

Leaf Diversity and Photosynthesis in Canola Germplasms

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Introduction

- This project was formed around the idea: "Diversity of leaf shapes in canola germplasm and the implications for photosynthesis"(Gorim, 2022)
- At the St. Albert Research Station northwest of Edmonton, are 540 plots of trials of selectively bred canola plants (L. Gorim, personal communication, July 6th, 2022)
 - Each trial of canola produced different leaf shapes and sizes, which has impact on the plant's photosynthesis (P. Eustaquio, 2019)
 - Photosynthesis is the process by which plants create food with sunlight and carbon dioxide
 - The photosynthesis in plant can impact the yield of product, which is important to farmers
- Study implications for photosynthesis in the plant by analyzing the affect the shape and size of the leaf has on plant growth

Purpose

- Analyzing the leaf shapes and the effect it has on photosynthesis to determine the breed of canola to provide to farmers in the future

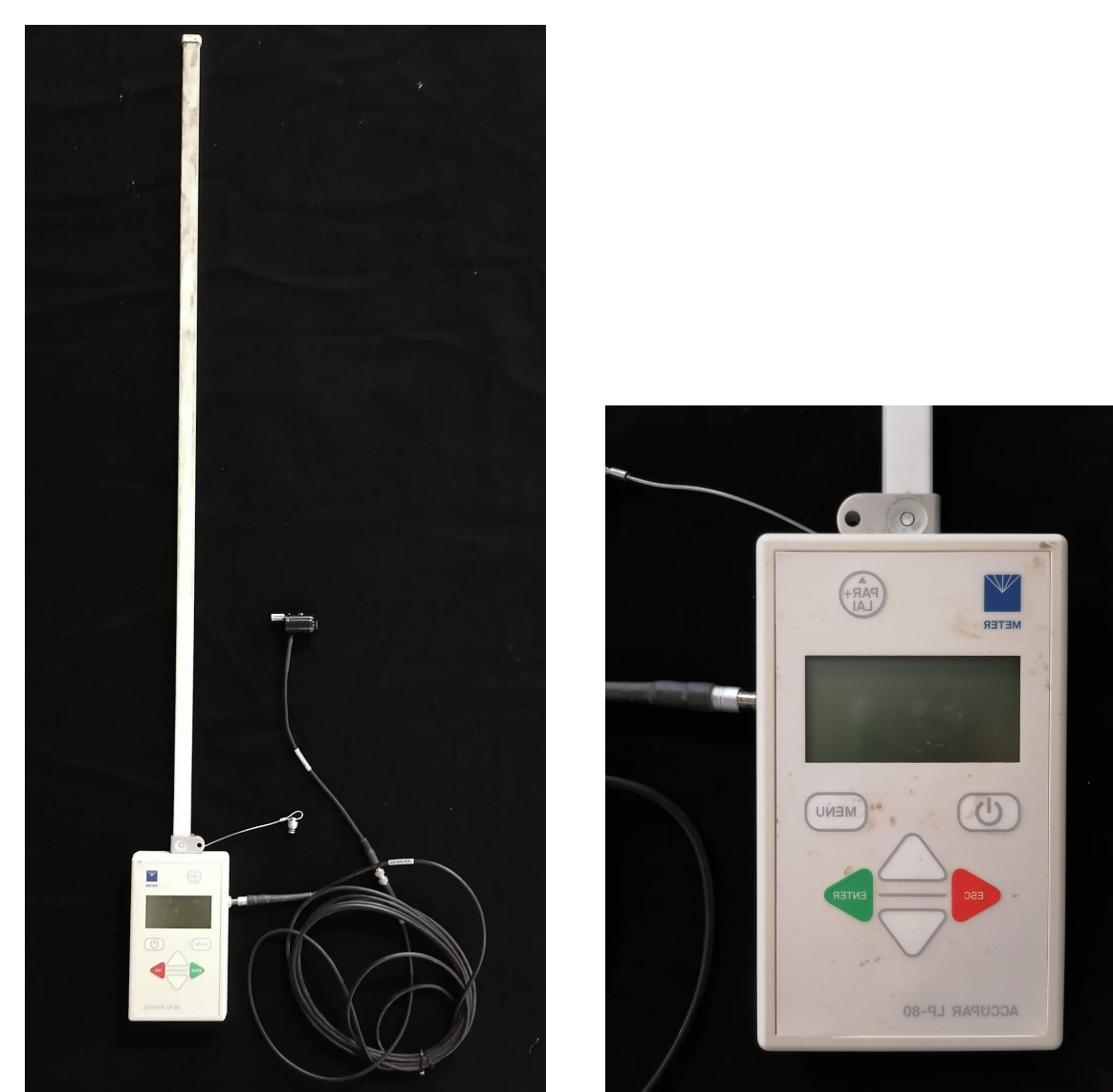
Methods

- Data Collected (at flowering stages):

- Leaf Shape** (taken with camera) (BBCH-65)
- Leaf Area Index (LAI)**: the amount of leaf per meter squared (Leaf Area Index (LAI): The Researcher's Complete Guide | METER, n.d.) (BBCH 65)
- Soil Plant Analysis Development (SPAD)**: the chlorophyll concentration per area in a leaf (BBCH-53)
- Plant Height** (BBCH-53)

- Devices used to take measurements:

- Accupar LP-80**: used to measure LAI. It does so by taking the photosynthetically active radiation (PAR) available, which are the measurable lightwaves that the leaf uses in photosynthesis, from the top and bottom of a plant's canopy (Leaf Area Index (LAI): The Researcher's Complete Guide | METER, n.d.)
 - That is then used to estimate the light energy transmitted, which then can mesure LAI



ACCUPAR LP-80

- SPAD-502 Meter**: measures chlorophyll concentrations in a non-destructive way
 - Measurements can be influenced by nutrient availability and environmental stresses such as drought, salinity, cold and heat (Jarvis, n.d.)

- Meter Stick**

SPAD-502 Meter



https://www.researchgate.net/figure/SPAD-502-Chlorophyll-Meter_fig2_325159560



Data can be gathered almost immediately with this device, just stick a leaf between the two clamps.

<https://www.specmeters.com/nutrient-management/chlorophyll-meters/chlorophyll-sp502/>

- One measurement of LAI is taken per plot, two SPAD measurements per plot, and three plant height measurements per plot

Results

Fig 1.

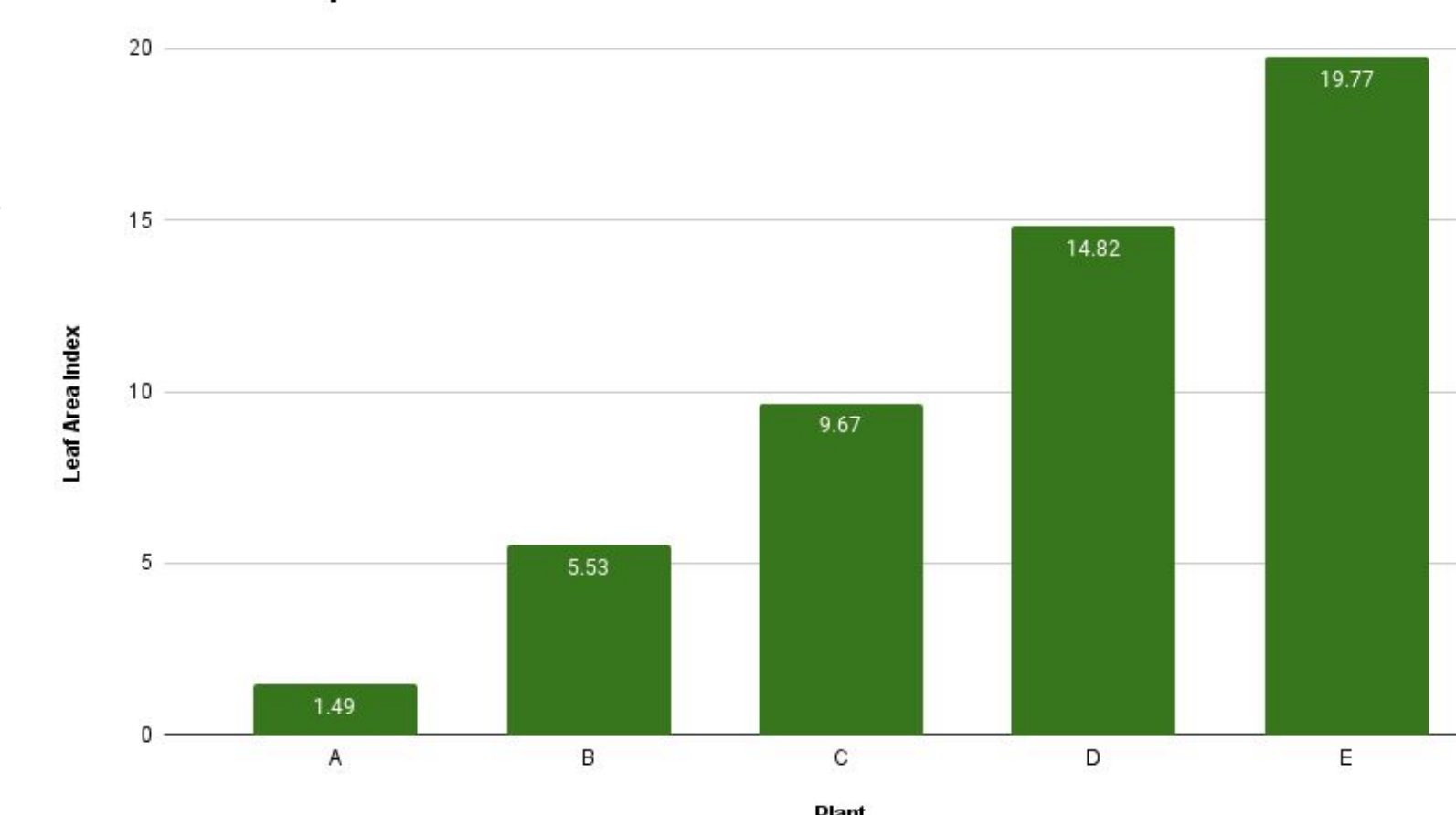


Plant A Plot no. 1615 Plant B Plot no. 225 Plant C Plot no. 511 Plant D Plot no. 1019 Plant E Plot no. 807

Fig 1. Comparison images of the different leaf shapes and the plots they came from

Fig 2.

Leaf Area Index per Plant

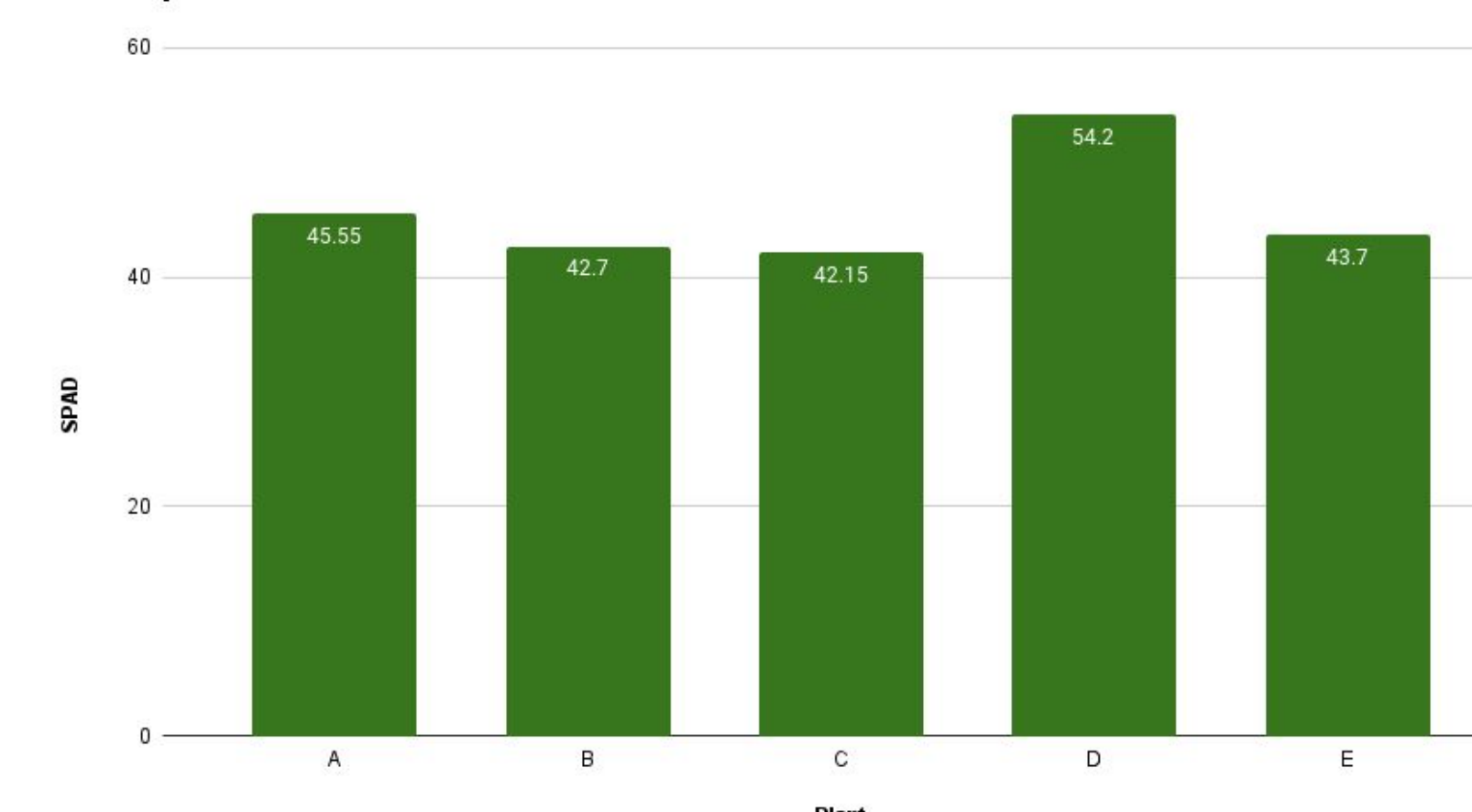


Comparison of leaf area index measurements (taken with Accupar LP-80) between leaves.

Higher values mean there are more leaves in the square meter of measurement, while lower values are the opposite.

Fig 3.

SPAD per Plant

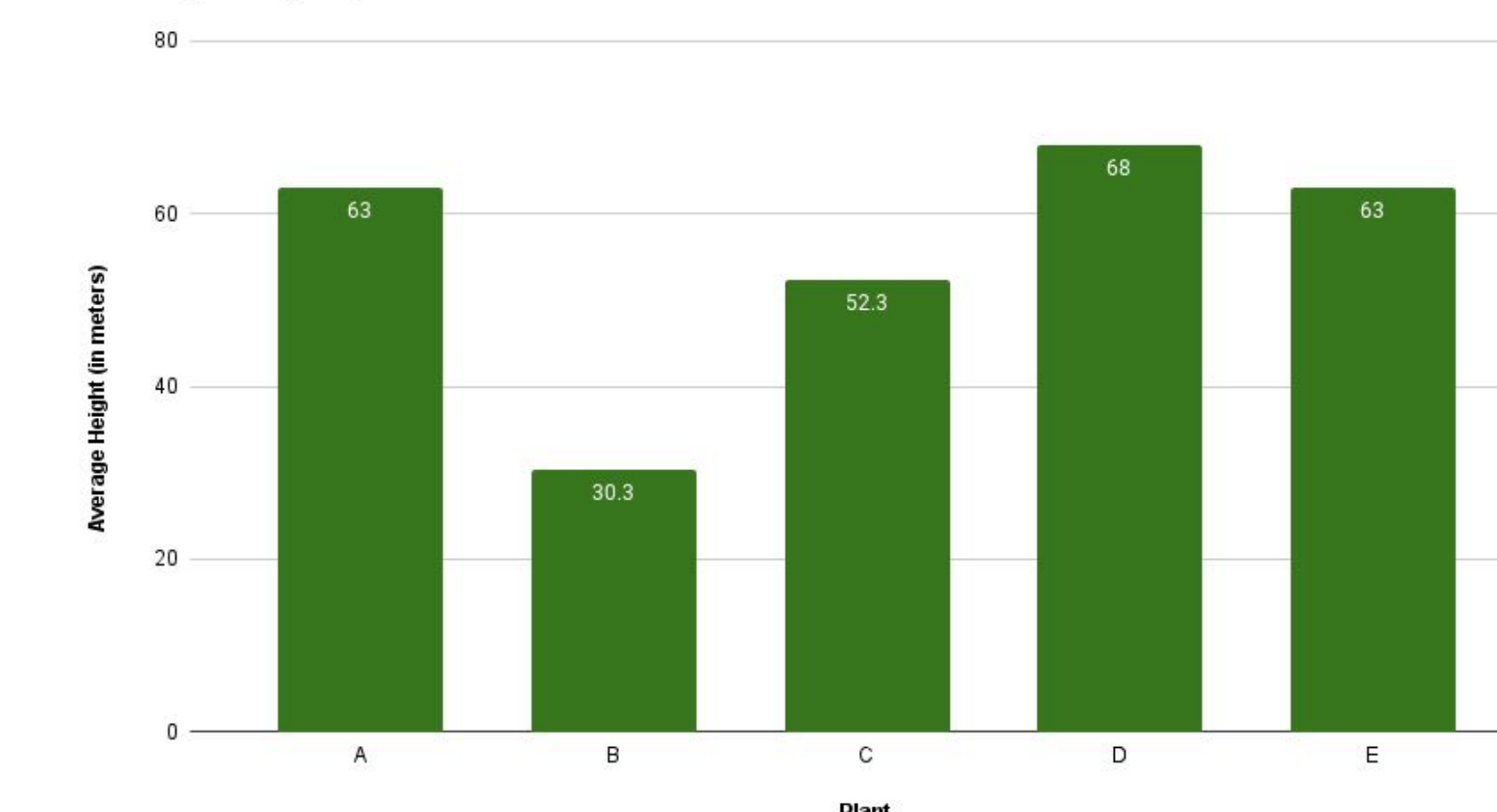


Soil plant analysis development measurement comparison between leaves.

SPAD Measures the concentration of chlorophyll in a select area of the leaf.

Fig 4.

Average Height per Plant Plot



Comparison of average height of three plants measured per plot

Conclusion

→ LAI is affected by the shape and size of the leaf to an extent, but plant height and SPAD measurements are not dependant on the size or shape of the leaf.

◆ **LAI**: Leaves with higher LAI tend to have larger, wider leaves, while leaves with lower LAI tend to have long, skinny leaves

- Larger leaves sizes and shapes should allow for higher levels of photosynthesis

- Plant height does not correlate with LAI

- LAI and SPAD measurements does not seem to have any correlation

◆ **SPAD and Plant Height** does seem to have correlation

- Higher SPAD tend to have a greater height

- Higher chlorophyll concentration indicates a higher level of nutrients for which the plant can use in growth

→ Biomass measurements of these plants can be taken to be compared to LAI, SPAD and height measurements to further enhance the data collected and conclusion reached.

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Citations

- Gorim, L. (2022). Topics. Does Leaf Size Affect Photosynthesis? - BYJU'S NEET. (n.d.). Byju's. Retrieved July 28, 2022, from <https://byjus.com/neet-questions/does-leaf-size-affect-photosynthesis/>
- Jarvis, P. (n.d.). Use of a SPAD-502 meter to measure leaf chlorophyll concentration in Arabidopsis thaliana. PubMed. Retrieved July 28, 2022, from <https://pubmed.ncbi.nlm.nih.gov/21188527/>
- Leaf Area Index (LAI): The Researcher's Complete Guide | METER. (n.d.). METER Group. Retrieved July 28, 2022, from <https://www.metergroup.com/en/meter-environment/education-guides/researchers-complete-guide-leaf-area-index-lai>