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Efficacy of post emergence herbicides in soybean (*Glycine max* (L.) Merrill)

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Abstract
The field investigation was conducted at experimental farm of Department of Agronomy, College of Agriculture, V.N.M.K.V., Parbhani (M.S), India during *Kharif* season of 2017-18 to evaluate efficacy of herbicides in soybean. The experiment was laid down in randomized block design. The treatments consisted of T_1- Propaquizafop + Imazethapyr PoE @ 75+100 g a.i /ha, T_2- Fluazifop-p-butyl + Fomesafen PoE @ 250 g a.i /ha, T_3- Imazethapyr + Quizalofop ethyl PoE @ 100+75 g a.i/ha. (Tank mix), T_4- Imazethapyr + Imazamox PoE @ 70 g a.i/ha, T_5- Diclosulam PE @ 22 g a.i/ha, T_6 - Haloxyfop + Imazethapyr PoE @ 50+100 g a.i/ha. (Tank mix), T_7- Haloxyfop PoE @ 75 g a.i /ha, T_8- Cultural practices (1HW + 1Hoeing), T_9- Weed free, T_{10}– Weedy check with the objectives to study the efficacy of herbicides in soybean. The data indicated that PoE Fluazifop-p-butyl + Fomesafen @ 250 g a.i/ha and cultural practices 1HW + 1Hoeing recorded significantly higher values of yield attributes like seed yield per plant, number of seeds per pod etc and seed yield over other chemical weed management treatments but remained statistically at par with the weed free. The lowest weed count for monocot and dicot weeds was recorded with PoE application of Fluazifop-p-butyl + Fomesafen @ 250 g a.i /ha and was comparable with weed free. Thus PoE application of Fluazifop-p-butyl + Fomesafen was found effective for weed control in soybean.

Keywords: Soybean, herbicides, weed control

Introduction
Among the various factors responsible for the low yield of soybean, weeds have been considered to be of prime importance. The losses caused by weeds exceed the losses from any other category of biotic factors like insects, nematodes, diseases, rodents etc. In soybean, the weed competition cause yield loss, to the tune of 30-80 % depending upon the type of weeds, their intensity and time of crop weed competition (Yaduraju, 2002) [5]. A large number of weed species infest the crop during *kharif* season, which results in declined production. Thus, intense weed competition is one of the main constraints in increasing soybean productivity. Weeds compete with crops for natural and applied resources besides being responsible for reducing quantity and quality of agricultural productivity (Rao *et al.* 2015) [2], harvesting difficulties as well as act as hosts for pests and pathogens. Application of weedicide is one of the best option for timely weed control. The most of herbicides presently available either pre-emergence or pre-plant incorporated and have a narrow spectrum of weed control. Further, if farmers skip application of these pre-emergence or pre- incorporated herbicides due to one or the other reason, require alternative post-emergence herbicides for managing weeds. Therefore, there is a need of new pre and post emergence herbicides which have broader spectrum of activity. Recently some new pre and post emergence herbicides have been released for weed control in soybean. Keeping these facts in view, the present investigation was undertaken during *Kharif* 2017 to evaluate the performance of herbicides in soybean at experimental farm, Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani with an objectives to study the comparative performance of the herbicides in soybean. (*Glycine max* (L.) Merrill.).

Methodology
The field experiment was conducted during *kharif* season of 2017-18 at Department of Agronomy, V.N.M.K.V., Parbhani with a view to assess the effect of herbicides on weed control, production and profitability of soybean. The experiment was laid out in randomized block design with ten treatments. Each experimental unit was of 5.4 m x 4.5 m and 4.5 m x 4.2 m in gross and net plot size, respectively. The treatments were T_1- Propaquizafop + Imazethapyr PoE @ 75+100 g a.i /ha, T_2- Fluazifop-p-butyl + Fomesafen PoE @ 250 g a.i /ha, T_3- Imazethapyr + Quizalofop ethyl PoE @ 100+75 g a.i/ha.(Tank mix), T_4- Imazethapyr + Imazamox PoE @ 70 g a.i/ha, T_5- Diclosulam PE @ 22 g a.i/ha,

T_6- Haloxyfop + Imazethapyr PoE @ 50+100 g a.i/ha.(Tank mix), T_7- Haloxyfop PoE @ 75 g a.i /ha, T_8- Cultural practices (1HW + 1Hoeing), T_9- Weed free, T_{10}– Weedy check. Sowing was done on 26th June 2017. The recommended dose of nutrients and plant protection schedule was followed. In each experimental plot, an area of a quadrate 1m X 1m was fixed and observations on monocot, dicot, and total weed population were recorded at 30,45,60,75,90 DAS and at harvest stage. Total dry matter of weeds was also recorded at the same stages.

Results

Among the weed management treatments, significantly lower weed density of monocot and dicot weeds was recorded with the PoE application of Fluazifop-p-butyl + Fomesafen @ 250 g a.i /ha (T_2), it was comparable with weed free treatment and was followed by cultural practices 1HW + 1Hoeing (T_8) and Imazethapyr + Imazomox PoE @ 70 ga.i/ha. The highest weed density was recorded in weedy check at different stages of observation. All the weed control treatments resulted in significant reduction in weed population as compared to weedy check at different growth stages. Singh *et al.* (2014) [4] also reported that effective control of grasses and non-grassy weeds with application of PoE herbicide Fluazifop-p-butyl + Fomesafen. Deshmukh *et al.* (2014) [1] also reported that lowest weed count with PoE herbicide and maximum weeds in weedy check.

The treatment weed free (T_9) recorded significantly higher seed yield plant^{-1}, number of seeds plant^{-1} over rest of treatments but it was statistically at par with Fluazifop-p-butyl + Fomesafen PoE @ 250 g a.i /ha (T_2) and Cultural practices 1 Hand Weeding + 1 Hoeing (T_8). The lowest seed yield plant^{-1} was recorded by Weedy check (T_{10}). However there were no significant differences were observed in seed index amongst different weed control treatments.

Data on seed yield of soybean indicated that among different weed management practices, Weed free treatment recorded significantly higher seed yield but remained statistically at par with post emergence application of Fluazifop-p-butyl + Fomesafen @ 250 g a.i/ha (T_2), Cultural practices 1HW + 1Hoeing (T_8) and with post emergence application of Imazethapyr + Imazomox PoE @ 70 ga.i/ha. This might be due to higher seed yield plant^{-1} which occurred from increased pod number, number of seeds plant^{-1} while the lowest number of pods plant^{-1}, number of seeds plant^{-1}, number of seeds pod^{-1}, seed yield plant^{-1} and the lowest seed yield of soybean was recorded with weedy check treatment. The results are in line with those reported by. Sangeetha *et al.* (2016) [3].

Table 1: Yield attributes of soybean as influenced by different treatments

T. No	Treatments	Seed Yield plant^{-1} (g)	No. of seeds pod^{-1}	No. of seeds plant^{-1}	Seed index (g)	Seed yield (kg ha^{-1})
T_1	Propaquizafop + Imazethapyr PoE @ 75+100 g a.i /ha	4.48	2.24	56.26	7.96	1719
T_2	Fluazifop-p-butyl + Fomesafen PoE @ 250 g a.i /ha	6.18	2.34	72.94	8.47	2418
T_3	Imazethapyr + Quizalofop ethyl PoE @ 100+75 g a.i/ha.	5.22	2.24	65.31	7.99	2025
T_4	Imazethapyr + Imazomox PoE @ 70 g a.i/ha	5.87	2.31	70.44	8.33	2294
T_5	Diclosulam PE @ 22 g a.i/ha	4.26	2.18	53.63	7.94	1617
T_6	Haloxyfop + Imazethapyr PoE @ 50+100 g a.i/ha.(Tank mix)	5.51	2.27	68.42	8.05	2144
T_7	Haloxyfop PoE @ 75 g a.i /ha	4.01	2.07	50.61	7.92	1512
T_8	Cultural practices (1HW + 1Hoeing)	5.99	2.32	71.12	8.42	2338
T_9	Weed free	6.56	2.36	78.72	8.55	2579
T_{10}	Weedy check	3.23	2.03	40.86	7.90	1220
SE +		0.22	0.44	2.60	0.29	87.23
C.D. at 5%		0.66	NS	7.74	NS	259.20
General mean		5.13	2.23	62.83	8.15	1987

Table 2: Mean weed count (m^{-2}) of monocot and dicot weeds in soybean as influenced by different treatments

Treatments	15 DAS		30 DAS		45 DAS		60 DAS		At harvest	
	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot
T_1:Propaquizafop + Imazethapyr PoE @ 75+100 g a.i /ha	21.66	12.33	17.66	12.50	20.83	13.66	23.66	19.50	28.50	24.83
T2:Fluazifop-p-butyl +Fomesafen PoE @ 250 g a.i /ha	21.33	12.50	4.00	2.33	6.50	4.16	9.83	6.66	15.33	12.16
T_3: Imazethapyr + Quizalofop ethyl PoE @ 100+75 g a.i/ha.(Tank mix)	21.33	12.66	15.16	10.83	18.83	12.50	21.16	18.83	26.50	22.66
T_4: Imazethapyr + Imazomox PoE @ 70 ga.i/ha	21.16	12.50	11.33	8.33	15.66	11.33	19.16	15.16	21.33	18.66
T_5: Diclosulam PE @ 22 ga.i/ha	9.16	7.50	19.00	15.83	24.83	15.50	26.00	19.33	30.83	25.33
T_6: Haloxyfop + Imazethapyr PoE @ 50+100 g a.i/ha.(Tank mix)	21.50	12.16	14.16	10.66	17.83	12.16	20.83	16.00	24.16	21.33
T_7: Haloxyfop PoE @ 75 g a.i /ha	21.50	12.33	17.50	13.66	21.16	12.83	25.66	20.16	24.83	29.83
T_8:Cultural practices (1HW + 1Hoeing)	21.50	12.33	4.16	2.66	6.83	4.66	15.00	10.33	18.83	16.50
T_9: Weed free	0.00	0.00	1.33	0.66	3.16	2.00	6.33	4.16	10.16	7.33
T_{10}: Weedy check	21.83	12.83	35.83	29.16	50.66	43.66	64.33	57.16	70.16	64.50

Conclusion

Among the chemical weed management practices post emergence application of Fluazifop-p-butyl + Fomesafen @ 250 g a.i /ha recorded significantly higher values of yield attributes and seed yield with lower weed density of monocot and dicot weeds as compared to rest of treatments under study and was comparable with weed free, Cultural practices (1HW + 1Hoeing) and post emergence application of Imazethapyr + Imazomox PoE @ 70 g a.i/ha.

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