------

If no, is there any reason for not adopting crop rotation? ----------------

iii) Do you practice intercropping?

If yes, what crop you grow as main crop ------------------ and as intercrop - -------------

Is there any specific reason for using these crops? ---------

What do you think the benefits of intercropping? ----------------------------

Where did you learn of intercropping practices? -----------------------

If no, have you ever practiced intercropping in the past? Yes/no -----------

If yes, why did you drop such practice now?-------------------

If no, is there any reason for not adopting intercropping? ----------------

9. Data on Soil and Water Management

Soil

i) What kind of tillage method you practice? Is there any change in your practices after the adoption of GM crops?
ii) What do you do to keep and improve soil quality? ---------------------
iii) How do you identify the condition and the nature of soil quality?
    iii) Did/Do you use any biofertilizers for soil development?
    iv) If yes, what is the purpose and costs involved?
    v) Who involves in biofertilizers development and application?
    vi) What do you think the benefits of indigenous soil conservation practices? ---

vii) If no, why biofertilizers (manure etc) are not using? ----------------------
----
----

viii) Did you notice any change in land quality after adopting GM seeds?
If yes, what kind of change you noticed? ----------------------------------
----
What do you think the reason might be for such change? ----------------
----

Water

ix) What kind of water conservation methods you practice? -----------------
----

x) Do you see any relationship between the adoption of the new seeds and the change in soil and water quality? How does this change affected farm management practices and overall farm life ---------------
----

10. Data on Implements

i) What kind of change you notice in the use of farm implements over the years?
ii) Do you see any relationship between the use of new seeds and the use of new implements?
iii) Are there any implications of new implements for soil, water, labor, and farm environment?

11. Indigenous Knowledge System

i) Have you ever involved in the development and preservation of farm seeds? If yes, could you explain the process?
ii) How did the new technology affect your knowledge about seed development, land and water management?
iii) Who involves in selection, collection and preservation of farm seed?
iv) Do women have any specific knowledge about seed development?

v) What role women play in agriculture? Do woman have any specific knowledge about any specific activity in the entire process of production system?
vi) Do you intend to transfer your agricultural knowledge to younger generations? If yes, what mechanism you adopt to transmit local knowledge of nature and crops?
vii) How do you see the impact of the new agricultural technologies on farmer's local knowledge and farmer's interaction with nature?
viii) Were the new technologies empowered or disempowered farmers, and how?
ix) What are the implications of the process of empowerment or disempowerment for farm community?

12. Agro- biodiversity

i) What were the major crops in your early farming life? -------------------

ii) What are the crops that disappeared?

Crop varieties lost	When did disappear and what might be the reason?	Implications of the disappearance of these varieties for the environment and livelihood?

13. Culture and Nature

i) Are there any changes in terms of community relations or farmers interpersonal and intergenerational interactions after the adoption of new seed technologies?

ii) Is there any change over the last 10 years in your food consumption in terms of what you eat and where you get it? If yes, how do you explain these changes?

iii) What is your everyday like? Is there any impact of the new agricultural technologies on your personal everyday life?

iv) According to you, what is the relationship among nature, spirituality, and culture?

v) How do you perceive and understand the changing conditions of production and its impact on the way of living?

14. Labor Force

i) How many members from your family fully participate in farm activities
Male------, Female----------

ii) Does your family labor power satisfy labor need? Yes/no

If no, do you hire labor from outside? Yes/no
If yes, for which crop and activities?

iii) How did GM seeds affect family labor conditions?

- hours/days of labor requirement

- quality of labor

- remuneration/wages

- health

- gender division of labor

15. Data on credit

i) Do you have any debts? Yes/no

    a. If yes, the amount of debts-------------

ii) What was the purpose you borrowed money for? --------

What is the source of credit? -----------

What is the interest rate? ----------------

What are the terms of repayment? -------------

iii) Have you able to repay as per the agreement? Yes/no

    a. If no, why? ----------------------------------

iv) What happened when you failed to repay your loan/credit?

viii) How frequent do you borrow? Every year or every cropping season?

ix) Is there any change in your overall financial condition after the adoption of GM crops? If yes, how; if no, why?

x) What was your credit condition before and after the adoption of Bt cotton?

Before the adoption of GM crop	After the adoption of GM crop
Amount:	Amount:

16. Government support

i) Have you ever received any of government subsidies/extension services/advice /training? Yes/no

   a. If no, why?
   b. If yes, what kind of subsidy you have received and in what form?
   c. What is your opinion on such subsidy programs?

17. Gender relations before and after the adoption of the new agricultural technologies

Inputs	**Pre-production**	**Production**	**Harvesting**	**Post-harvesting**	**Local value addition**	***Marketing***
1. Who enters into the market to purchase inputs (seeds, fertilizers, pesticides, and capital)?	1. Role of men and women in land development, seed treatment etc	1. Who does what?	1. Who does what?	1. The role of women and men in: transportation, storage etc.	1. What are the existing practices of local value addition and the role of men and women in those practices	1. Process of marketing the produce
2. If it is man who enters into the market all the time, then what are the factors that restrict woman to entering into the market?	2. Who makes decision on agricultural land use, cropping pattern or mixed cropping etc.	2. Number of person days available for men and women in the production processes.	2. Do you face any problems with the current harvesting methods?		2. Who makes decision on the following activities: grading, retention for later use, distress sales, etc.	2. Do farmer has a choice of whom to sell? If yes, who decides on this?
	3. Who will be considered in case of agricultural extension services or training?	3. Whose work burden is reduced or increased due to technological intervention.	3. What are the problems in the current practice?			3. What are the specific constraints/problems for women to participate in marketing affairs?
	4. Who gets implements and machinery ready?	4. What are the problems/risks in the existing production practice? How do you cope up with them?				4. Who takes decision on money management in a household after selling the produce?
						5. Does entry into the market makes any difference in the bargaining power of women?

18. Migration

Did anybody of your family members migrate to elsewhere?

If yes, how many? ---------; when? --------; why? -------; to where? ---------; and what kind of work they do? -------

19. Farmers' movements

i) What kind of farmers' movements you have seen in the past?
ii) According to you what was the agenda of the past movements?
iii) What were the implications of the past movements for agrarian transformation?
iv) How do you understand or perceive the current farmers movements?
v) Who do you think is responsible for the existing socio-economic and ecological problems in your community? Do you propose any alternatives to the current socio-ecological crises?

20. Life history apects

1. When did you start working on farm? How did you learn the methods of farming?
2. What was your experience in the early days of farming? Did you have farm animals and livestock? What did you grow?
3. Describe a typical day farming in your youth?
4. How did you learn reasoning seasons, estimating land quality, selecting, collecting and preserving seed, land development procedures etc.?
5. How did you do your land development?
6. How did you share information about your crop, pests, and weeds with other farmers?
7. What were local festivals related to nature and agriculture like when you were growing? How did you celebrate them? Were there any community festivals? How did you participate in them?
8. How was your social relationship with other farmers in the community? What change did you see now? What do you think the reason might be for social change?
9. What instruments did you use from the pre-production stage to harvestation? When did you first get your iron plough or tractor?

10. What kinds of seeds you sowed first? What was the output like?
11. When did you first get electricity? How did it change your life?
12. When was the best harvest (output) that you can still remember? What was the crop? How much was the produce?
13. What were the best seed varieties that you used and still remembered?
14. When did you first hear about high yielding varieties (HYVs)? From who? When did you first adopt them? Where did you get them?
15. Who did the selection, collection and preservation of seeds before you adopted the new seeds? If it was women, then why women were assigned to this task of seed collection?
16. How did new agricultural technologies change your way of life? How does this change affect your relationship with your nature/agricultural field and the community? Is there any other change in the community that you can attribute to the new technologies?
17. When did you first cultivate GM crop in your field? What was the crop like? What was the initial phase of production like? Did you notice any change in your agricultural practices after the adoption of the new crop? (Soil development methods/crop rotation/mixed cropping/irrigation/seed collection).
18. Did you notice any change in the soil after the adoption of the new seed? What do you think the cause might be? If soil quality damaged, do you think it is possible to restore your land quality? How?
19. What was your staple food when you were growing? Was there any change in your diet? What was the change? How did you feel about "new" food and where did you get it? Why did not you go back to your "traditional" food? Do your children like the food that you used to eat?
20. When did you first apply synthetic fertilizer and agro-chemicals (pesticides/insecticides/herbicides) on your field? What do you think of the affects of agro-chemicals to land, water, and farmer health?
21. Do you feel empowered with the adoption of new technologies? If yes, how? If no, why?

22. Do you see any risks (in terms of production and marketing the produce) with GM crops?
23. How do you consider the overall change that took place since the adoption of new agricultural technologies? Do you think the new technologies are good for farmers and the environment? If yes, in what ways? If no, why? What kind of alternatives you think would be good for farmers?