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Weed Management Strategy for Enhancing Productivity and Profitability of Pigeonpea (*Cajanus cajan* L. Millspaugh)

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ABSTRACT

The on farm trial (OFT) was conducted to find out the cost-effective weed management practices for pigeonpea during *Kharif* season of 2021-22 with four replication one at in crop cafeteria (Technical Park) of Krishi Vigyan Kendra and remaining three conducted at farmers' field of village Bharauli block Sohaon, district Ballia Uttar Pradesh. Seven treatments were *viz.,* T_1-weedy check, T_2-Hand weeding, T_3-Pendimethalin @ 750g a.i. ha^{-1} as PE, T_4 -Imazethapyr @ 100g a.i. ha^{-1} at 30 DAS, T_5 - quizalofop-ethyl @ 50g. a.i. ha^{-1} at 30 DAS , T_6 - Pendimethalin @ 750g a.i. ha^{-1} as PE fb Imazethapyr @ 100 g a.i.ha^{-1} at 30 DAS [POE], T_7 - Pendimethalin @ 750g a.i. ha^{-1} as PE fb quizalofop-ethyl @ 50g. a.i. ha^{-1} at 30 DAS [POE]. The pre-emergent herbicide i.e., Pendimethalin was sprayed within 24 hr of sowing and post emergence herbicides *i.e.,* Imazethapyr and Quizalofop-ethyl were sprayed 30 DAS between the crop rows (directed sprays).

Among all the treatments, pre-emergence application of Pendimethalin followed by Imazethapyr at 30 days after sowing (DAS) was significantly recorded lowest weed growth and weed dry weight with WCE of 82.64 per cent at 60 DAS and 76.80 percent at 90 DAS, respectively.

Key Words: Control, Efficiency, Hand weeding, Pigeonpea, Weed.

INTRODUCTION

Pigeonpea (*Cajanus cajan* L.) is the second important pulse crop in India after chickpea. It is cultivated over an area of 4.56m.ha with a total production of 3.78 m.t and productivity of 829 kg/ ha (Anonymous, 2019). Pigeonpea is an important pulse crop of Uttar Pradesh state, having 2.84 lakh ha area, 2.85 lakh tones production and 1005 kg/ ha productivity. The low productivity is due to an array of biotic and abiotic factors especially weed infestation. Weeds compete with crop for light, moisture and nutrients, with early season competition being the most critical. In Uttar Pradesh, pigeonpea is mainly grown during *Kharif* season. Due to its slow initial growth, wider spacing and continuous rains in monsoon season, pigeonpea is highly infested with narrow and broad leaved weeds cause maximum damage up to 32-65 percent (Meena *et al,* 2010). The critical period of crop weed competition is during the first eight weeks after sowing (Sharma *et al*, 2014). Timely weed control is very essential for realization of yield potential of pigeonpea. At present weeds are controlled by one hand weeding during 30 to 45 days after sowing. However, due to continuous rains during monsoon season it becomes difficult for manual and mechanical weeding at right time. Furthermore, non-availability of labour, increasing labour cost and being time consuming it was felt to find out suitable weed control methods involving herbicides.

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MATERIAL AND METHODS

The on farm trial (OFT) was conducted to find out the cost-effective weed management practices for pigeonpea during *Kharif* season of 2021-22 with four replication one at in crop cafeteria of Krishi Vigyan Kendra and remaining three conducted on farmers' field of village Bharauli block Sohaon, district Ballia Uttar Pradesh. The pigeonpea variety Narendra Arhar-2 (280-285 d) was sown on ridge bad method having plant geometry (ridge x plant) at 75 cm x 30 cm during second week of July and harvested manually during second week of April. The recommended fertilizer dose (20:50:20 kg/ha as N: P2O5 and K2O) was applied at the time of sowing through urea and single super phosphate. The crop was raised under rained conditions with recommended package of practices. The OFT was laid out in randomized block design with comprised of seven treatments *viz*; T_1-weedy check, T_2-Hand weeding, T_3- Pendimethalin @ 750g a.i. ha^{-1} as PE, T_4 -Imazethapyr @ 100g a.i. ha^{-1} at 30 DAS, T_5 - quizalofop-ethyl @ 50g. a.i. ha^{-1} at 30 DAS , T_6 - Pendimethalin @ 750g a.i. ha^{-1} as PE fb Imazethapyr @ 100 g a.i.ha^{-1} at 30 DAS [POE], T_7 - Pendimethalin @ 750g a.i. ha^{-1} as PE fb quizalofop-ethyl @ 50g. a.i. ha^{-1} at 30 DAS [POE]. The pre-emergent herbicide i.e., Pendimethalin was sprayed within 24 hours of sowing and post emergence herbicides *i. e.,* Imazethapyr and Quizalofop-ethyl were sprayed 30 DAS between the crop rows (directed sprays). The soluble herbicide was applied after duly mixing with water 500 l/water per hectare.

WCE% =	Dry matter of weeds in weedy check – Dry matter of weeds in treated plot	x 100
	Dry matter of weeds in weedy check	

An iron square of size 0.25 m2 (side 0.5 m) was used to take observations on weed population and weed dry weight through random sampling in each plot at (just before application of Imazethapyr), 30, 60 90 DAS and at harvest. The value is converted in per square meter. The total number of weeds were counted species wise in each plot separately and analyzed. Weed control efficiency (WCE) was calculated by the following method as per the procedure given by Meena *et al* (2010). Economics of treatments was computed on the basis of prevailing market price of inputs and outputs under each treatment. The total cost of cultivation of crop was calculated on the basis of different operations performed and materials used for raising the crop including the cost of fertilizers and seeds. The cost of labour incurred in performing different operations was also included. Statistical analysis of the data was done as per the standard analysis of variance technique for the experimental designs following SPSS software based programme, and the treatment means were compared at $P<0.05$ level of probability using t-test and calculating CD values.

RESULTS AND DISCUSSION

The major weed flora were observed in all experimental field of pigeonpea and also included grassy weeds like*, Cynodon dactylon*, *Dactyloctenium aegyptium*, *Echinochloa colona*, *Echinochloa crussgulli*, *Eleusine indica, Parthenium hysterophorus and Digitaria sanguinalis.* Sedges like *Cyperus rotundus*, *Cyperus iria*, *Cyperus difformis* and broad leaved weeds like *Ageratum conyzoides*, *Digera arvensis*, *Physallis minima, Trianthema portulacastrum, Boerrhivia diffusa, Euphorbia hirta*, *Phyllanthus niruri* and *Bidens biternata.* Total weed density (No. m-2) was recorded at 30, 60, 90 DAS and at harvesting. Dry weight of weed was recorded at 60 and 90 DAS. All the weed control treatments significantly recorded lower weed density and weed dry weight over weedy check at all stages of observations (Table 1). The integrated treatments were found to be superior to mono application of herbicides in reducing weed growth. Among the treatments, pre-emergence application of Pendimethalin followed by Imazethapyr at 30 DAS was significantly recorded lowest weed growth and weed dry weight with WCE of 82.64 per cent at 60 DAS and 76.80

Table 1. Effect of different weed management treatments on density and dry weight of weeds in pigeonpea.

Treatment	Dose gm *a.i.* ha^{-1}	Time of application (DAS)	Total weed density No m^{-2} at				Total weed dry weight gm^{-1}		Weed Control Efficiency (%)	
			30 DAS	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	60 DAS	90 DAS
Weedy check- T_1	-		13.64 (216.52)	21.92 (452.68)	16.39 (380.75)	11.46 (108.66)	25.12 (583.42)	21.73 (436.60)	-	-
Hand weeding- T_2	-	30 & 60	2.65 (5.98)	7.45 (66.34)	6.51 (48.20)	4.92 (15.06)	4.72 (16.35)	3.23 (11.20)	81.21	73.64
Pendimethalin- T_3	750 gm	Within- 2	8.22 (67.06)	9.22 (84.56)	8.07 (65.03)	6.85 (46.35)	19.31 (440.22)	18.33 (85.52)	23.12	15.64
Imazethapyr -T_4	100 gm	30	10.16 (102.66)	6.93 (47.23)	5.94 (30.82)	5.36 (27.83)	5.23 (26.9)	5.61 (27.90)	79.17	74.18
Quizalofop-ethyl- T_5	50 gm	30	10.41 (109.85)	6.96 (47.33)	6.04 (31.34)	5.73 (29.35)	6.86 (27.80)	7.23 (29.20)	72.69	66.72
Pendimethalin+ Imazethapyr -T_6	750 + 100 gm	Within- 2 + 30	8.15 (65.94)	8.98 (80.15)	7.62 (57.40)	7.35 (51.56)	4.36 (28.32)	5.04 (41.03)	82.64	76.80
Pendimethalin+ Quizalofop-ethyl- T_7	750 + 50 gm	Within- 2 + 30	8.35 (69.58)	9.36 (87.57)	7.97 (63.74)	7.62 (60.15)	6.33 (28..26)	6.95 (34.97)	74.80	68.01
SEM ±			0.563	0.480	0.422	0.362	0.794	0.381	0.69	1.21
CD at 5%	-	-	1.45	1.52	1.37	1.25	2.38	1.24	1.73	3.14

Table 2. Effect of different weed management treatments on yield and yield parameters in pigeonpea

Treatment	Dose gm *a.i.* ha^{-1}	Time of application (DAS)	Plant height (cm)	No of branches/ plant	No of pods/ pod	No of seed/ pod	100 seed weight (gm)	Seed Yield (kg/ ha)	Stalk yield (kg/ ha)	Grass cast (Rs-/ ha)	Net returns (Rs-/ ha)	BCR (Rs-/ ha)
Weedy check -T_1	-		136.72	9.27	172.72	3.3	11.1	418	1482	25500	5014	1.19
Hand weeding- T_2	-	30 & 60	181.46	17.52	424.05	4.3	12.0	1425	5164	32800	71225	2.17
Pendimethalin- T_3	750 gm	Within- 2	166.54	14.46	210.23	3.7	11.9	763	3652	27500	28199	2.02
Imazethapyr -T_4	100 gm	30	175.06	15..62	227.35	4.0	12.1	1185	4368	27400	59105	3.15
Quizalofop-ethyl-T_5	50 gm	30	169.47	15.20	214.86	4.0	12.1	1052	4129	27400	49396	2.80
Pendimethalin+ Imazethapyr -T_6	750 + 100 gm	Within- 2 + 30	187.90	18.32	450.74	4.5	12.3	1478	5986	29400	78494	3.66
Pendimethalin+ Quizalofop-ethyl-T_7	750 + 50 gm	Within- 2 + 30	182.25	17.86	442.32	4.4	12.1	1220	5864	29400	59660	3.02
SEM ±			12.36	0.91	20.42	0.21	0.42	62.30	206.45	-	-	-
CD at 5%	-	-	34.58	2.46	58.36	0.58	1.3	186.27	586.74	-	-	-

percent at 90 DAS, respectively which was at a par with hand weeding (T_2) at 30 and 60 DAS. No crop injury was recorded with the herbicides, which were studied under this project.

The results indicated that all the weed control treatments were significantly reduced the weed growth over the weedy check (T_1) at different stages of observation. Plant height, number of primary and secondary branches per plant, number of pods per plant, number of seeds per pod, 100 seed weight and pod yields were significantly influenced by the weed management treatments. Among the treatments, pre-emergence application of Pendimethalin followed by Imazethapyr at 30 DAS was significantly recorded the highest grain yield (1478 kg/ha) and 70.66 per cent of yield reduction was recorded over unweeded check (Table 2). Unweeded check recorded the lowest seed yield (418 kg/ha) with a yield loss of 71.71% compared to pre emergence application of pendimethaline @ 750 *a.i.* kg ha^{-1} followed by Imazethapyr at 30 DAS. The similar results were reported by Rao *et al* (2015) and Sharma *et al* ,(2014).

The economics was worked out based on the total cost of cultivation of pigeonpea in the eastern plain zone, Ballia districts of Uttar Pradesh. The cost of cultivation differed due to different weed management practices. Higher cost of cultivation was involved in Hand weeding plot (Rs. 32800 / ha) followed by Pendimethalin+ Imazethapyr and Pendimethalin+ Quizalofop-ethyl Rs. 29400/ha, respectively whereas weedy check recorded the minimum cost (Rs. 25500/ ha) of cultivation. The next best treatments with respect to lower cost of cultivation were noticed with imazethapyr @ 100 g a.i. ha^{-1} at 30 DAS (Rs. 27400/ha). Higher net returns (Rs. 78494 and Rs. 71225/ha) with higher benefit cost ratio (2.74 and 2.64) were recorded with treatment T_6 Pendimethalin (PE) fb Imazethapyr (post-emergence) application with in 2 day of sowing fb 30 DAS and treatment hand weeded, respectively similar results are reported by Singh *et al* (2020). On the basis of

benefit cost ratio the treatment Pendimethalin (PE) fb Imazethapyr (POE) give highest BCR 3.66 followed by treatment Imazethapyr (POE) 3.15. Above described treatments of Pendimethalin (PE) fb Imazethapyr (post-emergence) application with in 2 day of sowing fb 30 DAS was statistically at par with T2 as net return and T4 and T7 (3.15 & 3.02) in terms of B:C ratio.

CONCLUSION

It can be concluded that pre emergence application of Pendimethalin @ 750 ml *ai.* (2 DAS) followed by Imazethapyr 10 SL @100 gm *ai*. (30DAS) was found effective and economical for weed management in *kharif* redgram.

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