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13th Australian Soybean Conference

Soybeans: Maximising Potential

Barooga Sports Club, Barooga
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SUMMARY: 13th AUSTRALIAN SOYBEAN CONFERENCE¹

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Introduction

I thank the Organisers for asking me to present a Summary Overview of the Conference. I approach the task from the point of view of someone who 'cut his teeth' on soybeans 37 years ago but has been away from the industry for the past 10 years. I do so by addressing four questions: What remains much the same? What has changed? What were some of the conference highlights? What are the key challenges for the future?

SLIDE 1. THE SOYBEAN INDUSTRY 1970-2005

- What remains much the same ?
- What has changed ?
- Some Conference highlights – a personal perspective
- Challenges for the future

What remains much the same?

Given the Conference theme, *Soybeans: Maximising Potential*, it was a bit surprising to see that current soybean production is not much more than during the 1970s, and is certainly lower than the peak of ~125 Kt during the late 1980s (see Figure 1 in my earlier paper). Clearly, soybean remains a difficult and risky crop to grow and it is apparent there are several reasons why this is so.

SLIDE 2. WHAT REMAINS MUCH THE SAME ?

- Production still ~ 1975 level, certainly << peak
- Gross margins still tight
 - Prices have not moved a lot, but nor has mean yield
 - Need for more attention to basics of agronomy ?
 - Isis group has shown higher yields are possible given good agronomy (are canegrowers showing up graingrowers ?)
- Insect challenges (heliethis, sucking bugs) still there
- Disease challenges (phytophthora) still there
- Good seed quality still an issue

The most important is that gross margins remain tight, especially in irrigation areas where the crop must compete with more profitable uses for limited and increasingly expensive water. Like many commodities, prices for oilseed soybean have not moved a lot from those of 10-20 years ago. Neither it seems have average seed yields, and this is of some concern, since it is the main area where producers can affect the outcome.

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At ~ 1.8 t/ha, average seed yields are less than half the potential yields of well-grown modern varieties under irrigation. We heard examples from most irrigated regions of some growers achieving on-farm yields in the 4-5 t/ha range. The corollary is that given the low average yield across the industry, and allowing for the fact some areas are dryland, there must also be many poor crops around.

This raises the question of whether there is need for greater attention to the basics of crop agronomy. The high average yields reported from the coastal sugar areas around Childers (Skilton *et al.* 2005) certainly suggest higher yields are possible. While everyone there was acknowledged as 'on a steep learning curve', it was apparent there was a lot of emphasis on getting the agronomy right among the technical support team. If novice canegrowers can do it, why not seasoned graingrowers?

While there has been undoubted progress, some of the other management issues that dogged the soybean industry in its early days still persist. The crop is highly attractive to insects, and both seed yield and seed quality are very sensitive to insect damage, particularly from the pod chewing insects like heliothis and the sucking bug complex. Soybean therefore requires above-average management skills to ensure high yields of high quality seed.

The challenge posed by phytophthora stem rot disease has if anything expanded, with multiple races now in most production areas (Ryley 2005). Apart from the direct effects on yield, the persistent disease risk necessitates careful attention to rotations, especially in irrigated areas. At the same time, breeding effort is diverted from other priorities into stacking resistance genes into new varieties.

Seed quality remains a problem in terms of both weather and insect damage. While some breeding progress has been made in improving weathering tolerance in humid coastal regions, the harsh extremes of the Australian climate make it difficult to rely on genetic means alone for achieving good quality seed for the next crop. Quality issues will assume even greater importance in the context of the move to culinary beans.

What has changed?

One of the most significant changes that has occurred is that the industry is now 'smeared' over a wide range of locations from northern Victoria to the Atherton Tableland, the NT and the Ord. As Andrew James pointed out, this presents an immense challenge for the breeders in that they have to target adaptation to many very different environments (James & Rose 2005).

SLIDE 3. WHAT HAS CHANGED ?

- **Production now 'smeared' over a very wide range of environments**
 - **Challenges for breeders**
 - **Opportunities for targeted production for end uses**
- **Focus has changed from 'industrial' crop to culinary**
 - **Greater range of value-added uses**
 - **No longer seen as a 'main crop'**
- **90 participants - much greater diversity of interests, skills**
- **Coordinated breeding program**
- **Fewer District Agronomists to assist local growers; more private agencies**

On the positive side, this has also opened up opportunity for targeting the production of beans for particular speciality end-uses to regions with suitable weather. While the concept appeals, I wonder whether we have adequate crop improvement resources available to readily achieve it.

Another significant change is the shift in focus from an industrial crop to one with a range of higher value uses, with crushing or stockfeed uses mainly a back-up for when circumstances (e.g. quality, transport cost) preclude culinary use. At the same time, and perhaps partly as a consequence, soybean

is no longer seen as a main crop. This contrasts starkly with the early hopes that the crop would become a mainstay in irrigated summer cropping areas.

Associated with the changed emphasis on end-uses, there is a wider range of interests and expertise among the conference attendees than would have been the case 10-20 years ago. In particular, there is a healthy sprinkling of marketers and end-users as well as several private technical service providers.

Another change is the move to a coordinated national public breeding program, instead of several independent programs focussed on specific regions. The coordination of the public breeding effort through one national program has no doubt eliminated any previous duplication of effort. However, I suspect that the associated reduction in the number of public breeders has gone well beyond removing any putative duplication and has not been offset by the couple of low-profile private programs.

There also seem to be fewer 'district agronomists' available to advise growers on crop management and agronomy, a gap that has only been partly filled by private providers.

Some conference highlights

The development that I found most interesting was the considerable progress that has been made in understanding and developing soybeans for higher value culinary uses (James and Rose, 2005, Moore *et al.* 2005). Firstly, there is now greater understanding of the compositional and structural attributes of seed that determine the suitability (i.e. the 'quality') of different genotypes for various culinary uses. Genetic sources with specific desirable attributes have been identified and breeding populations established from which improved culinary types are being selected.

SLIDE 4. SOME CONFERENCE HIGHLIGHTS – a personal perspective

- **Breeding for higher value end uses**
 - **Starting to understand quality attributes & G X E for quality**
 - **But demand more exacting management (breeders' challenge to growers)**
- **Exciting developments with bio-insecticides**
- **Granular inoculants**
- **Soys in sugar areas**

Secondly, there is an emerging understanding of how the field environment and genotype x environment interaction impinge on these culinary attributes. This is helping the breeders to identify which production areas are likely to be most suited for which types of soybean. As the breeders noted, however, culinary varieties require high level management to ensure that their potentially higher value is actually realised i.e. they can not be managed the same way as an oilseed crop.

We also heard about exciting developments with microbial bio-pesticides for the control of sucking bug pests like green vegetable bugs and whitefly (Hauxwell *et al.* 2005, Knight *et al.* 2005). Hopefully these developments will soon be translated into commercial reality. Another interesting albeit more prosaic development is that of successful granular inoculants that appear more robust in general field use. Nodulation failure remains a problem with soybeans in new ground.

From a wider industry perspective, the expansion of grain soybean into coastal sugar areas in Queensland is a significant development with much further to run.

Challenges for the future

In the context of the Conference theme *Soybeans: Maximising Potential*, a key challenge if the decline in soybean production is to be reversed is to reliably improve gross margins. Smarter management is needed to lift average yields closer to those currently achieved by better growers. The switch to higher

value end-uses also has the potential to improve gross margins, but only if management is adequate to ensure a high quality product.

SLIDE 5. CHALLENGES FOR THE FUTURE

- **Smarter management - must lift yields to get economic use of water/inputs – cane groups are showing the opportunities are there**
- **More info needed to enable targeting specific markets in specific regions**
- **Ditto re managing specific stresses e.g. water deficits, cool temperatures**
- **Fitting sugar into the sugar system**
- **How to exploit gains in basic science (gene discovery/genomics etc)**
 - **Science looking for an application**
 - **Difficult to see capacity to translate into on-farm outputs in near future**
- **Soybean can be more than niche crop - 'self-fulfilling prophesy'?**

More R&D is needed to clarify environmental effects on the various attributes of culinary quality, to help better match production of specific bean types to particular regions. There remains the need for better understanding of specific environmental stresses like drought (James 2004, 2005) and cool temperature (Grey 2005), although given the industry's limited crop improvement capacity, it is likely these issues will remain unresolved for some time.

In the near term, there remains a considerable amount of 'fine-tuning' to fit soybean into sugar rotations, with one package unlikely to meet all needs in the different sugar regions. Market development should also be seen as a priority in areas remote from current markets.

In any other conference, the gene discovery / genomics work reported by Peter Gresshoff would be seen as an exciting development. At this conference, however, the work elicited modest enthusiasm, partly because of concern that GM soybeans might jeopardise the niches being developed in Australia for high value culinary varieties.

Apart from the GM issue, genes for nodulation and nitrogen fixation are unlikely to be of great commercial relevance in the near term in Australia, although as Peter pointed out, there are other ways in which the basic scientific advances being made might be exploited in soybean improvement (Gresshoff 2005). However, given the present structure of the Australian soybean improvement effort, there is simply not the 'spare capacity' to devote the resources to exploring how these advances in basic science might be exploited in practical terms.

Finally, what I believe is the main R&D challenge for the future: the re-positioning of soybean in Australia as a 'main crop' rather than passively accepting it as a niche crop meeting local demand for culinary beans, with lower quality beans used for feed or crushing purposes. The latter view will simply ensure the crop's longer term demise.

For soybean to be a main crop does not necessitate a return to its primary use as an industrial crop. Rather, there is sufficient world demand for culinary soybean products that Australia should be able to develop a role as a major supplier of high value products in the international market.

That is, soybean has the potential to become a major crop in a country that has positioned itself to be a niche supplier of high value culinary products in a world market where the larger players continue to produce soybeans largely as an industrial crop. The challenge is to put in place the capacity for reliable supply and to develop those international markets.

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