

## Weed management through new generation herbicides and their effect on yield in transplanted rice

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### ABSTRACT

A field experiment conducted during the *kharif* season of 1999 showed that hand weeding twice at 20 and 40 DAT resulted the lowest weed dry matter of 2.87, 5.85 and 10.91 g/m<sup>2</sup> at 30, 60 and 90 DAT respectively which were at par with the treatment Anilofos + Ethoxy sulfuron at 390 g a.i./ha (Ready-mix). The highest WCE (92.55%) was obtained at 90 DAT with hand weeding treatment which was closely followed by the treatment Anilofos + Ethoxy sulfuron at 390 g a.i./ha. Number of effective tillers/m<sup>2</sup> and number of filled grains/panicle differed significantly. The highest rice grain yield (4.48 t/ha) was obtained with the hand weeding twice treatment which however, was at par with ready-mix herbicide mixture Anilofos + Ethoxy sulfuron at 390 g a.i./ha yielding 4.42 t/ha. Among all the herbicides tested, the ready-mix herbicide mixture Anilofos + Ethoxy sulfuron at 390 g a.i./ha applied 10 DAT proved to be the best for controlling all categories of weeds resulting the highest grain yield of rice.

India occupies the largest area under rice but still the country is in lower position among the rice growing countries in respect to total yield. The yield of rice has to increase by 25-30% from the present level of 1.9 t/ha even by moderate estimates, if the country is to remain self sufficient in rice by 2010 (1). In case of transplanted rice weed infestation is a serious problem and crop-weed competition in rice during the critical period (30-45 DAT) causes 15-40% reduction in yield (2). So, weed management in transplanted rice is a must to get higher productivity. Manual method of weed control (hand weeding) could not be the choice as it involves huge cost on manual labourers resulting minimum profitability. For this reason it is now high time to go for weed control through chemical

herbicides. This study help to evaluate the comparative efficiency of some new herbicides and herbicide mixtures with butachlor in controlling weeds in transplanted rice under West Bengal situation.

### MATERIALS AND METHODS

The field trial was conducted during the *kharif* season of 1999 at the Regional Research Sub-Station (New Alluvial Zone), Chakdaha, Bidhan Chandra Krishi Viswavidyalaya. The experiment was laid out in a randomised block design (RBD) with thirteen treatments replicated thrice. The net plot size was 5m x 4m. The treatments comprised of butachlor, fenoxaprop-p-ethyl, acetochlor and pyrazosulfuron ethyl (PSE) alone and combination of anilofos + ethoxy sulfuron (ready-mix) and anilofos + triclopyr

(tank-mix); hand weeding twice at 20 and 40 DAT and unweeded control. The rice variety used was IET-4094 (Khitish). The transplanting operation was done on 7<sup>th</sup> of August with 28 days old rice seedlings and the harvesting was done on 7<sup>th</sup> of November. Observations relating to weed parameters were taken at 30, 60 and 90 DAT, whereas,

the yield attributes and grain yield of rice were recorded at harvest.

## RESULTS AND DISCUSSION

The experimental field was mainly dominated by *Echinochloa crusgalli*, *Monochoria vaginalis*, *Cyperus rotundus*, *Leersia hexandra*, *Marsilea quadrifoliata* and *Ludwigia parviflora*.

**Table 1 Effect of treatments on total weed density**

| Treatments   | Weed Population/m <sup>2</sup> |        |        |
|--|--------------------------------|--------|--------|
|  | 30 DAT                         | 60 DAT | 90 DAT |
| T <sub>1</sub> Butachlor @ 1.5 kg a.i./ha                              | 5.00                           | 10.66  | 18.33  |
| T <sub>2</sub> Anilofos + Ethoxy sulfuron @ 0.26 kg a.i./ha            | 8.00                           | 14.66  | 21.33  |
| T <sub>3</sub> Anilofos + Ethoxy sulfuron @ 0.39 kg a.i./ha            | 5.00                           | 9.66   | 16.33  |
| T <sub>4</sub> Fenoxaprop-p-ethyl @ 0.056 kg a.i./ha                   | 19.66                          | 40.66  | 40.00  |
| T <sub>5</sub> Fenoxaprop-p-ethyl @ 0.075 kg a.i./ha                   | 18.00                          | 37.66  | 38.00  |
| T <sub>6</sub> Acetochlor @ 0.075 kg a.i./ha                           | 17.66                          | 35.66  | 34.00  |
| T <sub>7</sub> Acetochlor @ 0.100 kg a.i./ha                           | 17.33                          | 33.00  | 31.33  |
| T <sub>8</sub> Pyrazosulfuron-ethyl @ 0.005 kg a.i./ha                 | 11.66                          | 24.66  | 29.33  |
| T <sub>9</sub> Pyrazosulfuron-ethyl @ 0.010 kg a.i./ha                 | 9.33                           | 18.33  | 23.33  |
| T <sub>10</sub> Anilofos @ 0.25 kg a.i./ha + Trichlopyr @ 1 kg a.i./ha | 9.66                           | 17.66  | 26.00  |
| T <sub>11</sub> Anilofos @ 0.50 kg a.i./ha + Trichlopyr @ 1 kg a.i./ha | 6.66                           | 13.00  | 18.33  |
| T <sub>12</sub> Hand Weeding twice                                     | 4.00                           | 8.66   | 16.66  |
| T <sub>13</sub> Unweeded control                                       | 69.66                          | 132.33 | 172.66 |
| C.D. at 5%   | 4.85                           | 8.87   | 6.20   |

In 30 and 60 DAT, lowest weed population was found in case of T<sub>12</sub> (hand weeding) treatment though at 90 DAT lowest weed count was recorded in the treatment T<sub>3</sub> (Rice Guard @ 0.39 kg a.i./ha) closely followed by T<sub>12</sub> and other treatments like T<sub>1</sub>, T<sub>11</sub> and T<sub>2</sub> which were all at par among themselves. In all the observations, poorest

results were obtained from T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> though they all significantly differs from T<sub>13</sub> (unweeded control). It can be stated that hand weeding treatment was superior to all other treatments in controlling all categories of weeds, but it was statistically at par with the treatments T<sub>3</sub>, T<sub>1</sub>, T<sub>11</sub> and T<sub>2</sub>.

**Table 2 Effect of treatments on weed dry weight (g/m<sup>2</sup>) and weed control efficiency (%) in transplanted rice at different growth stages**

| Treatment  | Dose<br>(g a.i./ha) | Weed dry weight<br>(g/m <sup>2</sup> ) |       |        | Weed control<br>efficiency |       |       |
|--|---------------------|--|-------|--------|----------------------------|-------|-------|
|  |                     | 30                                     | 60    | 90     | 30                         | 60    | 90    |
| T <sub>1</sub> Butachlor @ 1.5 kg a.i./ha                                      | 1500                | 3.39                                   | 7.36  | 12.00  | 93.22                      | 91.77 | 91.81 |
| T <sub>2</sub> Anilofos + Ethoxy sulfuron @ 0.26 kg a.i./ha                    | 260                 | 6.37                                   | 9.41  | 19.33  | 87.26                      | 89.48 | 86.81 |
| T <sub>3</sub> Anilofos + Ethoxy sulfuron @ 0.39 kg a.i./ha                    | 390                 | 3.81                                   | 6.45  | 11.24  | 92.38                      | 92.79 | 92.33 |
| T <sub>4</sub> Fenoxaprop-p-ethyl @ 0.056 kg a.i./ha                           | 56                  | 15.28                                  | 26.07 | 36.15  | 69.44                      | 70.85 | 75.34 |
| T <sub>5</sub> Fenoxaprop-p-ethyl @ 0.075 kg a.i./ha                           | 75                  | 13.83                                  | 27.51 | 34.73  | 72.34                      | 69.24 | 76.30 |
| T <sub>6</sub> Acetochlor @ 0.075 kg a.i./ha                                   | 75                  | 13.43                                  | 23.94 | 32.83  | 73.14                      | 73.23 | 77.60 |
| T <sub>7</sub> Acetochlor @ 0.100 kg a.i./ha                                   | 100                 | 13.25                                  | 22.25 | 28.67  | 73.50                      | 75.12 | 80.45 |
| T <sub>8</sub> Pyrazosulfuron-ethyl @ 0.005 kg a.i./ha                         | 5                   | 9.25                                   | 16.50 | 28.33  | 81.50                      | 81.55 | 80.67 |
| T <sub>9</sub> Pyrazosulfuron-ethyl @ 0.010 kg a.i./ha                         | 10                  | 7.79                                   | 12.86 | 19.43  | 84.42                      | 85.62 | 86.74 |
| T <sub>10</sub> Anilofos @ 0.25 kg a.i./ha + Trichlopyr250+1000 @ 1 kg a.i./ha |                     | 7.81                                   | 13.85 | 22.07  | 84.38                      | 84.51 | 84.94 |
| T <sub>11</sub> Anilofos @ 0.50 kg a.i./ha + Trichlopyr500+1000 @ 1 kg a.i./ha |                     | 5.19                                   | 8.79  | 12.40  | 89.62                      | 90.17 | 91.54 |
| T <sub>12</sub> Hand Weeding twice   | 20 & 40<br>DAT      | 2.87                                   | 5.85  | 10.91  | 94.26                      | 93.45 | 92.55 |
| T <sub>13</sub> Unweeded control   |                     | 50.01                                  | 89.44 | 146.65 |                            |       |       |
| C.D. at 5%   |                     | 4.25                                   | 4.14  | 6.13   |                            |       |       |

Rice guard (Herbicide mixture) @ 0.39 kg a.i./ha showed the best performance among the different chemicals tried in the investigation and this might be due to the fact that such herbicide mixture was the optimum lethal dose for all the dominant weeds and could persist in the soil at least upto critical growth period of paddy crop. This finding was at par with the reporting of Hacker *et al.* (1995).

Among all the treatments, hand weeding twice (at 20 and 40 DAT) resulted the minimum weed dry matter which was statistically at par with mixture of anilofos + ethoxy sulfuron at 390 g a.i./ha, butachlor at 1500 g a.i./ha and mixture of anilofos + triclopyr at (500 + 1000) g a.i./ha at all stages of crop growth (Table 1). Similar type of finding was earlier reported by Hess (3).

The highest weed control efficiency (WCE) to the tune of 94.26, 93.45 and 92.55% were obtained in the hand weeding (twice) treatment at 30, 60 and 90 DAT respectively which were followed by the treatments anilofos + ethoxysulfuron at 390 g a.i./ha and butachlor at 1500 g a.i./ha for all dates of observations.

The number of effective tillers was the highest (422/m<sup>2</sup>) in hand weeding (twice) treatment which was statistically at par with ready-mixture of anilofos + ethoxy sulfuron at 390 g a.i./ha and Butachlor at 1500 g a.i./ha (Table 2).

The effect of different treatments on the length of panicle was not significant, whereas, number of filled grains/panicle differed significantly with the treatments. The maximum number of filled grains/panicle (115.66) was obtained in the hand weeded plots which was at par with anilofos + ethoxy sulfuron at 390 g a.i./ha and Butachlor at

1500 g a.i./ha recording 114.66 and 110.33 numbers of filled grains/panicle respectively. Again test weight (1000 grain weight) did not differ significantly among the treatments which is a genetical character.

Rice grain yield differed significantly among various treatments. The highest grain yield (4.48 t/ha) was obtained with the hand weeding treatment having no significant difference with the mixture of Anilofos + ethoxy sulfuron at both the doses, butachlor at 1500 g a.i./ha, PSE at 10 g a.i./ha and the mixture of anilofos + triclopyr at (500 + 1000) g a.i./ha producing 4.42, 4.3, 4.41, 4.22 and 4.35 t/ha of grain respectively. Earlier findings corroborated the present result (4).

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**Table 3 Effect of treatments on yield attributes and grain yield of transplanted rice**

| Treatment  | Dose (g a.i./ha) | No. of effective tillers/m <sup>2</sup> | Panicle length (cm) | No. of filled grains/ panicle | 1000 grain weight (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|--|------------------|---|---------------------|-------------------------------|-----------------------|--------------------|--------------------|
| T <sub>1</sub> Butachlor @ 1.5 kg a.i./ha                              | 1500             | 418.33                                  | 23.42               | 110.33                        | 22.12                 | 4.41               | 5.30               |
| T <sub>2</sub> Anilofos + Ethoxy sulfuron @ 0.26 kg a.i./ha            | 260              | 408.33                                  | 23.47               | 107.33                        | 22.00                 | 4.30               | 5.03               |
| T <sub>3</sub> Anilofos + Ethoxy sulfuron @ 0.39 kg a.i./ha            | 390              | 419.66                                  | 23.60               | 114.66                        | 22.11                 | 4.42               | 5.39               |
| T <sub>4</sub> Fenoxaprop-p-ethyl @ 0.056 kg a.i./ha                   | 56               | 378.66                                  | 22.95               | 84.00                         | 21.68                 | 3.80               | 4.59               |
| T <sub>5</sub> Fenoxaprop-p-ethyl @ 0.075 kg a.i./ha                   | 75               | 380.00                                  | 22.95               | 84.33                         | 21.73                 | 3.87               | 4.86               |
| T <sub>6</sub> Acetochlor @ 0.075 kg a.i./ha                           | 75               | 384.33                                  | 22.94               | 86.33                         | 21.61                 | 3.87               | 4.86               |
| T <sub>7</sub> Acetochlor @ 0.100 kg a.i./ha                           | 100              | 390.66                                  | 23.02               | 87.33                         | 21.64                 | 3.93               | 4.87               |
| T <sub>8</sub> Pyrazosulfuron-ethyl @ 0.005 kg a.i./ha                 | 5                | 397.00                                  | 23.33               | 94.66                         | 21.87                 | 4.08               | 4.92               |
| T <sub>9</sub> Pyrazosulfuron-ethyl @ 0.010 kg a.i./ha                 | 10               | 403.66                                  | 23.34               | 103.66                        | 21.98                 | 4.22               | 5.00               |
| T <sub>10</sub> Anilofos @ 0.25 kg a.i./ha + Trichlopyr @ 1 kg a.i./ha | 250+1000         | 399.00                                  | 23.34               | 100.33                        | 21.95                 | 4.17               | 4.95               |
| T <sub>11</sub> Anilofos @ 0.50 kg a.i./ha + Trichlopyr @ 1 kg a.i./ha | 500+1000         | 414.00                                  | 23.43               | 110.00                        | 22.06                 | 4.35               | 5.22               |
| T <sub>12</sub> Hand Weeding twice                                     | 20 & 40 DAT      | 422.00                                  | 23.62               | 115.66                        | 22.03                 | 4.48               | 5.39               |
| T <sub>13</sub> Unweeded control                                       |                  | 342.00                                  | 21.87               | 73.00                         | 21.62                 | 3.17               | 3.95               |
| C.D. at 5%   |                  | 8.34                                    | NS                  | 5.62                          | NS                    | 0.273              | 0.171              |