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Effect of weed management practices on weed flora, density, weed control efficiency and yield of soybean under agro-climatic situation of Chhattisgarh

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ABSTRACT

A field experiment was conducted during the rainy season of 2004 at the Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalya, Raipur (C.G.) to study the performance of herbicides for weed dynamics in soybean under agro-climatic situation of Chhattisgarh state. The soybean variety JS-335 was grown as test crop. The experiment consisted fourteen weed management practices with three replications. In the experimental field, *Cynotis axillaries, Brachiaria ramosa, Cyperus rotundus, Echinochloa colona, Phyllanthus niruri* were the dominant weeds and were found throughout the crop growth period. The weed dry matter accumulation was significantly highest in unweeded check. Application of metribuzin attributed to their effective weed killing capacity during the early crop growth period and supplementation of imazethapyr at 22 DAS to metribuzin treatments further helped in weed control by reducing weed population and dry matter accumulation. Seed yield and stalk yield was maximum under metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1}. Maximum weed index were noticed under unweeded control where as minimum weed index were registered under metribuzin 300 g ha^{-1} fb quizalofop 80 g ha^{-1}. The maximum weed control efficiency was recorded under metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1}, which was followed by hand weeding and imazethapyr 80 g ha^{-1} fb quizalofop 50 g ha^{-1}.

Key words : Weed flora, Weed density, Weed control efficiency and yield of soybean, Weed management practice

INTRODUCTION

Soybean (*Glycine max L.*) is a major *Kharif* oilseed crop grown mainly in sandy loam to clay loam soils in Chhattisgarh which, by virtue of their water holding capacity, do not turn up in working condition, hindering the timely weeding and intercultural operation. Weed flush come at the same time in almost all the *Kharif* crops, which also restrict the availability of manpower for weeding operation in this crop. Intermittent rains during *Kharif* season leads to heavy infestation resulting in 35-80 % loss in yield (Billore *et al.,* 1999). Meena and Jadan (2009) reported that application of herbicide significantly reduced the weed density and its dry biomass at 30 and 60 DAS. The maximum weed control efficiency of 82.3 % at 30 DAS and 88.2 % at 60 DAS was recorded in hand weeding twice at 20 and 40 DAS followed by clomazone ethyl (1.0 kgh^{-1}) + HW once (81.5%) at 30 DAS and quizalofop ethyl (50 kgh^{-1}) + chlorimuron ethyl (9 gha^{-1}) (83.9%) at 60 DAS manual weeding in the best option for weed control but due to intermittent rains it is delayed and same times becomes very costly. Herbicides are effective only to certain group of weeds and for a limited period, Hence, as attempt was made to find out the effect of different weedicides like metribuzin, chlorimuron, imazethapyr, quizalofop and fenoxaprop on weed dry weight and weed control efficiency of soybean.

MATERIALS AND METHODS

The field experiment was conducted during *Kharif* season of 2004 at the Instructional Farm, Indira Gandhi Krishi Vishwavidyalya, Raipur (C.G.). The soil of experimental field was clayey in texture (Vertisol). The chemical composition of field soil was pH 7.14, electrical conductivity 0.17 dsm^{-1}, available N 217.35 kg ha^{-1}, available P_2O_5 14.10 kg $ha^{-1}$and available K_2O 365.27 kg ha^{-1}. The experiment was laid out in Randomized Block Design of with three replications consisted of fourteen weed management practices *viz.,* the treatments metribuzin @ 300 g ha^{-1} as (PE), imazethapyr @ 80 g ha^{-1} (PE), metribuzin @ 300 g ha^{-1} (PE) fb quizalofop @ 50 g ha^{-1} (POE), metribuzin @ 300 g ha^{-1} (PE) fb fenoxaprop @ 80 g ha^{-1} (POE), imazethapyr @ 80 g ha^{-1} (PE) fb fenoxaprop @ 80 g ha^{-1} (POE), imazethapyr @ 80 g ha^{-1} (PE) fb quizalofop @ 50 g ha^{-1} (POE), chlorimuron @ 4 g ha^{-1} (POE), chlorimuron @ 4 g ha^{-1} + fenoxaprop @ 80 g ha^{-1} (POE), chlorimuron @ 4 g ha^{-1} + quizalofop @ 50 g ha^{-1} (POE), fenoxaprop @ 80 g ha^{-1} (POE), quizalofop @ 50 g ha^{-1} (POE), hand weeding at 40 DAS, hoeing at 40 DAS and unweeded control. The soybean variety 'JS-335' was taken as test crop. The crop was sown during first week of July. The fertilizers N, P_2O_5 and K_2O were applied @ 20, 50 and 20 kg ha^{-1}, respectively.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads:

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Dry matter production of weeds:

At 20 DAS, metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1} allowed minimum dry matter production of weeds which was significantly lower than rest of the treatments except metribuzin 300 g ha^{-1} fb fenoxaprop 80 g ha^{-1}. At 40 DAS, metribuzin 300 gha^{-1} fb quizalofop 50 gha^{-1} proved to be the best in reducing dry matter production of weeds. At 60 and 80 DAS, hand weeding at 40 DAS was found significantly superior to rest of the treatments in alleviating dry matter production of weeds. On the other hand, at harvest, imazethapyr 80 gha^{-1} fb quizalofop 50 gha^{-1} was found most effective in reducing dry matter production of weeds. It was also noted that, through out the period of investigation dry matter production of weeds was maximum under unweeded control. In case of weed dry matter accumulation, at all the time interval (20, 40 DAS) and treatment metribuzin @ 300 g ha^{-1} fb quizalofop 50 g ha^{-1}, hand weeding (60, 80 and at harvest) proved better in minimizing dry matter accumulation of weed. The weed dry matter accumulation was significantly highest in unweeded check which was due to absence of suitable weed management practices. Application of metribuzin attributed to their effective weed killing capacity during the early crop growth period and supplementation of imazethapyr at 22 DAS to metribuzin treatments further helped in weed control by reducing weed population and dry matter accumulation. The results are conformity with the finding by Singh and Singh (1992).

Weed density:

The weed density recorded at 20, 40, 60, 80 and at harvest. Weed management practices had a remarkable effect on weed density. *Brachiaria ramosa, Cynotis axillaris, Phyllanthus niruri, Cyperus rotundus, Echinochloa colona* were major weeds in the experimental field. Maximum weed density of these weeds was observed through out the period of investigation under unweeded control. Minimum density of weeds was observed under metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1}, upto 80 DAS. At harvest metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1}, imazethapyr 80 g ha^{-1} fb fenoxaprop 80 g ha^{-1} and imazethapyr 80 g ha^{-1} fb quizalofop 50 g ha^{-1} were found more effective in reducing weed density of weeds than other treatments. All the weed species *i.e. Cynotis, Brachiaria, Cyperus, Echinochloa* and *Phyllanthus* were remarkably reduced under metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1}, metribuzin 300 g ha^{-1} fb fenoxaprop 80 g ha^{-1}, imazethapyr

Table 1 :Effect of different weed management practices on weed dry weight and weed density at different growth stage in soybean

Treatments	Total weed dry weight (gm^{-2})					Weed density(m/m^2)				
	20 DAS	40 DAS	60 DAS	80 DAS	At harvest	20 DAS	40 DAS	60 DAS	80 DAS	At harvest
T_1 - Metribuzin 300 g ha^{-1}	6.81	33.13	74.69	133.49	148.85	49.69	62.18	71.16	76.10	61.02
T_2 - Imazethapyr 80 g ha^{-1}	15.03	38.68	83.54	162.68	161.27	65.46	49.34	62.42	70.03	50.56
T_3 - Metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1}	3.63	13.25	41.76	91.21	73.34	27.10	23.85	32.13	40.29	25.42
T_4 - Metribuzin 300 g ha^{-1} fb fenoxaprop 80 g ha^{-1}	4.08	18.63	44.31	97.00	80.47	36.74	29.73	36.15	46.13	29.10
T_5 - Imazethapyr 80 g ha^{-1} fb fenoxaprop 80 g ha^{-1}	13.56	16.23	40.70	91.77	70.90	49.52	34.60	37.93	46.35	25.19
T_6 - Imazethapyr 80 g ha^{-1} fb quizalofop 50 g ha^{-1}	13.12	16.66	41.47	69.51	55.33	43.63	39.87	44.96	41.16	24.51
T_7 - Chlorimuron 4 g ha^{-1}	16.93	51.32	88.58	139.78	123.77	70.60	75.78	86.32	80.62	53.30
T_8 - Chlorimuron 4 g ha^{-1} + fenoxaprop 80 g ha^{-1}	14.60	33.79	70.88	132.70	137.02	62.38	54.62	59.69	65.42	46.55
T_9 - Chlorimuron 4 g ha^{-1} + quizalofop 50 g ha^{-1}	16.13	26.09	61.71	101.08	129.08	67.23	50.88	60.26	52.87	44.69
T_{10} - Fenoxaprop 80 g ha^{-1}	15.19	26.80	61.39	103.31	119.95	62.80	53.87	59.21	58.15	42.79
T_{11} - Quizalofop 50 g ha^{-1}	16.26	34.27	61.53	136.70	137.08	68.02	64.47	60.93	71.07	51.00
T_{12} - Hand weeding	22.40	51.45	6.97	44.30	88.63	70.51	43.17	47.33	50.82	42.60
T_{13} – Hoeing	21.65	56.19	10.82	56.72	89.38	69.47	35.88	46.74	46.87	45.67
T_{14} - Unweeded control	26.65	68.80	140.46	224.16	140.65	103.97	117.15	130.71	129.98	89.60
S.E.±	0.19	0.22	0.27	0.66	1.19					
C.D. (P=0.05)	0.58	0.67	0.80	1.93	3.48					

80 g ha^{-1} fb fenoxaprop 80 g ha^{-1} and imazethapyr 80 g ha^{-1} fb quizalofop 50 g ha^{-1} upto 40 DAS and hand weeding at 40 DAS, and T_{13}-Hoeing at 40 DAS were also effective in reducing weed density of these weeds at 60 DAS onward. The weed species namely *Brachiaria ramosa, Phyllanthus niruri, Cynotis axillaris, Echinochloa colona, Cyperus rotundus* consisted the bulk of the weed flora in unweeded check and dominant through the crop growth period. Mishra and Bhan (1996) and Rani and Ramaiah (1998) also identified similar type of weed flora in soybean crop. Application of metribuzin @ 300 g ha^{-1} fb quizalofop 50 g ha^{-1} treatment proved better in minimizing the total weed population at 20, 40, 60, 80 DAS and at harvest. Similar results have also been reported by Hallstead and Harvey (1986). Singh *et al.* (1991) also noted that acceptable control of weeds with metribuzin at 0.5 kg ha^{-1} and found better than other herbicides.

Seed yield:

The maximum seed yield was produced under metribuzin @ 300 g ha^{-1} fb quizalofop @ 50 g ha^{-1} (23.50 q ha^{-1}) as compared to other weed management practices (Table 2). Minimum seed yield was observed under unweeded control (7.44 q ha^{-1}), which was significantly lower than rest of the treatments. This might be due to high growth and yield attributes as well as low crop-weed competition under these treatments. High growth in terms of LAI produced large amount of photosynthetic which acts as source and helped in developed of high yield attributes. The capacity of plants to produce seed yield depends not only on the size of photosynthetic system, it's efficiently and length of the time for which it is active but also on translocation of dry matter in to the economic sink. The final build up of yield is the cumulative function of yield components. The results are conformity with the finding by Billore *et al.* (1999). Amongst weed management practice, metribuzin @ 300 g ha^{-1} fb quizalofop @ 50 g ha^{-1} produced the maximum stalk yield of (55.19 q ha^{-1}). All the herbicides alone or in combination were significantly superior to unweeded control. This was due to better suppression of weeds, more availability of nutrients, production of higher crop growth and favorable influence on sink capacity and its effective translocation towards the maximum seed and pod $plant^{-1}$ under metribuzin @ 300 g ha^{-1} fb quizalofop @ 50 g ha^{-1}. The similar result were also reported by Dubey (1995).

Weed index:

Weed index indicate the reduction in yield due to

Table 2: Effect of different weed management practices on yield and weed control efficiency at different growth stages of soybean

Treatments	Seed yield (q ha^{-1})	Straw yield (q ha^{-1})	Weed index (%)	Weed control efficiency (%)				
				20 DAS	40 DAS	60 DAS	80 DAS	At harvest
T_1 - Metribuzin 300 g ha^{-1}	21.76	48.98	7.40	74.44	51.84	46.82	40.45	38.14
T_2 - Imazethapyr 80 g ha^{-1}	19.62	48.06	16.57	43.60	43.77	40.52	27.69	32.98
T_3 - Metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1}	23.50	55.81	-	86.37	80.74	70.26	59.31	69.52
T_4 - Metribuzin 300 g ha^{-1} fb fenoxaprop 80 g ha^{-1}	23.13	55.19	1.57	84.68	72.92	68.45	56.73	66.56
T_5 - Imazethapyr 80 g ha^{-1} fb fenoxaprop 80 g ha^{-1}	22.76	53.95	3.14	49.11	76.48	71.02	59.06	70.53
T_6 - Imazethapyr 80 g ha^{-1} fb quizalofop 50 g ha^{-1}	22.45	51.78	4.46	50.76	75.78	70.47	68.99	77.00
T_7 - Chlorimuron 4 g ha^{-1}	13.95	37.21	40.63	36.47	25.40	36.93	37.64	48.56
T_8 - Chlorimuron 4 g ha^{-1} + fenoxaprop 80 g ha^{-1}	13.70	36.15	41.70	45.21	50.88	49.53	40.80	43.06
T_9 - Chlorimuron 4 g ha^{-1} + quizalofop 50 g ha^{-1}	13.08	34.10	44.34	39.47	62.07	56.06	54.90	46.36
T_{10} - Fenoxaprop 80 g ha^{-1}	9.67	31.93	58.85	43.00	61.05	56.29	53.91	50.17
T_{11} - Quizalofop 50 g ha^{-1}	8.99	28.52	61.74	38.98	50.18	56.19	39.01	43.03
T_{12} - Hand weeding	15.25	39.69	35.10	15.95	25.22	95.03	80.23	65.17
T_{13} – Hoeing	14.69	39.07	37.48	18.76	18.33	92.29	77.37	62.69
T_{14} - Unweeded control	7.44	25.11	66.34	-	-	-	-	-
S.E.±	1.52	3.35						
C.D. (P=0.05)	4.43	9.73						

weed competition as compared to the maximum attained seed yield. Weed index had remarkably influenced by weed management practices. Maximum weed index were noticed under unweeded control (66.34%) where as minimum weed index were registered under metribuzin 300 g ha^{-1} fb quizalofop 80 g ha^{-1}. It was observed that the weed index was substantially lowered when either metribuzin or imazethapyr was supplemented with post-emergence application of either quizalofop or fenoxaprop-p-ethyl. One hand weeding as well as one hoeing showed weed index in the range of 35.10 to 37.48 per cent. It might be due to the fact that there was minimum yield under unweeded control.

Weed control efficiency:

The weed control efficiency was recorded at 20, 40, 60 80 DAS and at harvest. In the initial period of 40 DAS, the maximum weed control efficiency was noted under application of metribuzin 300 g ha^{-1} fb quizalofop 50 g ha^{-1}. Whereas, during later stages *i.e.* 60 DAS, 80 DAS and at harvest, maximum weed control efficiency was observed under hand weeding, hoeing and imazethapyr 80 g ha^{-1} fb quizalofop 50 g ha^{-1}, respectively. It was also noted that there was enhancement in weed control efficiency due to herbicides applied either in sequence or tank mixed. Weed control efficiency is directly proportional to dry matter production of weed. Maximum weed control efficiency under application of pre-emergence herbicide metribuzin @ 300 g ha^{-1} fb quizalofop 50 g ha^{-1} at 20 and 40 DAS and hand weeding at 60 and 80 DAS. This might be owing to less dry matter production and population of weed in the above treatment.

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