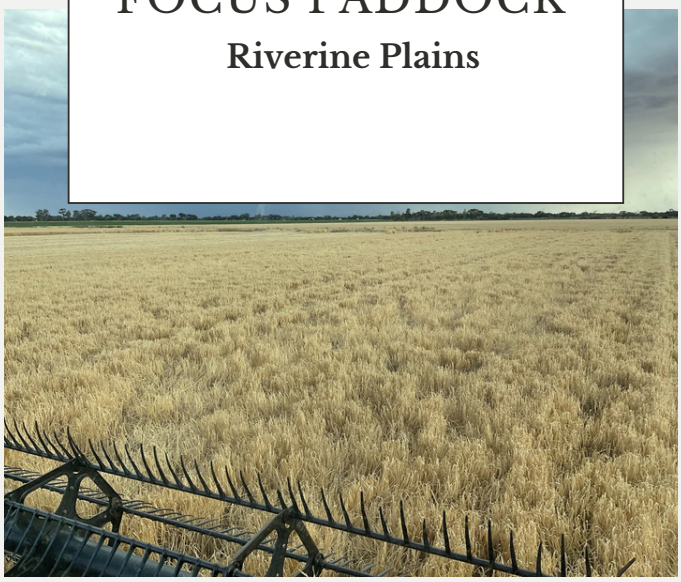
Optimise returns from grazing irrigated crops

Kate Coffey, Finance and project officer with Riverine Plains Inc
email: kate@riverineplains.org.au

FOCUS PADDOCK
Riverine Plains



In 2021, members of the GRDC Riverine Plains Irrigation Discussion Group tested the practical and financial implications of grazing irrigated wheat and canola.

Key Learnings

In wet and cold conditions, grazing irrigated wheat and canola will require more intensive management, and a stock containment area would be helpful remove stock from paddock if water logging conditions are predicted.

A more even grazing can be obtained by crash grazing a large mob of sheep on a small area compared to a small mob of sheep on a large area.

Sow the variety suited to your environment early, with sufficient seeding rates to establish desired plant density in the vicinity of 150plants/m2 wheat and 30 plants/m2 canola.

Remove stock prior to wheat growth stage 31 and canola two weeks prior to stem elongation to preserve yield potential.

Monitor livestock growth rates and feed test grazing crops to identify any deficiencies or toxicities and provide additional roughage to compliment the grazing crop.

GRDC have invested in a suite of irrigation research projects across the southern irrigation zones. This included projects looking to develop and validate soil amelioration and agronomic practices for irrigated grain crops as well as maximising the dollar return per megalitre of water.

To tie these research projects more closely with farmer needs, farmer-driven irrigation discussion groups have been established across the southern region. The discussion groups enable farmers to be more actively involved in the irrigated grains research process.

The Riverine Plains Irrigation Discussion Group has been established to help farmers learn from one-another, build new peer and industry networks, gain access to the latest research data and provide the opportunity to shape project trial work to ensure it is relevant and meeting local needs.

Method

Two farmers, who are part of the Discussion groups, hosted the focus paddocks and recorded grazing, water application and yield data. One farm hosted a grazing wheat paddock at Barooga and the other farmer hosted a grazing canola paddock at Boorhaman.

Focus Paddock 1, Barooga
Paddock Details

Row spacing:	250mm
Paddock size:	22ha
Sowing date:	18 March
Sowing rate:	80kg Kittyhawk wheat, 1kg tillage radish
Soil mineral N:	07/06/21 0-30cm:27.4kgN/ha 30-60cm: 14.4kgN/ha
Nitrogen applied:	10kgN/ha (MAP 18/03/21) 31kgN/ha (sulfate of Ammonia 28/04/2021) 69kgN/ha (urea 23/06/21) 46kgN/ha (urea 20/08/21)
Soil mineral N:	06/01/22 0-30cm:28.5kgN/ha 30-60cm: 10.5kgN/ha
Irrigation border check:	130mm 10/03/21 90mm 05/05/21 60mm 21/09/21
Rainfall:	103mm (Jan – Mar) 249mm (Apr – Oct)
Plant counts:	76/m2

"Remove stock prior to wheat growth stage 31 and canola two weeks prior to stem elongation to preserve yield potential"

Paddock 1 Results

Nitrogen

The total nitrogen required for a target yield of 6t/ha for wheat was 276kgN/ha. The total nitrogen available, including soil was 198kgN/ha.

Assuming that the soil mineralised 50kgN/ha in the growing season, the paddock then had a 28kgN/ha deficit for the targeted yield of 6t/ha. The post-harvest soil N tests taken in the same GPS located site, showed that the soil nitrogen levels were close to the pre-sowing levels, indicating that applied fertiliser was utilised by the crop.

Grazing

Cuts were sampled and dried from the wheat prior to grazing. The total dry matter sampled on the 26 May 2021 was0.84tDM/ha (Table 1). The total dry matter sampled on the 30 June 2021 was 1.60tDM/ha. The estimated crop growth rate crop was15kg/DM/day.

Measuring growth rates of lambs

1100 ewes and 900 lambs started grazing the paddocks on Thursday 8 July until Monday 19 July. This formed a total of 12 days on the focus paddock. The estimated growth rate (lambs) 0.160kg/day

Feed Test Results

Feed test samples were taken from the wheat paddock on the 26 May 2021 (Table 1). Mixed cereal and/or brassica crops can have a low fibre content. Fibre is important to maintain normal rumen function, saliva production and ruminal pH. Providing continual access to hay may provide a more balanced diet, improve weight gains and reduce effects on animal health (Braine, K, Riverine Plains newsletter, September 2021). Hay was provided to the ewes and lambs on the wheat paddock.

Table 1. Feed test results grazing wheat

Paddock	Neutral Detergent Fibre %	Crude Protein %	Metabolisable Energy %	DOMD %	DM/ha measured prior to grazing t/ha
Barooga Wheat and tillage radish mix	40	29.4	13.0	79	0.84 (26/05/21) 1.60 (30/06/21)

DOMD: Digestibility of the Organic Dry Matter This value is calculated to represent the amount of organic matter that is digested by the animal.

Grazing Results

The returns from lambs were calculated by measuring gains from grazing across all the irrigation area (120ha) and calculating the gain per hectare. A total of 900 lambs grazed the area for 28 days and gained 0.160kg/head/day, a total of4.48kg/hd liveweight. Accounting for a dressing percentage of 48, and lamb hook price $8.60 per kg the gain was $18.50/hd or $138 per hectare.

Wheat Yield

The wheat yielded 4.5t/ha with 11% protein.

Discussion

The focus paddock yielded 1t/ha lower than other irrigation areas of the farm, with a water use efficiency of 9.92kg/mm/ha (Appendix 1) below a target of 15kg/ha/mm. Potentially the paddock got too wet: exacerbated by a very dry summer/autumn followed by a wet winter after the paddock had been irrigated. In addition, the plant numbers were lower than the target of 150plants/m2 and the tillage radish was quite competitive with the wheat.

Lamb growth rates of 0.160kg/hd/day were acceptable by industry standards and returns were good due to current high lamb prices. The grazing did require careful management to ensure that the ground did not get too pugged up by the sheep during the wet winter. The farmer is planning to sow a combination of wheat and tillage radish again this year for grazing but will probably halve the rate of the tillage radish and increase the seeding rate of wheat, to ensure that the irrigated wheat yield can reach its potential.

Focus Paddock 2, Boorhaman
Paddock Details

Row spacing:	250mm
Paddock size:	70ha
Variety:	Canola 970CL
Sowing date:	6 April
Soil mineral N:	50kgN/ha (estimate)
Nitrogen applied:	10kgN/ha (MAP 06/04/21) 37kgN/ha (urea 08/05/2021) 37kgN/ha (urea 15/06/2021) 46 kgN/ha (urea 01/07/21) 46kgN/ha (urea 19/08/21)
Irrigation spray:	32mm (3 applications 10-26/04/2021)
Rainfall:	204mm (Jan – Mar) 311mm (Apr – Oct)
Plant counts:	56/m2

Paddock 2 Results

Grazing

Dry matter samples were taken on 2 June 2021 and were measured at 1.05tDM/ha (Table 2).

Table 2. Feed test results grazing canola

Feed test samples were taken from the canola on the 2 June 2021 (Table 2).

Paddock	Neutral Detergent Fibre %	Crude Protein %	Metabolisable Energy %	DOMD %	DM/ha measured prior to grazing t/ha
Boorhaman 970CL Grazing Canola	29	24.2	13.4	81	1.05 (02/06/21)

DOMD: Digestibility of the Organic Dry Matter This value is calculated to represent the amount of organic matter that is digested by the animal.

Nitrogen

The total nitrogen required for the target yield of 3.3t/ha canola was 264kgN/ha.The total nitrogen available, including estimated starting soil nitrogen was 226kgN/ha. Assuming that the soil mineralised 50kgN/ha in the growing season, this brought the total nitrogen available to 276kgN/ha, which was sufficient to meet the targeted yield.

Measuring growth rates of lambs

Two hundred and 22 merino lambs were grazed from 17/06/21 to 31/07/21, which was 47 days. These were averaging 45kg in weight when they commenced grazing in the focus paddock. The estimated growth rate was 0.82kg/head/day.

Canola Yield

The whole paddock yielded 2t/ha, which was well below the dryland average of 3t/ha. The majority of the paddock was an irrigated circle while there were dryland areas in the corners. It was estimated that the irrigated section yielded 2.5t/ha with a water use efficiency of 8.31kg/ha/mm (Figure 1 and Appendix 1), which is below the target of 12kg/ha/mm.

Figure 1.Yield Map Irrigated Canola Paddock.

Discussion

One of the reasons for the lower than expected yield in canola, was that the paddock had some wet areas which were exacerbated by the paddock being cultivated to incorporate lime. The sheep heavily grazed the northwest quarter of the paddock (see top left corner in Figure 1), which was quite wet at the time, and this impacted the final canola yield.The cold conditions which caused the animals to huddle in the corner of the paddock may have also affected lamb growth rates. It was estimated that the canola yield loss in this area, representing about 30% of the paddock, was 50% of the total yield. Grazing yield loss was due to a combination of dry matter removal as well as pugging and plant loss caused by the wet conditions.

Another potential issue in the paddock was sclerotinia.The paddock was not sprayed with a preventative fungicide, as the grazing canola was later flowering, and the conditions were less favourable for the disease. These wet conditions were also not conducive to spraying from the ground at the optimal time. This combined with regular late rain events meant sclerotinia was evident and significant. The yield map shown in Figure 1 shows the better areas topping out at 3-3.5t/ha rather than 4t/ha+ in other crops on the farm.

Another limiting factor may have been stress at flowering which impacted on canola grain fill. The farmer concluded that this was because the variety of canola used was a long season type, not suited to the local environment and it did not fully develop. Because the canola was harvested late, this delayed the planting of the subsequent maize crop and also limited the maize's yield potential.

Conclusions

The two Focus paddocks had lower water use efficiency than expected (Appendix 1). On the canola paddock, the lower water use efficiency was in part due to sheep grazing causing reduced biomass production in one part of the paddock. This was due to the sheep pugging the soil in wet conditions. The lower water use efficiency on the wheat paddock was believed to be due to lower wheat plant numbers, the competitive nature of the tillage radish and water logging conditions.

The lower water use efficiency was offset by the grazing returns, which in the wheat paddock were estimated at $132/ha. The grazing returns in the canola paddock were less, and this was partially a result of the sheep requiring time to adjust to the different diet of grazing canola. The grain and graze project (Kirkegaard et al, 2022) has shown that dryland grazed winter wheat and canola crops are $300 to $1,000/ha more profitable than grain only crops. In these trials, the key driver to profitable returns were stock utilising the dry matter produced by the crop (2.1 – 3.1t/ha).These focus paddocks produced between 1.05 and 1.6t/ha of dry matter, which indicates that there is room for improvement to achieve higher returns from grazing on these winter irrigated dual purpose crops. One of the ways this could be achieved is by earlier sowing.

The wet season and waterlogged conditions meant that the livestock were more prone to causing pugging in the soil. Therefore, more management was required to move stock around prior to heavy rainfall events. In addition, it was found that more even grazing of the crop could be achieved by crash grazing a large mob of sheep on a small area compared to a small mob of sheep on a large area.

References

Kirkegaard, J, Sprague, S, Bell, L Swan T and Dunn, M, (2022) Dual purpose crops – roles, impact and performance in the medium rainfall farming systems. Dual-purpose crops – roles, impact and performance in the medium rainfall farming systems - GRDC

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Appendix 1. Water Use Efficiency Calculation

Potential Yield Calculation		
	Barooga	Boorhaman
	Border check	Spray
	Kittyhawk Wheat	970 CL
Actual yield (t/ha)	4.5	2.5
Jan- March Rainfall mm	103	204
April - October Rainfall (mm)	249	311
Irrigation Water applied (mm)	280	32
Less Evaporation (mm)	110	110
Total available water (mm)	454	301
Actual Water Use Efficiency (kg/mm/ha)	9.92	8.31
Target Water Use Efficiency (kg/mm/ha)	15	12
Water Use Efficiency % of actual	66%	69%

Note: Canola should normally have a WUE of 12, wheat WUE of 20mm on spray and 15mm on border check.