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RESEARCH NOTE

Weed management in chickpea at South Saurashtra of Gujarat, India

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ABSTRACT

A field experiment was conducted during winter *(Rabi)* season of 2019-20 at Instructional Farm, Department of Agronomy, College of Agriculture, JAU, Junagadh, Gujarat, India, to study the effect of different weed management treatments on weeds, yield attributes and yield of chickpea. The experiment comprised of twelve treatments laid out in randomized block design with three replications. Significantly higher plant height, number of branches / plant, number of pods/plant, seed yield and stover yield, were recorded with pre-emergence application (PE) of pendimethalin 900 g/ha followed by (*fb*) post-emergence application (PoE) of sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha ready-mix (RM) at 40 DAS and hand weeding (HW) twice at 20 and 40 days after seeding (DAS) as they effectively minimized the weed biomass and lowered weed index with higher weed control efficiency. The highest net return and B:C ratio were recorded with pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE at 40 DAS followed by alachlor 750 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 +165 g/ha (RM) PoE at 40 DAS and HW twice at 20 and 40 DAS.

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

Pulses constitute one of the most important components of human diet and major source of protein particularly for the vegetarians. The inherent higher nutritive value and capacity to restore soil productivity, made pulses an important constituent of sustainable cropping systems. Among pulses, chickpea (*Cicer arietinum* L.) holds a prime position in area and production of winter (*Rabi*) pulse crops in India. It is a leguminous crop, belongs to family Fabaceae, subfamily Faboideae and originated from South-West Asia. India ranks first in production of chickpea in the world and contributing about 65% of global chickpea production. Weeds cause crop yield loss by competing for space, nutrients, water and light. Chickpea is a poor competitor with weeds due to its slow growth rate and limited leaf development at early stage of crop growth and establishment (Kumar *et al*. 2014). If weed management is neglected, yield loss may extend up to 75% (Chaudhary *et al*. 2005). The farmers are preferring the use of herbicides for controlling weeds in order to reduce cost of cultivation due to prevailing shortage and high cost of labor. Hence there is a need to evaluate available herbicides for identifying effective herbicides that are economical than the existing cultural weed control methods and previously recommended herbicides for weed management and to obtain higher productivity and profitability of chickpea.

An experiment was conducted, to identify economical and effective weed management option in chickpea (*Cicer arietinum* L.), during winter *(Rabi)* season of the year 2019-20. The soil of the experimental plot was clayey in texture, slightly alkaline in reaction with pH 8.0, EC 0.33 dS/m, medium in available nitrogen (249 kg/ha), high in available phosphorus (30 kg/ha) and high in available potash (283 kg/ha). The experiment was laid out in a randomized block design with twelve treatments replicated thrice. The twelve weed management treatments comprised of pre-emergence application (PE) of pendimethalin 900 g/ha followed by (*fb*) hand weeding (HW) at 40 days after seeding (DAS); alachlor 750 g/ha PE *fb* HW at 40 DAS; HW at 20 DAS *fb* post-emergence application (PoE) of propaquizafop 50 g/ha at 40 DAS; HW at 20 DAS *fb* sodium-acifluorfen + clodinafop-propargyl 80+165 g/ha ready-mix (RM) PoE at 40 DAS; pendimethalin 900 g/ha PE *fb* propaquizafop 50 g/ha PoE at 40 DAS; pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl (RM) 80 + 165 g/ha PoE at 40 DAS; alachlor 750 g/ha PE *fb* propaquizafop 50 g/ha PoE at 40 DAS; alachlor 750 g/ha PE *fb* sodium-acifluorfen + clodinafop-

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propargyl (RM) 80 +165 g/ha PoE at 40 DAS; HW at 20 DAS, HW twice at 20 and 40 DAS; weed free and un-weeded check. The pre-emergence applications of herbicides were done one day after sowing and post-emergence application of herbicides was done at 40 DAS using water 375 l/ha. Gram variety *Gujarat Gram-5* was used for sowing with seed rate of 60 kg/ha. The seeds were placed at 4-5 cm depth, keeping inter row spacing of 45 cm and covered with the soil. The crop was uniformly fertilized with 20 kg/ha N and 40 kg/ha P in the form of urea and diammonium phosphate, respectively as a basal application. Gap filling was done at 10 DAS to facilitate optimum plant population by maintaining intra row spacing of 10cm.

Total weed density at harvest was estimated by using an iron quadrat measuring 1.0 square meter, placed randomly in each of the net plot and number of weeds observed within the quadrat were counted and recorded. The weed biomass at harvest was estimated by collecting weeds from net plot area, sun dried and then dry weight of weeds was recorded from respective treatments and expressed as kg/ha. The SPAD meter value was measured from selected five plants in each plot at 35, 55 and 70 DAS by using the chlorophyll meter (Minolta SPAD-502).

Effect on weeds

The dominant weeds in the experimental field were: dicot weeds, *viz*. *Digera arvensis* Forsk, *Launaea nudicaulis* (L.) Hook.f., *Euphorbia hirta* L., *Portulaca oleracea* L., *Amaranthus viridis* L., *Chenopodium album* L., *Physalis minima* L., *Phyllanthus niruri* L., *Parthenium hysterophorus* L. and *Indigofera glandulosa* Roxb. ex Willd., monocot weeds, *viz*. *Brachiaria* spp., *Echinocloa colona* (L.) Link. *Cynodon dactylon* (L.) Pers. and *Dactyloctenium aegyptium* (L.) Willd. and sedge weed *Cyperus rotundus* L.

The weed biomass, weed index (WI), weed control efficiency (WCE) and herbicidal efficiency index (HEI) were influenced by different treatments (**Table 1**). The lowest weed biomass and WI and higher WCE and HEI were observed with pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE at 40 DAS followed by HW twice at 20 and 40 DAS (**Table 1**), among the weed control treatments other than weed free. The lowest weed growth observed with these treatments was due to early season control of weeds by application of pre-emergence herbicides, at later stage by post-emergence herbicides and removal of escaped weeds by hand weeding. The findings are in parallel with results reported by Rupareliya *et al.* (2018).

Chickpea growth and yield parameters

Significantly highest chickpea plant height, no. of branches/plant at 60 DAS and at harvest, highest yield attributes and yield, *viz.* number of pods per

Table 1. Effect of different treatments on weeds and chickpea growth parameters

Treatment	Total weed density at harvest	Weed biomass (kg/ha)	Weed index (%)	Weed control efficiency (%)	Herbicidal efficiency index	Plant height at 60 DAS	Plant height at harvest	No. of branches / plant at 60 DAS	No. of branches plant at 60 DAS
Pendimethalin 900 g/ha PE *fb* HW at 40 DAS	8.9(78.3)	208.33	0.18	82.21	3.95	34.67	36.20	6.00	7.33
Alachlor 750 g/ha PE *fb* HW at 40 DAS	10.5(109.3)	291.67	0.22	75.10	2.47	35.63	36.87	6.67	7.00
HW at 20 DAS *fb* propaquizafop 50 g/ha PoE at 40 DAS	9.7(93.3)	350.00	0.17	70.12	2.37	35.59	36.00	6.67	8.00
HW at 20 DAS *fb* sodium-acifluorfen + clodinafop-propargyl 80+165 g/ha (RM) PoE at 40 DAS	8.8(77.0)	163.33	0.19	86.05	4.85	35.65	36.67	6.33	7.33
Pendimethalin 900 g/ha PE *fb* propaquizafop 50 g/ha PoE at 40 DAS	10.0(99.7)	376.67	0.22	67.85	1.91	35.27	36.33	6.67	7.33
Pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE at 40 DAS	7.0(49.0)	91.33	0.08	92.20	11.58	38.16	39.00	7.67	9.67
Alachlor 750 g/ha PE *fb* propaquizafop 50 g/ha PoE at 40 DAS	10.0(99.7)	560.00	0.22	52.20	1.28	35.62	36.00	6.67	7.67
Alachlor 750 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 +165 g/ha (RM) PoE at 40 DAS	10.9(119.0)	343.67	0.15	70.66	2.57	35.85	36.80	6.33	8.33
HW at 20 DAS	11.2(125.7)	581.67	0.31	50.35	-	33.27	35.13	5.67	6.67
HW at 20 and 40 DAS	7.7(59.7)	132.67	0.09	88.67	-	37.20	39.07	7.33	9.33
Weed free	0.7(0.0)	00	00	100.00	-	40.40	41.27	8.33	10.33
Unweeded check	13.1(170.3)	1171.67	0.51	-	-	27.42	27.67	4.33	5.33
LSD(p=0.05)	0.765	67.445	#	#	#	4.26	4.35	1.07	1.11
C.V. %	5.00	11.19	#	#	#	7.11	7.07	9.70	8.40

PE: Pre-emergence; *fb*: Followed by; HW: Hand weeding; DAS: Days after seeding; PoE: Post-emergence

Table 2. Effect of different treatments on SPAD meter readings, chickpea yield attributes, yield and economics

Treatment	SPAD meter reading		Pods/ plant	Seed yield (t/ha)	Stover yield (t/ha)	Gross return (x10^3 ₹/ha)	Cost of cultivation (x10^3 ₹/ha)	Net return (x10^3 ₹/ha)	Benefit Cost ratio
	55 DAS	70 DAS							
Pendimethalin 900 g/ha PE *fb* HW at 40 DAS	63.67	66.33	54.67	2.49	2.96	124.12	38.60	85.52	2.21
Alachlor 750 g/ha PE *fb* HW at 40 DAS	62.67	66.33	52.67	2.37	2.88	117.96	38.32	79.63	2.07
HW at 20 DAS *fb* propaquizafop 50 g/ha PoE at 40 DAS	65.00	74.33	50.00	2.50	3.02	124.74	38.50	86.24	2.24
HW at 20 DAS *fb* sodium-acifluorfen + clodinafop-propargyl 80+165 g/ha (RM) PoE at 40 DAS	54.67	67.00	53.00	2.46	3.01	122.37	37.74	84.63	2.24
Pendimethalin 900 g/ha PE *fb* propaquizafop 50 g/ha PoE at 40 DAS	63.67	66.67	55.00	2.36	2.93	117.82	36.39	81.42	2.23
Pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE at 40 DAS	54.00	74.67	68.00	2.79	3.36	138.74	35.92	102.82	2.86
Alachlor 750 g/ha PE *fb* propaquizafop 50 g/ha PoE at 40 DAS	63.33	67.00	51.67	2.37	2.98	118.01	35.83	82.18	2.29
Alachlor 750 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 +165 g/ha (RM) PoE at 40 DAS	53.33	67.33	57.67	2.57	3.03	127.90	35.36	92.54	2.61
HW at 20 DAS	58.33	64.33	51.00	2.08	2.58	103.65	36.44	67.21	1.84
HW at 20 and 40 DAS	67.00	66.67	67.00	2.77	3.34	138.07	40.99	97.08	2.36
Weed free	71.33	76.00	76.00	3.05	3.62	151.78	52.94	98.84	1.86
Unweeded check	54.33	56.00	41.67	1.46	1.72	72.84	32.45	40.39	1.24
LSD (p=0.05)	7.40	8.80	9.05	0.47	0.53	#	#	#	#
C.V. %	7.17	7.67	9.46	11.36	10.52	#	#	#	#

Where, # symbol indicates that these parameters were not statistically analyzed

plant, seed yield and stover yield were observed with pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE at 40 DAS and HW twice at 20 and 40 DAS, which were at par with weed free. This could be due to lesser weeds during active crop growth leading to better nutrient availability to crop which helped in luxurious crop growth. Significantly lowest chickpea plant height at 30, 60 DAS and at harvest, no. of branches/plant at 60 DAS and at harvest was documented under unweeded check. These conclusions are similar to those reported by Bankoti *et al.* (2021).

Chickpea phytotoxicity

Slight phytotoxicity in chickpea was observed with the application of sodium acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE. Symptoms like chlorosis and epinasty were observed, degree of phytotoxicity on chickpea by checking the apical growth was minimum and crop regained its satisfactory growth within a week as was also observed by Nath *et al.* (2018).

Economics

The highest gross and net returns were obtained under weed free followed by pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE at 40 DAS and HW twice at 20 and 40 DAS (**Table 2**). However, maximum B:C ratio was obtained with pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE at 40 DAS followed by alachlor 750 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80+165 g/ha (RM) PoE at 40 DAS and HW twice at 20 and 40 DAS, respectively due to less cost of herbicides and higher production of yield as reported by Aliveni *et al.* (2016) and Indrajeet *et al.* (2020).

Based on the results it was concluded that effective and economically viable weed management in chickpea under south Saurashtra agro-climatic zone can be achieved by application of pendimethalin 900 g/ha PE *fb* sodium-acifluorfen + clodinafop-propargyl 80 + 165 g/ha (RM) PoE at 40 DAS or by using HW twice at 20 and 40 DAS depending on the availability of labours.

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