Impact of Nitrogen on water intake in irrigated Canola "silos" Vaucluse, Tasmania

Focus Paddock Summary

High Canola prices in 2022 encouraged Tasmanian growers to embrace the crop. Nutrition in canola crops remain a central question for Tasmanian croppers, as growers who can produce high yielding cereal crops are unable to replicate their success in Canola. High fertiliser and fuel costs in 2022 also motivated many management decisions. The extent that nitrogen rates impact yield and how this interacts with water use under reduced nitrogen conditions.

We put this into practise with a strip of low nitrogen in the paddock, intending to put in moisture probes in the nitrogen and farm management strips.

In what turned out to be a very difficult season with extremely high rainfall towards the end of winter, soil profiles were completely full regardless of Nitrogen application with high denitrification in the paddock reducing the impact of N strips and fully waterlogged and flooded fields didn't allow for timely instalment of moisture probes nullifying the second aspect of the focus paddock.

Background and paddock Aims

The 2022 Optimising irrigated grains project was undertaken at Vaucluse Agricultural farm, in the central midlands of Tasmania. The Focus paddock was set over a winter sown Canola crop with a low Nitrogen strip through the centre of the paddock. Moisture probes were then to be installed in each strip to measure and compare the crops use of water under different nutrition conditions.

The aim of the focus paddock was to ascertain the yield difference in canola under different nutrition management, in conjunction with interaction of nitrogen availability with moisture uptake in canola.

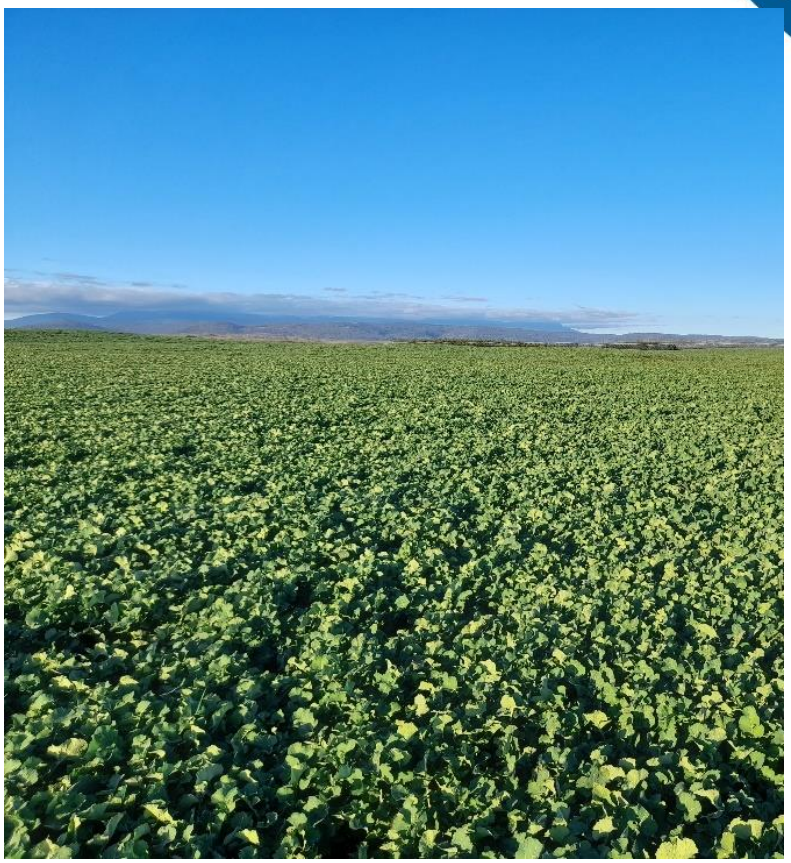
Fertiliser prices drove many decisions at the start of the growing season in 2022. With urea prices reaching over $1000 per ton, questions around the profitability of traditionally high input systems. The irrigation group met in July 2022 to discuss what might be useful learning opportunities this year. We focused on soil moisture sensors and the role that can play in assisting irrigation decision making.

We planned to do a single no N strip on a commercial farm in Epping Forest Tasmania, with the rest of the paddock treated under agronomist recommendation. In conjunction with this we would have a moisture monitor in the low and standard treatment areas looking to see how plant moisture uptake is impacted by relative nitrogen availability.

The midlands region has sections of delicate duplex soils, that frequently waterlog, and are prone to severe structural damage from heavy machinery traffic. Waterlogging was a topic that was highly important to growers, their continued concern on this topic is well noted as we had severe waterlogging issues in the region this year. Moisture sensor use is slowly increasing in Tasmanian farms to better understand the hydrological state of soils. This is linked with increased practice of drainage in easily waterlogged soils in the region.

Focus Paddock Details

Paddock Details:	*Silo Paddock*
Paddock size:	*66ha*
Variety	*Canola – SF Ignite TT*
Sow date:	*9 July 2022*
Sow rate:	*4kg/ha*
Total N applied:	*21kg N (NPKS 14-10-11-1 9/6/22)* *100kg (Canola Extra 30/8/22)* *150kg (SOA/UREA 50/50 4/9/22)*
Annual Rainfall:	*668ml*
Total growing season rainfall:	*559ml*



Methodology

A low Nitrogen strip was set through a representative section of the larger paddock, this was measured on the farm's spreader, which operational staff switched off for the runs that spreader used, ensuring no overlap.

Moisture sensors were planned to be placed in each treatment to ascertaining how different nutrition applications impacts plant moisture uptake under pivot irrigation. The rest of the paddock was to follow the farmers applications.

Harvest of the two strips was intended to be completed by a Zurn small plot header, getting direct yield data between runs directly adjacent to each other. The termination of a trial in the same region meant that this was no longer economically unfeasible.

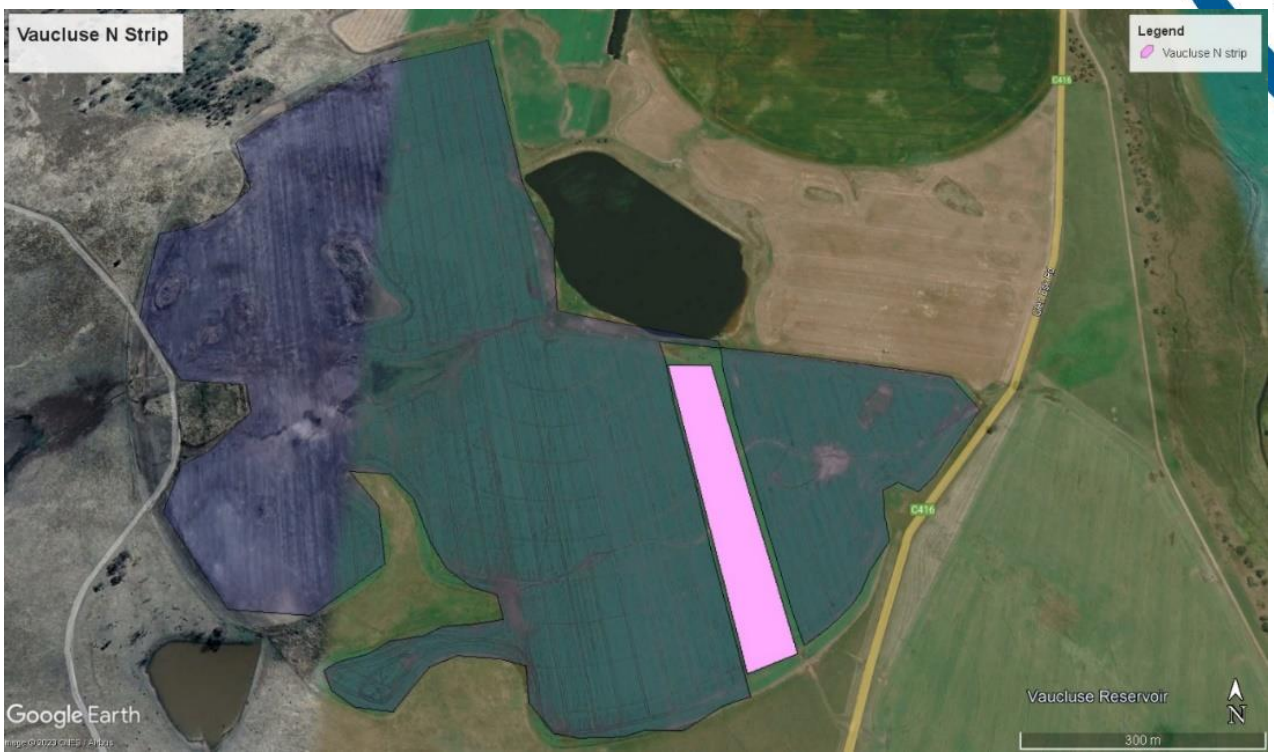


Figure 3 Location of Nitrogen strip in Canola paddock

Agronomic result

There was no significant difference in yield in the two strips, this cannot however be directly linked to the treatments due to severe lack of uniformity across the paddock. NDVI images show patchy development throughout the paddock. Water logging, in conjunction with high weed burdens in patches of poor establishment of canola. Deer damage in the area was also detrimental to the trial area.

The trial methodology detailed that outside of sowing fertiliser, the low N strip would receive no fertilisers for the duration of the crop. With very poor weather in late winter, the decision was made to deliver nutrition via plane as the fields were un-trafficable. The low accuracy of the plane meant that the first nutrition application after sowing was applied to the strip. This meant that the low Nitrogen strip received an additional 33 units of N. Just over half of the total N applied to the paddock. This would still allow for a comparison between treatments; however no discernible difference was able to be made in the yield maps. Severe water logging made inserting moisture probes in the profile unfeasible, and therefore examining water use under different Nitrogen treatments was not done.

The yield map (excerpt figure 2 below; see appendix 1) shows severe variation even in the smaller region that the N strip was located, with no difference between the two areas being discernible.

Harvest date	11 January 2023
Paddock size	66.1ha
Total yield (t)	182
Yield (t/ha)	2.8

Table 1 Nitrogen fertiliser application treatments

Date	Fertiliser type	N strip	Kg N	Grower practice	Kg N	Method of application
9/6/22	NPKS (14-10-11-1)	150kg	21	150kg	21	Fert Spreader at sowing
30/8/22	Canola Extra (33:0:0:12)	100kg	33	100kg	33	Plane
4/9/2022	SOA/ UREA (50%/50%)	0 kg	0	150kg	49.5	Spreader
Total N units		54		103.5		

Figure 2 Extract of yield map Silos Canola paddock

Economic Results:

It would be widely assumed that reduced application of nitrogen into the system reduces crop costs in a year such as 2022. The rate of denitrification in these areas was likely extremely high, with some sections better draining sections of the paddock yielding higher.
We ran three scenarios using a excel model, based on the Tasmanian Department of Natural Resource Management – farm business planning tools. In these scenarios we exclusively looking at the role of fertiliser application and irrigation inputs and what impact this would make on gross margins.
The low and farmer rate applications were modelled as well as the impact of reduced and increased irrigation with rough estimations of yield loss or gain.
These scenarios suggested that higher Nitrogen application had a much stronger return on investment, and that reduced irrigation would be feasible in a year like that we experienced in 2022.
Please find full models in appendices

Table 2 Gross margins under scenarios

	Low N	Irrigation	Reduced irrigation	Increased irrigation
Total Variable Expenses	$41,720.47	$53,680.05	$52,022.92	$54,093.42
Gross Margin/ha	$82,217.03	$85,129.95	$71,914.58	$84,716.58

Key learnings & recommendations

There is much to be learned and optimised in canola agronomy in Tasmania. With good infrastructure in place for irrigated cropping, the Tasmanian midlands hold great capacity for improved canola yields.

Key takeaways from this season and this study are muted yet we can still ascertain a few key learnings.

Long periods of waterlogging impact plants capacity to uptake nitrogen, inability to get on to the crop and deliver nitrogen early enough may have impacted overall yield despite the arial applications.

Management decisions are limited in these conditions, the use of aerial spreading is particularly useful in delicate soils that won't recover from machinery damage.

Compounding factors in Severely wet years with high rainfall in critical growth times and chemical input windows all impact crop health and weed management, as well as nitrogen.

References:

Department of Natural Resources and Environment Tasmania (2022) *Farm Business Planning Tools Department of Natural Resources and Environment Tasmania*. Available at: https://nre.tas.gov.au/agriculture/investing-in-irrigation/farm-business-planning-tools (Accessed: April 29, 2023).

Figure 1 Deer damage and grass weed in treatments