

EVALUATION OF ARGENTINEAN SOYBEAN LINES IN THE NORTH-EAST OF SOUTH AFRICA

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In 2009, the Protein Research Foundation (PRF) of South Africa and the National Institute of Agricultural Technology (INTA) of Argentina signed a Memorandum of Understanding (MOU) with the main objective to evaluate Argentinean soybean genotypes in South Africa. Twenty five INTA soybean experimental lines and seven local controls were sown in 11 environments, 5 sites in 2009 and 6 sites in 2010 in the north-east of South Africa. Variables like yield, lodging, shattering and green stem syndrome were recorded. The trial design was a randomized complete block design with 3 replications. A statistical variance analysis was made adjusted as a factorial design with the replications nested within the factor environment and a multivariate analysis GGE Biplot was made in order to study the stability of the genotypes and the occurrence of mega-environments. Yields were between 3250 and 2299 kg/ha and a significant genotype by environment interaction was observed which indicates that the average yield differences between the genotypes were not stable in the different environments. Significant differences between the environment and genotypes were also observed. The best average yields were observed in 2010/2011, mainly associated with a correct sowing date (November). The INTA soybean lines LAE9972503 (3150 kg/ha), J071283 (3127 kg/ha), J031891 (3119 kg/ha), LAE9649001 (3093 kg/ha), J032998 (3041 kg/ha) and J040095 (3037 kg/ha) stood out with the best yields, higher than the controls ($P < 0.005$). Therefore, this soybean line can be selected for future stages of the MOU. They belong to the Maturity Groups 4 - 6, being excellent genotypes to be sowed in the north-east of South Africa. In addition, they showed low lodging, shattering and green stem syndrome. The two main components of the biplot analysis explained 59,9% of the variation and defined 4 mega-environments with the best soybean lines in each one. The soybean line J071283 showed the greatest yield stability in all environments.

Evaluation of Argentinean Soybean Lines in the North East of South Africa

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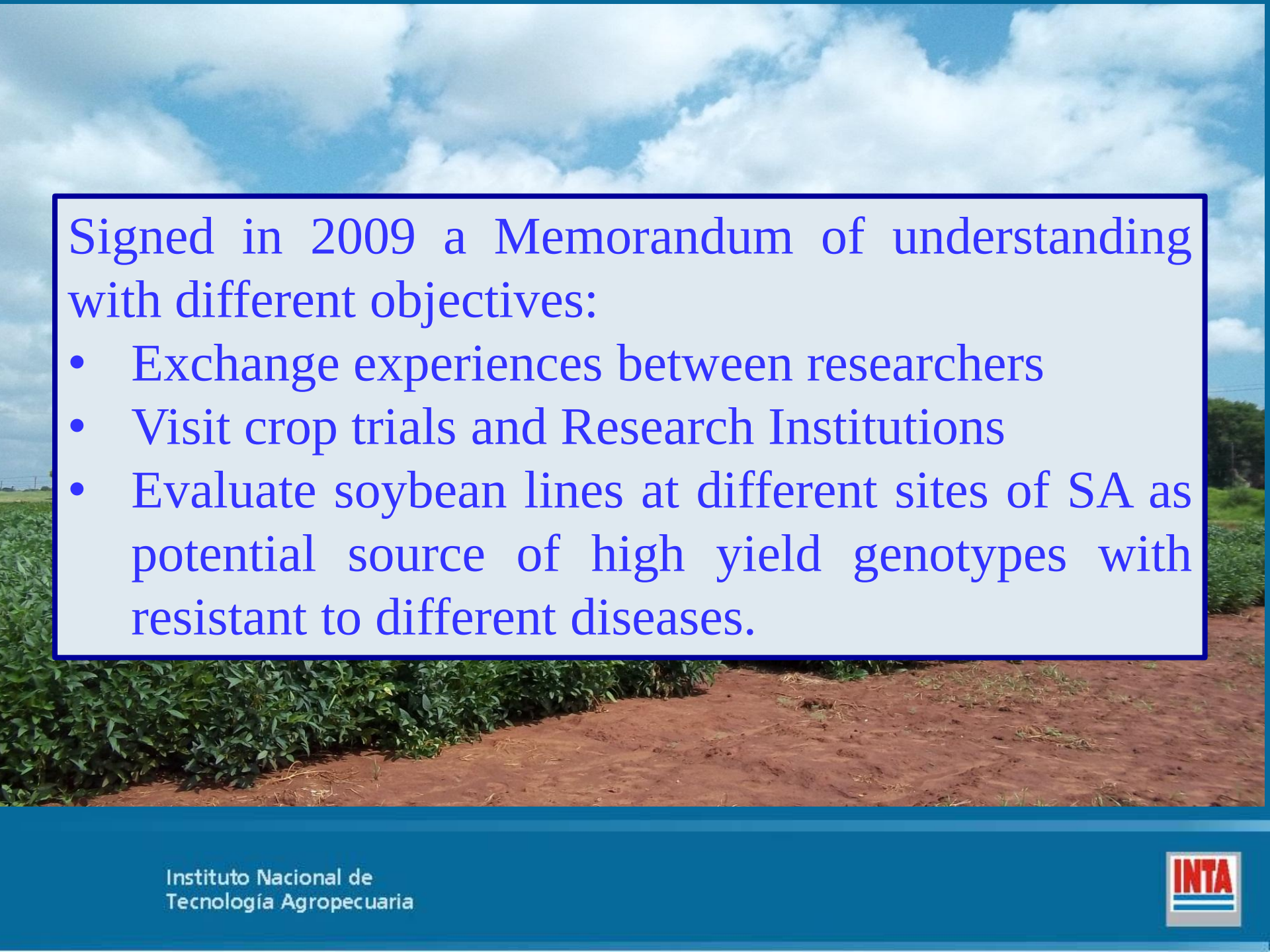
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PROTEÏENNAVORSINGSTIGTING
PROTEIN RESEARCH FOUNDATION

INTA: Establish and consolidate links with Institutions of other countries associated with agricultural research and technology. www.inta.gob.ar

PRF: Stimulate and fund research in order to increment the protein production for animal nutrition in the RSA www.proteinresearch.net



Signed in 2009 a Memorandum of understanding with different objectives:

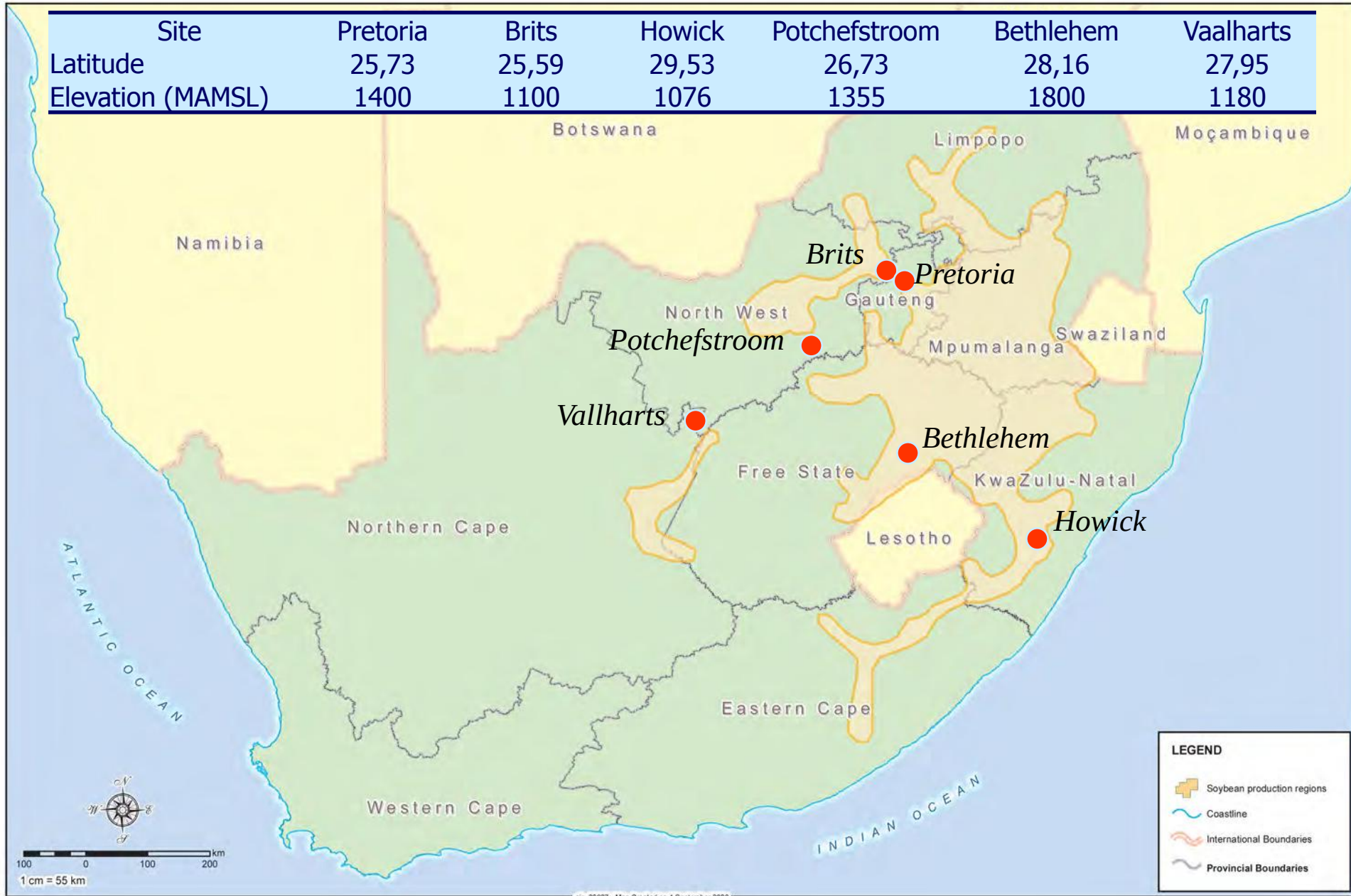
- Exchange experiences between researchers
- Visit crop trials and Research Institutions
- Evaluate soybean lines at different sites of SA as potential source of high yield genotypes with resistant to different diseases.



Consortium's soybean production regions

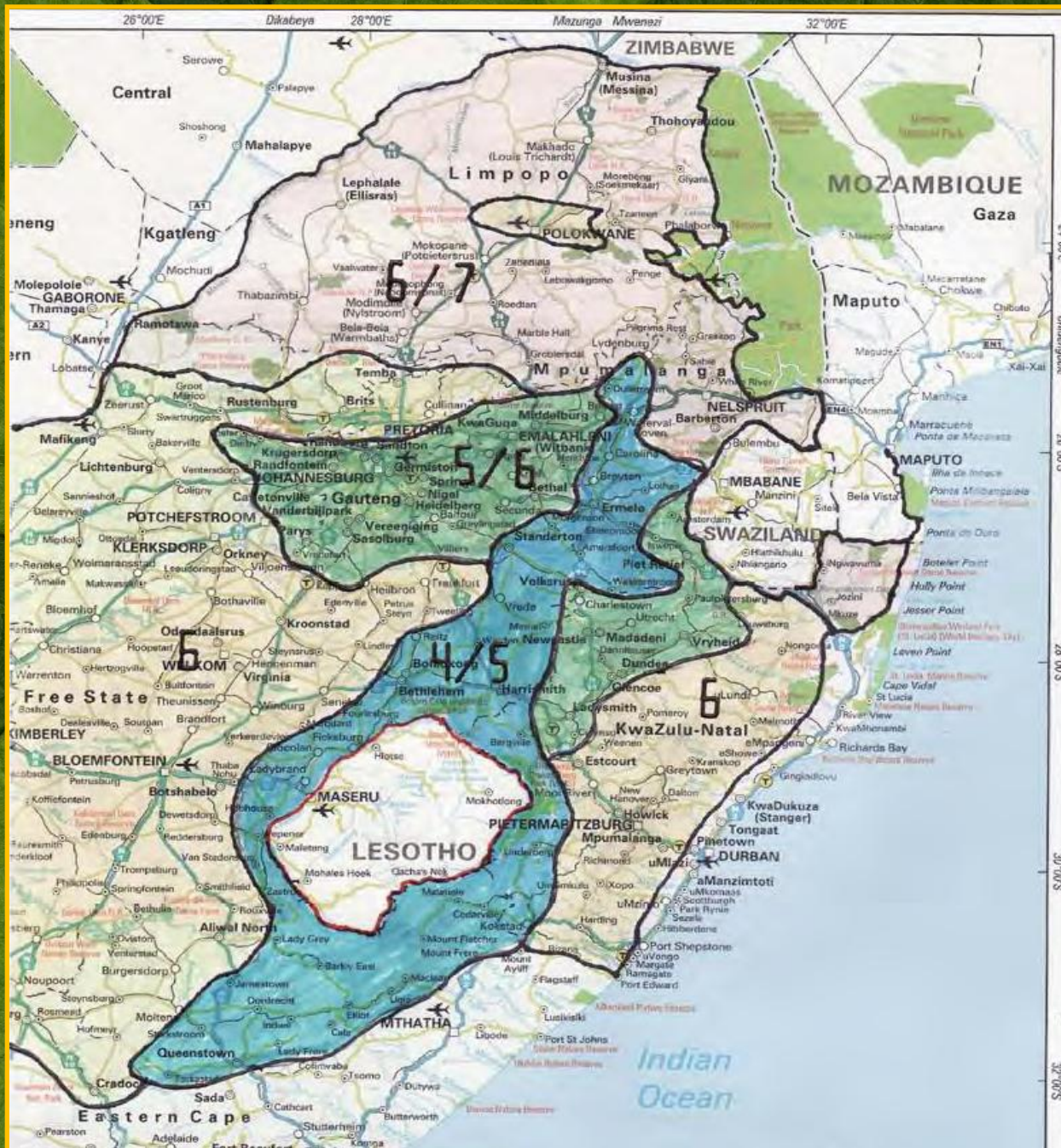


Site	Pretoria	Brits	Howick	Potchefstroom	Bethlehem	Vaalharts
Latitude	25,73	25,59	29,53	26,73	28,16	27,95
Elevation (MAMSL)	1400	1100	1076	1355	1800	1180



LEGEND

- Soybean production regions
- Coastline
- International Boundaries
- Provincial Boundaries



Soybean lines of INTA: 25

N of controls of South African seed companies: 7

Design: Randomized complete block design

N of Replications: 3

Sowing date

2009-2010 -11 December 2009

2010-2011 -17 November 2010

Distance between rows (cm)

90/45

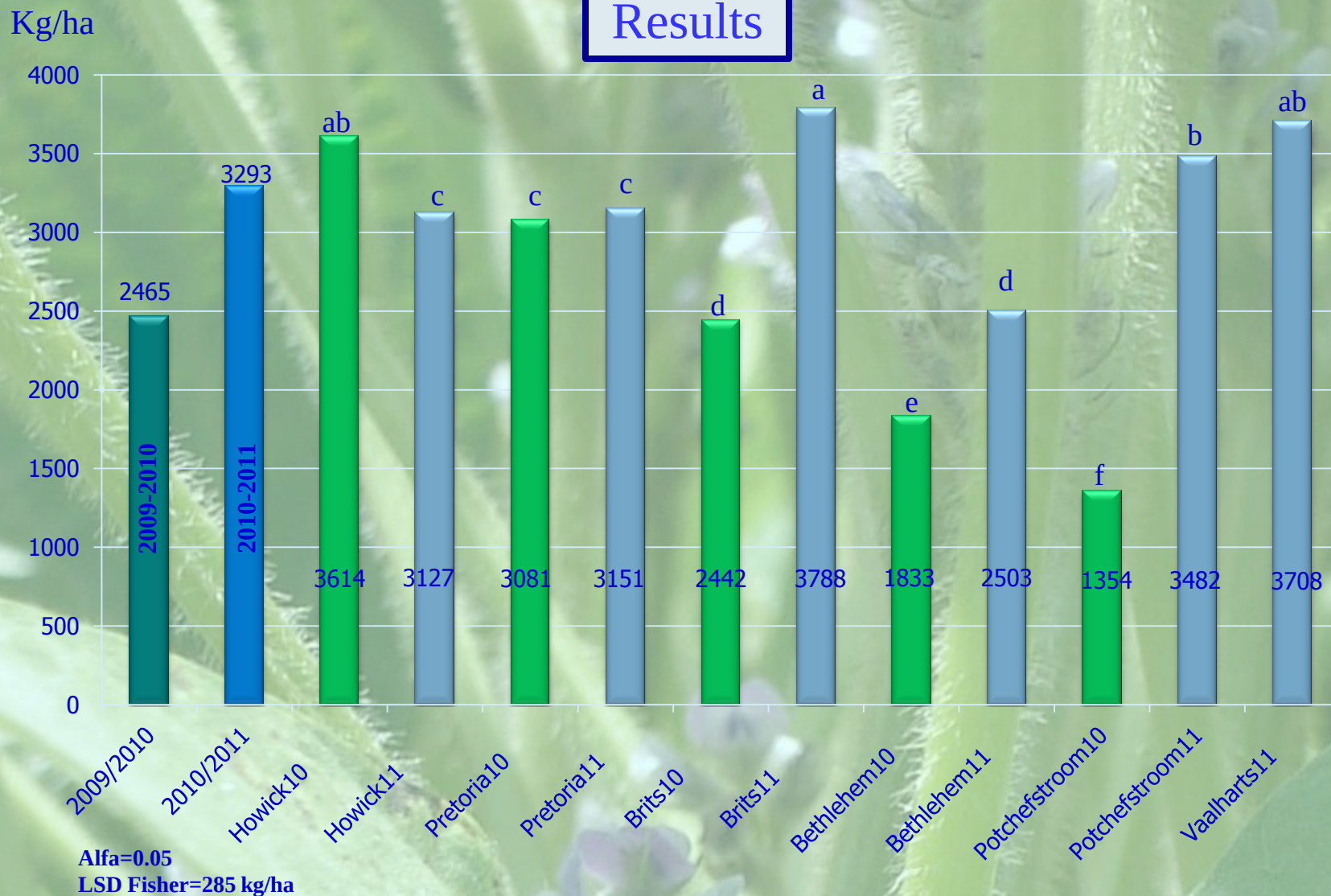
24-18 pl/m

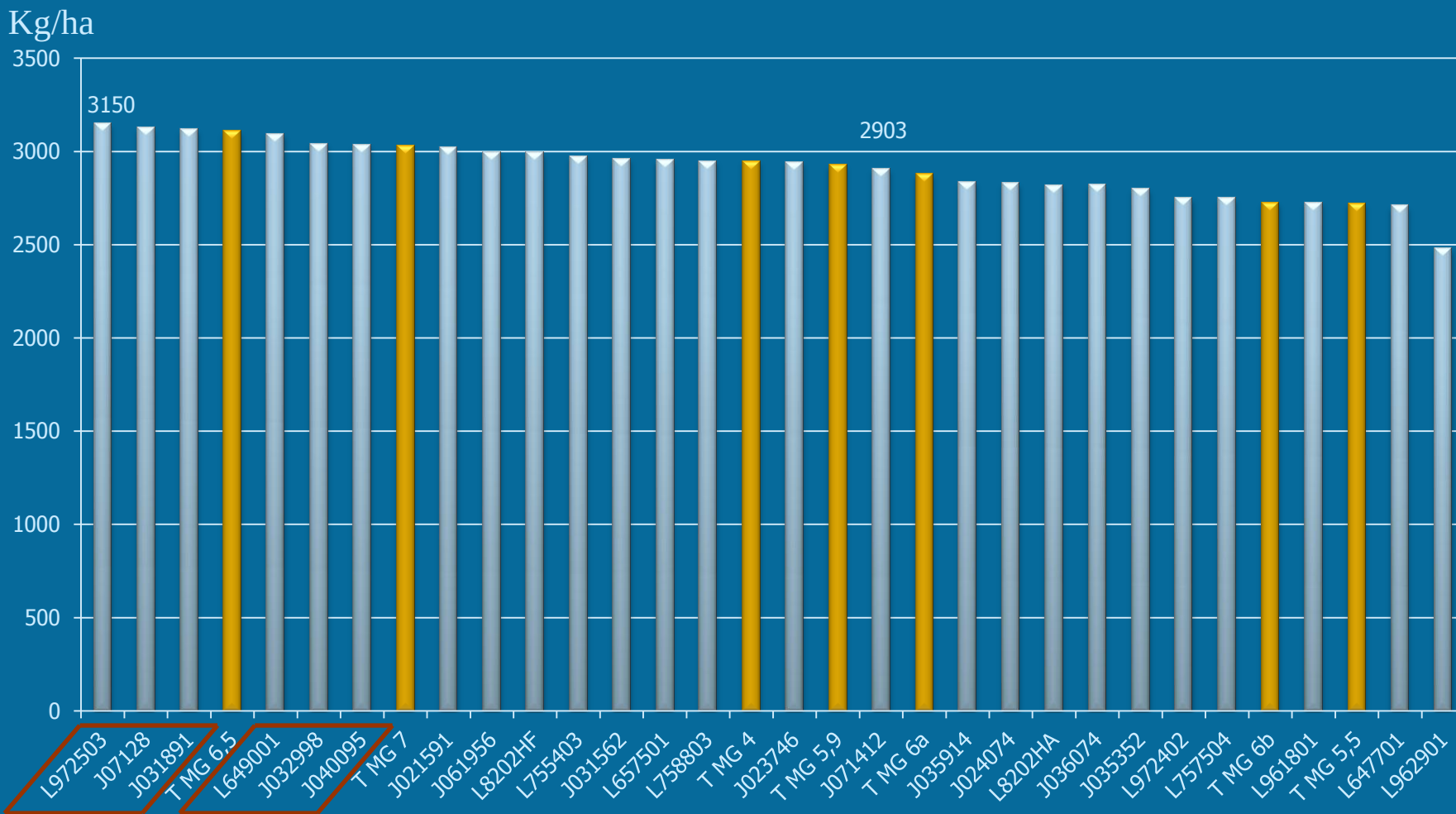


- Variables: yield (kg/ha), lodging (1-9), shattering (1-9) and green stem syndrome (1-9).
- An ANOVA was made adjusted as a factorial design with the replications nested within the factor environment.
- The interaction $G \times E$ was studied with a program developed by Masiero & Castellano (1991) that use the IML procedure of SAS and a GGE Biplot analysis was made with the Infogen Software (2011).

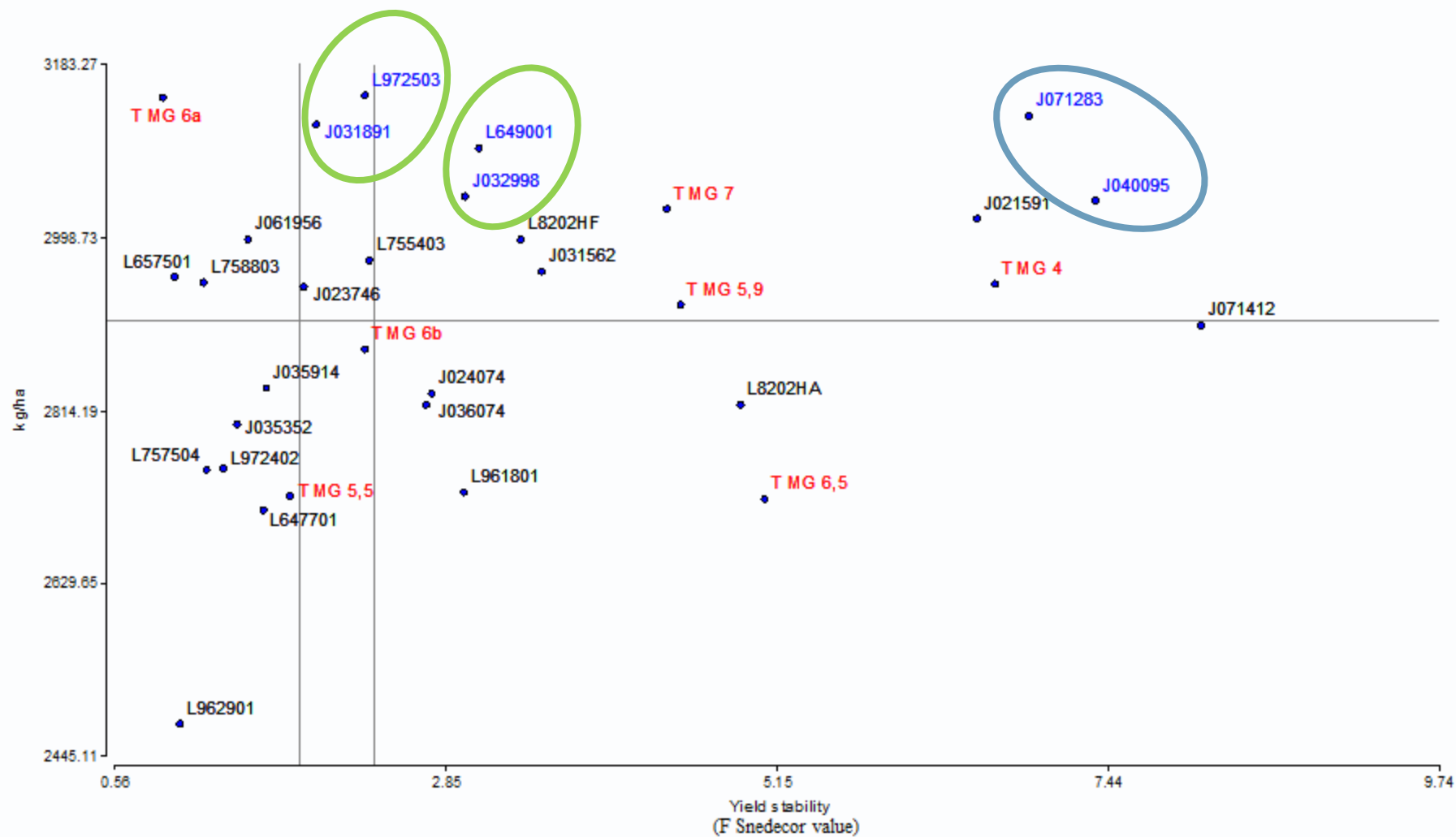


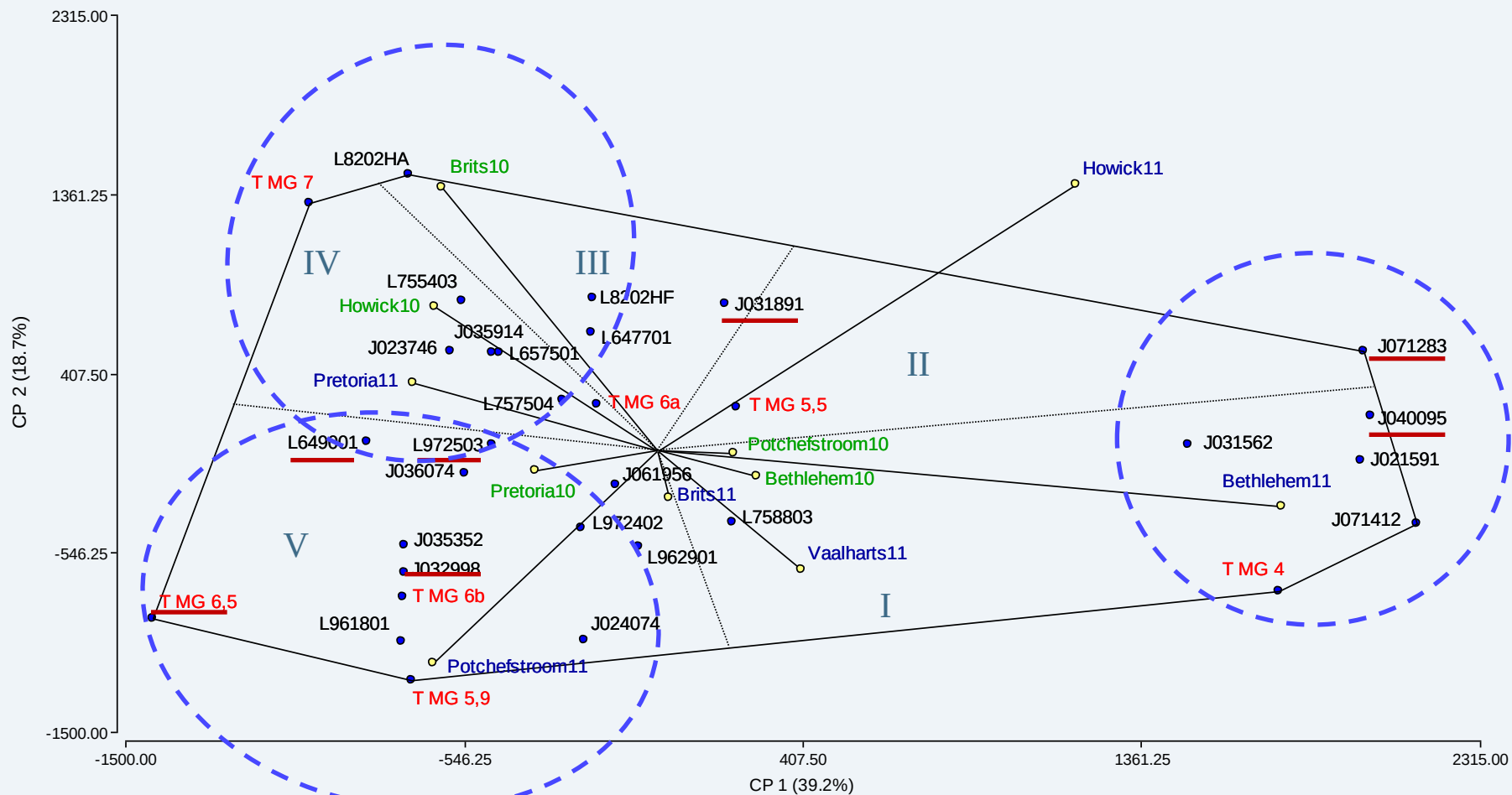
Results





LSD Fisher Alfa=0.05
DMS=231

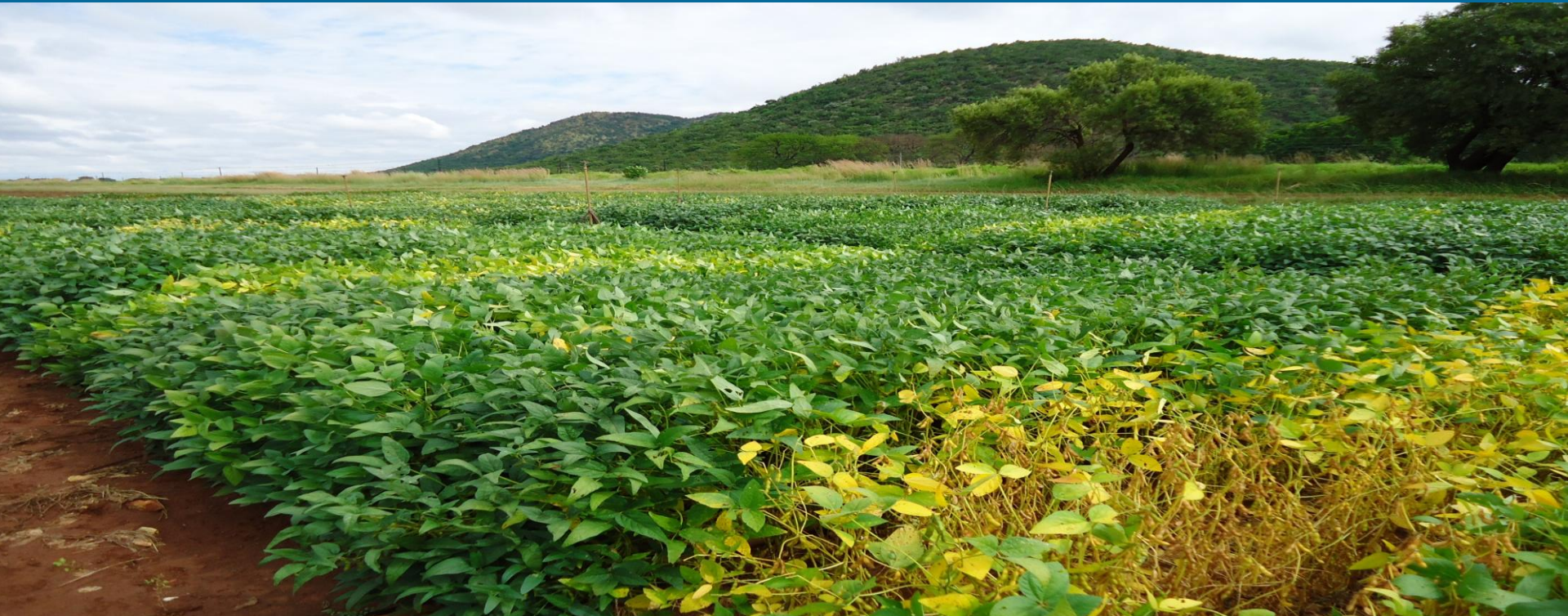




N	Genotype	MG	GH	LODGING (1-9)	GSSYNDRO (1-9)	SHATTER (1-9)
28	LS6162	4	I	1	1-2	1-3
10	J040095	4,6	I	1	1-2	1
1	J021591	4,8	I	1	1-2	1
4	J031562	4,8	I	1	1	1
12	J071283	4,8	I	1	1-2	1
13	J071412	4,8	I	1	1-2	1
5	J031891	5,1	D	1	1-5	1
3	J024074	5,2	D	1	1-7	1
11	J061956	5,2	D	1	1-3	1
24	L972402	5,5	I	1	1-2	1
31	PAN535	5,5	D	1-3	1-2	1
6	J032998	5,6	D	1-3	2-5	1
20	L961801	5,8	I	1-3	1-3	1
30	PAN1664	5,9	D	1-2	1-8	1
29	LS6164	6	D	1-2	1-2	1
9	J036074	6,1	D	1	1-9	1-2
8	J035914	6,1	D	1-2	2-7	1
2	J023746	6,2	D	1	2-5	1
15	L649001	6,2	D	1	1-3	1
26	LS6050	6	D	1-2	2	1
27	LS6150	6,5	I	1-3	1	1
7	J035352	6,6	D	1	1-8	1
25	L972503	6,6	D	1-5	1-2	1
21	L962901	6,7	I	1-5	2-3	1
22	L8202HA	6,8	I	1-2	1-8	1
23	L8202HF	6,8	I	1-2	2-3	1
18	L757504	7	SD	1-6	1-6	1
32	PAN737	7	D	1-4	1-5	1
16	L657501	7,5	SD	1-4	2-7	1
19	L758803	7,5	D	1-6	1-3	1
14	L647701	7,6	D	1-2	1-2	1
17	L755403	7,6	D	1-4	1-4	1

Conclusions

- Four soybean lines that belong to the MG 5 and 6 presented the highest yields and stability at the different sites.
- Two soybean lines that belongs to the MG 4 had excellent yields and behavior at Bethlehem where are recommended soybeans of the MG 4. At the other sites, their behavior was variable.
- The Argentinean soybean lines presented variability in their behavior at the different tested sites and those with the highest yields and tanking in account the their stability or their interaction with specific environments could contribute to the soybean production in South Africa.



Thanks

Acknowledgements

- PRF
- INTA
- Masiero B.



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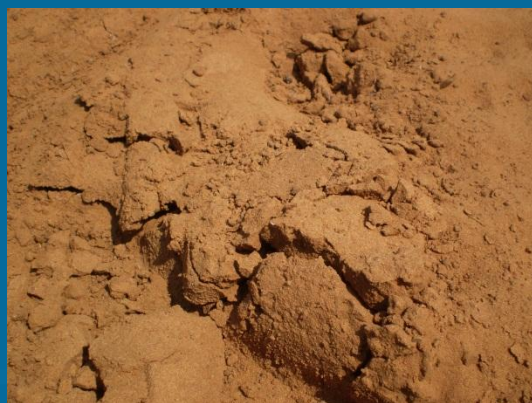
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Latitude	25,73	25,59	29,53	26,73	28,16	27,95
Altitude (msm)	1400	1100	1076	1355	1800	1180

Site	Pretoria	Brits	Howick	Potchefstroom	Bethlehem	Vaalharts
P (mg/kg)	21	5	16,0	24	42	37
K (mg/kg)	49	209	320	105	97	129
Ca (mg/kg)	390	1464	1745	1032	549	469
Mg (mg/kg)	116	477	377	417	87	141
Na (mg/kg)	7	40	-	10,7	2	14
R (ohm)	2575	815	-	1240	2285	1350
pH	5,9	7,5	5,8	7,2	7,2	7,4
Corg	0,76	0,46	-	0,3	0,34	-
Clay (%)	5	30,5	47	27,5	14	10



Results

Variable	N	R ²	R ² Aj	CV
kg/ha	1017	0.86	0.77	16.02

Source	SS	df	MS	F	P-value	(Error)
Model	836617294.71	367	2279611.16	10.48	<0.0001	
Environment	584802772.91	10	58480277.29	67.07	<0.0001	(Ambiente>Rep)
Genotype	20148699.53	31	649958.05	2.99	<0.0001	
Environment>Rep	19181365.42	22	871880.25	4.01	<0.0001	
Genotype*Environment	212484456.85	304	698962.03	3.21	<0.0001	
Error	141208461.89	649	217578.52			
Total	977825756.60	1016				