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# Weed management in transplanted rice (*Oryza sativa*) under rainfed, lowland situation

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## ABSTRACT

A field experiment was conducted during wet season of 1996 and 1997 to study the effect of various weed–management practices on yield, weed growth, and nitrogen uptake by rice (*Oryza sativa* L.) and weeds in transplanted situation condition. Keeping the weed-free-up to 60 days after transplanting (DAT) and application of Anilofos 0.4 kg a.i./ha followed by hand-weeding at 40 DAT resulted in at par and significantly higher grain yield and nitrogen uptake over rest of the treatments. Among chemical weed-control methods, minimum weed density and dry weight were recorded with Anilofos 0.4 kg a.i./ha applied as pre-emergence supplemented with 1 hand-weeding at 40 DAT. Weedy check till maturity reduced the grain yield by 49% while minimum reduction was recorded with Anilofos 0.4 kg a.i./ha + 1 hand/weeding at 40 DAT (4%) as compared to weed-free up to 60 DAT. Weedy check till maturity removed significantly highest nitrogen through weeds (12.97 kg/ha). Pre-emergence spray of Anilofos 0.4 kg a.i./ha + 1 hand-weeding at 40 DAT resulted in higher net income and benefit : cost ratio.

***Key words*** : Weed management, Transplanted rice, Rainfed lowland

In transplanted, rainfed, lowland rice, high weed infestation is a major constraint which causes severe reduction in the grain yield. The loss in grain yield caused by weeds varies from 30 to 50% (Singh *et al.*, 1991; Brar *et al.*, 1995). Hand-weeding is the most common and effective method of weed control in rice but it is being difficult and uneconomical day-by-day due to high wages and non-availability of laboures at peak period of farm operations. Under lowland, transplanted rice, weed flora are variable and may not be controlled by herbicide alone, as flushes of weeds come up at different stages. Hence, there is need to use herbicide mixture (pre- or post-emergence) or supplement by hand-weeding to control weeds under the present situation. An attempt was thus made to study the economic feasibility of various herbicidal

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treatment to control weeds in transplanted rice in rainfed, lowland situation.

## MATERIALS AND METHODS

A field experiment was conducted at the Crop Research Station, Ghaghraghat (Bahraich), during wet season of 1996 and 1997 in ICAR–IRRI collaborative IFAD-supported project. The soil was sandy loam, with pH 8.2, organic carbon 0.4%, available N 243, $P_2O_5$ 22.87 and $K_2O$ 152 kg/ha. Eight treatments comprised, weedy check, 2 hand-weedings (20 and 40 DAT) weed free up to 60 DAT, Anilofos + 2, 4-DEE (0.4+0.6 kg a.i./ha), Anilofos (0.4 kg a.i./ha)+1 hand-weeding at 40 DAT, Butachlor + 2, 4-DEE (1.5 + 0.6 kg a.i./ha), Butachlor (1.5 kg a.i./ha) +1 hand-weeding at 40 DAT, and smothering by plant population (15 cm × 10 cm) were tested in randomized block design with 4 replications. Rice variety 'Jalpriya' was transplanted with 25-day-old seedling at 20 cm × 15 cm spacing using 2–3 seedlings/hill in second week of July during both the years. The herbicides were applied on day 3 after transplanting using 600 litres water/ha. Crop was fertilized @ 80 N + 40 $P_2O_5$+40 $K_2O$ kg/ha. Full dose of P and K, and half dose of N were applied basal after puddling and rest amount of N was top-dressed in 2 splits at maximum tillering and panicle-initiation stage. At harvest, observations on weed composition and dry matter were recorded from 3 random quadrates of 0.25 $m^2$ in each plot. All improved package of practices were followed to raise the rice crop. Total rainfall received during the respective years was 915 mm and 1,095 mm. Water started accumulating in the experimental plot on 9 September 1996 and 20 August and reached the maximum level of 45 cm in 1996 and 37 cm in 1997. The stagnation of water in the field was for 33 days in 1996 and 38 days in 1997 and remained in the range of 30–50 cm depth.

## RESULTS AND DISCUSSION

### *Weeds*

The major weed flora in the experimental site comprised grasses: *Cynodon dactylon* (L.) Pers., *Leptochloa chinensis* L., *Echinochloa crus-galli* (L.) P. Beauv; and *Echinochloa colonum* (L.) Link.; sedges: *Cyperus rotundus* L., *Fimbristylis miliaceae* (L.) Vahl, *Cyperus iria* L. and *Cyperus difformis* L.; and broad-leaved weeds: *Caesulia axillaris, Commelina benghalensis* L. and *Cynotis axillaris.*

Application of herbicides or hand weeding resulted significant decrease in total number of weeds and their dry matter as compared to weedy check (Table 1). Maximum weed density and dry weight were recorded with weedy check treatment. However, crop received weed-free treatment up to 60 DAT recorded the minimum weed density and weed dry weight. Among the herbicidal treatments, pre-emergence application of Anilofos @ 0.4 kg a.i./ha supplemented with 1 hand–weeding at 40 DAT was found most effective in controlling density and dry weight of weeds, followed by Butachlor @ 1.5 kg a.i./ha +1 hand-weeding at 40 DAT. Weed density and dry weight in the plot received 2 hand-weedings, Anilofos + 2, 4-DEE (0.4 + 0. kg a.i./ha), and Butachlor + 2,4-DEE (1.5 + 0.6 kg a.i./ha) were at par with each other.

**Table 1.** Weed population, dry weight, and nutrient uptake by rice and weeds as influenced by various weed-control measures (average of 2 years)

| Treatment | Weed population/ $m^2$ at harvest | Weed dry weight (q/ha) | Weed-control efficiency (%) | Weed index (%) | N uptake (kg/ha) by rice | | | | Total N uptake (kg/ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grain | Straw | Total | Weeds | |
| Weedy check | 443 | 14.26 | | 48.68 | 17.68 | 11.33 | 29.01 | 12.97 | 41.98 |
| 2 hand-weedings | 38 | 2.66 | 81.35 | 10.05 | 30.94 | 20.91 | 51.85 | 2.35 | 54.20 |
| Weed-free up to 60 DAT | 16 | 1.04 | 92.71 | | 34.44 | 23.13 | 57.57 | 0.89 | 58.46 |
| Anilofos + 2, 4–DEE (0.4 + 0.6 kg a.i./ha) | 47 | 3.14 | 77.98 | 20.26 | 27.44 | 19.51 | 46.95 | 2.70 | 49.65 |
| Anilofos 0.4 kg a.i./ha + 1 hand-weeding at 40 DAT | 30 | 2.11 | 85.20 | 3.74 | 33.14 | 21.66 | 54.80 | 1.82 | 56.62 |
| Butachlor + 2, 4-DEE (1.5 kg + 0.6 kg a.i./ha) | 54 | 4.75 | 66.59 | 21.31 | 27.05 | 18.89 | 45.95 | 4.11 | 50.06 |
| Butachlor 1.5 kg a.i./ha + 1 hand-weeding at 40 DAT | 45 | 3.04 | 78.68 | 6.24 | 31.57 | 20.86 | 52.43 | 2.64 | 55.07 |
| Smothering by plant population (15 cm ×10 cm) | 189 | 10.15 | 28.82 | 24.85 | 25.85 | 18.65 | 44.50 | 9.05 | 53.55 |
| CD (P = 0.05) | 18 | 0.90 | 6.14 | 1.98 | 1.48 | 1.50 | 2.87 | 0.95 | 2.10 |

**Table 2.** Yield attributes, yield and economics of rice under rainfed, lowland, transplanted conditions

| Treatment | Yields (q/ha) | | | | Panicles/ $m^2$* | Panicle length (cm)* | Panicle weight (g)* | 1,000-grain weight* (g) | Net income (Rs/ha)* | Benefit: cost ratio* |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain | | Straw | | | | | | | |
| | 1996 | 1997 | 1996 | 1997 | | | | | | |
| Weedy check | 15.07 | 16.18 | 26.37 | 26.95 | 186 | 22.2 | 3.01 | 24.55 | 473 | 1.08 |
| 2 hand-weedings | 27.96 | 26.84 | 48.37 | 47.78 | 309 | 24.8 | 3.30 | 26.12 | 2,875 | 1.37 |
| Weed-free up to 60 DAT | 29.97 | 30.95 | 51.54 | 52.39 | 327 | 25.6 | 3.52 | 26.54 | 3,438 | 1.41 |
| Anilofos + 2,4-DEE (0.4+0.5 kg a.i./ha) | 24.03 | 24.55 | 43.60 | 43.10 | 278 | 23.0 | 3.22 | 25.18 | 3,506 | 1.58 |
| Anilofos (0.4 kg a.i./ha) + 1 HW at 40 DAT | 28.86 | 29.77 | 50.21 | 51.68 | 319 | 25.3 | 3.48 | 26.25 | 4,670 | 1.70 |
| Butachlor + 2,4-DEE (1.5 kg + 0.6 kg a.i./ha) | 24.11 | 23.83 | 43.14 | 42.73 | 269 | 22.9 | 3.18 | 25.03 | 3,389 | 1.57 |
| Butachlor 1.5 kg a.i./ha + 1 HW at 40 DAT | 27.80 | 28.09 | 48.46 | 47.47 | 310 | 24.9 | 3.41 | 26.04 | 3,935 | 1.57 |
| Smothering by plant population (15 cm×10 cm) | 22.63 | 23.14 | 42.60 | 43.11 | 255 | 22.8 | 3.10 | 24.95 | 2,951 | 1.49 |
| CD (P = 0.05) | 1.18 | 1.21 | 1.38 | 1.07 | 12 | 0.5 | 0.10 | 0.61 | | |

*Average of 2 years

Highest weed-control efficiency was obtained with weed-free till 60 DAT (92.7%), followed by that of Anilofos + 1 hand-weeding (85.20%). The higher weed-control efficiency with the above treatment could be attributed due to lower weed dry weight.

### *Rice*

Integration of Anilofos @ 0.4 kg a.i./ha supplemented with 1 hand-weeding at 40 DAT resulted grain yield at par with that of weed-free up to 60 DAT in both the seasons, and significantly higher grain yield over other treatments (Table 2). On the other hand, the yield obtained with 2 hand-weedings was at par in 1996 with that of Anilofos followed by hand-weeding at 40 DAT. Higher yield with the above treatment could be attributed to significant reduction in weed density and dry weight, and improvement in yield attributes, i.e. panicles/$m^2$, panicle length, panicle weight and 1,000-grain weight. Pre-emergence application of Anilofos + 2, 4-DEE, and butachlor + 2, 4-DEE resulted similar yield. Weedy check till maturity resulted 49%, reduction in grain yield (4%) was recorded in Anilofos 0.4 kg a.i./ha followed by 1 hand-weeding at 40 DAT.

### *Nutrient uptake*

Significantly highest N uptake by rice crop was recorded with weed-free till 60 DAT, followed by Anilofos + 1 hand-weeding at 40 DAT, and 2 hand-weedings (Table 1). However, weedy check treatment depleted the highest amount of N through weeds and the lowest amount of N by rice crop, mainly due to high weed infestation and poor crop yield (Table 1). The total N uptake in weed free up to 60 DAT, and Anilofos (0.4 kg a.i./ha), followed by 2 hand-weedings.

Pre-emergence application of anilofos @ 0.4 kg a.i./ha supplemented with 1 hand+weeding at 40 DAT resulted highest net income and benefit : cost ratio, followed by butachlor 1.5 kg a.i./ha + 1 hand-weeding at 40 DAT (Table 2).

It can be concluded that weeds under transplanted, rainfed, lowland situation can be controlled effectively and economically by pre-emergence spray of Anilofos @ 0.4 a.i./ha followed by hand-weeding at 40 DAT.

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