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## Evaluation of Pre-emergence Herbicides and their Application Methods for Weed Control in Soybean

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### Abstract

Four pre-emergence herbicides (pendimethalin at 1.48 kg ai/ha, oxadiazon at 0.45 kg ai/ha, trifluralin at 0.75 kg ai/ha and isoproturon at 1.0 kg ai/ha) were tested with three different methods of application, i.e., spray, sand mix broadcast and soil incorporation during spring 1992 and 1993 at NARC, Islamabad. A total of 12 weed species were recorded. The lowest weed density and weed biomass was recorded in pendimethalin treatment. Highest plant height and number of pods per plant were obtained from weed free treatment. No negative effect on the germination and growth of the crop was observed. Pendimethalin proved to be the best herbicide for weed control in soybean applied by soil incorporation method. Highest gain yield (1523 kg ha<sup>-1</sup>) was obtained from weed free treatment followed by pendimethalin (1475 kg ha<sup>-1</sup>) while the lowest yield (1127 kg ha<sup>-1</sup>) was produced in weedy check.

### Introduction

Globally, soybean [*Glycine max* (L.) Mer.] is economically and nutritionally the most important oil seed crop of the world. In Pakistan, it is non-conventionally grown on 5137 hectares producing 2885 tones grains during (Anonymous, 1994). This national yield per unit area is well below the potential yield of the recently recommended genotypes under modern soybean production technology (Aslam *et al.*, 1995). Reason for the low yield is attributed to many factors. Out of these poor weed management is the most important one. The extent of losses due to weeds, however, vary with the intensity and kind of the weed. According to Sajjapongse and Roan (1981) yield losses were 63 percent. Chandler *et al.* (1984) estimated that losses in soybean yield due to the weed infestation ranged from 90 percent in Canada to 17 percent in United States. In our country, traditionally weeds are controlled by hand weeding and very few farmers control weeds by mechanical or chemical means. Sadiq and Habib (1988) revealed that chemical weed control was more economical and efficient as compared to mechanical and hand weeding in rainfed area due to frequent and extensive rains during early growth stages. Balyan (1992) revealed that soybean yield in pendimethalin and weed free plots were at par. No doubt the chemical method of weed control can be adopted but it requires technical awareness and more initial investment. For the farmers having low capital investment ability and low technological skill, the use of herbicides becomes a limiting factor. Keeping such points in view this study was conducted to find out an efficient and economically cheaper herbicide application method for effective weed control in soybean.

### Materials and Methods

The experiment was conducted at National Agricultural Research Centre (NARC) Islamabad during spring, 1992 and 1993 (Anonymous, 1994). Soybean variety NARC-II was planted in rows 30 cm apart with single hand drill on a plot size of 2.4 x 5 m.

Recommended doses of fertilizer (25:50 NP kg ha<sup>-1</sup>) were applied at the time of sowing. Seed was inoculated at the time of sowing. Experiment was laid out in randomized split plot design with six treatments replicated three times.

Four pre-emergence herbicides pendimethalin at 1.48 kg ai/ha, oxadiazon at 0.45 kg ai/ha, trifluralin at 0.75 kg ai/ha and isoproturon at 1.0 kg ai/ha were applied with the following three different methods.

**Spray:** A hand operated nap-sack sprayer with flat fan nozzle was used.

**Sand mix broadcast:** Sand mix broadcast was carried out by mixing the herbicides with 12.5 kg/ha dry sand after sowing of the crop.

**Soil incorporated application:** The herbicides were applied before sowing of trial and were mixed in the soil.

The weed density and weed biomass was recorded using a quadrat of 25 x 25 cm after 45 days of sowing. Plant height (cm) and number of pods per plant, yield (kg ha<sup>-1</sup>) and 100 seed weight were recorded at harvest. Data over years were consistent, therefore the combined analysis of variance and least significant difference at 5 % probability level were used to test the significant means using MSTATC computer software.

### Results and Discussion

Weeds flora present in soybean during spring season experiment (Table 1) consisted of 12 weed species belonging to 10 families, these weeds were grassy, broad leaved and sedges. All the four herbicides had no negative effect on the germination of the crop. Though these herbicides controlled most of the annual grasses and broad leaved weeds but after 60 days of sowing, weeds such as *Sorghum halepense*, *Cynodon dactylon* and *Cyperus rotundus* appeared.

The effect of weed control treatments on weed density and

Table 1: Weeds flora recorded in soybean crop in spring

Local name	Botanical name	Habit	Family
Baroo	<i>Sorghum halepense</i>	Gr-P	Gramineae
Khabbal	<i>Cynodon dactylon</i>	Gr-p	Gramineae
Mama	<i>Medicago ploymorpha</i>	Bi-A	Legumiosae
Senji	<i>Mehiatus indica</i>	Bi-A	Legumiosae
Jangli haloon	<i>Coronopus didymtis</i>	Bi-A	Cruciferae
Deela	<i>Cyperusx rotundus</i>	Sdg-P	Cyperaceae
Shatra	<i>Fumaria indica</i>	BL-A	Fumariaceae
Billi booti	<i>Anagallis arvensis</i>	Bl-A	Primulaceae
Chateri Dadak	<i>Euphorbia helioscopia</i>	Br-A	Ell phort)iaceae
Dranak	<i>Polygonum plebejum</i>	Bl-A	Polygonaceae
Lill	<i>Convolvulus arvensis</i>	Bl-P	Convolvulaceae
Bathoo	<i>Chenopodium album</i>	Bl-A	Chenopodiaceae

A = Annual  
P = Perennial  
Gr = Grasses

Sdg = Sedges  
Bl = Broad leavesy

Table 2: Weed density/weed biomass, plant height and number of pods per plant as affected by herbicides in soybean

Treatment	Weed density No/m <sup>2</sup>	Weed dry biomass g/m <sup>2</sup>	Plant height (cm)	No. of pods per plant	Seed yield (kg ha)
Pendimethalin	30.67c	18.48bc	42.07bc	27.82b	1945a
Oxadiazon	40.11bc	22.90b	39.08c	28.53b	1341b
Trifluralin	45.56bc	25.90b	42.57b	27.49b	1282c
Isoproturon	58.44b	27.94b	42.31 bc	26.20b	1200d
Weed free	0.00d	0.00c	46.78a	32.98a	1523a
Weedy check	259.80a	164.60a	34.38d	20.18c	1127e

Means in a column followed by same letter are not significantly different at 5% level of significance

Table 3: Application methods and its effect on weed density/biomass and different characters in soybean

Treatment	Weed density No/m <sup>2</sup>	Weed dry biomass g/m <sup>2</sup>	Plant height (cm)	No. of pods per plant	Seed yield (kg ha <sup>-1</sup> )
Spray	71.39NS	43.61NS	42.84a	24.33b	1308c
Sand mix broad cast	76.11	42.78	40.47b	26.19b	1436b
Soil incorporate	69.78	43.50	40.28b	31.00a	1601a

Means in a column followed by same letter are not significantly different at 5 % level of significance

their dry matter accumulation as presented in the Table 2 showed that average values were significantly different from each other. Among the herbicide treatments, lowest weed density and bio-mass were recorded in pendimethalin which reveals the effectiveness of this herbicide followed by oxadiazon. The highest plant height was recorded in weed free treatment followed by pendimethalin and the lowest in weedy check (Table 2). Efficacy of herbicidal treatments on the development of pods per plants was statistically similar but significantly different from weed free and weedy check.

Effectiveness of weed control on the grain yield was evaluated through the ranked means of the treatments, Grain yield recorded in weed free and pendimethalin plots was statistically similar which means that weed control efficiency of pendimethalin was at par with weed free treatment. Our results are in accordance

with the results of Balyan (1992). Grain yield of weed free treatment gave highest yield while the lowest yield was produced by weedy check. Losses in yield were more than 35 percent. Our results are in accordance with the result of Sajjapongse and Roan (1981) and Chandler *et al.* (1984). All the herbicide application method gave better results. Data presented in Table 3 reveals that weed density and biomass as affected by application method were apparently different but statistically similar. Significantly higher plant height was noted in spray method than other two methods. However the higher number of pods/plant were recorded in-soil incorporation method. This might be due to higher mortality rate of weeds and thus crop utilized more nutrients while the spray and sand mix broad cast method remained at par. The highest yield was obtained in soil incorporation method showing the higher efficacy of this application method for weed control.

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