

## Weed and nitrogen management for direct seeded low land rice

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**Summary** The selectivity of pre-emergence herbicide is often narrow in direct seeded rice as the seedlings of rice plants and the weeds may show the same degree of susceptibility to the applied herbicides. Nitrogen is by far the most important yield raising nutrient but it also encourages the weed growth. Keeping this in view, field experiments were conducted at Annamalai University Experimental Farm, Department of Agronomy, Annamalai Nagar, Tamil Nadu (India) to devise suitable weed and nitrogen management practices for direct seeded low land rice. The results revealed that application of butachlor with safener 4 DAS + hand weeding 30 DAS along with 25 per cent increased 'N' than recommended dose + *Azospirillum* holds promise as a agronomically efficient and economically viable practice for achieving sustained production of direct sown rice.

**Keywords** Direct seeded rice, butachlor + safener, nitrogen, yield, *Azospirillum*.

### INTRODUCTION

The availability of safener added herbicides makes it entirely feasible to use highly active herbicides under direct sown conditions. The efficiency of fertiliser nitrogen is very low in direct seeded rice. Growing concerns over energy shortages and the consequent rise in fertiliser prices in the recent years have generated serious interest in the efficient use of fertilisers. Efficient weed management practices and application of appropriate quantity of nitrogen are the key factors to boost the yield of direct seeded low land rice. Hence, the experiments were carried out to study the bioefficacy of butachlor with safener on weeds and to fix the optimum dose of nitrogen for direct seeded rice.

### MATERIALS AND METHODS

Field experiments were conducted in the Experiment Farm, Department of Agronomy, Annamalai University, Annamalai Nagar during 'Navarai' (January–April 2000) and 'Kuruvai' (June–Sept 2000) seasons to evolve an effective weed and nitrogen management practices for direct seeded lowland rice. The experiments were laid out in a split plot design and replicated thrice. The experiment consisted of four main treatments, weedy check ( $M_1$ ), hand weeding twice on 20 and 40 DAS (days after seeding) ( $M_2$ ), butachlor at 1.5 kg a.i. ha<sup>-1</sup> 8 DAS

with hand weeding 30 DAS ( $M_3$ ), butachlor with safener (fenclorin) at 1.5 kg a.i. ha<sup>-1</sup> 4 DAS + hand weeding 30 DAS ( $M_4$ ) and four sub treatments., recommended dose of N – 120 kg ha<sup>-1</sup> N ( $S_1$ ), 160 kg ha<sup>-1</sup> N ( $S_2$ ), recommended dose of N with *Azospirillum* ( $S_3$ ) and 160 kg ha<sup>-1</sup> N with *Azospirillum* ( $S_4$ ).

### RESULTS AND DISCUSSION

The dominant weed flora in both the seasons were *Echinochloa colonum* (Radhamani *et al.* 1997), *Leptochloa chinensis* and *Cyperus difformis*. Other weed like *Bergia capensis*, *Eclipta alba*, *Marsilea quadrifolia* were also present.

**Weed control efficiency** Among the weed control measures  $M_4$  (butachlor with safener + hand weeding) recorded the maximum weed control efficiency viz., 92.83 and 91.32 per cent in 'Navarai' and 'Kuruvai' seasons respectively, which was followed by  $M_2$  (hand weeding twice). In the sub treatments,  $S_1$  (recommended dose of 'N') recorded the highest weed control efficiency viz., 67.34 and 67.45 which was significantly followed by  $S_3$  (recommended dose of 'N' + *Azospirillum*). Weed control efficiency was highest with the application of butachlor with safener 4 DAS integrated with hand weeding 30 DAS (Figure 1) when compared to butachlor 8 DAS along with hand weeding. Application of butachlor on 8 DAS was not effective in controlling the weeds compared to application of butachlor with safener 4 DAS and this might be due to the early emergence of weeds before the butachlor application at 8 DAS. Twice hand weeding did not contain the weeds, particularly grasses which could be due to the difficulty in distinguishing the grasses at early stages from rice seedlings. Integration of butachlor with safener 4 DAS + hand weeding 30 DAS gave a greater degree of weed control attributable to inhibition of early emerging weeds by butachlor applied on 4 DAS and removal of late emerging weeds by hand weeding. Higher weed control efficiency with butachlor along with safener in direct sown rice was earlier reported by Kalyanasundaram (2000).

**Grain yield** All the treatments had significant influence on grain yield in both the seasons (Table

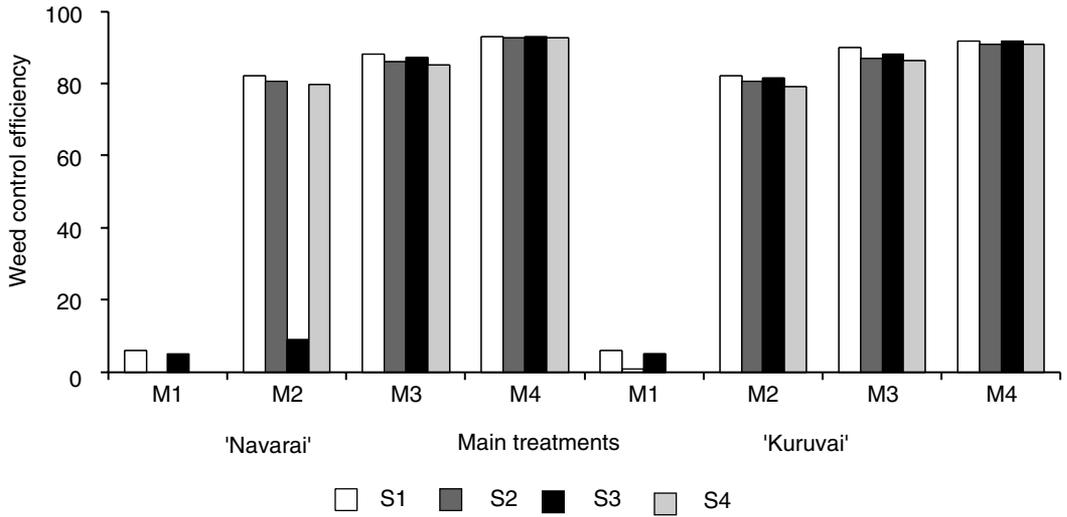


Figure 1. Effect of weed control methods on weed control efficiency.

Table 1. Effect of weed control methods on grain yield (t ha<sup>-1</sup>).

Sub plot treatments	Navarai (First crop)					Kuruvai (Second crop)				
	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>	Mean	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>	Mean
S <sub>1</sub>	1.96	4.44	3.79	4.86	3.76	2.06	4.66	3.98	5.10	3.95
S <sub>2</sub>	2.25	5.26	4.41	4.91	4.32	2.36	5.52	4.62	5.66	4.54
S <sub>3</sub>	2.10	4.48	4.17	5.03	4.00	2.21	4.96	4.37	5.27	4.20
S <sub>4</sub>	2.4	5.53	4.72	5.67	4.58	2.52	5.81	4.96	5.96	4.81
	SE <sub>D</sub>	CD (P = 0.05)				SE <sub>D</sub>	CD (P = 0.05)			
Main	0.11	0.21				0.11	0.22			
Sub	0.12	0.24				0.13	0.25			
M × S	0.08	0.17				0.07	0.15			
S × M	0.08	0.17				0.09	0.18			

1). Application of butachlor with safener + hand weeding (M<sub>4</sub>) gave the highest grain yield of 5.23 and 5.49 t ha<sup>-1</sup> respectively in 'Navarai' and 'Kuruvai' seasons. This was followed by hand weeding twice (M<sub>2</sub>), which registered a grain yield of 4.98 t ha<sup>-1</sup> and 5.23 t ha<sup>-1</sup> in 'Navarai' and 'Kuruvai' seasons respectively. The least grain yield was obtained in weedy check (M<sub>1</sub>) with a yield of 2.17 t ha<sup>-1</sup> and 2.28 t ha<sup>-1</sup> respectively. Among the sub plot treatments, S<sub>4</sub> (25 per cent increased 'N' dose than the recommended dose + *Azospirillum*) recorded an yield of 4.58 t ha<sup>-1</sup> and 4.81 t ha<sup>-1</sup> in 'Navarai' and 'Kuruvai' seasons.

The interaction effects between weed control measures and nitrogen dose were found to be significant. The highest grain yield of 5.61 t ha<sup>-1</sup> and 5.96 t ha<sup>-1</sup> was registered in M<sub>4</sub>S<sub>4</sub> (Butachlor with safener + hand weeding along with 25 per cent increased 'N' than the recommended N + *Azospirillum*). The least grain yield of 1.96 t ha<sup>-1</sup> and 2.06 t ha<sup>-1</sup> was recorded in weedy check with recommended dose (M<sub>1</sub>S<sub>1</sub>) in 'Navarai' and 'Kuruvai' seasons, respectively.

Grain and straw yield were highest with the application of Butachlor with safener + hand weeding along with 25 per cent increased 'N' than the recommended dose + *Azospirillum* (M<sub>4</sub>S<sub>4</sub>). Increased yield components in the above treatment jointly reflected in

yield increase. This could be attributed to less weed competition throughout the crop growth period without any phytotoxicity on rice seedlings, higher nutrient uptake by crop and reduced nutrient depletion by weeds. Reports of Padhi *et al.* (1991) and Kalyanasundaram (1999) favoured the weed control efficiency of butachlor with safener + hand weeding. Increased 'N' dose for yield maximisation were reported by Singh and Prasad (1999).

**Economics** The interaction between weed control measures and nitrogen dose was found to be significant. Highest net income and return per rupee invested (Rs. 2.50 and 2.57) were obtained in M<sub>4</sub>S<sub>4</sub> (butachlor with safener + hand weeding + 25 per cent increased 'N' than recommended dose + *Azospirillum*) in 'Navarai' and 'Kuruvai' seasons, respectively which was followed by M<sub>2</sub>S<sub>4</sub> (hand weeding twice + 25 per cent increased N than recommended dose + *Azospirillum*, respectively).

#### CONCLUSIONS

From the results, it may be concluded that application of butachlor with safener 4 DAS + hand weeding 30 DAS along with 25 per cent increased 'N' than recommended dose + *Azospirillum* holds promise as an agronomically efficient and economically viable practice for achieving sustained production of direct sown rice.

#### REFERENCES

- Kalyanasundaram, D. (1999). Agronomic management of direct sown rice. Ph.D. Dissertation, Annamalai University, Annamalai Nagar, Tamil Nadu, India.
- Kalyanasundaram, D. and Kuppuswamy, G. (2000). Agronomic strategies on effective weed control in direct seeded puddled rice. Intl. Rice Res. Conference, March 31–Apr. 3, IRRI 2000, Los Banos, The Philippines, p. 201.
- Padhi, A.K., Sahoo, B.K and Das, K.C. (1991). Effect of weed management on yield of direct seeded puddled rice. *Indian J. Agric. Sci.* 61 (1), 27-30.
- Radhamani, S., Sankaran, S. and Jayakumar, R. (1997). Efficiency of herbicide mixture in direct seeded puddled rice. *Madras Agric. J.* 84 (4), 192-194.
- Singh and Prasad. (1999). Response of promising spring sown rice (*Oryza sativa* L.) to sowing time, N levels under upland situation. *Ann. Agric. Res.* 20 (3), 296-300.

#### Footnote

*Azospirillum* is an associative nitrogen-fixing bacterium.