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RESEARCH NOTE

Effect of pre- and post-emergence herbicides on weeds and yield of soybean

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ABSTRACT

A field experiment was conducted at Agricultural Research Station, Ummedganj, Kota, Rajasthan during rainy *(Kharif)* season, 2019 to study the comparative efficacy of pre- and post-emergence herbicides in managing weeds and improving productivity of soybean (*Glycine max* L. Merrill). The experimental field was infested with grassy weeds (48.60%), broad-leaved weeds (39.49%) and sedges (11.91%). *Cynodon dactylon* (L.) Pers., *Eleusine indica* (L.) Gaertn., *Echinochloa crus-galli* (L.) Beauv and *Echinochloa colona* (L.) Link among grassy weeds, *Boerhavia diffusa* L. nom. cons., *Convolvulus arvensis* L., *Commelina benghalensis* L., *Digera arvensis* Forsk., *Celosia argentea* L. among broad-leaved weeds and *Cyperus rotundus* L., the sedge were major associated weeds. Maximum soybean seed yield (1800 kg/ha) and higher weed control efficiency (77.79%) were recorded with hand weeding twice at 20 and 40 days after sowing (DAS) followed by post-emergence application of sodium-acifluorfen 16.5% + clodinafop- propargyl 8% (premix) 165 + 80 g/ha (1550 kg/ha).

Keywords: Hand weeding, Herbicides, Soybean, Sodium-acifluorfen + clodinafop-propargyl, Weed management

Soybean (*Glycine max* L. Merrill) is an important oilseed and food grain legume crop in India. Soybean crop faces severe weed competition during early stages of crop growth, resulting in severe yield loss up-to 58-85%, depending on the weed intensity, nature, environmental condition and duration of weed competition (Jha *et al.* 2014). Thus, it is important to keep the crop free from weeds during the critical period to get optimal soybean yield (Kewat *et al.* 2000). Manual weeding is normally followed by farmers as it is effective, but is becoming prohibitive to use due to unavailability of adequate labourers, costly labour, greater time consumption and difficulty due to intermittent rains during the rainy season during which soybean is grown. Therefore, it is necessary, to find out the alternative methods for manage weeds during early growth period of soybean to get optimal yield economically. Herbicides were found to be economical to manage weeds. Hence, the present study was carried out to find out effective pre- and post-emergence herbicides to manage weeds in soybean.

The experiment was conducted during rainy *(Kharif)* season of 2019 at Agricultural Research Station, Ummedganj, Kota, Rajasthan. The experiment was laid out in randomized block design with eight treatments with three replications. Eight treatments include: pre-emergence application (PE) of pendimethalin 1.0 kg/ha, pendimethalin 30% EC + imazethapyr 2% SL (premix) 960 g/ha PE, post-emergence application (PoE) of sodium-acifluorfen 16.5% + clodinafop-propargyl 8% EC (premix) 165 + 80 g/ha at 20 DAS, quizalofop-ethyl 50 g/ha PoE at 20 DAS, imazethapyr 100 g/ha PoE at 20 DAS, imazethapyr 3.75% + propaquizafop 2.5% ME (premix) 50 + 75 g/ha PoE at 20 DAS, hand weeding twice at 20 and 40 days after seeding (DAS) and weedy check. The soil of the experimental field was clay loam in texture and the soil having medium fertility status. Soybean variety RKS-113 (Kota Soya-1) was used as experimental material developed at ARS, Kota (Rajasthan).

Effect on weeds

Dominating weed flora of the experimental field were: *Cynodon dactylon* (L.) Pers., *Eleusine indica* (L.) Gaertn., *Echinochloa crus-galli* (L.) Beauv and *Echinochloa colona* (L.) Link among grassy weeds, *Boerhavia diffusa* L. nom. cons., *Convolvulus arvensis* L., *Commelina benghalensis* L., *Digera arvensis* Forsk., *Celosia argentea* L. among broad-leaved weeds and *Cyperus rotundus* L., the sedge. The grassy weeds (48.60%) were more predominant than broad-leaved weeds (39.49%) and sedges (11.91%) in the experimental field. Similar observations were made earlier by Meena *et al.* (2011).

The lowest weed biomass was recorded with hand weeding twice. Among herbicide treatments,

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Table 1. Effect pre- and post-emergence (PE and PoE) herbicides on soybean yield attributing characters, yield and economics

Treatment	Pods/ plant (No.)	Seeds/ pod (No.)	Seed Yield/ plant (g)	Seed index (g)	Soybean seed yield (kg/ha)	Soybean straw yield (kg/ha)	Net returns (₹/ha)	B:C ratio
Pendimethalin 1.0 kg/ha PE	33.9	2.00	4.29	11.00	1225	1792	25350	1.07
Pendimethalin + imazethapyr (premix) 960 g/ha PE	37.2	2.13	4.85	11.20	1475	2128	34561	1.42
Sodium-acifluorfen + clodinafop-propargyl (premix) 165 + 80 g/ha PoE at 20 DAS	41.2	2.20	5.32	11.33	1550	2233	38204	1.61
Quizalofop-ethyl 50 g/ha PoE at 20 DAS	34.9	2.13	4.56	10.97	1325	1930	29370	1.24
Imazethapyr 100 g/ha PoE at 20 DAS	35.9	2.13	4.65	11.07	1425	2091	33981	1.47
Imazethapyr + propaquizafop (premix) 50+75 g/ha PoE at 20 DAS	39.5	2.13	5.21	11.10	1520	2190	36804	1.54
Hand weeding twice at 20 and 40 DAS	46.7	2.27	6.10	11.43	1800	2592	39571	1.22
Weedy check	24.1	1.93	2.82	10.93	700	1028	5859	0.26
LSD (p=0.05)	3.86	NS	0.51	NS	122.93	193.28	4921	0.20

Table 2. Effect of pre- and post-emergence (PE and PoE) herbicides on weed biomass (g/m) and weed control efficiency at 60 days after seeding (DAS)

Treatment	Biomass (g/m^2)				Weed control efficiency (%)
	Grassy weeds	Broad-leaved weeds	Sedges	Total weeds	
Pendimethalin 1.0 kg/ha PE	5.05(24.50)	4.59(20.2)	2.38(4.7)	7.09(49.3)	44.39
Pendimethalin + imazethapyr (premix) 960 g/ha PE	4.09(15.8)	3.76(13.1)	2.18(3.7)	5.80(32.6)	63.28
Sodium acifluorfen + clodinafop-propargyl (premix) 165+80 g/ha PoE at 20 DAS	4.01(15.1)	3.52(11.4)	2.04(3.2)	5.53(29.6)	66.67
Quizalofop-ethyl 50 g/ha PoE at 20 DAS	3.76(13.2)	4.81(22.1)	2.24(4.0)	6.35(39.3)	55.71
Imazethapyr 100 g/ha PoE at 20 DAS	4.48(19.1)	3.97(14.8)	2.21(3.9)	6.22(37.7)	57.52
Imazethapyr + propaquizafop (premix) 50+75 g/ha PoE at 20 DAS	4.04(15.3)	3.67(12.5)	2.18(3.8)	5.71(31.6)	64.39
Hand weeding twice at 20 and 40 DAS	3.33(10.2)	2.87(7.2)	1.81(2.3)	4.55(19.7)	77.79
Weedy check	6.87(46.3)	6.25(38.3)	2.74(6.6)	9.48(88.8)	0.00
LSD (p=0.05)	0.51	0.49	0.22	0.29	4.03

Data in parentheses are original values of weed biomass. Square root transformed value ($\sqrt{x+1}$) of weed biomass used for statistical analysis

post-emergence application of sodium-acifluorfen + clodinafop-propargyl (pre-mix) 165+80 g/ha at 20 DAS was most effective in significantly reducing the weed biomass, than the rest of herbicide treatments as also observed by Verma and Kushwaha (2019). The highest weed control efficiency at 60 DAS was recorded with hand weeding twice at 20 and 40 DAS (77.79%), followed by sodium-acifluorfen + clodinafop-propargyl (premix) 165+80 g/ha PoE at 20 DAS (66.67%).

Effect on soybean

Hand weeding twice at 20 and 40 DAS has recorded tallest plants, maximum branches/ plants, greater dry matter production, higher values of yield attributing characteristics and higher soybean straw and grain yield. Next best treatment was sodium-acifluorfen + clodinafop-propargyl (premix) 165 + 80 g/ha PoE. The current experimental findings confirmed earlier reported efficacy of hand weeding (Kamble *et al.* 2017 and Patel *et al*. 2021) and sodium-acifluorfen 16.5% + clodinafop-propargyl 8% EC (premix) 187.5 g/ha PoE (Harithavardhini *et al*. 2016 and Verma and Kushwaha 2019). The benefit: cost ratio was highest (1.61) with post-emergence application of sodium-acifluorfen + clodinafop-propargyl (pre-mix) 165 + 80 g/ha which was more remunerative than other herbicide treatments and hand weeding twice (1.22). Thus, it was concluded that hand weeding twice or sodium-acifluorfen 16.5% + clodinafop-propargyl 8% EC (pre-mix) 165 + 80 g/ha may be used for effectively managing weeds and attaining higher soybean productivity.

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