



Weed management in rice

2008–09 field research results

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- Mixtures of Magister® (clomazone) and Stomp® (pendimethalin) applied post seeding and pre-crop emergence in drill sown rice have demonstrated equivalent or improved control of barnyard grass.
- This combination of herbicides is likely to increase the reliability of weed control in drill sown crops managed with delayed permanent water.

Effective herbicides are critical to ensuring weed free rice crops are successfully established to reach their full yield potential and achieve maximum water use efficiency. In excess of 98% of the Australian crop is treated annually to ensure freedom from weeds. Failure to control weeds can commonly result in complete crop failure.

Australian rice production relies upon rapid direct seeding techniques that inevitably encourage simultaneous establishment of a range of aquatic and terrestrial annual weeds. Drill seeding and water seeding (aerial sowing) involve differing irrigation management regimes that favour distinct types of

weeds. Drill seeding favours barnyard grass (*Echinochloa* spp.) whilst water seeding favours aquatic sedges and broadleaf weeds.

Each establishment method presents contrasting logistical demands to rice growers – that often impact upon the farm decision making process to a greater extent than weed management issues ever will. Nevertheless we seek to improve weed management options for both of these rice establishment methods, so that Australian growers can achieve variations in technique to reduce the dependence upon any single herbicide product.



Figure 1. Drill seeding rice into a stale seedbed where winter moisture was conserved by not cultivating the soil for weed control and using a knockdown herbicide instead.



Figure 2. Overall view of a trial site with plots sprayed perpendicular to drill rows. Untreated barnyard grass escaping control in foreground.

New methods for changing times

One attractive option for rice crop establishment in a changing climate is to conserve winter moisture with an undisturbed fallow. Weeds are controlled by chemical means and then the crop is sod seeded into a 'stale seedbed'. This system enables rice to be sown on time, despite being unsure as to the ultimate availability of water resources to finish the crop. It is a low cost, rapid operation that offers minimal risk to the farm business.

The aerobic soil conditions associated with drill seeding and delayed permanent water result in a shift in the weed spectrum compared with that found in crops sown into permanent water. Delayed permanent water favours terrestrial species such as barnyard grasses. Minimising soil disturbance enables early cohorts of grass weeds to be controlled with non-selective herbicides (glyphosate and paraquat) prior to crop emergence, whilst later germinations can be targeted using residual herbicides such as pendimethalin and clomazone. Californian researchers have advanced this principle in order to address problems of multiple herbicide resistance in barnyard grass populations.

In the 2008–09 season the author sought to test the efficacy and crop safety of clomazone and pendimethalin mixtures (MAGISTER® and STOMP®, respectively) in drill sown rice as a means of concurrent delivery of two alternate modes of herbicidal activity upon the same cohorts of rice weeds.

The trials

Portions of five commercial rice crops were selected near Goegeldrie (Barry and Gillian Kirkup), Wilbriggie (Ian Blight), Hanwood (Dick Thompson), Jerilderie (Russell Ford) and Cobram (Malcolm Taylor) to encompass a range of soil types and seeding conditions.

Replicated field trials were established at each site in drill seeded rice to evaluate the efficacy and crop safety of clomazone plus pendimethalin mixtures for control of barnyard grass (*Echinochloa crus galli*).

Trial designs were randomised complete blocks using four replications of 16 treatments. Treatments included clomazone @ 144 and 288 gai/ha, pendimethalin @ 743 and 1485 gai/ha applied alone, in tank mixtures or in sequence.

Treatments were applied either post flushing, pre-emergence (PFPE) or early post emergence (EPE) using a small plot boom

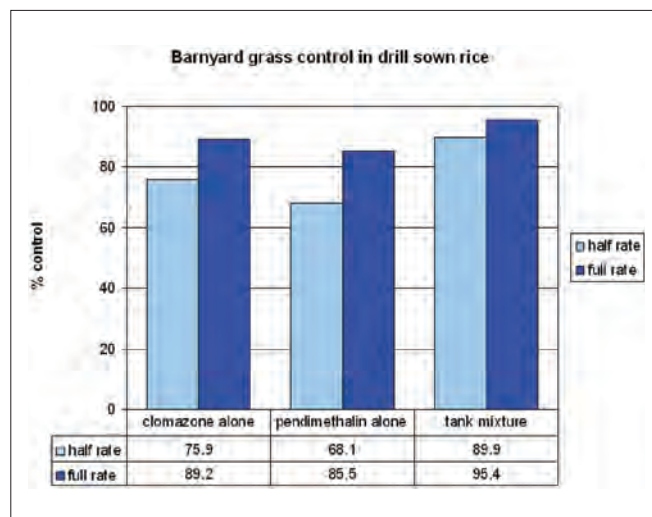


Figure 3. Barnyard grass control across five sites in drill sown rice

delivering 120 L/ha of spray solution. Glyphosate or paraquat were added to PFPE treatments to remove emerged weeds.

The results

Tank mixtures of clomazone plus pendimethalin @ 144 plus 743 gai/ha (ie half the label rate of each product) provided approximately equivalent or increased barnyard grass control when compared to either herbicide when applied alone at the full rate (Figure 3).

Thiobencarb (Saturn®) plus pendimethalin gave lower barnyard grass control than clomazone plus pendimethalin.

Rice tolerance was acceptable with all treatments. Minor and transient bleaching was often encountered with clomazone treatments.

The implications

Keep herbicide and seed separated

Application timings of these treatments varied across the sites, however in each case, rice had received a flush irrigation or rainfall event to achieve a settling of the soil surface, which is critical for crop safety when using pendimethalin.

A physical separation between herbicide and rice seed is required with pendimethalin (and similar root growth inhibitor herbicides). Triple disc drills may not achieve this when seeding into moist clays, leading to some poor examples of rice crop tolerance to these types of herbicides in the past in Australia. Modern narrow point seeders fitted with presswheels ought to be reliable to achieve this spatial tolerance.

Any promotion of these herbicide treatments needs to be accompanied with a recognition that herbicide treated soil must not be permitted to accumulate directly over the top of the drill row in the furrow. Current label recommendations for pendimethalin mention this issue. Trailing levelling harrows when seeding would assist to avoid this problem.

Tank mixtures better than sequential application

Tank mixtures present an opportunity to simultaneously apply clomazone and pendimethalin at their optimal timings. Where the crop has yet to emerge glyphosate or paraquat can also be added to remove any early cohort of weeds. If the crop has already emerged propanil (Stam®) can be added.



Figure 4. A trial site at the commencement of permanent inundation. Note the rank barnyard grass growth on the left hand side of the photo. The right hand side was treated with the clomazone plus pendimethalin mixture and rice plants are establishing virtually in a weed free environment.

Sequencing clomazone and pendimethalin (or thiobencarb) did not exhibit any advantage over a tank mixture and often resulted in poorer efficacy and/or crop safety. Clomazone is best applied before the emergence of the crop to minimise bleaching of the rice seedlings.

Across five sites in 2008–09 we demonstrated that tank mixtures of clomazone plus pendimethalin offered effective control of barnyard grass in drill sown rice that is established often with prolonged aerobic periods to conserve moisture, ie in crops with delayed permanent water. Such treatments enable rice to be drill seeded in the confidence that it won't be overwhelmed with competition from rank barnyard grass. Where pre-emergence herbicides were omitted, the rice stand was overwhelmed with barnyard grass. Such circumstances present a tough challenge to post-emergence herbicides such as profoxydim (Aura®) and cyhalofop (Barnstorm®) that can prove unreliable in dry weather conditions and are highly prone to selection for herbicide resistance.

Follow-up control at 4–5 leaf stage

The period of residual control offered by clomazone and pendimethalin will vary from site to site, influenced primarily by factors such as soil organic matter, microbial activity, moisture and temperature. Sequencing herbicide applications may be beneficial in attaining prolonged weed free periods, however if clomazone or pendimethalin applications are split, this would compromise the advantages of the tank mixture demonstrated in these experiments. Accordingly a strategy for prolonged residual weed control may be to use a clomazone plus pendimethalin

mixture PFPE, followed by thiobencarb applied at around 4–5 leaf stage rice. Thiobencarb at such a timing would be safe to the crop and would offer early post emergence and residual control of barnyard grass, silvertop grass and dirty Dora until rice canopy closure.

Wider rows put more pressure on residual control

Rice drill row spacings are likely to impact upon the success of residual herbicide treatments in rice. Traditional row spacings of 17.5 cm for drills operating in prepared seedbeds or early triple disc drills will result in more rapid canopy closure than contemporary no till drills that have adopted 25–33 cm spacings. Adopting wider row spacings will place added pressure on residual herbicide performance to prevent weed competition prior to canopy closure.

Other potential benefits of the mixture

Other weed species, notably silvertop grass (*Leptochloa fusca*) and dirty Dora (*Cyperus difformis*) will often become problematic in drill sown rice, especially if rain events closely follow each other or a flush irrigation. Pendimethalin is labelled for both weed species, whilst clomazone is weak on silvertop grass and ineffective against dirty Dora. The mixture would therefore be likely to exhibit additional control benefits above and beyond that demonstrated in this experiment.

A principle objective of this work was to find a treatment that reduces selection intensity for clomazone resistance in barnyard grass. Pendimethalin (HRAC Group D) has seen minimal use in rice in Australia, thus the combination of clomazone plus pendimethalin represents simultaneous delivery of two alternate




modes of herbicidal action to the same cohort of weeds. Effective use of such a treatment will also reduce the need to apply the group A herbicides (profoxydim and cyhalofop) that are highly prone to resistance development.

Results obtained have confirmed that tank mixtures of the two herbicides (at half normal rate) can offer effective control of barnyard grass that was equivalent or better than either herbicide applied alone at the full label rate. Further evaluation of higher rates may be worthwhile, as would larger scale (whole bay) demonstrations.

Conclusion

Clomazone plus pendimethalin tank mixtures have been demonstrated in these experiments to offer reliable grass weed control in drill sown rice. This adds confidence that growers who wish to establish rice in this manner will keep weeds under control to enable their crops to attain full yield potential.

Australian rice growers have increasingly chosen to drill seed rice in recent seasons as a means of seeding crops on time despite irrigation water availability remaining in doubt. As a risk management strategy this has merit, for farm profitability is substantially influenced by the tonnage of rice harvested. Using an affordable pre-emergence herbicide after seeding and once germination has commenced is a viable tactic when attempting to establish rice in a situation of a tight water supply.

Accordingly this work should assist the quest for Australian rice growers to maintain viable farm businesses each spring when the interplay of rainfall, irrigation water availability, markets and crop sowing windows is moving so rapidly. 

Further information

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