Optimising
Irrigated Grains

Key Learnings (Chickpeas)

2020 and 2021

SOWING THE SEED FOR A BRIGHTER FUTURE

Chickpeas under irrigation

i) Crop structure and Plant population

Key Points:

- ***Chickpea yields under irrigation have reached yields over 4.0t/ha.***
- ***35 seeds/m^2 resulting in plant populations averaging 21-25 plants/m^2 were the most profitable populations tested under surface and overhead irrigations systems from a late April sowing.***
- ***The influence of lower chickpea populations can result in productivity losses of 1.0t/ha.***
- ***Higher yields have come from April sowing compared to May sowing. Where sowing is delayed, populations need to be increased to 35 plants/m^2.***
- ***Yields have not been stable between the two years of trials. Yields from the Finley site were approximately half in 2021 compared to 2020, with the overhead irrigation suffering the higher yield reduction. Kerang 2021 yields were similar between seasons.***
- ***Lodging has been observed in higher plant populations, but this is also influenced by cultivar choice.***

Crop structure and Plant population

Growing chickpeas under irrigation has demonstrated that there are yield penalties for crops that have reduced biomass. With early pod set determined by temperature (>15 degree C) and grain fill impacted by high temperatures later in spring, there is a window of opportunity for maximising yield by taking advantage of higher biomass promoted by higher seeding rates or earlier sowing (Figure 1).

ii) Inoculation of Chickpeas

Key Points:

- ***As chickpeas require a specific inoculum (Group N), it is highly recommended that seed be inoculated before sowing.***
- ***Using higher rates of Alosca granules resulted in increased nodulation in 2020 but there was no advantage to higher rates over 10kg/ha in 2021. Untreated plants had few root nodules.***
- ***While yields were lower in the untreated plots, there was no statistically significant difference between inoculated and uninoculated crops in the trials.***
- ***Applying artificial nitrogen (40kg N/ha) has not influenced nodulation in research conducted so far, but equally it hasn't been associated with yield increase.***
- ***High soil N at sowing may have the effect of removing some of the reliance on nitrogen fixed by the crop.***

Irrigated Cropping Council
Promoting irrigated agriculture
GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION
FAR AUSTRALIA

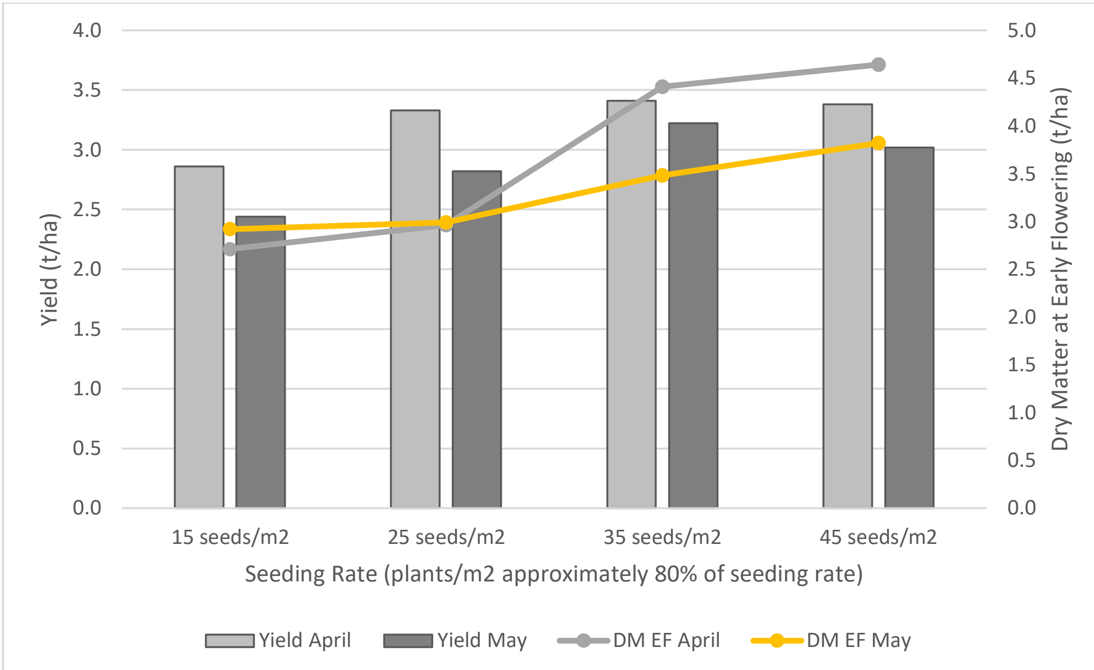

Figure 1: Chickpea yield (t/ha) and dry matter (t/ha) at early flower (EF) averaged from two cultivars – Finley, NSW cv Genesis 090 and PBA Royal.

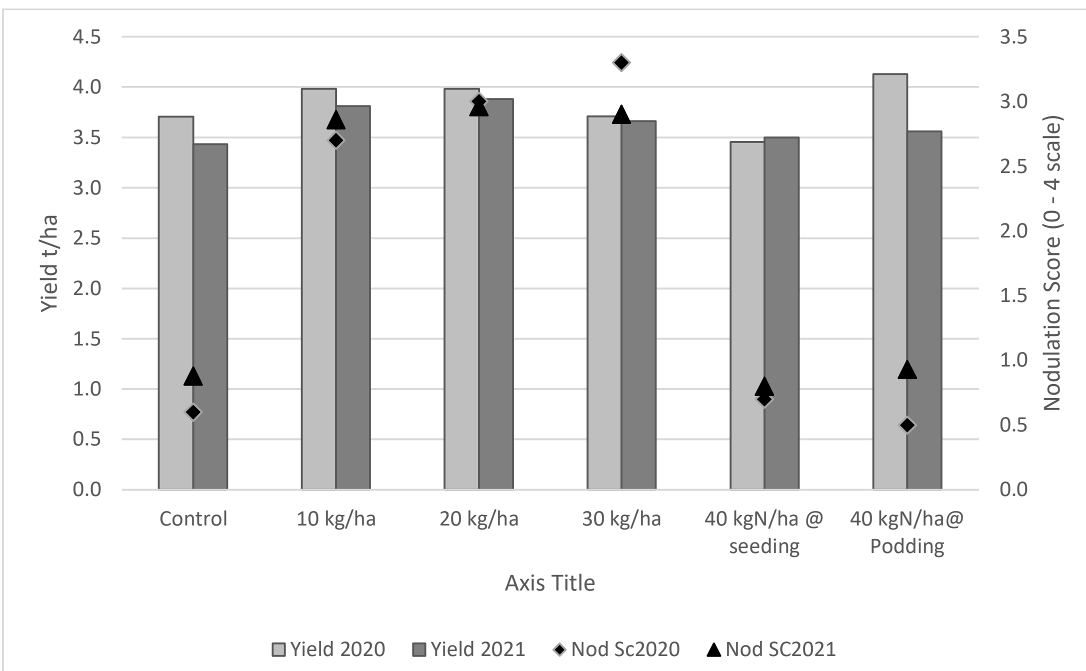

Figure 2: Influence of inoculant (ALOSCA granules) rate (kg/ha) and applied nitrogen kg N/ha on chickpea yield (t/ha) and Nodulation Score (NodSc) from the Kerang, Vic 2020 and 2021 trials – cv PBA Royal.

Inoculation has resulted in a significant improvement in nodulation scores assessed 9 weeks after sowing. However, the grain yields have not followed a similar trend, with yields regarded as statistically similar.

Irrigated Cropping Council Promoting irrigated agriculture
GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION
FAR AUSTRALIA

iii) Disease management in irrigated chickpeas

Key Points:

- ***Chickpeas have been more susceptible to foliar disease, specifically ascochyta, than faba beans at both research sites.***
- ***The disease rating of the cultivar was an important indicator of cultivar yield performance.***
- ***The benefit of an 'Expensive' strategy using a combination of SDHI (group 7) and QoI (Group 11) chemistry gave significantly better disease control and significantly higher yields than 'Cheap' strategy based on chlorothalonil and tebuconazole, but only with PBA Monarch at both sites.***
- ***Genesis 090 showed good response to fungicide but there was far less advantage to the more expensive fungicide strategy.***
- ***While the untreated yields at Kerang were approximately 50% of the yields where disease was controlled, the actual grain produced in the untreated was unlikely to have any commercial value due to the number of small and discoloured chickpeas in the sample.***

The OIG project has been looking at the influence of newer fungicide chemistry in chickpeas grown under either surface or overhead irrigation compared to historic standards using chlorothalonil (Table1).

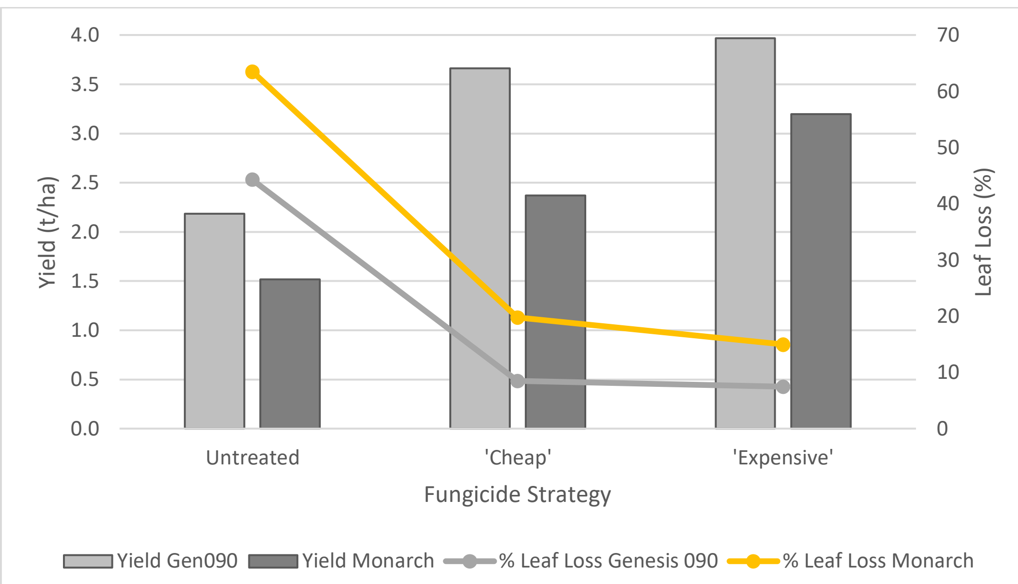

Figure 3: Influence of cultivar and fungicide strategy (based on three applications) on yield (t/ha) and % leaf loss – Kerang, VIC, cv Genesis 090 and Monarch.

Table 1. Trial treatment summary.

TRT	Variety	Management Strategy	4-5 weeks post emergence	Pre-Flower	Late Flower
1		Untreated*	-	-	-
2		Cheap	Chlorothalonil 720 1 l/ha	Chlorothalonil 720 1 l/ha	Chlorothalonil 720 1 l/ha
3		Expensive	Veritas 1l/ha	Aviator Xpro 600ml/ha	Veritas 1l/ha

Pre irrigation – it's not just 'add water' and enjoy the high yields

Key Learnings:

- **Water savings can be made with improved irrigation infrastructure such as overhead sprays.**
- **Irrigation districts have varying access to water during the winter season, with some irrigators having no access from mid-May to mid-August.**
- **Not having sufficient soil moisture going into winter may leave the crop susceptible to 'winter drought', that can have a negative impact on yield.**
- **Similarly, having a full soil profile at the beginning of winter may increase the risk of waterlogging, particularly with surface irrigation in systems that don't drain well.**
- **Soil type, location and appetite for risk all play a part in irrigators' decisions regarding pre-irrigation.**

Two years of GRDC's Optimising Irrigated Grains (OIG), on top of research conducted under the 'Smarter Irrigation for Profit' project, have highlighted the irrigation decisions that need to be made by irrigators on how and when to use their irrigation water to set up their irrigated crops to be the most profitable.

The changing irrigation environment has seen irrigation water become an input where the price can be highly variable based on seasonal conditions and allocations. Efforts to make irrigation more efficient has seen investment in improved layouts and infrastructure such as overhead sprinklers or fast flow surface irrigation, giving irrigators flexibility in the amount of water applied and the choice of crops.

Pre-irrigation (where fallow paddocks are irrigated prior to the sowing of a crop) has always been a judgment call by irrigators, based on timing to enable timely sowing and adequate moisture for the crop to develop over winter. Using surface irrigation, this could mean using anywhere between 0.75 to 2.0 Mega litres/ha (75-200mm/ha) to wet up the soil profile. The timing of pre-irrigation must be considered in order to allow the paddock to dry sufficiently to enable sowing on time, but not to dry too much and then be at the mercy of 'the autumn break' for sowing similar to a dryland grower. Many irrigators have a story about the pre-irrigation that went badly – where it rained, and sowing couldn't proceed or winter waterlogging was detrimental to the crop as the soil profile was full going into winter. However, pre-irrigation does provide soil moisture over winter as some irrigation regions do not have access to water between 15 May and 15 August to allow the water authorities to service and repair the water delivery network.

Irrigators have installed overhead irrigation as a means to be able to have more control over the amount of water applied. Instead of the large volume of water applied via surface irrigation as a pre-irrigation, irrigators can apply enough water to ensure timely establishment of their crop. This can be a considerable saving of water but does then run the risk of a 'winter drought' if the winter period is dry and winter rainfall is inadequate to meet the needs of the crop. In these cases, yield potential is lost before the irrigation water becomes available in the spring. In shorter season crops or in warmer regions where spring growth occurs earlier (before mid-August) yield potential starts to be reduced since crops are stem elongating but without the water reserve to sustain this period of rapid development.

The OIG project, with its geographically diverse project partners, has illustrated the different thinking that drives irrigators decision making on irrigation. Higher rainfall regions are unlikely to pre-irrigate due to the risk of autumn irrigating leading to waterlogging if they go into winter with a full profile.

Similarly, those in the east of the Murray and Murrumbidgee valleys are more confident of a timely break for sowing and follow-up winter rainfall to get the crop through to the spring when irrigation can commence. Those to the west who have soils (e.g. grey clays) that require more water to fill the profile, are less confident of the break being in late April/early May and have lower winter rainfall to tide them over until the irrigation season opens in the spring. Depending on the crop type, restoration of yield potential with spring irrigation following a winter drought can be more limited with early maturing wheat, since it has already started developing rapidly whilst the crop is under spring drought conditions. In some cases, the restoration of yield potential is adequate (e.g. faba beans) but this does depend on whether heat stress was additional to the lack of soil moisture and becomes part of the yield equation. These geographical differences also manifest themselves in the responses to disease management where irrigation does not appear to favour conditions that promote the fungal diseases compared to the naturally more disease prone high rainfall zones.

CONTACT US

VICTORIA (HEAD OFFICE)
Shed 2/ 63 Holder Road,
Bannockburn, Victoria 3331
+61 3 5265 1290

NEW SOUTH WALES
12/ 95-103 Melbourne Street,
Mulwala, NSW 2647
+61 3 5744 0516

WESTERN AUSTRALIA
9 Currong Street
Esperance, WA 6450
0437 712 011

www.far.org.nz