



Grains Research **UPDATE** NORTHERN REGION

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Benchmarking sunflowers in NNSW & SQLD

Simple changes in agronomic practices and harvesting can improve the reliability of sunflower profitability in northern NSW and southern Queensland says NSW DPI district agronomists Loretta Serafin and Stephanie Belfield. Their benchmarking study of agronomic practices included 134 sunflower paddocks grown by 78 growers, on more than 15,000ha over three seasons. The geographic spread of the crops stretched from Gunnedah and Moree in NSW, to Dalby, Toowoomba and Warwick in Queensland, with the majority grown under dryland conditions.

Trends from the benchmarked paddocks are summarised below:

- Yield was optimised at plant populations of 25-35,000 plants/ha.
- Crops with a higher average plant height tend to yield more.
- Larger head diameter is a trait linked with higher yields.
- Yield is slightly positively correlated with nitrogen and phosphorus rate.
- Nitrogen and head diameter are negatively correlated, meaning the higher the nitrogen rate the smaller the head diameter (beyond an optimum N rate).
- Higher plant populations per hectare = smaller mean head diameters and taller plants.
- Higher plant population crops tend to have higher N rates applied
- Oil content declines with excessive nitrogen application.
- Sowing date is negatively correlated with oil content, hence the earlier you sow the higher the oil content and conversely the later the sowing date the lower the oil content.

- Crops sown deeper tend to have higher oil content.
- The higher the rate of P and Zn applied, the higher the established plant population.

Sunflower agronomic practices and production are highly variable across the northern grains region, so it is important to focus attentions on key agronomic issues like nitrogen and soil water budgeting, plant population and establishment, and insect and weed management practices. Strategic management to achieve improved yield, oil, quality and economic outcomes is required.

Sunflowers require approximately 42kg/ha N to produce 1 tonne of grain. Sunflowers extract more deep (>60cm) soil water and nitrogen from the soil profile than many other crops. Therefore growers need to be more aware of N availability, particularly bulges lower in the profile which can be accessed by sunflowers. It is advisable to test the soil profile for starting soil N prior to sowing.

Balancing N and water is important for profit - both to maximise yield and oil content and to minimise variable costs. An outcome of this project is the establishment of new crop lower limits for sunflowers on soils around Gunnedah and Moree. This will aid in improved accuracy of soil water calculations for sunflower growers and agronomists.

In northern NSW sorghum is the major crop occupying 69% of the total summer crop area (230,000ha), with sunflowers at 13% and maize at 5% on average. The area of sunflowers grown in northern NSW and southern Qld has markedly declined since the mid 1990's to a point where domestic demand consistently outstrips supply. It is hoped with improved agronomic and economic management, sunflowers can remain a viable crop in our northern farming system and one day return to production areas consistent with domestic demand.

A more detailed paper on the results and implications of this work was presented at the recent Moree Grains Research Update. This paper along with others is available on line on the GRDC's website at: www.grdc.com.au

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Improving reliability in rainfed corn

“More accurate yield models of rainfed corn production indicate it to be a more reliable crop option in Northern New South Wales than it is often credited as,” says Dr Colin Birch of the University of Queensland. Dr Birch used the APSIM model for corn and found moderate to high predicted yields with early to medium maturing varieties when sown with a full water profile in soil with a moderately high plant available water holding capacity (150 mm at Goondiwindi and 190 mm at Moree was assumed), low populations and appropriate planting time. There was wide variability around the predicted median yields shown in the table below – including some very high predicted yields (7-8 t/ha¹), emphasising the impact of seasonal variability over the 100 years of weather data used in the analysis.

Early planting of short season cultivars is a strategy to minimize the impact of high temperatures, where as late planting takes advantage of summer-autumn conditions with a generally more favourable water supply and moderate temperatures during grain filling. Agronomic practices that improve water use efficiency should be

preferred, and risk can be further managed by having the flexibility to cut failing grain crops for silage.

For areas like Moree and Goondiwindi, the optimum planting time is early (August) or late (January-February). Quick maturing cultivars should be used at relatively low populations (ie ~ 20,000 /ha) and only sown into a full profile. Higher populations were generally not supported for these cases by the analysis.

The modelling studies provide guides to sound practices at a regional scale, however, for specific sites similar investigations need to be done – for example if plant available water holding capacity is greater. In this case higher yields would be expected, with less variability.

A copy of Dr Birch's paper as presented at the Moree GRDC Update in July 2007 is on the GRDC website at: www.grdc.com.au

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Additional phosphorus required?

Shallow fertiliser placement of immobile nutrients in continuously cropped systems has led to relatively enriched surface layers and depleted subsoils. New research led by Dr Mike Bell, with the Department of Primary Industries at Kingaroy Qld, has found up to a 35-40% yield increase with additional phosphorus (P) applied pre-planting, compared to the practice of applying only starter P at seeding. The size of the yield response decreased as soil P increased, and although deep placed P increased yield, so did pre-plant P applied in the cultivated layer (5-7cm). There is not yet any clear

Table 1: Summary of Predicted Median Yield (PMY, t/ha¹) for a quick and a medium maturity maize cultivar, sown at 20000 plants ha², on 3 dates with Plant Available Water (PAW) of 100% and 67% of capacity to a depth of 1.8 m at Moree or Goondiwindi

		Moree	Goondiwindi	Moree	Goondiwindi
Quick cultivar 20,000 pl/ha		100% PAW	100% PAW	67% PAW	67% PAW
Sown:	Aug 15	3-4t	3-4t	2-3t	<2t
	Nov 15	3-4t	2-3t	2-3t	<2t
	Feb 15	3-4t	3-4t	2-3t	2-3t
Medium cultivar 20,000 pl/ha		100% PAW	100% PAW	67% PAW	67% PAW
Sown:	Aug 15	<2t	<2t	<2t	<2t
	Nov 15	2-3t	2-3t	2-3t	<2t
	Feb 15	<2t	2-3t	<2t	2-3t

evidence of a need to place additional P deeper in the soil profile, although the residual effects in subsequent years are yet to be assessed.

Phosphorus was direct drilled using custom-made 30 inch coulters with a fertiliser shoot down the side. This allowed P to be placed as deep as 20cm with minimal soil disturbance.

“The results are proving current farming practices are running down the native soil fertility, especially in the 10 to 30cm parts of the profile. It is thought that this run down is the reason that P responses in addition to starter P fertilisers are being recorded”, said Dr Bell.

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Millet cover crops to augment VAM

“Growing a short-term millet cover crop can increase VAM (Vesicular-arbuscular mycorrhizae) fungi and nematode activity, increase water infiltration and subsequent cereal yields and reduce soil erosion,” said Nikki Seymour from Queensland’s Department of Primary Industries and Fisheries in Toowoomba.

Trials conducted on Vertosols in the Goondiwindi region from 2004 to 2006, show White French millet planted in a long fallow resulted in increased VAM activity compared to a long bare fallow. VAM activity was not significantly different between millet brown manured at 6 weeks and millet allowed to mature (10 weeks). As well as the broader agronomic benefits, this VAM effect has implications both for crop rotation and for crop uptake of nutrients like P and Zn after a long fallow,” said Dr Seymour.

“Increased VAM levels were likely to lead to better establishment and improved cereal growth, even though wheat is not considered as dependent on VAM as other

crops,” said Dr Seymour. An increase in free-living nematode numbers is also a sign of improved soil microbial biomass. This is most likely due to increased soil organic matter following the millet cover crop and is beneficial to crop production as organic matter decomposition and nutrient cycling in the soil will generally be enhanced.

Dr Seymour indicated that numbers of the pathogenic nematode, *Pratylenchus thornei* above 2,500/kg of soil at planting are starting to be an issue for wheat production and so tolerant varieties are recommended. At most sites, levels of these and a much less damaging but still pathogenic nematode *M. brevidens* were well below levels of concern, even after millet.

Crop reliance on VAM for maximum growth varies with the crop species and variety, and with the P and Zn status of the soil.

Table 2. Crop rating on VAM dependency.

Mycorrhizal dependency	Winter Crops	Summer Crops
Very high	Linseed Faba bean	Cotton Maize Pigeon pea Lablab
High	Chickpea	Sunflower Soy bean Navy bean Mung bean Sorghum
Low	Field pea Oats Wheat Triticale	
Very low	Barley	
Independent	Canola Lupins	

Table 1. Soil biology results from different millet cover crop trials.

Site/paddock	Nematodes/kg dry soil							
	VAM colonisation (%)		<i>P. thornei</i>		<i>M. brevidens</i>		Free-living nematodes	
	Millet	Fallow	Millet	Fallow	Millet	Fallow	Millet	Fallow
Oats	14.0	5.6						
Wheat 1	41.2	23.0						
Wheat 2	1.6	0.6	311	88	0	0	7,846	895
Wheat 3	5.9	1.8	207	24	0	55	5,403	764
Wheat 4			487	46	0	0	2,413	2,580
Wheat 5	22.8	2.4	2,512	93	1,276	0	5,700	2,107

Drought-enforced long fallows may affect 2007 crop yields, as VAM levels are reduced. The longer the fallow, the less chance of survival of these beneficial organisms and the higher the chance of 'Long fallow disorder' (LFD). Primarily LFD is a P or Zn deficiency and can be overcome by additional P &/or Zn fertilisers. If soils are suspected of having low VAM levels, crops which host and have low dependency on VAM should be planted to build soil VAM inoculum for the subsequent crop.

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Chickpea *Heliothis* thresholds

New guidelines for *Heliothis* thresholds in chickpeas give northern region chickpea growers and advisers the means to calculate an economic threshold for control.

The guidelines are based on four seasons of research supported by the Grains Research and Development Corporation (GRDC) and are presented in a new technical brochure put out by Queensland's Department of Primary Industries and Fisheries (QDPI&F). The guidelines help to define the cost of inaction and provide a rational basis to calculate the economic break even point for a spray decision.

Detailed in the new brochure are the impacts of *Heliothis* on chickpea yield and quality, and how larval behaviour impacts the crop. A key issue, is that this research has confirmed earlier findings by QDPI&F's Ian Titmarsh, that larvae presence during flowering has little impact on yield.

This work has the potential to save one spray in many crops, as crops are often sprayed during flowering to prevent the loss of flowers and buds and then again during the more critical time of pod filling-maturity.

This work has involved several QDPI&F researchers in different regions, including; Melina Miles and Richard Lloyd in Toowoomba and Paul Grundy and Sherree Short in Biloela.

A four-page brochure is available from the DPI&F Business Information Centre on 13 25 23.

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Latest on rust

The GRDC website has links to the latest on cereal rust to help you find the latest information you need fast. Whatever your information need is in relation to cereal rust, it is likely that the resources on the GRDC website can assist.

www.grdc.com.au/rustlinks

**Visit Australia's Grains
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Diary dates

Grains Research Updates – dates set for 2008

Dubbo – February 27 and 28th

Goondiwindi – March 5 and 6th

**Detailed diary dates are located
on the GRDC website**

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