ABSTRACT: 346

GROWTH AND YIELD RESPONSE OF SOYBEAN (*GLYCINE MAX* L. MERR) CULTIVARS TO DIFFERENT ENVIRONMENTS

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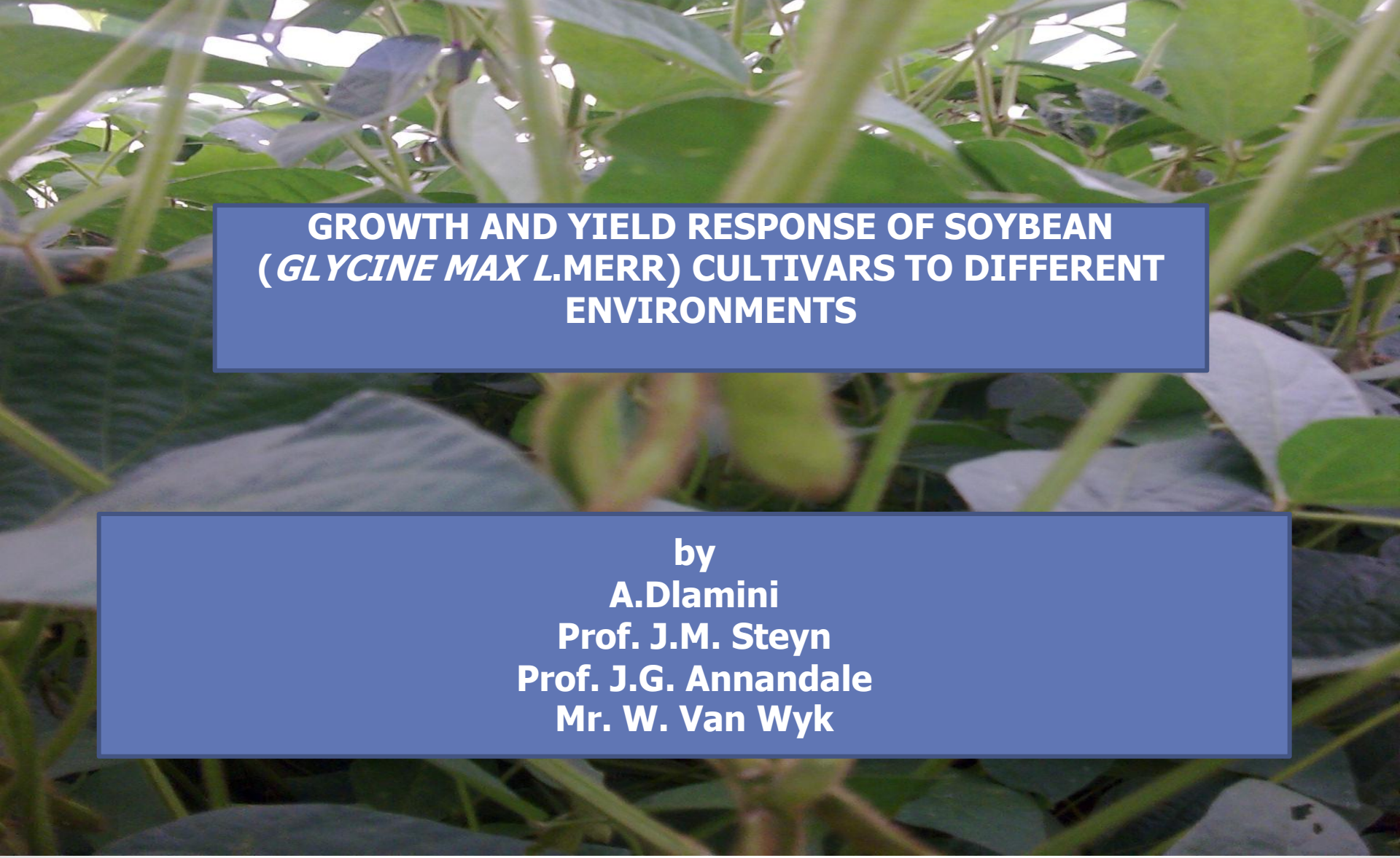
Soybean (*Glycine Max* L. Merr) is one of the most important food crops in the daily diets of humans and animals, as it provides essential proteins and other nutrients. The crop is not only a source of food, but is also beneficial to the soil, as it is able to fix nitrogen from the atmosphere. Although soybean is a crop grown world-wide, individual cultivars often demonstrate a limited adaptation to specific agro-ecological conditions. Since soybeans are photoperiod sensitive, day length during the growing season is one of the most important factors to take into consideration for cultivar choice. The aim of this study is to determine the growth, development and yield response of soybean cultivars in different maturity groups to different agro-ecological environments.

Field experiments were conducted in Pretoria, South Africa and two locations in Swaziland, at the Malkerns Research Station and Nhlangano Experimental Farm. Six soybean cultivars of different maturity groups (determinate and indeterminate) were planted at these sites. Growth analyses were carried out every two weeks, from plant establishment until physiological maturity. This data will be used to calculate parameters and calibrate a crop growth model for soybeans, which will be used to estimate crop performance and yield under varying environmental conditions. In addition, thermal time requirements to reach different growth stages were calculated and final grain yield was determined at harvest.

The growing degree day requirement from planting to crop emergence was 62^{o}Cd for all six cultivars. Thermal time requirement for completion of the vegetative stage ranged from 274 to 586^{o}Cd, with the determinate cultivar LS 6162 R having the lowest requirement of 274^{o}Cd, while the indeterminate cultivar PAN 737 required 586^{o}Cd. The different cultivars also showed distinct differences in growth during the season. Grain yields obtained from the different cultivars ranged from 1.94 t/ha (LS 6162 R) to 3.294 t/ha (PAN 1664 R). The indeterminate cultivars (PAN 1664 R and LS 6150 R) gave significantly higher yields, compared to the determinate cultivars (PAN 535 R and LS 6162 R) at all three locations.

The six soybean cultivars that were evaluated in these experiments have demonstrated substantial differences in growth, development and yield potential. Cultivar specific model growth parameters will now be calculated from the collected data, which should enable us to forecast how varieties of different maturity groups will perform in different environments.



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Presentation outline

- Introduction
- Methodology
- Results
- Discussion
- Recommendations
- Acknowledgements

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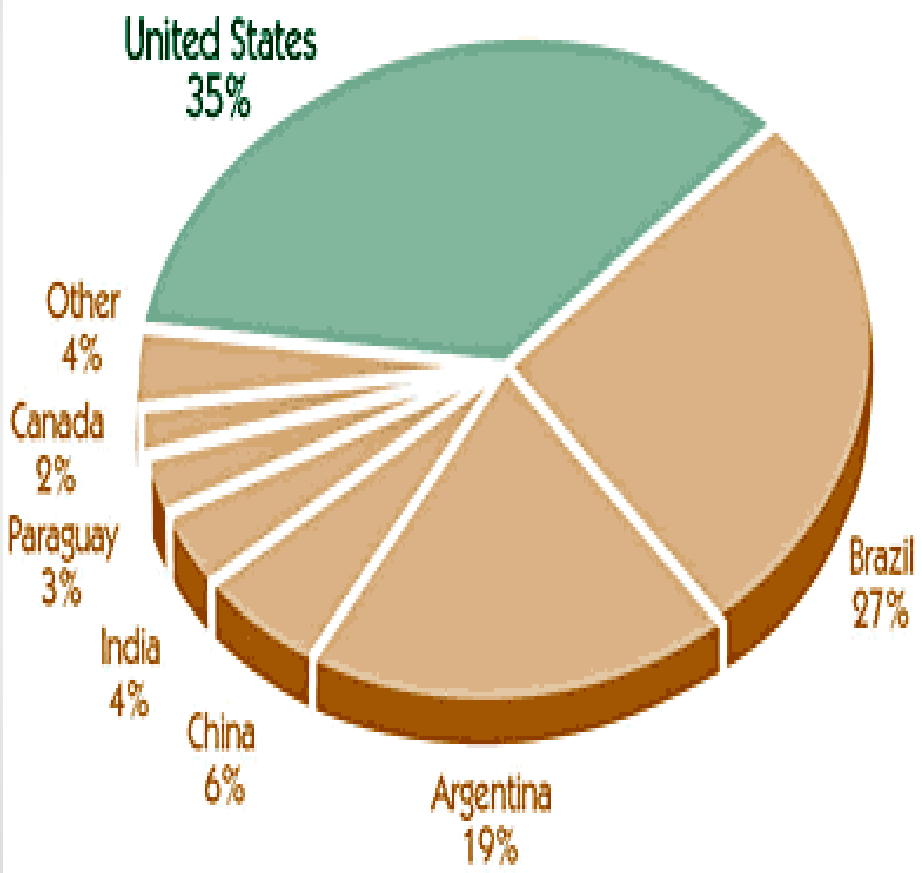
Introduction

- Soybean is an important crop
- Both humans and animals
- Provides essential proteins and other nutrients
- Able to fix atmospheric nitrogen in the soil
- Crop is grown world wide

World Soybean Production 2010

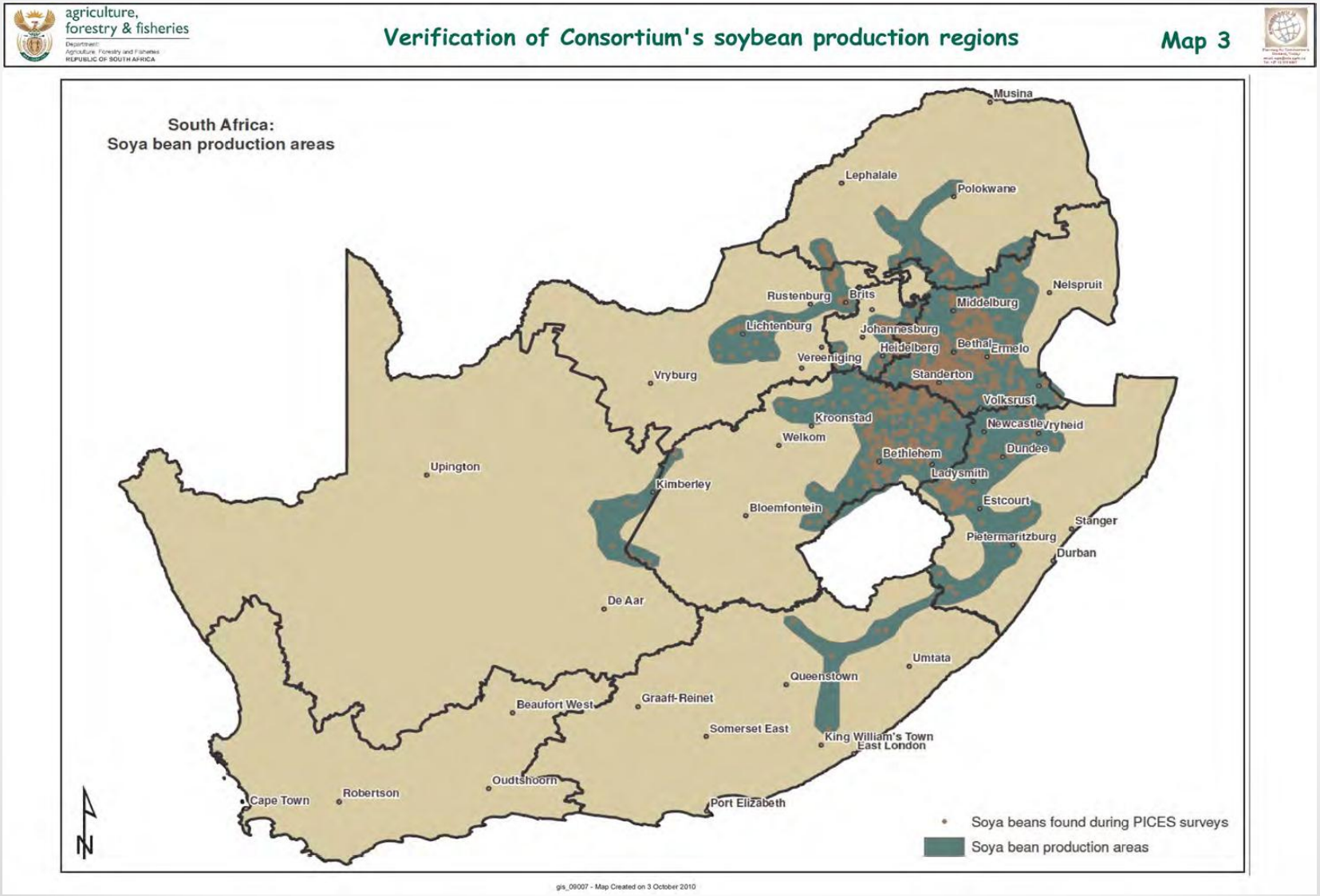


			Million metric tons
United States			90.6
Brazil			70.0
Argentina			49.5
China			15.2
India			9.6
Paraguay			7.5
Canada			4.3
Other			11.6
Total			258.4

Introduction

- S.A consumption is 1.3 million t/annum
- South Africa produces 400 000 - 560 000 t/annum
- 90 % of import from Argentina

Soybean producing areas in South Africa



Introduction

- Cultivars often demonstrate limited adaptation to specific agro-ecological conditions.
- Studies needed in different agro-ecological environments to develop sound recommendations on the suitability of a cultivar in a certain environment.
- Models need to be calibrated and used to predict yield in different agro-ecological environments.

Hypothesis

- Soybean cultivars will respond differently in growth, development and yield to different agro-ecological environments

Aims of the study

- Determine growth, development and yield response of six soybean cultivars of different maturity groups to different agro-ecological environments

Methodology

Area	Altitude (m)
Pretoria	1264
Malkerns	684
Nhlangano	1050

Methodology

Cultivar	Maturity group	Growth habit
1. LS 6162	IV	DETERMINATE
2. PAN 535	V	DETERMINATE
3. PAN 1664	VI	DETERMINATE
4. LS 6164	VI	INDETERMINATE
5. LS 6150	VI	INDETERMINATE
6. PAN 737	VII	DETERMINATE

Methodology

- Field experiments conducted in South Africa [Pretoria] and Swaziland [Malkerns and Nhlangano].

- Planted
  - Pretoria 18 November 2010
  - Nhlangano 29 December 2010
  - Malkerns 30 December 2010

- RCBD with 6 cultivars and 4 replications

Methodology

- Trial Layout

Plot 1 LS 6162	Plot 2 Pan 1664	Plot 3 Pan 737	Plot 4 Pan 535	Plot 5 LS 6150	Plot 6 LS 6164
Plot 12 PAN 535	Plot 11 PAN 737	Plot 10 PAN 1664	Plot 9 LS 6164	Plot 8 LS 6162	Plot 7 LS 6150
Plot 13 LS 6164	Plot 14 LS 6150	Plot 15 PAN 1664	Plot 16 PAN 737	Plot 17 Pan 535	Plot 18 LS 6162
Plot 24 PAN 1664	Plot 23 LS 6163	Plot 22 Pan 535	Plot 21 LS 6162	Plot 20 LS 6150	Plot 19 PAN 737

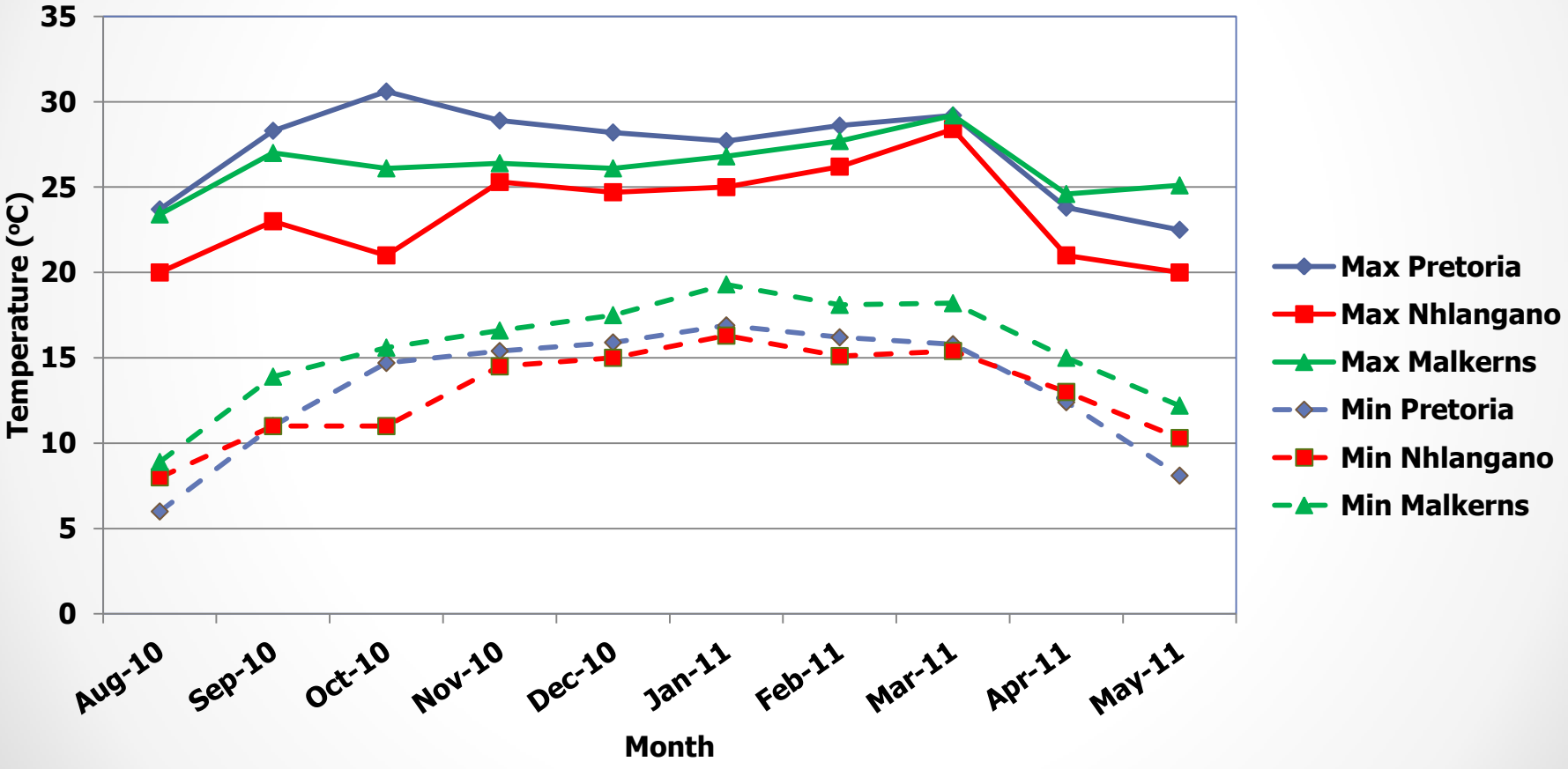
Methodology

Data collected

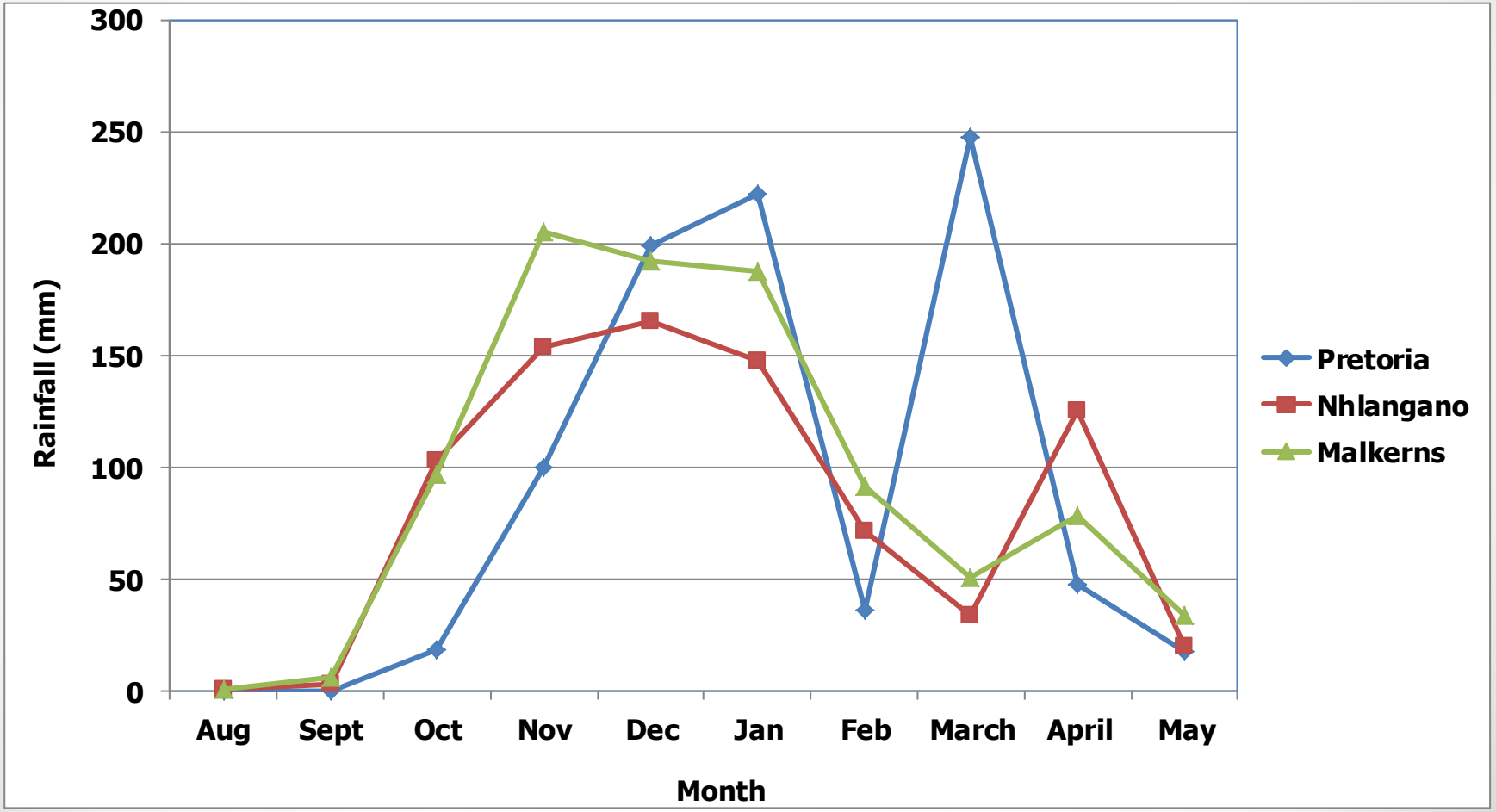
- Plant growth analysis (leaf, stem, pod mass)
- Yield parameters (total dry matter)
- Seed yield
- SAS 9.1 used for data analysis

❑ Results and discussion

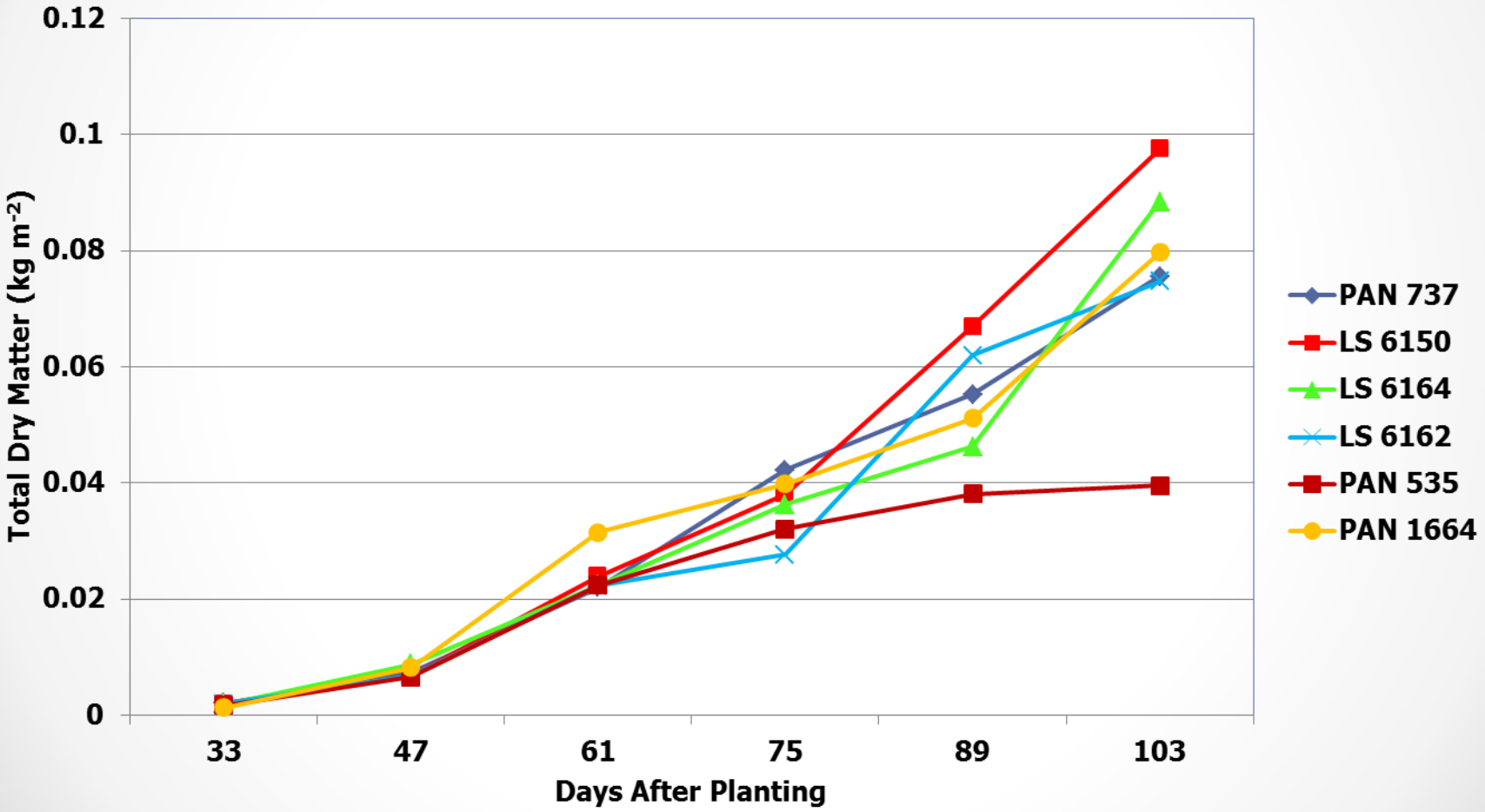
Monthly Mean Maximum and Minimum temperatures



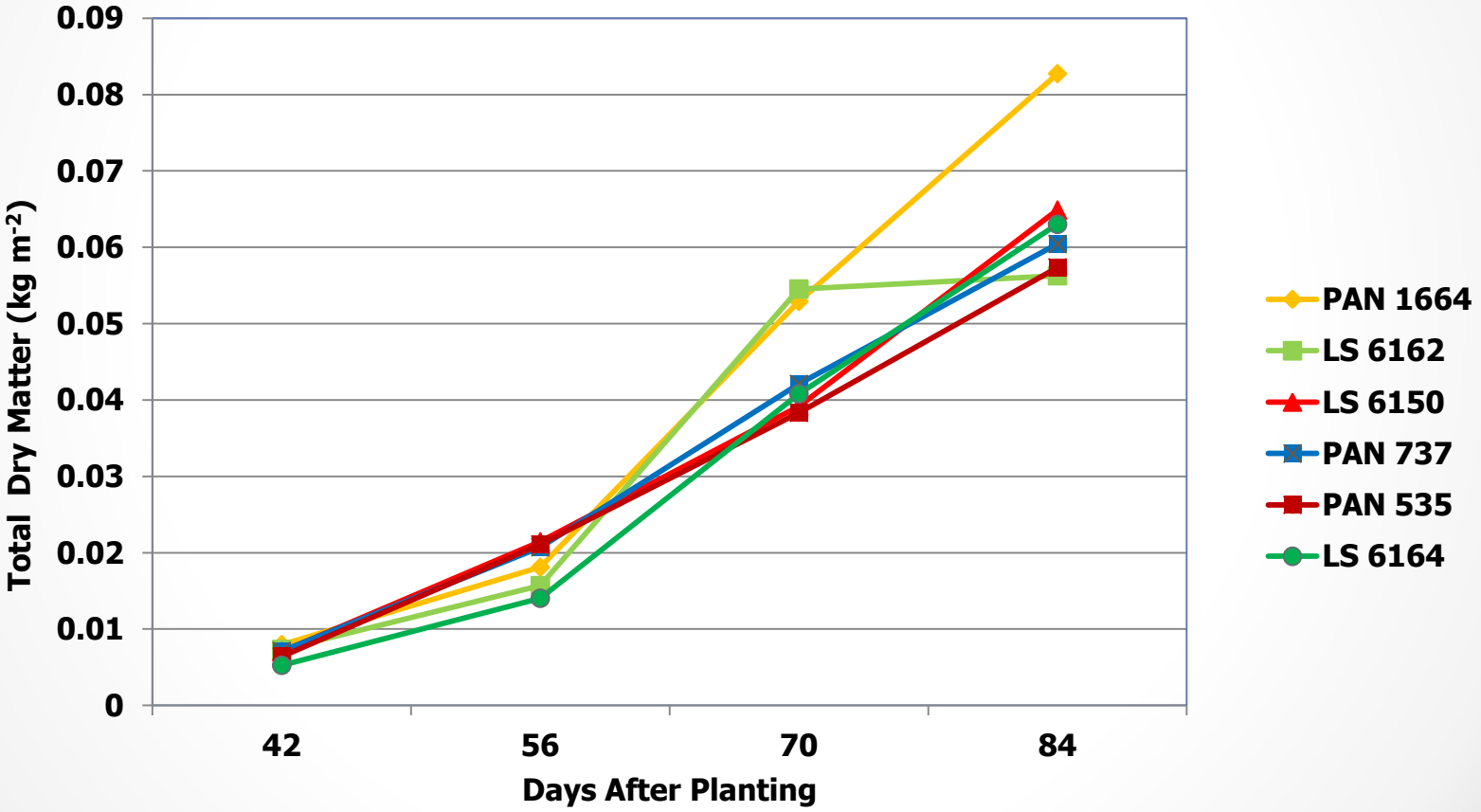
Monthly rainfall at different sites



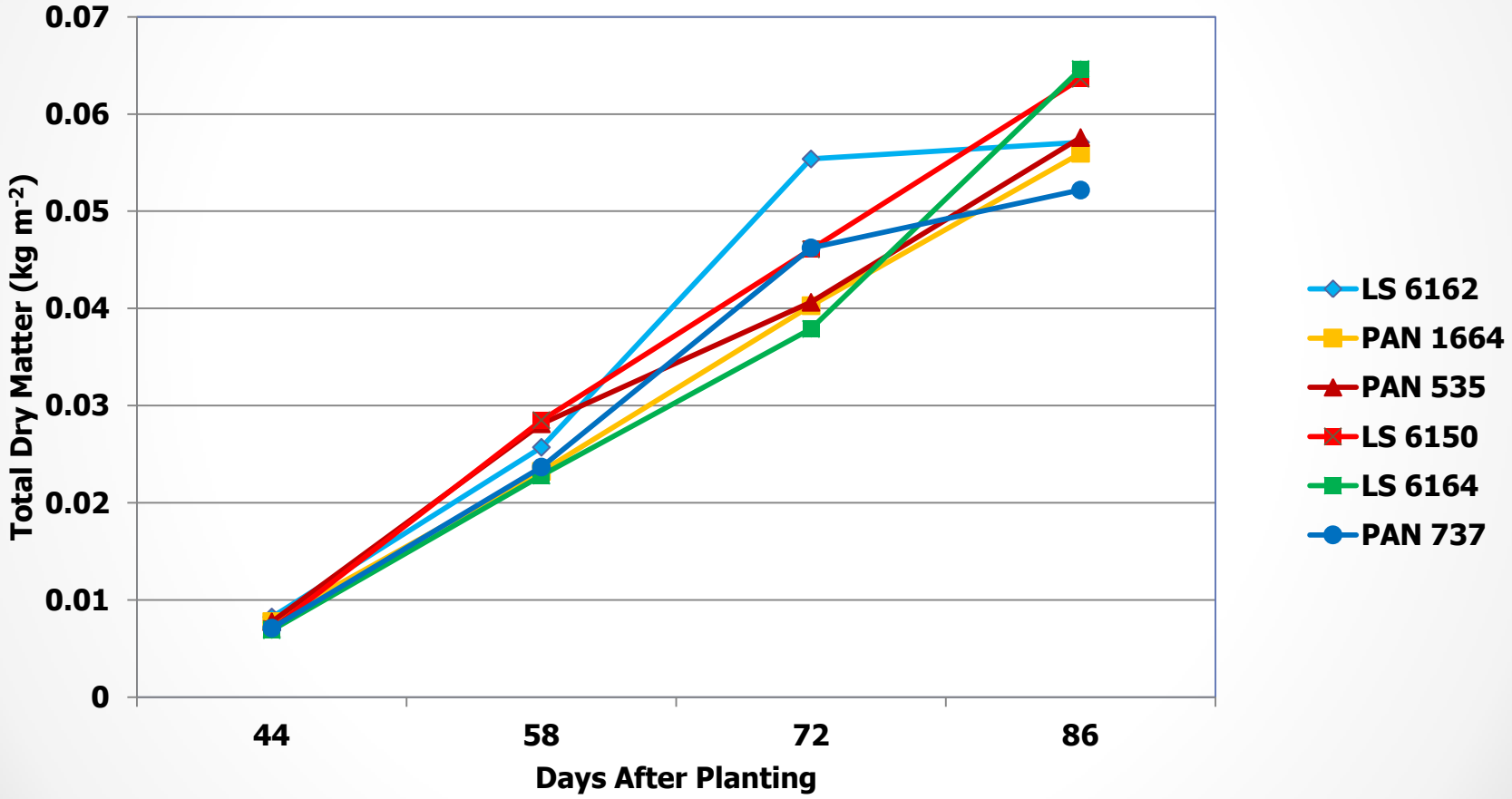
Total Dry Matter plant growth analysis [Pretoria]



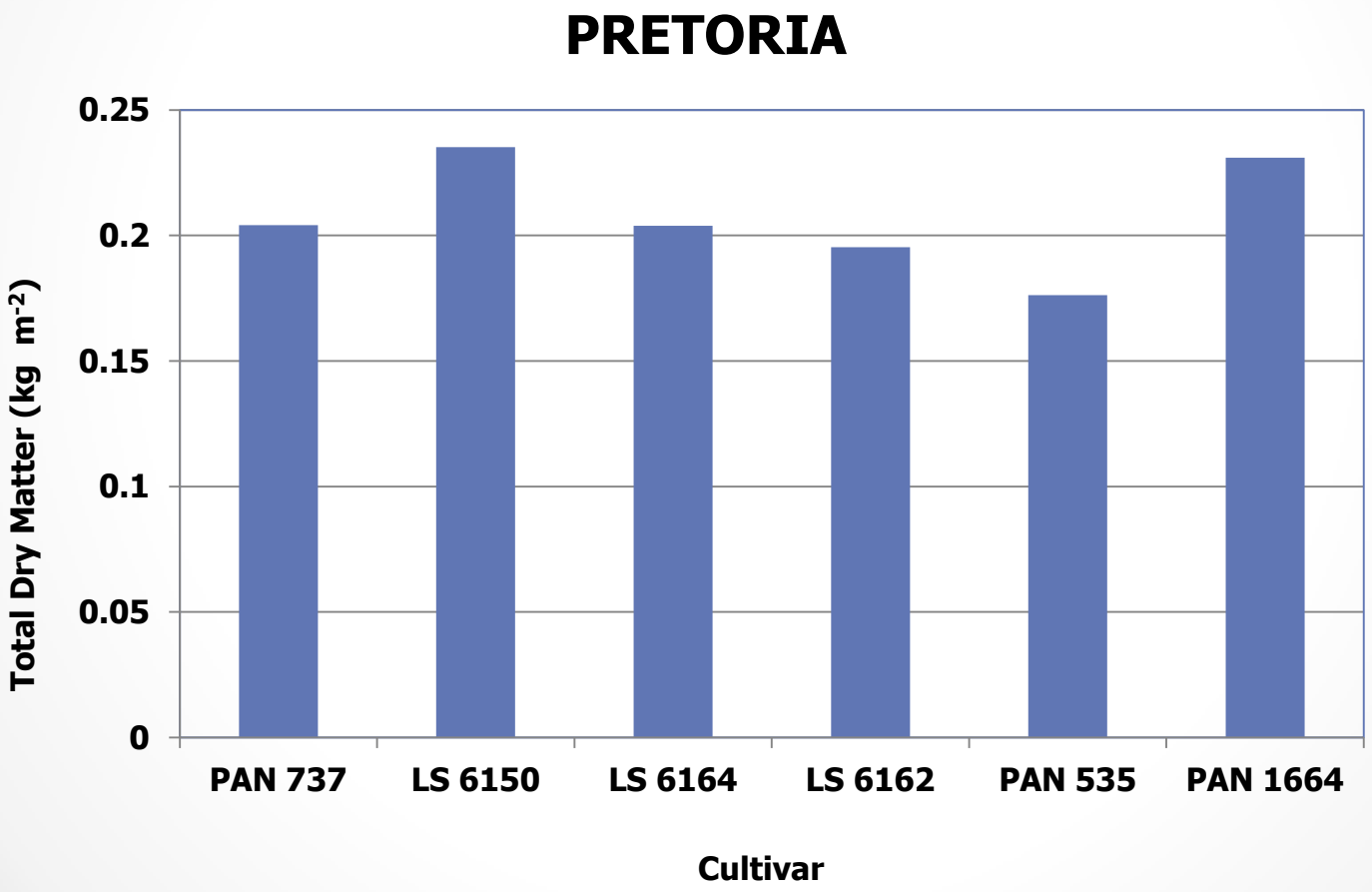
Total Dry Matter plant growth analysis [Malkerns]



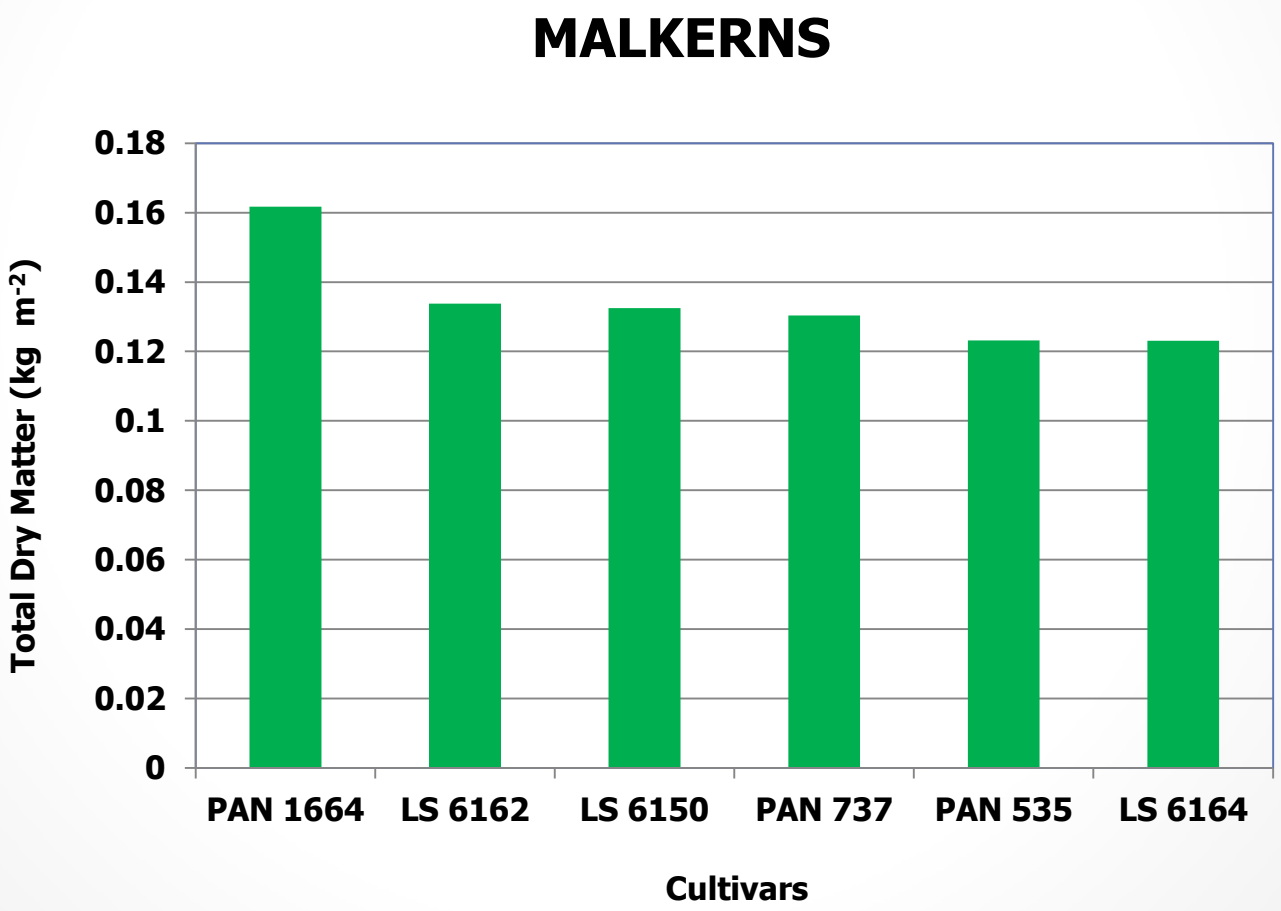
Total Dry Matter plant growth analysis [Nhlangano]



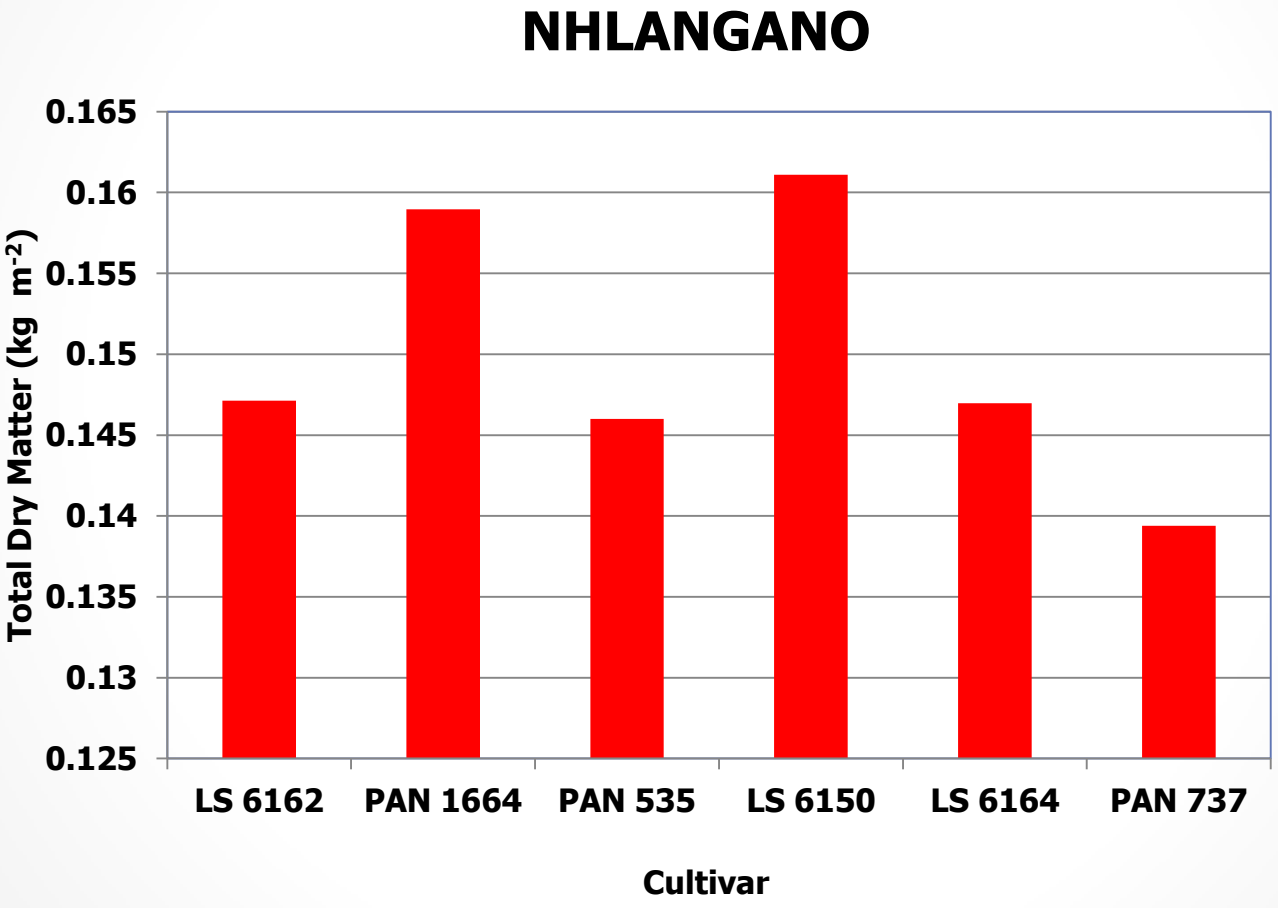
Final Dry Matter



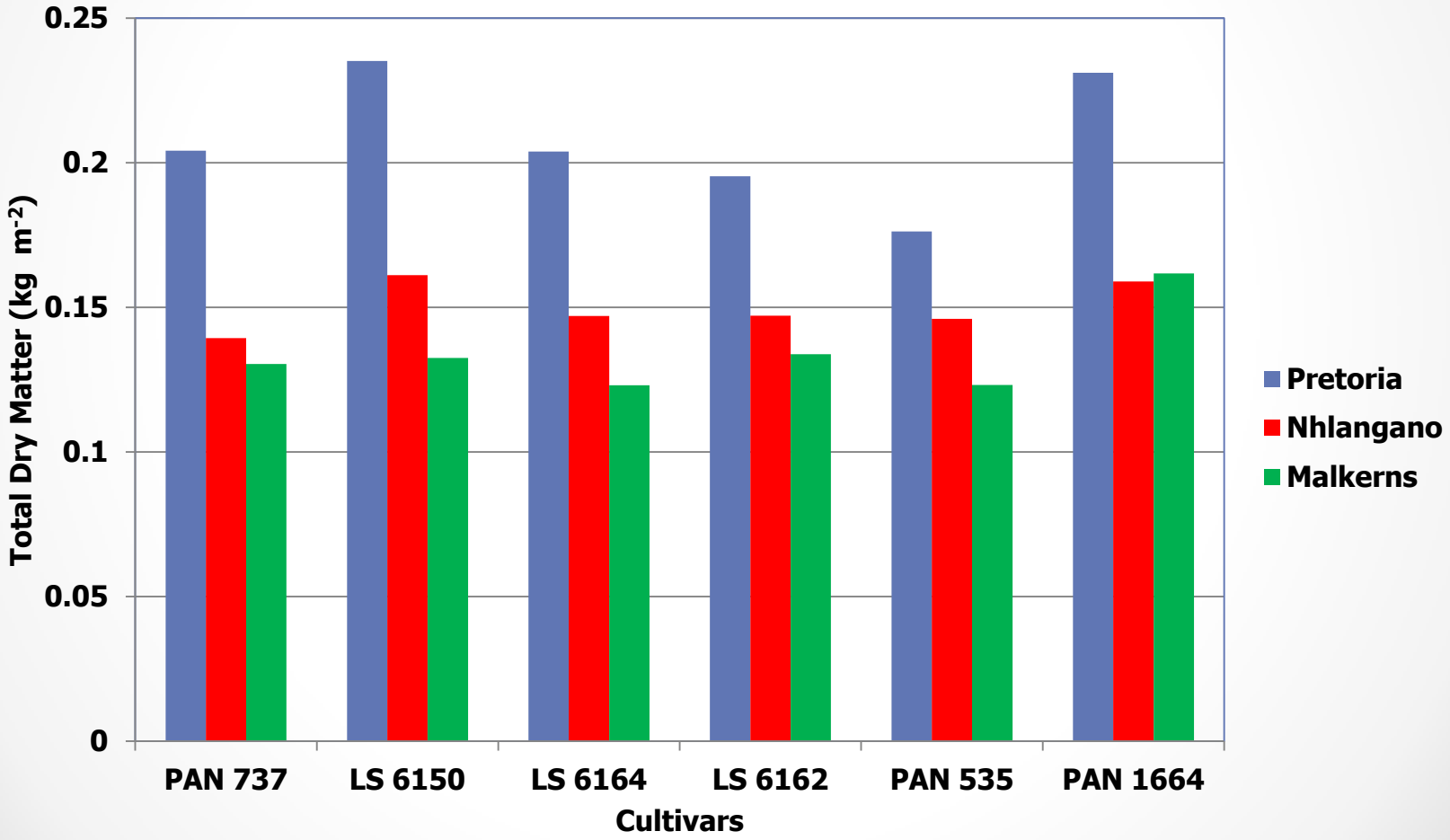
Final Dry Matter



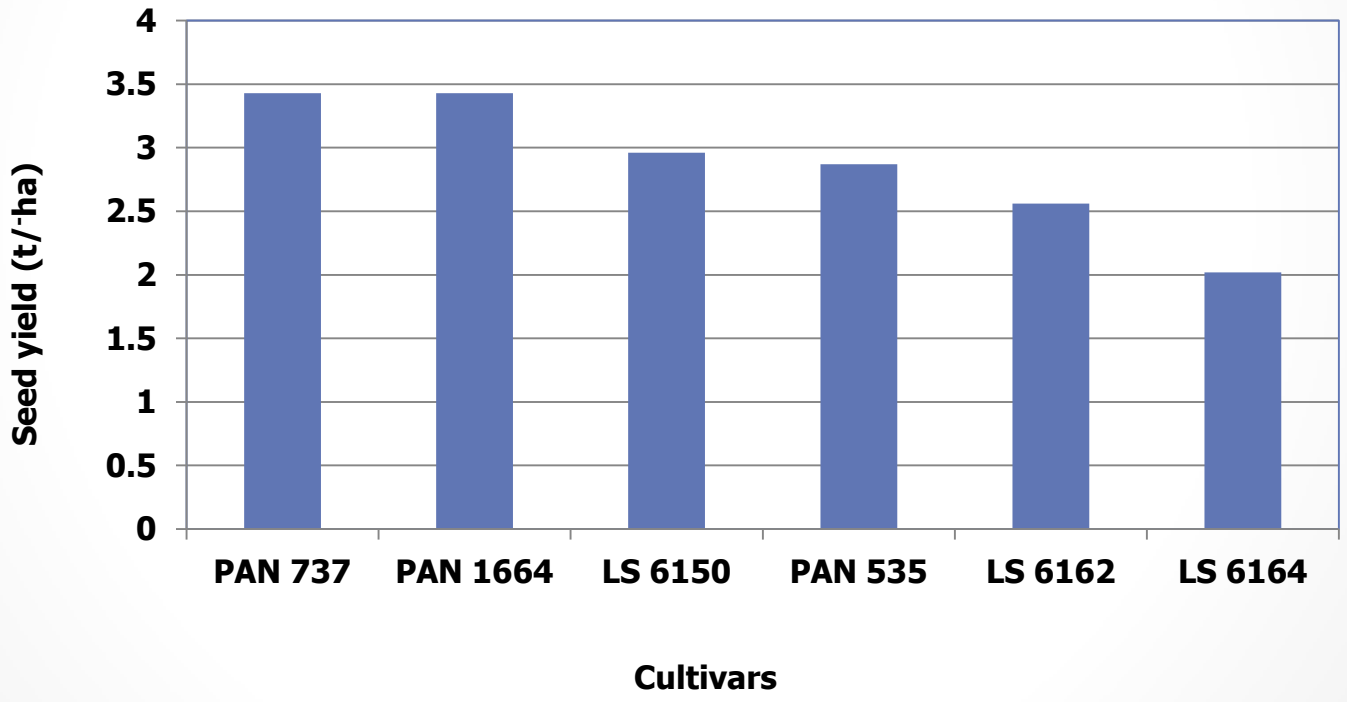
Final Dry Matter



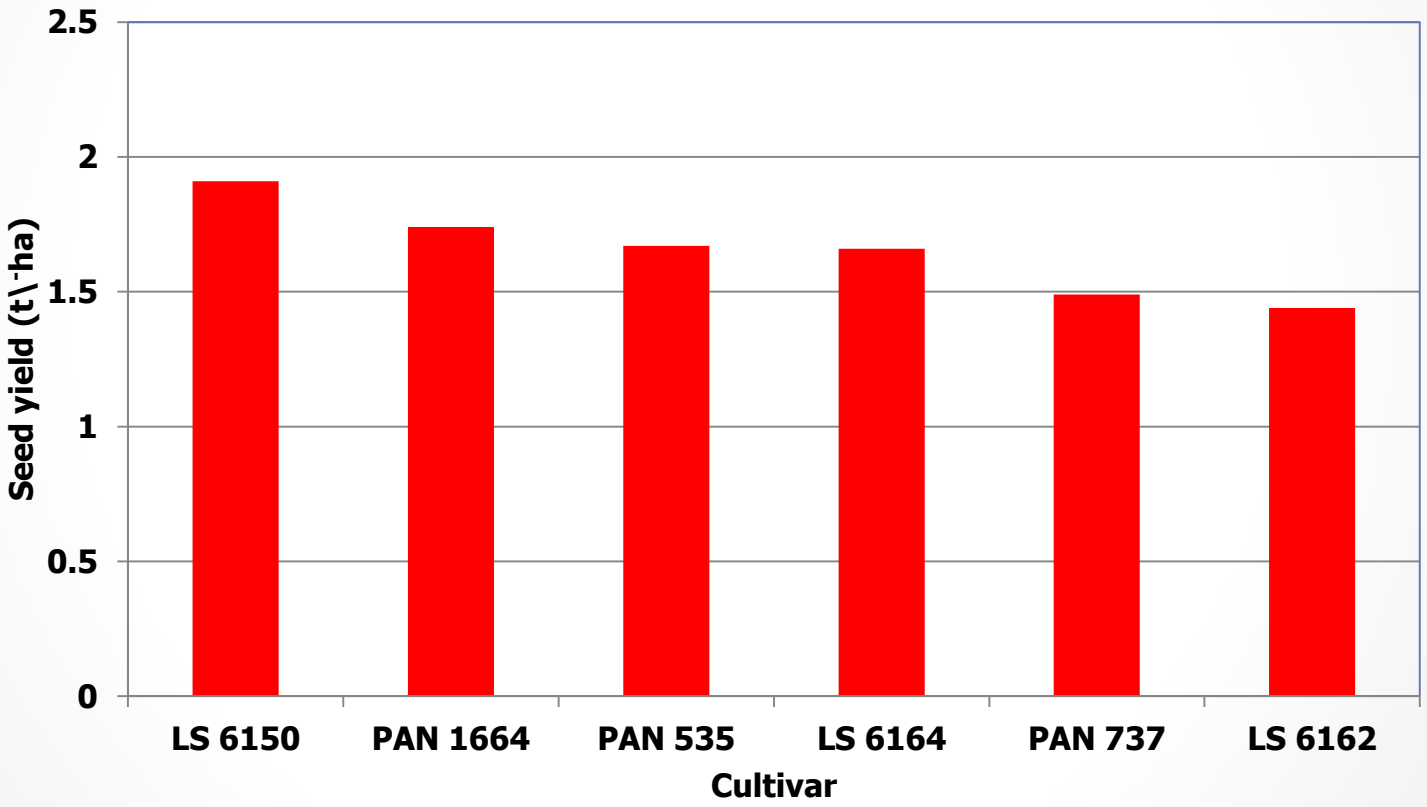
Final Dry Matter across sites



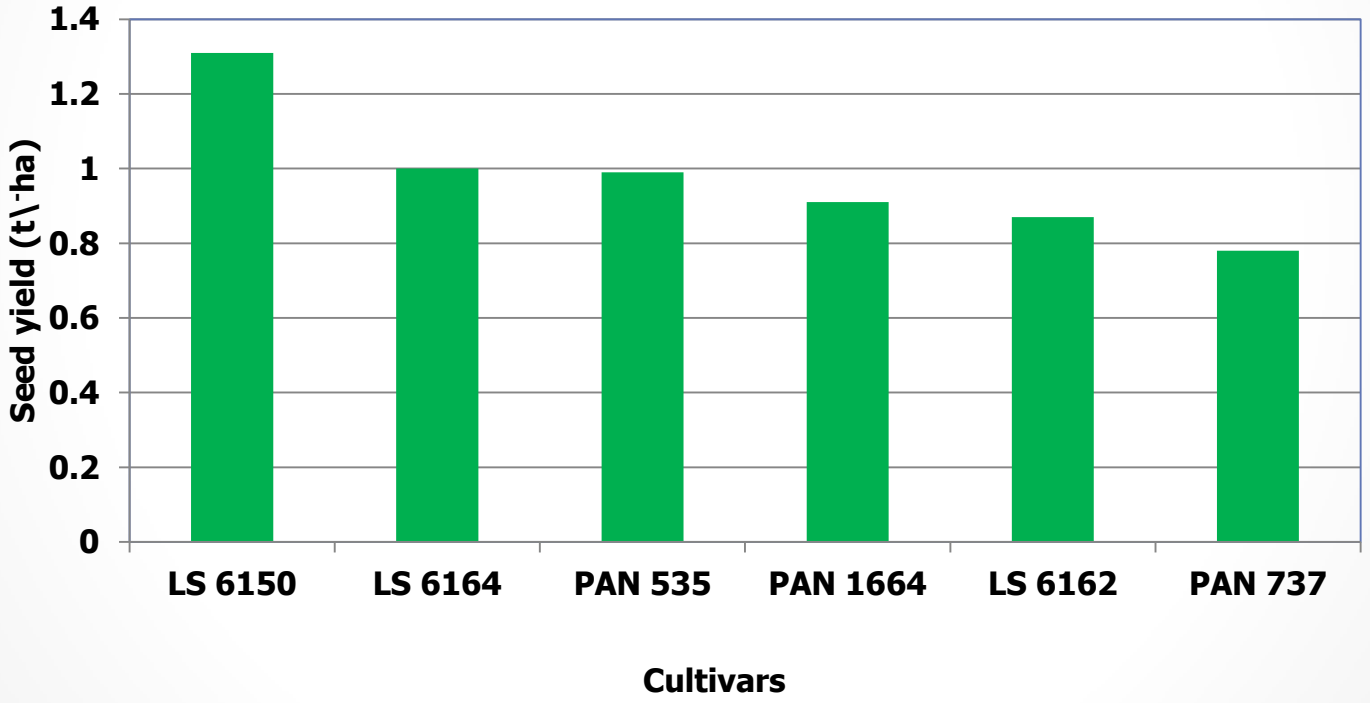
Seed yield t/ha [Pretoria]



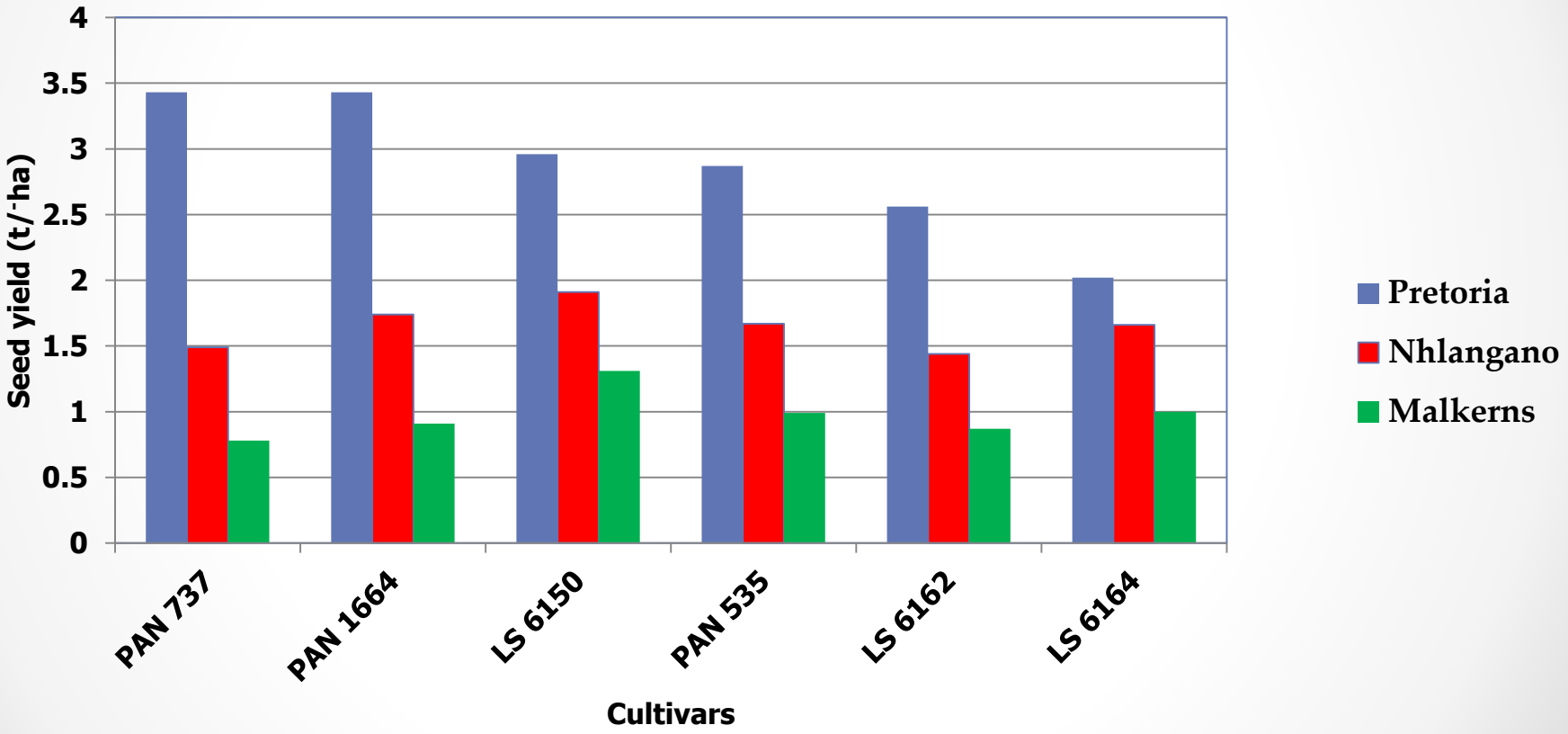
Seed yield t/ha [Nhlangano]



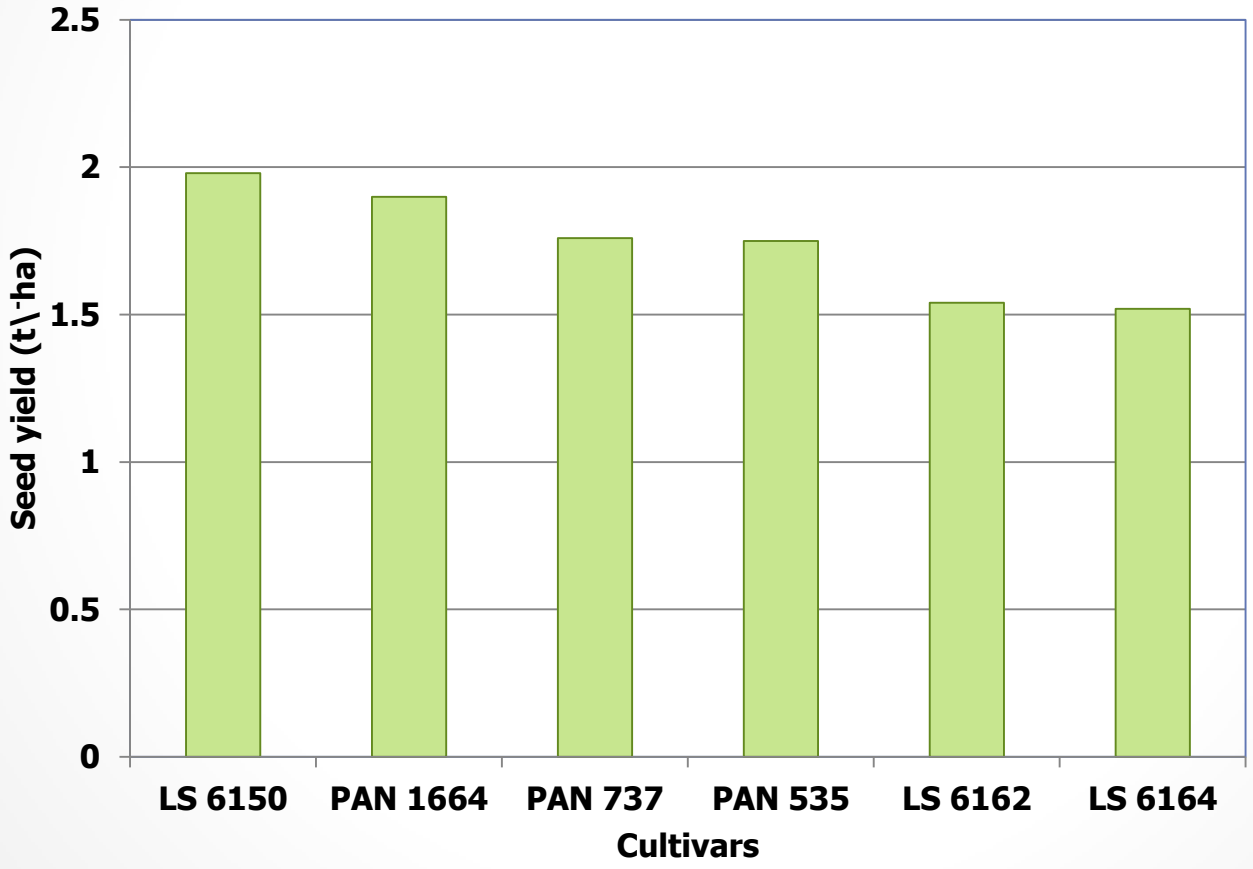
Seed yield t/ha [Malkerns]



Performance of cultivars at different sites



Mean Seed yield t/ha [Across sites]



Discussion

- Individual cultivars demonstrated that they grow and develop differently at different agro-ecological environments
- Early maturing cultivars accumulate dry matter faster than late maturity cultivars (e.g LS 6162)
- Individual cultivars gave different grain yields in different environments

Discussion

- Cultivars of different maturity groups gave highest seed yields at different sites

- Time of planting play a crucial role in soybean production as it influences length of available growing season

Recommendations

- The results have shown that cultivars perform differently in different environments.

- Data can be used to calibrate a crop model that can be used to predict soybean yields in other agro-ecological environments.

Acknowledgements

- My supervisors

- The staff at all the experimental sites

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