

Efficacy of pre and post emergence herbicides for weed control in soybean

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ABSTRACT

A field experiment was conducted at Research Farm, College of Agriculture, Tikamgarh during kharif season, 2016 to study the efficacy of pre and post emergence herbicides for weed control in soybean. The major weed species observed in the experimental area were *Cyperus rotundus*, *Cynodon dactylon*, *Brachiaria ramosa*, *Echinochloa crusgalli* and *Commelina benghalensis* as monocots whereas *Digera arvensis*, *Mollugo pentaphylla* and *Phyllanthus niruri* among dicots. The treatments comprised of pre-emergence herbicides; clomazone @ 1 kg/ha, pendimethalin @ 1 kg/ha and alachlor @ 1 kg/ha and post-emergence herbicides; imazethapyr @ 75 g/ha, imazethapyr + imazamox @ 70 g/ha, quizalofop-p-ethyl @ 50 g/ha+ chlorimuron-ethyl @ 9 g/ha, quizalofop-p-ethyl @ 50 g/ha, chlorimuron-ethyl @ 9 g/ha, two hand weeding at 20 and 40 DAS and weedy check. Hand weeding twice registered the lowest weed intensity and weed dry weight among all the treatments, whereas among herbicides imazethapyr + imazamox proved potent in reducing the weed intensity and dry weight over all other herbicidal treatments. The highest weed control efficiency was recorded under hand weeding twice at 20 and 40 DAS (92.88 %) followed by post emergence application of imazethapyr + imazamox (61.47%), whereas it was lowest under pendimethalin (24.82 %). The result of different treatments on seed yield revealed that it was significantly the highest under hand weeding twice at 20 and 40 DAS (1033 kg/ha) followed by imazethapyr + imazamox (825 kg/ha). The maximum net monetary return was recorded under imazethapyr + imazamox (Rs. 23951/ha) followed by hand weeding twice (Rs. 22950/ha) whereas it was the lowest under pendimethalin (Rs. 11718 /ha) and weedy check (Rs. 5394/ha).

Key words: Clomazone, imazethapyr, imazamox, quizalofop-p-ethyl.

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INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] is an important oilseed and legume crop. It is called as 'miracle bean or wonder crop' because it is a major source of protein, energy, polyunsaturated fat, fibers, vitamins, minerals, both for humans and livestock. Soybean seed contain 40-42% good quality protein, 18-22% oil and 17-19% carbohydrate, depending upon genetic and environmental factors [2]. In the world, the crops cover an area of about 120.73 million ha and total production 324 million tonnes. Madhya Pradesh is known as 'Soybean State' which contributes nearly 5.81 million ha area and 6.69 million tones production of soybean in the country during kharif 2014-15 with an average yield of 1150 kg/ha [1]. It grows well during the kharif or monsoon season (July-October) in the dryland areas of peninsular India. In kharif season due to continuous rains, high weed infestation and weed competition is one of the most important causes of yield loss in soybean and is estimated to be 22-77 %. To overcome the deleterious effects of weeds in soybean, it is imperative that weeds population be kept below the economic threshold level. In soybean, weed is generally managed through manual weeding and hoeing but due to intermittent rainfall during rainy season and scanty labours, timely inter culture becomes a very difficult task. Adverse weather conditions also limit the use of tools and implements for

clearing weeds in field. Under such situations, different pre and post-emergence herbicides can control annual and broad-leaved weeds effectively in soybean [8]. Herbicides combinations are more effective weapons in talking weed menace and thereby nutrient depletion by them than a single herbicide approach [5, 7]. For this purpose, several pre and post-emergence herbicides have been recommended to control the weeds in soybean, which can be applied in combinations. Hence, present investigation has been carried out to find out performance of pre and post emergence herbicides for weed control in soybean.

MATERIAL AND METHODS

The field experiment was conducted at Research Farm, College of Agriculture, Tikamgarh, Madhya Pradesh during *Kharif* season, 2016 to study the efficacy of pre and post emergence herbicides for weed control in soybean. The topography of the experimental area was fairly uniform. The field was infested with location specific weeds representative of this area. Tikamgarh is situated at 426.7 meter above the mean sea level. It falls under subtropical climatic conditions. The mean annual rainfall of the area is about 1000 mm and nearly 90% of the total annual rainfall mainly receives during the period between ends of June to end of September. The maximum and minimum temperature ranges between 34°C to 20°C, respectively and the relative humidity ranges between 80 to 90%. The soil of the experimental field was clay loam in texture having pH 7.2, electrical conductivity 0.26 ds/m and organic carbon content 0.62 percent and was low in available nitrogen (233 kg/ha), medium in available phosphorus (19.7 kg/ha) and medium in potassium (347 kg/ha). The experiment was laid down in randomized block design replicated thrice with ten weed control treatments comprised of pre-emergence herbicides; clomazone @ 1 kg/ha, pendimethalin @ 1 kg/ha and alachlor @ 1 kg/ha and post-emergence herbicides; imazethapyr @ 75 g/ha, imazethapyr + imazamox @ 70 g/ha, quizalofop-p-ethyl @ 50 g/ha+ chlorimuron-ethyl @ 9 g/ha, quizalofop-p-ethyl @ 50 g/ha, chlorimuron-ethyl @ 9 g/ha, two hand weeding at 20 and 40 DAS and weedy check. All herbicides alone and in combination were applied at 14 Days after sowing (DAS) in 500 liters of water per ha with knapsack sprayer using flat fan nozzle. Soybean variety 'JS-20-29' was sown @ 80 kg/ha on 18 July with a row spacing of 30 cm. Full dose of major plant nutrients (20 kg N+ 60 kg P₂O₅ + 20 kg K₂O/ha) was applied as basal application through urea, SSP and Muriate of potash at the time of sowing. The whole quantities of all the fertilizers were applied manually at the time of sowing in the furrows about 3 cm below the seed. The species wise weed population and weed dry weight was recorded by the quadrat (1.0 m × 1.0 m) at 45 DAS and the weed control efficiency was calculated by using the formula given by Mani et al. 1973. The data of weed density and weed dry weight were subjected to square root transformation $\sqrt{x + 0.5}$ before statistical analysis.

RESULTS AND DISCUSSION

Effect on weeds

Predominant weed species observed in the experimental field consisted of grassy weeds viz; *Brachiaria ramosa*, *Commelina benghalensis*, *Cynodon dactylon*, *Cyperus rotundus* and *Echinochloa crusgalli* and broad leaved weeds viz. *Digera arvensis*, *Mollugo pentaphylla* and *Phyllanthus niruri*. Similar weed flora in the soybean field was observed by Girothia and Thakur [3] and Jha and Soni [4].

Hand weeding twice registered the lowest weed intensity and weed dry weight among all the treatments, whereas among herbicides imazethapyr + imazamox proved potent in reducing the weed intensity and dry weight over all other herbicidal treatments (Table 1). This was due to the effectiveness of imazethapyr + imazamox against monocot and dicot weeds. Vyas and Jain [8] and Girothia and Thakur [3] also reported the similar results.

Application of post emergence imazethapyr was at par with quizalofop-ethyl + chlorimuron ethyl and these treatments registered significantly lower weed intensity and dry weight over pre emergence clomazone, pendimethalin and alachlor and post emergence quizalofop-ethyl and chlorimuron-ethyl. The conformity in views was endorsed by Meena et al. [6]. The weed control efficiency among herbicides and its combination varied from 24.82–61.47 %. The highest weed control efficiency was recorded under hand weeding twice at 20 and 40 DAS (92.88 %) followed by post emergence application of imazethapyr + imazamox (61.47%), whereas it was lowest under pendimethalin (24.82 %).

Effect on crop

Yield attributing characters viz; number of pods/plant, number of seeds/pod and 100 seed weight attained greater values under herbicidal treatments and hand weeding than weedy check. All the yield attributes attained higher values under hand weeding at 20 and 40 DAS followed by herbicidal application of imazethapyr + imazamox, quizalofop-ethyl + chlorimuron-ethyl and imazethapyr. Meena *et al.* [6] also reported that, two hand weeding at 20 and 40 DAS produced the best growth parameters and yield attributing characters followed by imazamox + imazethapyr (Table 2).

Table 1. Effect of different treatments on weed intensity, weed dry weight and weed control efficiency (%) in soybean

Treatment	Total weed intensity (per m ²) at 45 DAS	Weed dry weight (g/m ²) at 45 DAS	Weed control efficiency (%)
T ₁ - Clomazone @ 1 kg/ha	7.48 (55.70)	8.28 (68.14)	50.88
T ₂ - Pendimethalin @ 1 kg/ha	7.94 (62.52)	9.00 (80.55)	48.48
T ₃ - Alachlor @ 1 kg/ha	7.83 (60.93)	8.81 (77.18)	49.67
T ₄ - Imazethapyr @ 75 g/ha	6.34 (39.87)	5.52 (29.98)	77.17
T ₅ - Imazethapyr + Imazamox @ 70 g ha ⁻¹	5.02 (24.76)	3.52 (11.89)	86.19
T ₆ - Quizalofop-p-ethyl @ 50 g/ha	7.16 (50.77)	6.31 (39.28)	65.16
T ₇ - Chlorimuron-ethyl @ 9 g/ha	8.97 (79.93)	9.71 (93.88)	48.30
T ₈ - Quizalofop-p-ethyl @ 50 g/ha + Chlorimuron-ethyl @ 9 g/ha	6.24 (38.44)	4.61 (20.75)	76.03
T ₉ - Hand weeding (20 & 40 DAS)	1.60 (2.33)	1.26 (1.10)	97.35
T ₁₀ - Weedy check	10.53 (110.43)	12.59 (158.14)	0.00
SEm±	0.23	0.17	
CD (P=0.05)	0.69	0.51	

Data subjected to square root transformation and figure in parenthesis are the original value

Table 2. Effect of different weed control treatments on yield attributing characters, yield and economics of soybean

Treatment	Number of pods/plant	Number of seeds per pod	100 seed weight (g)	Seed yield (kg/ha)	Net monetary return
T ₁ - Clomazone @ 1 kg/ha	10.93	2.47	8.95	644	14016
T ₂ - Pendimethalin @ 1 kg/ha	10.52	2.37	8.76	586	11718
T ₃ - Alachlor @ 1 kg/ha	10.70	2.40	8.84	630	13822
T ₄ - Imazethapyr @ 75 g/ha	11.52	2.63	9.27	713	17740
T ₅ - Imazethapyr + Imazamox @ 70 g/ha	12.67	2.83	9.87	825	23951
T ₆ - Quizalofop-p-ethyl @ 50 g/ha	11.33	2.60	9.15	663	16390
T ₇ - Chlorimuron-ethyl @ 9 g/ha	10.66	2.37	8.94	588	13085
T ₈ - Quizalofop-p-ethyl @ 50 g/ha + Chlorimuron-ethyl @ 9 g/ha	12.17	2.77	9.53	733	19259
T ₉ - Hand weeding (20 & 40 DAS)	13.33	3.13	10.10	1033	22950
T ₁₀ - Weedy check	9.85	2.13	8.29	402	5394
SEm±	0.33	0.07	0.14	25	
CD (P=0.05)	0.99	0.21	0.43	74	

Data subjected to transformation and figure in parenthesis are the original value

The result of herbicidal weed control treatments on seed yield revealed that it was significantly the highest under hand weeding twice at 20 and 40 DAS (1033 kg/ha). Among the herbicides, imazethapyr + imazamox (825 kg/ha) registered significantly higher seed yield followed by quizalofop-ethyl + chlorimuron-ethyl (733 kg/ha) and imazethapyr (713 kg/ha) and these herbicidal treatments were found significantly superior over pre emergence application of clomazone (644 kg/ha), alachlor (630 kg/ha) and pendimethalin (586 kg/ha) and alone application of chlorimuron-ethyl (588 kg/ha). Dry weight of weeds at 45 DAS and yield of soybean had noticed with negative linear relationship with coefficient of determination 0.816 (Figure 1). The maximum net monetary return was recorded under imazethapyr + imazamox (Rs. 23951/ha) followed by hand weeding twice (Rs. 22950/ha) whereas it was the lowest under pendimethalin (Rs. 11718 /ha) and weedy check (Rs. 5394/ha).

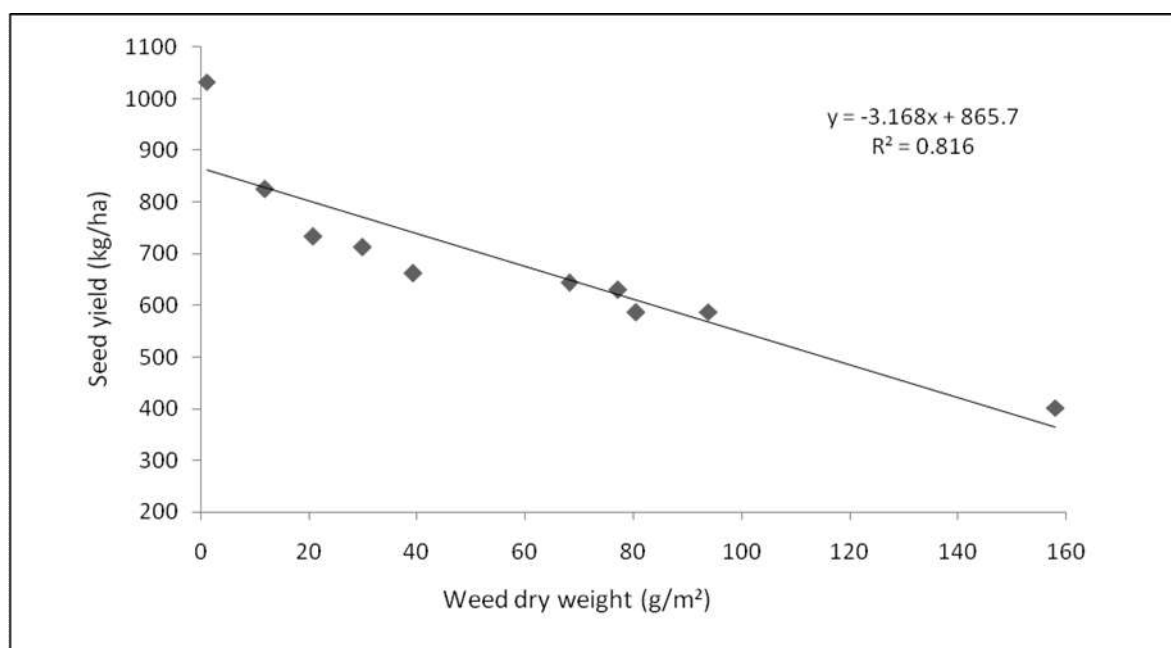


Figure 1. The relationship between seed yield of soybean and weed dry weight at 45 DAS

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