The importance of urea pricing in farming systems performance

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Take home message

- Nitrogen requirements are strongly driven by yield potential. As many systems have similar yield potential, they too have similar nitrogen requirements
- Pulse crops either reduce or eliminate the need for nitrogen application in year of growth, however soil nitrogen benefits for following crops have been variable in the Northern Farming Systems
- Whilst systems with lower nitrogen inputs (Lower Intensity, Higher Legume) have smaller declines in profitability than other systems due to higher nitrogen pricing, the overall system ranking by profitability at average and peak nitrogen pricing typically remains the same, suggesting that N pricing should not be a key driver of farming systems decisions.

Introduction

Nitrogen (most often applied as urea) is a critical input for grain production systems in the Northern Region, particularly for nitrogen demanding crops such as wheat and sorghum.

The Northern Farming Systems Project (NFS) was established in 2015 at seven locations across the northern grains region, with core experimental site at Pampas near Toowoomba with 38 different systems, and six regional sites, Emerald, Billa Billa and Mungindi in Queensland, as well as Narrabri, Spring Ridge and Trangie, in New South Wales. These sites aim to examine the long-term sustainability and profitability of farming systems in the face of challenges such as climate variability, increasing soil-borne pathogens, herbicide resistance and more specifically in regard to this paper, declining soil fertility and increasing reliance on costly fertiliser inputs.

Each site has its own locally relevant best management practice system (“Baseline”), with additional systems functioning as modifications to that system via changes in nutrition, intensity, or crop diversity (**Error! Reference source not found.**).

Table 1. Northern Farming Systems experimental treatments.

System Name	Characteristics
Baseline	This system represents the accepted district best management practice. Typically aiming for 1 crop per year. Nutrient applications target the median (50th percentile) seasonal yield potential.
Higher Nutrition	In this system, nitrogen and phosphorus rates are increased to target the 90th percentile yield potential based on soil moisture.
Higher Intensity	This focuses on increasing the cropping intensity by reducing the soil water threshold to sow a crop and thereby increase the number of crops grown over time.
Lower Intensity	This system increases the soil water threshold required to sow. It requires higher-value crops to offset longer fallow periods, and so includes dryland cotton, wheat, chickpeas and sorghum in some environments.
Higher Legume	In this system, the frequency of pulses is increased to one pulse crop every 2 years. This is to assess the impact of more legumes on profitability, soil fertility, disease and weeds. Nitrogen rates still target the median seasonal yield potential.
Higher Diversity	This forces a double break between crops, reducing the risk of disease build-up and herbicide resistance. A greater suite of crops is grown including some non-traditional options. Nitrogen rates target the median seasonal yield potential.

Fertiliser costs typically account for 20–30% of total variable production costs (Figure 1), with nitrogen (N) contributing approximately 70% of these fertiliser expenses.

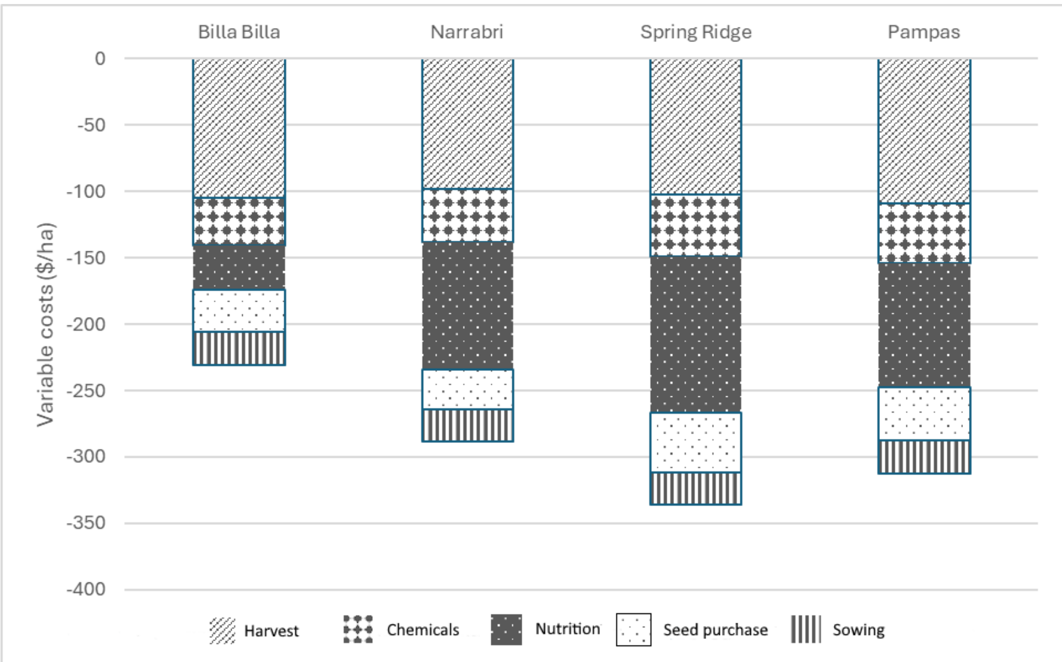

Figure 1. Average variable costs Baseline system at four NFS sites, 2015–2024 ($/ha)

Historically, urea prices typically range between $400 and $600 per tonne, but recent global disruptions, such as extreme weather events, the Russia-Ukraine conflict in 2022 and Israel-Iran tensions in 2025, have caused prices to spike to $800–$1,200 per tonne (Figure 2). These geopolitical factors are significant for Australia, as all urea is now imported and more than half of the country's supply typically comes from the Middle East.

In response to these price spikes growers and agronomists across the northern region are asking what impact persistent higher N prices have on their farming systems performance. The NFS project has 10 years of data from different farming systems at sites across the northern grains region. System profitability has been a key metric of farming system performance and has been calculated using a rolling 10-year average price for input costs, including $764/t average urea price. In response to feedback these long-term sites have facilitated the recalculation of system returns using peak pricing ($1300/t urea), versus the average price to identify whether there would be any changes to expected long-term profitability between the farming systems in an environment of sustained high nitrogen pricing (Table 2). Specially, this allows us to compare a Baseline system, with systems that incorporate more legumes (Higher Legume), or more diverse crop options (Higher Diversity), or higher (Higher Intensity) and lower intensity (Lower Intensity) and investigate if system profitability differs under high nitrogen prices (Table 2).

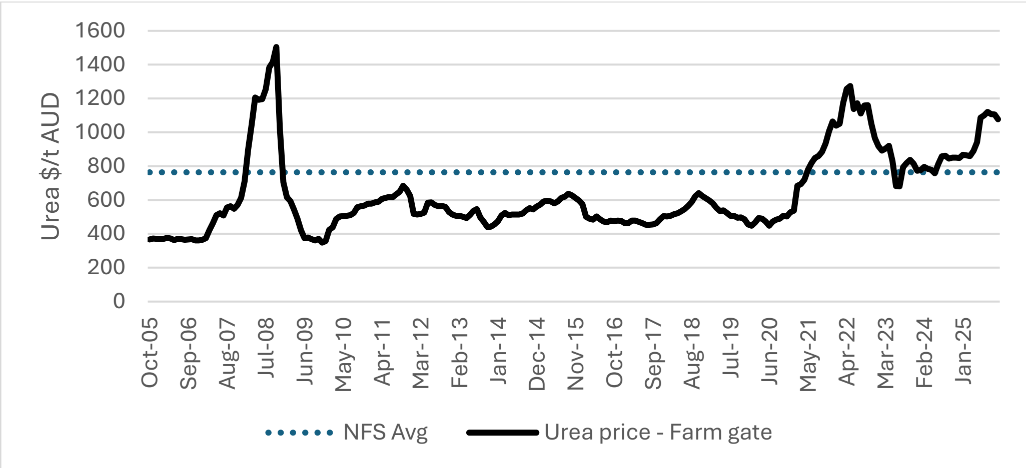

Figure 2. Price of urea + transport 200 km (Farm gate), and NFS project average pricing 2005–2025 (AUD $/t)

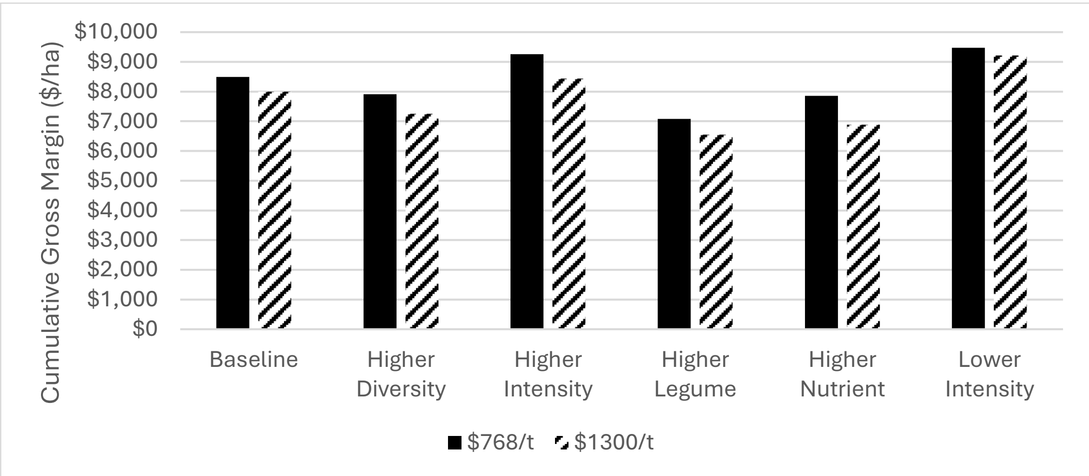

Figure 3. Cumulative gross margin returns over 10 years at Narrabri using average ($768/t) versus peak ($1300/t) urea pricing

At peak urea pricing the most notable difference is a decline in profitability across the board (Figure 3). However, some systems were more greatly impacted, for example the Higher Intensity system annual return was reduced by $820/ha compared to a $500/ha drop in the Baseline system. Importantly, the relative ranking of the systems did not change.

Differences in nitrogen demand by farming system

The increases in urea price raises questions about whether there are systems growers in the northern region may be able to adopt that have lower N fertiliser demands to mitigate the impact of higher urea prices.

Table 2. Total nitrogen applied at all sites in NNSW and SQld over ten years (2015–2024) (kg N/ha)

	Total nitrogen applied (kg/ha)			
Treatment	**Billa Billa**	**Narrabri**	**Spring Ridge**	**Pampas**
Baseline	29	281	410	403
Higher Diversity	30	464	337	511
Higher Intensity	261	625	375	669
Higher Legume	31	265	360	130
Higher Nutrient	138	623	641	685
Lower Intensity	187	223	275	372

Note: Billa Billa Low Intensity had N applied in summer 24/25 sorghum crop, whilst Baseline was in chickpea in winter 2024, and did not receive an N application until winter 2025 which is not captured in this table.

Baseline systems across the different sites have had a wide range of N applications; from 29 kg/ha at Billa Billa which had very high starting soil N levels hence not requiring additional N to meet crop requirements for target yield versus 410 kg/ha at Spring Ridge which required N applications in most crops to reach target yield potential.

From this data (Table 2) we can see that there are only two systems (Higher Legume and Lower Intensity) which generally had lower N applications compared to Baseline. Higher Legume differences were small at Narrabri and Spring Ridge with 24 and 50 kg/ha differences respectively (2.4 and 5.0 kg/ha/yr). However, as N savings in the NFS project have largely only been observed in the year of pulse (legume) being grown these small reductions are not surprising as the Higher Legume treatments at Narrabri and Spring Ridge only have 1 additional pulse crop compared to the baseline treatment (Figure 4).

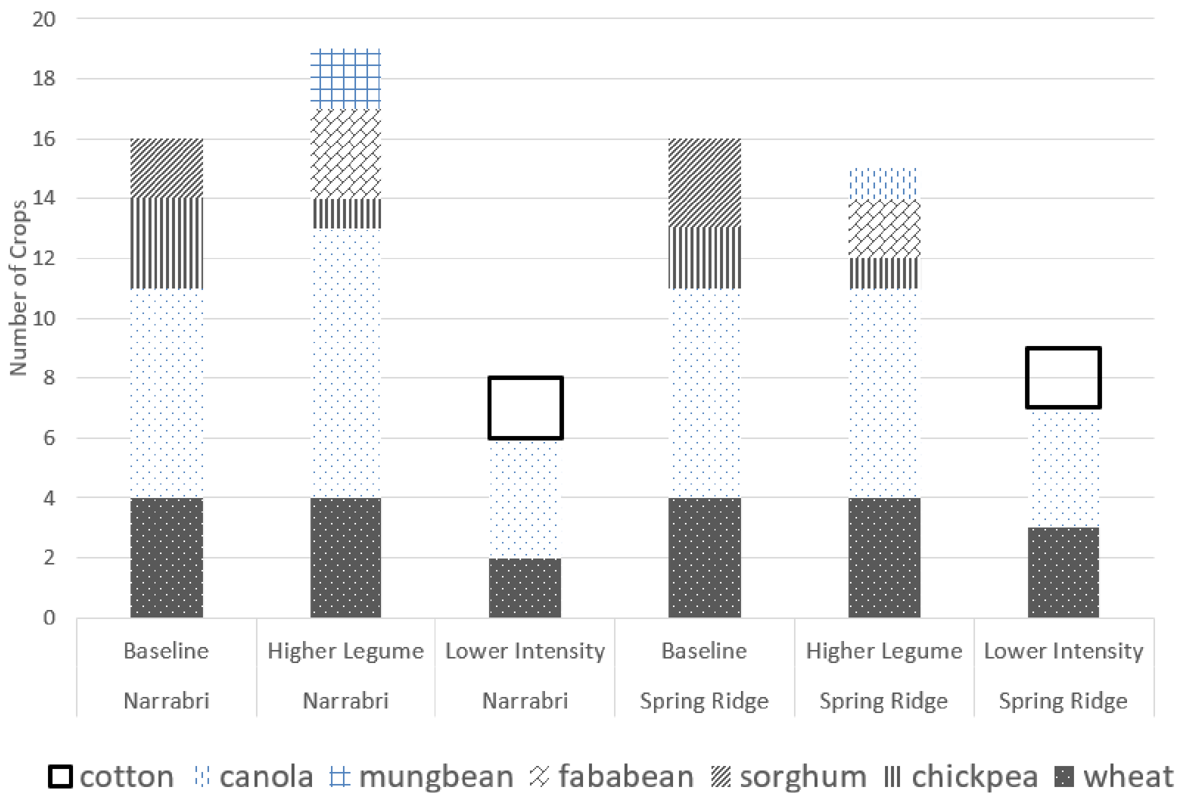

Figure 4. Crop type by system at Narrabri and Spring Ridge

Higher Legume at Pampas had a significant N input reduction of 270 kg N/ha compared to the Baseline with this benefit accruing from the summer 2021 season through to winter 2024 (Figure 5). The benefit was made up of both avoided N applications under a pulse versus a cereal, and greater available soil N at planting reducing N application requirements; however given this was after a long fallow we are unable to attribute this benefit solely to the previous mungbean crop (Table 4).

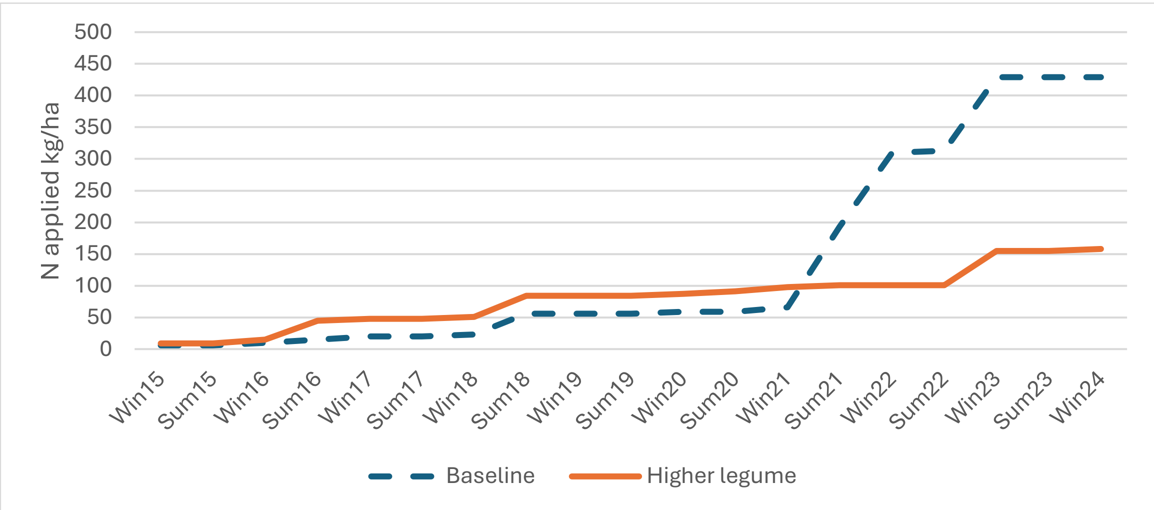

Figure 5. Cumulative N applied at Pampas

Table 3. Crop type and N application in Baseline and High Legume treatments, summer 2021 to winter 2024 at Pampas

System		Sum21	Win22	Sum22	Win23	Sum23	Win24
Baseline	Crop	Sorghum	Wheat	Fallow	Wheat	Fallow	Chickpea
	N applied (kg/ha)	127	117	0	116	0	0
Higher Legume	Crop	Mungbean	Fallow	Fallow	Wheat	Fallow	Fababean
	N applied (kg/ha)	3	0	0	51	0	0

The Lower Intensity system also had consistently lower applied N requirements, with 31 kg less at Pampas, 68 kg less at Narrabri and 135 kg less applied at Spring Ridge (Table 2). A key feature of each of these systems, other than their low cropping frequency (4 crops in 10 years at Narrabri, 5 in 10 at Nowley, and 7 in 10 at Pampas) has been the inclusion of cotton and the high N inputs for this crop, i.e. at Pampas N applied before cotton accounts for 205 kg of the total of 372 kg applied over 10 years. Whilst these systems have been highly profitable at each of the sites, one crop at each site accounts for between 40 and 60% of total return over a ten-year period, they also have additional fixed cost and machinery cost implications which are not appropriately captured at the gross margin level.

Conclusion

Utilising the long-term NFS project data has demonstrated that higher urea prices lead to a notable decline in profitability across all farming systems with the relative ranking of systems based on gross margins remaining unchanged. This indicates that there is limited flexibility in mitigating the financial impact of elevated nitrogen costs through system adjustments alone.

While systems with higher legume inclusion and lower intensity had some reduction in N application, these savings were usually modest and largely the result of avoiding application in the year of pulse crop growth. The low intensity system consistently required less N due to reduced cropping frequency; however, performance was often being supported by one highly profitable crop in a 10-year period. Evaluation at a gross margin level does not capture other challenges that low intensity cropping systems may bring, such as cash flow, ground cover and soil carbon.

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