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Nutrient and quality of chickpea as influenced by sowing dates and weed control measures in western Rajasthan

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Abstract
An experiment was carried out during *rabi* 2015-16 to evaluate growth and yield of chickpea under different sowing dates and weed control measure. 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 crop sown on 15th October remained statistically at par with sowing on 30th October recorded significantly higher nitrogen, phosphorus & potassium content & uptake by crop and protein content and yield potential of crop. Further weed free recorded significantly higher nitrogen, phosphorus & potassium content & uptake by crop and protein content and yield potential followed by pendimethalin 0.75 kg/ha as pre emergence and quizalofop 37.5 g/ha at 20 DAS as post emergence.

Keywords: Pre emergence, post emergence, nitrogen, phosphorus, potassium and protein

Introduction
Chickpea (*Cicer arietinum* L.) is a legume and play important role in Indian economy. It is popularly known as "Gram" or "Bengal gram". Being a rich and cheap source of protein, it can help people to improve the nutritional quality of their diet. India is the largest acreage holder and producer of chick pea in the world. In India, it covers 10.56 million hectares cultivated area and 11.23 million tonnes an annual production with productivity of 1063 kg/ha in 2017-18 (GOI, 2018) [2]. The early sown crop results in excessive vegetative growth, poor setting of pods and greater weed competition, whereas in double cropping areas due to cultivation of long duration in *kharif* crop varieties, the planting of chickpea is usually delayed. Under such situation, the crop has to be sown up to December. This late sown crop experiences very low temperature at initial stages of crop growth resulting in poor and slow vegetative growth, where as the early sown crop allows better yield and growth improvement. A study reported that number of fertile pods on the primary branch, grains per pod, weight of 100 grains, and grain yield per unit area were affected by planting date (Mohammadnejad and Soltani, 2005) [5].

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. 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. Hand hoeing still widely practiced for controlling weeds is costly for local farmers. The high cost and non-availability of labour at right time force the farmers for opting alternative, cheaper and easier method of weed control. Several herbicides *viz.* pendimethalin, quizalofop and imazethapyr are presently being used for controlling both grassy and broad-leaved weeds but their effects under different climatic conditions are not well defined. A good weed management practice with sowing at right time may help in realizing better yield. With

this view field experiments were conducted to identify the optimum sowing time, and appropriate weed control measure for the nutrient uptake 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 28º 01'N latitude and 73º 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 37.3^0c 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

Effect of sowing dates

Results revealed that significant variation in protein content, nutrient content and uptake was recorded due to sowing dates (Table 1). Crop sown on 15 October being statistically at par with crop sown on 30 October recorded highest protein content as compared to sowing on 15 November and 30 November. Sowing of chickpea on 15 October increased protein content in seed to the tune of 7.84 and 20.88 per cent, respectively, over chickpea sown on 15 November and 30 November. Sethi (2012) [9] also obtained maximum protein content when the crop was sown early on 20 October produced significantly higher protein content than all other late sowings in chickpea. The crop sown on 15 October being statistically at par with crop sown on 30 October recorded the highest nutrient content in seed and straw as compared to sowing on 15 November and 30 November (Table 1). Percentage increase in nitrogen content (7.85, 21.02 & 5.68, 16.25), phosphorus content (4.90, 13.83 & 3.29, 11.56) and potassium content (7.59, 15.25 & 2.89, 7.29) in seed and straw by crop sown on 15 October over sowing on 15 November and 30 November. Significantly higher uptake by seed and straw as well as total nutrient uptake was observed by crop sown on 15 October over 15 November and 30 November but which was statistically at par with 30 October (Table 2). Prasad (2009) [7] also reported that total N P K uptake by chickpea significantly differed in dates of sowing. Sowing on 15 October, percentage increases in total nitrogen (22.65 & 64.57), phosphorus (18.58 & 53.66) and potassium uptake (16.76 & 18.15) by chickpea over sowing on 15 November and 30 November.

Highest seed, straw, biological yield was recorded by crop sown on 15 October which was statistically at par with 30 October over sowing on 15 November and 30 November (Table 2). 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 15 November and 30 November, respectively. 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) [8].

Table 1: Effect of sowing dates and different weed control measures on nutrient and protein content in chickpea

Treatment	N content (%)		P content (%)		K content (%)		Protein content (%)
	Seed	Straw	Seed	Straw	Seed	Straw	
Sowing dates							
15 October	3.57	0.93	0.428	0.251	0.340	0.677	22.29
30 October	3.48	0.92	0.421	0.249	0.332	0.671	21.74
15 November	3.31	0.88	0.408	0.243	0.316	0.658	20.67
30 November	2.95	0.80	0.376	0.225	0.295	0.631	18.44
S.Em.±	0.03	0.01	0.003	0.002	0.003	0.004	0.22
C.D.(0.05)	0.12	0.04	0.009	0.006	0.012	0.013	0.75
Weed control measures							
Weedy check	3.18	0.85	0.392	0.230	0.306	0.646	19.85
Weed free	3.69	0.97	0.438	0.255	0.356	0.690	23.09
Pendimethalin @ 0.75 kg/ha as PE	3.31	0.87	0.408	0.243	0.319	0.657	20.69
Imazethapyr @ 20 g/ha at 20 DAS as PoE	3.22	0.86	0.401	0.240	0.310	0.650	20.10
Quizalofop @ 37.5 g/ha at 20 DAS as PoE	3.23	0.87	0.402	0.241	0.312	0.653	20.19
S.Em.±	0.03	0.01	0.002	0.001	0.003	0.003	0.17
C.D.(0.05)	0.09	0.02	0.006	0.003	0.008	0.008	0.50

DAS = Days after sowing, NS = Non Significant

Table 2: Effect of sowing dates and weed control measures on nutrient uptake and yield of chickpea

Treatment	N Uptake (kg/ha)			P Uptake (kg/ha)			K Uptake (kg/ha)			Yield (kg/ha)		
	Seed	Straw	Total	Seed	Straw	Total	Seed	Straw	Total	Seed	Straw	Biological
Sowing dates												
15 October	61.86	29.33	91.19	7.43	7.89	15.32	5.91	21.26	27.17	1734.9	3142.0	4877.0
30 October	57.21	28.69	85.90	6.90	7.72	14.62	5.46	20.85	26.32	1625.6	3089.4	4715.0
15 November	49.36	24.99	74.35	6.07	6.86	12.92	4.71	18.56	23.27	1474.1	2804.1	4278.3
30 November	36.67	18.74	55.41	4.65	5.32	9.97	3.67	14.67	18.34	1211.6	2305.3	3516.9
S.Em.±	1.52	0.51	2.02	0.18	0.20	0.38	0.15	0.46	0.61	42.4	80.1	122.5
C.D.(0.05)	5.24	1.76	6.99	0.62	0.68	1.30	0.52	1.59	2.10	146.7	277.1	423.9
Weed control treatments												
Weedy check	34.43	16.95	51.38	4.23	4.65	8.88	3.31	12.83	16.14	1055.7	1968.9	3024.6
Weed free	72.09	35.58	107.67	8.54	9.34	17.88	6.95	25.26	32.21	1945.2	3654.4	5599.7
Pendimethalin @ 0.75 kg/ha as PE	54.07	26.85	80.92	6.67	7.46	14.12	5.21	20.12	25.34	1628.9	3061.3	4690.2
Imazethapyr @ 20 g/ha at 20 DAS as PoE	43.66	21.58	65.24	5.40	6.02	11.42	4.20	16.25	20.45	1328.7	2482.7	3811.5
Quizalofop @ 37.5 g/ha at 20 DAS as PoE	52.13	26.23	78.36	6.47	7.28	13.75	5.02	19.72	24.74	1599.1	3008.7	4607.9
S.Em.±	1.46	0.79	2.24	0.18	0.20	0.38	0.14	0.56	0.70	42.9	81.6	124.6
C.D. (0.05)	4.21	2.27	6.44	0.51	0.58	1.09	0.41	1.61	2.02	123.7	235.1	358.9

Effect of weed control measures

Weed free increased the protein content, nutrient content and nutrient uptake of seed and straw of chickpea significantly over all other treatments. Among chemical weed control measures, all herbicide treatments being statistically at par with each other significantly increased the protein content and nutrient content of seed and straw over weedy check. Results revealed that all weed control treatments significantly increased the nitrogen, phosphorus and potassium uptake through seed, straw and total nutrient uptake over weedy check. The maximum and significantly higher nitrogen, phosphorus and potassium uptake was recorded under weed free treatment over all weed control treatment and weedy check. Application of pendimethalin @ 0.75 kg/ha and quizalofop @ 37.5 g/ha being at par to each other, recorded significantly higher nitrogen, phosphorus and potassium uptake over imazethapyr @ 20 g/ha and weedy check. Application of weed control measures as pendimethalin @ 0.75 kg/ha and quizalofop @ 37.5 g/ha, respectively, increased total nitrogen (24.03, 57.49 & 20.11 52.51 per cent), phosphorus (23.64, 59.01, & 20.40, 54.84 per cent) and potassium uptake (23.91, 57 & 20.97, 53.28 per cent) as compared to imazethapyr @ 20 g/ha and weedy check.

Weed free treatment produced significantly higher seed, straw and biological yield over rest of all chemical weed control treatments and weedy check (Table 2). Chemical weed control treatments such as quizalofop @ 37.5 g/ha and pendimethalin @ 0.75 kg/ha being statistically at par with each other, produced significantly higher seed, straw and biological yield over imazethapyr @ 20 g/ha. 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 @ 0.75 kg/ha, imazethapyr @ 20 g/ha and quizalofop @ 37.5 g/ha over weedy check, respectively.

Conclusion

The crop sown on 15 to 30 October overall better than other dates of sowing it was recorded significantly higher protein content nutrient content and uptake, and yield. The maximum content, protein content and nutrient uptake recorded under weed free followed by pendimethalin @ 0.75 kg/ha as PE and quizalofop @ 37.5 g/ha as PoE.

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