Mid-season 'drainage' of rice - is it worth trialing on your crop?

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in a nutshell

- Grain yield response from mid-season draining of rice has been evaluated over the last five rice seasons
- There was an increase in grain yield in all the experiments and some of the on-farm demonstrations
- In commercial crops there is unlikely to be much reduction in water use – the intent is to increase grain yield, therefore any water saving is a bonus
- If you plan to topdress nitrogen on to the dry soil reduce your application rate by 30%

A number of rice growers in the Murray Valley routinely 'drain' their crops during late tillering to reduce the likelihood or severity of straighthead. This water management technique is also recommended in the USA, in Texas and Arkansas, wherever straighthead is anticipated.

Mid-season drainage has been a recommended practice in the Philippines since the early 1970s and is common in a number of regions in China. In these countries straighthead is not an issue.

In the 2001–02 season, two commercial crops in the eastern Murray Valley inadvertently received a mid-season 'drain' due to water delivery 'hassles'. They recovered and went on to produce impressive grain yields. This result and other reports encouraged the research summarised here. During the course of the work a number of anecdotal instances of crops (bays) recovering from severe water stress at the late tillering stage and producing surprisingly good yields have been reported. A crop at Coleambally produced a yield increase of 25%. The few days delay in the development of the crop may have influenced this result (warmer night temperatures during early pollen microspore (EPM)).

What is mid-season drainage?

Mid-season drainage involves the removal of surface water from the crop for about seven days towards the end of tillering (long enough for the rice plants to experience visible moisture stress). Regular inspections of 18 commercial crops during 2004–05 and 2005–06 indicated that cumulative ETo varied from 77–100 mm during the time the water was removed. Presumably this variation was due to differences in crop vigour and soil type. Some surface water may still be present in the bay for up to two days after the toe furrow has drained. It is necessary to actually walk out and check when the crop has used most of the surface water. The degree of soil cracking will depend on the soil type and on the spatial distribution of the plants. The field is then re-flooded as quickly as possible. It is only necessary to just cover the soil surface with water so the plant can start to recover. Water depth can then be gradually increased to that required for protection of the developing head from low temperatures during the EPM stage.

During the last five seasons a number of experiments (replicated treatments) and on-farm demonstrations have been conducted. None of these sites had a history of straighthead nor were there symptoms of straighthead observed during crop growth.

Grain yields

Table 1 lists the grain yields from experiments at Deniliquin and Coleambally and from the on-farm demonstrations where it was possible to have a valid comparison, ie where the water management was monitored and a reliable measurement of grain yield was available.

There was an increase in grain yield in all the experiments and some of the on-farm demonstrations. Although it is difficult to accurately sample for grain yield components, the increased yield seems to be due to an increase in the number of grains (filled florets)/head. The experiment at Coleambally also had more productive heads.

The results from the on-farm demonstrations in 2004–05 were unduly influenced by delayed crop development (see below). The only negative result in this project was from the Doongara crop at Willbriggie. Detailed temperatures recorded at the site indicated that the four-days delay in development, due to the draining, shifted the timing of EPM

for the drained bay from the last week in January to the first few days of February, exposing that bay to a period of unprecedented cold (at least since the arrival of Amaroo). Doongara is also the most sensitive of the current varieties to cold stress at EPM. The crops at Coleambally and Logie Brae were similarly affected. It is reasonable to assume that given more favourable temperatures an increased grain yield was likely. The other two crops were not sown until early November and thus the control bay and the 'drained' bay were exposed to similar night temperatures during EPM.

The results reported in Table 1 and comments from growers indicate that you are unlikely to get a negative result. There will always be a chance that the delay in crop development will move EPM into a period of colder temperatures. As the delay is only a few days it is just as likely that the delay could correspond to a period of more favourable temperatures.

Nitrogen efficiency

Responses at Deniliquin in 2004–05 and Coleambally in 2005–06 indicate that nitrogen topdressed on the dry soil before re-applying the flood water will be more efficient than the same rate applied into water at panicle initiation. At Deniliquin, 60% of the nitrogen applied to the dry soil had been taken up by panicle initiation. At Coleambally, plots that were topdressed on dry soil produced more dry matter at flowering, substantially more leaf area, more heads, and had a lower harvest index. These plots were severely lodged before harvest maturity. The demonstration at Coree also included a strip that had nitrogen applied to the dry soil. This increased grain yield by 10%.

If you intend to topdress on to dry soil it is suggested that you reduce the nitrogen rate by 30%. This will be more of an issue if the total nitrogen available to the crop is approaching the optimum, and thus a higher amount would increase the risk of sterility and lodging.

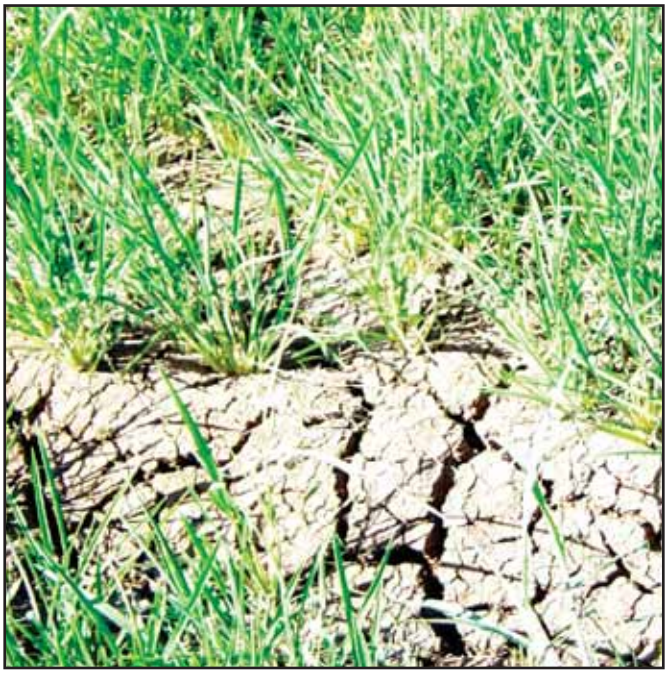

Figure 1: Grain yield has increased, over five rice seasons, in response to mid-season draining in all experiments and some on-farm demonstrations

Table 1: Grain yield from experiments and on-farm demonstrations

Experiments (four replicates)

Season	Location	Variety	Grain yield (t/ha) Control	Grain yield (t/ha) Drained	Difference (%)
2001–02	Deniliquin	Amaroo	9.3	10.1	+ 9
	Deniliquin	Illabong	12.2	13.7	+ 13
2002–03	Deniliquin	Amaroo	11.1	12.2	+ 10
2003–04	Deniliquin	Amaroo	10.9	12.3	+ 13
	Deniliquin	Quest	10.4	11.8	+ 14
2004–05	Deniliquin	Amaroo	9.6	10.6	+ 10
2005–06	Coleambally	Quest – 0 N	8.3	8.8	+ 6
	Coleambally	Quest – 120 N	11.0	11.7	+ 6
	Coleambally	Quest – 180 N	13.2	13.6	+ 3

On-farm demonstrations (adjacent bays)

Season	Location	Variety	Grain yield (t/ha) Control	Grain yield (t/ha) Drained	Difference (%)
2004–05	Willbriggie	Doongara	10.5	8.9	- 15
	Coleambally	Amaroo	Not available	Not available	No difference
	Jerilderie	Quest	9.0	9.0	No difference
	Logie Brae	Illabong	8.0	8.0	No difference
	Deniliquin	Quest	9.0	9.0	No difference
2005–06	Denilquin	Amaroo	12.1	13.3	+ 10
	Coree	Quest	11.5	11.5	No difference
	Berrigan	Amaroo	9.2	10.3	+ 12
	Morago	Amaroo	11.3	11.3	No difference

Water saving

At Deniliquin, the experimental bays (approximately 12 m x 50 m, 0.06 ha) that were drained used between 0.5 and 0.75 ML/ha less water than those that were continuously ponded. Daily water use will be lower whilst the soil surface is not saturated and for the first few days as the crop recovers from the stress. In a commercial crop, where water control is likely to be less precise, there is unlikely to be much reduction in water use. The intent of mid-season drainage is to achieve an increase in grain yield; any reduction in water use would be a bonus.

Can you stress the crop for too long?

It is obviously possible to have the water off for too long and thus produce a lower yield. However, when stressed for moisture at late tillering, the rice crop appears to be forgiving. In this last season, a crop near Deniliquin was stressed beyond my 'comfort zone' (and well beyond the grower's) yet yielded 11.3 t/ha.

Potential disadvantages

Delayed maturity

Mid-season drainage delays the development of the crop. Flowering has been 3–4 days later and harvest maturity may be 7–10 days later. This will not be important in a dry autumn but may be an issue if wet weather is experienced at harvest. Sow on time!

Increased potential to lodge

In seasons with high yield potential, such as 2005–06, lodging may be an issue especially if harvest is delayed due to the header not being available when the crop is ready. The experiment at Coleambally and the on-farm demonstrations at Deniliquin and Morago all lodged whilst waiting for the header. Mid-season drainage may increase plant height (up to 5 cm) and this will make the crop more prone to lodging, especially when grain yield is high.

Armyworms

In 2004–05 two crops at Coleambally were sprayed to control armyworms. It would be prudent to check your crop if you are in a district where armyworms could be expected. It is possible that draining the crop could increase the numbers of armyworms however, this potential link has not been investigated.

Conclusion

There was an increase in grain yield in all experiments and some of the on-farm demonstrations. This work suggests that mid-season drainage of the crop is likely to lead to an increase in grain yield.

Allowing the soil to dry out and aerate seems to provide more favourable conditions for crop development. Perhaps there is often a low level of straighthead that is not obvious and draining the crop leads to more florets actually filling.

If you are interested in trialing mid-season drainage, it is suggested that you trial one or two bays. If you have a conventional contour layout then avoid including the bottom bay in your trial. This is often the most convenient one to drain but the yield may be influenced by factors unrelated to the current water management – additional weed pressure, deeper water during establishment, higher salinity during the current or previous crops.

This work has also shown that if the crop dries out for several days during late tillering than there is no need to panic!

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Further information

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