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Integrated Weed Management in Chickpea

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ABSTRACT

The results of the experiment conducted on Vertisol soils of Junagadh during *rabi* season of 1992-93, 1994-95 and 1995-96 on "Integrated weed management in chickpea' revealed that maximum yield of grain (1432 kg ha^{-1}) and fodder (1660 kg ha^{-1}) as well as the highest net return (Rs. 15450 ha^{-1}) and additional income over control (Rs. 7508 ha^{-1}) could be obtained by one hand weeding + interculturing at 30-35 days after sowing the crop. However, the integration of herbicides with hand weeding and interculturing was found efficient as far as the weed control efficiency is concerned.

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INTRODUCTION

Chickpea (*Cicer arietinum* L.) is world's important *rabi* pulse crop occupying third position among the grain legumes. In India, where people are predominantly vegetarian, pulses form the main source of protein in daily diet. In Gujarat, it occupies an area of about 0.967 lakh hectares producing 0.551 lakh tonnes of grain annually with productivity of 570 kg ha^{-1} (Anon., 1995). Competition between weeds and crop for moisture becomes aggressive, particularly during early stage of crop growth. The chickpea is generally grown under conserved soil moisture conditions specially in Ghed as well as *Bhal* tracts of Gujarat. But there is a large area of chickpea in Gujarat taken as irrigated crop during *Rabi* season. Due to irrigation, there will be severe competition between crop and weeds for moisture, nutrients and space. The magnitude in yield losses due to weeds was recorded to the tune of 31-61% under Junagadh conditions (Gediya, 1988). There is always paucity of labour during the peak period of crop growth for hand weeding. For the farmers point of view the labour charges are also too high. The importance of integrated approach is well established instead of only one weed control method (Bhan and Malik, 1983). Considering the fact highlighted above, the present experiment was carried out to find out an efficient and economical weed management system for chickpea crop under South Saurashtra agro-climatic conditions.

MATERIALS AND METHODS

A field experiment was conducted in the research farm of weed control project, Department of Agronomy, Gujarat Agricultural University, Junagadh during *rabi* seasons of

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1992-93, 1994-95 and 1995-96 on Vertisol. The soil was slightly alkaline in reaction (pH 8.2), normal in respect to salt content (Ec 0.28 dSm^{-1}). The soil was low in available nitrogen (216.4 kg ha^{-1}), high in available phosphorus (60.3 kg ha^{-1}) and medium in available potash (268.8 kg ha^{-1}). The experiment comprising of twelve treatments (Table-1) was laid out in a randomized block design with four replications. The crop was fertilized with 20 kg N and 40 kg P_2O_5 ha^{-1} at the time of sowing. The chickpea var. ICCC-4 was sown at 30 cm apart using seed rate of 6 kg ha^{-1} on 13, 30 and 22 November and harvested on 11, 28 and 6 March in the year 1992-93, 1994-95 and 1995-96, respectively. The number of irrigations given were 6, 6 and 8 in respective years. The crop yield and dry weight of weeds were subjected to statistical analysis and then interpreted with Duncan's New Multiple Range Test accordingly.

RESULTS AND DISCUSSION

WEED STUDIES

A. Weed Flora

The seven weed species viz. *Digera arvensis* (38.33%), *Echinochloa crusgalli* (26.18%), *Indigofera glandulosa* (11.51%) *Eluropus villosus* (4.07%), *Portulaca oleracea* (1.74%), *Physalis minima* (0.54%) and *Chenopodium album* (0.39%) contributed about 82.76% of total weed flora (Table-1). Contributional data of differemt weeds indicated that the experimental plots were more dominated with broad leaf weeds (52.51%) than the grassy weeds (30.25%). *Digera arvensis* was found the most dominant weed in all the treatments except treatment K where two hand weedings and interculturing were carried out at 20 & 40 days after sowing.

B. Weed Density

Data presented in Table-2 indicated that the lowest weed density of all the 7 weed species were recorded under treatment K where two hand weedings and interculturings were carried out at 20 & 40 days after sowing. In general the treatment weedy check recorded the highest dansity of *D. arvensis*, *E crusgalli, E. villosus* and *P. oleracea.*

Data further revealed that the application of pendimethalin at lower as well as higher rate with or without HW + IC was found effective for the control of *E. crusgalli.* Likewise the use of fluchloralin was also found beneficial. The higher level of oxyfluorfen was found effective to control the *E. crusgalli.* All the three herbicides at either level were found less effective for the control of *D. arvensis* as compared to *E. crusgalli.*

C. Dry Weed Weight

The critical examination of data (Table-3) showed that the maximum dry weed weight of 778 kg ha^{-1} was recorded under treatment L where nothing was done. The findings are in accordance with those of Saxena and Ali (1995). Whereas, the lowest dry weed weight of 116 kg ha^{-1} was registered under treatment I (oxyfluorfen 0.120 kg ha^{-1}, pre emergence + one HW & IC at 30-35 DAS).

The higher rates of all the three herbicides were found effective to reduce the dry weed weight when compared to lower rates of respective herbicides. The data further indicated that when integrated approach is adopted in either herbicides was found most effective to control the weeds as compared to the herbicide used alone either at lower or higher rate.

Per cent composition of different weeds (Mean over three years).

	Treatments	*Rate kg/ha*	*D. arvensis*	*E. crusgalli*	*I. glandulosa*	*E. villosus*	*P. oleracea*	*P. minima*	*C. album*	*Others*
A	Pendimethalin, Pre	0.600	60.67	16.58	8.33	0	0	0.22	1.89	12.31
B	Pendimethalin, Pre	0.900	42.40	28.40	10.14	0.90	0.28	2.25	0.14	15.49
C	Pendimethalin, Pre+ 1 HW & IC at 30-35 DAS	0.600	43.58	18.18	16.58	3.65	0.92	1.09	0	16.00
D	Fluchloralin, Pre	0.675	49.40	13.71	11.58	5.31	8.33	0.80	0.80	10.07
E	Fluchloralin, Pre	0.900	41.12	27.53	8.19	6.03	0.70	0	0.81	15.62
F	Fluchloralin, Pre + 1 HW & IC at 30-35 DAS	0.675	34.89	27.79	16.14	2.94	0	0	0	18.24
G	Oxyfluorfen, Pre	0.120	41.23	40.25	13.60	0.55	0.76	0	0	3.61
H	Oxyfluorfen, Pre	0.180	36.52	32.90	10.97	0.84	0.45	1.02	0.64	16.66
I	Oxyfluorfen, Pre + 1 HW & IC at 30-35 DAS	0.120	38.57	32.06	15.70	3.38	1.39	0.93	0	7.97
J	1 HW & IC at 30 & 35 DAS	—	32.68	26.09	12.36	8.37	5.35	0	0	15.15
K	2 HW & IC at 20 & 40 DAS	—	2.75	17.52	5.58	5.41	2.07	0	0	66.67
L	Weedy check	—	36.15	33.23	9.00	11.44	0.64	0.11	0.34	9.09
	Mean	—	38.33	26.18	11.51	4.07	1.74	0.54	0.39	17.24

Pre = Pre-emergence, HW = Hand weeding, IC + Interculturing, DAS = Days after sowing.

TABLE 2

Specieswise weed density during the crop growth period (mean over three years).

Treatments	No./sq.m.						
	D. arvensis	*E. crusgalli*	*I. glandulosa*	*E. villosus*	*P. oleracea*	*P. minima*	*C. album*
A	6.42	2.22	1.43	0	0	0.05	0.30
B	5.43	2.86	1.88	0.25	0.10	0.25	0.05
C	2.72	1.73	1.18	0.34	0.05	0.15	0
D	8.05	1.83	3.16	1.09	0.05	0.25	0.20
E	6.27	9.53	1.83	0.74	0.25	0	0.20
F	4.05	2.67	2.76	0.25	0	0	0
G	7.61	17.38	2.57	0.36	0.15	0	0
H	5.14	5.09	1.53	0.20	0.10	0.25	0.05
I	3.06	5.38	1.09	0.30	0.15	0.10	0
J	3.31	8.64	1.78	1.83	0.30	0	0
K	0.49	0.25	0.10	0.15	0.05	0	0
L	10.32	25.88	2.47	5.38	0.39	0.05	0.15

TABLE 3

Effect of different treatments on yield of chickpea, dry weed weight, weed control efficiency and economics (Pooled over 3 years).

	Treatments	*Rate (kg/ha)*	*Yield (kg/ha)*		*Dry weed weight kg/ha*	*W.C.E. (%)*	*Net return (Rs./ha)*	*Additional income over control (Rs./ha)*
			Grain	*Fodder*				
A	Pendimethalin, Pre	0.600	852 cd	1472 ab	313 bc	59.8	9124	1182
B	Pendimethalin, Pre.	0.900	1045 abcd	1566 a	243 bc	68.8	10975	3033
C	Pendimethalin, Pre+ 1 HW & IC at 30-35 DAS	0.600	1073 abcd	1458 ab	139 c	82.1	11140	3198
D	Fluchloralin, Pre.	0.675	898 bcd	1536 a	425 b	45.4	9799	1857
E	Fluchoralin, Pre.	0.900	1005 bcd	1535 a	311 bc	60.0	10826	2884
F	Fluchoralin, Pre.+ 1 HW & IC at 30-35 DAS	0.675	1248 abc	1609 a	125 c	83.9	13191	5249
G	Oxyfluorfen, Pre	0.120	1090 abcd	1486 ab	248 bc	68.1	11846	3904
H	Oxyfluorfen, Pre.	0.180	1068 abcd	1538 a	182 bc	76.6	11369	3427
I	Oxyfluorfen, Pre. + 1 HW & IC at 30-35 DAS	0.120	1260 ab	1486 ab	116 c	85.1	13096	5154
J	1 HW & IC at 30-35 DAS	—	1432 a	1660 a	229 bc	70.6	15450	7508
K	2 HW & IC at 20 & 40 DAS	—	1260 ab	1609 a	179 bc	77.0	13243	5301
L	Weedy check	—	691 d	1135 b	778 a	—	7942	—
	C. V. %	—	10.79	8.51	20.63	—	—	—

Pre = Pre-emergence, HW = Hand weeding, IC = Interculturing, DAS = Day After Sowing.

Note = The same alphabet indicates at par values (by DNMRT) of yield and dry weed weight.

D. Weed Control Efficiency

The highest weed control efficiency of 85.1% was recorded in the treatment I followed by treatment F (83.9%) and C (82.1%) means integration of lower rate of herbicides with one HW & IC was quite efficient in weed control as compared to sole herbicide or other cultural practices.

Effect on Yield

The pooled results presented under Table-3 showed that different weed management treatments exerted their significant effect on grain as well as fodder yield of chickpea. The highest grain yield of 1432 kg ha^{-1} and fodder yield of 1660 kg ha^{-1} were produced under the treatment J i.e. one HW & IC at 30-35 DAS. It was closely followed by treatment K (2 HW & IC at 20 & 40 DAS). The lowest grain (691 kg ha^{-1}) and fodder (1135 kg ha^{-1}) yield were recorded under the treatment weedy check. The reduction in yield under treatment weedy check in comparison to treatment J were 52 and 32 per cent in case of grain and fodder yield, respectively. These findings were in agreements with those of Ahuja and Yaduraju(1995) and Saxena and Ali (1995). When compared with lower rate, the higher rate of any herbicides was found superior in case of grain yield of chickpea. In comparison to either lower or higher rate of any herbicides, the adoption of integrated approach was found beneficial as far as grain yield of chickpea is concerned.

Economics of Different Treatments

The highest net return of Rs. 15450 ha^{-1} and maximum additional income over control of Rs. 7508 ha^{-1} were achieved with the treatment J. The lowest net return of Rs. 7942 ha^{-1} was observed under the treatment weedy check.

It could be concluded that for effective and profitable weed management in chickpea, one hand weeding with one interculturing at 30-35 days after sowing is worth adoptive for the chickpea growing farmers of South Saurashtra region. However, on the bases of weed control efficiency, it could be concluded that integration of pre-emergence application of either oxyfluorfen, fluchloralin or pendimethalin at lower rates with one hand weeding + interculturing at 30-35 DAS proved efficient to minimise weed problems in chickpea as compared to sole herbicide or sole cultural practice.

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