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Using CropARM to Assess Grain Grower Responses to Rising Fertiliser Costs

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Cover Image

Wheat ripe for harvest at Scrubby Mountain: Keith Pembleton

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Enquires about this report

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General enquires about the CropARM decision support tool can be directed to Prof Keith Pembleton, Centre for Sustainable Agricultural Systems, University of Southern Queensland: Keith.Pembleton@unisq.edu.au

For specific questions or help with using the ARMonline tools, please contact the ARMonline team via our discord channel: https://discord.gg/emqKSZJzk8

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Introduction

With the new and escalating conflict in the Middle East, and the potential of this conflict to expand into other areas around the globe, there have been and will continue to be interruptions to global supply chains. While Australia is a net exporter of agricultural products, we rely on international supply chains for many of the inputs for our agricultural production. Fertiliser imports is a prime example of this international supply chain exposure.

Currently Australia imports a significant proportion of fertiliser from suppliers in the Middle East, including from Qatar, Bahrain, Saudi Arabia and Kuwait. Exports from all these countries have been extensively interrupted since the conflict between the USA-Israel alliance and Iran which commenced on the 28th of February 2026. At the time of writing (9th March), this had already caused an increase in urea prices of A$150/t with some experts forecasting price increases of up to A$350/t in the coming weeks[1].

Urea fertiliser application rates of up to 450 kg urea/ha are common for cereal crops (wheat, barley and oats) in Australia and with urea prices potentially reaching $1200/t (up from $850/t in early February) or greater in the coming weeks[1], grain growers are facing challenging decisions as they prepare for the upcoming winter cropping season. Options such as reducing fertiliser application rates, planting pulse crops (which, as legumes, require minimal amounts of urea) or even rotating to summer crops to delay the need to purchase urea are all options to consider. Growers already in a summer crop rotation, growing cotton or sorghum (both of which typically require between 200 and 650 kg/ha of urea), may be considering if it is worthwhile double cropping into a winter crop rotation to avoid currently high urea prices and supply limitations.

This report presents a series of analyses completed with the CropARM decision support tool. These analyses explore options for grain growers facing a considerable increase in the cost and limited supply of a key cropping input. CropARM is part of the ARMonline (www.ARMonline.com.au) suite of decision support tools that have been developed by the University of Southern Queensland (UniSQ) and the Queensland Department of Primary Industries (DPI). CropARM is a pre-season decision support tool to help grain growers make key decision such as what to plant, when to plant, what cultivar to use and how much fertiliser to apply. As such it is ideally suited to this type of analysis. The tool utilises the APSIM[2] farming systems model as its analytical engine, which has been developed over 30 years by leading agricultural research organisations globally.

Potential impact of high urea prices on crop gross margins

For this (and subsequent analysis) we have selected Pittsworth, Queensland, as the location of interest. Pittsworth is centrally located on the Darling Downs, a major rainfed/dryland cropping region. In CropARM it is possible to select from over 58 different locations across Australia so growers and agronomists can repeat/tailor this analysis to their own specific circumstances.

We completed the analysis for a field with a Vertosol soil with 190 mm of plant available water holding capacity (PAWC; typical for cropping soil around Pittsworth). We have assumed that the field is in a winter cropping rotation, so has been fallowed over summer to store soil moisture. Consequently, we have selected an initial soil mineral nitrogen status (to 90 cm soil depth) of 50 kgN/ha and that the soil is 90% full of water. We will plant a cultivar similar to the standard cultivar Janz on the 15th of May at a sowing rate that achieves a plant density of 100 plants/m^2. The initial fertiliser rate we will use is 100 kg N/ha. As urea is 46% nitrogen this is the equivalent of applying 217 kg/ha of urea. On average a rainfed (dryland) crop sown like this should achieve a yield of 4.1 t/ha with a range of yields between 3.4 and 4.9 t/ha (Figure 1). A gross margin analysis using input costs sourced from the AgMargins[3] database and a wheat price of $340/t showed a decrease in the average gross margin of $76/ha from urea prices increasing from $850/t to $1200/t.

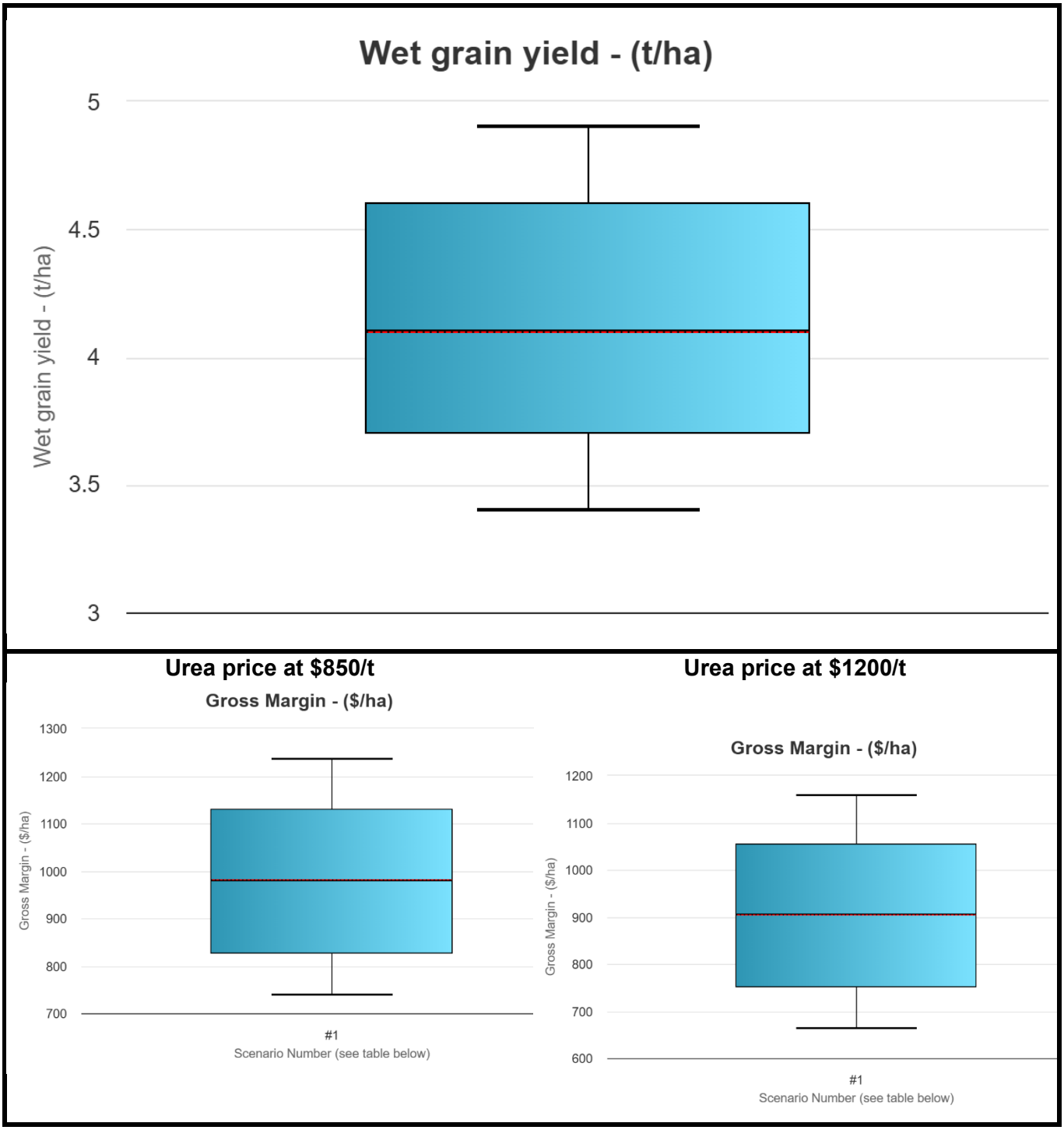

Figure 1. Yield distribution of a rainfed wheat crop grown at Pittsworth Qld, and the impact of a urea price of $850/t or $1200/t on gross margin. Note: The gross margin plots are offset to facilitate visual comparison.

Options to manage high fertiliser costs

Impacts of reducing urea fertiliser inputs to wheat yields and gross margins

The immediate response of a grain grower to an increase in fertiliser costs may be to reduce the fertiliser application rates. We use the previously described scenario of rainfed wheat grown at Pittsworth with a range of fertiliser rates from 25 to 100 kg N/ha (the equivalent of 54 to 217 kg urea/ha) and an increased urea price at $1200/t. The impact on average yields from a reduction in fertiliser on yield is clear (Figure

2), with 15% yield penalty from decreasing fertiliser from 100 to 75 kgN/ha. The impact on the gross margin was also clear with a 18% decrease.

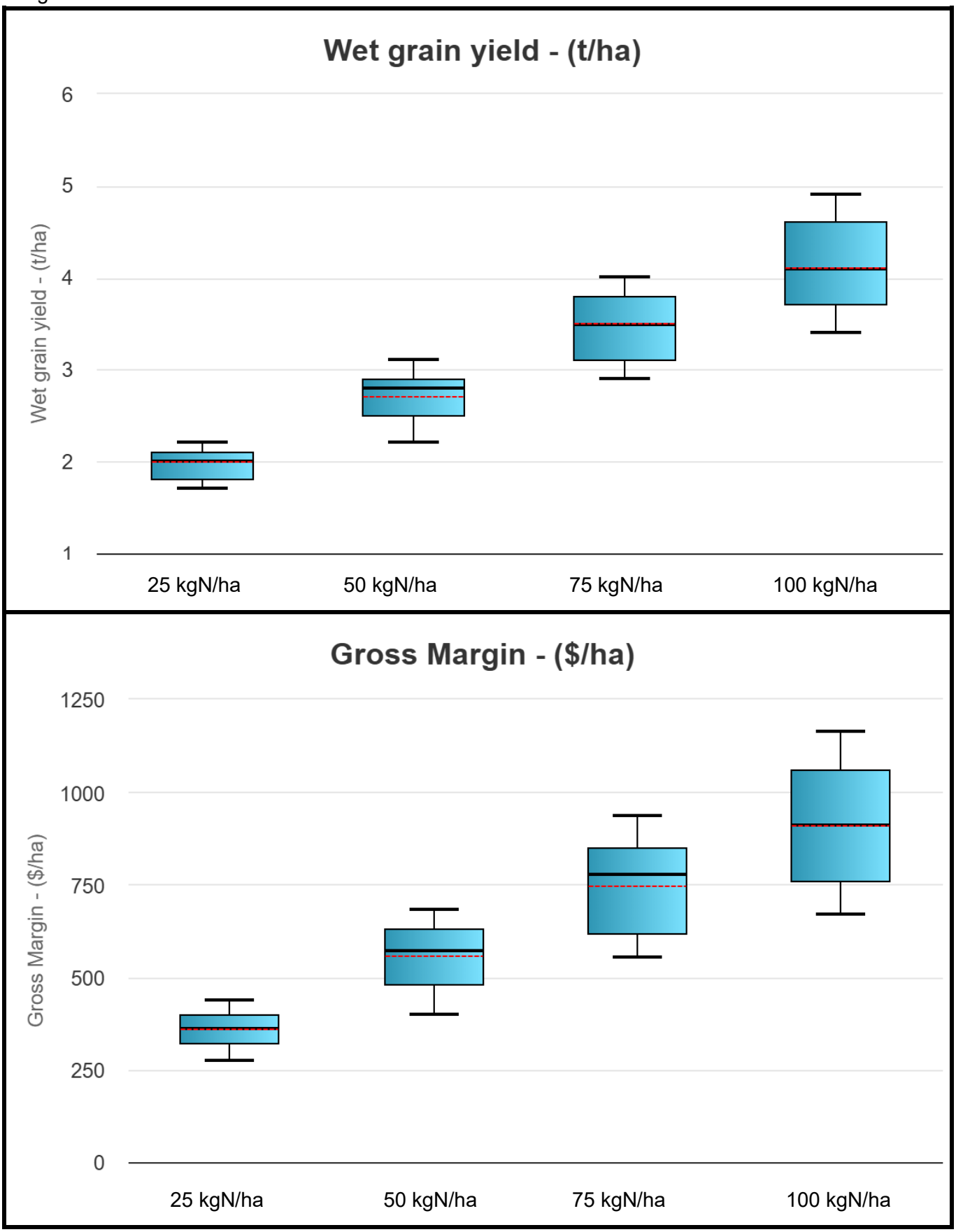

Figure 2. Impact of different nitrogen fertiliser rates on the rainfed wheat yield and gross margin (with a urea price of $1200/t and a wheat price of $340/t) of wheat grown at Pittsworth.

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Further to the reduced yields and gross margins, the reduced urea application also resulted in a decrease in soil mineral nitrogen at harvest (Figure 3). The depletion of the soil's nitrogen bank will need to be corrected through future fertiliser applications to prevent long term productivity reductions. If urea supply remains constrained in the long term, this could present potentially considerable reduced yields and economic returns to the grower.

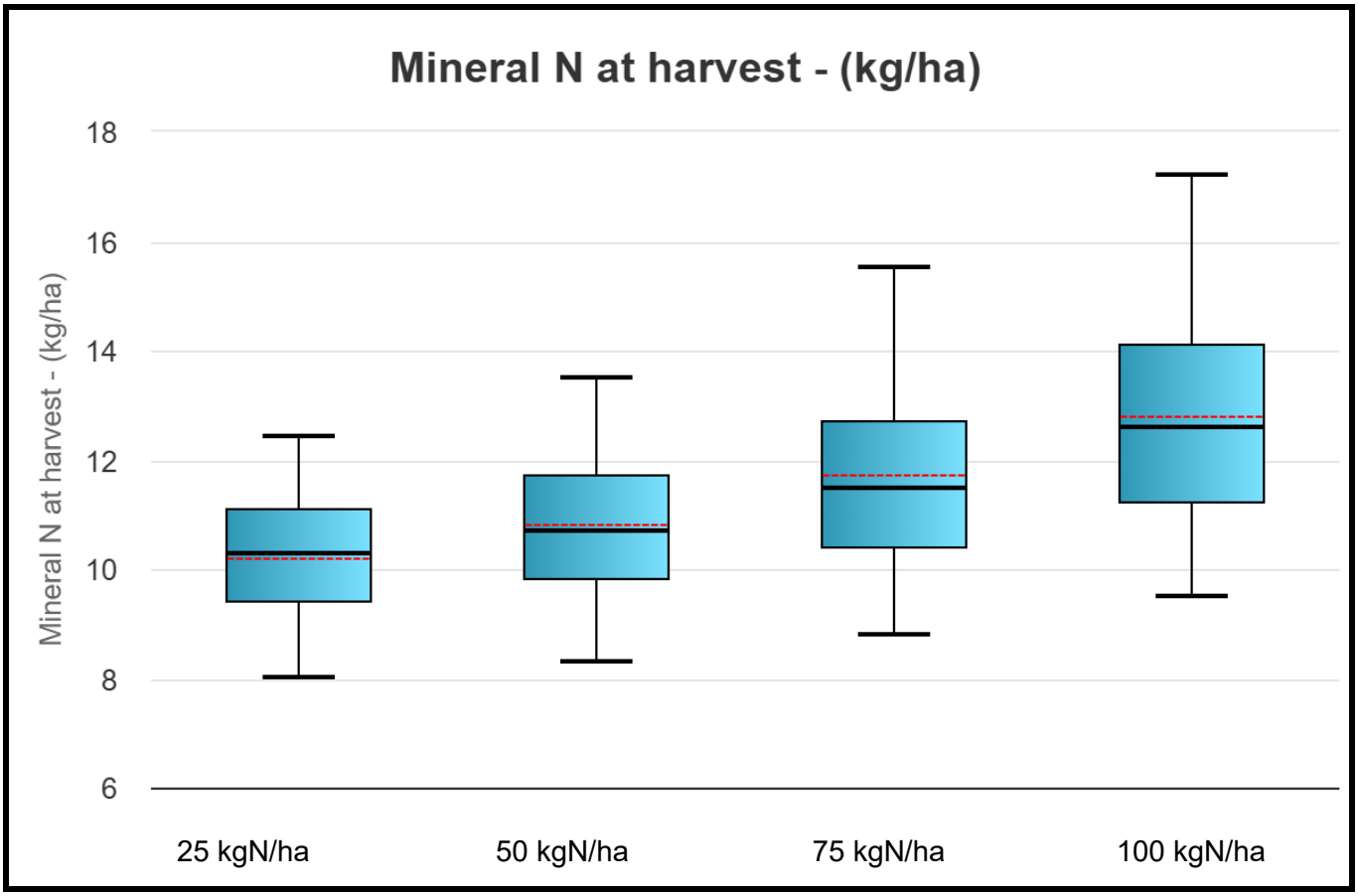

Figure 3. Impact of different nitrogen fertiliser rates on soil mineral nitrogen (kgN/ha) at harvest of rainfed wheat grown at Pittsworth.

Growing chickpeas instead of wheat

Grain growers may consider growing pulse crops that do not have a requirement for nitrogen fertilisers (i.e. urea) to avoid the impact of urea price increases. Around Pittsworth, the most commonly grown winter pulse crop is chickpea. Figure 4 shows the expected yield and gross margin of a chickpea crop sown under the same conditions to the aforementioned wheat crop, using the Amethyst cultivar sown on the 30th of June. On average the expected chickpea yields were 2.9 t/ha with a gross margin of $1,647/ha, highlighting that planting chickpeas is an attractive option for growers looking to minimise the impact of increased urea prices. Some caution does need to be taken in applying these results as chickpea prices historically are more volatile than wheat prices[4] and if an expansion in the current conflict occurs, key markets for Australian chickpeas in the UAE, Pakistan and further afield could be impacted. Moreover, if many Australian grain growers opt out of winter cereal to grow pulse crops, this increase in supply into a relative thin market can drive down pulse crop prices.

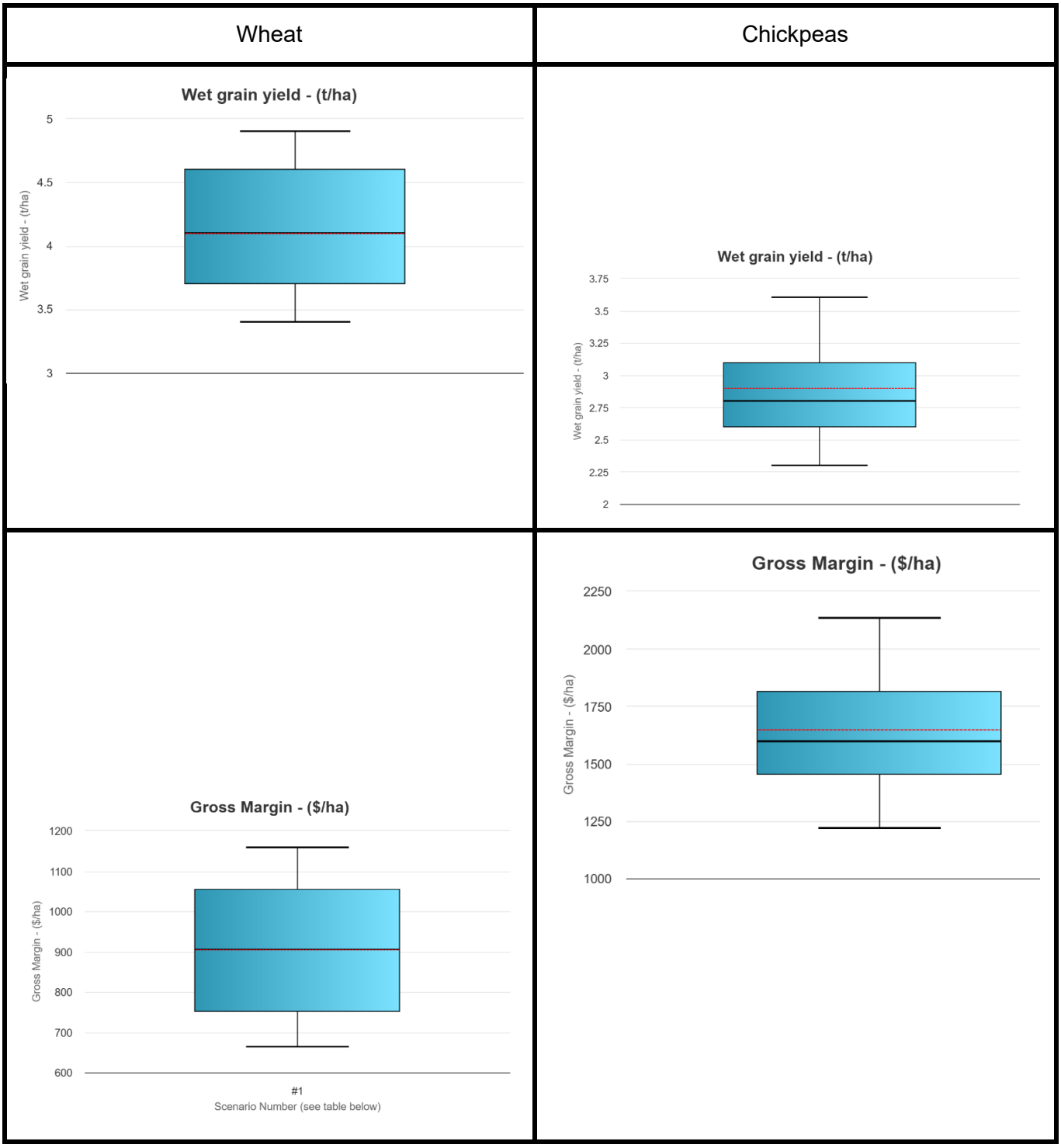

Figure 4. A comparison of the rainfed crop yields and gross margins of wheat and chickpeas grown at Pittsworth. For the calculation of gross margins, the urea price was $1200/t, the wheat price was $340/t and the chickpea prices was $713/t. Note: Plots have been offset to facilitate visual comparison.

Transitioning from a winter crop rotation to a summer crop rotation (long fallowing into sorghum)

Growers may consider skipping a winter crop and then planting a summer crop in spring, with the hope that urea prices and supply have returned to more normal levels by then. The risk with such a strategy is that the supply disruptions may prevail until then or possibly get even worse. Consequently, we have

analysed the yield and gross margin of a sorghum crop grown at Pittsworth when the urea price is at $850, $1200 and $1800/t to explore this risk (Figure 5). In this scenario, a medium maturity cultivar of sorghum is planted on the 15th of September at a target plant density of 4 plants/m^2 and a fertiliser rate of 100 kgN/ha (217 kg urea/ha) is applied. The average gross margin of the sorghum crops reduced from $1204/ha, to $1128/ha, to $997/ha as urea fertiliser prices increased from $850/t, to $1200/t, to $1800/t. Higher urea prices will further decrease the gross margin of sorghum production.

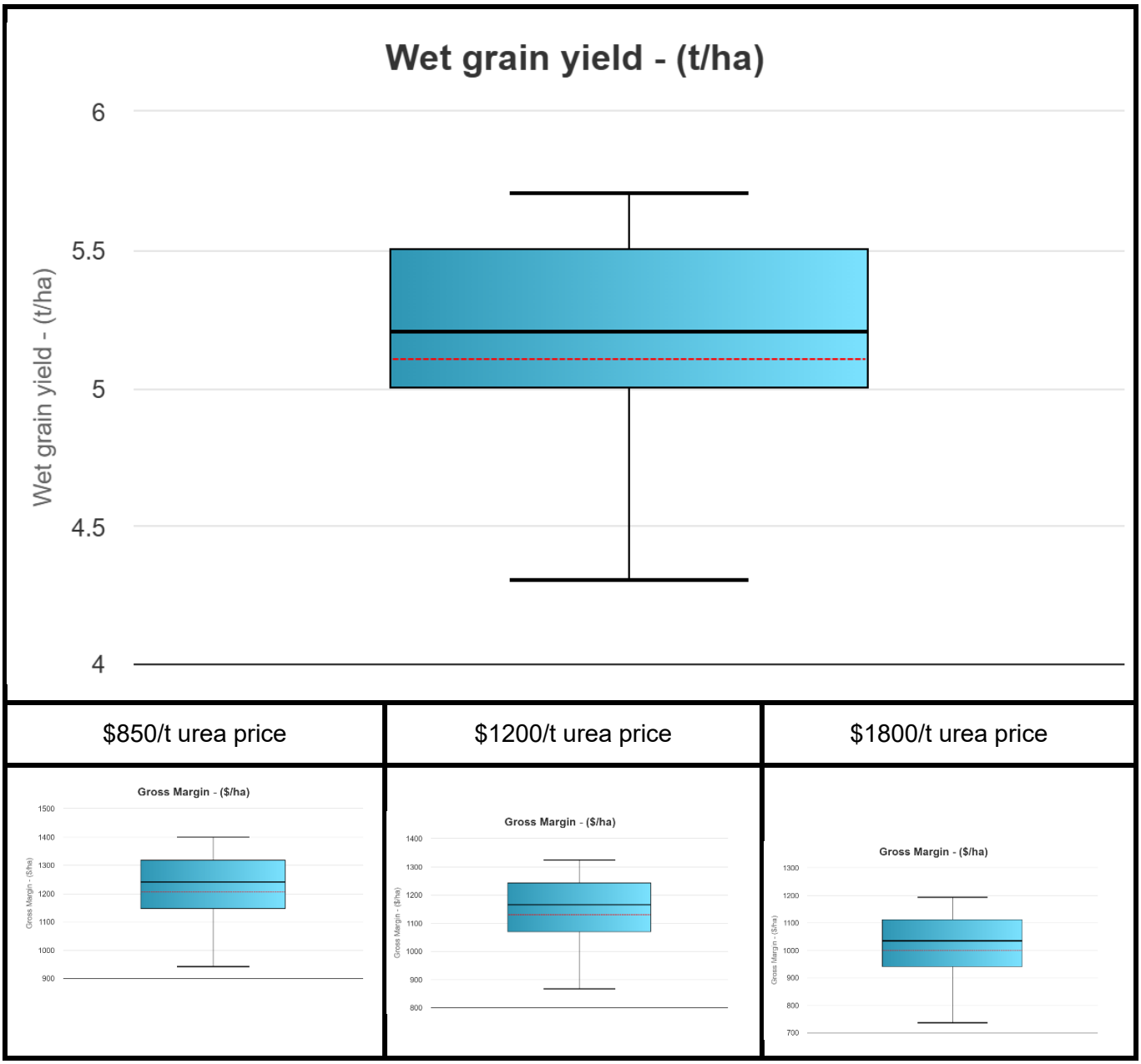

Figure 5. Long-fallowed sorghum yield and gross margin for a urea price of $850, $1200 and $1800/t and a sorghum price of $340/t. Note: Gross margin plots are offset to facilitate visual comparison.

Transitioning now by double-cropping into a winter crop

Growers already operating in a summer crop rotation may be weighing the risks of ongoing fertiliser supply disruptions and, with favourable late-summer and early-autumn rainfall in some areas, they may be considering transitioning by double-cropping into winter crops. In such situations, fields where a summer crop was grown will generally have lower soil water content and residual soil mineral nitrogen than fields that remained in fallow. To explore this scenario, we completed an analysis for rainfed wheat

and chickpeas grown at Pittsworth. To reflect the reduced availability in soil water and nitrogen when double cropping, the soil water content was set to 60% and the initial soil mineral nitrogen was set to 10 kgN/ha. In this scenario, the wheat crop received 100 kgN/ha. Chickpeas appear very attractive for this option with an average gross margin of $1370/ha compared to $473/ha for wheat. As noted previously, growers should also consider price volatility and the ongoing uncertainty surrounding access to key chickpea markets when weighing up this option. Note, although long-fallowing does tend to decrease risk and increase soil-moisture and crop yields, it does reduce cropping intensity and thereby the average farm income, $/ha/year.

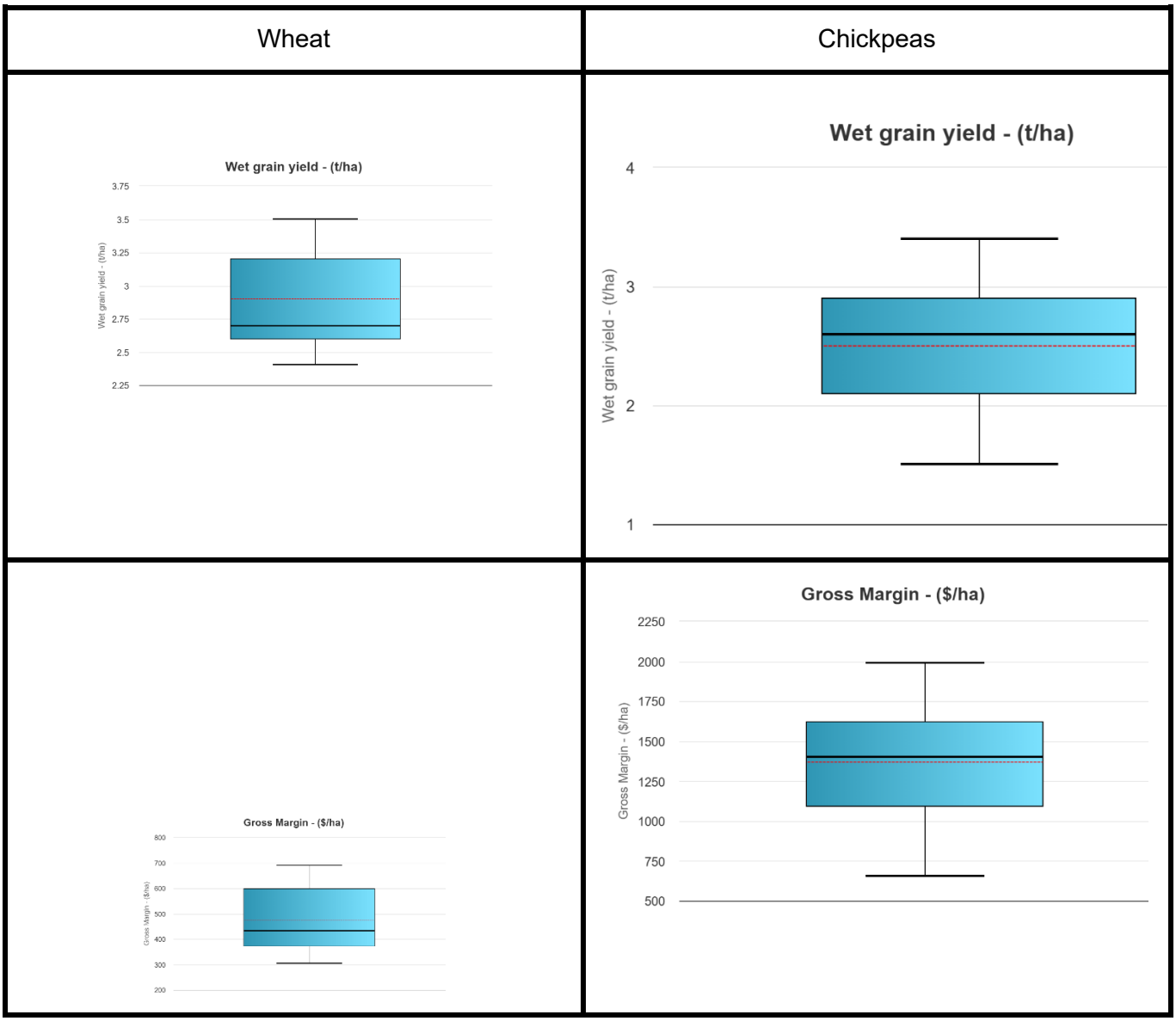

Figure 6. A comparison of the yield and gross margins of wheat and chickpeas grown directly following a summer crop (i.e. double cropping) at Pittsworth. For the calculation of gross margins, the urea price was $1200/t, the wheat price was $340/t and the chickpea price was $713/t. Note: Plots are offset to facilitate visual comparison.

Conclusions

The report outlines options for grain growers in response to rising urea prices and supply disruptions for the upcoming winter cropping season. Despite the projected increase in urea prices, wheat grown using

standard urea fertiliser rates is anticipated to achieve higher gross margins than by reducing fertiliser rates. In this case urea supply rather than price may become the key constraint. In cases where urea cannot be sourced, chickpeas present a viable cropping option. However, price volatility and the potential for disruptions to key export markets should also be considered. Transitioning to a summer cropping program may be a viable option as long as the urea supply disruption is temporary. If it continuous and worsens into the beginning of the summer cropping season, there will be considerable impacts on summer crop production and gross margins. Moreover, with global events affecting supply chains even future crop prices are uncertain, increasing production risk. Overall, a balanced application of all these options explored in this analysis will enable grain growers to manage the risks and uncertainties caused by the current urea supply disruptions and price rises.

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