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# Effect of Weed Control Methods on Weed Dynamics and Productivity of Transplanted Rice (*Oryza sativa* L.) in Eastern Uttar Pradesh

***Abhishek Mishra[1*], Vaibhav Pandey[2], Vishuddha Nand[1], Digvijay Singh[2], Vineet Kumar Shukla[3] and Atish Yadav[3]***

*[1]Department of Agronomy,*
*Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (Uttar Pradesh), India.*
*[2]Department of Agronomy,*
*Dr. Rajendra Prasad Central Agricultural University, Samastipur (Bihar), India.*
*[3]Department of Agronomy,*
*Institute of Agricultural Sciences, BHU, Varanasi (Uttar Pradesh), India.*

*(Corresponding author: Abhishek Mishra*)*
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**ABSTRACT: It is important to understand that weeds are unwanted, undesirable plants that absorb nutrients faster and in greater quantities than crops, resulting in the reduction of plant yields even at higher rates of fertilization. As a consequence, it is important that promising weed management approaches are developed to determine how to enhance rice productivity. Keeping in this view the present investigation, the experiment was conducted at Agronomy Research Farm of ANDUA&T, Kumarganj, Ayodhya (U.P.) during *Kharif* 2021. The experiment was laid out in Randomized Block design with three replications, *viz*., (Pretilachlor @1000 g ai ha$^{-1}$ (PE), Pretilachlor @1000 g ai ha$^{-1}$ (PE) + Bispyribac sodium @ 25g ai ha$^{-1}$ (PoE), Pretilachlor @1000 g ai ha$^{-1}$ (PE) + One hand weeding at 35 DAT, Bispyribac sodium @ 25g ai ha$^{-1}$ (PoE), Bispyribac sodium @ 25g ai ha$^{-1}$ (early PoE at 25 days) + One hand weeding at 45 DAT, Two Hand Weeding at 20 and 40 DAT, Weed free up to 60 days, Weedy check. Based on the results of the experiment, it was concluded that all the growth parameters and yield attributes were significantly affected by the different treatments used. It is clear from the scrutiny of the yield attribute data revealed that the weed free up to 60 days resulted significantly maximum value of growth, yield attributes and yields followed by two hand weeding at twenty and forty DAT. Among herbicides the Pretilachlor @1000 gram ai ha$^{-1}$ (PE) + One hand weeding at 35DAT having higher growth, yield attributes and yield with other rest herbicides.**

**Keywords:** Herbicides, Pre and post-emergence, Rice, Transplanted, Weeds, Weed control efficiency, Weed index.

## INTRODUCTION

Rice (*Oryza sativa* L.) is a monocot plant belonging to the family Poaceae and the genus Oryza. It is one of the most important food crops in the world after wheat, and it is a monocot plant. A major staple crop of the world, it is consumed by 2.7 billion people and it contains 7-8% protein, 3% fat and 3% fiber in its composition. Rice can grow best on soils that have a high concentration of clay and organic matter along with capacity to retain water. A hot, humid climate is necessary for the rice cultivation. A crop needs an average temperature between 21 °C and 37 °C during its growth and development. There are a lot of weeds in the rice fields, which makes it hard to grow crops. Weeds like *Echinocloa crusgalli, Echinocloa colonum (E. colona), Sedges* (*Cyperus rotundus*), *Cynodon dactylon, Cyperus difformis, Cyperus iria, Fimbristylis miliacea*), and broad leaves usually take over rice fields (*Ammannia baccifera, Ludwigia parviflora*). Rice and weeds compete for the same nutrients, light, moisture, temperature, and space. Most of the time, the loss in yield is between 15% and 20%, but in extreme cases, it can be more than 50%, depending on the type and amount of weeds (Das *et al.*, 2015). So, spraying herbicides in a certain order can get rid of different kinds of weeds that grow at different stages of crop growth. The current trend in herbicide use is to find an effective way to get rid of weeds by using low-dose herbicides that work well. This will not only cut down on the total amount of herbicides used, as well as it will also make their application easier and cheaper.

## MATERIAL AND METHOD

The experiment was conducted during Kharif season 2021 at the Agronomy Research Farm of ANDUA&T, Kumarganj, Ayodhya, U.P., India. A well-leveled field with good soil conditions was present in the field. According to its geographic location, it is located in the subtropical climate of Ayodhya (Kumarganj) and lies at

26°47 North latitudes, 82°12 East longitudes with an altitude of 113 meters above mean sea level. The experimental site is situated on the main campus of the university on the left side of the Ayodhya-Raibarelli road at a distance of 42 km from the Ayodhya district headquarter. The soil of the experimental field was slightly alkaline in reaction 9.4 pH, low in organic carbon 0.28 percent, available nitrogen 115.3 kg per hectare, medium in phosphorus 15.32 kg per hectare, and potassium 252.40 kg per hectare. The experiment was laid out in a randomized block design with three replications, *viz*., Pretilachlor @ 1000 g ai $ha^{-1}$ (PE), Pretilachlor @ 1000 g ai $ha^{-1}$ (PE) + Bispyribac sodium @ 25g ai $ha^{-1}$ (PoE), Pretilachlor @ 1000 g ai $ha^{-1}$ (PE) + One hand weeding at 35 DAT, Bispyribac sodium @ 25 g ai $ha^{-1}$ (early PoE at 25 days) + One hand weeding at 45 DAT, Two Hand Weeding at 20 and 40 DAT, Weed free up to 60 days, Weedy check The 25-day-old seedling of rice variety NDR-2065 was transplanted in an experimental field on July 21, 2021, using 2-3 per hill for a seedling 20 × 10 cm. Experimental crop was fertilized @120 N + $60P_2O_5$ + 40 $K_2O$ kg $ha^{-1}$. The herbicides were applied using a manually driven Knapsack sprayer equipped with a flat fan nozzle as pre-emergence (2 DAT), early post-emergence (25 DAT), and post-emergence (35 DAT) using 300 litre of water per hectare. In the weedy check plots, we left them undisturbed throughout the entire cropping season. Data on weed density and dry weight of various weed flora $m^{-2}$ were recorded at various stages of rice crop growth. The yield of rice grain along with different yield components like panicle length and panicle weight were recorded at harvest stage and statistically analyzed as per procedure (Gomez and Gomez 1984). At the 30$^{th}$, 60$^{th}$, and 90$^{th}$ day stages, three randomly selected locations were used to record the weed species using a quadrate. Weed dry matter was determined from the sample taken for weed density at the 30$^{th}$, 60$^{th}$, and 90$^{th}$ day stages. To achieve a constant weight, the samples were first sun-dried and then maintained in an electric oven at 70 °C ± 1.0 °C for 48 hours. Weed control efficiency and weed index of different weed management practices were calculated on the basis of weed dry weight by the following formula.

$$1.\ WCE = \frac{WPC - WPT}{WPC} \times 100$$

Where, WCE = Weed control efficiency
WPC = Weeds population in control plot
WPT = Weeds population in treated plot

$$2.\ W.I. = \frac{YWF - YT}{YWF} \times 100$$

Where, YWF- Yield of crops in weed-free areas
YT = yield of crops in the treated plot

## RESULT AND DISCUSSION

**Weed Flora.** *Echinochloa colonum* and *Echinochloa crusgalli* among grasses and Cyprus rotundas in the sedges and Phyllanthus niruri in broad- were the dominant weed species in the weedy check plot. A number of scientists working in various agro-climatic zones of the country have also discovered similar weed flora in rice crops left under normal conditions.

**Effect on Weed Density.** It is evident from the data presented in Table 1 that different weed control methods significantly affected the weed density at the 90-day stage. The weed density in the weedy check plot increased upto 90$^{th}$ days. All weed control methods reduce the weed density per unit area over a weedy check at various growth stages at the 30$^{th}$, 60$^{th}$, and 90$^{th}$ DAT. As per result Pretilachlor @1000 g ai $ha^{-1}$ (PE) + 1 Hand weeding at 35 DAT was recorded more effective in decreasing the density of weeds as compared to other herbicide treatments. However, sequential and mixed application of other herbicides molecules also controls all the weed species too fairly. Likewise, Bispyribac sodium @ 25g ai $ha^{-1}$ (early PoE at 25 days) + 1 hand weeding at 45 DAT showed better control of sedges along with grassy and BLBs. Scientists like Yadav *et al*. (2009); Suganthi *et al*. (2005) discovered a similar conclusion.

**Effect on Dry Weight.** A weed-free (up to 60 days) application was found to have the least dry weight, followed by a two-hand weeding application at (20 and 40 DAT) during the entire crop growth duration. Weedy check recorded the highest dry weight at the entire crop growth stages. Among the chemical treatments applied, the combination of Pretilachlor @1000g ai $ha^{-1}$ (PE) + 1 Hand weeding at 35 DAT ($T_3$) recorded the lowest dry weight, followed by Bispyribac sodium @ 25g ai $ha^{-1}$ (early PoE at 25 days) + 1H and weeding at 45 DAT ($T_5$) at each of the stages of crop development.

**Effect on Weed Control Efficiency and Weed Index.** In regard to weed control efficiency, the best results were recorded under the weed-free treatment up to 60 days at all stages of the experiment, possibly because of the fact that over time, weed under this treatment effectively controlled weed than under any of the other treatments. Among herbicides maximum weed control efficiency was occurred when applied Pretilachlor @1000 g ai $ha^{-1}$ (PE) + one hand weeding at 35 DAT ($T_3$). Herbicides applied as pre-emergence control the weeds in the early stage and the first emergence controlled the post emerged weeds efficiently was the main reason for lower weed dry weight and higher weed control efficiency with selectively spray treatment. There was also a high degree of agreement with the results presented by Survase *et al*. (2013) as well as Kumaran *et al.* (2015).

As a result of weed index, it shows that weedy check ($T_8$) was the weed treatment which contributed the most to the maximum reduction in grain yields due to weeds. Among herbicides, minimum loss due to weed was recorded under Pretilachlor @1000 g ai $ha^{-1}$ (PE) + one Hand weeding at 35DAT.

**Effect on Crop Growth Attributes.** As a result of weed control up to 60 days ($T_7$), a significantly higher plant height was recorded than $T_1$-Pretilachlor at 1000 g a.i. $ha^{-1}$ (PE), as well as $T_8$-Weedy check, assessed as at par with other treatments. We found that the number of tillers per $m^{-2}$, and the leaf area index were significantly higher in the $T_1$-Pretilachlor @1000g ai $ha^{-1}$ (PE), $T_4$-Bispyribac sodium @25g ai $ha^{-1}$ (PoE), as well as the

$T_8$- Weedy test and it was found at par with the rest of the treatments.

**Effect on Yield Attributes and Yield.** According to the data presented in the table, it was determined that weed free upto 60 days ($T_7$) recoded significantly greater number of panicle $m^{-2}$ (309.10), panicle length (21.80 cm) as compare to $T_1$- Pretilachlor @1000 g ai $ha^{-1}$ (PE) and $T_8$- Weedy check and found at par with rest of treatments while in case of panicle weight treatment $T_7$ found significantly higher as compare to $T_1$, $T_4$, and $T_8$ and at par with rest of treatments. In case of no. of grain $panicle^{-1}$ and test weight, treatment $T_7$ recorded highest value 88.0 and 22.60 g respectively. The data analyzed showed that the in treatment $T_7$ grin yield 55.06 quintals per hectare, straw 74.60 quintals per hectare, yield and biological yield 129.66 quintals per hectare recoded significantly higher result as compare to $T_1$, $T_4$, and $T_8$ and found at par with rest of treatments, while in case of harvest index data recorded non significant among different combination of treatments.

**Table 1: Effect of weed control methods on weed density ($m^{-2}$) at 90 DAT of different weed species of Rice (*Oryza sativa* L.).**

| Sr. No. | Treatment | Weed density species wise at 90 DAT | | | | | |
|---|---|---|---|---|---|---|---|
| | | ***Echinochloa colonum*** | ***Echinochloa crusgalli*** | ***Cyprus rotundus*** | ***Phyllanthus niruri*** | **Other weeds** | **Total weeds** |
| $T_1$ | Pretilachlor @1000 g ai $ha^{-1}$ (PE) | 4.41 (19) | 3.93 (15) | 3.81 (14) | 3.39(11) | 2.73(7) | 8.15(66) |
| $T_2$ | Pretilachlor @1000 g ai $ha^{-1}$ (PE) + Bispyribac sodium @ 25g ai $ha^{-1}$ (PoE) | 2.91(8) | 3.08(9) | 3.08 (9) | 2.34(5) | 2.34(5) | 6.04(36) |
| $T_3$ | Pretilachlor @1000 g ai $ha^{-1}$ (PE)+ One hand weeding at 35 DAT | 2.73(7) | 2.91(8) | 2.91 (8) | 2.12(4) | 2.12(4) | 5.60(31) |
| $T_4$ | Bispyribac sodium @ 25g ai $ha^{-1}$ (PoE) | 3.23(10) | 3.39(11) | 3.39 (11) | 2.74(7) | 2.74(7) | 6.81(46) |
| $T_5$ | Bispyribac sodium @ 25g ai $ha^{-1}$ (early PoE at 25 days) + One hand weeding at 45 DAT | 2.83(7.5) | 3.00(8.5) | 3.00 (8.5) | 2.23(4.5) | 2.23(4.5) | 5.83(33.5) |
| $T_6$ | Two Hand Weeding at 20 and 40 DAT | 2.74(7) | 2.59(6.2) | 2.73 (7) | 2.55(6) | 2.02(3.6) | 5.50(29.8) |
| $T_7$ | Weed free upto 60 days | 1.58(2) | 1.58(2) | 1.87(3) | 1.22(1) | 1.87(3) | 3.38(11) |
| $T_8$ | Weedy check | 9.51(90) | 9.08(82) | 7.45(55) | 6.95(48) | 4.06(16) | 17.03(291) |
| | **SEm±** | **0.11** | **0.11** | **0.11** | **0.13** | **0.08** | **0.35** |
| | **CD at 5%** | **0.35** | **0.35** | **0.33** | **0.41** | **0.24** | **1.06** |

**Table 2: Effect of weed control methods on weed dry weight ($gm^{-2}$) at different stages of Rice (*Oryza sativa* L.).**

| Sr. No. | Treatment | Weed dry weight ($gm^{-2}$) at 30 DAT | Weed dry weight ($gm^{-2}$) at 60 DAT | Weed dry weight ($gm^{-2}$) at 90 DAT |
|---|---|---|---|---|
| $T_1$ | Pretilachlor @1000 g ai $ha^{-1}$ (PE) | 2.61 (6.3) | 5.58 (30.6) | 6.58 (42.9) |
| $T_2$ | Pretilachlor @1000 g ai $ha^{-1}$ (PE) + Bispyribac sodium @ 25g ai $ha^{-1}$ (PoE) | 2.45 (5.5) | 4.01 (15.6) | 4.88 (23.4) |
| $T_3$ | Pretilachlor @1000 g ai $ha^{-1}$ (PE) + One hand weeding at 35 DAT | 2.02 (3.6) | 3.98 (15.4) | 4.53 (20.1) |
| $T_4$ | Bispyribac sodium @ 25g ai $ha^{-1}$ (PoE) | 3.08 (9) | 4.08 (16.2) | 5.51 (29.9) |
| $T_5$ | Bispyribac sodium @ 25g ai $ha^{-1}$ (early PoE at 25 days) + One hand weeding at 45 DAT | 2.77 (7.2) | 3.36 (10.8) | 4.71 (21.7) |
| $T_6$ | Two Hand Weeding at 20 and 40 DAT | 1.92 (3.2) | 3.38 (11) | 4.45 (19.3) |
| $T_7$ | Weed free upto 60 days | 0.71 (0) | 0.71 (0) | 2.74 (7) |
| $T_8$ | Weedy check | 7.65 (58.1) | 11.30 (127.2) | 13.76 (189.2) |
| | **SEm±** | **0.10** | **0.14** | **0.22** |
| | **CD at 5%** | **0.30** | **0.43** | **0.66** |

**Table 3: Weed control efficiency (%) and Weed index (%) at successive growth stages of rice crop as affected by weed control methods.**

| Sr. No. | Treatment | Weed control efficiency | | | Weed index |
|---|---|---|---|---|---|
| | | 30 DAT | 60DAT | 90 DAT | |
| $T_1$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE) | 89.16 | 75.94 | 77.33 | 20.79 |
| $T_2$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE) + Bispyribac sodium @ 25g ai ha$^{-1}$ (PoE) | 90.53 | 87.74 | 87.63 | 10.75 |
| $T_3$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE) + One hand weeding at 35 DAT | 93.80 | 87.89 | 89.38 | 5.38 |
| $T_4$ | Bispyribac sodium @ 25g ai ha$^{-1}$ (PoE) | 84.51 | 87.26 | 84.20 | 16.67 |
| $T_5$ | Bispyribac sodium @ 25g ai ha$^{-1}$ (early PoE at 25 days) + One hand weeding at 45 DAT | 87.61 | 91.51 | 88.53 | 7.89 |
| $T_6$ | Two Hand weeding at 20 and 40 DAT | 94.49 | 91.35 | 89.80 | 3.41 |
| $T_7$ | Weed free upto 60 days | 100.00 | 100.00 | 96.30 | 0.00 |
| $T_8$ | Weedy check | 0.00 | 0.00 | 0.00 | 37.63 |
| | **SEm±** | - | - | - | **1.31** |
| | **CD at 5%** | - | - | - | **3.99** |

**Table 4: Effect of weed control methods on crop growth attributes of Rice (*Oryza sativa* L.).**

| Sr. No. | Treatment | Plant Height (cm) | DMA (g m$^{-2}$) | No. of tillers m$^{-2}$ | LAI |
|---|---|---|---|---|---|
| | | 90 DAT | 90 DAT | 90 DAT | 90 DAT |
| $T_1$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE) | 103.00 | 903.00 | 293.00 | 4.50 |
| $T_2$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE) + Bispyribac sodium @ 25g ai ha$^{-1}$ (PoE) | 107.40 | 1012.22 | 315.00 | 5.10 |
| $T_3$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE) + One hand weeding at 35 DAT | 110.00 | 1065.97 | 320.00 | 5.40 |
| $T_4$ | Bispyribac sodium @ 25g ai ha$^{-1}$ (PoE) | 105.00 | 947.72 | 300.00 | 4.75 |
| $T_5$ | Bispyribac sodium @ 25g ai ha$^{-1}$ (early PoE at 25 days) + One hand weeding at 45 DAT | 109.00 | 1038.88 | 323.00 | 5.25 |
| $T_6$ | Two hand weeding at 20 and 40 DAT | 112.40 | 1087.04 | 328.00 | 5.50 |
| $T_7$ | Weed free upto 60 days | 115.00 | 1121.44 | 334.00 | 5.70 |
| $T_8$ | Weedy check | 86.00 | 744.76 | 244.00 | 3.60 |
| | **SEm±** | **3.30** | **54.14** | **9.59** | **0.20** |
| | **CD at 5%** | **10.10** | **164.24** | **29.09** | **0.61** |

**Table 5: Yield attributes of rice as influenced by different weed control methods.**

| Sr. No. | Treatment | No. of panicles (m$^{-2}$) | Panicle length (cm) | Panicle weight (g) | No. of grains panicle$^{-1}$ | Grain yield (q ha$^{-1}$) | Straw yield (q ha$^{-1}$) | Biological yield (q ha$^{-1}$) | Harvest index(%) |
|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE) | 271.70 | 19.80 | 1.88 | 80.00 | 43.02 | 60.80 | 103.82 | 42.42 |
| $T_2$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE) + Bispyribac sodium @ 25g ai ha$^{-1}$ (PoE) | 293.70 | 20.60 | 1.96 | 83.00 | 49.30 | 67.90 | 117.20 | 42.14 |
| $T_3$ | Pretilachlor @1000 g ai ha$^{-1}$ (PE)+ One hand weeding at 35 DAT | 299.20 | 21.00 | 2.04 | 86.00 | 53.15 | 71.15 | 124.30 | 42.72 |
| $T_4$ | Bispyribac sodium @ 25g ai ha$^{-1}$ (PoE) | 281.60 | 20.20 | 1.91 | 81.00 | 46.66 | 63.70 | 110.36 | 42.26 |
| $T_5$ | Bispyribac sodium @ 25g ai ha$^{-1}$ (early PoE at 25 days) + One hand weeding at 45 DAT | 302.50 | 20.90 | 1.96 | 83.00 | 51.23 | 69.40 | 120.63 | 42.51 |
| $T_6$ | Two hand weeding at 20 and 40 DAT | 305.80 | 21.60 | 2.04 | 86.00 | 54.26 | 72.50 | 126.76 | 42.79 |
| $T_7$ | Weed free upto 60 days | 309.10 | 21.80 | 2.09 | 88.00 | 55.06 | 74.60 | 129.66 | 42.53 |
| $T_8$ | Weedy check | 232.10 | 18.20 | 1.73 | 74.00 | 28.80 | 41.80 | 86.66 | 40.21 |
| | **SEm±** | **12.27** | **0.49** | **0.05** | **3.12** | **2.59** | **3.40** | **3.29** | **2.06** |
| | **CD at 5%** | **37.24** | **1.50** | **0.15** | **9.48** | **7.86** | **10.33** | **10.01** | **NS** |

## CONCLUSIONS

Weed free up to 60 days was most effective to control of all sorts of weeds, growth and yield of transplanted rice followed by Pretilachlor @1000 g ai ha-1 (PE) + One hand weeding at 35 DAT.

## FUTURE SCOPE

This study provides knowledge about various methods of weed control in transplanted rice and subsequent investigations should wit h made to confirm that which method and strategy should with best for transplanted rice.

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