*Indian J. Weed Sci.* **38** (1 & 2) : 49-53 (2006)

# Integrated Weed Management in Direct Dry Seeded Rainfed Lowland Rice

**U. P. Singh, R. P. Singh and Y. Singh**
Department of Agronomy
Institute of Agricultural Sciences
Banaras Hindu University, Varanasi-221 005 (U. P.), India

## ABSTRACT

An integrated weed management experiment was conducted consecutively during wet season of 1998, 1999 and 2000 at Agricultural Research Farm, Institute of Agricultural Sciences, BHU, Varanasi to evolve suitable weed management technique for direct dry seeded rainfed lowland rice. Pre-emergence application of butachlor+2, 4-D (1.5+0.5 kg $ha^{-1}$), thiobencarb+2, 4-D (1.5+0.5 kg $ha^{-1}$) and anilofos+2, 4-D (0.4+0.5 kg $ha^{-1}$) in combination with one hand weeding (25 DAS) were maximum and equally effective in minimizing weed growth during pre-flooding and enhancing coarse rice grain yield as compared to these herbicidal combinations of treatments without hand weeding. Weedy check marked a mean yield loss of 53.8% and this loss ranged from 10.1 to 28.8% under hand weeding (25 and 50 DAS) and herbicidal treatments.

## INTRODUCTION

Direct dry seeding of rice is a better and cheaper alternative to transplanting and is gaining popularity in rainfed lowlands (0-50 cm) condition. Weed is a major constraint under this system and weed infestation during the early period of crop growth caused yield reduction to the tune of 33-74% or some time more depending upon the types of the weeds and their intensities (Tosh and Jena, 1984 ; IRRI, 1997). Their timely control is important to raise the productivity of this crop. Therefore, the present investigation was undertaken to provide appropriate options to farmers for effective weed management in dry seeded rainfed lowland rice.

## MATERIALS AND METHODS

An experiment was carried out consecutively during wet season (summer monsoon season) of 1998, 1999 and 2000 at Agricultural Research Farm, Institute of Agricultural Sciences, BHU, Varanasi to evolve appropriate weed management technique for rainfed lowland rice (RLR) eco-system. The soil was sandy clay loam with pH 7.3 and moderately high in fertility status. Altogether 12 treatments (Table 1) including chemical and manual weeding were tested in randomized complete block design with three replications. The RLR cultivar Rajshree was direct seeded under dry condition in the first week of June each year with a seed rate of 80 kg $ha^{-1}$ and 20 cm row spacing apart. At the time of seeding sufficient moisture was present in the field. A fertilizer dose of 60 kg N, 30 kg $P_2O_5$ and 30 kg $K_2O$ $ha^{-1}$ was applied. Half dose of N and full dose of phosphorus and potash were applied at the time of seeding and remaining half dose of N was applied at 60 DAS which coincides with maximum tillering and prior to excessive flooding (above 30 cm). Herbicides were applied just after sowing as pre-emergence using 800 litre of water per hectare. Weed intensity was recorded at 50 days after sowing prior to water stagnation. Depth of flooding varied from 0 to 50 cm during August to October. Harvesting was done during last week of November in each year. The performance of different treatments was studied in terms of types of weed flora, weed intensity, weed biomass and their subsequent effect on crop growth, yield attributes and grain yield of rice.

Table 1. Effect of different weed management treatments on weed population (No. $m^{-2}$) and dry weight (g $m^{-2}$) in direct dry seeded rainfed lowland rice (Pooled data of three years)

| Treatment | Population of major weed species | | | Total weed population | Dry weight of total weeds |
|---|---|---|---|---|---|
| | *E. colonum* | *O. sativa* | *C. rotundus* | | |
| | (volunteer/weedy rice) | | | | |
| Weedy | 9.08 (98) | 7.71 (62) | 7.08 (61) | 19.53 (418) | 178.6 |
| Weed-free | 0.07 (0.0) | 0.07 (0.0) | 0.07 (0.0) | 0.70 (0.0) | 0.0 |
| Hand weeding 25 and 50 DAS | 5.10 (28) | 4.61 (22) | 4.10 (18) | 12.25 (178) | 91.6 |
| Butachlor 1.5 kg $ha^{-1}$ | 6.79 (52) | 7.10 (5.7) | 6.90 (58) | 17.32 (301) | 114.7 |
| Thiobencarb 1.5 kg $ha^{-1}$ | 7.66 (62) | 6.90 (52) | 7.09 (61) | 17.10 (297) | 113.5 |
| Anilofos 0.4 1.5 kg $ha^{-1}$ | 7.34 (54) | 6.71 (46) | 6.71 (53) | 16.98 (289) | 118.7 |
| Butachlor+2, 4-D (1.5+0.5 kg $ha^{-1}$) | 6.94 (48) | 6.83 (52) | 6.56 (45) | 15.19 (270) | 106.4 |
| Thiobencarb+2, 4-D (1.5+0.5 kg $ha^{-1}$) | 6.78 (53) | 6.91 (49) | 6.20 (40) | 15.80 (286) | 108.6 |
| Anilofos+2, 4-D (0.4+0.5 kg $ha^{-1}$) | 7.79 (60) | 7.36 (58) | 6.16 (38) | 14.69 (205) | 107.3 |
| Butachlor+2, 4-D (1.5+0.5 kg $ha^{-1}$) fb HW 25 DAS | 5.10 (32) | 5.71 (37) | 4.26 (22) | 13.76 (167) | 93.6 |
| Thiobecarb+2, 4-D (1.5+0.5 kg $ha^{-1}$) fb HW 25 DAS | 4.48 (23) | 5.64 (34) | 4.48 (26) | 13.90 (187) | 97.6 |
| Anilofos+2, 4-D (0.4+0.5 kg $ha^{-1}$) fb 1 HW 25 DAS | 4.61 (22) | 5.95 (39) | 4.10 (19) | 12.67 (175) | 95.5 |
| LSD (P=0.05) | 1.12 | 1.07 | 0.95 | 1.65 | 8.5 |

Population figures are transformed to $\sqrt{X+0.5}$. Figures in parentheses are original.

## RESULTS AND DISCUSSION

### Weed Flora

The predominant weed flora recorded during the pre-flood environments were *Echinochloa colonum* (L.) Link, *E. crusgalli* (L.) Beav, *Oryza sativa* L. (volunteer/weedy rice), *Cyperus rotundus* (L.), *Cynodon dactylon* (L.) Pers. *Eleusine indica* (L.) Hassk, *Fimbristylis miliacea* (L.) Vahal and *Eclipta alba* (L.) Hassk. However, *Ipomea aquatica* Forsk., *Sirpus erectus* L., *Nymphea nouchale* Burn and *Oryza sativa* L. (volunteer/weedy red rice) were also observed during post-flooding. Infestation of weeds was more severe from seedling emergence to prior of water stagnation.

### Effect on Weeds

Herbicidal and manual weed control treatments resulted in significant reduction in total weed density and dry matter production of weeds as compared to weedy check. Higher weed populations were recorded when herbicides were applied alone (i. e. butachlor, thiobencarb and anilofos) as compared to their combined application with 2, 4-D. Weed biomass (g $m^{-2}$) also recorded the similar trend. Significantly lower population of *E. colonum*, *0. sativa* and *C. rotundus* was observed in combined herbicidal application with one hand weeding as compared to their alone application. Similar response was noticed against population of *E. colonum* and *0. sativa* when butachlor, thiobencarb and anilofos were used alone or in combination with 2, 4-D. Lower population of *C. rotundus* was observed in combined herbicidal application with 2, 4-D alongwith hand weeding (Table 1). Reduction in total population and dry weight of weeds due to pre-emergence application of butachlor+2, 4-D (1.5+0.5 kg $ha^{-1}$), thiobencarb+2, 4-D (1.5+.05 kg $ha^{-1}$) and anilofos+2, 4-D (0.4+0.5 kg $ha^{-1}$) alongwith one hand weeding (HW) at 25 days after sowing (DAS) was comparable to hand weeding twice. Different herbicidal combinations without subsequent hand weeding once had significantly higher weed dry weight than integrating respective herbicidal combinations with hand weeding once at 25 DAS. The significant effect of herbicides in combination with hand weeding can be ascribed to the broad spectrum weed control as the herbicides have controlled specific weed and the subsequent hand weeding may have removed sedges and broad-leaved weeds which were not controlled by herbicides. Hand weeding twice (25 and 50 DAS) also maintained a weed-free environment during initial crop growth which provided competition free environments for natural and applied resources, thereby helping in faster crop growth and smothering of weeds at later stages. Tosh and Jena (1984), Malik and Singh (1996), Singh (1997) and Singh and Rath (2000) observed similar results.

### Effect on Crop

Application of herbicides under test did not show any phytotoxic symptom on rice plant. All the herbicidal treatments either applied alone or in combination with herbicide or with hand weeding once significantly increased crop growth, yield attributes and yield of RLR as compared to weedy check during all the three years of investigation. This is due to the fact that application of herbicides or manual weeding reduced the weed competition which enabled the RLR plants for better utilization of nutrients and other growth factors which ultimately resulted in higher plant height, effective tillers $m^{-1}$, grains $panicle^{-1}$, panicle length, test weight and harvest index, and thereby grain yield (Table 2). However, integration of butachlor+2, 4-D (1.5+0.5 kg $ha^{-1}$), thiobencarb+2, 4-D (1.5+0.5 kg $ha^{-1}$) and anilofos+2, 4-D (0.4+0.5 kg $ha^{-1}$) with one hand weeding proved to be more effective in increasing yield attributes and grain yield than application of herbicides either alone or in combination. Results also showed that combination of herbicides with one hand weeding was on par with two manual weedings in all these respects. This may be attributed to least competition as a result of effective

Table 2. Crop growth, yield attributes and yield of direct dry seeded rainfed lowland rice as influenced by different weed management treatments (Pooled data of three years)

| Treatment | Plant height (cm) | No. of panicles $m^{-2}$ | Grains $panicle^{-1}$ | Panicle length (cm) | 1000-grain weight (g) | Grain yield (t $ha^{-1}$) | Harvest index |
|---|---|---|---|---|---|---|---|
| Weedy | 140.3 | 110.5 | 98.6 | 17.5 | 18.7 | 1.50 | 20.0 |
| Weed-free | 157.6 | 214.8 | 156.7 | 22.3 | 21.5 | 3.20 | 33.8 |
| Hand weeding 25 and 50 DAS | 158.2 | 197.8 | 149.7 | 23.6 | 22.2 | 2.90 | 32.5 |
| Butachlor 1.5 kg $ha^{-1}$ | 150.6 | 150.7 | 120.4 | 19.5 | 20.5 | 2.36 | 27.5 |
| Thiobencarb 1.5 kg $ha^{-1}$ | 147.2 | 147.8 | 119.7 | 20.4 | 20.2 | 2.29 | 28.7 |
| Anilofos 0.4 1.5 kg $ha^{-1}$ | 148.8 | 139.8 | 127.5 | 18.9 | 21.5 | 2.35 | 31.5 |
| Butachlor+2, 4-D (1.5+0.5 kg $ha^{-1}$) | 153.5 | 170.7 | 130.6 | 21.4 | 20.2 | 2.42 | 29.4 |
| Thiobencarb+2, 4-D (1.5+0.5 kg $ha^{-1}$) | 155.7 | 179.8 | 140.8 | 20.7 | 22.5 | 2.47 | 28.4 |
| Anilofos+2, 4-D (0.4+0.5 kg $ha^{-1}$) | 153.9 | 180.2 | 136.5 | 22.0 | 21.5 | 2.49 | 30.8 |
| Butachlor+2, 4-D (1.5+0.5 kg $ha^{-1}$) fb HW 25 DAS | 158.7 | 190.2 | 146.7 | 22.6 | 21.4 | 2.79 | 31.4 |
| Thiobencarb+2, 4-D (1.5+0.5 kg $ha^{-1}$) fb HW 25 DAS | 156.5 | 197.8 | 145.7 | 22.5 | 21.7 | 2.75 | 32.6 |
| Anilofos+2, 4-D (0.4+0.5 kg $ha^{-1}$) fb I HW 25 DAS | 159.7 | 203.6 | 156.2 | 23.7 | 22.2 | 2.87 | 32.5 |
| LSD (P=0.05) | 011.7 | 015.7 | 010.2 | 02.7 | 01.8 | 0.25 | 06.5 |

suppression of sedges and dicot weeds thereby enabling plant to exhibit full potential in a competition free environment as evident by higher WCE in the said treatments.

Further, the significantly higher grain yield due to hand weeding twice and herbicides (butachlor, thiobencarb and anilofos combined with 2, 4-D) alongwith one hand weeding could be attributed to the better yield attributes due to effective weed control (Table 1). The yield losses in these treatments were also lowest (10.1 to 13.9%). Weedy check treatment recorded significantly lower grain yield than other treatments and marked a mean yield loss of 53.8%. The data also showed that weeds remained uncontrolled under different weed control treatments during pre-flooding stage offering yield reduction to the tune of 10.1 to 28.8%. The variation in grain yield under different treatments was the result of variation in weed intensity and weed biomass (Table 1) and the treatments which had more weed growth had low yield. These observations are in agreement with the findings of BRRI (1980), De Datta (1986), Pandey *et al.* (1997) and Singh and Singh (2001).

The studies revealed that pre-emergence applications of either butachlor+2, 4-D (1.5+0.5 kg $ha^{-1}$) or thiobencarb+2, 4-D (1.5+0.5 kg $ha^{-1}$) or anilofos+2, 4-D (0.4+0.5 kg $ha^{-1}$) followed by one hand weeding at 25 DAS were effective ways to minimise weed competition and enhance grain yield of direct dry seeded rainfed lowland rice.

## REFERENCES


BRRI (Bangladesh Rice Research Institute), 1980. A comprehensive report of the results of Agronomy Division for boro 1978-79 and *aus* and *aman* 1979 seasons. Internal Review, 14-19 January.

De Datta, S. K. 1986. Technology development and the spread of direct seeded flooded rice in South-East Asia. *Ext. Agric.* **22** : 417-426.

IRRI, 1997. Annual Report for 1996. International Rice Research Institute, P. O. Box 933, Manila, Philippines.

Malik, R. K. and S. Singh, 1996. Potency of anilofos and butachlor applied alone or in combination with 2, 4-D against barnyard grass [*Echinochloa crusgalli* (L.) Beav.]. *Indian J. Weed Sci.* **28** : 44-45.

Pandey, P. C., P. S. Bishat and P. Lal, 1997. Evaluation of herbicides for broad spectrum weed control in lowland rice. *ORYZA* **34** : 156-158.

Singh, S. K. and P. C. Rath, 2000. Relative efficacy of different weed control methods in direct sown and transplanted rainfed lowland rice. *ORYZA* **37** : 62-63.

Singh, U. P. 1997. Studies on weed management and crop establishment in rainfed medium deep, waterlogged rice eco-system. *Indian J. Weed Sci.* **29** : 46-49.

Singh, U. P. and R. P. Singh, 2001. Effect of weed management practices, fertility and cultivars on weed growth and yield of rainfed lowland, submergence-prone rice. *Indian J. Weed Sci.* **33** : 124-126.

Tosh, G. C. and H. C. Jena, 1984. Weed control in dry seeded lowland rice with bentazon combined with 2, 4-D. *IRRN* **9** : 19.