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Effect of Weed Management Practices on Weed Control Efficiency in Soybean and Pigeonpea Intercropping System

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ABSTRACT: The present investigation was carried at Research Farm of R.A.K. College of Agriculture, Sehore (Madhya Pradesh), during *kharif* 2016. Major objective of the investigation was to evaluate effect of weed management practices on associated weed flora in soybean + pigeonpea intercropping system. A very limited work on weed management in soybean + pigeon pea intercropping has been done as an application of herbicide. Six weed control practices were evaluated in randomized block design with three replications. The results of present study revealed that hand weeding twice at 30 and 45 DAS recorded least weed index and highest weed control efficiency followed by application of imazethapyr 35% + imazemox 35% 70 WG 70 g/ha at 20 DAS (PoE) and pendimethalin 30 EC 1 kg/ha (PE) *fb* imazethapyr 10 SL 100 g/ha (PoE). Present study helped in finding suitable weed control practices in soybean + pigeonpea intercropping system.

Keywords: Weed management, Weed control efficiency, Weed density, Intercropping, Herbicides.

INTRODUCTION

Soybean + pigeonpea is important intercropping system, particularly in rainfed ecosystem and has been successfully introduced of Madhya Pradesh particularly in Malwa and Vindhyan plateau. The system is being a rich and cheaper source of high quality protein (soybean-40%, pigeonpea-22%), and edible oil (soybean-20%) for the ever-increasing population, fetches higher price than other *kharif* crops to farmers and also is good cover and helps in improving soil health. Weed suppression and reduction of weed growth by crop interference, have been referred as one determinant of yield advantage of intercropping. Suitable intercropping systems are useful to increase the total production through efficient utilization of production factor. There are several constraints in the soybean and pigeonpea intercropping system one of them is weeds which often pose serious problems. Weeds compete with crop plants for moisture, nutrients, light and space. In addition, they also serve as an alternate host for several insect pests and diseases. In soybean, if weed are not control in time, they caused yield reduction in the ranged of 58 to 85 per cent, depending upon the types and intensity of weeds (Kewat *et al*., 2000). In rainy season, weeds come in 2-3 flushes and growth is very fast, therefore, they compete for light, nutrient and space are responsible for considerable reduction in yield which is reported upto 55-60% in pigeonpea (Kandasamy, 1999). Pigeonpea is grown during rainy season, slow initial growth and sowing at wider spacing, weed infestation in pigeonpea more severe as compared to other pulses at the initial period of growth and the crop requires due attention towards weed control at intialperiod. However, grain yield losses were only 38.19% in soybean+ pigeonpea intercropping system (Talnikar *et al*., 2008).

Manual weeding during critical growth stages is sometimes not possible due to uncertain weather, soil condition and labour problems (Jadhav, 2015). Under such circumstances use of herbicides in combination with cultural practices can offer cost effective weed control in pigeonpea and soybean intercropping system (Iranna *et al*., 2018).

MATERIAL AND METHODS

The experiment was conducted at the Research Farm of R.A.K. College of Agriculture, Sehore (Madhya Pradesh), during *kharif* 2016. The regions soils are medium to deep in depth, black in colour. The soil in the experimental field was, neutral in reaction (pH 7.6) with a medium OC content (0.60%), and EC (0.39 dS/m) and analyzed low in available nitrogen (218 kg/ha), Medium in available phosphorus (16 kg/ha), and high in available potassium (418 kg/ha). Total rainfall during the crop season was 1976.7 mm. The field experiment consisted with 6 treatments and they were tested in randomized block design with 3 replications. The details of the treatments are presented in Table 1.

Table 1: Treatments details of the experiment.

Sr. No.	Treatment Details
T_1	Weedy check
T_2	Two hand weeding at 30 & 45 DAS
T_3	Imazethapyr 10% SL @ 100 g a.i./ha at 20 DAS (PoE)
T_4	Imazethapyr 35% + Imazamox 35% 70 WG (Pre-mix formulation) @ 70 g a.i./ha at 20 DAS (PoE)
T_5	Pendimethalin 30% EC @ 1.00 kg a.i./ha (PE)
T_6	Pendimethalin 30% EC @ 1000 g a.i./ha (PE)*fb* Imazethapyr 10% SL 100 g a.i./ha at 30 DAS (PoE)

Soybean variety JS 95-60 and pigeonpea pea varietyJKM-189 were sown in intercropping system of row ratio 4:2 respectively. Best management practices were adopted as per recommended for both crops in Madhya Pradesh. The observations on weeds were recorded species wise at different time intervals. The observations on weeds were taken manually by using quadrat of 0.25 square meter (0.5 m × 0.5 m). Quadrat was randomly placed at 4 different places in weed infested plots to calculate the weed indices. The different weed indices were worked out as per the following formulas suggested by Kewat and Jha (2018).

$$\text{Weed density/m}^2 = \frac{\text{Total number of weeds in all quadrates}}{\text{Total number of quadrats studied}}$$

$$\text{Relative density (\%)} = \frac{\text{Total number of individuals of a given weed species}}{\text{Total number of individuals of all species}} \times 100$$

$$\text{Weed index (\%)} = \frac{\text{Yield from weed free plot} - \text{Yield from treated plots}}{\text{Yield from weed free plot}} \times 100$$

$$\text{Weed control efficiency (\%)} = \frac{\text{WCU} - \text{WCT}}{\text{WCU}} \times 100$$

Where,

WCU = Weed count in untreated plots; WCT = Weed count in treated plots

The data of the experiment were analyzed by using OPSTAT software (Sheoran *et al.,* 1998).

RESULTS AND DISCUSSION

A. Weed flora of experimental weedy check plot

Weed density was recorded in weedy plot on 40 DAS stage is presented in Table 2. The *Cyperus rotundus* was the most dominant weed, sharing 38.71% of total weed population, while *Dinebra retroflexa* with 21.66 % share was second in order followed by *Digera arvensis, Echinochloa crusgalli, Alternanthera sessilis, Acalypha indica, Commelina benghalensis and Eclipta Alba* with 10.60, 7.37, 7.37, 7.37, 6.45, and 0.46 percent share, respectively. Similar weed flora was reported by Keer *et al.* (2020); Vyas and Kushwah (2008).

B. Effect of weed control practices on weed density

The effect of various weed control treatments on the weed density was analyzed statistically and presented in Table 3 and 4. Total weed density significantly varied due to weed control treatments at 20, 40 and 60 DAS. At 20 DAS, minimum population of total weeds was recorded in pendimethalin 30 EC @ 1 kg/ha (PE) (T_5) which was at par to treatment pendimethalin 30 EC EC @ 1kg/ha (PE) *fb* imazethapyr 10 SL @ 100 g/ha (T_6).At 40 and 60 DAS, total weed density was observed minimum in treatment two hand weeding (T_2).Among herbicidal treatments minimum weed density was recorded in Imazethapyr 35% + Imazamox 35% 70 WG (Pre-mix) @ 70 g a.i./ha (T_4) which was at par with treatment pendimethalin 30 EC@ 1kg/ha (PE) *fb* imazethapyr 10 SL @ 100 g/ha (T_6). Imazethapyr 35% + imazemox35% 70 WG @ 70 g/ha, controlled both emerged and flush of shallow germinating weeds, absorbed from the leaf surface, with translocation throughout the plant, moving in both the xylem and phloem, and accumulating in the meristematic tissues were more effective to dicot weeds. Similar results were reported by Padmaja *et al.* (2013); Rao *et al*. (2015); Namdeo *et al.* (2022).

Table 2: Species wise weed density and relative density in weedy check plot.

Sr. No.	Scientific name	Common name	Weed density (0.25 m²)	Relative Density (%)
Monocot weeds				
1.	*Cyperus rotundus*	Nut grass	42.00	38.71
2.	*Dinebra retroflexa*	Viper grass	23.5	21.66
3.	*Echinochloa crusgalli*	Barn yard grass	8.00	7.37
4.	*Commelina benghalensis*	Day flower	7.00	6.45
	Total monocot weeds		**80.5**	**74.19**
Dicot weeds				
5.	*Digera arvensis*	Amaranthus	11.50	10.60
6.	*Alternanthera sessilis*	Dwarf copper leaf	8.00	7.37
7.	*Acalypha indica*	Indian nettle	8.00	7.37
8.	*Eclipta alba*	False daisy	0.50	0.46
	Total dicot weeds		**28.00**	**25.81**
	Total weeds		**108.5**	**100**

Table 3: Density of monocot weeds, dicot weeds and sedges as influenced by weed control treatments in soybean: pigeonpea intercropping system at different stages.

Treatments		Monocot weeds (0.25 m²)			Dicot weeds (0.25 m²)			Sedges (0.25 m²)		
		20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
T_1	Weedy check	4.50 (2.24)	12.83 (3.65)	16.83 (4.15)	6.33 (2.61)	9.33 (3.13)	8.33 (2.97)	13.33 (3.71)	14.00 (3.81)	16.83 (4.16)
T_2	Two hand weeding at 30 & 45 DAS	5.00 (2.35)	0.50 (0.98)	1.50 (1.41)	6.67 (2.66)	2.17 (1.63)	2.00 (1.56)	11.17 (3.41)	6.00 (2.49)	6.83 (2.69)
T_3	Imazethapyr 10% SL @ 100 g a.i./ha 20 DAS (PoE)	4.67 (2.26)	6.33 (2.57)	10.00 (3.22)	5.83 (2.51)	4.50 (2.23)	6.50 (2.58)	12.67 (3.62)	11.67 (3.48)	10.00 (3.23)
T_4	Imazethapyr 35% + Imazamox 35% 70 WG (Pre-mix) @ 70 g a.i./ha at 20 DAS (PoE)	4.17 (2.16)	1.67 (1.47)	1.83 (1.43)	5.50 (2.43)	3.50 (1.95)	4.00 (2.11)	12.17 (3.56)	10.33 (3.28)	7.83 (2.89)
T_5	Pendimethalin 30% EC @ 1.00 kg a.i./ha (PE)	1.67 (1.47)	7.83 (2.89)	12.17 (3.56)	1.17 (1.23)	5.50 (2.44)	6.50 (2.64)	8.17 (2.92)	13.83 (3.75)	13.33 (3.71)
T_6	Pendimethalin 30% EC @ 1000 g a.i./ha (PE)*fb*Imazethapyr 10% SL 100 g a.i./ha at 30 DAS (PoE)	1.67 (1.46)	2.17 (1.62)	4.50 (2.19)	1.83 (1.44)	4.17 (2.16)	5.17 (2.34)	9.17 (3.11)	11.33 (3.43)	9.33 (3.09)
	S.Em ±	**(0.12)**	**(0.17)**	**(0.25)**	**(0.26)**	**(0.16)**	**(0.25)**	**(0.16)**	**(0.25)**	**(0.18)**
	C.D at 5%	**(0.37)**	**(0.54)**	**(0.80)**	**(0.81)**	**(0.50)**	**(0.79)**	**(0.52)**	**(0.79)**	**(0.58)**

Note: Figures in parenthesis are $(X + 0.5)^{1/2}$ transformed value

C. Effect of weed control practices on weed control efficiency and weed index

Weed control efficiency significantly varied due to different weed control practices which is presented in Table 5. Weed control efficiency at 20 DAS stage was highest in application of pendimethalin 30 EC @1kg/ha (PE) followed byapplication of pendimethalin 30 EC @1kg/ha (PE) *fb* imazethapyr 10 SL @ 100 g/ha (PoE). but at 40 and 60 DAS weed control efficiency was recorded higher in two hand weeding followed by application of imazethapyr 35% + imazamox 35% 70 WG @ 70 g/ha (PoE) and application of pendimethalin 30 EC @ 1 kg/ha (PE) *fb* imazethapyr 10 SL @ 100 g/ha (PoE). Similar results were reported by Upadhyay *et al.* (2012); Jadhav (2015); Keer *et al.* (2020); Hajari and Patel (2020). Weed index significantly varied due to different weed control practices which is presented in Table 5. Minimum weed index indicated maximum yield. Among all weed control practices minimum weed index was recorded two hand weeding (T_2) and among the herbicides imazethapyr 35% + imazamox 35% 70 WG 70 g/ha (PoE) recorded minimum weed index followed by pendimethalin 30 EC @ 1 kg/ha (PE) *fb* imazethapyr 10 SL @ 100 g/ha. The present findings are in close agreement with the observation reported by Kothawade *et al.* (2007); Malik and Yadav (2014); Khazi *et al.* (2018).

Table 4: Total weed density as influenced by weed control treatments in soybean: pigeonpea (4:2) intercropping system.

Treatments		Total weed density (0.25 m²)		
		20 DAS	40 DAS	60 DAS
T_1	Weedy check	24.17 (4.96)	36.17 (6.05)	42.00 (6.51)
T_2	Two hand weeding at 30 & 45 DAS	22.67 (4.81)	8.67 (2.99)	10.33 (3.28)
T_3	Imazethapyr 10% SL @ 100 g a.i./ha 20 DAS (PoE)	23.17 (4.86)	22.50 (4.79)	26.50 (5.19)
T_4	Imazethapyr 35% + Imazamox 35% 70 WG (Pre-mix) @ 70 g a.i./ha at 20 DAS (PoE)	21.83 (4.72)	15.50 (4.00)	13.67 (3.76)
T_5	Pendimethalin 30% EC @ 1.00 kg a.i./ha (PE)	11.00 (3.38)	27.17 (5.25)	32.00 (5.70)
T_6	Pendimethalin 30% EC @ 1000 g a.i./ha (PE)*fb*Imazethapyr 10% SL 100 g a.i./ha at 30 DAS (PoE)	12.67 (3.62)	17.67 (4.25)	19.00 (4.41)
	S.Em ±	**(0.19)**	**(0.20)**	**(0.14)**
	C.D at 5%	**(0.59)**	**(0.64)**	**(0.46)**

Note: Figures in parenthesis are $(X + 0.5)^{1/2}$ transformed value

Table 5: Weed control efficiency and weed index as influenced by weed control treatments in soybean: pigeonpea (4:2) intercropping system.

Treatments		Weed control efficiency (%)			Weed index (%)	
		20 DAS	40 DAS	60 DAS	Soybean	Pigeonpea
T_1	Weedy check	0.00	0.00	0.00	50.20	47.74
T_2	Two hand weeding at 30 & 45 DAS	6.21	76.03	75.40	0.00	0.00
T_3	Imazethapyr 10% SL @ 100 g a.i./ha 20 DAS (PoE)	4.14	37.79	36.90	28.78	19.66
T_4	Imazethapyr 35% + Imazamox 35% 70 WG (Pre-mix) @ 70 g a.i./ha at 20 DAS (PoE)	9.68	57.15	67.45	0.74	1.89
T_5	Pendimethalin 30% EC @ 1.00 kg a.i./ha (PE)	54.49	24.88	23.81	31.07	24.96
T_6	Pendimethalin 30% EC @ 1000 g a.i./ha (PE)*fb* Imazethapyr 10% SL 100 g a.i./ha at 30 DAS (PoE)	47.58	51.15	54.76	16.35	14.37

CONCLUSIONS

Based on the foregoing discussion, it can be concluded that among weed management practices hand weeding twice at 30 and 45 DAS recorded least weed index and highest weed control efficiency followed by application of imazethapyr 35% + imazemox 35% 70 WG 70 g/ha at 20 DAS (PoE) and pendimethalin 30 EC 1 kg/ha (PE) *fb* imazethapyr 10 SL 100 g/ha (PoE).

FUTURE SCOPE

In order to confirm the validity of results the experiment must be repeated over years and location with more accuracy and precision. Research should be carried to test other new herbicides for soybean:pigeonpea (4:2) intercropping which are recommended in other *kharif* legumes.

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Conflict of Interest. None.

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