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WEED MANAGEMENT IN CHICKPEA (*Cicer Arietinum* L) UNDER NORTH GUJARAT CONDITIONS

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Abstract: A field experiment was conducted during *rabi* season of 2014-15 at the Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, District Banaskantha (North Gujarat) to study the effect of weed management practices on chickpea *var.* Gujarat Chickpea-1. The soil of experimental plot was loamy sand in texture, low in organic carbon and available nitrogen, medium in available phosphorous and rich in available potassium status. The maximum values of yield attributes and yield of chickpea were recorded under Hand Weeding(HW) + Inter Culturing(IC) at 30 & 45 days after sowing(DAS) closely followed by Pendimethalin @ 1 kg/ha as Pre Emergence (PE) + Two IC at 30 & 45 DAS. Besides HW + IC at 30 & 45 DAS, Pendimethalin @ 1 kg/ha as PE + Two IC at 30 & 45 DAS was found more effective in reducing the weed population (*viz*., grassy, broad leaves and sedges) resulted into less dry weight of weeds (230 kg/ha), higher weed control efficiency (68.71%) as well as lower weed index (7.39). Hand weeding & IC at 30 & 45 DAS also recorded significantly the higher uptake of N (72.79 kg/ha), P (13.99 kg/ha) and K (20.23 kg/ha) by seeds and stover and significantly lower uptake of N (3.87 kg/ha), P (0.39 kg/ha) and K (1.68 kg/ha) by weeds.
Keywords: Chickpea, Weed management, Pre emergence, Weed control efficiency.

INTRODUCTION

Fighting weeds have been a costly problem for the farmers since the beginning of agriculture. Weeds steal space, air, water, light and nutrients from crop plants; Moreover, they increases production cost, harbor insects, pests and plant diseases, decreases quality of farm produces and reduces value of the land. In the field crops yield losses accounts, 45 per cent due to weeds, 30 per cent due to insects, 20 per cent due to plant disease and 5 per cent due to other pests have been reported (Rao, 1983). Due to unrestricted weed growth 31.33 % yield reduction was observed (Kachhadia, 2005). The beneficial effect of reduced crop weed competition is apparent from the dry matter accumulation of chickpea under weed-free and weed-infested environments, which are ultimately reflected on seed yield (Bhan and Kukula, 1986). Clean weeding increased the seed yield of chickpea by 107% and the first 4 to 6 weeks after sowing were the most critical period for crop weed competition (Ahlawat *et al*., 1981).

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MATERIALS AND METHODS

A field experiment was carried out at the Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, District Banaskantha (North Gujarat) during *rabi* season of 2014-15. The soil of experimental plot was loamy sand in texture, low in organic carbon and available nitrogen, while medium in available phosphorus and potassium. The soil was free from any kind of salinity /sodicity hazard. The experiment was laid out in randomized block design with ten treatments *viz.,* Oxyfluorfen @ 0.10 kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS, Oxyfluorfen @ 0.12 kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS, Oxyfluorfen @ 0.10 kg/ha as PE + Two IC at 30 & 45 DAS, Oxyfluorfen @ 0.12 kg/ha as PE + Two IC at 30 & 45 DAS, (Pendimethalin @ 1kg/ha as PE + Two IC at 30 & 45 DAS, (Pendimethalin @ 1kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS, Pendimethalin @ 0.75kg/ha as PE + Two IC at 30 & 45 DAS, Pendimethalin @ 0.75kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS, HW & IC at 30 & 45 DAS and Unweeded as control and three replications. Chickpea variety Gujarat Chickpea-1 was used for sowing with seed rate of 60 kg/ha during the month of November 2014. The seeds were placed at 3-5 cm depth by manually in furrow keeping row to row spacing of 45 cm and plant to plant distance of 10 cm. The liquid form of herbicides *viz*., Oxyfluorfen, Pendimethalin and Quizalofop ethyl were measured by measuring cylinder as per the required quantity at the time of preparation of solution. The spraying was done by using Knapsack sprayer with flat fan nozzle using 500 liters of water per hectare. Recommended dose of fertilizers (20-40-00 kg N- P_2O_5 -K_20/ha) was applied in the form of diammonium phosphate and urea at the time of sowing. Periodical observations on weeds were recorded at 30,60 DAS and at the time of harvest using 0.25 m^2 quadrant placed in 3 randomly selected spots in each net plot and average values was worked out. Chemical analyses of crop plants and weeds were carried out by taking representative sample excluding roots from each net plot at harvest of crop. The samples were oven dried at 60^0 C for 24 hours and then powdered by using pestle and mortar. Finally, powdered samples were utilized for extraction of various elements. In general, weather conditions were favourable for plant growth and no severe pest and diseases were noticed during both the years of experimentation. The package of recommended practices was adopted to maintain the crop.

RESULTS AND DISCUSSION

Yield attributes and yield

Different weed management treatments tried in this study exerted their significant effect on seed yield of chickpea. Among the treatments, HW + IC at 30 & 45 DAS established its superiority by recording significantly the highest seed yield (2562 kg/ha). It was 71.9 per cent higher over unweeded control. The second best treatment emerged out from the study was Pendimethalin 1.00 kg/ha as PE + Two IC at 30 & 45 DAS which recorded seed yield of 2373 kg/ha. It was closely followed by Pendimethalin 0.75 kg/ha as PE + Two IC at 30 & 45 DAS having seed yield of 2311 kg/ha. Different weed management treatments had significant effect on stover yield of chickpea. Among the treatments HW + IC at 30 & 45 DAS recorded significantly the highest stover yield (3046 kg/ha). However, it was found statistically at par with Pendimethalin 1.00 kg/ha as PE + Two IC at 30 & 45 DAS and Pendimethalin 0.75 kg/ha as PE + Two IC at 30 & 45 DAS having stover yield of 2845 and 2815 kg/ha, respectively. Higher seed and stover yield obtained under these treatments might be due to the maintenance of weed free environment, especially during critical growth stages of crop growth as evident from increased in the values of yield attributes under these treatments (Table- 1). In addition to this the least weed population, dry weight of weeds and higher weed control efficiency were recorded under these treatments are also responsible for better seed yield. Severe weed competition for resources in unweeded control resulting poor growth and yield attributes leading to poor seed yield of chickpea. These findings are in accordance with those reported by Poonia *et al.,* (2013), Kaushik *et al.,* (2014) and Kour *et al.,* (2014).

Weed dynamics among the treatments, HW + IC at 30 & 45 DAS, Pendimethalin 1.00 kg/ha as PE + Two IC at 30 & 45 DAS was found more effective in reducing the weed population (*viz*., grassy, broad leaves and sedges) resulted into less dry weight of weeds (230 kg/ha), higher weed control efficiency (68.71%) as well as lower weed index (7.39 %). Under HW + IC at 30 & 45 DAS and Pendimethalin @ 1.00 or 0.75 kg/ha as PE + Two IC at 30 & 45 DAS found equally effective in this aspect. It might due to the lethal effect of pre emergence herbicide at early stage of crop growth controlled weeds and at later, the weeds escaped the herbicidal effects which were controlled by hand weeding and interculturing at 30 and 45 DAS resulting a significant reduction in weeds population which was responsible for the lower dry weight of weeds. Significantly the highest dry weight of weeds was recorded in unweeded control. It was due to absence of pre emergence of herbicide application as well as

interculturing and hand weeding at 30 and 45 DAS. These findings are in close conformity with the findings of Patel *et al.,* (2006), Sharma O.L (2009) and Kour *et al.,* (2014).

Nutrient removal

The N, P and K removed by weeds and chickpea seeds and stover were significantly influenced by various weed management practices (Table 2). Significantly higher N and P uptake by seeds (72.79 and 13.99 kg/ha) were recorded by HW + IC at 30 & 45 DAS) over other treatments except Pendimethalin 0.75 and 1.0 kg/ha as PE + Two IC at 30 & 45 DAS. In case of K uptake, it was recorded significantly the highest in HW + IC at 30 & 45 DAS. Amongst the herbicidal treatments, Pendimethalin 1.0 kg/ha as PE + Two IC at 30 & 45 DAS and Pendimethalin 0.75 kg/ha as PE + Two IC at 30 & 45 DAS found equally effective and recorded the highest K uptake by seeds (17.49 and 16.31 kg/ha). Unweeded control recorded the lowest value of nutrient (N, P and K) uptake by seeds. The greater nutrient uptake by seeds could be attributed to poor competition of weeds with chickpea. Hand weeding, interculturing and use of herbicide effectively controlled the weeds effectively and consequently made more nutrients available to the crop throught crop growth period thereby higher uptake of nutrients by seeds. These findings corroborate the result of Mani (1975), Vasave *et al.,* (2014), Kour *et al.,* (2014).

Hand weeding + IC at 30 & 45 DAS registered significantly the highest N, P and K uptake of 41.84, 9.44 and 42.33 kg/ha, respectively by stover. The second best treatment emerged out from the study was Pendimethalin 1.0 kg/ha as PE + Two IC at 30 & 45 DAS having 37.52, 8.43 and 38.87 kg/ha N, P and K uptake by stover, respectively. Unweeded control recorded the lowest N, P and K uptake by stover. The higher nutrient uptake by these treatments might be facts that controlled the weeds effectively at initial crop growth period under these treatments, might be made more nutrients available to crop and consequently encouraged higher concentration of nutrients and more stover yield thereby higher uptake of nutrients. These findings corroborate the reports of Mani (1975), Vasave *et al.,* (2014), Kour *et al.,* (2014).

It was obvious that HW + IC at 30 & 45 DAS recorded significantly the lowest uptake of N, P and K by weeds followed by Pendimethalin 0.75 or 1.0 kg/ha as PE + Two IC at 30 & 45 DAS. Significantly the highest nutrient uptake (N, P and K) by weeds were registered in unweeded control. The lower values of nutrients uptake (N, P and K) under these treatments might be due to lower weeds population from beginning to harvest of the crop might be due to pre emergence herbicidal application inhibit germination of weeds and escaped weeds

removed by interculturing resulting lower population and dry weight of weeds, might be made lower crop weed competition and made more nutrients available to crop and less nutrient available to weeds. These findings are in agreement with those of Ahlawat *et al.,* (1983), Mani (1975), Vasave *et al.,* (2014), Kour *et al.,* (2014).

From the results of the experiment it is concluded that for getting higher seed and stover yield with effective weed control in chickpea, the crop should be kept weed free by hand weeding followed interculturing at 30 and 45 days after sowing or pre mergence application of 0.75 kg/ha pendimethalin followed by two interculturing at 30 and 45 days after sowing under North Gujarat conditions.

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Table 1: Effect of different treatments on yield, harvest index, total weeds population per m^2 at Harvest, dry weight of weeds, weed control efficiency and weed index of chickpea

Treatments		Weed population per m^2 at harvest	Weed control efficiency (%)	Dry weight of weeds (kg/ha)	Weed index (%)	Stover yield (kg/ha)	Seed yield (kg/ha)	Harvest index (%)
T_1	Oxyfluorfen @ 0.10 kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS	*11.66b (135.67)	40.22d	437b	44.06a	1753d	2241cd	31.51b
T_2	Oxyfluorfen @ 0.12 kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS	11.06b (122.33)	43.26cd	415bc	44.40a	1843cd	2307cd	28.07bc
T_3	Oxyfluorfen @ 0.10 kg/ha as PE + Two IC at 30 & 45 DAS	7.77d (60.00)	50.98b	359d	43.73a	1972c	2550bc	22.97c
T_4	Oxyfluorfen @ 0.12 kg/ha as PE + Two IC at 30 & 45 DAS	7.38d (54.00)	51.40b	356d	43.12a	2037c	2687b	20.51c
T_5	Pendimethalin @ 1kg/ha as PE + Two IC at 30 & 45 DAS	6.28f (39.00)	68.71a	230e	45.48a	2373ab	2845ab	7.39de
T_6	Pendimethalin @ 1kg/ha as PE + Quizalofop-ethyl 40 g/ha	9.35c (87.00)	49.58bc	369cd	44.08a	1975c	2506bc	22.89c

	as PoE at 45 DAS							
T_7	Pendimethalin @ 0.75kg/ha as PE + Two IC at 30 & 45 DAS	6.79ef (45.67)	66.88a	243e	45.09a	2311b	2815ab	9.71d
T_8	Pendimethalin @ 0.75kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS	10.01c (100.00)	46.18bcd	393bcd	43.94a	1973c	2515bc	23.01c
T_9	HW & IC at 30 & 45 DAS	4.94g (24.00)	73.56a	193e	45.70a	2562a	3046a	0.00e
T_{10}	Control (Unweeded)	13.93a (193.67)	0.00e	733a	41.85a	1490e	2072d	44.60a
S.Em. ±		0.24	2.34	17.23	2.72	119.37	70.25	0.79
C.V. %		4.73	8.27	8.00	22.65	8.08	6.00	3.09

Means with at least one letter common are not statistically significant using DUNCAN's Multiple Range Test

*Original data given in parentheses were subjected to square root transformation $\sqrt{x+0.5}$ before analysis.

Table 2: Effect of different treatments on nutrient uptake by seeds, stover and weeds

Treatments		Nutrient uptake by seeds (kg/ha)			Nutrient uptake by stover (kg/ha)			Nutrient uptake by weeds (kg/ha)		
		N	P	K	N	P	K	N	P	K
T_1	Oxyfluorfen @ 0.10 kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS	45.07de	5.96de	10.77e	23.94ef	3.42gh	25.63fg	10.36b	1.53b	5.79b
T_2	Oxyfluorfen @ 0.12 kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS	48.13cd	6.01de	11.48de	25.19de	3.93fg	27.38ef	10.12b	1.47bc	5.52bc
T_3	Oxyfluorfen @ 0.10 kg/ha as PE + Two IC at 30 & 45 DAS	52.62bc	9.85bc	12.91cd	30.74c	5.70de	32.72cd	8.32bc	1.11de	4.69cd
T_4	Oxyfluorfen @ 0.12 kg/ha as PE + Two	56.00b	10.27b	13.80c	33.19bc	6.64cd	35.63bc	7.51cd	1.09de	4.37de

	IC at 30 & 45 DAS									
T_5	Pendimethalin @ 1kg/ha as PE + Two IC at 30 & 45 DAS	70.01a	13.47a	17.49b	37.52ab	8.43ab	38.87ab	5.23de	0.55f	3.27f
T_6	Pendimethalin @ 1kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS	52.23bcd	7.85cd	12.19cde	29.78cd	4.90ef	30.27de	8.83bc	1.18cde	5.08bcd
T_7	Pendimethalin @ 0.75kg/ha as PE + Two IC at 30 & 45 DAS	65.91a	12.99a	16.31b	36.52ab	7.59bc	37.83b	5.64de	0.89e	3.53ef
T_8	Pendimethalin @ 0.75kg/ha as PE + Quizalofop-ethyl 40 g/ha as PoE at 45 DAS	50.17bcd	7.34d	12.01de	28.61cde	4.53f	30.13de	8.81bc	1.34bcd	5.34bc
T_9	HW & IC at 30 & 45 DAS	72.79a	13.99a	20.23a	41.84a	9.44a	42.33a	3.87e	0.39f	1.68g
T_{10}	Control (Unweeded)	38.01e	4.41e	8.55f	19.58f	2.42h	22.78g	20.11a	2.86a	11.25a
	S.Em. $\pm$	2.39	0.73	0.58	1.86	0.34	1.46	0.79	0.10	0.29
	C.V. %	7.53	13.71	7.40	10.47	10.38	7.84	15.40	14.11	10.02

Means with at least one letter common are not statistically significant using DUNCAN's Multiple Range Test