Department of Primary Industries
Department of Regional NSW

DPI Primefact

Delaying permanent water on drill sown rice

June 2023, Primefact 1238, fourth edition

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Delayed permanent water (DPW) is an alternative water management practice for drill sown rice that increases water productivity. The rice crop is sown and initially managed the same as a conventional drill sown crop, but permanent water (PW) application is delayed until at least 50 days after the first flush irrigation.

Water savings

Four years of research on two soil types have demonstrated that DPW provides considerable water savings (Table 1). Delayed permanent water can save 2.5 ML/ha of water over conventional drill sown rice, while conventional drill uses 2 ML/ha less water than aerial sown rice.

The reduced time the crop grows in ponded water results in lower water use, primarily due to reduced evaporative losses from the water surface before the crop reaches full canopy cover. There are also water savings from reduced percolation losses, which vary with soil permeability.

Table 1. Grain yield, water use and water productivity for different rice growing methods (based on 4 years of research).

	Aerial	Drill	Delayed permanent water
Grain yield (t/ha)	12.1	12.1	11.6
Irrigation water use (ML/ha)	14.9	12.9	10.4
Water productivity (t/ML)	0.8	0.9	1.1

Grain yield

In the initial DPW research, grain yields were lower than for conventional drill sown rice (Table 1). As DPW management improved, so did grain yields, and they are now similar to conventional drill and aerial sowing.

Flush irrigation frequency and PW timing have the biggest effect on grain yield in DPW practice. The grain yield of the DPW treatment was reduced when there was excess moisture stress between irrigations.

An experiment conducted at Leeton in the 2017–18 season compared aerial, drill and DPW rice management (Figure 1). The grain yields were 12.8, 12.9 and 13.1 t/ha for aerial, drill and DPW treatments, respectively. The results highlight that similar grain yields can be achieved from all 3 sowing/management practices.

Figure 1. The experiment comparing 3 rice irrigation methods with 4 replicates of water treatments in individual bays where water supply and drainage were measured for each bay.

Sowing

Sowing method and water management both affect crop development; the longer a crop grows before PW is applied, the slower it develops. Also, the more a crop is moisture-stressed between irrigations, the greater the delay in development.

Crops planned for DPW should be sown 10 days earlier than conventional drill sown crops (Figure 2).

Do not delay PW when growing the short season variety Viand⦶ or if sowing later than the recommended sowing window. It will slow crop development and increase the risk of a lower yield and late harvest.

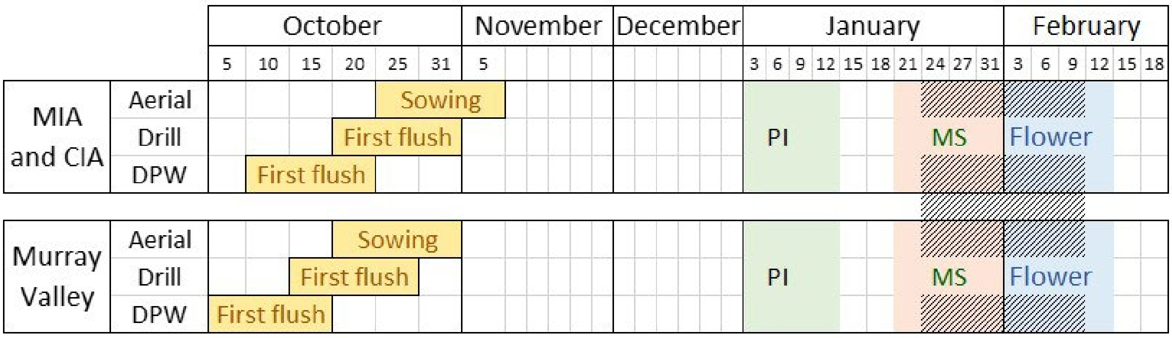

Figure 2. Recommended sowing and first flush dates for Reiziq⦶ and V071⦶, and the subsequent panicle initiation (PI), microspore (MS) and flowering times when sown in the recommended period for each district and sowing method. The hatched area shows the time of least risk of low temperatures. MIA – Murrumbidgee Irrigation Area, CIA – Coleambally Irrigation Area, DPW – delayed permanent water.

The recommended seed sowing rate for DPW is the same as for conventional drill sown rice. Rice grown using DPW produces as many tillers as conventional drill and aerial sown rice. Higher sowing rates create a denser crop, which requires more regular flush irrigations and therefore increased water use with no increase in yield.

Irrigation

Irrigation layouts that provide fast surface drainage are critical for successfully establishing drill sown rice. The layout must allow full surface water drainage within 24 hours of flooding, particularly after the first and second flush irrigations. Ponded water during establishment will result in a poor plant population. To ensure good establishment, do not severely moisture stress rice before it reaches the two-leaf stage.

Once the plants are established (Figure 3), increase the time between flush irrigations. The longer the period between irrigations, the greater the water savings, but as moisture stress is increased, plant crop development is delayed.

Using evapotranspiration (ETo) data to schedule irrigation timing is a simple and effective way to determine when to irrigate. Irrigate at a cumulative ETo of between 80 mm and 100 mm, depending on soil type, with crop coefficients of 0.6 and 0.8 for early and late November, respectively and 1.0 for December. Using ETo to manage irrigation timing also allows a good level of planning.

Alternatively, flush irrigate the crop once it starts to show visible signs of moisture stress in the thicker parts of the crop, i.e. corners or sowing overlap areas. Using this method requires access to irrigation water at short notice.

Figure 3. Flush irrigate delayed permanent water rice using evapotranspiration data or when the plants start to show signs of moisture stress in thicker crop areas.

When to apply permanent water

The later PW is applied, the greater the water savings; but it must be applied no later than 10–14 days before panicle initiation (PI).

If PW timing is delayed until PI or later, it does not provide enough time for the crop to build the biomass required to reach a desirable grain yield. Ten days before PI provides the time necessary for biomass to increase sufficiently after N and PW applications to reach a similar level to conventional drill sown crops.

It is wise to apply PW before Christmas, before any potential water supply difficulties occur due to high irrigation water demand. Permanent water can be applied earlier if required due to pressure from high weed populations.

Nitrogen management

It is important to use a starter fertiliser with the seed when drill sowing rice. The seed requires phosphorus during establishment and even though the nitrogen (N) does not increase yield, it often improves early growth.

If N is applied at sowing or between the flush irrigations, large N losses can result. The best N option for DPW rice is to apply 200–250 kg/ha of urea onto dry soil before PW (Figure 4).

Research has shown that applying urea to dry soil before applying PW provides the highest grain yield and best N use efficiency. This practice is very efficient, with an average of 72% apparent N recovery compared to 60% for conventional drill sown crops.

Sampling for the PI tissue test will provide accurate results, provided fertiliser and PW were applied no later than 14 days before sampling.

Figure 4. Applying urea to the dry soil before permanent water is a very efficient practice.

Weed control

Effective grass weed control is critical to profitable DPW practice. 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 for details on this and other chemical control options.

Aquatic weeds are often not a problem with DPW as the soil drying between flush irrigations controls them. Therefore, spray drift of broadleaf herbicides onto sensitive crops such as cotton, soybeans or grapes is avoided.

More information

Dunn B. 2023. Managing drill sown rice. Primefact 1253, third edition. NSW Department of Primary Industries. https://www.dpi.nsw.gov.au/agriculture/broadacre-crops/summer-crops/rice-agronomy/drill-sown

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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

Acknowledgements

The research used in this publication is a collaboration between NSW Department of Primary Industries, the Australian Centre for International Agricultural Research, the Ricegrowers' Association of Australia and AgriFutures.