Final report summary

Rice variety nitrogen and agronomic management

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Abstract

For rice to be competitive with other irrigated crops, growers require best management practice guidelines for rice varieties grown under the diverse range of water management practices and regions, to maximise grain yield, water productivity and profitability. This project collected essential rice agronomic, nitrogen and phenology data, validated it over several seasons, and produced user-friendly variety growing guidelines for all new release and existing rice varieties grown in southern New South Wales.

The most significant impact from the research undertaken in this project will be increased water productivity. From the start of this project to present, many growers have transitioned from aerial sown practice to the more water-efficient drill and delayed permanent water practices. The outputs from this project have provided the opportunity for rice growers to transition to drill and delayed permanent water, which will ensure rice can be competitive with other irrigated crops in southern NSW and support jobs in local communities.

Background

Rice is a valuable crop that provides numerous benefits to irrigated farming systems in southern NSW. But its production is under pressure due to reduced water availability, the associated increased cost of water and competition from other crops. To maximise water productivity, rice growers must have up-to-date information on best management practices for new and current varieties grown in their region, covering the range of sowing and water management practices. When this project started, there was limited data available on best management practice for current varieties and no process in place for developing growing guidelines for newly released varieties. The only varietal agronomy information available was for aerial sown crops, with no recommendations for the water-saving practices of drill sowing and delayed permanent water (DPW), which are vital to the sustainability of the rice industry.

Objectives

The project objectives were:

- Provide rice growers with an agronomic management package for current rice varieties and new varieties when released.
- Determine nitrogen requirements, including total N and split timings, for optimal growth and grain yield of current and new varieties when released.
- Understand the phenology of current and new varieties when aerial and drill sown in both valleys over different seasonal conditions.
- Incorporate nitrogen, agronomy and phenology results into the NIR Tissue Test nitrogen topdressing recommendations and ‘Rice variety guide’.
- Provide results and grain samples to the DPI Rice Breeding and Grain Quality teams and SunRice for grain quality testing and variety market evaluation.

Key findings and outputs

Agronomic management packages have been developed for 11 rice varieties, four of which were new or released during the time of the project. Data generated from the project has also been used in annual updates of the ‘Rice variety guide’. The ‘Rice variety guide’ and individual variety growing guidelines are distributed to growers at pre-season meetings, available for download on the NSW DPI and Rice Extension websites, included in Rice Extension grower newsletters and sent directly to growers with seed order information. Agronomic information was also presented to growers and agronomists at meetings and field walks by the researchers and Rice Extension.

Research

Growers and agronomists require accurate science-based growing recommendations to ensure optimum grain yields can be achieved. To enable the development of agronomic management guidelines for each variety, it was essential to establish several variety-by-nitrogen experiments each season to obtain the required data. During the project, 61 experiments were established across the rice-growing regions of southern NSW and included all sowing/water management practices.

Research was also conducted into the potential of growing rice aerobically (no ponded water) in southern NSW. Experiments were conducted comparing aerobic, drill and DPW management over four seasons. From the many experiments conducted, establishment vigour, nitrogen management, plant height, lodging potential, grain shattering and yield potential were determined for each variety. Results from multiple experiments over several seasons were required to account for environmental variability, which impacts crop establishment, growth, phenology, yield and quality.

When all this information is collated, specific variety attributes and accurate recommendations can be developed for each rice variety for the different growing practices and regions.

Implications for industry

The most significant impact from the research undertaken in this project will be increased water productivity from rice growing. Increased grain yields due to improved crop management combined with reduced water use due to changing growing practice have both led to increased water productivity.

The successful transition of growers from fully flooded aerial sown production to drill sowing and DPW over the past six years is an outcome that can be partly attributed to the outputs produced in this project. Prior to this project, all guidelines were based entirely on aerial sowing, which was how 76% of the rice crop area was grown in 2015. In 2020–21, only 44% of the rice crop area was aerial sown, meaning 32% of the rice crop area grown transitioned from aerial to drill and/or DPW practice.

Nitrogen recommendations that maximise grain yield while reducing the risk of cold-induced sterility and lodging have been developed for each rice variety and sowing/water management practice. The optimal rate and timing of nitrogen application varies between varieties and growing methods. Nitrogen recommendations have been incorporated into each variety growing guideline and the Tissue Test PI nitrogen topdressing recommendations.

Extensive phenology data collected in this project allowed the development of accurate optimal sowing dates for aerial, drill and DPW practices for all varieties and growing regions. Phenology data collected in this project has been used to develop the two-stage PI date predictor designed for drill and DPW rice where the permanent water date is variable.

Although not an objective of this project, the team investigated aerobic rice production in southern NSW in order to assess all potential water-saving practices. The water savings from aerobic production were not large enough to account for its lower grain yield. It was concluded that rice varieties better adapted to aerobic conditions are required before aerobic rice is a viable commercial option in southern NSW.
Changing from aerial to conventional drill sowing will conservatively result in a water productivity increase of 0.1 t/ML, while changing from drill to DPW can save another 0.15 t/ML. For a 50,000 ha crop, this change in growing practice would allow an extra 4000 ha of rice to be grown with the same amount of water.

Rice is an industry that has a high level of product value adding in the regional communities where the crop is grown and provides hundreds of jobs for people in regional towns. It is particularly important for rice to remain competitive with other irrigation industries and maximise $/ML return. The outputs from this project have provided the opportunity for rice to be competitive with other irrigated crops in southern NSW and support jobs in local communities.

**Recommendations for industry**

It is vital for rice growers and agronomists to continue having access to agronomic management packages for new rice varieties when they are released. It is also important that all varieties are assessed using all sowing and water practices to ensure water productivity from rice is maximised.

Once a rice grower places a seed order with SunRice for a specific variety, it is recommended that they be automatically emailed the appropriate variety growing guideline. They will then receive the required information to grow that variety at the optimal time, when they are most likely to read it.

It is recommended that the rice industry continues to move towards drill sowing and delayed permanent water practices for suitable soil types. For rice growing to remain competitive and sustainable in southern NSW, drill sowing with delayed permanent water needs to become the default growing practice, with aerial and dry broadcast methods only used in special circumstances.

Continual education of growers on agronomic management of varieties, especially with drill sowing and delayed permanent water, is essential. Collaboration between researchers, Rice Extension and SunRice Grower Services to improve the education of agronomists in rice management under drill sowing and delayed permanent water is imperative if the long-term viability of the rice industry is to be improved.

Further development of the two-stage PI date predictor and a maturity date predictor is important for crop management. It is recommended that growers record mid-flowering dates for their crops, so the accuracy of maturity date predictions is increased. Accurate prediction of maturity date allows growers to make more informed drainage decisions, increasing grain yield and quality.

**Publications**

Primefacts and NSW DPI publications

- Brian Dunn (2020). Illabong growing guide, Primefact 1650, 2nd edition
- Brian Dunn (2020). Topaz growing guide, Primefact 1483, 3rd edition
- Brian Dunn (2020). Koshihikari growing guide, Primefact 1486, 3rd edition
- Brian Dunn (2020). Doongara growing guide, Primefact 1587, 3rd edition

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Advisory publications

Brian Dunn, Tina Dunn, Craig Hodges and Chris Dawe (2020). The effect of water management on rice growth and grain yield. Southern NSW research results 2020, NSW DPI. pp. 113-117

Brian Dunn, Tina Dunn, Craig Hodges and Chris Dawe (2019). Research on sustainable practices helps growers reap benefits. 2019 Rice Program R&D Update. 21-22

Brian Dunn, Tina Dunn, Craig Hodges and Chris Dawe (2019). Effect of sowing rate, nitrogen rate and application timing on grain yield and protein of short grain rice. Southern NSW research results 2019, NSW DPI. pp. 155-158


Scientific publications


Dunn TS, Dunn BW and Orchard B (2017). Measuring seedling vigour in Australian rice varieties. 6th International Temperate Rice Conference, Griffith Australia, 6-9th March 201ww7

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