SOUTHERN SOYBEANS SHINE IN A WET YEAR

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QUICK TAKE

- The soybean area in southern NSW and northern Victoria has expanded, and now accounts for half of the NSW soybean crop.
- New variety Bidgee, produced by the Australian Soybean Breeding Program, will fit well into current cropping systems. It is a culinary clear hilum variety and a high protein type.
- Sowing on time (early November to mid-December) and timely management of irrigation, weeds and pests is the key to good yields and quality.
- There are huge and increasing opportunities for Australian culinary soybeans, especially for large stable volumes for Asian markets. Additionally, production could increase by 20,000 tonnes to meet domestic demand and replace imports.

In the 2011–12 season, the soybean crop of southern NSW and northern Victoria increased significantly in area from recent years as a direct result of very attractive soybean prices, improved varieties, ample water availability and relatively low growing costs.

Southern-grown soybeans now account for over 50% of the state's crop. According to Soy Australia, the national industry body, the area planted to soybeans in the Riverina increased from 5,100 ha in 2010–11 to more than 8,000 ha in 2011–12, with an additional 1,000 ha in northern Victoria and 600 ha in the Lachlan and Macquarie valleys. The total crop in NSW for 2011–12 was 18,100 ha, with the remaining crop being grown in the north of the state. With the Queensland planting of 13,000 ha, the Australian crop amounted to approximately 32,100 ha.

Seasonal conditions

In the Riverina, reliable high yields were achieved with planting in November and early December. However, after an extremely wet and extended period of waterlogging during the March floods, overall grain yields were not expected to be record breaking. An estimate to date has indicated an approximate regional average of 3.0 t/ha, with yields ranging from 2.3 t/ha to well over 4.0 t/ha. Generally, the higher yields correlated to less flooding and/or a minimal period of time the crop was under floodwater.

Reduced solar radiation and maximum temperatures (figures 1 and 2) during the critical pod filling stage from mid-February to late March had a negative effect on crop yields. Temperature is a key driver of soybean crop development, days to maturity and subsequent grain yields. This reduction in maximum temperatures and solar radiation coincided with flood events that waterlogged crops for up to 10 days in some cases. Some commercial crops escaped with very little yield reduction and that generally was a response to the crop growth stages at the time of flooding, as a direct result of early sowing. The crops that suffered the largest yield reductions were at early pod-filling stages at the flooding event. Many flowers and pods were aborted, reducing yields.

Over 32,000 ha of soybeans were grown in Australia in 2011–12, of which almost 10,000 ha were grown in southern NSW and northern Victoria.

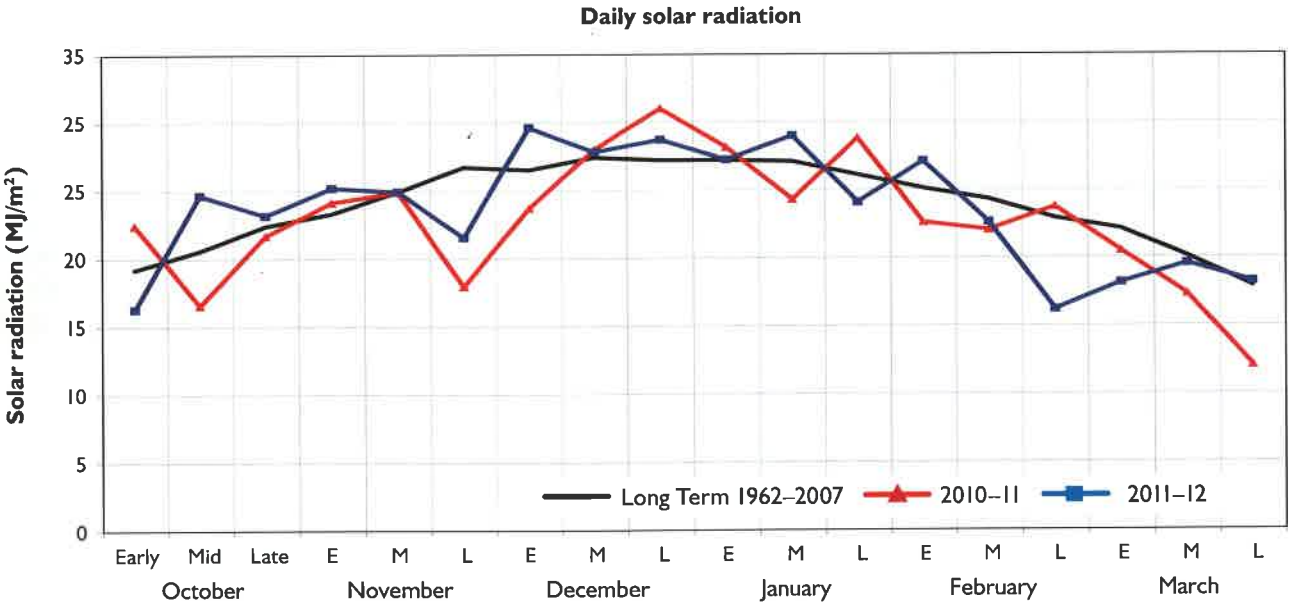

Figure 1. Murrumbidgee Valley climate data for 2010–11 and 2011–12 summer crop growing periods: mean daily solar radiation

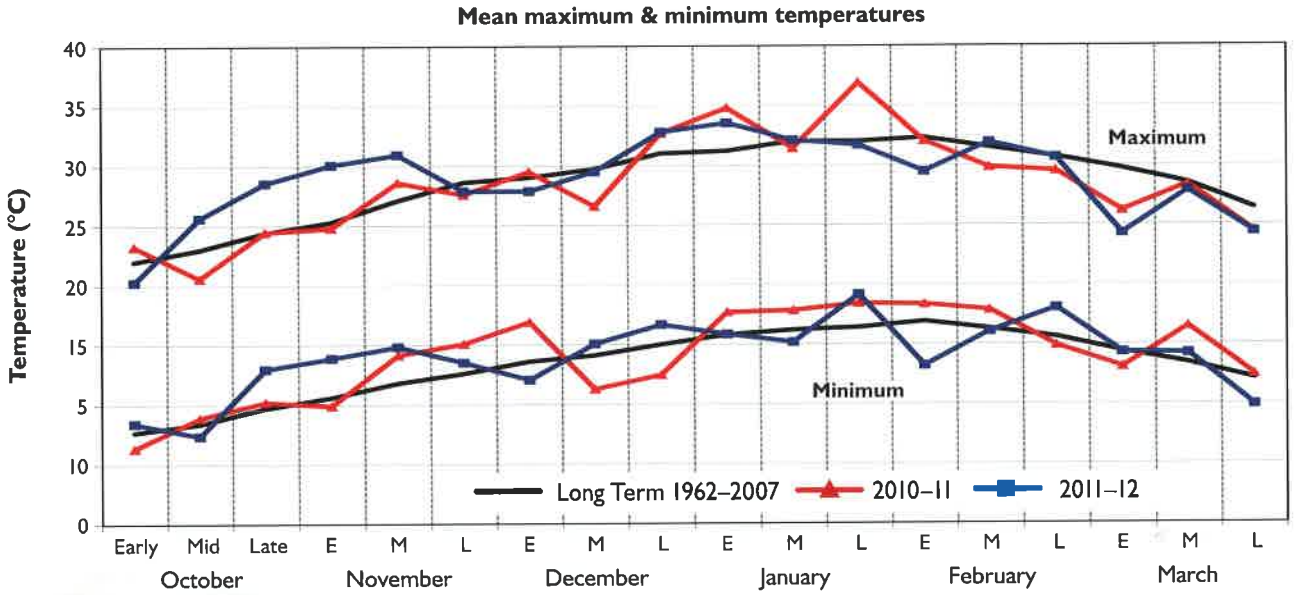

Figure 2. Murrumbidgee Valley climate data for 2010–11 and 2011–12 summer crop growing periods: mean daily maximum and minimum temperatures

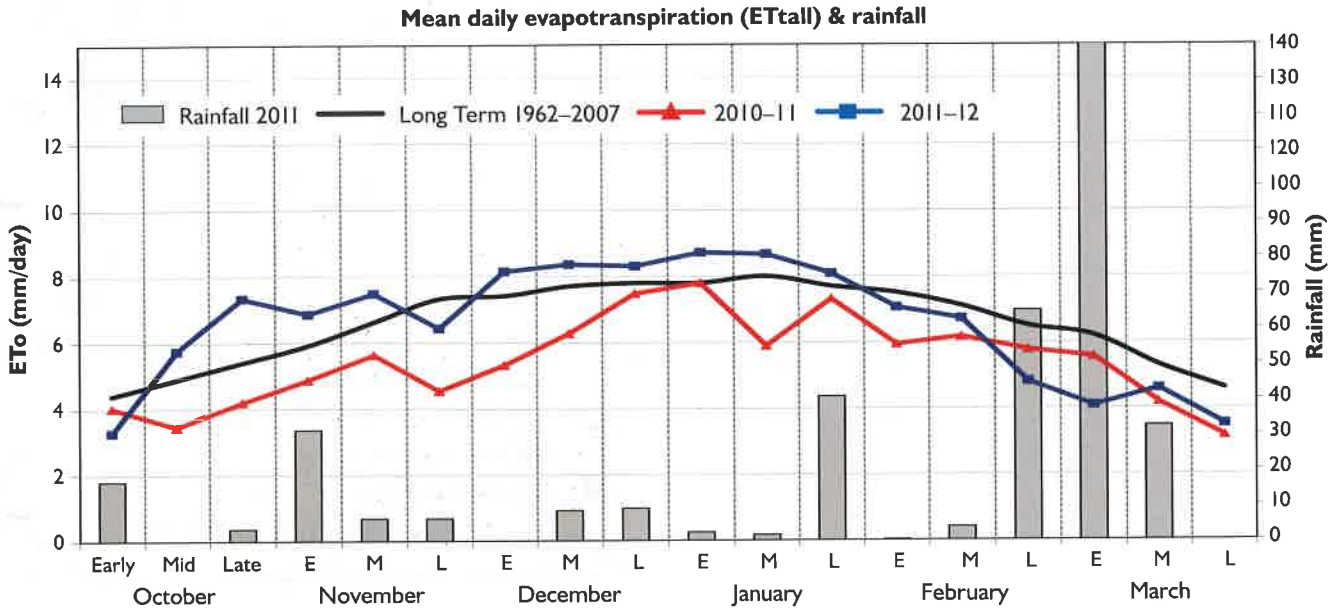

Figure 3. Murrumbidgee Valley climate data for 2010–11 and 2011–12 summer crop growing periods: mean daily evapotranspiration

The lower temperatures for the season delayed maturity and in some instances forced growers to desiccate their crop for the first time for many years. Many early flowering varieties/lines suffered greater yield losses than longer season types, especially when sown in late December. Normally Djakal has a relatively stable yield over November and mid December planting dates, albeit the earlier the sowing the better. In 2011–12 Djakal had some minor yield decline compared with longer term averages (Table 1), which was as a consequence of the lower temperatures and extreme flooding.

Varieties

Two varieties, Djakal and Snowy, were sown commercially in central NSW, the Riverina and northern Victoria, with small seed-increase blocks of the new human consumption variety, Bidgee scattered through the region. Djakal currently accounts for most of the crop area. Long-term yields can be seen in Table 1. The new variety Bidgee had the highest long-term yield average followed by Djakal.

Table 1. Long-term yields of irrigated soybean breeding trials at Leeton Field Station

Variety	7-year average (t/ha)	2011–12 (t/ha)
Djakal	4.13	3.83
Bidgee	4.35	3.47
Snowy	3.66	2.88
Bowyer	3.45	3.16

Bidgee

Bidgee is a new culinary clear hilum soybean variety for southern NSW. It was bred by the Australian Soybean Breeding Program funded by Grains Research and Development Corporation (GRDC), CSIRO and NSW DPI. Bidgee (formerly known as LO23B-23) was selected from hill plots in 2005–06. It was primarily selected on its early maturity, erect plant stature and moderate to high pod load. It has excellent early crop vigour and is fast growing. It is very quick to mature (about four days earlier then Djakal and nine days earlier than Snowy at the same planting date).

Bidgee is very high yielding with yields consistently similar or above Djakal, and well above that of Snowy, Bowyer and Curringa. It has narrow leaves, white flowers, and is the second clear hilum variety for the southern region. It has round seeds, a shiny seed coat, and similar sized to a slightly smaller seed size than Djakal. It has been bred with multi-gene resistance to phytophthora root rot.

Bidgee's protein is equivalent to Snowy which is about 3.3% higher then Djakal.

Djakal

Djakal is a very robust, high yielding, culinary variety with an early maturity that fits well into the Riverina farming systems and increases the opportunity for double cropping. It has some lodging resistance and generally good disease tolerance. Its protein can be low in some years where the crop suffers a setback or stress period. Growers must avoid moisture stressing the crop. It has early vigour, a narrow leaf and white flowers. Djakal is an excellent variety for new soybean growers and a very consistent yielder over different seasons. Djakal was bred by the Australian Soybean Breeding Program and released in 2001.

Snowy

Snowy is a mid-maturing, high yielding, human consumption variety. It was the first clear hilum, culinary quality soybean, combining good tofu-making qualities with good agronomic traits. Snowy is resistant to all commonly found races of phytophthora in the Riverina, including Race 25. It matures slightly later than Djakal, but notably earlier than Curringa. Snowy has a slightly larger seed size and higher protein than Djakal. A premium may be available in the culinary market for this variety. Snowy was bred by the Australian Soybean Breeding Program and released in 2005.

Key management strategies

- Plant at the optimum time to maximise yield potential and grain quality. This takes full advantage of daylight/heat units and avoids damage from early frosts. **The optimum, window for southern NSW is from early November until mid December**, but late December is still acceptable. Sowing in early January increases yield penalties. Sow early maturing varieties early (to maximise biomass prior to flowering) and sow late maturing types late.
- Irrigated soybean fields should preferably be pre-irrigated and budgeted to allow **6–8 ML/ha** of applied water use.
- **Check seed germination** and purity well before planting.
- **Always inoculate seed** correctly using the soybean-specific strain of inoculant (Group H, strain CB 1809).
- Plan weed control measures carefully, selecting appropriate herbicides (pre-emergent and/or post-emergent) and/or use inter-row cultivation. Shielded sprayers are also a very effective and economic way to control weeds with cheaper knock-down chemistry. **Pre-watering gives an excellent opportunity to knockdown weeds prior to soybean emergence.**
- Remember that seed size varies widely between varieties and seasons. Check each bag for seed size and use the formula in the box to calculate sowing rates based on seed size and the target plant population (not on bags of seed/ha). **Target 25–30 plants/m² established for early November sowing and 30–40 plants/m² for December sowing.**
- **Inspect crops for insect pests and beneficial insects** at least once a week while plants are vegetative, and twice a week from flowering to maturity. Always use a beat sheet to determine thresholds.
- **Harvest soybeans as soon as possible** to maximise grain quality by reducing the risk of weather damage or harvest losses from over-dry grain.

Calculating sowing rates

The following formula can be used to calculate sowing rates:

$$\text{Sowing rate (kg/ha)} = \frac{\text{target plant population/m}^2 \times 10{,}000}{\text{seeds/kg} \times \text{germination\%} \times \text{establishment\%}}$$

The formula takes into consideration:

- number of seeds/kilogram (seed size or seed weight – count 100 grams of seeds & multiply up)
- target plant population
- germination % (e.g. 90% germination = 0.9 in the formula)
- establishment % (usually 80%, unless sowing into adverse conditions; 80% = 0.8 in the formula)

Powdery mildew 2011–12

Minor outbreaks of powdery mildew, caused by the pathogen *Erisyphe diffusa*, were experienced for the first time ever in the Riverina and Victoria in 2011–12. All other soybean growing regions in Australia were affected. Although this pathogen is recorded as causing powdery mildew in soybeans in the USA and many parts of the world, it was only recently identified in Australian crops. The occurrence of this disease was more obvious on dense, heavily lodged and waterlogged fields.

Some varieties showed no infection whilst others were completely susceptible. If powdery mildew outbreaks occur again further screening will take place. However, this outbreak is considered irregular and of little consequence to grain yields. Greater grain yield losses could be associated with crop lodging, and the powdery mildew may be more a result of that.

"Good bug, bad bug" publication

A new Queensland Department of Agriculture, Fisheries and Forestry (DAFF) guide to beneficial and pest insects in pulse crops is now available in hard copy and online at **www.thebeatsheet.com.au** The publication allows growers and advisers to access the expertise of Hugh Brier, DAFF senior entomologist (pulse specialist) and the Grains Research and Development Corporation (GRDC) has supported its production. It features more than 300 photos of insects found in pulse crops to help growers and advisers confidently identify pest and beneficial insects in their crops.

Soybean breeding & the farming system

With the average market price at a base of $500–650/t (edible) on farm and an estimated production cost of around $600–700/ha, soybeans are a relatively inexpensive and low risk crop to grow. In addition to the good financial returns, soybeans can also provide a number of benefits as a break crop in the rotation. As soybeans are part of the legume family, they fix nitrogen in the soil, saving on nitrogen fertiliser. In addition, soybeans grown as a rotation crop prior to a winter cereal can help to improve soil structure as the stubble is relatively easy to handle, providing a good mulch to improve water use efficiency and soil health. When used as a break crop, soybeans can provide additional benefits through pest, weed and disease control in subsequent crops.

The varieties such as Djakal and Bidgee, have a shorter maturity than older varieties—Snowy (mid) and Curringa and Bowyer (longer)—so that they are a relatively fast crop to grow. If sown on time, soybeans are a good option for double cropping with winter cereals and to further increase total farm productivity and profits. Many long-term soybean growers have continued to include soybeans as a part of their crop rotation strategy because of these benefits. Double cropping after the soybean crop is relatively easy and maximises fixed nitrogen and stored soil moisture.

The national breeding program has focussed on clear hilum, culinary grade soybeans for the last 10 years. Culinary grade soybeans satisfy all the market requirements from high quality tofu and milk, through to flour, and they are excellent for oil crushing. There are normally price premiums paid above the crush market price for culinary and edible grade beans. While these will fluctuate with market influences each year, growers can generally achieve a $50–150/t premium for producing suitable varieties that meet all the market quality specifications.

Luke Gaynor in a seed increase block of the new variety, Bidgee. The picture was taken on 23 March, which clearly shows the early maturity of the variety.

Increasing grower interest in soybeans in southern cropping systems was reflected in an increase in the area planted from about 5000 ha to 8000 ha in the Riverina this year.

Soybeans are a good option for double cropping with winter cereals. The stubble is easily mulched, improving soil structure, and subsequent cereal crops can use fixed nitrogen and stored soil moisture. Soybeans are also useful as a break crop.

A trial was conducted at Yanco to test new and unreleased varieties when sown early and late. The trial indicated that Bidgee should be sown in November and Djakal can be sown into December.

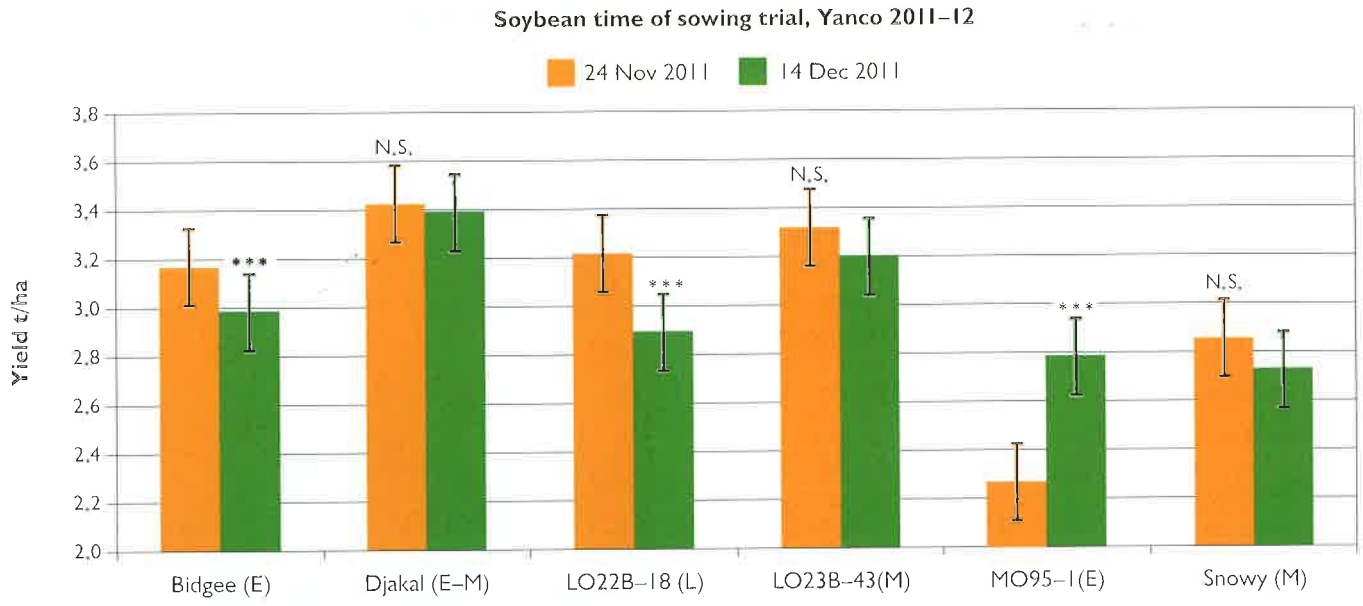

Figure 1. *Preliminary results of time of sowing trial at Yanco 2011–12*

E = early maturity type, M = mid maturity and L = late maturity type. *** means a significant difference was detected at P<0.05% between sowing dates. C.V. = 7.7%. There was a highly significant effect from variety detected.

Market opportunities

There are huge opportunities for Australian soybean growers with culinary soybeans, particularly the export market. Stabilised production and larger volumes of grain are needed to access these Asian-based markets.

Culinary markets generally prefer soybeans with high protein (40% or higher), high germination percentage and a large sized seed (18–24 g/100 seeds). The seed must be free from stains, soil, moulds and any damage to the seed coat. There is a very low tolerance of contamination from admixture and other seeds, including dark hilum soybeans and other pulses. Soy Australia has published a Soybean Marketing Guide for Growers, which is available at **www.australianoilseeds.com**

According to reports from Soy Australia, the domestic demand for *culinary grade* soybeans is at least 30,000 tonnes per annum but this could easily rise to over 50,000 tonnes, as there are still significant amounts of soy protein for soy milk manufacturing (also a range of other Asian soy foods) imported into Australia each year.

In addition, there is a huge opportunity for the export market. Of the 250 million tonnes of soybeans grown globally each year, China alone consumes nearly 70 million tonnes, 15 million from home grown production and imports over one million tonnes every week. Japan consumes over 4.5 million tonnes each year and Thailand, Korea, Taiwan and Indonesia about two million tonnes each. Australia could easily expand from its current 50–60,000 tonnes per annum to over 200,000 tonnes with a ready made export market at its doorstep.

Time of sowing trial

A time of sowing trial was conducted at Yanco in 2011–12 to test the response of new and unreleased varieties to early and late sowing dates. Plant populations were also tested. Grain yields, maturities, protein and lodging were some of the main variables studied.

Extreme flooding and wet conditions restricted the yield potential of this trial. It will be repeated 2012–13 for better reliable data. However these results are still valuable with a good level of statistical rigour. The early maturing types were more susceptible to yield losses than that of mid- and late-maturing types.

This time of sowing trial shows the stability of yield of some varieties if sown later into December. The trial indicates that Bidgee should be sown in November and Djakal can be sown into December (Figure 1).

Other data (not shown) comparing lodging to yields within sowing dates suggest the time of lodging may have significantly contributed to yield decline. This was more apparent with heavy rain events and prolonged waterlogging.

Acknowledgement

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