ISSUE 76

THE AGRONOMIST

BI-MONTHLY UPDATES FROM THE
NUTRIEN AG SOLUTIONS AGRONOMY TEAM

Nutrien Ag Solutions

GOING FURTHER®

EDITORS NOTE

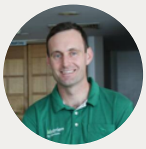
For WA readers, The Agronomist is returning for another season, but with new content and a new cadence. For SA readers, this is a brand new newsletter.

For new readers, The Agronomist contains timely, relevant articles from a selection of our agronomists across both WA and SA. The content will cover a range of topics, from weed management to crop nutrition, disease and insect management to good agronomic practices.

The intent is that you might pick up some new ideas that are implementable on your farm that make you more productive and profitable. By casting the net wider across two states, hopefully, there is a cross-pollination of the best ideas from both locations.

The Agronomist will now be a bi-monthly newsletter. Ideally, this will mean the articles take a more strategic and long-term management view than some of the in-season tactical articles that have been produced in the past.

From all at Nutrien, we hope you enjoy reading this newsletter and wish you a prosperous and productive 2025.



Tom Shaw
Farm Services Agronomist
North Fremantle, WA

FEATURED STORIES IN THIS ISSUE:

The Case for Nitrain on Urea

CONTRIBUTOR
Tom Shaw – Farm Services Agronomist

When urea is not immediately washed in by rainfall, a portion of the nitrogen can be lost to the atmosphere. This is a process called volatilisation.

Volatilisation risk is increased:

- As the period grows longer between spreading and a decent rainfall (approximately 10 mm of rain required for good incorporation). Plenty of loss occurs in the first 48 hours post-spread.
- When the soil surface is moist.
- When it's windy.
- When there's minimal crop canopy.
- On sandy soils.
- On soils with lots of crop residue.
- At a higher application rate – there's more N to lose!

So, the conditions that most growers spread urea in are the conditions most conducive to volatilisation (N loss)!

So how much N is usually lost? When there is a good rain immediately following application, loss can be as little as 0.1% of the applied N. However, when conditions are against you, losses can be as great as 34%. Across all research trials in dryland grain cropping, the average loss from spread urea is 10% (Barton et al. 2022).

The most successful way of reducing volatilisation loss is to wait for a good rainfall to spread. However, as farms get bigger, it gets more difficult to wait – sometimes the job just needs to get done. And that big front that the BOM promised doesn't always deliver!

The next best option is to use a urease inhibitor. This is a product that is coated onto urea that reduces the rate of change from urea (the N form you apply) to nitrate (the form the plant takes up).

So, at any one time, there is less N exposed to loss. A review of the research shows that the application of a urease inhibitor can reduce losses from spread urea to about 1% on average (Barton et al. 2022).

KEY MESSAGES:

- When growers are typically spreading urea, conditions are often conducive to loss of N (volatilisation).
- In research observations, it is normal to lose 10% of spread N to the atmosphere; losses of up to 34% have been recorded.
- Application of a urease inhibitor like Nitrain will typically reduce loss to 1-2%.
- Nutrien trials in 2024 support the research.
- At $5/ha per 100 kg/ha urea spread, Nitrain is a good investment.

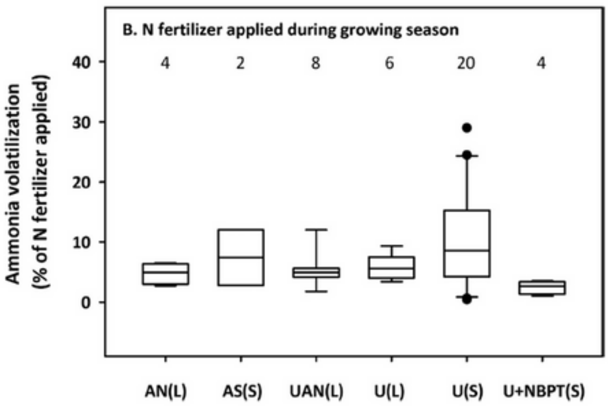


Figure 1. Loss of N as volatilised ammonia (as gas to the atmosphere). Spread urea (U(S)) averaged 10% loss across 20 observations. The worst case was 34% loss. Coating urea with a urease inhibitor (U+NBPT(S)) reduced loss to 1-2% on average across 4 observations. Source: Barton et al. 2022.

To prove the concept to ourselves, Nutrien had trials across WA to evaluate Nitrain, Nutrien's urea inhibitor.

In a trial on canola at Narrogin, treatments with Nitrain coated on urea yielded about 10% greater than those without Nitrain on the urea (Figure 2). In this trial, there were two urea applications: one 3 days before incorporating rainfall and one 6 days before. So, the loss of N from the untreated urea was expected because the urea was left exposed on the soil surface. In this case, approximately 10-15 kg/ha of N was preserved from loss.

Assuming $700/t canola and $700/t urea and 100 kg/ha N applied as spread urea:

- 15 kg/ha N conserved = $22.40/ha in N cost preserved
- 250 kg/ha additional yield from N conserved = $175/ha
- A total of $197/ha additional income from a $5/ha spend on Nitrain!

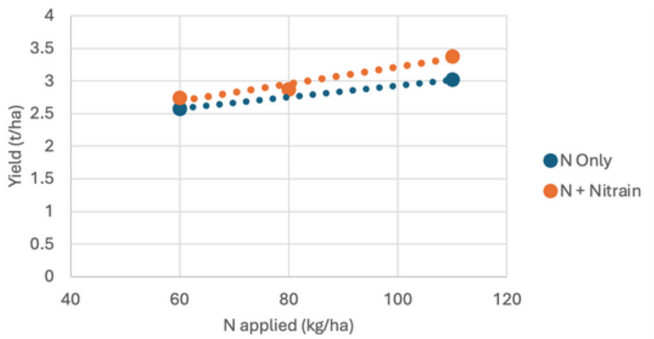


Figure 2. A Nutrien trial at Narrogin investigating Nitrain (urease inhibitor) on urea in canola. Urea (+ and − Nitrain) was applied at least 3 days before rain in conditions where loss was likely. Treatments with Nitrain coated on urea out-yielded straight urea treatments by about 10%. Estimate is 10-15 kg/ha N conserved.

In a trial in wheat at Dalwallinu, there was no increase in yield from Nitrain, but there was an increase in protein of 0.6-0.9% due to Nitrain in the fertiliser. Similarly, to the Narrogin trial, the two urea applications were exposed on the soil surface for 3 and 5 days. The increase in protein in the treatments coated with Nitrain is the equivalent of 15-20 kg/ha of N conserved.

Assuming $300/t wheat and $700/t urea with an application rate of 80 kg/ha N:

- 15 kg/ha N conserved = $22.40/ha in N cost conserved
- 1% increase in grain protein = in this case nothing
  - If the additional protein puts you into a higher delivery grade, it may be worth $30/ha

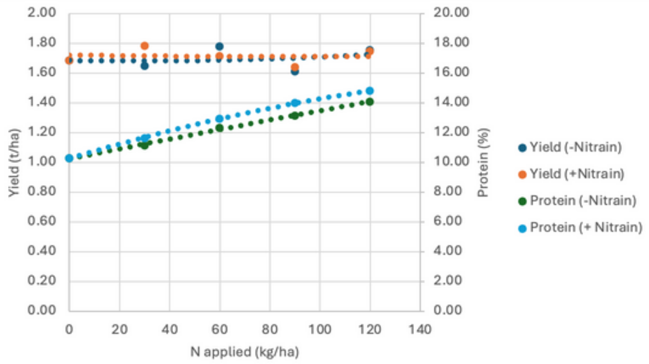


Figure 3. A Nutrien trial at Dalwallinu investigating Nitrain (urease inhibitor) on urea in wheat. Urea (+ and − Nitrain) was applied at least 3 days before rain in conditions where loss was likely. While there was no yield response, wheat with Nitrain treated urea (light blue curve) had protein almost 1% higher than straight urea (green curve); the equivalent of 15-20 kg/ha N conserved

Does having Nitrain on urea always work to prevent N loss? The product always works, but its application is not required where the urea is immediately washed in. In a trial in canola at York, there was no benefit to coating urea in Nitrain. But, nor should there have been; both applications of urea (with and without Nitrain) were washed in by more than 10 mm of rainfall within a few hours.

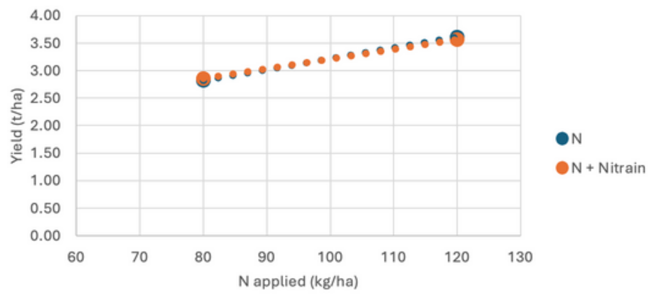


Figure 4. A Nutrien trial at York investigating Nitrain (urease inhibitor) on urea in canola. There was no yield benefit to coating urea with Nitrain in this trial, but nor should there have been. Both urea applications (+ and − Nitrain) were washed in by >10 mm rainfall within hours of spreading. Nitrain will be of most benefit where urea is not washed in within 24-48 hours of spreading.

To make your money back on Nitrain, you need to grow an extra 10 kg/ha canola or 20 kg/ha wheat. In addition to this, your $5/ha buys you the benefit of spreading whenever it is convenient for you. For the efficiency and the potential for yield and protein gain, is it worth investing in Nitrain? If you are interested in Nitrain coated on your fertiliser, please discuss it with your local Nutrien Agronomist or Nutrition Sales Manager.

Barton L, FC Hoyle, PR Grace, GD Schwenke, CA Scanlan, RD Armstrong and MD Bell. 2022. Soil nitrogen supply and N losses from Australian dryland grain cropping systems. Advances in Agronomy 174: (1-42).

Alternative Strategies for Weed Control

CONTRIBUTOR
Hayley Hill – Graduate Agronomist, Pingelly WA

The APVMA has recently proposed wholesale changes to the paraquat label, based on concerns relating to environmental impacts.

Industry has responded to this proposal, and as at the time of writing, the APVMA is considering the industry response. A final decision on the nature of paraquat product labels is likely to be made in Q4 2025. If, as expected, paraquat use is restricted to a point that it is no longer useful, there will be a challenge to preserve glyphosate. More broadly, the apparent tightening of regulation may mean that broadacre farming will face the challenge of reducing pesticide reliance generally.

The Weed Smart Big 6 framework offers a valuable guide to reducing chemical reliance by adopting diverse, integrated strategies. The 'Big 6' deserve a review in this context. Implementation of multiple approaches to weed control will enhance the sustainability and resilience of farming systems.

1. Rotate Crops and Pastures – The Recipe for Diversity

Crop rotation and diversification are fundamental strategies for reducing weed pressure and breaking the weed lifecycle. By planting a variety of crops and pastures, this will disrupt the conditions that allow weeds to thrive.

- Implement Break and Double Break Crops: Growing break crops such as legumes or canola helps to reduce weed seed banks. These crops not only diversify the rotation but also alter the environment, making it less conducive to the growth of specific weed species. Double break crops can further reduce weed populations.
- Adopt Herbicide-Tolerant Traits: The incorporation of herbicide-tolerant crops, such as certain wheat or canola varieties, adds another layer of flexibility in weed management. These traits allow different herbicides to be used without over-reliance on one specific chemical, reducing the risk of herbicide resistance.

KEY MESSAGES:

- Tightening of regulation around paraquat use and pesticides more generally will challenge our farming systems.
- For weeds, there are options that can complement herbicides that need to be considered in this new context.
- Growers should discuss with agronomists what a sensible weed management approach looks like that is resilient and sustainable.

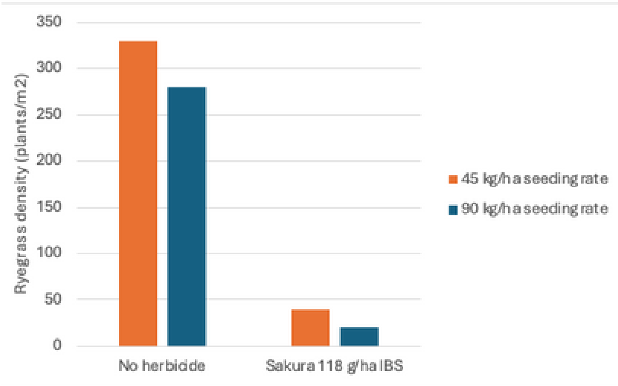


Figure 1. The combined effect of crop competition and pre-emergent herbicide on seeding rate in a trial at Dalwallinu. Better overall ryegrass control was achieved by increasing seeding rate and using a good pre-emergent herbicide. Source: Mike Ashworth/AHRI/GRDC

THE EFFECT OF WHEAT SEEDING RATE, TIME OF SEEDING AND HERBICIDE CHOICE ON RYEGRASS (ARG) SEED PRODUCTION.

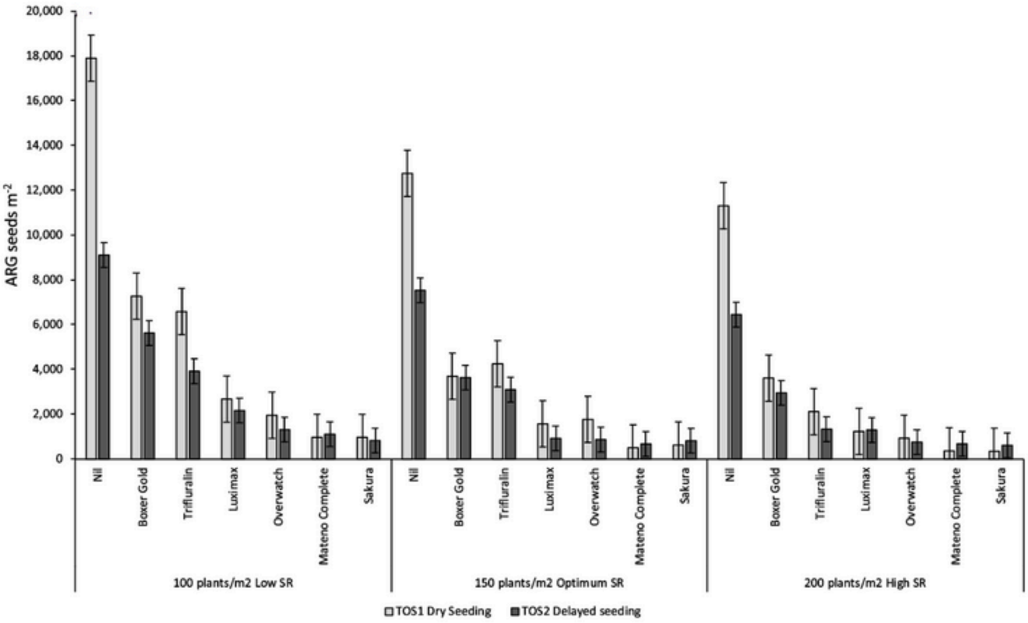


Figure 2. GRDC/AHRI trial work looking at the combined effects of crop density, time of sowing and pre-emergent herbicides on ryegrass seed set. While a knockdown certainly helps, great ryegrass control can be achieved under dry sowing conditions with a good pre-emergent herbicide and crop competition.

2. Increase Crop Competition and Optimise Crop Growth

Weeds struggle to establish in strong, healthy crops. Optimising crop growth and improving competition will naturally suppress weed populations.

- Competitive Crop Types and Varieties: Some crops are naturally better at competing with weeds than others. Choosing crop varieties that are more vigorous and fast-growing can help shade out weeds and limit their access to sunlight, water, and nutrients.
- Higher Seeding Rates: Increasing plant populations by using higher seeding rates has been shown to reduce weed competition.

For example, a trial conducted by AHRI in Dalwallinu found that increased wheat seeding rates (from 45 kg/ha to 90 kg/ha) resulted in significantly fewer annual ryegrass (ARG) plants (figure 1). Higher seeding rates allow crops to establish a denser canopy, which outcompetes weeds.

- Improve Soil Health and Crop Nutrition: Healthy soils are the foundation of robust crops. Ensuring that crops have access to optimal nutrition and a good growing environment can help them grow vigorously and reduce the chances of weed establishment. Weeds such as ryegrass have a greater tolerance to poor soil health and, therefore, will have more access to the nutrients and outgrow the crop.

3. Mix and Rotate Herbicide Groups – Rotating Buys You Time, Mixing Buys You Shots

Herbicides are still a valuable tool, but overreliance on a single mode of action can lead to weed resistance. Rotating herbicides with different modes of action and mixing herbicides in applications can extend the effectiveness of chemical controls.

A trial by GRDC/AHRI highlights the effects of seeding rate, herbicide choice, and time of sowing on annual ryegrass seed production (Figure 2). It is worth noting that for the dry-seeded treatments (without a knockdown), we can still achieve excellent weed control when the right pre-emergent herbicide is selected and crop competition is increased.

- Always Use Full Label Rates: To ensure herbicides work effectively, it's important to apply them at the full label rate. Under-dosing herbicides can encourage resistance and lead to poor weed control.
- Mix Different Modes of Action: Mixing herbicides with complementary modes of action in the same application or using them in consecutive applications helps prevent resistance development and improves the overall control of weed species.

4. Optimise Spray Efficiency – Make Every Droplet Count

- Maximising the efficiency of herbicide applications is key to reducing the overall amount of chemical used. By ensuring that each spray application is as effective as possible, it will in turn reduce costs and minimise environmental impact.
- Maximise Efficacy and Reduce Spray Drift: Spray drift not only wastes chemicals but can also harm non-target plants. Follow application instructions carefully, ensuring the correct nozzle, water volume, boom height, and adjuvants are used.
- Consider Water Quality: Water quality can influence the performance of herbicides. Clean, non-alkaline water helps optimise herbicide activity and ensures that the product works as intended.

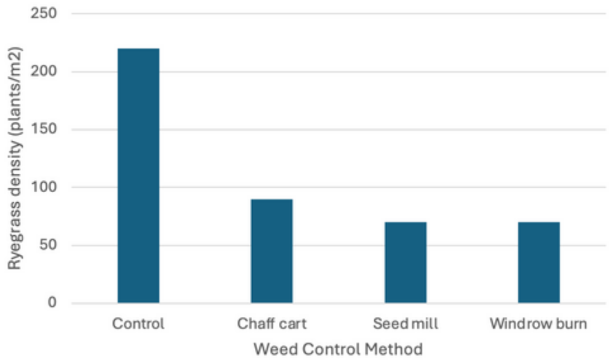


Figure 3. Trial completed by the Liebe Groupe in Buntine, 2011 looking at the effectiveness of harvest and post-harvest weed seed control options. Ryegrass density was measured the following autumn. Adding one of these methods of control does a great job of 'hammering the seed bank.'

4. Stop Weed Seed Set – Take No Prisoners

Preventing weeds from setting seed is one of the most effective ways to reduce future weed pressure. By taking aggressive action to stop seed production, this will progressively reduce weed populations over time.

- Aim for 100% Weed Control: After herbicide applications, always monitor paddocks for survivors. Weeds that survive can still set seeds, so it's crucial to address them quickly and effectively.
- Hay or Silage Production: In high-pressure situations, turning weeds into hay or silage can remove them entirely. This practice prevents seeds from being spread and helps manage high weed populations in a practical way.
- Desiccation/Crop Topping: There are a range of herbicide options available to reduce grass and broadleaf weed seed set.

	ROUNDUP ULTRA MAX	SLEDGE	SHARPEN
WHEAT	✓	✓	✓
CANOLA	✓		
BARLEY	✓	✓	✓
LUPINS		✓	

*Speak to your local Nutrien agronomist regarding product choice and rates.

5. Implement Harvest Weed Seed Control

Harvest time presents an opportunity to capture weed seeds that survive herbicide treatments and are still present in the crop. By using harvest weed seed control measures, weed seeds will not spread, and there will be a reduction in the weed seed bank.

- Seed destructors: These are installed on harvesters and crush weed seeds as they pass through, preventing them from being released into the environment and spreading.
- Chaff Lining or Chaff Decking: These systems concentrate weed seeds into a single area of the paddock where they can be either burned or removed, preventing them from being scattered.
- Chaff Carts: Chaff carts collect weed seeds during harvest and can be used in conjunction with other systems to ensure that weed seeds do not contribute to the seed bank in subsequent seasons.
- Burning: In certain situations, controlled burning of weed seeds after harvest can be an effective method to reduce weed seed survival.

If, as expected, regulation continues to tighten around herbicide use, growers will need to reconsider which of the 'big 6' will be required to manage weeds on their farm. The more diverse our approach to controlling weeds, the more sustainable the future of our farms will become.

Fleabane Management

CONTRIBUTOR
Jesse Rowe – Agronomist, Geraldton WA

Over the last couple years there has been a spike in the presence of Fleabane across paddocks in the Midwest of WA.

Being a prolific seeder, each plant potentially has 110,000 seeds at 80% viability (GRDC, 2013); fleabane numbers have skyrocketed following the wet harvest in 2024.

Fleabane has a natural tolerance to commonly applied rates of glyphosate. Many paddocks are still green following an early summer spray of the general glyphosate, Ester 680, and triclopyr brews that normally cover the summer weed spectrum of volunteer crops, roly poly, mulla mulla, and caltrop. It is the fleabane that is persisting. It may have to become a priority during summer, and changing up brews may need to be discussed to get a hold of it quickly. A trial was set up in Walkaway on the 10th of January in a very high-pressure paddock to revisit what options we have to combat fleabane.

Figure 1. The fleabane plants in a trial at Walkaway in summer 2025 were very large. Figure 2. A trial site for fleabane management, Walkaway, 2025.

Prior to the trial, standard practice for fleabane management has been a double knock of glyphosate followed by paraquat within 7 to 14 days. However, a double knock is not always a viable option due to logistics and operating costs. In the trial, we looked at products such as group 14s (Sharpen, Terrador), clopyralid, dicamba, and fluroxypyr to try and create a one-pass solution to control fleabane with glyphosate.

KEY MESSAGES:

- Fleabane has become a problem summer weed in the northern growing area in WA.
- A Nutrien trial reviewing control options determined that single pass solutions with glyphosate and mixing partners did not provide adequate control.
- While not perfect, paraquat gave promising results.
- A key to managing fleabane will be targeting them while small.

At 35 DAA (days after application) from 1.5 L/ha of glyphosate 570 and 500 mL/ha Ester 680, we controlled only 45% of the fleabane (Figure 1). The addition of a Group G herbicide, either Sharpen or Terrad'or, increased the control/brownout in early assessments but resulted in only 50% control at 35 DAA. There were also signs of new green regrowth from this treatment at the last assessment. The addition of dicamba (Kamba M) into the brew showed the largest increase in control (60%).

Clopyralid (Lontrel) and fluroxypyr were slower to control fleabane, but at 35 DAA, they were slightly more effective than glyphosate and ester on their own. These Group 4 herbicides work better when there is moist soil and rainfall a few days post-application, so a wet summer after application may help these products work better. These results indicate that we may need to look for other solutions to control fleabane beyond just adding other products to glyphosate, as 50-60% control is not adequate, especially with such a large number of viable seeds being produced.

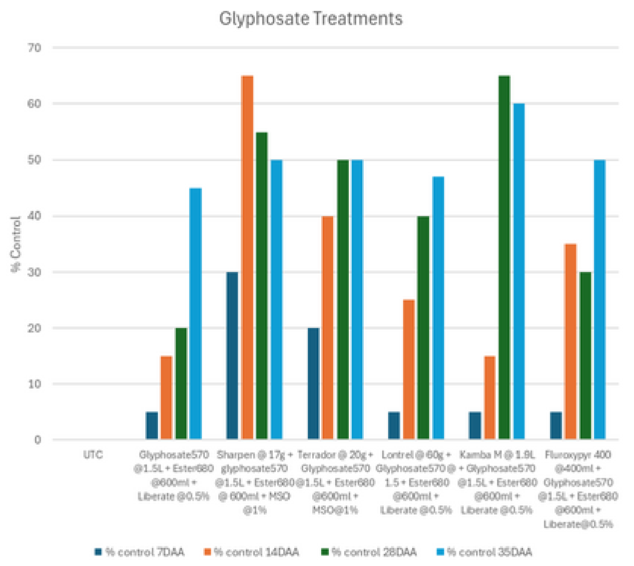


Figure 3. Control (%) of fleabane at 7, 14, 28 and 35 days after application with glyphosate and mixing partner single pass solutions. Glyphosate + Ester + Dicamba was the best result of the single pass solutions tested, but none of the treatments reached acceptable levels of control.

We also compared glyphosate to other non-selective herbicides such as Guerilla (paraquat + amitrole) and glufosinate, along with a double knock scenario (Figure 5). Glufosinate looked good early but faded, resulting in only 55% control. Guerilla at 2 L/ha with Ester 680 at 500 mL/ha was the only treatment that had the same control as the double knock treatment, achieving 85% control at 35 DAA.

Stems were cut open at the 35 DAA assessment to see which treatments were still green and showed signs of still translocating. Glyphosate and glufosinate stems still had green epidermis, and phloems looked active. In contrast, the treatments with paraquat had completely dead and dry stems that would snap easily. It was also observed that the group 14 spikes (Figure 2) still had green stems and exhibited new fresh regrowth, with seeds still looking viable, whereas paraquat treatments had no viable seeds at 35 DAA.

Figure 4. Some of the treatments 35 days after application

The conclusions we drew from this trial were that glyphosate and glufosinate are not suitable options when targeting fleabane in summer. Further, the addition of the group 14 products (Sharpen, Terrad'or) is not providing any increase in efficacy. Adding faster brown-out products like group 14s is potentially disrupting the systemic activity of glyphosate.

To reduce the possibility of returning to the paddock for a double knock scenario, using paraquat first seems to be the greatest opportunity when targeting fleabane. Treatments with paraquat at 35 DAA had the greatest control percentage.

To get the most out of paraquat, we still need to ensure that excellent coverage is achieved, with a high water rate and appropriate droplet size. Targeting smaller weeds should always be the priority as well. Asking any of these products to target large and almost flowering fleabane is probably asking too much of them. The ability to use optical sprayers where a high rate and high coverage can be achieved would also be beneficial.

There are still some other considerations to be made before just swapping glyphosate out for paraquat in summer, especially if melons are large, so discuss with your agronomist first. This trial is continuing for more assessments, so please get in touch for further results.

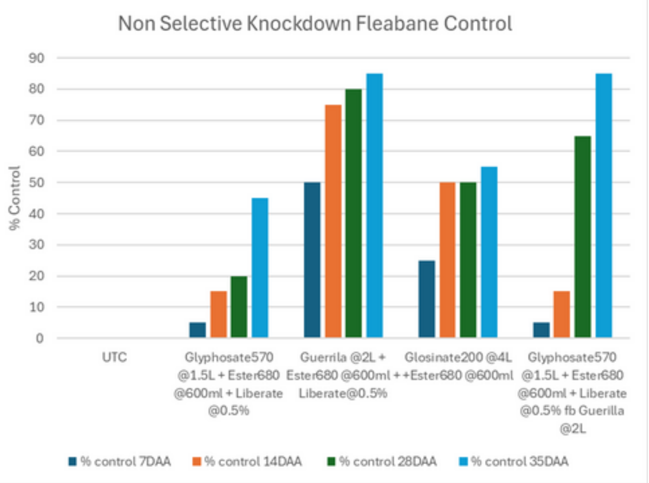


Figure 5. Control of fleabane 7, 14, 28 and 35 days after applications with alternative knockdown products (glufosinate, paraquat) and a double knock approach.

GRDC. (2013, Febuary 12). Fleabane Ecology and control in cropping systems of southern Asutralia. Retrieved from GRDC: https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2013/02/fleabane-ecology-and-control-in-cropping-systems-of-southern-australia

FLEABANE CONTROL RESULTS AT 35 DAYS AFTER APPLICATION

UTC

GLYPHOSATE

PARAQUAT

DOUBLE KNOCK

GLUFOSINATE

Figure 6. Fleabane control results at 35 days after application with (from L-R): no herbicide, glyphosate, paraquat, glufosinate and glyphosate followed by paraquat.

Putting Some 'Science' Behind Nitrogen Decisions

CONTRIBUTOR

Connor Fuss – Agronomist, Riverton SA

Rules of thumb and gut feel often become major driving forces when selecting nitrogen rates and timings throughout any given growing season.

For example, assuming a 50% recovery rate which has long been the industry standard, cereals require 40 kg/ha of soil mineral N per tonne of grain, and canola requires 80 kg/ha of soil mineral N per tonne of grain. To put this in perspective, this is 87 kg/t of urea for cereals (wheat/barley/oats) and 174 kg/t of urea for canola. This high demand is approximately 10-13 times the input requirements of phosphorus. This factor often causes angst around nitrogen decisions, which can be extremely taxing on both the hip pocket and the mind. A lot can be left on the table at the end of the season when decisions miss the mark, but getting it right is easier said than done.

The nitrogen cycle provides the basis for soil N and in-season plant-available N. The largest nitrogen pool in the soil is generally found in unavailable organic N components such as soil organic matter, which must be broken down microbially before becoming available. This breakdown creates plant-available ammonium (NH4+) or nitrate (NO3-). These microbes thrive in warm, moist conditions, meaning wet springs and summers are more conducive to organic N breakdown and hence higher levels of plant-available N at seeding. A key factor in all this, however, is the types of SOM in the soil and levels of N within these compounds. The carbon to nitrogen ratio dictates whether the microbes require N from the soil to break it down, the speed of breakdown, and the amount of N released into the soil. Cereals have high C:N ratios while legumes have low C:N ratios, which is why cereal stubbles generally take longer to break down and release far less N compared to legume stubbles.

KEY MESSAGES:

- Rules of thumb and gut feel are a risky way to approach an expensive decision.
- A deep soil test in autumn will establish baseline N availability.
- There are various N calculators available – we use a CSIRO calculator to assist in managing the gap between soil N supply and crop N demand.
- The net result of testing and using a scientific model is greater confidence around N decision-making.

2023 Crop	No. of Tests	Range Deep N's (kg/Ha N)	Average Deep N (kg/Ha N) 2024	Average Deep N (kg/Ha N) 2023	Average Deep N (kg/Ha N) 2022
Canola	46	28.3 - 166.4	74.3	91.3	117.2
Faba Beans	27	56.9 - 190.3	97.5	110.1	137.2
Field Peas	6	59.8 - 105.5	87.3	110.2	126.1
Lentils	25	58 - 185.6	101.2	106.1	121.2
Durum	9	39.7 - 142.0	91.6	89.2	119.9
Wheat	19	36.5 - 101.9	66.4	72	74.5
Oat Hay	0	n/a	n/a	31.2	44.7
Chickpeas	0	n/a	n/a	n/a	n/a
Pasture	6	21.8 - 93.3	68.3	119	n/a
Vetch	0	n/a	n/a	159.12	263.9
Fallow	0	n/a	n/a	185.4	259.5
Lucerne	0	n/a	n/a	n/a	62.2
Barley	1	37.4	37.4	86.7	n/a
Lupins	1	72.7	72.7	62.1	n/a
Sunflower	0	n/a	n/a	187.2	n/a
Total	140				

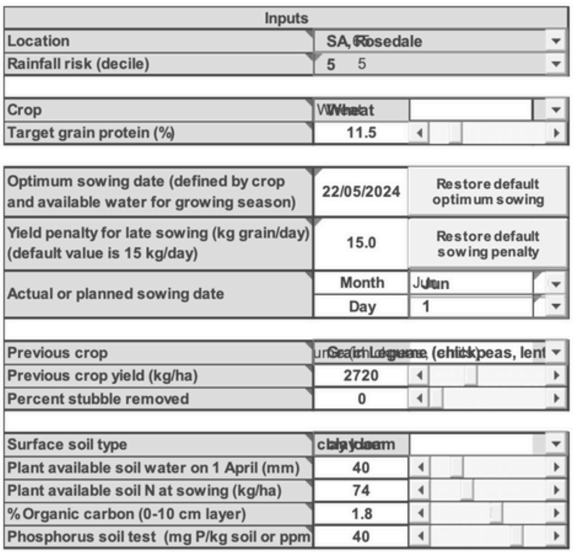
Table 1. Total nitrogen measured from 0-80 cm in the soil profile in autumn. Data is presented as average N available, segmented by prior crop. Measured soil N is used to adjust fertiliser N rates in season.

	Paddock	Core Depth (cm)	Previous Crop	Current Crop	Nitrate N	Ammonium N	N (kg/Ha)	Sulphur	Sulphur (kg/Ha)
Client Name	1	78	Lentils	Wheat	9	0	91.3	39	395.5
	2	72	Wheat	Wheat	5.8	0	54.3	17	159.1
	3	73	Lentils	Durum	6.3	0	59.8	19	180.3
	4	80	Durum	Wheat	7.9	0	82.2	34	353.6

Table 2. An example of the nitrogen summary we send to growers showing the measured soil N (and S) results with averages across crop types.

Plant available N is mobile in the soil but can be relatively easily measured, providing insight into the levels of available soil N at any given time. For this reason, deep nitrogen tests to 80 cm pre-seeding provide the basis for our nitrogen decisions. The system is not perfect, but our philosophy is that something is better than nothing and it provides vital information to form a more calculated decision at critical times throughout the year.

The number of tests conducted has doubled to around 130-140 paddocks in recent years and provides a wide snapshot of soil N levels across our geographical areas. With the number of paddocks we test (as seen below), we believe we are able to draw some really solid assumptions when crunch time comes during peak season to decide whether or not to spread and how much.



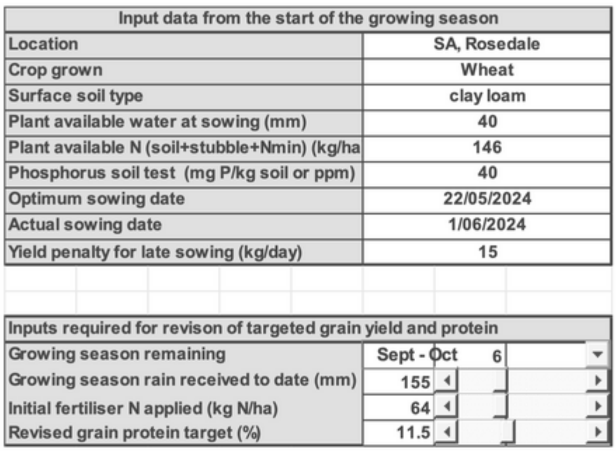
Inputs		
Location	SA, Rosedale	
Rainfall risk (decile)	5	
Crop	Wheat	
Target grain protein (%)	11.5	
Optimum sowing date (defined by crop and available water for growing season)	22/05/2024	Restore default optimum sowing
Yield penalty for late sowing (kg grain/day) (default value is 15 kg/day)	15.0	Restore default sowing penalty
Actual or planned sowing date	Month	Jun
	Day	1
Previous crop	Grain Legume (chickpeas, lent	
Previous crop yield (kg/ha)	2720	
Percent stubble removed	0	
Surface soil type	clay loam	
Plant available soil water on 1 April (mm)	40	
Plant available soil N at sowing (kg/ha)	74	
% Organic carbon (0-10 cm layer)	1.8	
Phosphorus soil test (mg P/kg soil or ppm)	40	

Figure 1. The CSIRO N calculator. Pre-seeding parameters and assumptions are entered to fine tune N supply and demand. We set P as a non-limiting factor to remove this as a variance in the results. However, if recent soil test results are available, they could be added. The location is largely irrelevant, it picks up on the average annual rainfall hence it can be used for multiple locations if the rainfall is similar.

Tables 1 and 2 are grower summaries that show levels on their own paddocks as well as averages across our client base and levels found in previous years.

We try to select representative paddocks across a farm to allow extrapolation of data. If levels exceed where we think they should be, we will look to re-test; however, sometimes the levels are just extremely high! We also measure sulfur in the profile, which is more opportunistic and generally doesn't change any management decisions for us the following season, as we are fortunate to have luxurious levels of sulfur in general.

With this information at our disposal, we then use the CSIRO nitrogen calculator. While it is about 25 years old, it has held great relevance through the years. It is not 100% accurate, but the output can be used in conjunction with prior knowledge, forecasts, and gut feel. It puts some science behind the decisions we are making. We tend to use the program for wheat, durum wheat, and canola, while the decisions around nitrogen applications in barley are much more basic in their approach, and we have found the program to be largely irrelevant.



Input data from the start of the growing season	
Location	SA, Rosedale
Crop grown	Wheat
Surface soil type	clay loam
Plant available water at sowing (mm)	40
Plant available N (soil+stubble+Nmin) (kg/ha	146
Phosphorus soil test (mg P/kg soil or ppm)	40
Optimum sowing date	22/05/2024
Actual sowing date	1/06/2024
Yield penalty for late sowing (kg/day)	15

Inputs required for revison of targeted grain yield and protein		
Growing season remaining	Sept - Oct	6
Growing season rain received to date (mm)	155	
Initial fertiliser N applied (kg N/ha)	64	
Revised grain protein target (%)	11.5	

Figure 2. The CSIRO N calculator. Parameters can be changed during the season pending revised protein targets, sowing dates, applied nitrogen and seasonal rainfall to date.

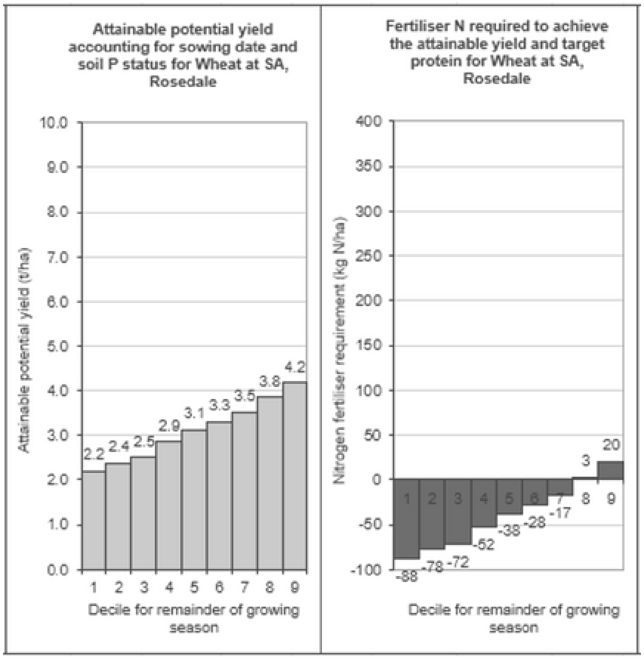


Figure 3. The CSIRO N calculator. The output of attainable yields for each decile of rainfall which may fall from a given point in the season (left) and the nitrogen required (kg/ha N required) to meet this yield potential.

The information in Figure 3 is critical to our decision-making. A client's optimism, attitude to risk, and gut feel may then tailor the nitrogen application decision to suit their situation. For example, if the client has an average finish from a given point, and they have enough nitrogen in the soil to meet yield potential based on that finish, they may be comfortable sitting on their nitrogen decision. Others, however, may be more optimistic and will look to push or top up later if the opportunity presents and the forecast becomes more promising. 2024 was an interesting season for this as we were getting early indications, particularly in canola, that there was adequate nitrogen available to meet yield potential given the late start and lack of rainfall. Some still looked to top up just in case, while others sat on their hands.

It is worth noting that Yield Prophet, which is derived from the APSIM model and is similar to the CSIRO calculator that I have detailed, is readily available. It does, however, require more accurate information, including soil characterization as well as segmented soil tests down the profile to assess soil properties and nutrition to depth. There is also a significant fee attached to this program.

As previously mentioned, this process isn't 100% accurate; however, our approach to soil nitrogen monitoring has given us reasonable levels of confidence around nitrogen decisions in season. This is especially true when deciding whether to spread on a disappearing forecast. Using nitrogen modelling, we can take some of the guesswork out of how we respond to different scenarios in season. While we can't control the forecast, we can control how we react to it.

Figure 4. Ute and soil coring trailer poised for sampling at sunset.

FURTHER READING:

Balancing risk and reward with high phosphorus and nitrogen input costs
https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2022/02/balancing-risk-and-reward-with-high-phosphorus-and-nitrogen-input-costs

Plant Available Nitrogen – Fact Sheet
https://grdc.com.au/__data/assets/pdf_file/0026/126494/grdc-fs-plantavailablenitrogen-pdf.pdf.pdf

Addressing the rundown of nitrogen and soil organic carbon
https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2021/02/addressing-the-rundown-of-nitrogen-and-soil-organic-carbon

“USING NITROGEN MODELLING, WE CAN TAKE SOME OF THE GUESS WORK OUT OF HOW WE RESPOND TO DIFFERENT SCENARIOS IN SEASON. WHILE WE CAN’T CONTROL THE FORECAST, WE CAN CONTROL **HOW WE REACT TO IT.**”

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