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Managing drill sown rice

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Brian Dunn, Research Agronomist, NSW DPI, Yanco

Drill sowing rice has several advantages over aerial sowing while achieving the same grain yield potential.

Increased water productivity and profitability are the most important benefits from drill sowing. Other benefits include no wind or muddy water problems during establishment, fewer aquatic weeds, fewer bloodworms, reduced duck and snail issues and minimal lodging.

Drill sowing can take many forms, but generally involves drilling the seed into the soil before applying flush irrigations to establish the crop. Permanent water (PW) can then be applied anytime between the two-leaf stage and late tillering.

Field layout

For successful drill sowing, surface drainage during establishment is critical. Field layouts with slopes of less than 1:1600 and no depressions are most suitable. Bankless channels and large outlets aid rapid bay filling and draining. This also improves irrigation efficiency and offers the potential for automation. A good recycling system to capture drainage water and supplement the supply to reduce irrigation time is also important.

Site preparation

Early site preparation is important for successful establishment. Preparation should begin in autumn to get a level field. Re-build banks and clean out toe furrows (Figure 1) to ensure quick drainage, as this is critical during rice establishment.

Figure 1. Levelling bays and re-building banks are important for drill-sowing.

Control weeds over winter using herbicides, leaving a firm seedbed, which often cracks along drill rows, improving emergence in crusting soils.

Seed placement

Seed depth uniformity is important as it is difficult to control weeds and manage irrigation timing when seeds are sown at variable depths and emerge at different times. Disc seeders often give superior seed placement and depth control than tyned seeders in dry seeding situations (Figure 2).

For most soil types, seed should be sown 25–30 mm deep. If too shallow, the soil around the seed can dry quickly and the field will need additional flush irrigations for successful establishment.

On crusting soils, the seed might need to be sown 40–50 mm deep to be below the dry crust layer.

Sowing deeper than 50 mm can make it difficult for the rice seedlings to push through the soil and emerge.

Figure 2. Disc seeders provide more uniform seed depth.

Sowing rate

Use the recommended sowing rate for the chosen variety (refer to NSW DPI Rice variety guide). While lower seed rates might produce adequate plant numbers when sown into a good seed bed at an accurate and uniform depth, they can result in insufficient plants when used in difficult establishment conditions.

Row spacing

Research has shown no reduction in yield when row spacing is increased from 180–270 mm. Yield decline has been observed at 360 mm row spacing. As the width between the rows increases, any gaps in the plant row reduce yield, as the neighbouring rows are too far away to compensate for the gap.

Wide row spacing restricts canopy closure (Figure 3), which can allow late germination of grass and aquatic weeds after chemical control periods have been exceeded.

Figure 3. Rice sown at wide row spacings often does not achieve full canopy closure.

Fertiliser at sowing

It is important to apply a starter fertiliser with the seed at sowing. Phosphorus is important for establishment and the N will boost seedling vigour, but it does not increase yield. Wetting and drying of the soil associated with the flush irrigations results in much of the N sown with the seed being lost to the atmosphere.

Extra phosphorus and zinc should be sown with the seed in areas where topsoil was removed during land-forming operations. The soils in the cut area often have high pH and carbonate levels, which promote zinc deficiency, leading to problems with seedling survival when PW is applied. Coating the seed with a zinc treatment or using a compound fertiliser with zinc incorporated into each particle can improve establishment in these situations.

Herbicide application

Grass weeds can become a significant problem in drill sown rice. Start by using a knockdown herbicide in August. A second knockdown herbicide application might be required just before sowing if rainfall has germinated some grass weeds (e.g. barnyard grass). If these seedlings are not controlled, they will grow more quickly than the rice and be difficult to control later.

Apply a three-way chemical mix after the first flush and before any rice emerges. This provides a knockdown for already established weeds and some residual grass weed control (refer to NSW DPI Rice crop protection guide).

Aquatic weeds often do not need herbicide control in drill sown rice if there is sufficient drying between the flush irrigations. With traditional row spacings (e.g. 180 mm), canopy closure prevents later weed germinations, but this might not happen with wide row spacings.

Irrigation management

First flush

Apply the first flush as soon as possible after sowing. Good rainfall following sowing might overcome the need for the first flush irrigation on some soils. However, flush irrigation is often required to provide an even germination.

The first flush irrigation should be on and off the field as quickly as possible to allow internal soil drainage. If water ponds for an extended period (more than 24 hours after application), oxygen is not available for the seed to germinate and poor establishment could result.

Second flush

The timing of the second flush is crucial. It is a balance between managing soil moisture around the seed and having the ground dry enough for spray equipment.

Good surface drainage following the second flush is critical. Any ponded water needs to be drained from the field within 12 hours of inundation or seedling establishment will be significantly reduced.

Once the rice seedlings have emerged from the soil (Figure 4), the time between flush irrigations can be extended. Digging into the soil and checking the moisture around the plant roots will help determine when to irrigate again.

Figure 4. Rice seedlings emerged from the soil.

Permanent water

Permanent water can be applied any time between the 3-leaf stage and as late as 10 days before panicle initiation (PI). The biggest risk in delaying PW is controlling weeds, notably barnyard grass (*Echinochloa crus-galli*). If grass weeds are not an issue, delaying PW application is a viable option that provides significant water savings (refer to NSW DPI Primefact 1238: Delaying permanent water for drill sown rice).

Once PW is applied, water management is the same as for an aerial sown crop. Maintain shallow water coverage (50 mm) to reduce subsequent weed germination, then increase water depth after PI to ensure deep water (minimum 250 mm on the high side of the bay) over the microspore period.

Nitrogen management

Pre-permanent water nitrogen

The most efficient time to apply nitrogen (N) fertiliser to drill sown rice is onto dry soil immediately before PW (Figure 5). The soil surface (minimum top 20 mm) should be dry for the N to move into the soil, otherwise much will be lost from the ponded water into the air.

The N (urea) rates applied before PW in drill sown rice are similar to those that would be drilled into the soil pre-PW for aerial sown rice (refer to NSW DPI Rice growing guides for each variety).

Any area of the field that had topsoil removed during land-forming might need extra N applied. Deep cut areas might require up to twice the N rate that was applied to the non-cut areas of the field. Deep-fill areas also often require extra N because subsoil from the deep cut areas is commonly placed in the deep fill areas.

Figure 5. Spreading urea onto dry soil before permanent water.

More information

Dunn B. 2023. Delaying permanent water on drill sown rice. Primefact 1238, third edition. NSW Department of Primary Industries. https://www.dpi.nsw.gov.au/agriculture/broadacre-crops/summer-crops/rice-agronomy/dpw

Dunn B and Dunn T. 2023. Rice variety guide. Primefact 1112, eleventh edition. NSW Department of Primary Industries. https://www.dpi.nsw.gov.au/agriculture/broadacre-crops/summer-crops/rice-agronomy/rice-variety-guide-2022-23

Troldahl D, Stevens M and Hoskins J. 2022. Rice crop protection guide. NSW Department of Primary Industries. https://www.dpi.nsw.gov.au/agriculture/broadacre-crops/summer-crops/rice-pests-and-diseases/rice-crop-protection-guide

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