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Research Article

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Weed Studies in Chickpea under Different Sowing Dates and Weed Control Measure

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ABSTRACT

An experiment was carried out at the Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during rabi *2015-16 on loamy sand soil. The experiment was laid out in split-plot design with three replications, assigning twenty treatments consisting of four date of sowing (15 October, 30 October, 15 November and 30 November) as main plot treatments and five weed control measure (Weedy check, Weed free, Pendimethalin @ 0.75 kg/ha as pre emergence, Imazethapyr @ 20 g/ha at 20 DAS as post emergence and Quizalofop@ 37.5 g/ha at 20 DAS as post emergence) as sub-plots.*

The results revealed that early sowing (15 October,) reduced the weed density, its dry matter accumulation, nutrient depletion by weeds and higher crop yield. Among different chemical weed control measures, pendimethalin at 0.75 kg/ha as PE recorded the lowest weed density and higher yield. Imazethapyr @ 20 g/ha at 20 DAS as PoE resulted in significantly lowest dry matter accumulation, nutrient depletion by weeds and higher weed control efficiency (69.90 percent).

Keywords: *Pendimethalin, Quizalofop and imazethapyr, Weed control efficiency, Chickpea*

INTRODUCTION

A good weed management practice with sowing at right time may help in realizing better yield. Early or delayed sowing reduces the optimum plant population which plays an important role in improving the productivity of crop (Kumar et al., 2003). Weeds are one of the important factors responsible for low productivity of chick pea which is responsible for reducing crop growth by two mechanism, *ie* completion for resources, such as light, space, water, nutrients *etc.* and allelopathic effect. In the initial growth of crop there is relatively shallow canopy and it slowly shades the inter-row area, which allows bumper weeds growth and thus chick pea becomes more susceptible to weed crop competition in the earlier growth period of the crop.

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Herbicides are most effective and economic weed control measures but always use of herbicides is not feasible due to some unavoidable circumstances like unavailability of proper herbicides, cropping system requirement and problem of weed flora shift due to continuous use of same group of herbicides. Thus, it is necessity to explore and test other alternative and economical methods of weed control. In view of above fact study on sowing dates and weed control measures was carried out for identifying most effective and economically viable method of weed control for harvesting higher yield of chickpea and less depletion of nutrient by weeds. With this view field experiments were conducted to identify the optimum sowing time, and appropriate weed control measure for the growth and yield performance in chickpea.

MATERIALS AND METHODS

The field experiment was conducted during *rabi* season of 2015-16 at Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, India, which is situated at a 28^{o} 01'N latitude and 73^{o} 22'E longitude at an altitude of 234.70 meters above mean sea level). The soil of experimental field was loamy-sand, alkaline in reaction (pH 8.38) having 89.25 kg/ha available N, low in available phosphorus (19.5 kg ha^{-1},) and medium in available potassium (190.35 kg/ha) in 0-15 cm soil depth at the start of the experiment. The experiment was laid out in split-plot design with three replications, assigning twenty treatments consisting of four date of sowing (15 October, 30 October, 15 November and 30 November) as main plot treatments and five weed control measure (Weedy check, Weed free, Pendimethalin @ 0.75 kg/ha as pre emergence, Imazethapyr @ 20 g/ha at 20 DAS as post emergence and Quizalofop@ 37.5 g/ha at 20 DAS as post emergence) as sub-plots.

The sowing of chick pea variety GNG-1581 using seed rate of 60 kg/ha and maintained crop geometry 30 × 10 cm was done on scheduled dates of sowing. The rainfall received during growing period (October to April) was 31.3 mm in 04 rainy days. The mean weekly minimum and maximum temperature during the crop season fluctuated from 4.0 to 37.3^{0}c with the average relative humidity from 51.4 to 91.8 %. Experimental crop was raised as per recommended package of practices. The data obtained were statistically analyzed accord with the Split Plot Design. Analysis of variance was used to test the significance of treatment effects at 5 percent level of probability. Least Significant Difference (LSD) Test was used to compare treatment means.

RESULTS AND DISCUSSION

Weed density

The most important weed species in the experimental field throughout the growing period were *Cyperus rotundus L., Melilotus indica, Chenopodium album, Chenopodium murale, Asphodelus tenuifolius, Convolvulus arvensis, Cynodon dactylon, Rumex dantatus and Avena ludoviciana.* Singh *et al.* (2003) also found that the predominance of these weeds in chickpea field. Results (Table 1) revealed that weed density did not influence significantly by sowing dates at any growth stage in chickpea. Crop *sown* on 15 October recorded lowest weed density. Among weed control measures, the highest weed density was found in the weedy check (control), which was statistically higher over the rest of treatments at 40, 80 DAS and at harvest (Table 1). Weed-free treatment recorded the lowest weed density at 40, 80 DAS and at harvest. The treatment Quizalofop @ 37.5 g/ha at 20 DAS as PoE resulted in significantly lowest weed density of monocot weeds as compared to the rest of treatments except weed-free condition at 40, 80 DAS and at harvest. In case of dicot weeds, application of Imazethapyr @ 20 g/ha + at 20 DAS as PoE resulted in lowest weed density as compared to the rest of treatments except weed-free condition at 40, 80 DAS and at harvest. The treatment pendimethalin at 0.75 kg/ha as PE resulted in significantly lowest weed density of total weed

count (both monocot & dicot) as compared to the rest of treatments except weed-free condition at 40, 80 DAS and at harvest. Quizalofop @ 37.5 g/ha at 20 DAS as PoE and Imazethapyr @ 20 g/ha + at 20 DAS as PoE was found less effective in reducing total weed density as compared to rest of chemical treatments.

Dry matter accumulation and weed control efficiency

Results (Table 2) revealed that sowing of the crop on 15 October recorded significantly lowest dry matter accumulation at 40, 80 DAS and at harvest, thereafter delaying of sowing dates of the crop up to 30 November, gradually increased dry matter accumulation at 40, 80 DAS and at harvest. Sowing of the crop on 30 October, 15 November, and 30 November, respectively, increases dry matter accumulation by 31.09, 86.98 and 104.71 percent at 40 DAS, 23.81, 67.52 and 81.23 percent at 80 DAS and 28.41, 85.80 and 102.98 percent at harvest, as compared to crop sown on 15 October. Among weed control measures, the highest dry matter accumulation was found in the weedy check (control), which was statistically higher over the rest of treatments at 40, 80 DAS and at harvest (Table 2). Weed-free treatment recorded the lowest dry matter accumulation at 40, 80 DAS and at harvest. The treatment Quizalofop @ 37.5 g/ha at 20 DAS as PoE resulted in significantly lowest dry matter accumulation of monocot weeds as compared to the rest of treatments except weed-free condition at 40, 80 DAS and at harvest. In case of dicot weeds, application of Imazethapyr @ 20 g/ha + at 20 DAS as PoE resulted in lowest dry matter accumulation as compared to the rest of treatments except weed-free condition at 40, 80 DAS and at harvest. The treatment imazethapyr @ 20 g/ha at 20 DAS as PoE resulted in significantly lowest dry matter accumulation of total weeds (both monocot & dicot) as compared to the rest of treatments except weed-free condition at 40, 80 DAS and at harvest. Quizalofop @ 37.5 g/ha at 20 DAS as PoE and pendimethalin @ 0.75 kg/ha as PE was found less effective in reducing dry matter accumulation and weed control efficiency due to less control of weeds as compared to rest of chemical treatments. Vaishya *et al.* (1999) also reported that pendimethalin @ 1.0 kg/ha were inferior in reducing weed dry weight. The highest weed control efficiency was observed in the weed-free plot (100 percent) due to the continuous removal of weeds during the crop period. Among all the chemical weed control measures, maximum weed control efficiency (69.90 percent) was recorded in imazethapyr @ 20 g/ha at 20 DAS as PoE over Quizalofop @ 37.5 g/ha at 20 DAS as PoE and pendimethalin @ 0.75 kg/ha as PE. The lowest weed control efficiency (19.54 percent) was recorded in quizalofop @ 37.5 g/ha at 20 DAS as PoE.

Nutrient depletion

Results (Table 3) revealed that the lowest nutrient depletion by weeds was recorded in early sown crop (15 October) as compared to crop sown on 30 October, 15 November, and 30 November due to lower dry matter accumulation by weeds. Among weed control measures, N, P and K uptake by weeds almost followed the footsteps of weed biomass in trend. It was found that all weed control treatments significantly reduced the N, P and K uptake both by the individual weed categories and total weeds at harvest. The nil uptakes of N, P and K by weeds were recorded with weed-free treatment. Treatment Quizalofop @ 37.5 g/ha at 20 DAS as PoE recorded lower N, P, & K depletion by monocot weeds. Whereas, treatment imazethapyr @ 20 g/ha at 20 DAS as PoE recorded lower nutrient depletion by dicot and total weeds during the experimentation.

Yield

Results (Table 3) revealed that seed, straw & biological yield, test weigh and Harvest index influenced significantly due to sowing date and weed control measures. Highest seed, straw and biological yield was recorded by crop sown on 15th October which was statistically at par with 30th October over sowing on 15th November and 30th November. The reduction in seed yield under delayed sowings due to shortening of life span coupled

with lesser biomass production in chickpea crop had also been reported by Ray *et al*. (2011). The percentage increases in seed yield (17.69, & 43.20), straw yield (12.05, & 36.29) and biological yield (13.99, & 38.67) as compared to crop sown on 15th November and 30th November, respectively. Among weed control measures, weed free treatment produced significantly higher seed, straw and biological yield over rest of all chemical weed control treatments and weedy check. Among chemical weed control treatments such as quizalofop 37.5 g/ha and pendimethalin at 0.75 kg/ha being statistically at par with each other, produced significantly higher seed, straw and biological yield over imazethapyr 20 g/ha. Imazethapyr 20 g/ha recorded seed, straw and biological yield next lowest. The percentage increases in seed yield (54.29, 25.86, & 51.47), straw yield (55.48, 26.10, & 52.81) and biological yield (55.06, 26.02, & 52.34) by pendimethalin at 0.75 kg/ha, imazethapyr 20 g/ha and quizalofop 37.5 g/ha over weedy check, respectively.

Table 1: Effect of sowing dates and weed control measures on weed density in chickpea

Treatment	Weed density (No/m^2)								
	40 DAS			80 DAS			At Harvest		
	Monocot	Dicot	Total	Monocot	Dicot	Total	Monocot	Dicot	Total
Sowing dates									
15 October	2.61 (9.39)	2.19 (6.49)	3.49 (15.88)	2.85 (11.07)	2.37 (8.06)	3.80 (19.13)	2.89 (11.39)	2.42 (8.68)	3.88 (20.07)
30 October	2.93 (11.59)	2.64 (8.85)	4.02 (20.44)	3.10 (13.19)	2.84 (10.75)	4.33 (23.94)	3.12 (13.34)	2.88 (11.42)	4.39 (24.76)
15 November	3.29 (13.67)	3.42 (13.96)	4.78 (27.63)	3.50 (15.60)	3.68 (16.61)	5.13 (32.21)	3.52 (15.81)	3.73 (17.35)	5.20 (33.16)
30 November	3.41 (14.63)	3.61 (15.43)	4.98 (30.07)	3.63 (16.74)	3.86 (18.20)	5.34 (34.94)	3.65 (17.00)	3.90 (18.96)	5.40 (35.96)
S.Em.±	0.60	0.35	0.88	0.86	0.47	1.07	1.19	0.57	1.26
C.D.(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Weed control measures									
Weedy check	5.84 (33.61)	4.76 (22.39)	7.50 (55.99)	6.26 (38.73)	5.25 (27.37)	8.15 (66.10)	6.31 (39.42)	5.43 (29.30)	8.30 (68.73)
Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
Pendimethalin @ 0.75 kg/ha as PE	2.66 (7.09)	2.73 (8.11)	3.76 (15.19)	2.82 (8.08)	2.87 (9.19)	4.00 (17.27)	2.83 (8.18)	2.85 (9.24)	4.00 (17.43)
Imazethapyr @ 20 g/ha at 20 DAS as PoE	4.25 (17.73)	2.02 (4.26)	4.69 (21.99)	4.48 (19.82)	1.98 (4.10)	4.89 (23.92)	4.47 (19.73)	1.84 (3.50)	4.81 (23.22)
Quizalofop @ 37.5 g/ha at 20 DAS as PoE	1.86 (3.18)	4.61 (21.17)	4.92 (24.35)	2.08 (4.11)	5.14 (26.36)	5.51 (30.47)	2.16 (4.59)	5.34 (28.47)	5.75 (33.06)
S.Em.±	0.56	0.45	0.87	0.70	0.52	1.04	0.89	0.54	1.20
C.D.(0.05)	1.62	1.29	2.51	2.00	1.49	2.99	2.57	1.57	3.46

DAS = Days after sowing, NS = Non Significant; *: Figures in parenthesis are original, #: Weed density transformed to √ (n+05).

Table 2: Effect of sowing dates and weed control measures on dry matter accumulation by weeds and weed control efficiency in chickpea

Treatment	Dry matter accumulation (g/m^2)									Weed control efficiency (per cent)
	40 DAS			80 DAS			At Harvest			
	Monocot	Dicot	Total	Monocot	Dicot	Total	Monocot	Dicot	Total	
Sowing dates										
15 October	1.31	1.95	3.26	5.68	9.01	14.69	6.12	29.55	35.67	-
30 October	1.62	2.65	4.28	6.63	11.56	18.19	7.35	38.45	45.80	-
15 November	1.91	4.19	6.10	7.53	17.07	24.61	8.52	57.75	66.27	-
30 November	2.05	4.63	6.68	7.95	18.67	26.62	9.06	63.34	72.40	-
S.Em.±	0.08	0.11	0.17	0.26	0.38	0.59	0.34	1.33	1.58	-
C.D.(0.05)	0.29	0.37	0.61	0.90	1.32	2.05	1.16	4.61	5.48	-
Weed control measures										
Weedy check	4.70	6.72	11.42	16.58	26.68	43.26	19.89	90.87	110.77	-
Weed free	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Pendimethalin @ 0.75 kg/ha as PE	0.99	2.43	3.42	5.08	11.26	16.33	5.05	36.90	41.94	62.13
Imazethapyr @ 20 g/ha at 20 DAS as PoE	2.48	1.28	3.76	9.70	7.10	16.79	11.01	22.34	33.34	69.90
Quizalofop @ 37.5 g/ha at 20 DAS as PoE	0.45	6.35	6.80	3.38	25.36	28.74	2.86	86.26	89.12	19.54
S.Em.±	0.08	0.13	0.19	0.24	0.48	0.64	0.32	1.69	1.86	-
C.D.(0.05)	0.23	0.39	0.53	0.70	1.39	1.84	0.91	4.88	5.37	-

DAS = Days after sowing

Table 3: Effect of sowing dates and weed control measures on nitrogen, phosphorus and potassium uptake by weed and yield of chick pea

Treatment	Nutrient uptake (kg/ha)									Yield (kg/ha)		
	Nitrogen			Phosphorus			Potassium			Seed	Straw	Biological
	Mono	Dicot	Total	Mono	Dicot	Total	Mono	Dicot	Total			
Sowing dates												
15 October	2.05	10.88	12.93	0.41	1.81	2.22	1.66	8.92	10.58	1734.9	3142.0	4877.0
30 October	2.52	13.26	15.77	0.50	2.22	2.72	2.04	10.87	12.91	1625.6	3089.4	4715.0
15 November	3.65	17.88	21.53	0.73	3.01	3.74	2.95	14.66	17.61	1474.1	2804.1	4278.3
30 November	4.00	17.62	21.62	0.80	3.01	3.81	3.25	14.47	17.71	1211.6	2305.3	3516.9
S.Em.±	0.11	0.43	0.53	0.02	0.07	0.09	0.09	0.35	0.43	42.4	80.1	122.5
C.D.(0.05)	0.36	1.48	1.82	0.07	0.25	0.32	0.30	1.21	1.49	146.7	277.1	423.9
Weed control measures												
Weedy check	6.59	32.99	39.58	1.32	5.50	6.82	5.34	27.06	32.40	1055.7	1968.9	3024.6
Weed free	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1945.2	3654.4	5599.7
Pendimethalin @ 0.75 kg/ha as PE	2.22	10.73	12.95	0.44	1.82	2.26	1.80	8.80	10.60	1628.9	3061.3	4690.2
Imazethapyr @ 20 g/ha at 20 DAS as PoE	4.62	8.67	13.29	0.92	1.47	2.39	3.74	7.11	10.85	1328.7	2482.7	3811.5
Quizalofop @ 37.5 g/ha at 20 DAS as PoE	1.84	22.16	24.00	0.37	3.77	4.14	1.49	18.17	19.66	1599.1	3008.7	4607.9
S.Em.±	0.09	0.46	0.54	0.02	0.08	0.09	0.07	0.38	0.44	42.9	81.6	124.6
C.D.(0.05)	0.27	1.33	1.56	0.05	0.23	0.27	0.22	1.09	1.28	123.7	235.1	358.9

DAS = Days after sowing

CONCLUSION

From the present investigation it may be inferred that crop was sown on 15 to 30 October overall better than other dates of sowing it was recorded significantly lowest weed dry matter accumulation, nutrient depletion and higher yield of crop. Weed free plot recorded lowest weed dry matter accumulation, nutrient depletion and higher yield of crop. Pendimethalin @ 0.75 kg/ha as PE was most effective in controlling weeds and increasing yield of chickpea.

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