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Gross margin analysis: soybean variety Gwydir(Φ), Delungra 2021–22

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NSW DPI, Grafton.

Key findings

- The Gwydir(Φ) soybean crop was planted on 14 December 2021, approximately one month later than planned. It reached physiological maturity on 5 May 2022. Harvest was delayed by wet weather and was completed on 14 May. The crop yielded 2 t/ha with a grain protein concentration of 42% dry matter (DM) basis.
- The crop gross margin was $822/ha.
- This experiment demonstrated that Gwydir(Φ) soybean is well adapted to the northern slopes production region of New South Wales (NSW) in terms of yield, resistance to leaf diseases and maturity.
- Despite wet weather delaying harvest, the Gwydir(Φ) crop achieved the edible standard grade, demonstrating the weathering tolerance of this variety.

Keywords soybean, Delungra, gross margin, 2021, 2022, northern slopes, delayed planting, nitrogen, legume, wet conditions

Introduction

The ASBP has developed soybean varieties with high yield potential, adapted to early planting dates, and with suitable maturity for the NSW northern tablelands and slopes regions. Slow-maturing, long-season soybean varieties (e.g., variety Hayman(Φ)) are not ideally suited for grain production in this region due to the risk of frost damage to late-maturing crops.

The Australian Soybean Breeding Program (ASBP) bred the variety Gwydir(Φ). It has shown potential for producing high yields and grain protein (GP) concentration in previous experiments conducted at NSW DPI, Grafton. In the hot, dry season of 2018–19, in a replicated, on-farm experiment at a nearby property, Gwydir(Φ) (then line number T171A-2) produced a yield of 2.15 t/ha, comparable with the industry standard Richmond(Φ) (1.94 t/ha) and higher than industry standard Moonbi(Φ) (1.73 t/ha, l.s.d. 0.24 at p=0.05).

The variety Gwydir(Φ) was planted at Nathan Anderson farm at Baflour's Peak, north of Delungra in NSW as an initiative of the NSW DPI and GRDC project 'Soybean expansion in high rainfall zones of northern NSW'. A complete gross margin (GM) analysis was conducted on the crop.

Site details

Location	The Springs, 2335 Glenesk Road, Balfour's Peak, NSW 2403 Latitude 29° 31' 29.67" S, Longitude 150° 45' 12.64" E
Paddock history	• Barley winter 2021. • Soybean planted immediately following harvest of the barley crop.
Soil type and nutrition	• Grey clay. • Table 1 details the soil chemical analysis for the 0–15 cm depth.

Temperature and rainfall	A total of 591 mm of rain was received during the growing season; 178 mm more than the long-term average (431 mm) for the same period (Figure 1).
Planting date	14 December 2021.
Fertiliser	GAIN+Z® at 80 kg/ha (10% N, 21.8% P, 4% S, 1% Zn).
Sowing rate and established plant population	• Target population: 280,000 plants/ha. • Established population: 260,000 plants/ha.
Weed management	• Fallow application: Crucial 600® @ 2.5 L/ha (600 g/L glyphosate), Starane Advanced® 450 mL/ha (333 g/L fluroxypyr) and Valor® 30 g/ha (500 g/kg flumioxazin). • Post-emergent application: Spinnaker® @ 140 g/ha (700 g/kg imazethapyr) and Verdict® @ 150 mL/ha (520 g/L haloxyfop).
Insect management	• Skope® (218 g/L acetamiprid + 32.5 g/L emamectin) @ 350 mL/ha to control soybean looper (Thysanoplusia orichalcea) and redbanded shield bug (Piezodorus oceanicus). • Decis Options® (27.5 g/L deltamethrin) @ 500 mL/ha to control soybean looper and redbanded shield bug.
Disease management	Nil required.
Harvest date	Physiological maturity at 5 May 2022; due to wet weather, the harvest was not completed until 14 May 2022.

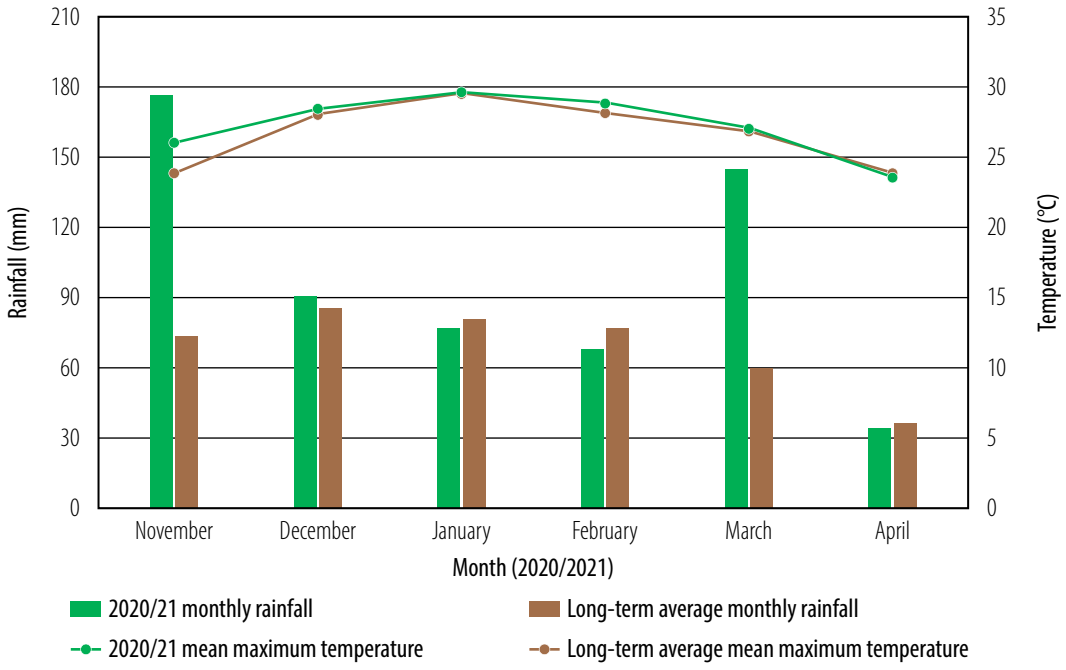

Figure 1 Temperature and rainfall for the 2021–22 growing season compared with long-term averages at Delungra, NSW.

Table 1 Soil chemical analysis of the experiment site at Balfour's Peak, NSW.

Characteristic/anolyte	Unit	Soil depth 0–15 cm
pH_{Ca}	pH units	6.8
pH (Water)	pH units	7.5
Electrical conductivity (1:5 water)	dS/m	0.13
Sulfur (S) (KCl40)	mg/kg	2
Colwell phosphorus (P)	mg/kg	16
Phosphorus buffer index		190
Organic carbon (C)	%	1.4
Ammonium nitrogen (N)	mg/kg	2.8
Nitrate nitrogen (N)	mg/kg	4.9
Chloride	mg/kg	<10
Boron	mg/kg	0.6
DTPA copper (Cu)	mg/kg	1.8
DTPA zinc (Zn)	mg/kg	0.38
DTPA manganese (Mn)	mg/kg	13
DTPA iron (Fe)	mg/kg	43
Exchangeable aluminium (Al)	cmol(+)/kg	<0.1
Exchangeable calcium (Ca)	cmol(+)/kg	48
Exchangeable potassium (K)	cmol(+)/kg	0.71
Exchangeable magnesium (Mg)	cmol(+)/kg	26
Exchangeable sodium (Na)	cmol(+)/kg	0.72
CEC	cmol(+)/kg	75
Calcium/magnesium	%	1.8
Aluminium saturation	%	<1

Results

Yield and grain protein

The Gwydir$^{\Phi}$ crop (Figure 2) yielded 2 t/ha with a GP concentration of 42% dry matter (DM basis. Because the crop was sown a month later than planned and was slow to establish due to prolonged wet weather, it can be assumed that the yield potential of this crop was reduced.

Observed changes in growth

The ASBP has collected data on the maturity of varieties at Grafton and from on-farm trials across northern NSW for several decades. From traditional planting dates in the first week of December, the variety Gwydir$^{\Phi}$ typically takes around 132 days to reach physiological maturity (P95 stage). From a planting date of 14 December at the Balfour's Peak site, Gwydir$^{\Phi}$ took 142 days to reach physiological maturity (P95). Seasonal conditions can affect crop maturity, for example, crops can finish more slowly in mild, wet weather as was experienced in the 2021–22 season.

The crop grew to 59.7 cm in height, compared with a long-term average of 75.4 cm for Gwydir$^{\Phi}$ planted in early December at Grafton, NSW (ASBP data). The wet weather that caused the later planting time probably accounts for the slow establishment and shorter than average plant height. The crop also had competition from weeds during the vegetative phase.

Gross margin analysis

Table 2 details the GM analysis for this crop, which was $822/ha for edible grade soybean ($722/t).

Table 2 Gross margin analysis of soybean variety Gwydir, Nathan Anderson, Balfour's Peak, NSW.

Soybean gross margin analysis – NSW DPI Grafton									
Crop: Soybean variety Gwydir[1]				**Location: Balfour's Peak, NSW**				**Date: 2021–22**	
Income/ha:						Crushing grade			
Grain	2.00 t/ha @			$720 /tonne		Edible grade			1440.00
A. Total income $/ha									**1,440.00**
Variable costs/ha:		**Machinery ex-GST**			**Inputs ex-GST**				**Total Cost $/ha**
Operation	**Date**	**Hrs/ha**	**Cost $/hour**	**Total $/ha**	**Rate /ha**	**Unit**	**Cost $/unit**	**Total $/ha**	
Sowing									
Gwydir[1] soybean seed		0.35	22.87	7.94	37.50	kg	1.75	65.63	**73.57**
Inoculant		with above				g			
Fertiliser									
GAIN+Z		0.14	20.17	2.80	0.80	t	104.00	83.20	**86.00**
Stoller COMO		0.14	20.17	2.80				32.00	**89.66**
In-crop plant protection (herbicide, insecticide, fungicide)									
Knockdown: glyphosate		0.14	20.17	2.80	3.20	L	6.60	21.12	**23.92**
Knockdown: Starane					0.30	L	31.00	8.00	**9.30**
Pre-emergent: Valor PSPE		0.14	20.17	2.80	0.21	kg	142.50	29.93	**32.73**
Post-ermergent: Spinnaker 700WG								0.00	**0.00**
Post-emergent: Verdict		0.14	20.17	2.80				0.00	**2.80**
Insecticide: Skope		0.14	20.17	2.82	0.32	L	117.00	37.44	**40.26**
Insecticide: Decis		0.14	20.17	2.80	0.50	L	12.50	6.25	**9.05**
Insecticide: Decis		0.14	20.17	2.80	0.50	L	12.50	6.25	**9.05**
Contract harvesting – minimum rate per ha per ha							172.73	per ha	**172.73**
plus increment for higher yields greater than			0.00	t/ha @			–	per 100 kg	**0.00**
plus fuel			–	L/ha @			–	per L	**0.00**
or own plant			–	ha/hr @			–	per hour	**0.00**
Costs related to income	Your notes								
Levies	http://www.agriculture.gov.au/ag-farm-food/levies/rates#field-crops						1.02%	income/ha	**0.00**
Insurance								income/ha	**0.00**
Other								income/ha	**0.00**
Costs related to yield	Your notes								
Cartage/freight	Cost of transport of grain to receival centre						34.55	/tonne	**69.09**
Levies							–	/tonne	**0.00**
B. Total variable costs $/ha:									**618.13**
Enterprise Unit: 1 ha									
C. Gross margin (A–B) $/ha:									**821.87**
Total gross margin for 1 hectare									**1445.45**

Grain quality and marketing

Despite wet weather delaying harvest, the Gwydir(ф) crop achieved the edible standard grade, demonstrating this variety's weathering tolerance. Grain protein concentration was 42% DM basis, which is above the edible standard specification of 40% DM.

Figure 2 Nathan Anderson's crop of Gwydir(ф) at Balfour's Peak, NSW.

Conclusions

Gwydir(ф) yielded 2 t/ha at this site with a gross margin of $822/ha. A higher yield potential would have been expected if wet weather had not delayed harvest of the preceding barley crop and delaying the soybean crop planting by a month. Provided soil moisture is not limiting, the traditional planting time for dryland soybean crops in this region is early to mid November.

Synthetic N fertiliser prices reached record highs during the 2021–22 season. The grower highlighted the benefit of N fixed by the soybean crop and the N-rich crop residues to his double cropping system with a winter cereal. This grower estimates the value of the residual N from the soybean crop at around $140/ha, which he includes in the GM analysis of the following barley crop.

More work is required to benchmark residual N from soybean crops in this region to allow growers to better estimate the economic benefit to their farming system. Future work is also required to define the value of other soil benefits provided by soybean crops, such as increased soil biological activity.

Frost is a risk to soybean crops on the northern slopes and tablelands of NSW. This late-planted crop was harvested on 14 May 2022, which is in the frost-risk period for this region. Variety selection and rotation choices should aim for soybean crops to reach physiological maturity as early in autumn as possible to minimise the risk of frost damage before harvest.

As spring is usually the driest season of the year in north-eastern NSW, having adequate moisture available at planting in non-irrigated crops is critical. It is recommended that planting only occurs on a full moisture profile using farming systems with minimal soil disturbance. In the northern slopes region of NSW, soybean should be considered in summers where wetter than average conditions are predicted (e.g., La Niña cycles).

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