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# Efficacy of haloxyfop, a post-emergence herbicide on weeds and yield of soybean

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## ABSTRACT

**A field experiment was conducted at G.B. Pant University of Agriculture & Technology, Pantnagar, Uttrakhand to evaluate the bio-efficacy of haloxyfop (10 EC), a post-emergence herbicide for weed control in soybean during *kharif* of 2007 and 2008. The experiment was conducted in randomized block design by taking eight treatments comprising, haloxyfop (10 EC) at 75, 100 and 125 g/ha, quizalofop 50 g/ha, fenoxaprop 100 g/ha, hand weeding (twice at 30 and 45 DAS), weed free and weedy. To evaluate the bio-efficacy of herbicides against grassy weeds, the broad leaf weeds were removed at 20 days after sowing of crop. The experimental field was mainly infested with *Eleusine indica, Digitaria sanguinalis, Eragrostis japonica and Brachiaria* species. Haloxyfop 100 g/ha was found effective when applied as post emergence to grassy weeds as compared to other treatments. This dose was found at par with haloxyfop 125 g/ha and better than Haloxyfop 75 g/ha. There was no phytotoxic effect on the crop due to haloxyfop. Untreated plot recorded 43 and 47% lower grain yield respectively in 2007 and 2008, as compared to weed free treatment. Application of fenoxaprop and quizalofop recorded comparable weed density with haloxyfop at 100 and 125 g/ha during the years.**

**Key words :** Soybean, Chemical control, Haloxyfop, Yield

Soybean (*Glycine max* L. Merril) posses a very high nutritional value. It contains about 20% oil and 40% high quality protein (as against 7.0% in rice, 12% in wheat, 10% in maize and 20-25% in other pulses). Soybean protein is rich in valuable amino acid-lycine (5%) in which most of the cereals are deficient. In addition, it contains a good amount of minerals, salts and vitamins (thiamine and riboflavin) and its sprouting grains contains a considerable amount of Vitamin C, Vitamin A in the form of precursor carotene.

Soybean is very sensitive to early weed competition. Weed infestation in soybean field may reduce yield up to 77% depending upon the intensity, nature, and the duration of weed competition (Tiwari and Kurchania 1990). Singh *et al.* (2004) has reported *Cyperus rotundus, Echinochloa colona, Commelina benghalensis* and *Celosia argentea* as major weeds in soybean field. Chhokar *et al*. (1995) reported that weed free maintenance up to 45 days after sowing resulted in 96% increase in grain yield of soybean. The crop smothers the weeds that emerge 30-40 days after sowing. During rainy season, weed control operation is not completed at the right time. Under such circumstances, use of herbicides have been found very effective. There are several pre-emergence herbicides which are commonly used for effective weed control in soybean. But, these are required within very short period of time after sowing of soybean. In monsoon season, if rains capture this critical period of application then pre emergence chemicals can not be used. This has necessitated the search of some post emergence chemicals for effective and economic control of weeds in soybean. Keeping these facts in view, this study was undertaken to evaluate the efficacy of a post emergence chemical haloxyfop for controlling the grassy weeds in soybean crop.

## MATERIALS AND METHODS

The experiment was conducted during rainy season of 2007 and 2008 at Crop Research Centre, of G.B. Pant University of Agriculture & Technology, Pantnagar, in randomized block design by taking 8 treatments consisting haloxyfop (10 EC) with three doses at 75, 100 and 125 g/ha, quizalofop (5EC) 50 g/ha, fenoxaprop (9.3 EC) 100 g/ha, two hand weeding (at 30 and 45 DAS), weedy and weed free with three replications. No adjuvants were used with any of the treatment.

Soybean crop variety *PS 1241* was sown on 8$^{th}$ July, 2007 in first season and 2$^{nd}$ July, 2008 for second season. All the herbicides were applied at 21 days after sowing of the crop using Knapsack sprayer fitted with flat fan nozzle with 750 litre water/ha. Cultural practices recommended for soybean were adopted during the crop growth period. Weed density (species wise) was counted at 30 and 45 days after sowing. Yield and yield attributes were recorded at harvest. Crop was harvested on 13$^{th}$ November, 2007 and 10$^{th}$ November, 2008 in 1$^{st}$ and 2$^{nd}$ year, respectively. To

evaluate the bio-efficacy of herbicide against grassy weeds, broad leaf weeds were removed at 20 days after sowing. Weed population and their oven dry weight were recorded at 30 and 45 days after sowing. Weed control efficiency (WCE) was computed by using formula, WCE = (X-Y/Y) x 100, where X and Y, respectively refer to oven dry weight of weeds at specific sampling in weedy check and particular treatment for which value was computed. Statistical analysis was carried out by method of Sokal and Rohlf (1981).

## RESULTS AND DISCUSSION

### Effect on weed flora

The most dominant grassy weeds species found in soybean plot (weedy check) through out the crop growth were *Eleusine indica, Echinochloa colona*, *Digitaria sanguinalis, Dactylotenium aegypticum, Eragrostis japonica* and *Brachiaria* sp. (Fig. 1). All the weed control treatments registered significantly lower number of weeds and total weed dry matter accumulation than the weedy check. The analysis of 2 years data indicated that the haloxyfop was found effective in arresting the grassy weed population and their growth. Tiwari *et al*. (2007) also reported that haloxyfop as post emergence at 100 g/ha was effective to control of grassy weeds.

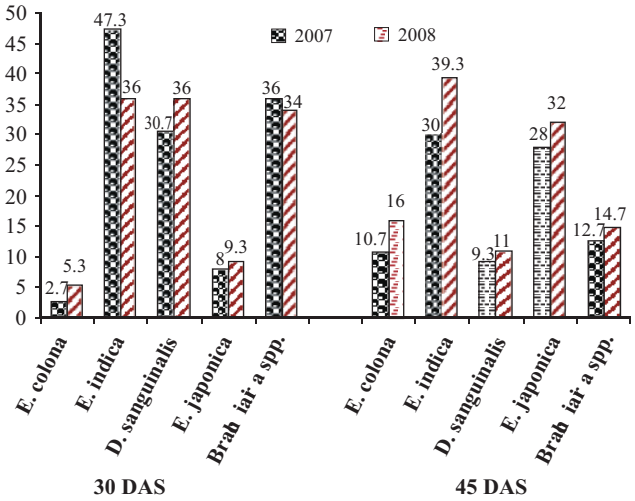


**Fig 1:** Grassy weed density at 30 and 45 days after sowing

Among the chemical treatments, it was found that haloxyfop 125 g/ha reduced the total grassy weed density up to 85% in both the years at 30 days after sowing. Among the treatments, the lowest weed density of grassy weeds was reported at 125 g/ha haloxyfop except weed free and it was also found at par with haloxyfop 100 g/ha in both the years. In first year, haloxyfop 125 g/ha was also found at par with standard check (quizalofop 5 EC 50 g/ha) but in second year, significantly lower weed density than standard check (quizalofop 5EC and fenoxaprop 9.3 EC) was observed in haloxyfop 125 g/ha at 30 and 45 days after sowing (Table 1 and 2).

In general, higher weed dry matter was recorded during first year (2007) than second year (2008) due to higher weed population in first year. Irrespective of doses, haloxyfop 10 EC 125 g/ha reduced the weed dry matter at 30 days (1.1 sq. m.) and 45 days (3.3 sq. m.) after sowing, however, the higher weed dry matter was observed in quizalofop at 30 days after sowing and in fenoxaprop 10EC at 45 days after sowing during both the years. Haloxyfop 10 EC at 125 g/ha recorded higher weed control efficiency (98.3 and 97.5 in both the years 2007 and 2008, respectively), among all the chemical treatments at 30 and 45 days after sowing (Fig. 2). Singh *et al*. (2002) also reported good weed control efficiency with haloxyfop at 100 g/ha.

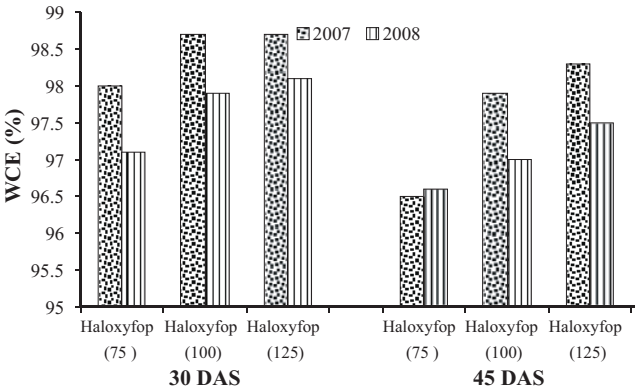


**Fig 2:** Weed control efficancy at 30 and 45 days after sowing

### Effect on crop yield and yield attributes

All the herbicide treated plots produced significantly higher grain yield than the unweeded plot. The highest grain yield was obtained in haloxyfop 100 g/ha which was found statistically equal with the yield of weed free during both the years, 2007 and 2008. Singh *et al.* (2002) reported that grain yield obtained in haloxyfop 100 g/ha treated plots was at par with weed free treatment. Among the treatments, the highest number of pods per plant was obtained in haloxyfop 100 g/ha except weed free plot in first year however, in second year, number of pods per plant in the same treatment was slightly (about 1%) less over the other higher dose of haloxyfop (Table 3).

In first year, number of grains per pod was not significantly affected by these chemical treatments, however, in second year, haloxyfop at higher doses (100 and 125 g/ha) and standard check (fenoxaprop 9.3 EC at 100 g/ha) produced equal number of grains per pod which

**Table 1. Effect of treatments on weed density, dry weight of grasses and weed control efficiency (WCE) at 30 DAS**

| Treatments | Dose (g/ha) | Grassy weed density (species wise) at 30 days | | | | | | | | | | Grassy weed density (no./m$^2$) | | Grassy weed dry wt. (g/m$^2$) | | WCE (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Echinochloa colona* | | *Eleusine indica* | | *Digitaria sanguinalis* | | *Eragrostis japonica* | | *Brachiaria* Spp. | | | | | | | |
| | | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 |
| Haloxyfop 10 EC | 75 | (0.0) 0.0 | (0.0) 0.0 | (6.7) 2.0 | (8.7) 2.2 | (24.0) 3.2 | (24.7) 3.2 | (0.0) 0.0 | (0.0) 0.0 | (2.0) 1.1 | (4.7) 1.7 | 32.7 | 38.0 | 1.9 | 2.1 | 98.0 | 97.1 |
| Haloxyfop 10 EC | 100 | (0.0) 0.0 | (0.0) 0.0 | (6.0) 1.9 | (7.3) 2.1 | (12.7) 2.6 | (13.3) 2.6 | (0.0) 0.0 | (0.0) 0.0 | (0.7) 0.4 | (2.7) 1.3 | 19.3 | 23.3 | 1.2 | 1.5 | 98.7 | 97.9 |
| Haloxyfop 10 EC | 125 | (0.0) 0.0 | (0.0) 0.0 | (4.7) 1.7 | (5.3)1.8 | (12.0) 2.6 | (10.0) 2.4 | (0.0) 0.0 | (0.0) 0.0 | (0.7) 0.4 | (2.7) 1.3 | 17.3 | 18.0 | 1.1 | 1.4 | 98.7 | 98.1 |
| Quizalofop 5 EC | 50 | (0.0) 0.0 | (0.0) 0.0 | (7.3) 2.1 | (11.3) 2.5 | (9.3) 2.3 | (10.7) 2.4 | (2.0) 0.9 | (3.3) 1.4 | (2.7) 1.1 | (6.7) 2.0 | 21.3 | 32.0 | 4.0 | 3.4 | 95.8 | 95.4 |
| Fenoxaprop 9.3 EC | 100 | (0.0) 0.0 | (0.0) 0.0 | (12.7) 2.6 | (14.7) 2.7 | (20.7) 3.0 | (22.7) 3.2 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | 28.0 | 37.3 | 2.5 | 2.7 | 97.4 | 96.4 |
| Two hand weeding | 30 and 45 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 |
| Untreated | - | (2.7) 1.0 | (5.3) 1.8 | (47.3) 3.8 | (36.0) 3.6 | (30.7) 3.4 | (36.0) 3.6 | (8.0) 2.1 | (9.3) 2.3 | (26.0) 3.3 | (34.0) 3.5 | 114.7 | 120.7 | 95.7 | 74.5 | 0.0 | - |
| Weed free | - | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | (0.0) 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 |
| LSD (P=0.0 5) | | 0.6 | 0.1 | 0.5 | 0.2 | 0.4 | 0.2 | 0.6 | 0.2 | 0.9 | 0.3 | 13.2 | 9.3 | 10.1 | 3.2 | - | - |

Figures in parenthesis are original values and transformed to log (x+1) for analysis, WCE - Weed control efficiency



**Table 2. Effect of treatments on weed density (no./m$^2$), dry weight of grasses and weed control efficiency at 45 DAS**

| Treatments | Dose (g /ha) | Grassy weed density (species wise) at 45 days | | | | | | | | | | Grassy weed density (no./m$^2$) | | Grassy weed Dry wt. (g/m$^2$) | | WCE (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Echinochloa colona* | | *Elusine indica* | | *Eragrotis japonica* | | *Brachiaria* spp. | | *D. aegyptium* | | | | | | | |
| | | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 |
| Haloxyfop 10 EC | 75 | (0.7)0.4 | (1.3)0.7 | (15.3) 2.8 | (20.7)3.1 | (16.0) 2.8 | (17.3)2.9 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | 50.7 | 39.3 | 6.9 | 5.1 | 96.5 | 96.6 |
| Haloxyfop 10 EC | 100 | (0.0)0.0 | (0.0)0.0 | (12.7) 2.6 | (15.3)2.8 | (10.7)2.5 | (13.3) 2.7 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | 37.3 | 28.7 | 4.1 | 4.4 | 97.9 | 97.0 |
| Haloxyfop 10 EC | 125 | (0.0)0.0 | (0.0)0.0 | (11.3) 2.5 | (12.7)2.6 | (10.0)2.4 | (10.7)2.4 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | 34.7 | 23.3 | 3.3 | 3.7 | 98.3 | 97.5 |
| Quizalofop 5 EC | 50 | (0.0)0.0 | (0.0)0.0 | (19.3) 3.0 | (25.3)3.3 | (8.7)2.3 | (10.0)2.4 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | 47.3 | 35.3 | 3.7 | 4.2 | 98.1 | 97.1 |
| Fenoxaprop 9.3 EC | 100 | (2.0)0.9 | (2.7)1.3 | (13.3 )2.6 | (18.0)2.9 | (16.0)2.8 | (16.0)2.8 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | 45.3 | 36.7 | 7.5 | 6.2 | 96.2 | 95.8 |
| Two hand weeding | 30 and 45 | (0.0)0.0 | (0.0)0.0 | (0.0) 0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 |
| Untreated | - | (10.7)2.4 | (16.0)2.8 | (30.0)3.4 | (39.3)3.7 | (28.0)3.4 | (32.0) 3.5 | (12.7)2.5 | (14.7)2.7 | (9.3)2.3 | (11.0)2.6 | 145.3 | 114.7 | 196.9 | 148.0 | 0.0 | - |
| Weed free | - | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | (0.0)0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 |
| LSD(P=0.0 5) | - | 0.7 | 0.5 | 0.3 | 0.2 | 0.3 | 0.2 | 0.3 | 1.0 | 0.2 | 0.1 | 8.8 | 6.6 | 43.7 | 19.4 | - | - |

Figures in parenthesis are original values and transformed to log (x+1) for analysis, WCE- Weed control efficiency

**Table 3. Effect of treatment on yield and yield attributes of soybean**

| Treatments | Dose (g /ha) | Pods | | Grains | | 1000 Grain wt. (g) | | Grain yield (kg/ha) | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 |
| Haloxyfop 10 EC | 75 | 123.5 | 126.0 | 2.5 | 2.6 | 115.0 | 117.3 | 2222 | 2188 |
| Haloxyfop 10 EC | 100 | 128.9 | 129.3 | 2.6 | 2.7 | 115.3 | 118.0 | 2367 | 2523 |
| Haloxyfop 10 EC | 125 | 116.6 | 130.7 | 2.6 | 2.7 | 115.7 | 118.0 | 2344 | 2465 |
| Quizalofop 5 EC | 50 | 110.4 | 119.3 | 2.5 | 2.5 | 115.7 | 117.7 | 2263 | 2280 |
| Fenoxaprop 9.3 EC | 100 | 110.9 | 120.7 | 2.6 | 2.7 | 107.0 | 115.3 | 2286 | 2338 |
| Two hand weeding | 30 and 45 DAS | 125.1 | 124.0 | 2.5 | 2.5 | 107.7 | 113.0 | 2176 | 2222 |
| Untreated | - | 82.1 | 91.3 | 2.2 | 2.2 | 105.3 | 108.7 | 1348 | 1331 |
| Weed free | - | 133.7 | 136.7 | 2.6 | 2.9 | 113.7 | 118.0 | 2372 | 2500 |
| LSD (P=0.05) | | 25.8 | 6.9 | NS | 0.20 | 6.7 | 3.1 | 222 | 192 |

DAS= day after sowing

were found at par with weed free plot. In second year (2008), 1000 grain weight of soybean obtained in higher doses of haloxyfop (10 EC) was found equal with 1000 grain weight obtained in weed free plot of soybean. Among the herbicidal treatments, the highest grain yield of soybean was obtained in haloxyfop at 100 g/ha which was also found more than grain yield obtained in weed free plot.

Based on two year field studies (*kharif* 2007 and 2008), it was concluded that haloxyfop at 100 g/ha is economically effective when applied as post emergence to control grassy weeds as compared to other treatments. There was no phytotoxic effect on soybean crop due to application of haloxyfop.

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