Optimising Irrigated Grains (FAR1906-003RTX)

A Grains Research & Development Corporation (GRDC) investment

Winter Crops

2020 Provisional Research Results

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2020 Winter Crop Provisional Results Summary

In 2020, 26 irrigated research trials were established at FAR Australia's Finley Irrigated Research Centre (Southern Growers Irrigation Complex) (GPS - 35.619083°, Longitude: 145.584803°) in southern NSW under the GRDC regional investment *"Optimising Irrigated Grains"* project. A further 22 trials were conducted by Irrigated Cropping Council (ICC) at the Kerang and Griffiths Irrigated Research Centres. The Finley research site is a collaboration between FAR Australia and Southern Growers, whilst the Griffiths Centre is a collaboration between ICC and the Irrigation Research and Extension Committee. With later harvest and spring crop trials the remaining eight trials in SE SA will be reported with the summer crop provisional results in August. The primary objective of these Irrigated Research Centre (IRC) was to look at all aspects of germplasm and input management to push the productivity boundaries for five irrigated crops (barley, faba beans, chickpeas, canola and durum wheat). At Finley the majority of trials were set up under overhead irrigation (travelling lateral) with a smaller number of identical trials set up on a flood irrigation system. At Kerang on the grey clay the reverse was the case. The Finley site was characterised by high fertility as a result of fallow in 2019 (cereal research only) and a failed faba bean crop affected by drought in 2018. Trials under overhead irrigation received a total of 125 or 150mm of irrigation (1.25- 1.5 Mega L/ha) applied as five or six applications of 25mm, whilst the flood irrigation bays received 240mm (2.4Mega L/ha) applied as three 80mm applications. This was in addition to a Growing Season Rainfall (GSR) of 244mm April – October. At Kerang, the fertility was relatively high as a result of brown manured dryland vetch in 2019. Trials that were conducted under flood were pre-irrigated or watered up in April, using approximately 150mm (1.5 Ml/ha) of irrigation. Spring irrigation application varied between trials, with most receiving 2 irrigations (approximately 180mm or 1.8 Ml/ha), with the chickpeas receiving a single irrigation (80mm) and the durums receiving 4 (280mm). Overhead irrigated trials received between 4 (108mm) and 8 (208mm) irrigations in the spring. Growing season rainfall (April – October) was 250mm, with April being a decile 10 start with 88.6mm for the month, which led into a dry winter until August and then a dry finish.

Finley, NSW

Grain yields and harvest dry matter production under the two irrigation systems

Though not statistically comparable, flood irrigation trials that received more water (484mm compared to 369mm) through the growing season were in general higher yielding than identical trials grown under an overhead irrigation system. Of the crops evaluated, all gave higher yields in identical plant population trials on the flood irrigation bays with canola yields peaking at 4.91t/ha (cv 45Y28), durum at 8.2t/ha (cv Vittaroi) and fabas at 7.45t/ha (cv PBA Amberley). Compared to peak yields under the overhead irrigation trials of 4.27t/ha with canola, 7.25t/ha with durum and 5.17t/ha with faba beans using the same cultivars.

Released:24 February 2021

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Nutrition

The research site was characterised by high levels of soil available nitrogen (N) at the start of the season with estimates of over 200kg N/ha at sowing on 0 – 90 cm following the fallow. This resulted in crops of canola and cereals being at their most profitable with lower and the lowest levels of applied nitrogen fertiliser. In addition to available soil mineral N at sowing there was evidence in durum of 70kg N/ha becoming available through mineralisation during the course of the season. High fertility and N mineralisation were mirrored in results observed with canola nutrition trials (following wheat stubble rather than fallow). Canola yields varied from 3.91 – 4.71t/ha based on 0 to 320kg N/ha applied with an optimum of 160kg N/ha. At harvest canola plots with no applied urea (N) fertiliser produced an N offtake of just over 140kg N/ha, harvest dry matter of 12.5t/ha and seed yield of 3.95t/ha. With the background fertility there were few significant differences in canola trials due to N timing.

Crop structure and lodging

Higher plant populations and associated problems with lodging was a constraint to yield observed in winter barley and durum wheat. The highest yields of durum wheat under a flood system were observed with a plant population of just less than 100 plants/m^2, despite a 19 May sowing date. Higher durum populations resulted in lower yields and higher levels of crop lodging, particularly in the flood irrigation trials. In barley a comparison of winter and spring germplasm showed that RGT Planet (spring) was higher yielding (mean 7.27t/ha in PGR trial) and less dependent on plant growth regulation than Cassiopée (winter) (mean 6.13t/ha). The fertility of the research site and earlier sowing (April 24) did not favour barley productivity and overall yields were disappointing, although lower fertility scenarios should produce better results.

In faba beans and canola experimental plant growth regulation treatments generated large reductions in canopy height and structure but produced no yield differences under overhead irrigation.

Chickpea sowing date

Under overhead irrigation two identical chickpea trials were set up to look at yield performance from an April and May sowing. The spatially separate trials are not statistically comparable however the population trial sown on 27 April gave an average yield of 3.32t/ha (with a peak yield 3.59t/ha cv Genesis090) compared to 19 May sowing with an average yield of 2.88t/ha (with a peak yield 3.41t/ha cv Genesis090). The optimum plant populations being approximately 30 plants/m^2 with the later sowing and approximately 20 plants/m2 with the earlier sowing. In both trials where plant population fell below the optimum at 10 plants/m^2, yields were reduced to 3.1t/ha and 2.39t/ha for early and late sowing.

Disease Management

Disease management was a key component to maximising yields on the Finley IRC site in chickpeas and durum. April sown chickpeas produced significant increases in seed yield from disease management strategies based on three fungicide applications. Although yields were higher with newer chemistry based on QoI (strobilurins) and SDHI chemistry the advantage over a chlorothalonil based strategy was not statistically significant. The highest yield achieved under full fungicide protection was 3.67t/ha (cv Genesis090). In canola good visual differences in branch blackleg infection

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did not result in large yield differences with the untreated, this was an unexpected result looking at at visual differences in treatments just prior to harvest.

Soil Amelioration (in collaboration with NSW DPI)

Following soil amelioration treatments being established by NSW DPI in March the trial area was sown with a commercial seed drill to faba beans on 19 May. The mixture of deep ripping, gypsum and organic amendment treatments produced significant yield increases of between 0.66 – 1.22t/ha over the untreated control but there were no significant yield differences amongst the soil amelioration treatments. Of the treatments it was noted that surface applied organic amendment (15t/ha Lucerne pellets) alone also produced a significant yield increase (0.66t/ha).

Ben Morris and Tom Price – FAR Australia

Kerang, Victoria and Whitton (Griffith), NSW

Grain yields and harvest dry matter production under the two irrigation systems

Though not statistically comparable, flood irrigation trials that received more water (300 – 430mm compared to 108-280mm) through the growing season, and in general, produced higher biomass than identical trials grown under an overhead irrigation system. Of the crops evaluated, canola gave similar yields between the two systems, but flood irrigation resulted in higher yields in durum wheat and faba beans. Canola yields peaked at 4.1 t/ha (cv 45Y28), durum at 10.0 t/ha (cv Aurora) and fabas at 7.8 t/ha (cv PBA Amberley). Peak yields under the overhead irrigation trials were 4.3 t/ha in canola, 6.0 t /ha in durum and 4.6 t/ha in faba beans using the same cultivars.

Nutrition

The research site was characterised by high levels of soil available nitrogen (N) at the start of the season with estimates of over 160kg N/ha at sowing on 0 – 60 cm (ranging from 100 to 215 kg N/ha) following brown manures dryland vetch. This resulted in crops of canola and cereals reaching a yield plateau at the lower levels of applied nitrogen fertiliser.

Canola yields varied from 3.00 – 3.63 t/ha based on 0 to 320kg N/ha applied with an optimum of 80kg N/ha. Visually it was difficult to discern the various N rates or timings in the canola trial during the season. At early flowering, canola plots with no applied urea (N) fertiliser produced an N offtake of just over 250kg N/ha, harvest dry matter of 11.2 t/ha and seed yield of 3.00t/ha.

Similarly, the durum wheat plots that received no applied urea produced an N offtake of 174 kg N/ha, with a harvest dry matter of 14.5 t/ha and 7.8 t/ha of grain. In durum wheat, where grain protein of greater than 13% is a requirement to meet DR1 specifications, this was achieved by applying 200 kg N/ha on top of the soil N at sowing of 130 kg N/ha (0-60cm).

Crop structure and lodging

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Higher plant populations or higher rates of N, and associated problems with lodging, was a constraint to yield observed in faba beans and long season barley. Variety stem strength was also in play in the durum wheat trials.

The highest yield of durum wheat under a flood system were achieved with Aurora at 196 plants/m2, but that was not statistically different to all other sowing rates ranging from 72 – 240 plants/m^2. Lodging was controlled in Vittaroi with the single application of a PGR at GS31, whereas this was insufficient to prevent lodging in Aurora.

Where there was no control of lodging in Aurora, yield was reduced by 20% over the standard label rate and timing of Moddus Evo.

In faba bean experimental plant growth regulation treatments generated small reductions in canopy height and had limited effect on lodging at harvest. Lodging was influenced by seeding rates, where the lower rate of 12 plants/m^2 reduced lodging with no effect on yield. A late PGR application at the end of flowering saw reduced yields due to reduced seed size. In terms of target faba bean plant populations, the seeding rate trial saw yield plateau once a population of 17 plants/m^2 was reached, suggesting further research on target populations is required.

Disease Management

While disease management was a key part of the trials program, a dry winter and the few local crops saw little incidence of disease in the pulses. The disease strategies in chickpeas in both Griffith and Kerang saw no response, but a response to the 'expensive' strategy in Samira faba beans of 0.45 t/ha over the control despite little disease being visible.

Stripe rust was detected in the durum wheat trials, although the main infection period was before GS39, and so the flag leaf remained relatively unaffected. No treatment was significantly different to that of the untreated control.

Soil Amelioration (in collaboration with NSW DPI)

Following soil amelioration treatments being established by NSW DPI in March, the trial area was sown to a forage seed oat crop on 24 April. Initial response was to where the organic amendment had been applied, either to the surface or placed in the rip line, as increased crop biomass. These differences remained at flowering but by harvest, the mixture of deep ripping, gypsum and organic amendment treatments produced significant seed yield increases of between 0.9 – 1.4t/ha over the untreated control in all but one treatment where excessive lodging may have contributed to reduced yield.

Damian Jones – Irrigated Cropping Council

Caution: *Please note that this provisional results summary has been produced prior to spatial analysis being carried out by SAGI. It is at this stage one-year results therefore please use caution in interpretating the results.*

Nick Poole – FAR Australia, Project Leader

25th February 2021

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SOWING THE SEED FOR A BRIGHTER FUTURE

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