Rinskor™ active – a new herbicide for rice weed control in Australia

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Summary In 2016 Dow AgroSciences submitted registration application for Rinskor™ active (300 g L^{-1} florpyrauxifen-benzyl ester), a new herbicide for grass, sedge and broadleaf weed control in rice. This product provides good control of key weeds including barnyard grass (*Echinochloa crus-galli* (L.) P.Beauv.), water plantain (*Alisma plantago-aquatica* (L.), starfruit (*Damasonium minus* (R.Br.) Buchenau), arrowhead (*Sagittaria montevidensis* Cham. & Schltdl. subsp. *calycina* (Engelm.) Bogin), jerry jerry (*Ammania multiflora* Roxb.) and dirty Dora (*Cyperus difformis* L.) suppression, whilst being selective to rice. It will be registered for weed control in rice and represents a new option for rice weed management in Australia. New products are essential for the rice industry due to weed resistance to existing treatments and potential loss of products through industry regulation.

Keywords Rinskor, efficacy, selectivity, plant-back, weeds, control, rice.

INTRODUCTION

There have been no new herbicides released for weed control in rice for more than 10 years in Australia. Rinskor is a new rice selective herbicide that controls key weeds and exhibits short persistence in soil.

Rinskor was first introduced in 2015 (Weimer *et al.* 2015), where the general utility of Rinskor for rice and other crops was outlined. Soil persistence was reported to be as short as 56 days to replant soybeans safely in the southern United States (Miller *et al.* 2016).

This paper summarizes new research trials to confirm rice selectivity, plant-back safety and weed efficacy for registration of Rinskor in rice in Australia.

MATERIALS AND METHODS

Trials were conducted in southern New South Wales and northern Victoria on rice research farms. Replicated small plot trials using 3 or 4 replications were conducted from 2012 to 2015 to determine the selectivity, weed control efficacy and crop rotation safety. Applications were made with gas powered small plot booms delivering 100 L ha^{-1} of spray solution. Data were summarized using Agricultural Research Manager Summary Across Trials software (Gylling 2015) and analysed using Analysis of Variance (ANOVA) with Duncan's Multiple Range means comparison test and 5% significance level.

Rice selectivity Seven weed-free selectivity trials were conducted in summers of 2013 to 2015, covering 10 commonly grown rice cultivars (both medium and long grain types). Rinskor was applied at 30 to 90 g a.i. ha^{-1} at the three to five leaf stage of rice development. Crop oil concentrate was added at 2% v v^{-1}. Crop injury was measured by visual assessment where 0 = no injury and 100 = complete crop loss. Grain yields were taken at normal harvest time and expressed as t ha^{-1} and percent of the untreated control.

Weed efficacy Seventeen weedy trials were conducted to determine the efficacy of Rinskor on barnyard grass (14 trials), dirty Dora (9), water plantain (3), starfruit (7), arrowhead (7) and jerry jerry (1). Weed control was measured using visual assessment where 100 = complete control.

Weeds were treated at the small seedling stage up to 5 cm across and 5 leaf stage. Rinskor was applied at rates of 20, 30 and 40 g a.i. ha^{-1} to determine what rate was effective. Crop oil concentrate at 2% v v^{-1} was applied in all treatments. Weed efficacy was considered acceptable if control was more than 95% at final assessment.

Plant-back safety Five weed-free trials were conducted to determine the plant-back safety of Rinskor, either applied in fallow to bare soil, or in rice crops. Rinskor was applied at rates of 5 to 90 g a.i. ha^{-1} prior to planting lentil (*Lens culinaris* Medik.), chickpea (*Cicer arietinum* L.), field pea (*Pisum sativum* L.), clover (*Trifolium balansae* Boiss.) or subclover (*Trifolium subterraneum* L.). Planting times varied from 39 to 141 days after treatment. Rainfall (mm) was monitored at the nearest weather station. Crop injury was measured by visual assessment where 100 = complete crop loss. A positive standard treatment, with long term soil persistence was included to determine relative injury compared with Rinskor.

RESULTS AND DISCUSSION

Rice selectivity Rinskor applied at 30 to 90 g a.i. ha^{-1} resulted in average injury of less than 16% for all 10 varieties (Table 1). This was commercially acceptable for rice in Australia.

All varieties gave statistically similar or higher yield than weed free untreated control (NS P = 0.05, Table 2).

Weed efficacy Rinskor applied post-emergence at up to 5 leaf weed stage gave control of barnyard grass, water plantain, starfruit, arrowhead or jerry jerry and suppression of dirty Dora (Table 3). Rinskor gave similar high control of all weeds irrespective of rate, apart from dirty Dora, where highest rate gave best suppression.

Plant-back safety Minimum plant-back periods of six months were indicated for pasture and grain legumes after Rinskor application to rice (Tables 4 and 5).

CONCLUSIONS

Rinskor active is a new product that has acceptable rice selectivity, broad weed control spectrum and short soil persistence. Therefore it is a significant new product for weed management in rice in Australia.

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Table 1. Mean rice injury (%) by Rinskor at 30 to 90 g a.i. ha^{-1}. (Brackets = replicates of data assessed).

	Rinskor rate (g a.i. ha^{-1})			
Variety	30	45	60	90
Doongarra (7)	1	0	2	2
Koshihikari (7)	8*	7	4	7
Kyeema (3)	0	0	3	3
Langi (3)	0	0	2	3
Opus (7)	1	0	0	2
Reziq (7-25)	8	0	9*	0
Sherpa (7-25)	7	0	7	0
Topaz (3-21)	11*	7	16*	5
YRK 5 (4)	0	0	0	0

* Significantly (P = 0.05) higher than untreated.

Table 2. Mean relative rice yield as percentage of untreated. (Values in brackets show the number trials harvested with each variety).

	Rinskor rate (g a.i. ha^{-1})			
Variety	30	45	60	90
Doongarra (2)	104	103	100	103
Koshihikari (1)	111	99	104	109
Kyeema (1)	102	97	99	96
Opus (2)	103	105	105	116
Reziq (5)	99	107	100	98
Sherpa (5)	102	104	104	104
Topaz (4)	104	99	100	101
YRM 70 (1)	102	102	100	101
YRL 127 (1)	104	103	102	96
YRK 5 (1)	101	99	101	94
All varieties	102	103	102	103

Table 3. Mean weed control (%) by Rinskor at 20 to 40 g a.i. ha^{-1}. (Values in brackets show the number of trials assessed).

	Rinskor rate (g a.i. ha^{-1})		
Weed	20	30	40
Arrowhead (3–7)	99	100	100
Barnyard grass (5–14)	98	96	99
Dirty Dora (4–8)	60^{b}	80^{a}	83^{a}
Jerry jerry (1)		100	
Starfruit (3–7)	100	100	100
Water plantain (1–3)	100	100	100

Dirty Dora LSD (P = 0.05) = 12.7.

Table 4. Mean legume injury (%) by Rinskor at 5 to 15 g a.i. ha^{-1} and LSD values, after treatment of bare fallow soil.

Trial	155001ML	155001ML	152008HG	152008HG	142004HG
Site	Halbury, SA	Halbury, SA	Breeza, NSW	Breeza, NSW	Breeza, NSW
Replant (days)	36	57	63	85	39
Rain (mm)	93	131	83	115	60
Crop	Lentil	Lentil	Chickpea	Chickpea	Chickpea
Untreated control	0	0	0	0	0
Rinskor 5 g a.i. ha^{-1}	20	53	14	4	
Rinskor 10 g a.i. ha^{-1}	38	70	18	6	0
Rinskor 15 g a.i. ha^{-1}	54	80	33	20	
Arylex + Florasulam 5 + 5 g a.i. ha^{-1}	94	91	27	17	75^
LSD (P = 0.05)	11.3	15.3	9.9	6.3	

^ 90 g a.i. ha^{-1} clopyralid.

Table 5. Mean legume injury (%) by Rinskor at 30 to 90 g a.i. ha^{-1} and LSD values, after treatment of rice.

Trial	H43-14	H43-14	H43-14	H51-14	H51-14
Site	Cobram, Vic	Cobram, Vic	Cobram, Vic	Cobram, Vic	Cobram, Vic
Replant (days)	89	141	89	50	50
Rain (mm)	97	177	97	24	24
Crop	Subterranean clover	Subterranean clover	Field pea	Subterranean clover	Shaftal clover
Untreated control	8	20	0	7	6
Rinskor 30 g a.i. ha^{-1}	13	16	6	9	8
Rinskor 60 g a.i. ha^{-1}	11	10	0	38	24
Rinskor 90 g a.i. ha^{-1}	23	23	4	78	45
Quinclorac 600 g a.i. ha^{-1}	91	90	53	98	96
LSD (P = 0.05)	19.5	23.4	10.7	17.9	19.3