NSW DPI
primefacts
PROFITABLE & SUSTAINABLE PRIMARY INDUSTRIES www.dpi.nsw.gov.au
NOVEMBER 2007 PRIMEFACT 719 PRODUCTION GUIDE

Soybeans: inland northern NSW planting guide 2007–2008

Ian Rose

Special Research Agronomist (Soybean Breeding), Rural Innovation, Narrabri

Don McCaffery

Technical Specialist (Pulses and Oilseeds), Extensive Industries Development, Orange

Jeff Lowien

District Agronomist, Extensive Industries Development, Glen Innes

Bob McGufficke

District Agronomist, Extensive Industries Development, Inverell

Soybeans are a profitable option for many farming systems in northern New South Wales, particularly where the crop attains the quality standards for human consumption markets. The crop has been successfully grown over a long period in all of the irrigation areas from the Macquarie valley north to the Queensland border. While the areas grown reflect strong competition for scarce water from other crops, many producers have retained soybeans in their crop rotations. Long-term success has also been achieved in many seasons growing dryland soybeans in the milder areas of the North-West Slopes and Northern Tablelands. Dryland soybeans have been shown to have a beneficial role in mixed livestock and crop-farming systems. Benefits experienced in the Inverell and Glen Innes districts include:

- increased cash flow
- substantial contribution to the soil nitrogen balance, since soybean is a legume crop
- improved soil structure, resulting in improved pasture establishment
- valuable grazing from stubble and the occasional failed crop, and
- expanded options for hay and silage in the Northern Tablelands.

Consistent achievement of high soybean yields requires careful attention to many important aspects of crop management. The major publication *Soybeans* (Agfact P5.2.6, second edition August 1995) deals with almost all of these aspects in considerable detail. However, it does not include a list of suitable varieties for the different growing regions as this information can change from year to year. This Agfact is included in the *Australian Soybean Grower's Manual* along with more recent information on varieties, insect management, and other management and marketing aspects. The manual is available for growers to use as a ready reference and to store all current and future information on soybeans. It can be obtained from your local NSW DPI office.

Some regions have developed crop check guides for soybeans, which target best management practices. The Australian Oilseeds Federation publication *Australian oilseeds grower quality guide* outlines specific strategies for growers targeting human consumption soybean markets. Budgets for dryland and irrigated soybeans are available from the NSW DPI website www.dpi.nsw.gov.au. Growers should access all publications here for the most recent growing information.

Varietal characteristics

Select a preferred variety according to location, disease resistance, maturity, yield potential and suitability for the target market.

If a large area of soybeans is planned, consider selecting more than one variety. Use varieties of different maturity to spread planting and harvesting operations. Information is provided on the main varieties for each area, with emphasis on recent releases.

Human consumption varieties

Ivory

Bred by NSW DPI at Narrabri, Ivory is now being widely grown by irrigators in northern NSW from the Macquarie Valley north to the Queensland border.

It is a yellow hilum type, making it suitable for some segments of the human consumption trade as well as for crushing. It is a high yielding variety (see Table 3). Ivory is resistant to races 1 and 4 of phytophthora root and stem rot with field tolerance to race 15 It also has resistance to bacterial pustule and blight. Highly recommended for all irrigated and late dryland sowings.

Soya 791

Soya 791 was bred in the USA by Pioneer Hi-Bred. It has performed well in farmer trials in a wide range of locations from the Macquarie Valley north (see Table 3). It has resistance to phytophthora races 1 and 4, but is susceptible to race 15. Soya 791 has a light hilum, making it suitable for some segments of the human consumption trade as well as for crushing.

Recommended as an alternative to Ivory.

Cowrie

Bred by NSW DPI at Narrabri, Cowrie was first selected for its value in coastal production. In that environment it has proven a variety suited to premium human consumption markets for tofu and milk manufacture. It is being trialled in inland irrigated areas and has performed reasonably well. It is resistant to phytophthora race 1 but is susceptible to race 15. Cowrie is the only option available in northern inland areas for large seed yellow hilum markets. Suitable for irrigation and high rainfall tablelands districts. Not recommended for dryland slopes and plains.

Bunya

Bred by CSIRO, Bunya was released in 2006. It is a large-seeded human consumption type released for production in southern Qld. Limited testing indicates it may have some application in the Liverpool Plains (see Table 3). Resistant to phytophthora including race 15. Seed size is up to 15% bigger than Cowrie. This increases the risk of seedcoat damage at harvest and resulting poor establishment from damaged seed. Germination checks and attention to careful seed handling during planting are essential.

Crushing varieties

Hale

Hale was bred by NSW DPI at Narrabri and released in 2000. It has improved yield potential and disease resistance. It has shown excellent yields under both irrigated and dryland conditions (see Tables 3 and 4) and has immunity to races 1, 4 and 15 of phytophthora.

In northern NSW, Hale has out-yielded Valiant under irrigated conditions by 8.5% averaged over 9 trials and across six seasons. Its yield under dryland conditions is 2% higher than Valiant and 13.5% greater than Intrepid over six seasons of testing. Maturity, seed size, oil and protein content are very similar to Valiant.

Hale is the preferred variety for dryland situations. It is also promoted to irrigated cotton growers in northern river valleys as an early maturing alternative to the traditional full season varieties.

Valiant

Valiant, bred by NSW DPI at Narrabri, is a dryland variety suited to northern inland NSW.

It has field tolerance to races 1, 4 and 15 of phytophthora. Preliminary evidence indicates that its field tolerance is also effective against race 25. It is resistant to bacterial pustule and bacterial blight.

Intrepid

Intrepid, bred by NSW DPI at Narrabri, is a dryland variety recommended for northern inland NSW. It has less tolerance to phytophthora races 1 and 15, than Hale and Valiant. It has vigorous vegetative growth, making it a good competitor with weeds and it seems suited to minimum tillage. Its bottom pods are also slightly higher than Valiant and Hale. Intrepid is highly regarded by growers in the Northern Tablelands region.

Seasonal Reminders

Check seed germination and seed quality

Don't be caught with low quality planting seed. Soybean seeds are relatively short-lived and even when produced under optimum conditions can lose germination and vigour after a few months in storage.

Obtain a reliable germination test after harvest to make sure seed is worth keeping and test it again 4–8 weeks before sowing to ensure it has not deteriorated. Germination tests cost $30–$50 per sample. Seed testing laboratories are listed on the back page.

Prolonged wet weather before harvest reduces seed quality by the alternate wetting and drying of seed in the pods. Seed with high moisture levels will lose germination capacity after only a few months storage.

Seeds have only a thin seedcoat, making them more susceptible to damage than other crop species. Incorrect seed handling, the use of spiral augers, and long drops of seed onto hard surfaces will damage the thin seedcoat. Larger seeded types, grown for human consumption markets, are at greater risk of mechanical damage than the smaller-seeded crushing types.

Seeding rates and plant populations

Potential yield is determined by the ability to obtain a uniform and timely plant stand. The planting window for maximum yield potential opens in mid November. Yield potential declines with late plantings. The critical cut-off date varies from mid December in the Macquarie, Namoi and tablelands to late December in the irrigated border areas. By mid January yield potential has declined to the extent that other crops are preferred.

Experience has shown that dryland soybeans yield best when sown at lower seed rates than irrigated crops, particularly in the hotter, drier regions. However, plant populations lower than 15–20 plants/m^2 on the slopes and plains may increase harvesting problems because of pods set too close to the ground in the early-maturing varieties.

The desired row spacing under irrigation is as narrow as possible without compromising other management such as weed control. In cotton rotations soybeans will yield well under 100 cm spacings but yield advantages of 10–20% have been reported from narrowing rows to 50 cm.

Soybean plant growth must achieve full ground cover by the start of flowering (determinate varieties) or by mid flowering (indeterminate varieties). Evaluate management practices if full ground cover was not achieved by the optimum time for maximum yield potential.

Dryland crops on the slopes and plains should be sown on a 100 cm row spacing, which has been shown to conserve moisture for podfill. In the more favoured rainfall areas of the tablelands, crops are normally planted on 18 cm rows, although spacings can vary from 18 cm to 53 cm. Wider rows are acceptable provided complete ground cover is achieved by early to mid flowering and weeds are not expected to be a problem. Narrow rows are preferred when planting late or where weeds are likely to be a problem as the crop canopy closes more quickly.

Dryland yield and rainfall

The breeding program at Narrabri has been planting early indeterminate types in late November / early December for 24 seasons. In all seasons, full moisture profiles have been used on a heavy clay soil with 100 cm rows and the recommended dryland population.

This has allowed the development of a relationship between rainfall over the 120 days following planting and the resulting yield. Figure 1 illustrates the relationship: each point represents the actual yield obtained for the rainfall measured at the Australian Cotton Research Institute, Narrabri.

Growers might use this relationship as a guide to the yield expectation at their site. As an example, the expected rainfall at Narrabri for the 120 days from 1 December is 260 mm. This translates to a yield expectation of around 1.3 t/ha. If the rainfall expectation is less than 200 mm, yield expectations will drop below 1 t/ha. At the higher yielding end of the relationship, it is clear that yields above 2 t/ha can only be expected where rainfall in the growing period exceeds 300 mm. However, the yields should be discounted by about 10% to allow for the difference between experimental plot yields and commercial crop yields.

Table 1. Plant populations and seeding rates

Location	Population – plants/m^2	Seeding rate – kg/ha
Irrigation / mild dryland areas	25–30	50–60
Dryland / Slopes and Plains	15–20	35–40
Tablelands	35–40	70–80

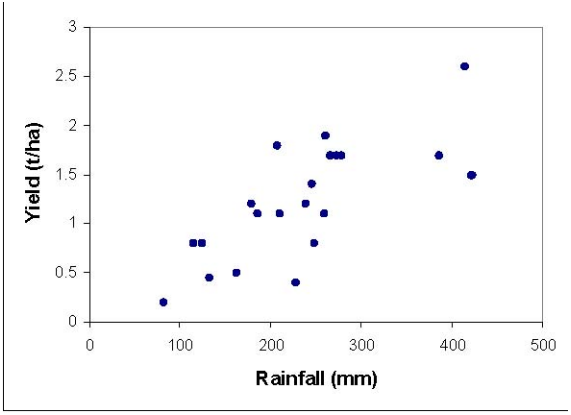

Figure 1. Relationship between dryland soybean yield and rainfall

Check nutrient deficiencies

Zinc deficiency is widespread on the grey clays of the irrigated production areas of NSW. Although this is a well-known problem with soybeans, zinc deficiency is still occasionally found. Some varieties may be more sensitive than others.

Zinc can be applied to either the soil or the foliage. Apply 30 kg/ha of zinc oxide to the soil every 5–7 years or apply zinc sulfate heptahydrate at 4 kg/ha as a foliar spray 6–8 weeks after planting. Apply the foliar spray as two split applications of 2 kg/ha in 100–200 L/ha of water about ten days apart to avoid leaf burn (see *Soybeans*, Agfact P5.2.6 for further information).

In acid soils (pH <5.0 $CaCl_2$), molybdenum deficiency is likely and can be corrected by applying 50 to 100 g/ha of molybdenum every 3 to 4 years. Molybdenum is commonly applied to the seed when inoculating or as a pre-mixed fertiliser.

Insect pests

Monitoring for insects throughout the season is highly recommended. It should be done weekly then twice a week from flowering onwards. Later maturing crops usually have increased insect pressure and require greater vigilance. Check the crop between 7 am and 9 am when the insects are most active on top of the crop canopy. Soybeans can tolerate up to 33% loss of leaf area before flowering without any yield penalties. However, once flowering commences soybean is less tolerant of leaf loss and damage can occur to growing points, flowers and pods. Loss of growing points can dramatically restrict plant growth and reduce yield potential. This can often occur well before visual damage can be seen. Leaf-feeding pests such as heliothis, soybean moth, looper caterpillar and grass blue butterfly are most likely to cause this damage.

A number of new insecticides have been approved for use in soybeans which are 'softer' on beneficials and can be used as part of an integrated pest management (IPM) program.

Green vegetable bug (GVB), red-banded shield bug, brown stink bug and the brown bean bug are the most common sucking pests occurring in soybeans. Green vegetable bugs can severely reduce both yield and quality by feeding on young pods and developing seed, and is by far the most damaging of the sucking pests. Sucking pests cause damage from very early pod development through to harvest. Growers targeting high quality tofu and milk markets should be aware of lower insect damage thresholds in seed for these markets.

Table 2. Thresholds for sucking pests of soybeans at early pod-fill

Pest	Threshold (human consumption) per m^2	Threshold (crushing) per m^2
Green vegetable bug	0.33	1.0
Brown bean bug	0.5	1.5
Red-banded shield bug	1.0	3.0
Brown stink bug	1.7	5.7

(Source: H Brier, QDPI &F)

The incidence of insect infestation will vary each year. For example, during unseasonably hot weather, soybean moth and lucerne seed web moth can be a problem. Growers sometimes fail to recognise variable pest problems before significant damage occurs because they were not present in the previous year.

Silverleaf whitefly (B-biotype) is an emerging pest of soybeans in Queensland and the North Coast of NSW. Growers should be on the lookout for whitefly in crops and have them positively identified. Information is available in the publication *Silverleaf whitefly alert for soybean growers*, available through NSW DPI District Agronomists or from the NSW DPI website:
http://www.dpi.nsw.gov.au/reader/crops

More detailed information on insect pests and their control is available in the second edition of *Soybeans* (Agfact P5.2.6), the QDPI&F publication *What soybean insect is that?*, TopCrop's *Crop insects: The ute guide*, and the guide *Insect and mite control in field crops*. The latter publication is available from district agronomists or can be found on the NSW DPI website
http://www.dpi.nsw.gov.au/reader/crops

Phytophthora root and stem rot

Both irrigated and dryland growers should be aware of their paddock susceptibility and management strategies that minimise losses.

The disease is first seen in poorly drained sections of the field. Plants wilt and have characteristic dark-brown to black lesions on the stem extending from ground level upwards. Older varieties can be completely susceptible to certain races, while newer varieties can display different levels of field tolerance or complete resistance. The breeding program has bred in resistant genes to counteract the development of new races.

Race 1. Prior to 1990 most phytophthora isolates from NSW belonged to race 1, with race 15 also present at low levels.

Race 15. Observations in Queensland during 1989–90 detected a shift from race 1 to race 15 at some sites on the Darling Downs, resulting in severe yield losses in field tolerant varieties such as Davis, Forrest and Dragon. Shifts from race 1 to race 15 in NSW had been observed in the Berrigan/ Finley area between 1993 and 1995. In the 1998/99 season the shift to race 15 was detected at Gunnedah, where one grower suffered some losses, and on the research plot area at Narrabri.

Other races are so far isolated to southern areas, however, the increasing number of races in those areas serves as a reminder that phytophthora deserves constant attention. Growers should constantly monitor their crops and follow the management strategies outlined below to sustain the usefulness of the available cultivars:

- Ensure that waterlogging is minimised by selecting only well drained paddocks and by carefully scheduling irrigations.
- Develop crop rotations that minimise continuous soybean cropping, and monitor crops closely so that even low levels of disease are detected.
- Restrict susceptible and field tolerant varieties to well-drained sites with no previous history of either soybean growing or phytophthora infection.
- Once phytophthora has been identified, growers should consult with their district agronomist to have the race(s) identified and to develop a control strategy. This will allow incidences of disease to be monitored and will also help with early detection of changes in race patterns.

GRDC and QDPI&F have recently developed the TopCrop *Mungbean & soybean disorders: The ute guide.* Growers should purchase a copy of this guide as it contains valuable information on soybean diseases, nematodes, nutritional and environmental disorders and herbicide injuries. The Ute Guide can be purchased from GRDC Ground Cover Direct by phoning (freecall) 1800 11 00 44.

Table 3. Irrigated yield (t/ha) of soybean varieties at Narrabri and Breeza

	2006/07		2005/06		2003/04		2002/03		2001/02	
	Narrabri	Breeza	Narrabri	Breeza	Narrabri	Breeza	Narrabri	Breeza	Narrabri	Breeza
Ivory	–	2.68	2.45	3.28	3.28	4.20	3.15	3.00	3.00	3.04
Cowrie	–	2.49	2.08	3.13	2.84	3.69	2.80	2.16	nt*	
Soya 791	–	2.36	2.35	3.35	3.04	3.63	2.97	1.28	3.34	3.14
Valiant	–	2.02	2.01	3.29	3.37	3.90	1.87	1.63	2.71	3.17
Hale	–	2.42	2.61	3.27	2.65	3.21	2.07	1.96	2.97	3.39
Bunya	–	2.74	2.51	3.75						

nt = not tested.
Trials were not conducted in 2004/05.
– = data too variable

Table 4. Dryland yield (t/ha) of soybean varieties at Narrabri

	2003/04	2001/02	2000/01	1999/2000
Ivory	1.22	0.33	0.10	0.73
Cowrie	1.29	nt*	nt*	nt*
Soya 791	1.09	0.51	0.12	0.84
Valiant	1.17	0.68	0.90	0.39
Hale	1.30	0.95	0.98	0.52

* nt = not tested.
Trials were not conducted in 2002/03.

Harvesting

Harvest soybeans as soon as possible to minimise harvest delays caused by wet weather. The problem of wet weather at maturity is more frequent in the southern irrigation areas, but can occur in northern inland areas.

- Aim to sow early so that crops can mature as early as possible, preferably in April.
- Harvest at 15% moisture content if drying equipment is available – normally 10 days after physiological maturity. Alternatively, wait until the grain moisture falls to 13%.
- Be prepared to harvest at moisture content greater than 15% if the crop is likely to mature in May. Some drying costs will be incurred, but it is cheap insurance.
- Use an oven-dried sample to measure moisture. There are many cases of moisture meters reading inaccurately, especially at moisture levels above 16%. An oven-dried sample is the only reliable measurement if there is any uncertainty.

Seed testing laboratories

SGS Agritech
214 MacDougall Street
PO Box 549
Toowoomba Qld 4350
Phone (07) 4633 0599; Fax (07) 4633 0711

E M Pascoe Seed Testing Services
12 Ridge Rd
Greensborough Vic 3088
Phone/Fax (03) 9434 5072

Futari Grain Technology Services
34 Francis Street
PO Box 95
Narrabri NSW 2390
Phone (02) 6792 4588; Fax (02) 6792 4221

GrainCorp Grower Services
30 Barwon Street
Narrabri NSW 2390
Phone (02) 6792 1433; Fax (02) 6792 3825

Seed Services Centre
SA Department of Primary Industries
GPO Box 1671
Adelaide SA 5001
Phone (08) 8303 9549; Fax (08) 8303 9508

Useful websites

Australian Oilseeds Federation
www.australianoilseeds.com

Grains Research and Development Corporation
www.grdc.com.au

GrainCorp
www.graincorp.com.au

National Agricultural Commodities Marketing Association Inc.
www.nacma.com.au

National Oilseed Processors Association
www.nopa.org

NSW Department of Primary Industries
www.dpi.nsw.gov.au/reader/crops

Pulse Australia
www.pulseaus.com.au

Qld Department of Primary Industries & Fisheries
www.dpi.qld.gov.au

ISSN 1832-6668

Check for updates of this Primefact at:
www.dpi.nsw.gov.au/primefacts

Job number 8343