# Herbicide molecules for the management of weeds and their effect on grain yield of rice

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## ABSTRACT

*Four new herbicides were evaluated in transplanted rice at Crop Research Center of G.B. Pant Univeristy of Agriculture and Technology, Pantnagar for the management of weeds and grain yield. The major weed species in experimental field were Echinochloa colona, E. crusgalli, Ischaemum rugosum, Cyperus iria, C. difformis, Fimbristylis dichotoma, F. miliacea, Scirpus spp., Eclipta alba, Caesulia axillaris, Commelina benghalensis and Ludwigia parviflora. All weed control treatments caused significantly higher grain yield over non-weeded control in both the years. In 2004 the post-emergence application of bensulfuron-methyl 0.05 kg ha$^{-1}$ produced grain yield 5.16 t ha$^{-1}$, which was statistically at par with two hand weeding, pre emergence (PE) trisulfuron 0.009 kg ha$^{-1}$ and bensulfuron-methyl at all the doses. In 2005 the combination of trisulfuron + pretilachlor (0.009 + 0.5 kg ha$^{-1}$) produced 5.28 t ha$^{-1}$ grain yield, 228 panicle m$^{-2}$ and 3.38 g panicle weight which was found at par to weed free, hand weeding twice and all other testing and standard herbicides. All new herbicides decreased the density and dry weight of weeds significantly over non-weeded control.*

***Key words:*** *Chemical weed management, new herbicide and rice yield*

In India about 1400 weed species of 466 genera belonging to 97 families have been found in different rice cultures in India (Moody, 1989). Weeds cause major problem in rice production, which do not only compete with crops but also hinder quality (Kathiresan, 2001). Yield reduction in transplanted rice has been reported to be 28 to 45% due to uncontrolled weeds (Raju and Reddy, 1995). Chemical method of weed control has been found to be safe, time saving and economical. Many times due to various constraints at farm level, the applicaiton of pre emergence (PE) herbicides is not possible and further, continuous use of same herbicide either as pre emergence or post emergence in same field causes resistance in weeds. Therefore, there is necessity of rotating the herbicide in transplanted rice to avoid resistance of rice weed flora and to allow farmers to choose herbicides (Pre or Post emergence) alone or tank mixture to widen weed control. The objective of this study was to evaluate the dose and time of application of new herbicides trisulfuron, bensulfuron-methyl alone and combination of trisulfuron + pretilachlor on their bioefficacy and yield of rice.

## MATERIALS AND METHODS

The experiment was carried with 16 weed control treatments (Table 1) allocated in a Randomized block design with four replications at Crop Research Center, G.B. Pant University of Agriculture and Technology, Pantnagar during wet seasons of 2004 and 2005. Two hand weeding, weed free, non-weeded control and recommended herbicide butachlor was taken to standared. The rice variety Jaya was transplanted with 2 seedlings at 20 × 20 cm spacing with recommended dose of fertilizer (120 kg N + 60 kg $P_2O_5$ + 40 kg $K_2O$ ha$^{-1}$) in both the years. For the control of *khaira* (Zn deficiency), two sprays of 0.5% zinc sulphate were done at 15 and 25 days after transplanting. There was slight incidence of stem borer which was controlled by applying Cartap hydro chloride-4 G @ 20 kg ha$^{-1}$. Observation on weeds density and dry weight were taken at 60 days after transplanting by placing a quadrate of 1 m x 1 m randomly at two places in each plot. Grain yield was expressed at 14 per cent moisture.

## RESULTS AND DISCUSSION

The major weed species in experimental field were

**Table 1. Grain yield, panicle number, panicle weight, density of weeds and dry weight of weeds as influenced by different weed control treatments**

| Treatment | Grain yield (t ha$^{-1}$) | | Panicles (m$^{-2}$) | | Panicle weight (gm) | | Density of Weeds (m$^{-2}$) | | Dry weight of weeds(g m$^{-2}$) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 |
| Weed free | 6.25 | 6.02 | 231 | 237 | 2.84 | 3.85 | 0.00 (00) | 0.00 (00) | 0.00 (00) | 0.00 (00) |
| Two hand weeding | 5.65 | 5.80 | 224 | 218 | 2.74 | 3.71 | 4.07 (58) | 3.60 (36) | 3.59 (35.88) | 3.33 (26.98) |
| Butachlor @ 1.5 kg ha$^{-1}$ (3 DAT) + 1 HW | - | 5.45 | - | 216 | - | 3.49 | - | 3.76 (47) | - | 3.42 (29.74) |
| Butachlor @ 1.0 kg ha$^{-1}$ (3 DAT) | 4.22 | - | 176 | - | 3.98 | - | 4.71 (110) | - | 4.45 (86.91) | - |
| Butachlor @ 1.5 kg ha$^{-1}$ (3 DAT) | - | 5.40 | - | 214 | - | 2.82 | - | 4.02 (56) | - | 3.55 (34.10) |
| Pretilachlor @ 0.5 kg ha$^{-1}$ (3 DAT) | 4.15 | 4.70 | 141 | 205 | 2.66 | 3.01 | 5.49 (246) | 4.68 (107) | 4.87 (141.08) | 4.42 (82.32) |
| Pretilachlor @ 0.75 kg ha$^{-1}$ (3 DAT) | 4.28 | 5.27 | 173 | 221 | 2.69 | 3.37 | 4.55 (94) | 4.02 (56) | 4.40 (81.04) | 3.60 (35.81) |
| Trisulfuron @ 0.009 kg ha$^{-1}$ (6 DAT) | 4.47 | 4.86 | 195 | 207 | 2.78 | 3.11 | 5.28 (204) | 5.12 (167) | 4.84 (130.97) | 4.43 (83.04) |
| Trisulfuron @ 0.006 kg ha$^{-1}$ (6 DAT) | 3.93 | - | 179 | - | 2.33 | - | 5.55 (257) | - | 4.98 (145.49) | - |
| Trisulfuron @ 0.009 kg ha$^{-1}$ (13 DAT) | - | 4.83 | - | 203 | - | 3.09 | - | 5.23 (187) | - | 4.48 (86.89) |
| Trisulfuron + pretilachlor (0.009 + 0.5 kg ha$^{-1}$ at 6 DAT | - | 5.28 | - | 228 | - | 3.38 | - | 4.00 (54) | - | 3.51 (32.78) |
| Bensulfuron-methyl @ 0.05 kg ha$^{-1}$ (6 DAT) | 4.93 | - | 183 | - | 2.62 | - | 5.52 (250) | - | 4.99 (146.95) | - |
| Bensulfuron-methyl @ 0.06 kg ha$^{-1}$ (6 DAT) | 4.70 | - | 187 | - | 2.71 | - | 5.52 (250) | - | 5.07 (158.64) | - |
| Bensulfuron-methyl @ 0.05 kg ha$^{-1}$ (23 DAT) | 5.16 | 4.58 | 197 | 193 | 2.80 | 2.93 | 4.45 (85) | 5.38 (216) | 3.95 (55.44) | 4.59 (97.77) |
| Bensulfuron-methyl @ 0.06 kg ha$^{-1}$ (23 DAT) | 4.90 | 4.80 | 179 | 190 | 3.01 | 3.07 | 5.37 (218) | 5.27 (195) | 4.52 (98.96) | 4.51 (90.39) |
| Non-Control | 3.46 | 3.41 | 149 | 164 | 2.38 | 2.53 | 5.79 (339) | 5.66 (277) | 5.61 (303.74) | 5.66 (286.24) |
| SEm ± | 0.26 | 0.32 | 11 | 13 | 0.24 | 0.21 | 0.07 | 0.09 | 0.16 | 0.05 |
| CD (P = 0.05) | 0.78 | 0.93 | 33 | 38 | NS | 0.61 | 0.23 | 0.27 | 0.48 | 0.14 |
| CV (%) | | | | | | | | | | |

DAT = Days after transplanting, EC = Emulsifiable concentrate, WSG = Water soluble granules, DF = Dry formulation, HW=hand weeding at 30 DAT, * = weeding at 20, 40, 60 Days after transplanting, - = treatments were not conducted. (Original values are given in parentheses)

*Echinochloa colona, E. crusgalli, Ischaemum rugosum, Cyperus iria, C. difformis, Fimbristylis dichotoma, F. miliacea, Scirpus* spp., *Eclipta alba, Caesulia axillaris, Commelina benghalensis* and *Ludwigia parviflora* (Singh *et al.*, 2003). Both density and dry weight of weeds were significantly reduced in different treatment plots as compared to non-weeded control. In wet season 2004, among the herbicidal treatments the lowest density and dry weight of weeds were recorded with application of bensulfuron-methyl 0.05 kg $ha^{-1}$ (23 DAT) which was statistically at par with application of pretilachlor 0.75 kg $ha^{-1}$. In wet season 2005, among the herbicidal treatments the lowest weed density was recorded with butachlor 1.5 kg $ha^{-1}$ + one hand weeding which was statistically at par with application of trisulfuron +pretilachlor (0.009 +0.5 kg $ha^{-1}$), butachlor 1.5 kg $ha^{-1}$ and pretilachlor 0.75 kg $ha^{-1}$. Among the herbicidal treatments the lowest dry weight of weeds was recorded with butachlor 1.5 kg $ha^{-1}$ + one hand weeding which was statistically at par with application of trisulfuron + pretilachlor (0.009+0.5 kg $ha^{-1}$), butachlor 1.5 kg $ha^{-1}$. Lowest density and dry weight of weeds was recorded in weed free and two hand weeding.

There was significant increase in number of panicles $m^{-2}$ with the imposition of weed control treatment except butachlor 1 kg $ha^{-1}$, pretilachlor at both doses, trisulfuron 0.006 kg $ha^{-1}$ and bensulfuron-methyl 0.06 kg $ha^{-1}$ (23 DAT) in 2004 and bensulfuron-methyl at both the doses in 2005. Among the herbicide the highest number of panicles was recorded in POE application of bensulfuron-methyl 0.05 kg $ha^{-1}$ in 2004 and EPOE application of trisulfuron + pretilachlor (0.009 +0.5 kg $ha^{-1}$) in 2005. The panicle weight was significant in 2005. Among the herbicides (2005) the highest panicle weight was obtained with EPOE application of trisulfuron + pretilachlor 0.009 +0.5 kg $ha^{-1}$. Highest grain yield was recorded with POE application of bensulfuron-methyl 0.05 kg $ha^{-1}$ which was on par with two hand weeding, trisulfuron 0.009 kg $ha^{-1}$ (6 DAT) and bensulfuron-methyl at all the doses (2004). In 2005 the highest grain yield was produced in weed free treatment which was at par with EPOE application of trisulfuron + pretilachlor 0.009 +0.5 kg $ha^{-1}$ + 0.5 kg $ha^{-1}$, pretilachlor 0.75 kg $ha^{-1}$ , butachlor 1.5 kg $ha^{-1}$, butachlor 1.5 kg $ha^{-1}$ + one hand weeding and two hand weedings.

Evidently, POE application of bensulfuron-methyl 0.05 kg $ha^{-1}$ and EPOE application trisulfuron + pretilachlor 0.009 +0.5 kg $ha^{-1}$ may be used in place of butachlor 1.5 kg $ha^{-1}$ and pretilachlor 0.75 kg $ha^{-1}$ in the Aquic Hapludoll soil to control rice weeds and there by increase rice yield.

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