Keeping the lid on weeds in aerobic rice crops

The issue

Improving the water use efficiency of rice is a major challenge when attempting to meet the food requirements of a burgeoning world population competing for static or diminishing resources. Aerobic rice culture (i.e. production in the absence of ponding of irrigation water for some or all of the crop’s life) is one way of attempting to lift irrigation water productivity, however, this inevitably leads to severe competition from annual weeds (that would otherwise be suppressed by ponding).

Weed control in rice has been practiced continuously for thousands of years by an integrated approach of ploughing, puddling, transplanting in rows and hand pulling. Transplanting of rice is uneconomic in most advanced economies due to labour and cost constraints, thus direct seeding is practiced. Almost all direct seeded rice is highly dependent upon effective herbicides to render the crop free of weed competition.

Australian rice growers and researchers have actively sought to develop reliable methods of aerobic rice culture (“delayed permanent water”) throughout the drought years of the beginning of this century. Cold tolerant rice cultivars are now being released from the RIRDC-sponsored breeding program that will be more suited to growing under aerobic conditions. Identifying weed control methods that will maximise grain yield potential in aerobic rice culture was the purpose of this project.

Echinochloa crus-galli (barnyard grass) and Leptochloa fusca (silvertop grass) are two annual grass weeds that prove highly competitive with drill seeded (aerobic) rice in Australia. Additionally, Cyperus difformis (dirty Dora), an annual sedge species, may prove competitive if the soil surface remains moist for a prolonged period during crop establishment.

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Over-reliance on any one product can rapidly lead to selection of resistant weed biotypes that can render multiple herbicide products ineffective. Strategies to combat over reliance involve tactics such as crop rotations, clean seed, clean seedbeds, tactical cultivations, as well as dense and concurrent delivery of alternate mode of action herbicides to target the same cohort of weeds.
The trials identified new and improved herbicide treatments.

Research methods

Nine replicated field trials were established by the author in drill seeded aerobic rice near Jerilderie NSW, Finley NSW and Cobram Victoria during the 2011-12 summer. The purpose of these trials was to identify new and improved herbicide treatments to prevent weed competition in aerobic rice.

Two treatments were evaluated. The first was a prosulfocarb, isoxaflutole, prometryne and a micro-encapsulated formulation of pendimethalin, applied post sowing, pre-emergence (PSPE). The second were post emergence treatments which included propanil, pendimethalin, clomazone, thiobencarb, cyhalofop-butyl and profoxydim.

Research Findings

In the trials, PSPE applications of knockdown herbicides (e.g. paraquat or glyphosate) mixed with two selective residual herbicides (clomazone and pendimethalin) proved to be the most reliable and cost effective means of attaining freedom from weed competition in aerobic rice crops. Accurate timing proved critical as the applications needed to be made prior to the emergence of the rice crop, yet after a flush irrigation or rainfall event that will commence the germination of both the crop and grass type weeds. Observations of performance of this treatment combination in commercial crops was consistent with the experimental data.

Delaying these treatments to a post-emergence timing prevented the use of the highly effective and economical knockdown herbicides such as paraquat or glyphosate, resulting in a switch to selective grass herbicides such as propanil, cyhalofop-butyl or profoxydim that are more expensive, and often less effective.

None of the experimental treatments offered equivalent or improved efficacy and crop safety compared to the clomazone plus pendimethalin combinations.

Estimations of rice water use efficiency were highest for the clomazone plus pendimethalin treatments applied post sowing, pre emergence. Ineffective herbicides resulted in major reductions of rice grain yield and plummeting water use efficiencies.

As a result of this project, rice growers and agronomists can have increased confidence in the production of drill sown aerobic rice that will improve water use efficiency in seasons of low irrigation water availability.

For more information

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