THE EVALUATION OF SOYA BEAN CULTIVARS UNDER IRRIGATION AT GLEN

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Research Colloquium 18-20 October 2017

RESEARCH OBJECTIVES

- Soya bean cultivars or genotypes demonstrates a limited adaptation to specific geographical areas, and research is applied to address this challenge to enable producers to increase production

- The research trials' objectives are to compare soya bean cultivars for agronomic and economic performance and to test the adaptability of existing cultivars and newly released cultivars for cultivation practices

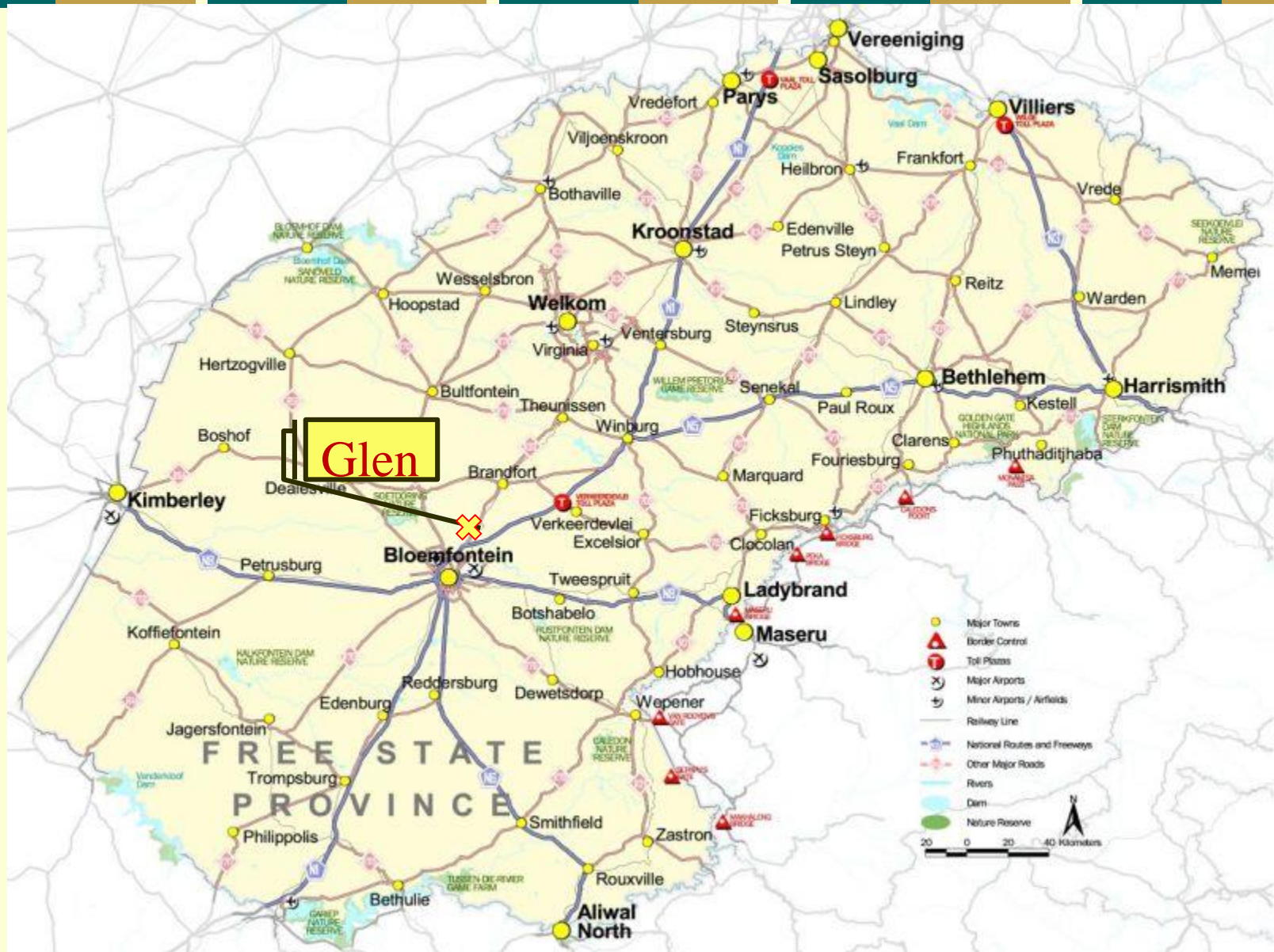- This soya bean trial at Glen forms part of the National Cultivar Evaluation Program (Fig. 1)

Figure 1 Map of the Free State Province

BACKGROUND

- South Africa is an importer of soya beans. South Africa's soybean oilcake requirements in 2015/2016 were 1.5 million tons, 55% of which was imported

- Soybean consumption in the country is estimated at 32% for oil and oilcake, 60% for animal feed (especially in the broiler and egg industries) and 8% for human consumption

- Over the past five years, Mpumalanga Province (363 000 tons) has been the major producer of soybeans followed by the Free State (156 600 tons), KwaZulu-Natal (60 000 tons), Limpopo (58 800 tons), Gauteng (52 200 tons), North west (18 000 tons), Eastern Cape (2 100 tons) and Western Cape (1 200 tons)

PRODUCTION AREAS

- Localities where soybean trials were conducted are divided into warm-, moderate- and cool areas
- When cultivar selections has been done, it is important to establish which localities has the required climate conditions
- Generally cultivars with a longer growing season will perform better in the warmer growing areas, cultivars with a medium growing season in the moderate growing areas, and cultivars with a shorter growing season in the cooler production areas
- Glen forms part of the moderate production areas (Table 1)

PRODUCTION AREAS

Table 1 Trial localities grouped into cool, moderate and warm production areas

COOL	MODERATE	WARM
Bethlehem (D)	Bergville (D)	Atlanta (D)
Clarens (D)	Cedara (D)	Brits (D)
Clocolan (D)	Dundee (D)	Groblersdal (I)
Delmas (D)	**Glen (I)**	Koedoeskop (I)
Kinross (D)	Greytown (D)	
Kokstad (D)	Greytown/Kranskop (D)	
	Kroonstad (D)	
	Lichtenburg (D)	
	Newcastle (D)	
	Potchefstroom (D/I)	

MATERIALS AND METHODS

- <u>The Soybean trial was planted according to the following layout:</u>
- Plot size   : 4 rows of 5 m each
- Net plot size   : Central 4 m of 2 inner rows
- Spacing between rows   : 75 cm
- Spacing within rows   : ±4.4cm (between plants)
- Plant population   : ±300 000 plants/ha
- Two manual rain gauges were used to measure rain and irrigation
- An automatic weather station in the vicinity of the trials was used to measure rain during the growing season

MATERIALS AND METHODS

- Planting time: 17/11/2015
- Previous crop: Soybeans
- Pre-emergence herbicide: Strongarm 15 g/ha + Alachlor 4 l/ha
- Mechanical weed control: It was done by means of a tractor mounted cultivator
- Post-emergence herbicide: None
- No fertilizer was applied
- Seed was inoculated with a bacterial inoculate (*Braby Rhizobium japonicum*)
- The soybean trial was harvested by hand (Fig. 2) using hand secateurs, bags and identity tickets

Figure 2 Harvesting soya beans at Glen

RESULTS AND DISCUSSION

- A comparison of seed yield between the different moderate regions for the 2015/16 growing season is given in Table 2

Table 2 Seed yield of the cultivars at the moderate localities 2015/16

Cultivar	Bergville	Cedara	Glen	Greytown	Greytown Kranskop	Kroonstad	Mean
			Moderate				
LS 6240 R	3595	1344	2297	2037	2962	1344	2263
PAN 1454 R	2956	1550	1808	2224	2700	1031	2045
SSS 4945 (tuc)	2340	1188	2604	1916	2579	953	1930
LS 6146 R	3330	1204	2014	1889	3135	1314	2147
PHB 94 Y 80 R	3799	1643	1930	1915	2801	1107	2199
LS 6248 R	3293	2357	2515	2315	3565	1183	2538
SSS 5449 (tuc)	2681	1681	2523	2320	3087	1067	2226
NS 5009 R	3779	1516	2487	2004	2835	1465	2348
DM 5.1i RR	3190	1220	2368	2104	2950	1012	2140
PHB 95 Y 20 R	2778	2596	2265	2411	2799	1030	2313
DM 5953 RSF	3520	1994	**4016**	2143	3341	890	2651
SSS 5052 (tuc)	3677	3022	2048	2586	3115	1334	2630
PAN 1521 R	3970	2854	2758	2548	3386	1148	2777
PAN 1500 R	3222	2721	1748	2486	2629	1041	2308
NS 5909 R	2875	3103	2808	3123	2953	1119	2663
LS 6261 R	2561	2658	2443	2257	3859	1228	2501
PHB 96 T 06 R	2909	2832	1844	2918	3560	1075	2523
PAN 1623 R	3590	3359	2885	3118	3829	1221	3000
LS 6161 R	2293	2939	**1712**	3113	3583	1130	2462
DM 6.2i RR	2350	3050	3955	3246	3087	1389	2846
SSS 6560 (tuc)	2702	2689	2619	2705	3560	1298	2596
LS 6164 R	3091	3029	2307	2651	4108	1273	2743
PAN 1614 R	3425	2773	1987	2710	3470	1092	2576
NS 6448 R	3643	2483	2616	2971	4039	1167	2820
DM 6.8i RR	2771	2977	2694	3186	3545	1053	2704
NS 7211 R	3736	2911	2186	2993	3062	1159	2674
Standaard 1	3586	1295	2483	1897	2777	1011	2175
Standaard 2	3393	3460	3031	2566	3242	1724	2903
Gem/Mean	3181	2373	2463	2513	3234	1173	2489
KV/CV	17,1	17,6	19,8	7,7	15,8	20,1	

RESULTS AND DISCUSSION

- At Glen the best mean yield of 4 016kg/ha was harvested from cultivar DM 5953 RSF and the lowest yield (1 712kg/ha) was obtained from cultivar LS 6161R for the 2015/16 season

- Data obtained were processed and yield probability potentials were calculated drawing a regression analysis of each cultivar means at specified yield potentials (1.0 – 4.5 t/ha) as per trial

RESULTS AND DISCUSSION

- The average yield potentials of each cultivar at the different sites were calculated and compared to the average yield potentials at Glen

- Cultivars LS 6248 R, LS 6261 R, PAN 1500R, PAN 1521 R, PAN 1614 R and PAN 1623 R were the most stable over the last 3 years with a yield probability potential of 50% and above (Table 3)

- Cultivars PAN 1623 R, PAN 1521 R and LS 6261 R have the best yield potential at Glen

Table 3 Yield probability potential above the y=x line: Moderate 3 years

Cultivar	Yield potential (t/ha)							
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
LS 6248 R	50.00	56.79	63.66	70.23	75.86	80.47	84.03	86.67
LS 6261 R	39.32	47.97	56.24	65.43	72.70	79.46	83.95	87.72
PAN 1500 R	46.74	44.38	41.96	39.62	37.46	35.59	34.01	32.77
PAN 1521 R	63.08	68.66	73.11	77.80	81.08	84.13	85.96	87.72
PAN 1614 R	64.97	61.40	57.37	52.99	48.51	44.20	40.27	36.82
PAN 1623 R	88.77	90.88	92.58	93.73	94.55	94.97	95.16	95.11

RESULTS AND DISCUSSION

- Soya bean yield potential alone is not enough to make an informed decision

- In order to make an informed decision, to determine the crop enterprise with the highest income potential, one can compare the gross margins of various crop enterprise options

Table 4 Expected gross margin between different irrigated crops (2015/2016)

	Yellow Maize	Soya beans
SAFEX price - month	March 2015	**March 2015**
SAFEX price (R/Ton)	R 1 845.00	**R 5 110.00**
Targeted yield (T/Ha)	12 t/ha	**4 t/ha**
Potential Income	R 22 140	**R 20 440**
Direct allocable variable costs (R/Ha)	R 20 380	**R 15 806**
Gross Margin (R/Ha)	R 1 760	**R 4 634**
Brake even yield (T/Ha)	11.05 t/ha	**3.09 t/ha**
Brake even price (R/Ton)	**R 1 698 /t**	**R 3 952 /t**

*Production cost figures courtesy of GWK Co-Op.

RESULTS AND DISCUSSION

- The data in Table 4 indicated that soya beans has a higher gross margin of R4 634 per hectare than yellow maize with a gross margin of R1 760. With the break even yield of soya beans and yellow maize 3.09 and 11.05 t/ha respectively, soya beans is the better option to choose. The uncertain climatic conditions might have a huge effect on the prices of the various commodities.

RESULTS AND DISCUSSION

- South Africa does not produce enough soya beans, although soya bean production expanded much more than other crops during the last decade (Fig. 3)
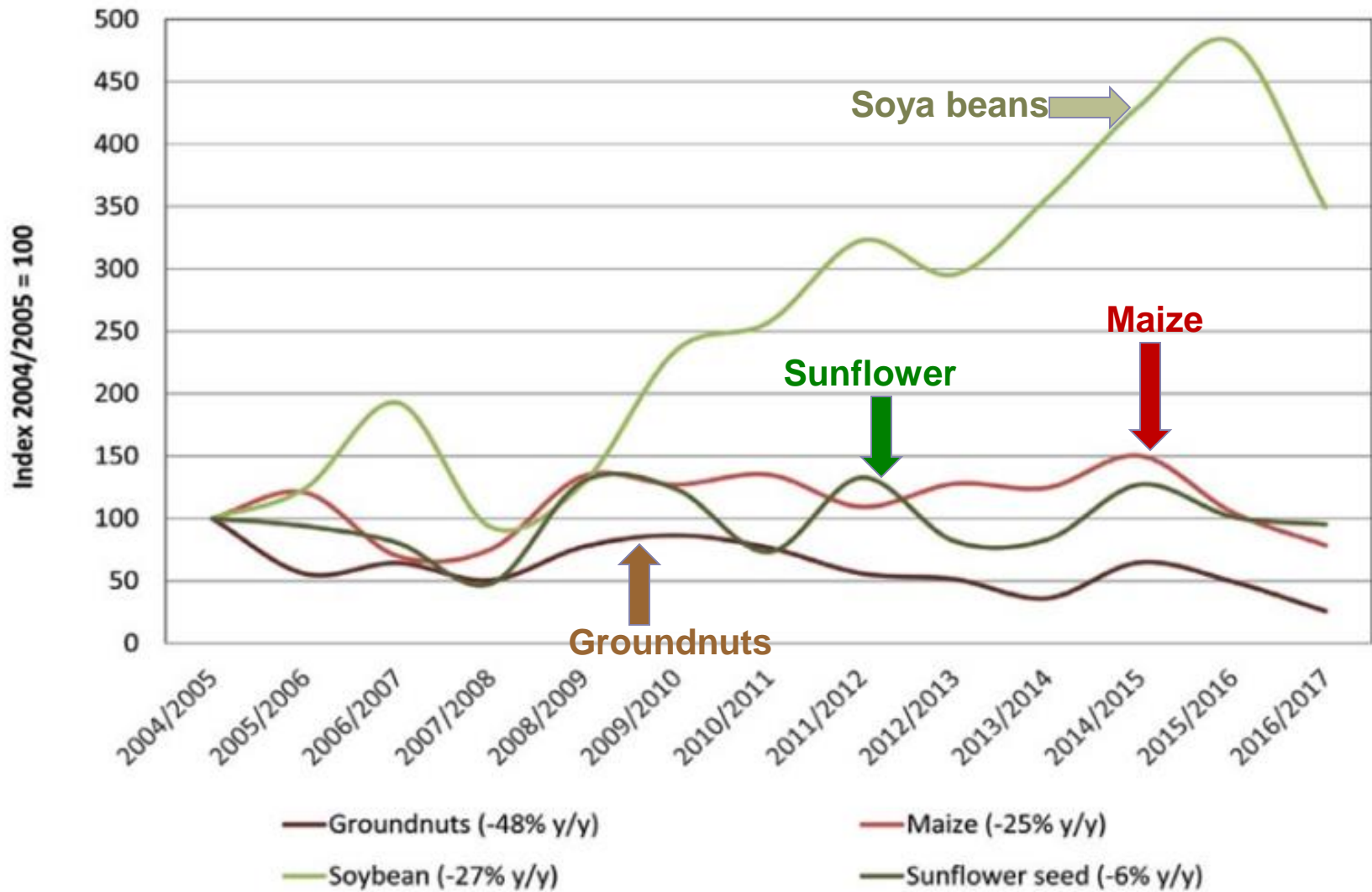
Figure 3 Production index of crops (Grain SA, March 2016).

CONCLUSION

- Soya beans can be produced economically, providing the correct cultivar selection is made for the specific climate region, as they are day length sensitive

- Choose cultivars with at least 3 years' results to get the best yield and quality within a specific geographical area

- Soya beans is a good alternative to use in a crop rotation system

- The demand for soya beans in South Africa (Free State Province) is much bigger than the supply

CONCLUSION

- Soya beans is a well-known protein source and is in high demand, especially in the animal feed industry

- Prof Michiel Scholtz (SA Society for Animal Science) that the demand for protein will increase 60% by 2050

- Soya beans is the only crop in South Africa that shows an increase in production in comparison to yellow maize, dry beans and wheat

- The production of soya beans in the Free State must increase in future

- Consequently, more farmers should be encouraged to produce soya beans

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THANK YOU