

## Effect of Bensulfuron-methyl (Londax 60 DF) on Sedges and Non-grassy Weeds in Transplanted Rice

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### ABSTRACT

Bensulfuron-methyl at 30 to 60 g ha<sup>-1</sup> applied alone or as tank mixture with butachlor at 1.0 kg ha<sup>-1</sup> reduced the density of all the sedges as well as *Caesulia axillaris* and *Commelina benghalensis*. At higher doses of bensulfuron methyl (50 and 60 g ha<sup>-1</sup>), there was almost complete control of sedges and non-grassy weeds. The differences in grain yields due to various doses of bensulfuron-methyl were non-significant and yields were at par with weed-free treatment. Bensulfuron-methyl was compatible with butachlor with report to control of various weeds.

### INTRODUCTION

Rice is an important crop of India contributing 45% to the total food grain production. Weed management is one of the major factors, which affect rice yield. Uncontrolled weeds cause grain yield reduction upto 76% under transplanted conditions (Singh *et al.*, 2004). Therefore, timely weed control is imperative for realizing desired level of productivity. In transplanted rice, *Echinochloa colona*, *Echinochloa crusgalli*, *Ischaemum rugosum*, *Caesulia axillaris*, *Commelina* spp., *Cyperus* spp. and *Fimbristylis millacea* are found to be the major weeds. Weed shift from grasses to non-grasses and annual sedges is being observed in transplanted rice fields due to continuous use of butachlor, anilofos and pretilachlor in most of the rice growing areas of the country. These herbicides provide effective control of annual grasses when applied as pre-emergence within 3-4 days after rice transplanting. The continuous use of herbicides with similar mode of action has to be restricted to avoid undesirable weed shift. In view of above facts, it would be desirable to develop alternative herbicides which may provide wide weed control spectrum. Therefore, the present investigation was undertaken to find out the effect of bensulfuron-methyl on sedges and non-grassy weeds in transplanted rice.

### MATERIALS AND METHODS

Field trial during rainy seasons of 2002 and 2003 was conducted at the Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar to study the weed control spectrum and efficacy of bensulfuron-methyl (Londax 60 DF) with special reference to sedges and non-grassy weeds in transplanted rice. The soil was clay loam, medium in organic carbon (0.7%), available phosphorus (19 kg P ha<sup>-1</sup>) and potassium (238 kg K ha<sup>-1</sup>) with pH 7.3. Treatments consisted of various doses of bensulfuron-methyl (30, 40, 50 and 60 g ha<sup>-1</sup>) applied alone and in combination with butachlor at 1.0 kg ha<sup>-1</sup> as tank mixture, butachlor (1.0 and 1.5 kg ha<sup>-1</sup>) alone and in combination with almix (4 g a. i. ha<sup>-1</sup>), two doses of pyrazosulfuron-methyl (25 and 30 g a. i. ha<sup>-1</sup>), weed-free and weedy (Table 1). All the herbicides were applied three days after rice transplanting as spray using knapsack sprayer fitted with flat fan nozzle at spray volume of 500 l ha<sup>-1</sup>. Experiment with 14 treatments and three replications was laid out in randomized block design. Rice cv. Narendra 359 was transplanted at spacing of 20 x 15 cm on July 10, 2002 and July 3, 2003. The experimental crop was grown adopting recommended package of practices. Seeds of sedges and non-grassy weeds were sown uniformly in the experimental field prior to transplanting to ensure sufficient population of these weeds.

Table 1. Effect of bensulfuron-methyl on weeds in transplanted rice (2002)

| Treatment             | Dose<br>(g ha <sup>-1</sup> ) | Weed density (No. m <sup>-2</sup> ) |        |        |                |        |        |                    |        |        |                     |        |        |                     |        |        |                       |  |  |
|-----------------------|-------------------------------|-------------------------------------|--------|--------|----------------|--------|--------|--------------------|--------|--------|---------------------|--------|--------|---------------------|--------|--------|-----------------------|--|--|
|                       |                               | <i>Echinochloa</i> spp.             |        |        | <i>C. iria</i> |        |        | <i>F. mitataea</i> |        |        | <i>C. difformis</i> |        |        | <i>C. axillaris</i> |        |        | <i>Commelina</i> spp. |  |  |
|                       |                               | 30 DAT                              | 60 DAT | 30 DAT | 60 DAT         | 30 DAT | 60 DAT | 30 DAT             | 60 DAT | 30 DAT | 60 DAT              | 30 DAT | 60 DAT | 30 DAT              | 60 DAT | 30 DAT | 60 DAT                |  |  |
| Bensulfuron-methyl    | 30                            | 10                                  | 5      | 2      | 0              | 3      | 0      | 2                  | 0      | 2      | 0                   | 3      | 0      | 5                   | 3      | 7      | 4                     |  |  |
| Bensulfuron-methyl    | 40                            | 8                                   | 7      | 0      | 1              | 0      | 0      | 0                  | 0      | 0      | 0                   | 0      | 0      | 2                   | 0      | 5      | 2                     |  |  |
| Bensulfuron-methyl    | 50                            | 11                                  | 5      | 0      | 0              | 0      | 0      | 0                  | 0      | 0      | 0                   | 0      | 0      | 1                   | 0      | 0      | 0                     |  |  |
| Bensulfuron-methyl    | 60                            | 9                                   | 4      | 0      | 0              | 0      | 0      | 0                  | 0      | 0      | 0                   | 0      | 0      | 2                   | 0      | 0      | 0                     |  |  |
| Bensulfuron-methyl+   | 30+                           | 6                                   | 3      | 0      | 0              | 5      | 0      | 0                  | 0      | 0      | 0                   | 0      | 0      | 7                   | 4      | 9      | 6                     |  |  |
| Butachlor             | 1000                          |                                     |        |        |                |        |        |                    |        |        |                     |        |        |                     |        |        |                       |  |  |
| Bensulfuron-methyl+   | 40+                           | 5                                   | 2      | 0      | 0              | 0      | 0      | 0                  | 0      | 0      | 0                   | 0      | 0      | 4                   | 1      | 3      | 0                     |  |  |
| Butachlor             | 1000                          |                                     |        |        |                |        |        |                    |        |        |                     |        |        |                     |        |        |                       |  |  |
| Bensulfuron-methyl+   | 50+                           | 4                                   | 5      | 0      | 0              | 0      | 0      | 0                  | 0      | 0      | 0                   | 0      | 0      | 3                   | 0      | 0      | 0                     |  |  |
| Butachlor             | 1000                          |                                     |        |        |                |        |        |                    |        |        |                     |        |        |                     |        |        |                       |  |  |
| Butachlor+Almix       | 1000+4                        | 2                                   | 0      | 1      | 2              | 0      | 0      | 0                  | 2      | 0      | 0                   | 0      | 0      | 0                   | 0      | 3      | 0                     |  |  |
| Butachlor             | 1000                          | 7                                   | 4      | 24     | 27             | 15     | 11     | 9                  | 11     | 9      | 11                  | 12     | 9      | 15                  | 11     | 11     | 11                    |  |  |
| Butachlor             | 1500                          | 0                                   | 0      | 21     | 19             | 17     | 13     | 11                 | 7      | 10     | 7                   | 10     | 7      | 12                  | 9      | 12     | 9                     |  |  |
| Pyrazosulfuron-methyl | 25                            | 7                                   | 5      | 19     | 13             | 15     | 9      | 11                 | 9      | 13     | 11                  | 14     | 12     | 14                  | 12     | 14     | 12                    |  |  |
| Pyrazosulfuron-methyl | 30                            | 4                                   | 2      | 17     | 11             | 13     | 7      | 13                 | 10     | 9      | 7                   | 16     | 13     | 16                  | 13     | 16     | 13                    |  |  |
| Weed-free             | -                             | 0                                   | 0      | 0      | 0              | 0      | 0      | 0                  | 0      | 0      | 0                   | 0      | 0      | 0                   | 0      | 0      | 0                     |  |  |
| Weedy                 | -                             | 11                                  | 9      | 33     | 21             | 16     | 11     | 13                 | 9      | 11     | 15                  | 17     | 15     | 17                  | 15     | 17     | 15                    |  |  |

Table 2. Effect of bensulfuron-methyl on weeds in transplanted rice (2003)

| Treatment             | Dose<br>(g ha <sup>-1</sup> ) | Weed density (No. m <sup>-2</sup> ) |        |                |        |                    |        |                     |        |                     |        |                       |        |
|-----------------------|-------------------------------|-------------------------------------|--------|----------------|--------|--------------------|--------|---------------------|--------|---------------------|--------|-----------------------|--------|
|                       |                               | <i>Echinochloa</i> spp.             |        | <i>C. iria</i> |        | <i>F. miliacea</i> |        | <i>C. difformis</i> |        | <i>C. axillaris</i> |        | <i>Commelina</i> spp. |        |
|                       |                               | 30 DAT                              | 60 DAT | 30 DAT         | 60 DAT | 30 DAT             | 60 DAT | 30 DAT              | 60 DAT | 30 DAT              | 60 DAT | 30 DAT                | 60 DAT |
| Bensulfuron-methyl    | 30                            | 12                                  | 10     | 4              | 1      | 5                  | 2      | 1                   | 0      | 4                   | 2      | 5                     | 3      |
| Bensulfuron-methyl    | 40                            | 11                                  | 8      | 2              | 0      | 2                  | 0      | 0                   | 0      | 1                   | 1      | 6                     | 2      |
| Bensulfuron-methyl    | 50                            | 13                                  | 9      | 0              | 0      | 0                  | 0      | 0                   | 0      | 0                   | 0      | 0                     | 0      |
| Bensulfuron-methyl    | 60                            | 15                                  | 12     | 0              | 0      | 0                  | 0      | 0                   | 0      | 0                   | 0      | 0                     | 0      |
| Bensulfuron-methyl+   | 30+                           | 8                                   | 4      | 3              | 2      | 4                  | 3      | 4                   | 1      | 6                   | 3      | 7                     | 4      |
| Butachlor             | 1000                          |                                     |        |                |        |                    |        |                     |        |                     |        |                       |        |
| Bensulfuron-methyl+   | 40+                           | 7                                   | 5      | 1              | 0      | 1                  | 0      | 0                   | 0      | 0                   | 0      | 2                     | 1      |
| Butachlor             | 1000                          |                                     |        |                |        |                    |        |                     |        |                     |        |                       |        |
| Bensulfuron-methyl+   | 50+                           | 9                                   | 6      | 0              | 0      | 0                  | 0      | 0                   | 0      | 0                   | 0      | 0                     | 0      |
| Butachlor             | 1000                          |                                     |        |                |        |                    |        |                     |        |                     |        |                       |        |
| Butachlor+Almix       | 1000+4                        | 1                                   | 0      | 0              | 0      | 2                  | 0      | 0                   | 0      | 2                   | 1      | 2                     | 0      |
| Butachlor             | 1000                          | 5                                   | 3      | 19             | 17     | 11                 | 7      | 15                  | 11     | 7                   | 9      | 7                     | 9      |
| Butachlor             | 1500                          | 1                                   | 0      | 17             | 14     | 13                 | 8      | 14                  | 9      | 5                   | 2      | 10                    | 6      |
| Pyrazosulfuron-methyl | 25                            | 15                                  | 12     | 15             | 17     | 11                 | 9      | 15                  | 12     | 7                   | 5      | 7                     | 5      |
| Pyrazosulfuron-methyl | 30                            | 11                                  | 3      | 11             | 12     | 9                  | 8      | 17                  | 15     | 5                   | 5      | 8                     | 4      |
| Weed-free             | -                             | 0                                   | 0      | 0              | 0      | 0                  | 0      | 0                   | 0      | 0                   | 0      | 0                     | 0      |
| Weedy                 | -                             | 16                                  | 13     | 24             | 19     | 14                 | 9      | 17                  | 13     | 9                   | 6      | 11                    | 7      |

Table 3. Effect of bensulfuron-methyl on weed dry matter production and grain yield of transplanted rice

| Treatment             | Dose<br>(g ha <sup>-1</sup> ) | Total weed dry weight       |       | Grain yield of rice    |      |
|-----------------------|-------------------------------|-----------------------------|-------|------------------------|------|
|                       |                               | (g m <sup>-2</sup> ) 60 DAT |       | (kg ha <sup>-1</sup> ) |      |
|                       |                               | 2002                        | 2003  | 2002                   | 2003 |
| Bensulfuron-methyl    | 30                            | 6.2                         | 4.3   | 6560                   | 6938 |
| Bensulfuron-methyl    | 40                            | 5.3                         | 3.4   | 6604                   | 6942 |
| Bensulfuron-methyl    | 50                            | 2.5                         | 2.1   | 6948                   | 7025 |
| Bensulfuron-methyl    | 60                            | 1.8                         | 2.0   | 6967                   | 7042 |
| Bensulfuron-methyl+   | 30+                           | 3.8                         | 2.7   | 6604                   | 6877 |
| Butachlor             | 1000                          |                             |       |                        |      |
| Bensulfuron-methyl+   | 40+                           | 2.3                         | 1.9   | 6771                   | 7105 |
| Butachlor             | 1000                          |                             |       |                        |      |
| Bensulfuron-methyl+   | 50+                           | 1.8                         | 2.3   | 7012                   | 7185 |
| Butachlor             | 1000                          |                             |       |                        |      |
| Butachlor+Almix       | 1000+4                        | 1.3                         | 1.2   | 7125                   | 7305 |
| Butachlor             | 1000                          | 260.2                       | 242.2 | 3202                   | 3581 |
| Butachlor             | 1500                          | 253.8                       | 218.7 | 4015                   | 4240 |
| Pyrazosulfuron-methyl | 25                            | 213.8                       | 207.5 | 3385                   | 4380 |
| Pyrazosulfuron-methyl | 30                            | 211.3                       | 205.9 | 3475                   | 4833 |
| Weed-free             | -                             | 0.0                         | 0.0   | 7185                   | 7190 |
| Weedy                 | -                             | 278.8                       | 244.5 | 2805                   | 325  |
| LSD (P=0.05)          |                               |                             |       | 615                    | 580  |

## RESULTS AND DISCUSSION

### Effect on Weeds

The mean relative density in weedy plots recorded at 30 days after transplanting was 14.1, 30.0, 15.5, 15.5, 10.4 and 14.5% for *Echinochloa* spp., *Cyperus iria*, *Fimbristylis miliacea*, *Cyperus difformis*, *Caesulia axillaris*, and *Commelina* spp., respectively (Table 1). Thus, grasses constituted 14.1%, sedge 71.4% and broad leaf weeds 14.5% of the total weed population at 30 days stage. Bensulfuron-methyl at none of the doses could control *Echinochloa* spp. The density of *Echinochloa* spp. due to tank mixing of butachlor less than the recommended dose (1.0 kg ha<sup>-1</sup>) with various doses of bensulfuron-methyl was reduced in comparison to application of bensulfuron-methyl alone. It shows compatibility of tank mixing of butachlor with bensulfuron-methyl. Bensulfuron-methyl at all the doses applied alone or as tank mixture with butachlor reduced the density of all the sedges observed in the experimental field as well as

of *C. axillaris* and *C. benghalensis*. At higher doses of bensulfuron-methyl there was almost complete control of sedges and non-grassy weeds during both the years (Tables 1 and 2).

Butachlor and almix (1.0 kg+4 g ha<sup>-1</sup>) also provided effective control of *Echinochloa* spp., sedges and non-grassy weeds. Pyrazosulfuron and butachlor reduced density of grasses but not of sedges and broad leaf weeds. Effect of various treatments on total weed dry matter production was similar to that of weed density (Table 3).

### Effect on Crop

On an average, there was more than 58% reduction in the grain yield of rice due to competition with weeds in weedy plots (Table 3). All the herbicide treated plots produced grain yields significantly more than the weedy plots. Butachlor applied alone at 1.0 and 1.5 kg ha<sup>-1</sup> and pyrazosulfuron methyl at 25 and 30 g ha<sup>-1</sup> yielded significantly less than all the doses of bensulfuron-methyl whether applied alone or tank mixture with

butachlor at 1.0 kg ha<sup>-1</sup>. The poor yields in these treatments were mainly due to non-control of sedges and broad leaf weeds. The differences in grain yields due to various doses of bensulfuron-methyl were non-significant. There was marginal increase in the grain yields due to tank mixing of butachlor with bensulfuron-methyl over the application of bensulfuron-methyl. There was no phytotoxic effect

of bensulfuron-methyl at any of the doses applied alone or tank mixed with butachlor on transplanted rice crop.

#### REFERENCE

Singh, V. P., Govindra Singh and Mahendra Singh, 2004. Effect of fenoxaprop-p-ethyl on transplanted rice and associated weeds. *Indian J. Weed Sci.* **36** : 190-192.