

DPI Primefact

Rice water depth management at microspore

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Rice is most sensitive to low temperatures at microspore

The microspore stage is when the pollen cells are starting to form in the anthers. Low temperatures at this time disrupt sugars moving into the microspores, reducing the number of viable pollen grains produced, leading to floret sterility.

Microspore occurs around the middle of the reproductive period, about 16–18 days after panicle initiation (PI) and 12–14 days before flowering (Figure 1). It is not possible to see microspore with the naked eye, but it occurs when the developing panicles are approximately 120–130 mm long. It takes 2–3 days for a panicle to complete microspore but a whole field can take 7–14 days due to plant and crop variability.

During microspore, air temperatures below 15–17 °C can damage the developing pollen, leading to floret sterility and yield loss.

Deep water buffers against cold temperatures

Several days of low temperatures multiply the effect, resulting in high levels of cold-induced floret sterility, reducing grain yield. Deep water effectively minimises damage caused by low temperatures at microspore by providing up to 7 °C increase greater than air temperature. This is effective while the panicle is still low in the plant and covered by water. Rice is also sensitive to low temperatures at flowering, but deep water does not provide any protection at this time.

Deep water provides a buffer from the low morning air temperatures because the water temperature decreases more slowly than the air temperature. As the day warms up, air temperature increases before the critical low temperature is reached in the water (Figure 2). The buffer effect is reduced with lower daytime temperatures, especially if they extend over a few days.

The buffer created by the ponded water can raise the temperature around the panicle up to 7 °C above the air temperature in the crop (Figure 2). The buffer effect does not extend far above the water surface. On a cool morning, there is little difference in air temperature at 50 mm above the water surface compared to 1 m (Figure 3), so the water must be deep enough to cover the panicles.



Figure 1. Flowering is approximately 12–14 days after microspore.

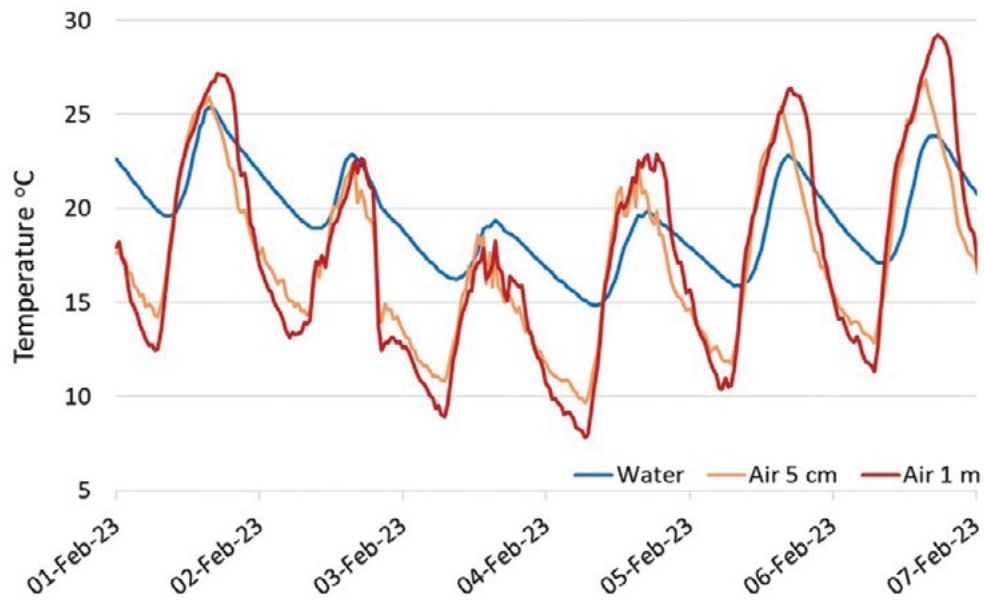


Figure 2. Water and air temperatures recorded in a rice crop at Conargo in 2023 (water depth was 280 mm). On 4 February, the minimum air temperature was 7.8 °C, while the lowest water temperature that morning was 14.9 °C.



Figure 3. Temperature probes used to measure water and air temperature in the rice crop.

How deep should deep water be?

Samples were collected from semi-dwarf rice varieties at microspore and measured for panicle length and height above the ground. This identified that the base of the panicle was 150–200 mm above the soil surface at microspore in a drill-sown crop. This, combined with the air temperature measured in the canopy at 50 mm above the water surface, indicates that 250 mm should be the minimum water depth during microspore.

Sowing and water management affect the height of the panicle at microspore. Drill sowing and delayed permanent water (DPW) produce shorter plants than aerial sowing. Shallow water during tillering also reduces panicle height at microspore.

When is the ideal time to apply deep water?

The ideal time to achieve a minimum of 250 mm water depth at microspore is approximately 7–10 days after PI, as there are approximately 16–18 days between PI and microspore. Once PI has been identified, start increasing the water depth to achieve 250 mm over the field. For crops sown at the recommended time, prepare to increase rice water depth around New Year. If water availability might be an issue, start filling the field earlier than at PI.

Applying deep water earlier, e.g. during late tillering and at PI is **not recommended** as it increases the plant height and elongates the airspace, which in turn pushes the panicle higher above the water surface. This means that even deeper water is required to protect the panicle from cold at microspore.

Deep water levels (250 mm) should be maintained during the microspore stage until mid-flowering when water levels can be allowed to recede to 50 mm deep until draining. Maintaining water levels at least 50 mm deep throughout the flowering stage helps reduce the risk of moisture stress on the crop due to high evaporative demand or restrictions to water supply.

The recommended sowing dates for rice are designed so the crop reaches microspore when there is the highest probability of warm night temperatures, usually between 15 January and 5 February. Therefore, there are different optimum sowing windows for each variety and sowing method (refer to NSW DPI [Rice variety guide](#)).

Summary

- Rice is most sensitive to low temperatures at microspore.
- Deep water at microspore provides a buffer against the effects of low night temperatures.
- Deep water needs to be applied after PI, not before.
- Water depth at microspore must be at least 250 mm and maintained until mid-flowering.

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