

EVALUATION OF SOYBEAN BREEDING LINES FROM THE EEAOC (TUCUMÁN, ARGENTINA) IN SOUTH AFRICA

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South Africa has a grain production area (3.73 million ha in 2011/2012) planted mainly with maize and, to a lesser extent, with soybean, in a percentage ratio close to 85/15. For this reason, the country needs to import high volumes of protein meal and soybean oil. That is why the Protein Research Foundation (PRF) strives to promote protein crops in South Africa, especially soybean. Accordingly, in 2010, the PRF signed an agreement with the Estación Experimental Agroindustrial Obispo Colombres (EEAOC), from Tucumán province, Argentina. The main objective of this cooperative work is to evaluate advanced breeding lines (ABLs), obtained by the Soybean Breeding Program of the EEAOC, in north-eastern South Africa, in order to identify the best suited materials for this region.

The project started with two distinct stages. The first phase was executed during the 2010/2011 season and was devoted to identify the maturity groups (MG) better adapted to the ecological conditions of the main soybean areas in South Africa. Four trials were planted at different locations: Pretoria (Gauteng province), Brits (North-west province), Potchefstroom (North-west province) and Bethlehem (Free State province). Each trial included representative ABLs of different MG (IV, V, VI, VII and VIII), which were compared with the best local cultivars as controls. Results of these trials showed that the best materials belonged principally to MG V, VI, and short VII. On average, EEAOC lines reached a 9% yield increase compared to the local controls.

The second phase took place in the 2011/2012 season. Sixteen ABLs were compared with six commercial controls. Trials were planted at five locations: the same four as in the previous season, plus Howick (KwaZulu-Natal province). Results from these trials revealed that the ABLs were highly promising and the average of them stood out with a 5% higher yield than the local controls' average (Table 1).

Considering results from each location, the ABLs showed average yield increases of 12% at Brits and 9% at Howick and Pretoria, in comparison with the controls. At Potchefstroom and Bethlehem, both locations were affected by a severe drought, and the ABLs did not perform better than the controls. Results from these first two seasons are considered preliminary and need to be confirmed with further evaluations.

Table 1. Average yields from soybean trials at five locations in South Africa in the 2011/2012 season. Results include average trial, average of the controls, average of the ABLs, and best ABL.

Average (kg/ha)	Pretoria	Brits	Potchefstroom	Bethlehem	Howick	All locations
Trial	3353	3368	1180	1566	3321	2558
Controls	3140	3095	1241	1761	3126	2472
ABLs	3433	3470	1157	1494	3394	2590
Best ABL	3927	4218	2008	3238	4207	3520

Evaluation of soybean breeding lines from the EEAOC (Tucumán, Argentina) in South Africa

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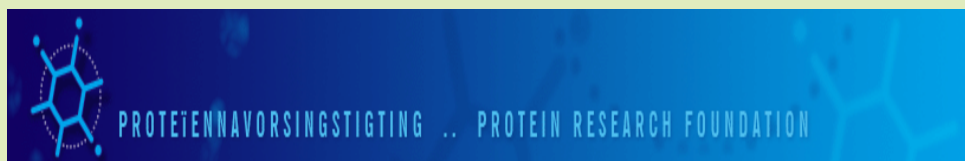
Wessel van WYK², Gawie DE BEER², Jos DE KOCK², Jan DREYER²,
Gerhard SCHOLTEMEIJER²

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Agroindustrial Obispo Colombres
Tucumán, Argentina**

2 Protein Research Foundation



ESTACION EXPERIMENTAL
AGROINDUSTRIAL
OBISPO COLOMBRES
Tucumán | Argentina





- **INTRODUCTION**
- **MATERIALS & METHODS**
- **RESULTS**
- **CONCLUSIONS**



INTRODUCTION

Current world population of 6,8 billion doubled over the past 40 years and is expected to grow with an additional 2 billion people to 9,3 billion by 2050, the highest growth being in developing countries. Urbanization and per capita income will increase in developing countries.

These trends mean that market demand for food will continue to grow and global production in food will need to double by 2050

The soybean crop is one of the most important crops worldwide. Since the last decades, the area in soybean production has the highest percentage increase compared to any other major crop.

Future soybean production is expected to increase more than other crops, due to expanded production area and higher yields and the increases in demand for protein meal and vegetable oil, and biodiesel use.

Soybean is an important source of high quality but inexpensive protein and oil (40% and 20%)



INTRODUCTION

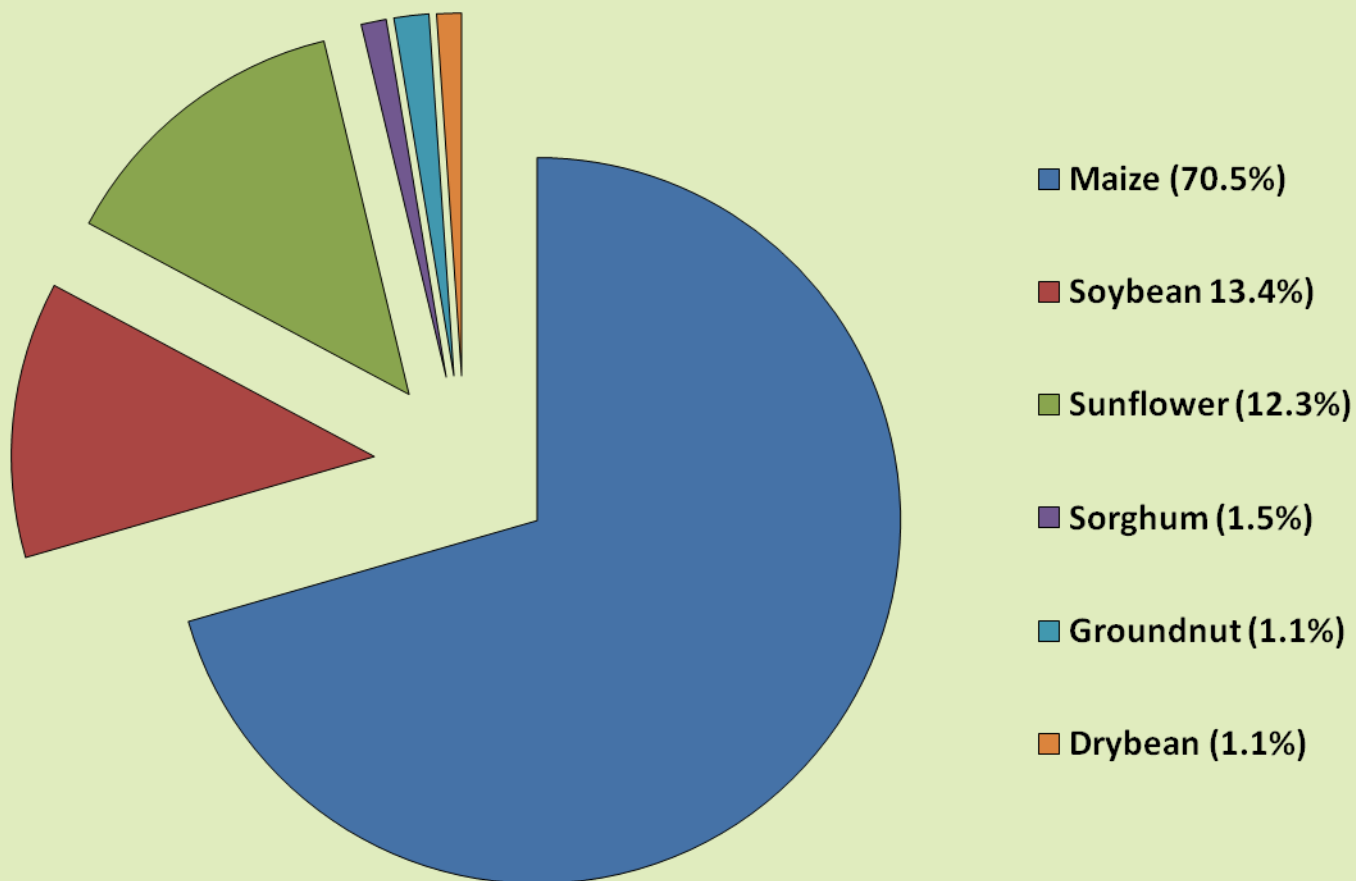
South Africa has a grain production area (3.94 million ha in 2012/2013) planted mainly with maize and, to a lesser extent, with soybean, in a percentage ratio close to 85/15.

For this reason, the country needs to import high volumes of protein meal and soybean oil.

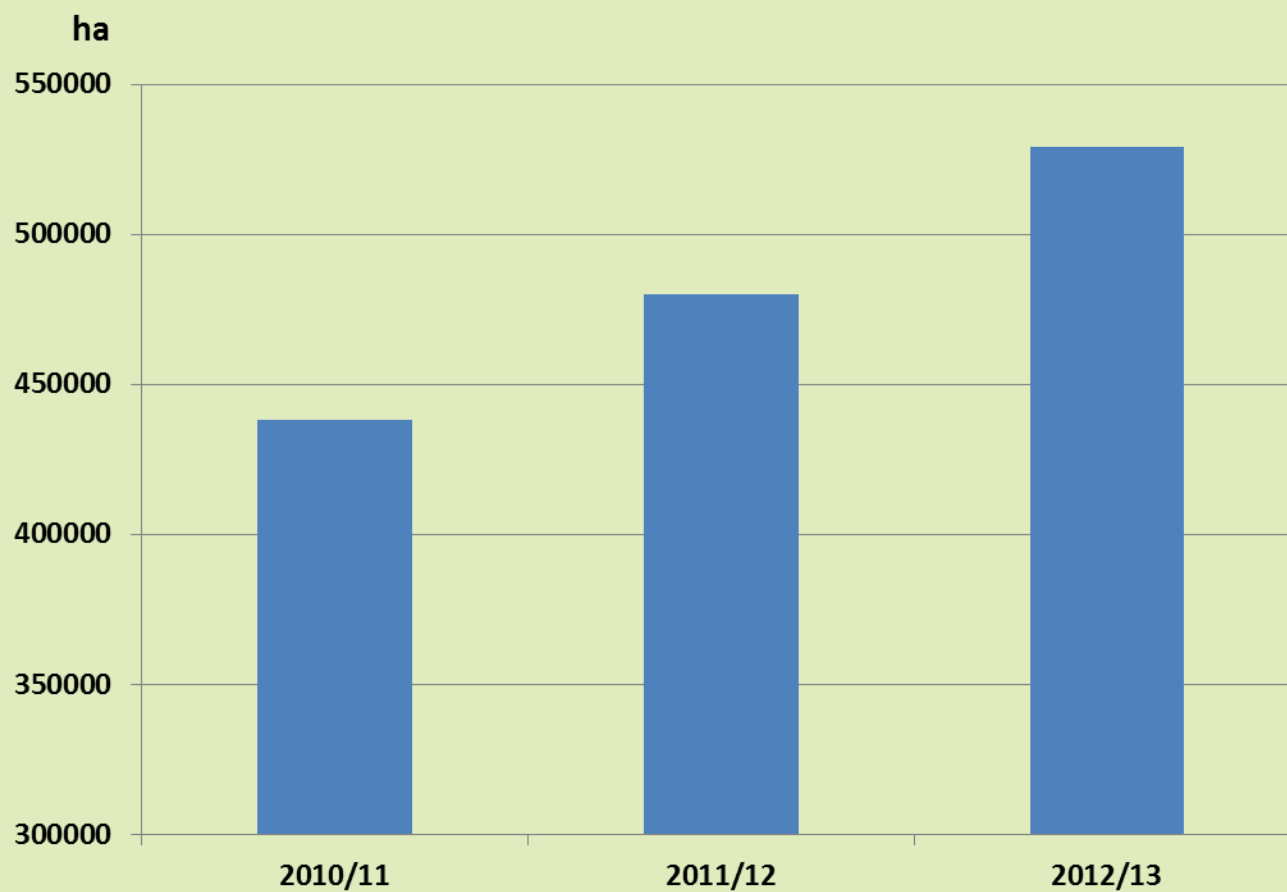
Even though the production is increasing, it is not enough to satisfy the internal demand.

South Africa summer crops for 2013

The preliminary area planted estimate

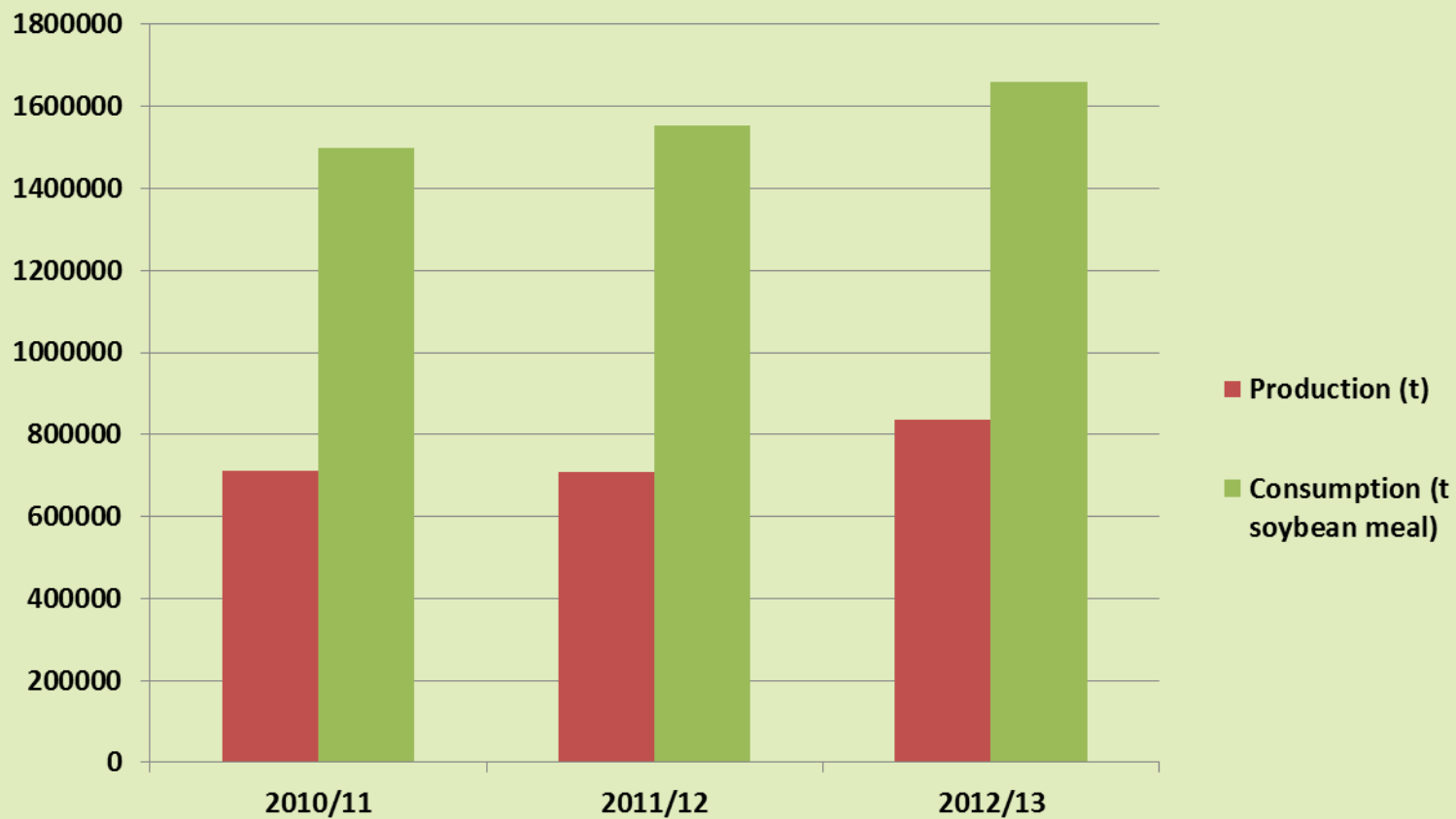


South Africa Soybean planted area 3 last seasons



Department of Agriculture, Forestry and Fisheries. Republic of South Africa. January 2013

South Africa Soybean Production and Consumption



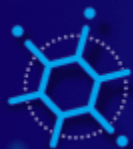
USDA



SOUTH AFRICA

Protein Research Foundation (PRF) strives to promote protein crops in South Africa, especially soybean.

The PRF's main objectives are to replace imported protein for animal use with locally produced protein, but also to promote better utilization of protein. These objectives are promoted through funding research and technology transfers.



PROTEÏENNAVORSINGSTIGTING .. PROTEIN RESEARCH FOUNDATION

NORTHWESTERN ARGENTINA



- The Northwestern region of Argentina (NWA) is located between 22° and 29° South Latitude and 63° and 68° West Longitude.
- Including the subtropical provinces of Tucuman, Salta, Jujuy, Santiago del Estero and Catamarca

Estación Experimental Agroindustrial Obispo Colombres (EEAOC)

Established 27 July 1909



For nearly 104 years, the EEAOC has played a key role in the development of the province of Tucumán, as well as the region known as northwestern Argentina (NWA).

The institution is aimed to find solutions for Tucumán's farming and agro-industrial problems, by means of research and technology development



NORTHERN ARGENTINA - EEAOC

- Official institution of the Province of Tucumán.
- Funded by growers and agro-industry from Tucumán.
- Interdisciplinary teams.
- Permanent interaction with growers and agro-industry.
- Networking.
- Great effort in the generation and transfer of technology.





NORTHERN ARGENTINA - EEAOC

Research Programs

- Sugarcane
- Citrus
- Grain crops
- Sugarcane industrialization
- Bioenergy





NORTHERN ARGENTINA - EEAOC

SOYBEAN/EEAOC/Grain Program

- INTERDISCIPLINARY TEAM
- PERMANENT INTERACTION WITH GROWERS

We have a soybean breeding programs: introduction of germplasm / created local varieties / evaluation of advanced lines and commercial varieties

But also integrating critical aspects for crop production: sanitary, nutritional, energetic, geographic, economic, quality, and food safety





Accordingly, in 2010, the PRF signed an agreement with the Estación Experimental Agroindustrial Obispo Colombres (EEAOC), from Tucumán province, Argentina.

The main objective of this cooperative work was to evaluate advanced breeding lines (ABLs), obtained by the Soybean Breeding Program of the EEAOC, in northeastern South Africa, in order to identify the best suited materials for this region.

MATERIALS AND METHODS

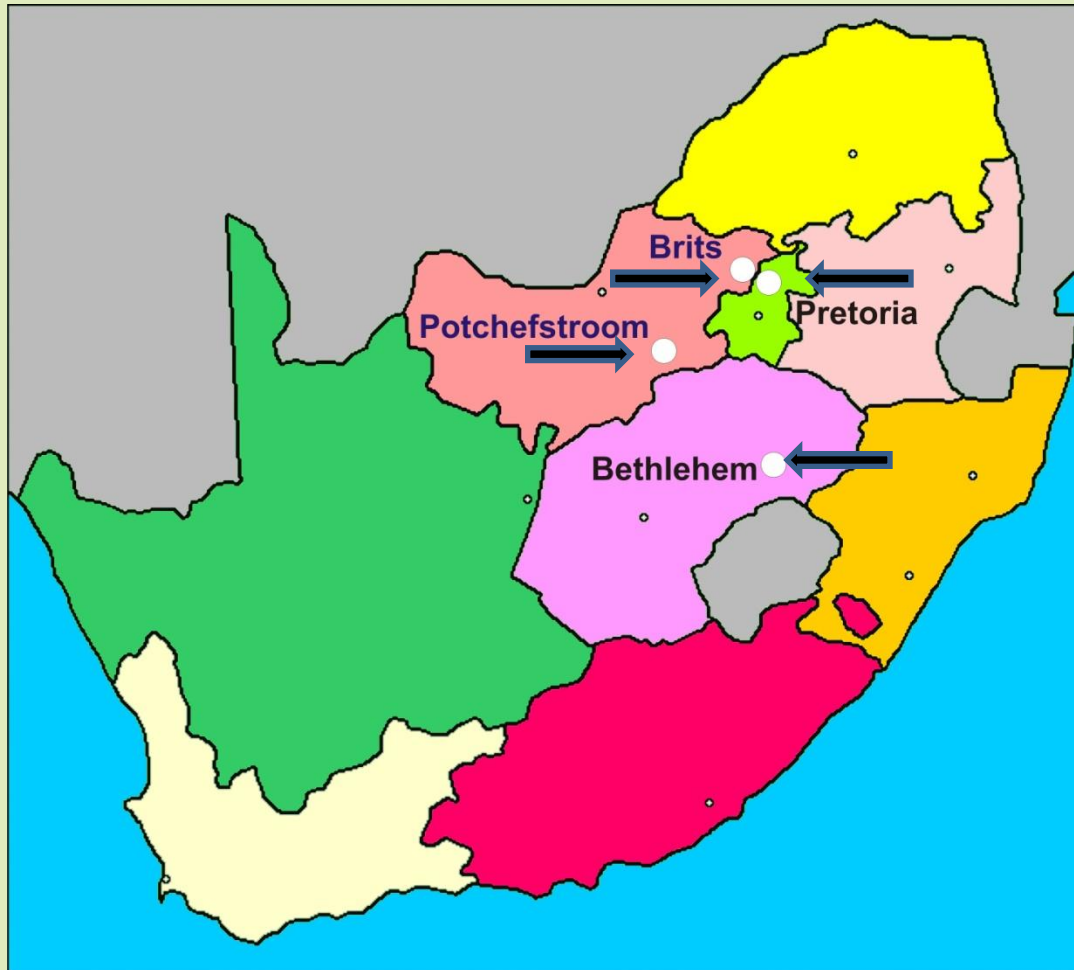
The project started with two distinct stages.

The first phase was executed during the 2010/2011 season and was devoted to identify the maturity groups (MG) better adapted to the ecological conditions of northeastern South Africa and evaluated the yields of the new lines.

Four trials were planted at different locations:

- Pretoria (Gauteng province-1.369 m) Lat, 25,44
- Brits (Northwest province-1.087 m) Lat, 25,35
- Potchefstroom (Northwest province-1.349 m) Lat, 26.44
- Bethlehem (Free State province-1.639 m) Lat, 28,09

South Africa 4 locations





MATERIALS AND METHODS

Each trial included representative ABLs of different MG (IV, V, VI, VII and VIII), which were compared with the best local cultivars as controls.

Advanced Breeding Lines (ABL)

1	ABL IV 1
2	ABL IV 2
3	ABL V 1
4	ABL V 2
5	ABL VI 1
6	ABL VI 2
7	ABL VII 1
8	ABL VII 2
9	ABL VIII 1
10	ABL VIII 2
11	ABL VIII 3

Controls

1	LS 6162 R
2	PAN 535 R
3	PAN 1664 R
4	LS 6164 R
5	LS 6150 R
6	PAN 737 R



MATERIALS AND METHODS

3 Rows/plot - Rows width 45 cm

3 Replications

Irrigation (Pretoria-Brits)

Fertilizer (superphosphate)

Planting dates

Pretoria: 19/11/2010

Brits: 24/11/2010

Potch: 16/11/2010

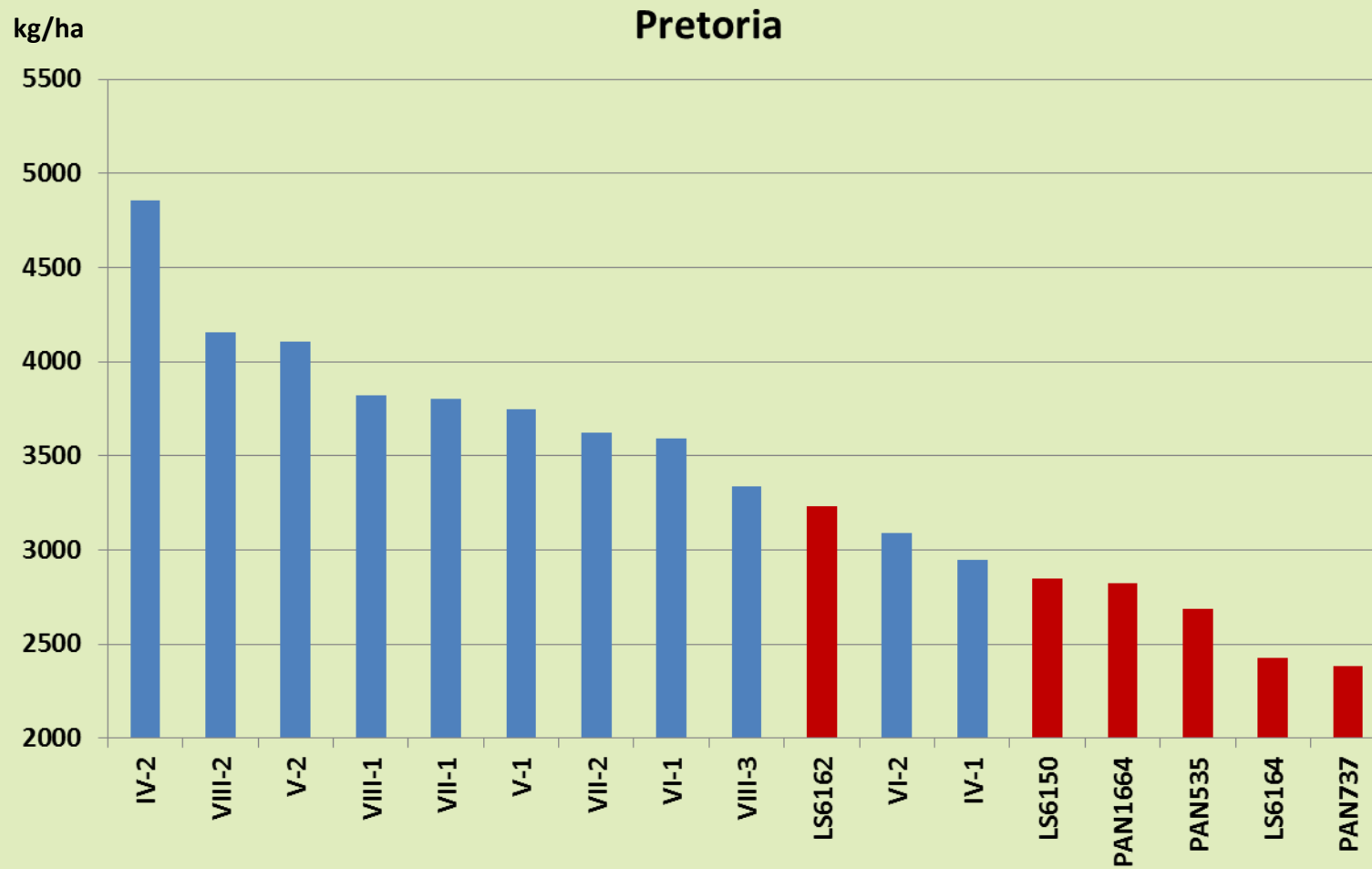
Bethl: 4/11/2010

Fisher Test was used to analyze the data for significant differences

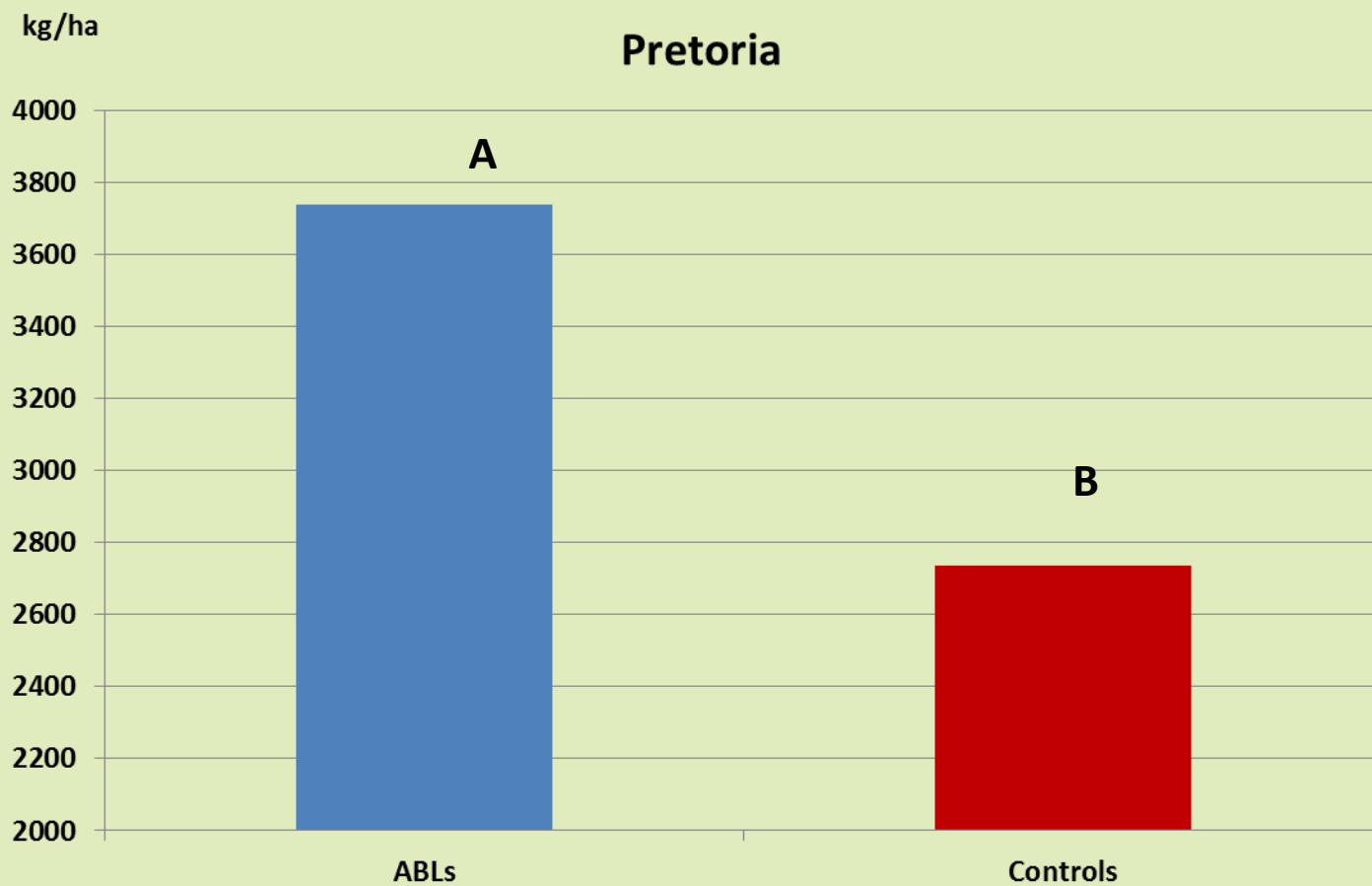
Pretoria



AVERAGE YIELDS



CONTROLS & ABLs





Pretoria

The average of locations was very good

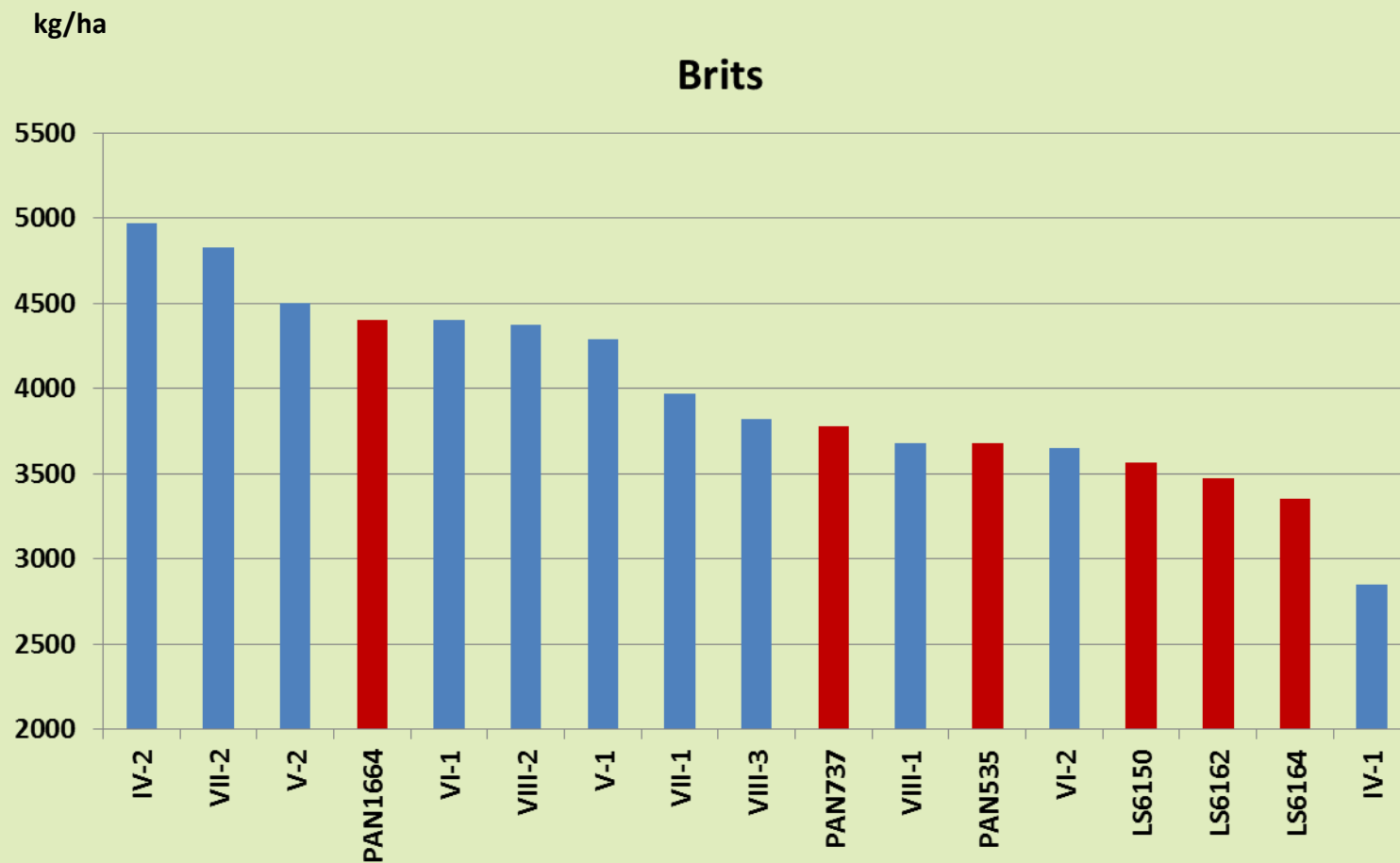
Most ABLs had better yields than controls

> 30%

Brits



AVERAGE YIELDS



CONTROLS & ABLs





Brits

Location with excellent average yield

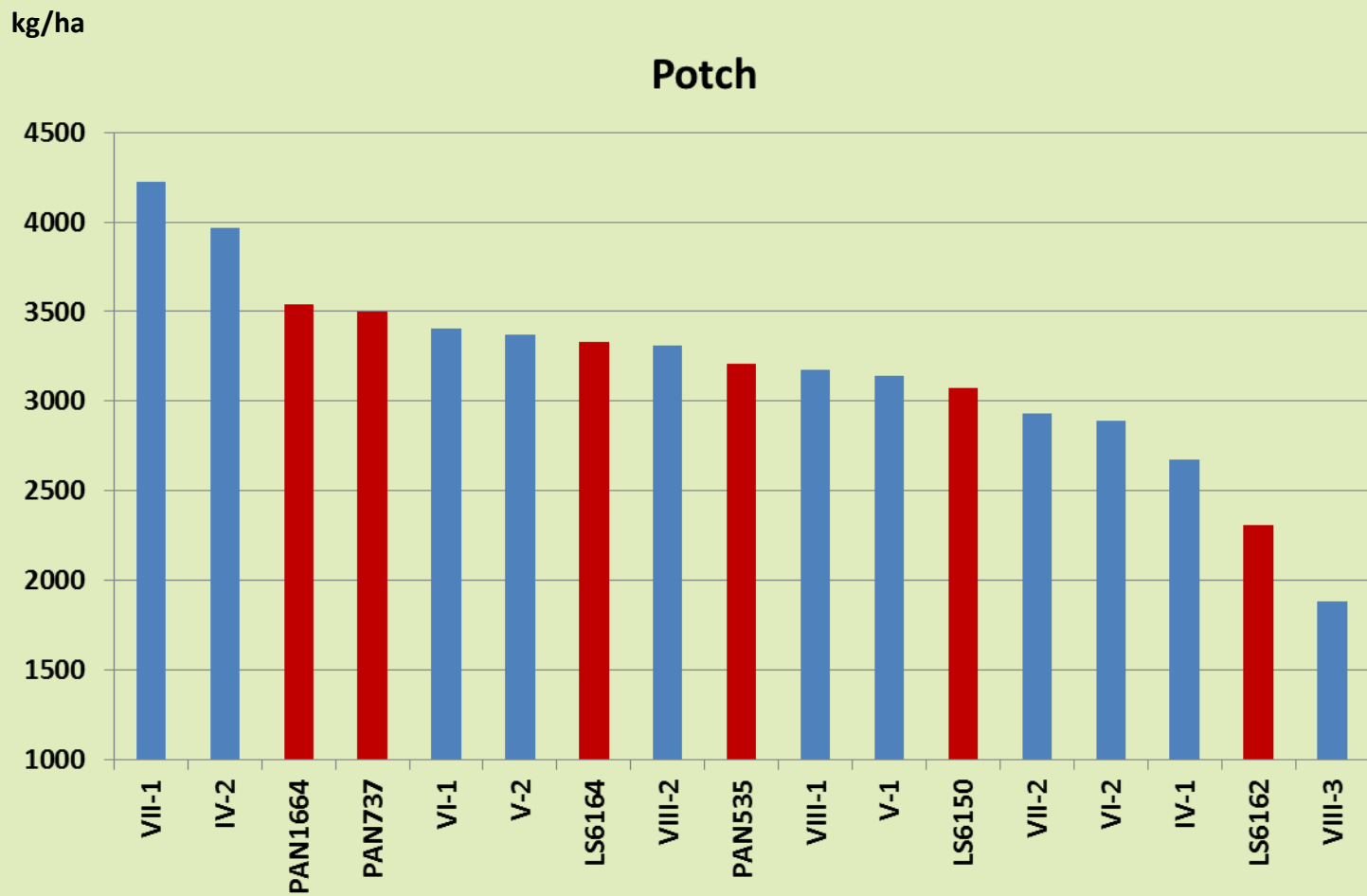
ABLS with good yields

> 11%

Potchefstroom



AVERAGE YIELDS



CONTROLS & ABLs





Potchefstroom

Location with good yield

Controls and ABLs , similar performance

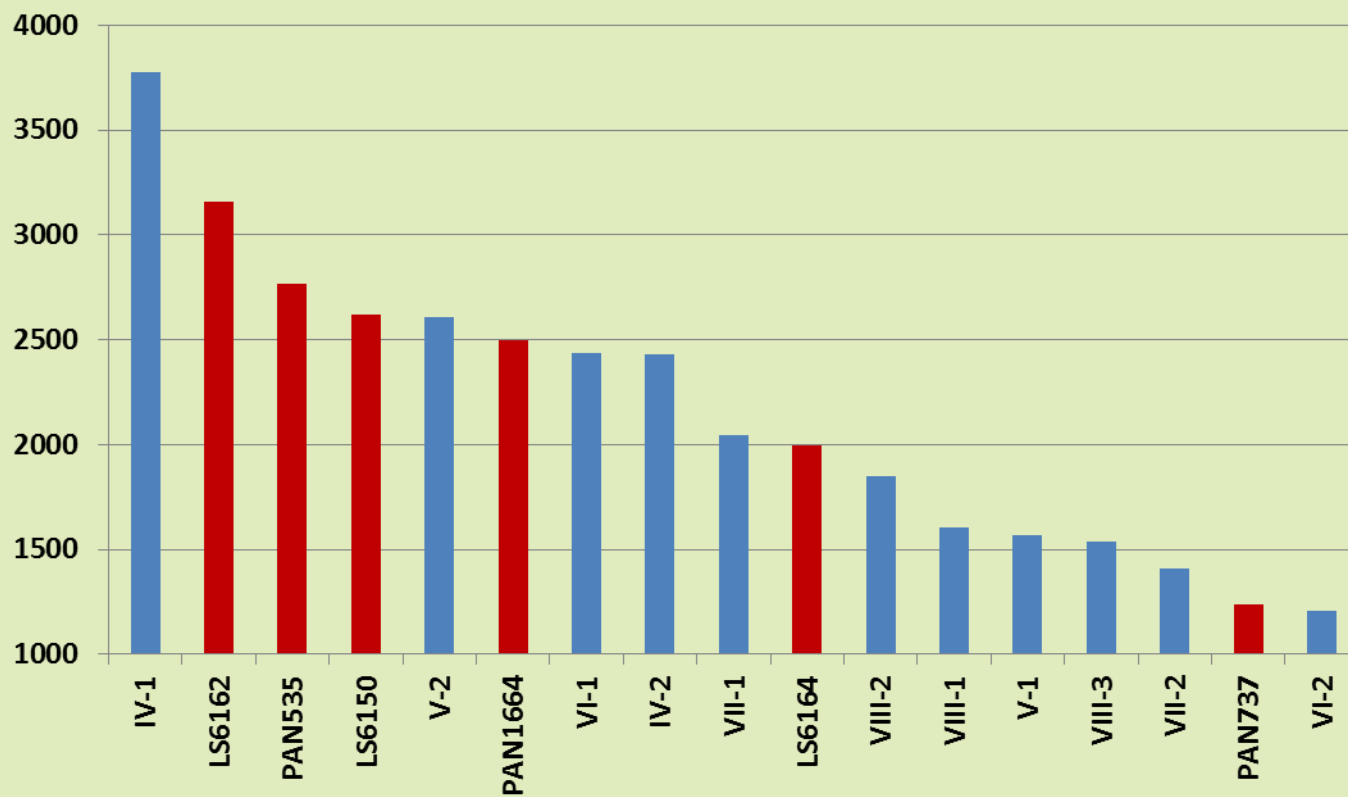
Bethlehem



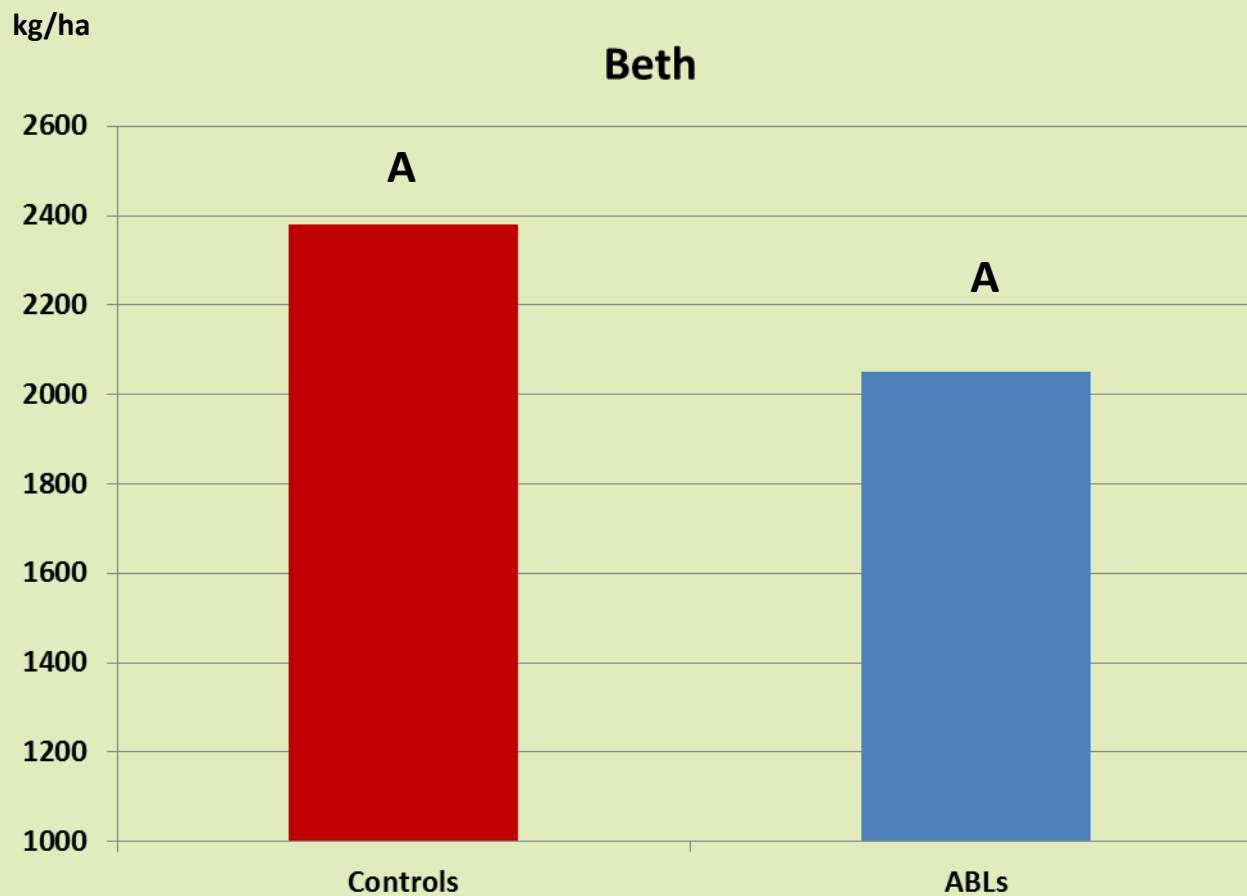
AVERAGE YIELDS

kg/ha

Bethl



CONTROLS & ABLs



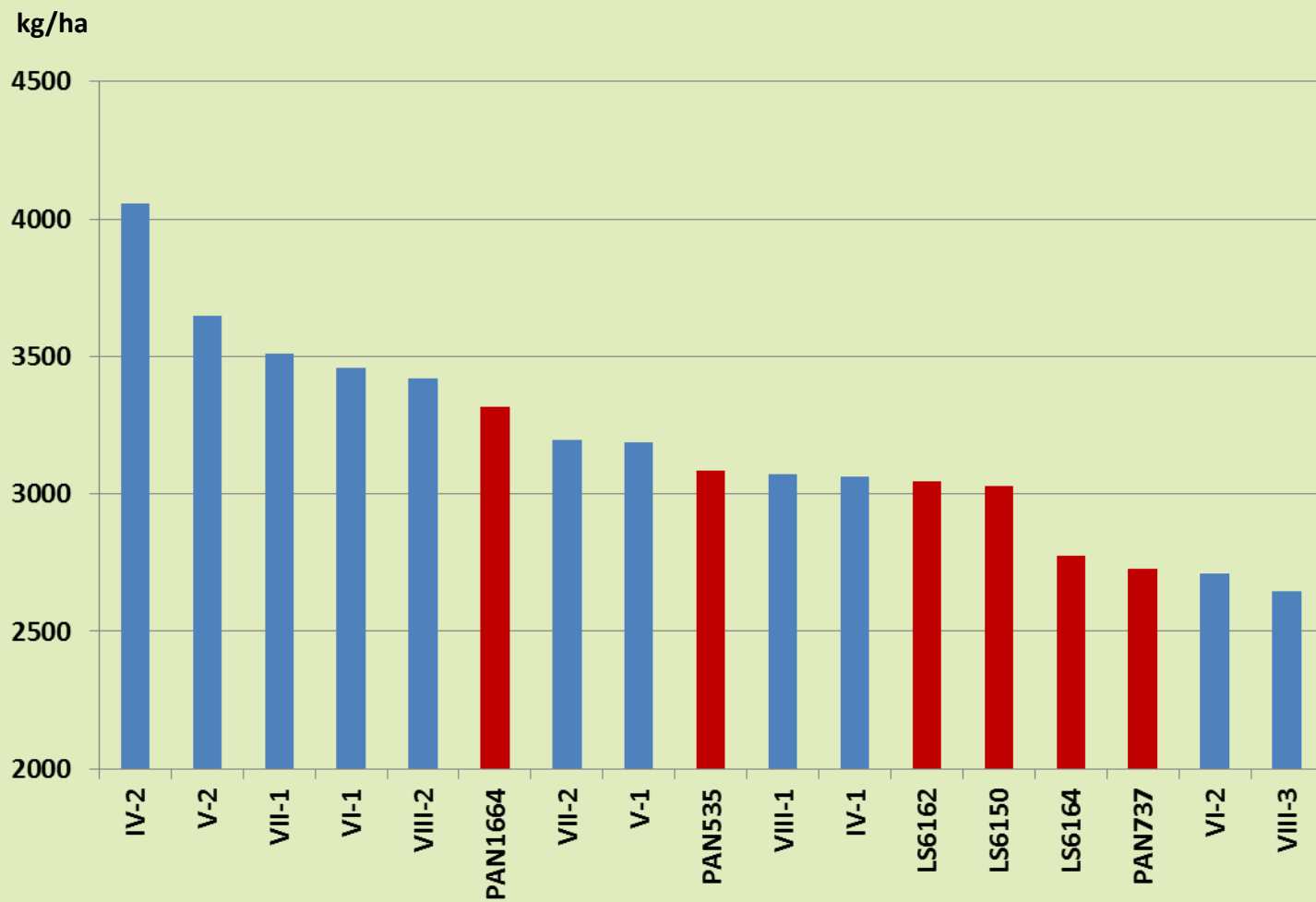


Bethlehem

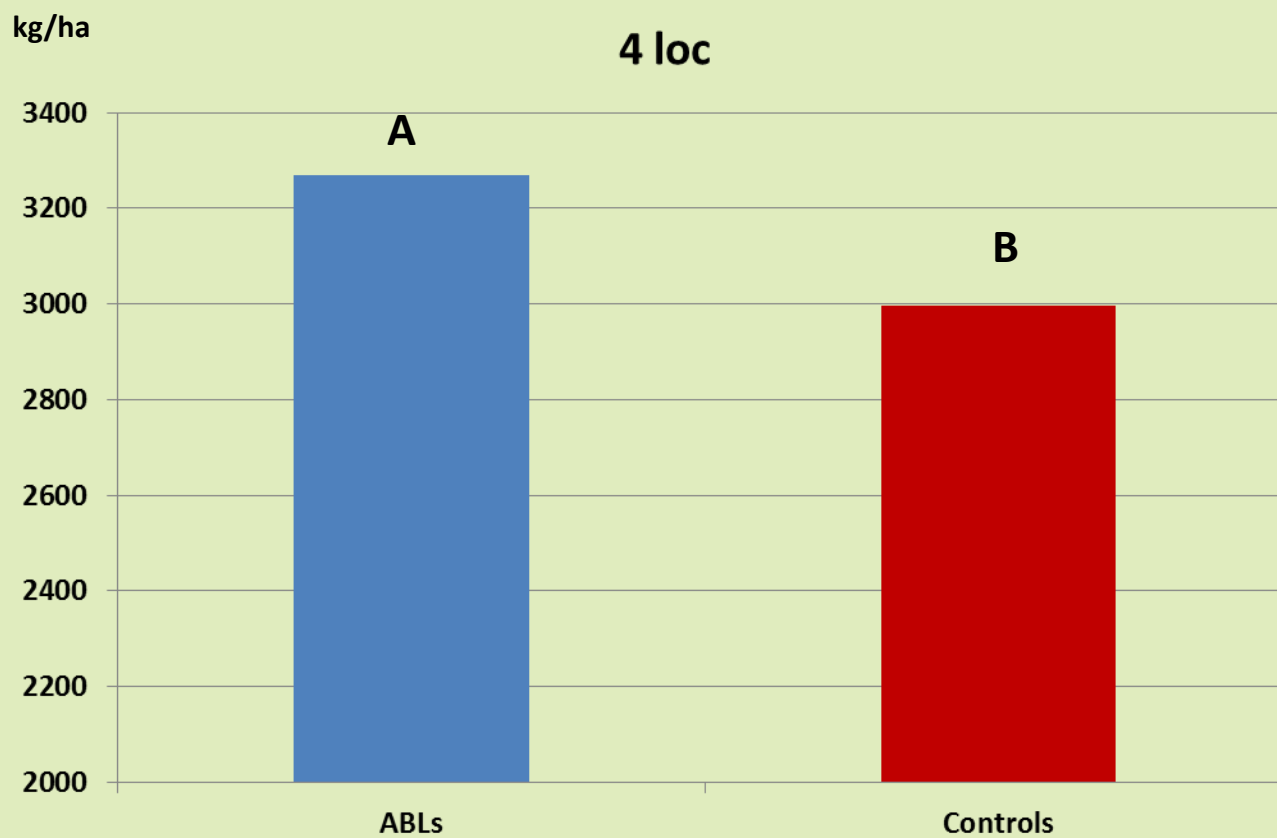
Controls had superior yields

Location with low yields comparing with any other

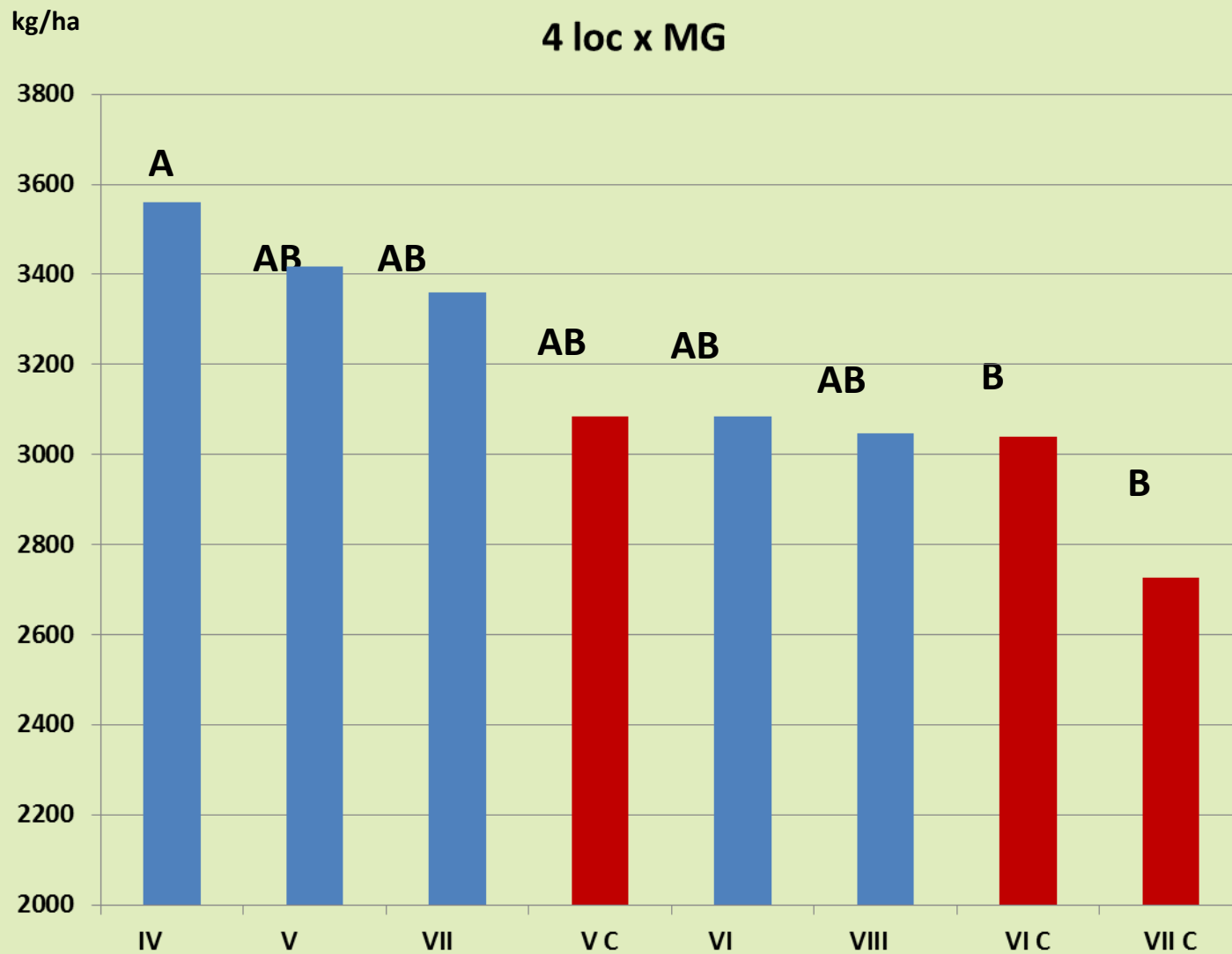
4 locations AVERAGE YIELDS



CONTROLS & ABLs

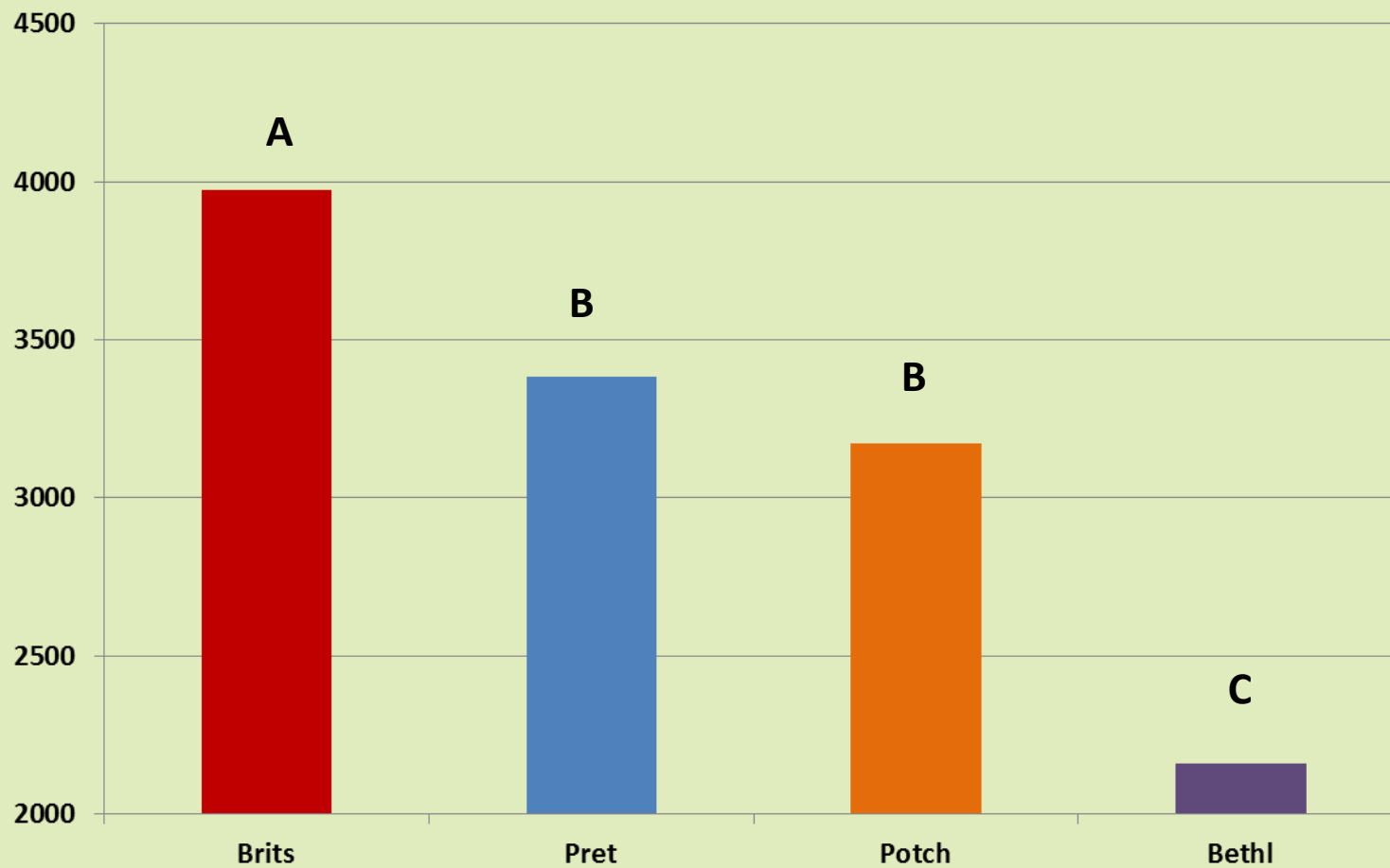


AVERAGE YIELDS



kg/ha

Average Locs





- Results of these trials showed that the best materials belonged principally to MG V, VI, and short VII.
- EEAOC lines reached a 9% yield increase as compared to the local checks.
- Some genotypes did so well at different localities and under irrigation. Genotypes actually behave as a longer MG that they really are in South Africa conditions.
- There were promising genotypes and it is necessary continued working in coming seasons.



The second phase took place in the 2011/2012 season. Sixteen ABLs were compared with six commercial checks. Trials were planted at five locations: the same four as in the previous season, plus Howick (KwaZulu Natal province).

Five trials were planted at different locations:

- Pretoria (Gauteng province-1.369 m) Lat, 25,44
- Brits (Northwest province-1.087 m) Lat, 25,35
- Potchefstroom (Northwest province-1.349 m) Lat, 26.44
- Bethlehem (Free State province-1.639 m) Lat, 28,09
- Howick (KwaZulu Natal province-1.046 m) Lat, 29,30

Each trial included new representative ABLs of MG V, VI (det and Indet), which were compared with the best local cultivars as controls (same of last year).



Each trial included representative ABLs of MG V and VI and 1 IV late, which were compared with the best local cultivars as controls.

Advanced Breeding Lines

1	V-1
2	V-2
3	V-3
4	V-4
5	V-5
6	V-6
7	V-7
8	V-8
9	V-9
10	VI-d-1
11	VI-d-2
12	VI-i-1
13	VI-i-2
14	VI-i-3
15	VI-i-4
16	LA IV 2

Controls

1	LS 6162 R
2	PAN 535 R
3	PAN 1664 R
4	LS 6164 R
5	LS 6150 R
6	PAN 737 R



4 Rows/plot - Rows width 45 cm

3 Replications

Irrigation (Pretoria-Brits)

Fertilizer (superphosphate)

Planting dates

Pretoria: 01/11/2011

Brits: 08/11/2011

Potch: 09/11/2011

Bethl: 03/11/2011

Howick: 15/12/2011

Fisher Test was used to analyze the data for significant differences

Pretoria

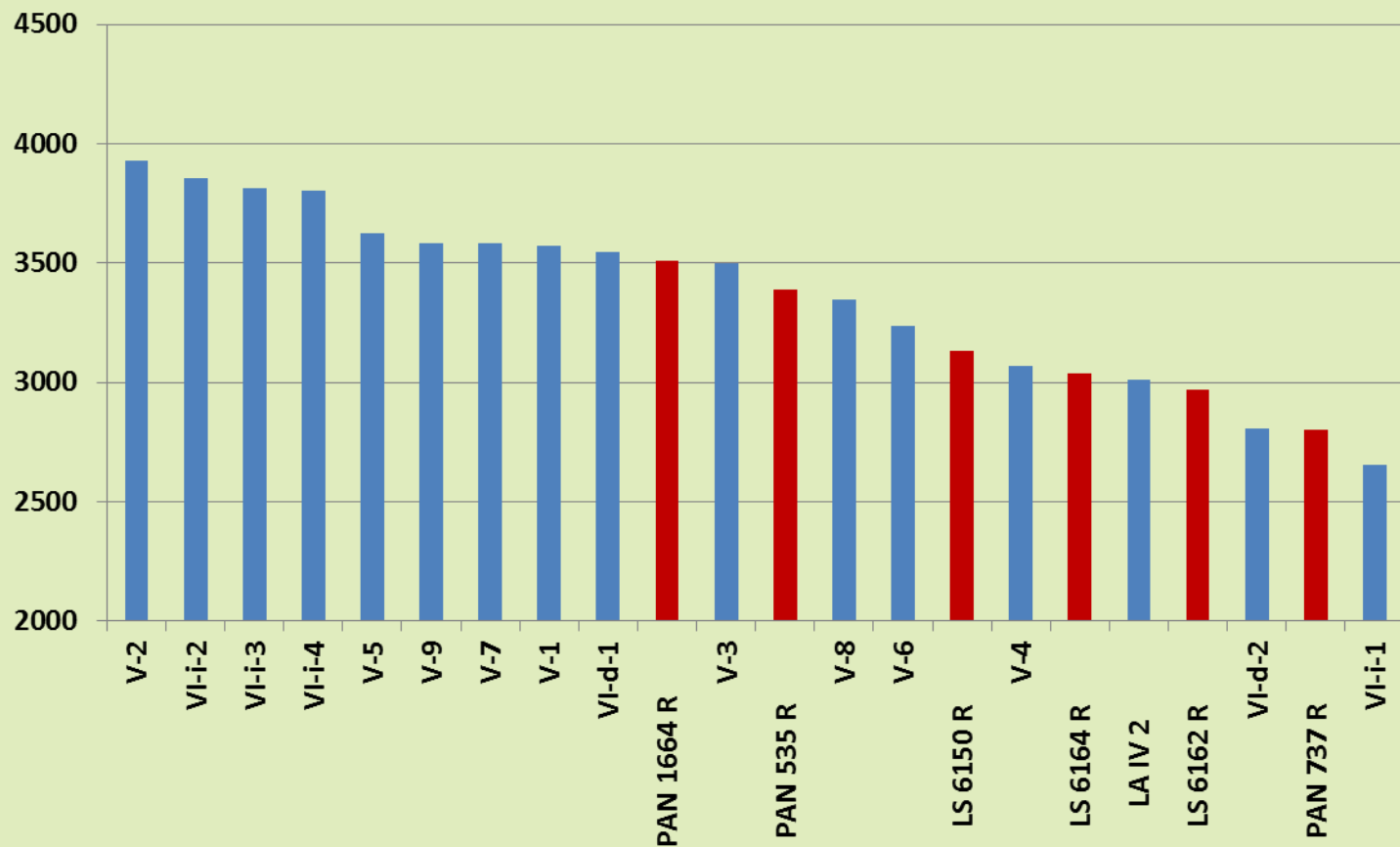


AVERAGE YIELDS

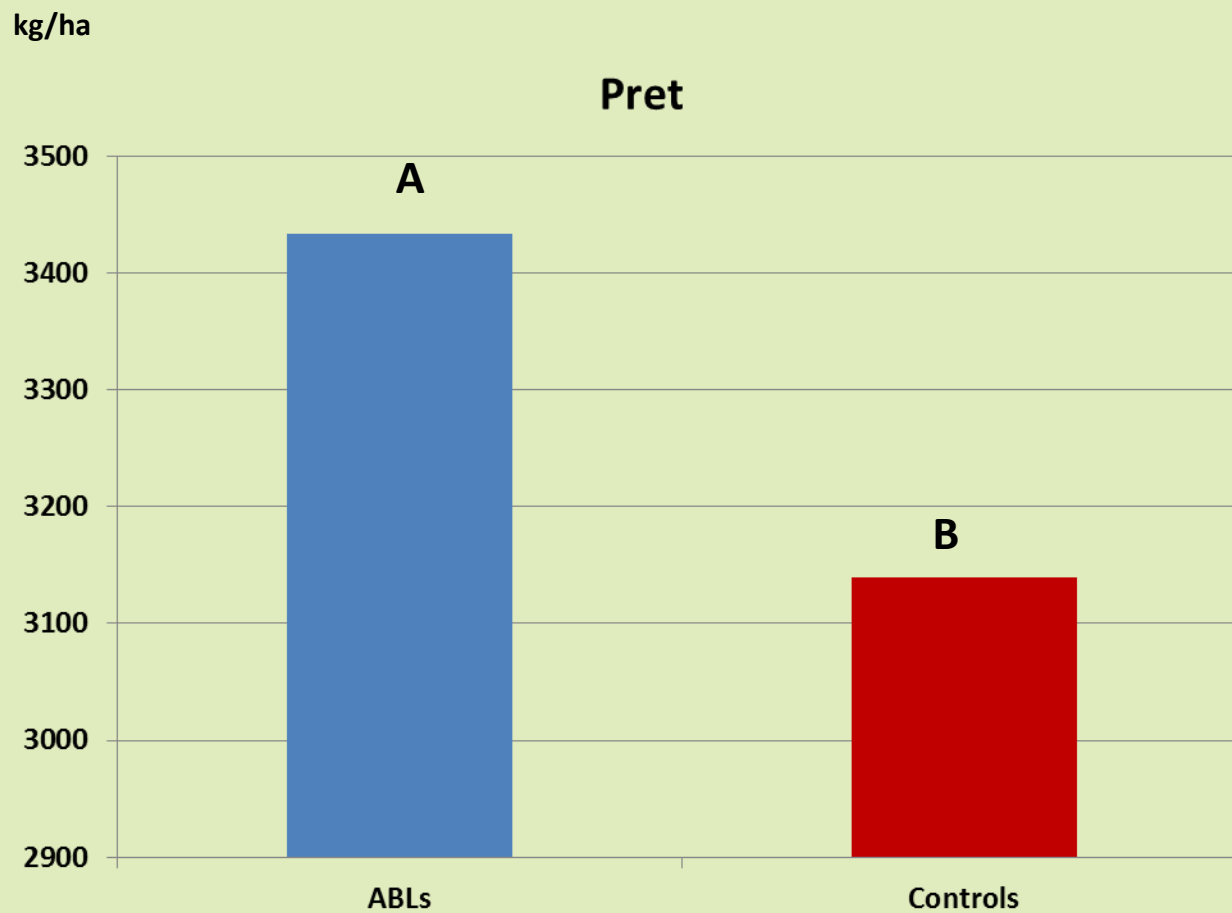


kg/ha

Pretoria



CONTROLS & ABLs





Pretoria

Most ABLs had superior yields comparing with cheks

Location with good yields

> 9%

Brits

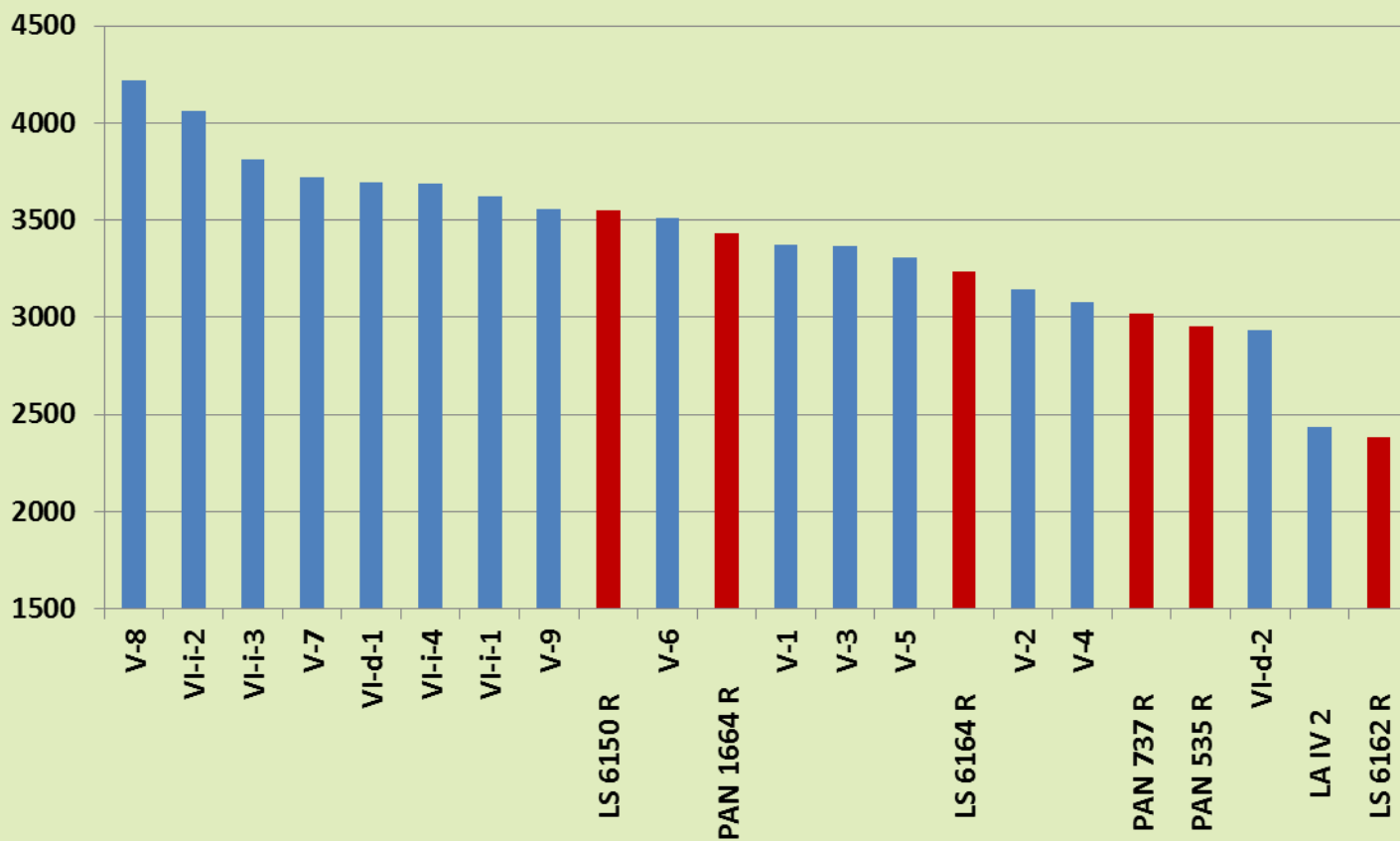
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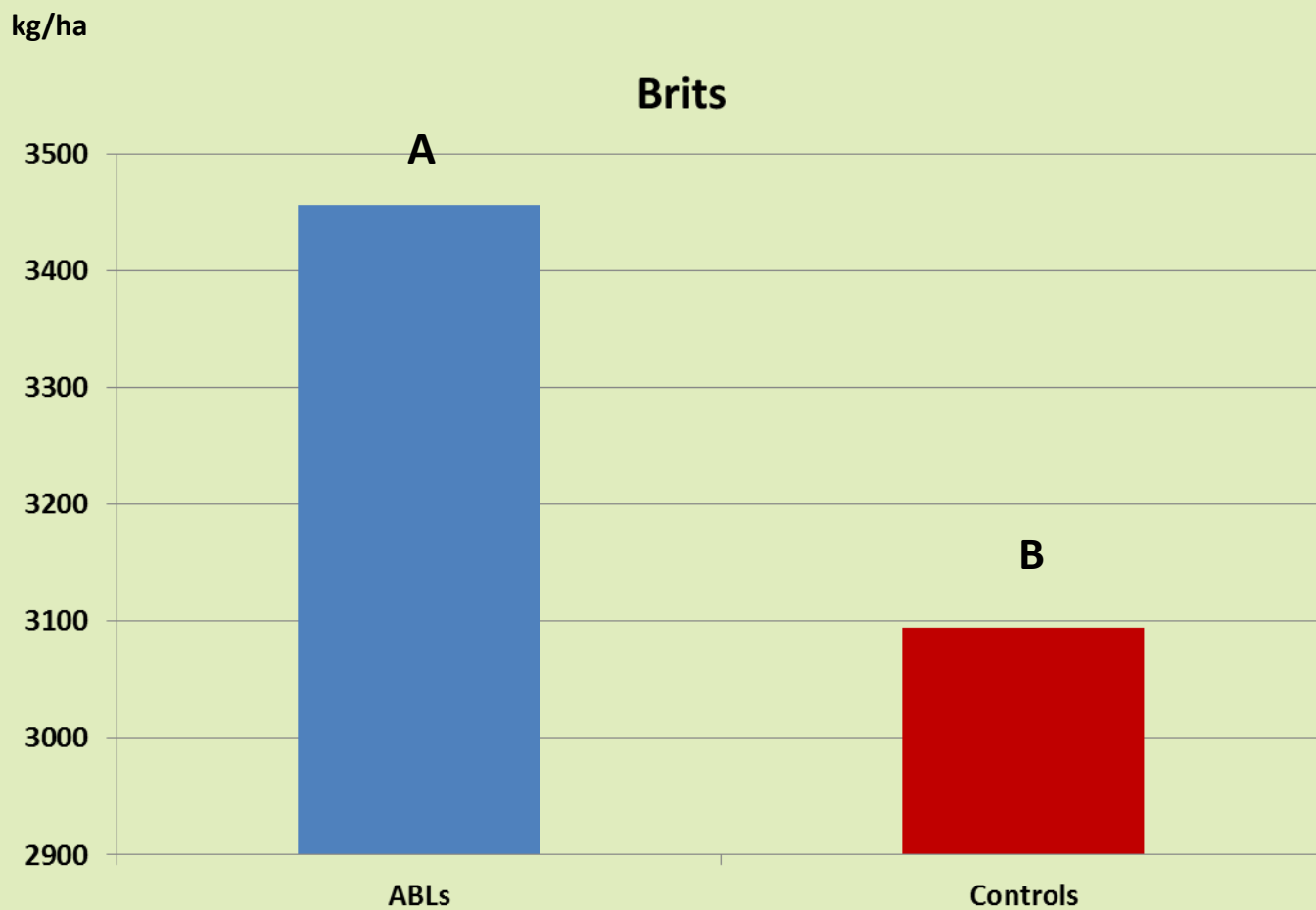
AVERAGE YIELDS

kg/ha

Brits



CONTROLS & ABLs





Brits

ABLS with superior yields

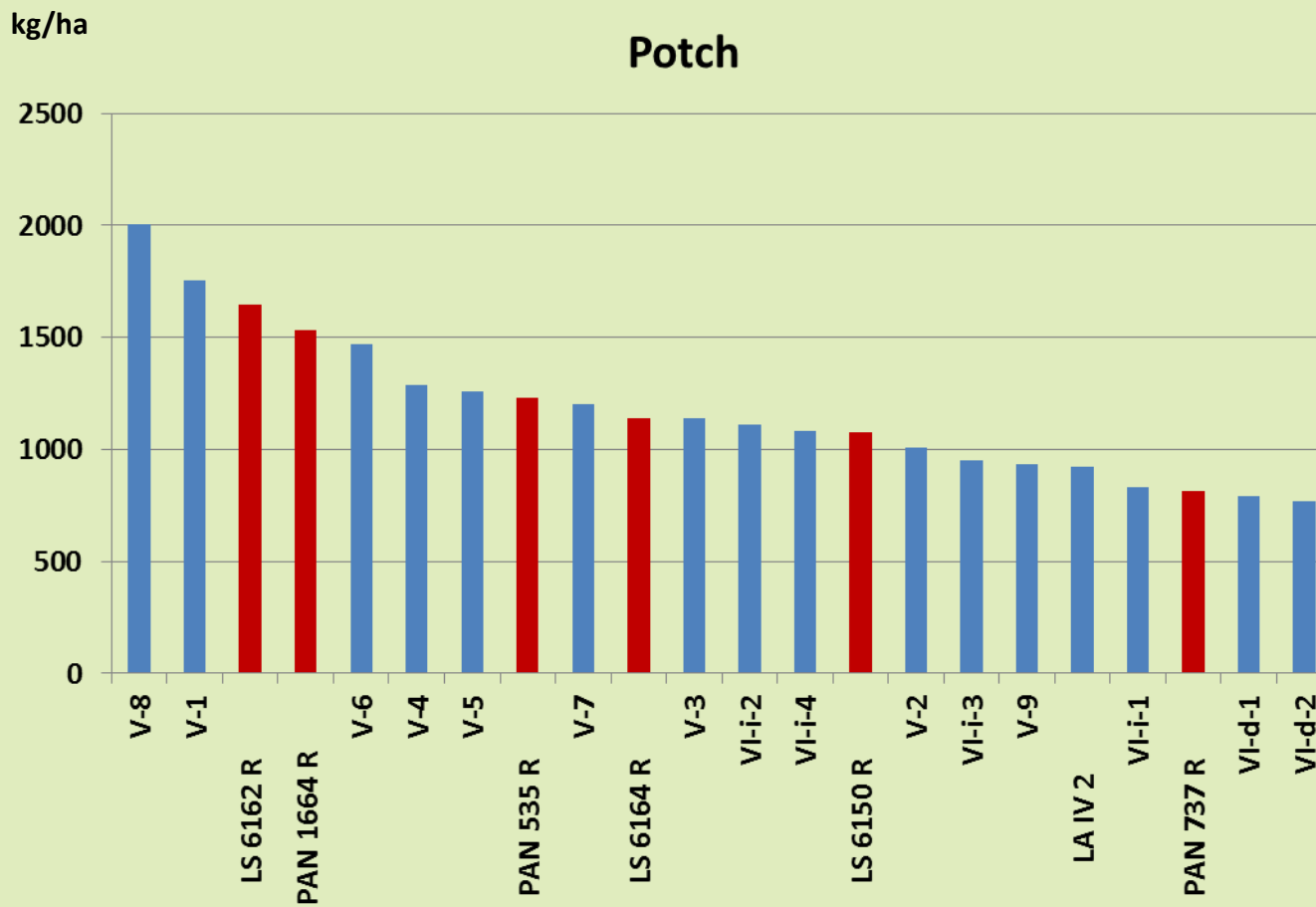
Location with high yield

> 12%

Potchefstroom



AVERAGE YIELDS



CONTROLS & ABLs





Potchefstroom

Similar yields among ABLs with controls

The yields at this location were very low

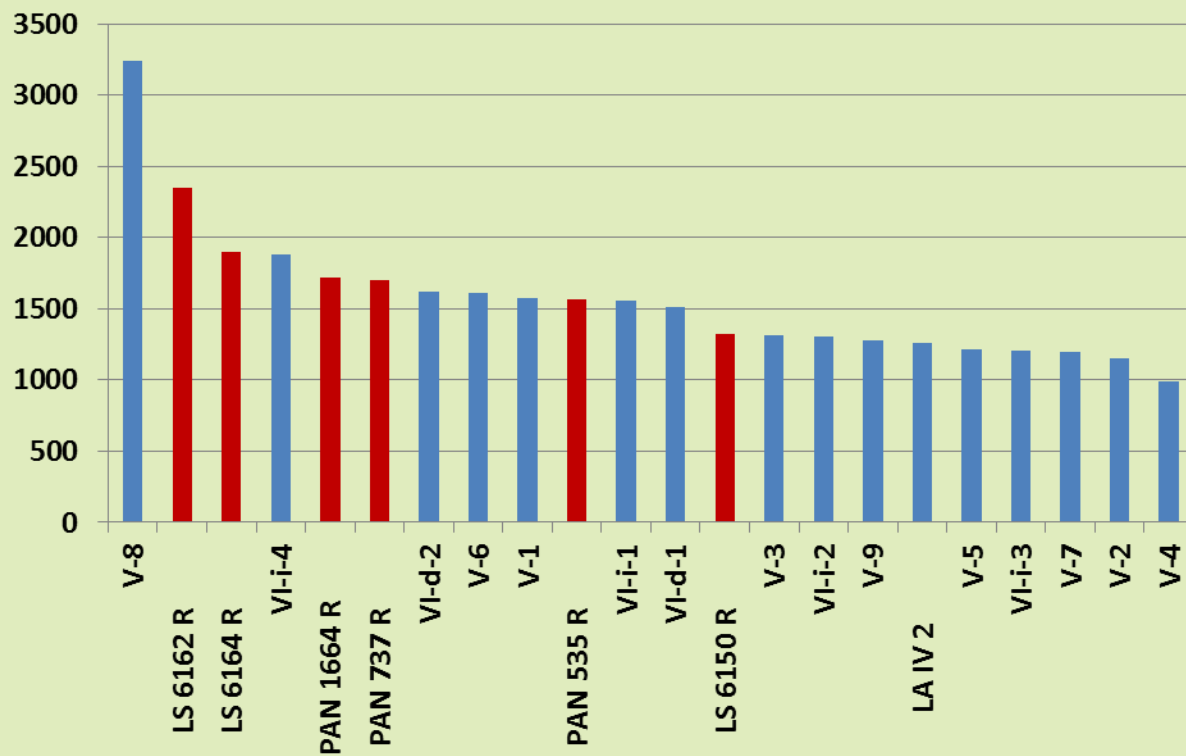
Bethlehem



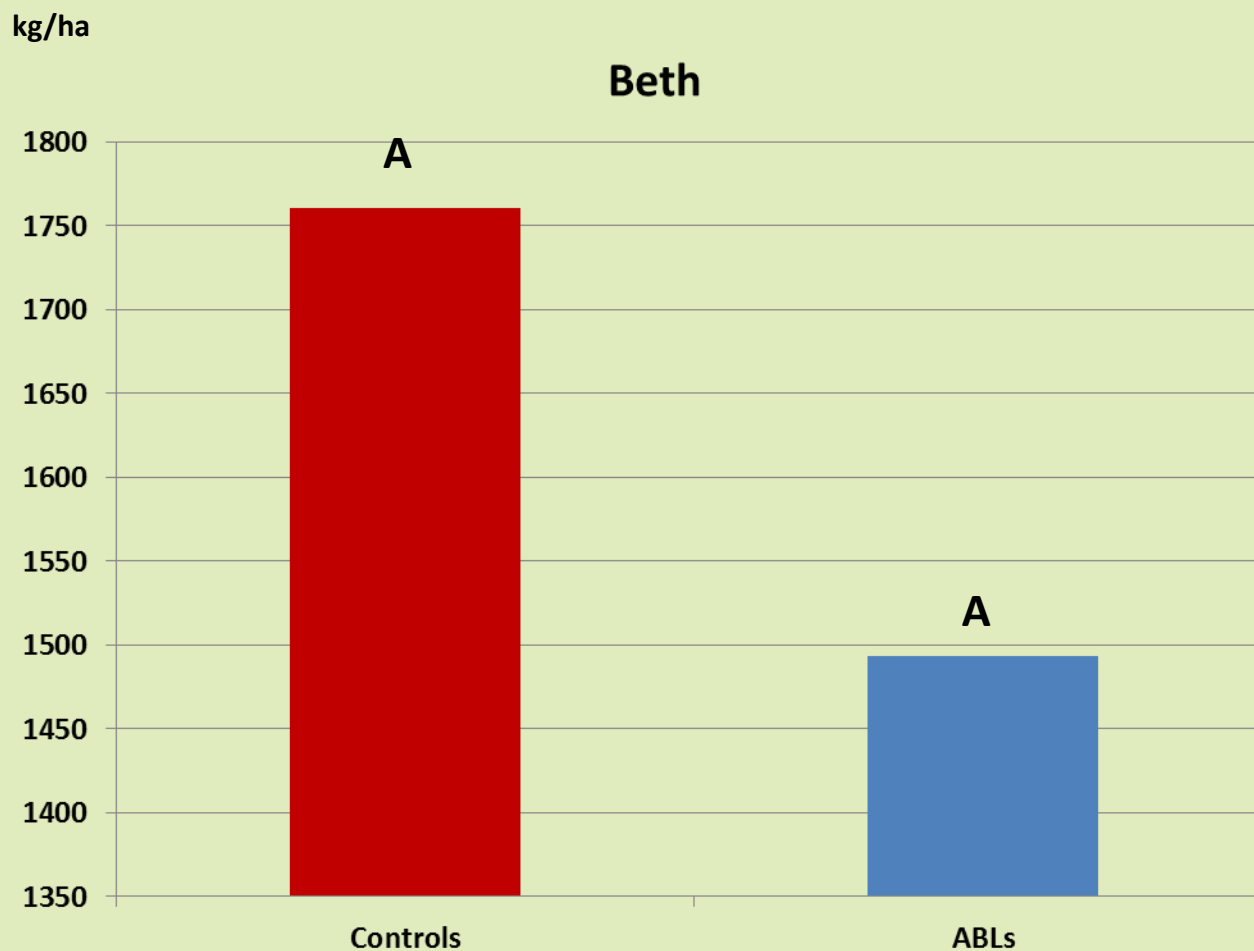
AVERAGE YIELDS

kg/ha

Beth



CONTROLS & ABLs





Bethlehem

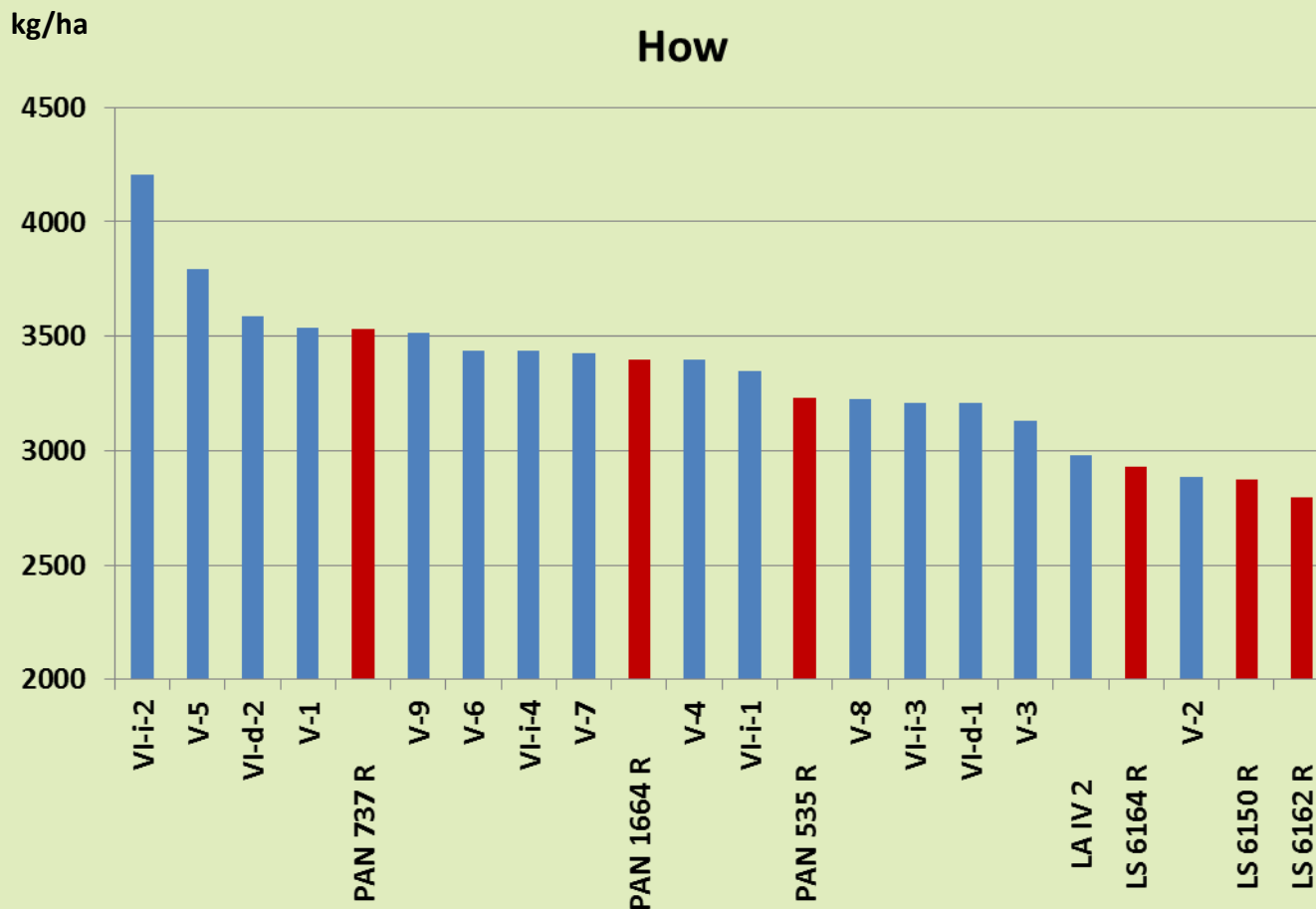
Most control with superior yields (17%)

Location with low yields

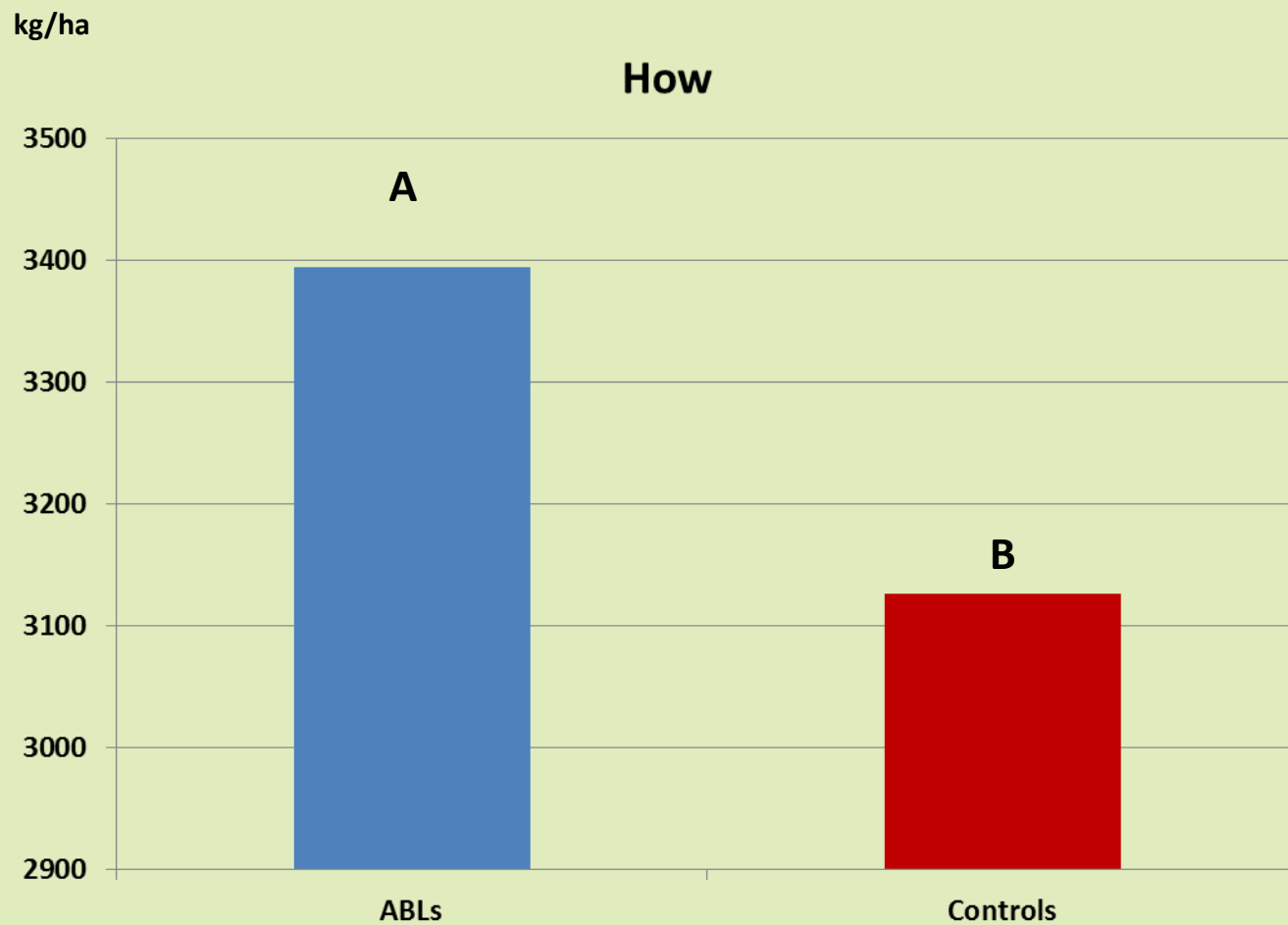
Howicks



AVERAGE YIELDS



CONTROLS & ABLs





Howicks

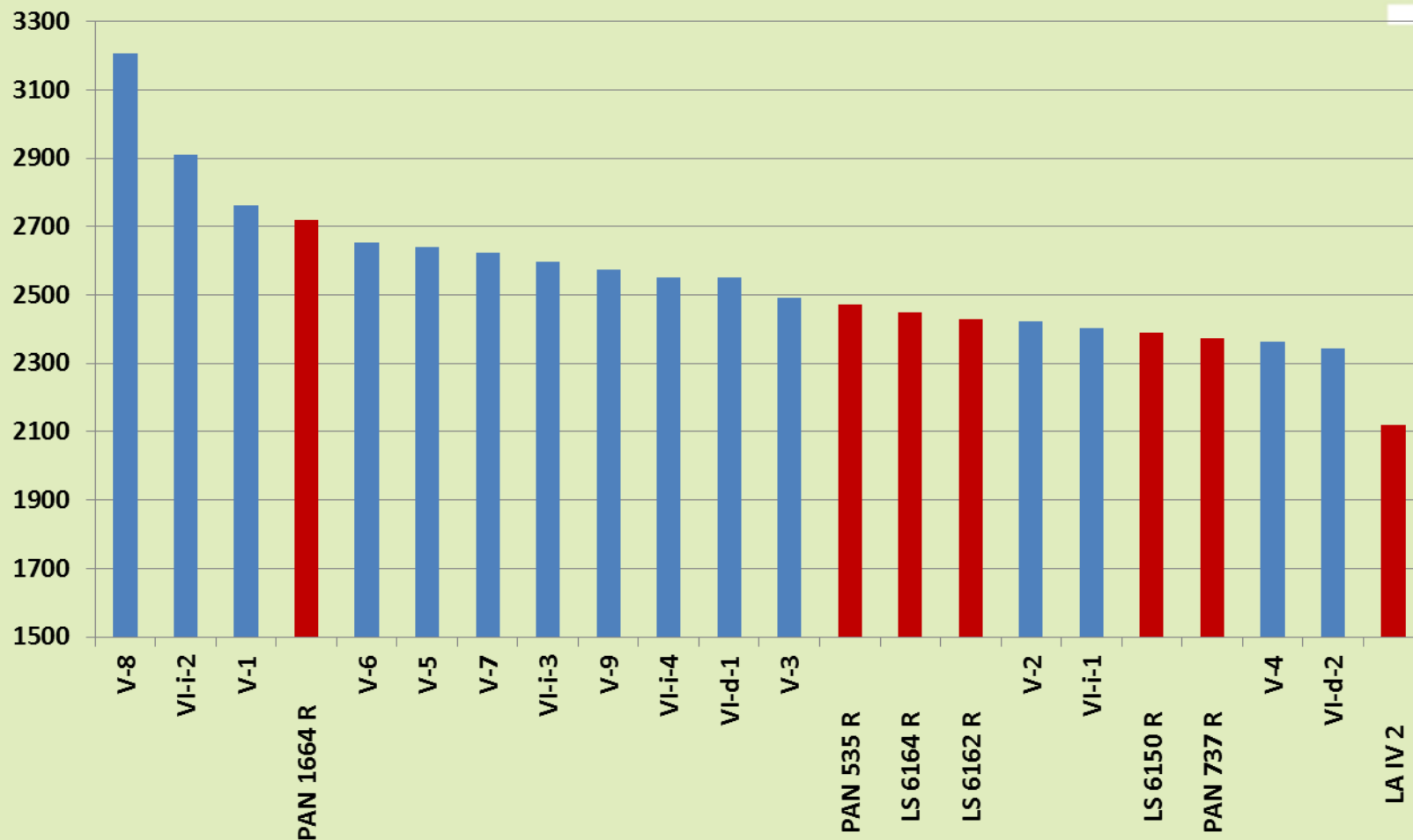
Most ABLs with superior yields

Location with good yields

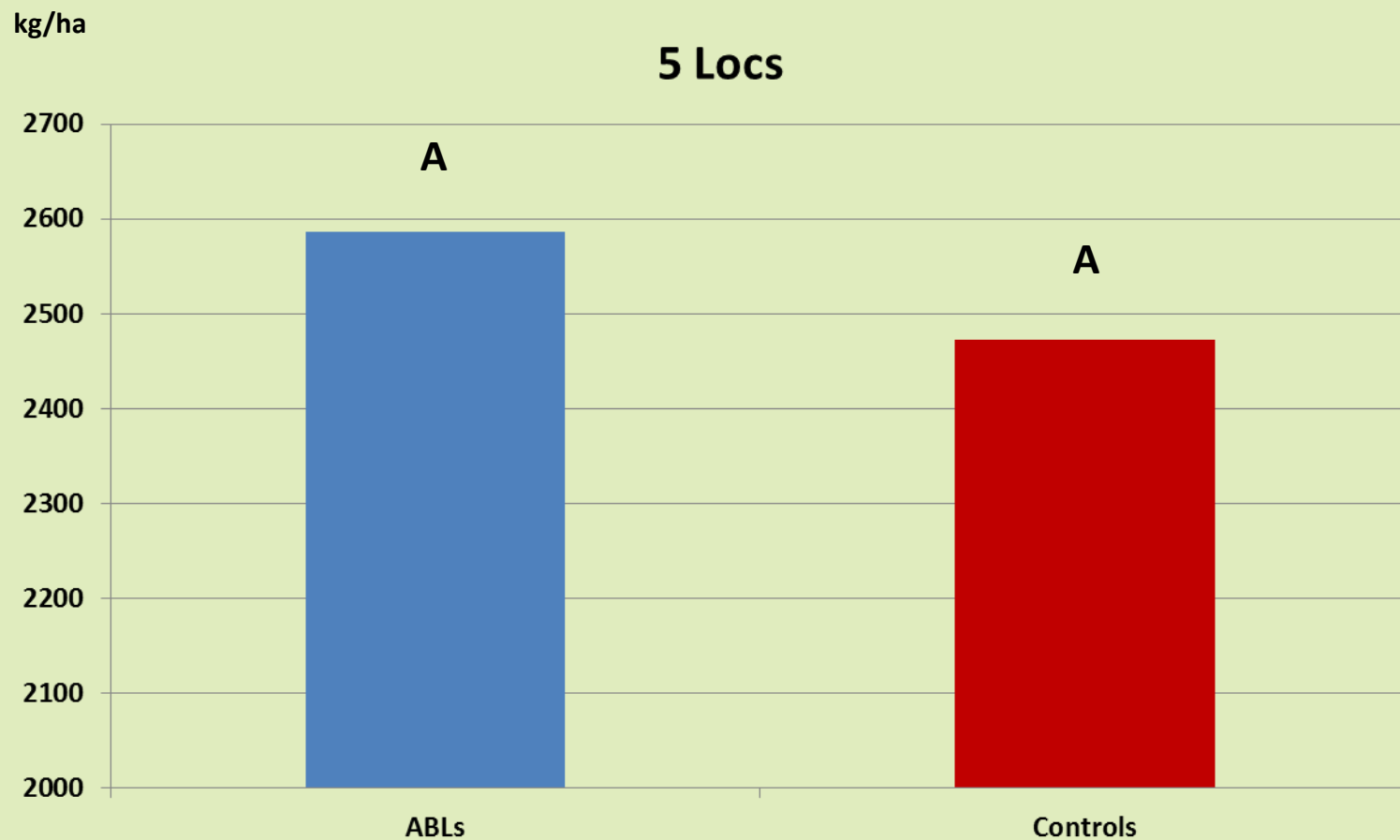
> 9%

5 locations AVERAGE YIELDS

kg/ha

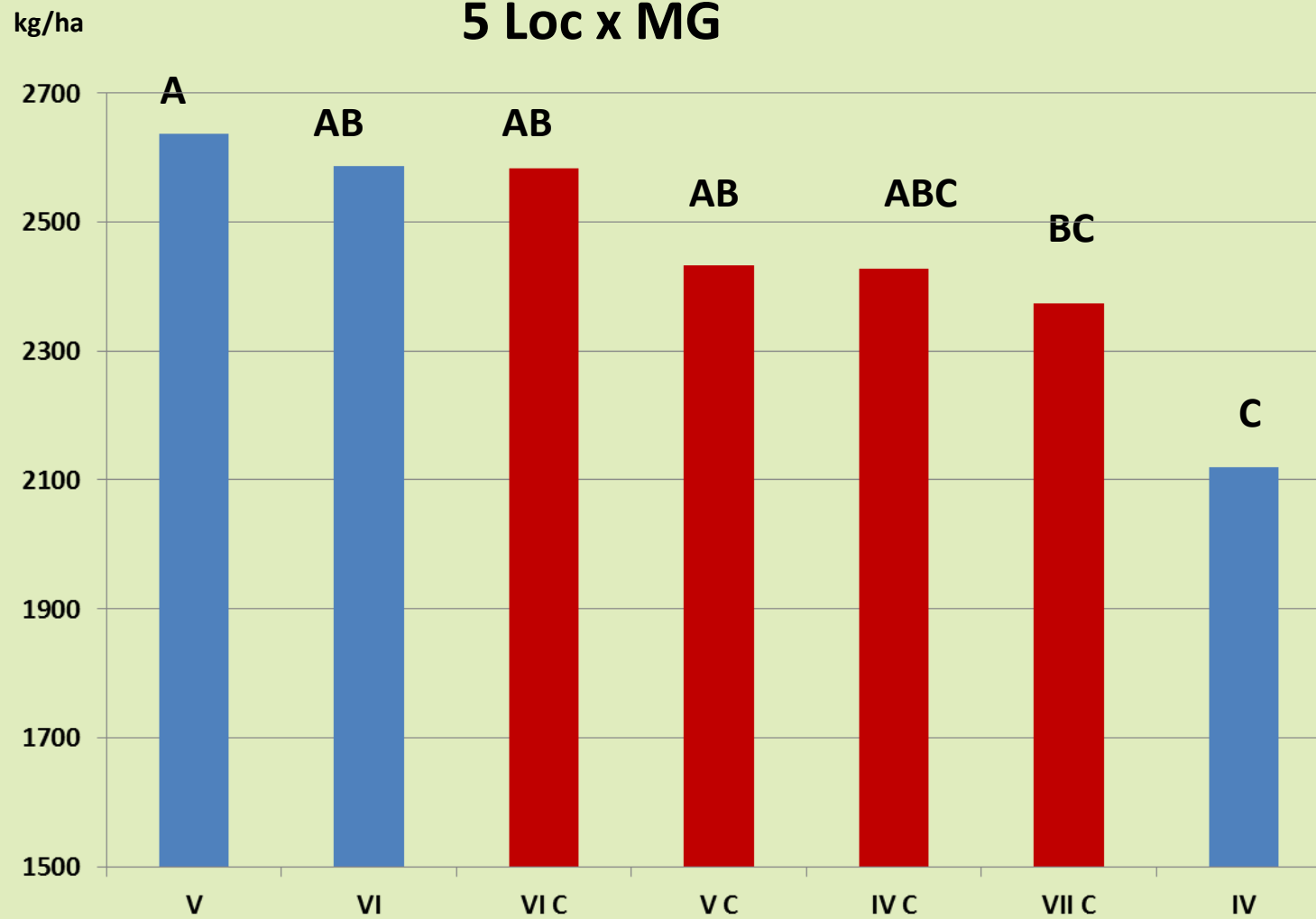


CONTROLS & ABLs



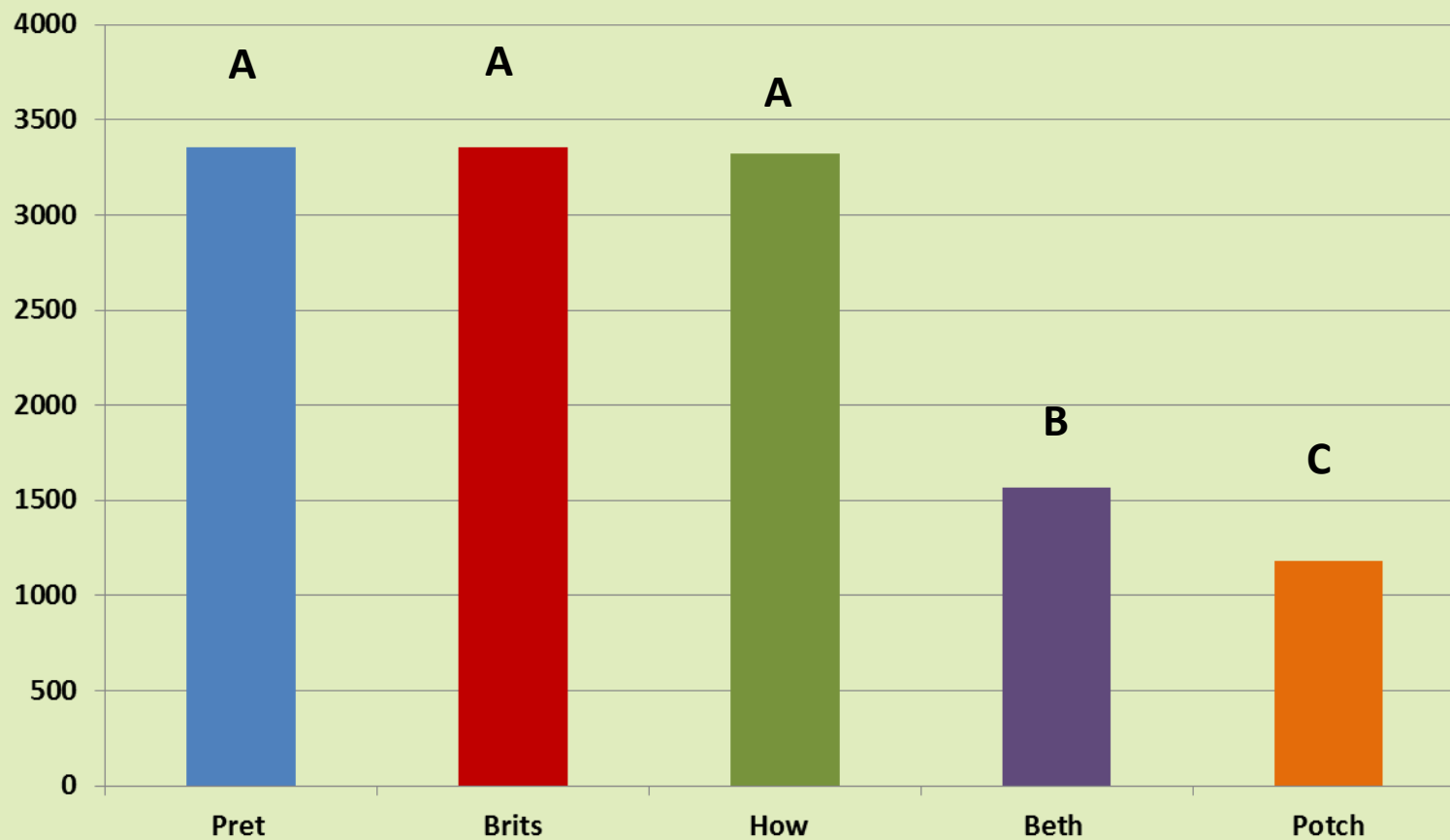
AVERAGE YIELDS

5 Loc x MG



kg/ha

Average Locs





CONCLUSIONS



- Considering results from each location, the ABLs showed average yield increases of 12% at Brits and 9% at Howick and Pretoria, in comparison with the controls.
- At Potchefstroom and Bethlehem, both locations affected by a severe drought, the ABLs did not perform better than the controls.
- Results from these trials revealed that the ABLs were highly promising and the average of them stood out with a 5% higher yield than the local checks average.



CONCLUSIONS

- ABLs yields showed good results at most locations (2 seasons).
- ABLs need good environments to express all their potential yield .
- MG V & VI had the best performance. (same of 2010/11 season).
- According with previous experiences, the most soybeans in South Africa are cultivated in the cool to moderate climate regions where it is necessary short MG cultivars with high yield
- It is especially important soybeans with a short season in order to try and side step sclerotinia which is a very common disease in these regions.
- Results from these first two seasons are considered preliminary and need to be confirmed with further evaluations.

Thank you for your kind attention

Ing. Agr. Fernando Ledesma

Grain Program

**Estación Experimental Agroindustrial Obispo Colombres
Tucumán, Argentina**



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