Soybean (Glycine max) is a small but important growing component of South Africa’s agricultural economy. For example, soybean production in the country increased from 144 000 t (25%) to 710 000 t on 418 00 ha in the 2010/11 production year in comparison with the previous year (566 000 t). However, individual cultivars are very limited in adaptability due to photoperiod sensitivity. Growing any soybean cultivar without knowing its potential in a particular environment may have dire consequences, even though such a cultivar may perform satisfactorily elsewhere. Cultivar evaluation programmes are therefore common practice in all soybean producing countries. A standardised national soybean cultivar evaluation programme was initiated by the ARC-Grain Crops Institute in South Africa in 1978/79 under government directives in order to stimulate and support the local soybean industry. The aim of the project was primarily to compare cultivars for agronomic performance and to test the adaptability of cultivars and new releases for specific areas and cultivation practices.

Progress over the past 34 years has been measured by looking, for example, at yield and other important agronomic developments that had a major impact on the soybean industry in South Africa. An average yield increase for the long seasonal cultivars was 0.43 t/ha and 0.56 t/ha for the short seasonal growers if the data of the 1981/82 and 2010/11 growing seasons are compared. However, the introduction of “Roundup Ready” cultivars impacted the most in such a way that 90% of the current production in South Africa consists of “Roundup Ready” cultivars. The development of root-knot nematode tolerant cultivars also contributed to the fact that soybeans can be planted on soils previously susceptible to substantial yield losses due to nematode occurrence. The first nematode tolerant cultivar, namely Egret, was released by the ARC in 2002.
The national soybean cultivar trials in South Africa – 34 years experiences and progress

A.S. de Beer and M.A. Prinsloo
Agricultural Research Council – Grain Crops Institute (ARC-GCI),
Private bag X1251, Potchefstroom, 2520, South Africa.
(debeerannelie@arc.agric.za)
South Africa: Soybean production areas

(Blignaut and Taute, 2010)
Average commercial soybean yield per hectare from 1970 to 2012 in South Africa

(Crop estimates committee, 2013)
Soybean production from 1970 to 2013 in South Africa

2012 – Irrigation = 51 200 ha (10.8%)

2009 – 237 750 ha
2009 – 516 000 ton
2012 - 472 000 ha
2013 - 529 000 ha
2011 - 710 000 ton

(Crop estimates committee, 2013)
Production targets

- 2015: 1 million tons on 455 000 hectares (2.2 t ha$^{-1}$)
- Since 2012 the above set hectare target has been reached
- 2020: 2.5 million tons on 1 million hectares (2.5 t ha$^{-1}$)
A typical national soybean trial
34 years from 1978 to 2011
Start of national soybean trials

was initiated in 1978/79 by the then Oil and Protein Seed Centre (now ARC-GCI) under government directives in order to stimulate and support the local soybean industry.
Aim of national soybean trials

- To compare cultivars for agronomic and economic performance; and
- To test the adaptability of cultivars and new releases for specific areas and cultivation practices
Statistics of the national soybean trials

- 943 entries were evaluated in the soybean trials
- 1486 trials were planted throughout the soybean cultivation area
- 35 conventional and 33 Roundup-Ready® (RR) cultivars is currently registered in South Africa (Sadie, 2012)
Variables measured:

- Days to 50% flowering
- Days to physiological maturity
- Days to harvest maturity
- Pod height
- Plant height
- Green stem %
- Lodging %
- Oil %
- Crude protein %
- Seed quality
- Shattering %
- Yield

Determined:

- Yield reliability and stability
Root-knot nematode tolerant research

- 1981/82 season a need for root-knot nematode (Meloidogyne incognita and M. javanica) tolerant research arose which resulted in the release of Egret during 2002
- This is still the only available root-knot nematode tolerant cultivar
• During 2000 the first Roundup-Ready® cultivar (A5409RG) was registered in South Africa and is still widely planted
Soybean production from 1970 to 2013 in South Africa

2002: 1st Root-knot tolerant cultivar

2000: 1st Roundup-Ready® cultivar

(Crop estimates committee, 2013)
# Maturity groupings

<table>
<thead>
<tr>
<th>Maturity group</th>
<th>Classification (growers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 - 4.9</td>
<td>Short (S)</td>
</tr>
<tr>
<td>5 - 5.9</td>
<td>Medium (M)</td>
</tr>
<tr>
<td>6 - 6.9</td>
<td>Medium-long (ML)</td>
</tr>
<tr>
<td>7+</td>
<td>Long (L)</td>
</tr>
</tbody>
</table>
Mean yield (kg ha$^{-1}$) vs Year

- **Mean L**: Trend = NS
- **Mean M**: Trend = NS
- **Mean ML**: Trend = $-115.57$ kg ha$^{-1}$y$^{-1}$
- **Mean S**: Trend = $-96.76$ kg ha$^{-1}$y$^{-1}$
<table>
<thead>
<tr>
<th>Maturity groups</th>
<th>Cool areas</th>
<th>Moderate areas</th>
<th>Warm areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short (4 - 4.9)</td>
<td>1.65b</td>
<td>2.40b</td>
<td>2.61b</td>
</tr>
<tr>
<td>Medium (5 - 5.9)</td>
<td>2.35a</td>
<td>2.47a</td>
<td>2.83a</td>
</tr>
<tr>
<td>Medium-long (6 - 6.9)</td>
<td>1.52b</td>
<td>2.48a</td>
<td>2.95a</td>
</tr>
<tr>
<td>Long (7+)</td>
<td>1.98b</td>
<td><strong>2.31c</strong></td>
<td>2.91a</td>
</tr>
<tr>
<td>LSD p=0.05</td>
<td>0.28</td>
<td>0.08</td>
<td>0.09</td>
</tr>
</tbody>
</table>
Annual average soybean yield per hectare from 1978 to 2011 in South Africa

Monetary trial value = 0.012 t x 34 (years)  
= 0.41 t ha\(^{-1}\) x R4500.00  
= R1826.97 ha\(^{-1}\)

Monetary commercial value = 0.016 t x 34 (years)  
= 0.56 t ha\(^{-1}\) x R4500.00  
= R2522.10 ha\(^{-1}\)
1979: Best overall performer with a yield of 2.31 t ha\textsuperscript{-1}
2011: Best overall performer with a yield of 2.64 t ha\(^{-1}\)
Conclusions/Highlights

- Medium growers (MG 5 – 5.9) widely adapted
- The increase in yield ha\(^{-1}\) is mostly due to the genetic improvement of cultivars
- 90% + of all plantings are Roundup-Ready® cultivars and can be regarded as the largest impact in the industry (A5409RG – 2000)
- ARC-GCI released the **first root-knot nematode tolerant** cultivar (Egret) in 2002 (Sandy soils)
Past

Present
Acknowledgements

ARC-GCI (Agricultural Research Council – Grain Crops Institute) and PRF (Protein Research Foundation) for funding the project.

The contributions of the following persons are gratefully acknowledged:

Dr M.A. Smit Dr J.W. Snyman
Dr J. Dreyer Dr J. de Kock
Dr K.W. Pakendorf Mr P. van Rooyen (late) (data analysis)
Mr J.N.H. Lemmer (late) Mr P. van Rooyen (late) (data analysis)
Mr M.A. Smit Mr G.P. de Beer
Mr T.E.M. Odendaal Mr J.L. Erasmus
Mr G.J. Bodenstein Mr A.J. Pretorius
Mr N.N. Mogapi Mr T.C. Ramatlotslo
Mr F.J. Calitz (statistical advice) Mrs H.S.J. Vermeulen
Mrs N. de Klerk Mrs A.J.S Swanepoel (data analysis)

Seed companies, co-workers and producers
References


• Cultivar evaluation reports (1979 to 2012).

• Sadie, J. 2012. South African variety list as maintained by the registrar of plant improvement.