RESPONSE OF PHOSPHORUS AND WEED CONTROL MEASURES ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF CHICKPEA (*CICER ARIETINUM* L.)

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Abstract: The field experiment was conducted during the rabi season of 2005-06 at Agronomy Research Farm at Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj) Faizabad, U.P. to, study the "Effect of phosphorus and weed control measures on growth and yield of chickpea (*Cicer arietinum* L.)" variety udai (KPG-59). Sixteen-treatment combinations comprised of four levels of phosphorus (control, 20, 40 and 60 kg P2 O5 ha-1) and four treatment of weed control measures (weedy check, Hand weeding at 30 DAS, pendimethline at 1 kg ha^{-1} and rice straw mulch) were tested in Randomized Block design with three replications . Growth and yield attributes as well as root length, number of take were affected significantly due to increase the phosphorus levels. However, weed density and weed dry weight were decreased significantly with increasing levels of root nodules and nodules dry weight, nitrogenase activity and nitrogen and phosphorus up phosphorus. Among the weed control measures, hand weeding at 30 DAS found promising to reduce the weed density as well as weed dry weight. Hand weeding at 30 DAS proved its superiority over other methods of weed control in respect of all the growth characters and yield attributes as well as grain and straw yield of chickpea crop followed by pendimethline at 1.0 kg ha-1. On the basis of economics the highest net return was recorded under the effect of Hand weeding at 30 DAS alone has been found most remunerative which was recorded the highest net income rupee invested of Rs 3.52

Keyword: Chickpea, phosphorus levels, weeds control measures

INTRODUCTION

The pulses in the dietary to the mankind make high edible protein which contains essential amino acid to meet the optimum protein requirement of vegetation population. The pulses fix the atmospheric nitrogen into the soil thereby enriching the soil with nitrogen at no extra cost among the winter season pulses. Chickpea has diversified use such as dal, basan, fresh green seeds for vegetable and fresh green leaves for sag for human consumption and feeding to animals. It is considered to have medicinal effect and it is used for blood purification, chickpea contains 18- 22 % protein, 52-70 % carbohydrate, 4- 10 % fat and sufficient quantity of minerals and vitamins. Besides, being a rich source of protein it is also considered important for sustainable agriculture, improves the physic-chemical characteristics and biological properties of soil and function as mini nitrogen factory. Chickpea (*Cicer arietinum* L) is one of the important pulse crops of rabi season. The chickpea is grown in India on an area of 8.81 mha, with production of 6.68 mt.which amounts 65 and 68 per cent of the global area and production respectively (Ali *et al*., 2003). In Uttar Pradesh, it is cultivated on an area of 868 lakh hectares with an annual production of 828.4 lakh tones. Thus, the average productivity of chickpea in Uttar Pradesh is very low out of several reasons for low productivity, soil fertility status and inadequate weed management may be considered are major constraints. Phosphate fertilization of chickpea of promotes of growth nodulation and enhance yield. Phosphorus imparts hardiness to shoots, improves grain quality, regulate the photosynthesis govern physio-biocamical processes and also helps in root enlargement, nodule production and there by increases nitrogen fixation. Weed control is achieved through direct methods and by adopting indirect methods such as altered land preparation, soil moisture regulation, planting methods and fertility management, manual weeding at 25 and 40 days after sowing increased seed yield of chickpea by 170 per cent over weedy check (Shekhawat and Sharma, 1988). Mulch also increased the grain yield and straw yield of Gram as reported by (Chaudhary *et al.* 2003).

MATERIAL AND METHOD

The field experiment was conducted during rabi season, 2005-2006 at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj) Faizabad (U. P.) India. The field study was planned and layout in randomized block design. Chickpea was sown in second fortnight of October and was harvested in the second fortnight of March. The soil of the experimental field was poor in available nitrogen and medium in phosphorus and potassium with alkaline in reaction. The organic carbon content in the soil was 0.34 per cent. During crop season, the maximum

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temperature varied from 21.8^{0}C to 35.0 ^{0}C. The maximum rainfall of 24.2 mm was recorded in the month of October and total rainfall received during the crop period was 69.5 mm. The sunshine hours ranges from October 2.6 to 9.9 hours. Relative humidity was the maximum 78% in the month of October respectively. Chickpea variety Udai (KPG-59) was sowing in furrows opened by Kudal at the spacing of 30 cm apart using 80 kg seed ha^{-1}. Soil of the experimental site has been classified as sandy loam and field was drained and leveled. Soil samples were collected at random from different parts of experimental field (16 places) with the help of a soil auger to a depth of 0-22.5 cm prior to the fertilizer application. The collected soil samples were mixed together and a composite sample was drawn and analyzed. A basal dose of 20 kg nitrogen through urea was applied uniformly to all plots. The observations pertaining to yield and yield contributes were recorded at harvest. Weed population was studied with the help of a quadrate (50cm x 50cm) placed in second row in the different corners of the plot in different observations. The populations counts were taken at different stages of crop growth i.e. 30, 60, 90 DAS and at harvest sampled plants were dried in sun and subsequently into oven at 70^{0}C till constant weight were obtained.

RESULT AND DISCUSSION

Growth attribute

Plant height : Phosphorus levels per hectare and weed control measures markedly influenced the plant height at all the crop growth stages in the year (Table 1). The plants grow slowly up to 60 days and there after a fast growth rate was observed up to 90 days stage. Plant height was affected significantly by different phosphorus levels, except at 20 kg P_2O_5 ha^{-1} (P_1) at all the stages of crop growth except 30th and 60th day stages. At30th and 60th day stages plant height was recorded at par due to various phosphorus levels. Among all the phosphorus treatments, higher plant height was recorded at w_0(P_3) at all the stages and lowest with control (P_0). Phosphorus 60 kg P_2O_5 ha^{-1} (P_3) recorded significantly higher plant height on all the lower levels of phosphorus at 90 and at harvest stages of crop growth.

The effect of different weed control measures on plant height is depicted. Plant height was affected significantly due to various weed control measures at all the stages of crop growth, except at 30th day crop stage. Among all the weed control treatments, height was recorded in mulch (w_3) and lowest in weedy check (w_0) treatments at all the stages of crop growth. All the weed control measures did not observe significant difference as compare to weedy check (w_0) at all the stages. Hand weeding (w_1) and pendimethaline @1.0 kg ha^{-1} (w_2) being at par with weedy check (w_0) at 90 day of crop growth. Mulch (w_3) recorded significantly higher plant height as compare to all the weed control measure at all the stages of crop growth except at 30 day stage.

Dry matter accumulation plant^{-1} (g)

Phosphorus levels per hectare and weed control measures markedly influenced the dry matter accumulation (gm.) at all the crop growth stages in the year (Table 2). In general, dry matter accumulation increased with increased with increasing in crop age. Lower doses of phosphorus resulted in substantially less dry matter as compared to all other treatments. Phosphorus at 20 kg P_2O_5 ha^{-1} (P_1) being at par with other higher level of phosphorus at 30th and at harvest recorded significantly more crop dry matter as compared to weedy check (w_0). Phosphorus 40 kg P_2O_5 ha^{-1} (P^2) being at par with 60 kg P_2O_5 ha^{-1} (P_3) recorded significantly more crop dry matter as compared to lower phosphorus levels at 60 DAS. At 60 kg P_2O_5 ha^{-1} (P_3) recorded significantly more crop dry matter as compared to lower phosphorus levels at 90 DAS. Among weed control measures, weedy check (w_0) resulted in significantly less dry matter accumulation as compared to all other treatments, at all the stages of crop growth. All the weed control measures being at par resulted in significantly higher dry matter accumulation at all the stages of crop growth as compared to weedy check (w_0).

Yield attributes

Number of pods plant^{-1}: The number of pods plant^{-1} was affected significantly by different phosphorus levels of phosphorus. Among all the phosphorus levels, highest number of pods plant^{-1} was recorded at 60 kg P_2O_5 ha^{-1} (P_3) which was significantly higher as compare with all lower levels, varying weed control measures recorded more number of pods plant^{-1} as compared to weedy check. Among weed control measures, hand weeding (W_1) being at par with pendimethaline 1.0 kg ha^{-1} (W_2) recorded significantly higher number of pods plant^{-1} as compare to mulch (W_3) and weedy check (W_0) treatments.

Number of grains pod^{-1}: Number of grains pod^{-1} was affected significantly by different phosphorus levels. Among all phosphorus levels, maximum number of grains pod^{-1} was recorded at 60 kg P_2O_5 ha^{-1} (P_3) which was significantly higher as compare to other lower levels. All the weed control measures resulted in significantly higher number of grains pod^{-1} as compared to weedy check (W_0) where all the weed control measures found at par.

Grain weight plant^{-1}: The perusal of data revealed that phosphorus at 60 kg P_2O_5 ha^{-1} (P_3) recorded significantly higher grain weight plant^{-1} as compare to lower levels of phosphorus. It is evident from the data given in table-1 that different weed control measurers did not influence the grain weight plant^{-1} significantly.

Test weight (100 grain weight (g): It is evident from the data given in table -1 that different level of phosphorus and weed control measures did not influence the test weight significantly.

Number of pods plant^{-1}, number of grains pod^{-1} and grain weight plant^{-1} only were influenced significantly by various levels of phosphorus and weed control measurers (table-1). Phosphorus at 60 kg P_2O_5 ha^{-1} (P_3) recorded significantly higher number of pods plant^{-1}, number of grains pod^{-1} and grain weight plant^{-1} than lower levels of phosphorus. These treatments may provide sufficient phosphorus for the growth of crop as well as yield contributing characters like number of pods plant^{-1} , number of grains pod^{-1} and grain weight plant^{-1} . saraf *et al*., (1997), Saini and Faroda (1998), Amar Nath *et al.* (2004), Meena *et al.* (2006) reported similar result.

Effect on yield: The perusal of the data revealed that phosphorus 40 kg P_2O_5/ha (P_2) being at par with 60 kg P_2O_5/ha (P_3) resulted in significantly higher grain yield as compared to lower phosphorus levels. Among weed control measures, weedy check (W_0) resulted significantly less grain yield as compared to rest of the treatments. Among weed control measures, hand weeding (W_1) showed significantly higher grain yield as compared to other weed control measures. The perusal of the data revealed that phosphorus 40 kg P_2O_5/ha (P_2) being at par with 60 kg P_2O_5/ha (P_3) resulted in significantly higher straw yield as compared to lower phosphorus levels. The control (P_0 recorded) the significantly less straw yield among all the treatments. Among weed control measures, weedy check (W_0) resulted in significantly less straw yield as compared to all other weed control measures while hand weeding (W_1) treatments being at par with pendimethaline 1.0 kg/ha (W_2) showed significantly higher straw yield as compared to other weed control measures. The different levels of Phosphorus weed control measures did not influence the harvest index of chickpea.

Phosphorus 40 kg P_2O_5/ha (P_2) being at par with 60 kg P_2O_5/ha (P_3) was found most promising and significant increase in the grain yield of crop as compared with other phosphorus treatments. The positive response of chickpea crop to phosphorus 40 kg P_2O_5/ha (P_2) in most of the yield contributing characters has reflected to obtaining higher grain yield (table-2). This may also be due to provide sufficient phosphorus for required growth factors under these treatments resulted in higher grain yield. Similar result also reported by Parihar (1990), Enania and Vyas (1995), Saraf *et al.* (1997). Bahadur *et al.* (2002), Meena *et al.* (2003), Amar Nath *et al.* (2004), Pyare and Dwivedi (2005), Khan *et al.* (2005), Meena *et al.* (2006).

Table 1: Effect of phosphorus and weed control measures on weed density (m^{-2})

	Crop growth stage (DAS)		
Treatment	60	90	At harvest
Phosphorus (Kg P_2O_5/ha)			
P_0	6.61(44.25)	7.21(56.25)	6.44(44.75)
P_1	6.25(39.50)	6.49(45.75)	5.24(29.25)
P_2	5.22(27.50)	5.65(33.75)	4.55(22.00)
P_3	4.90(24.25)	4.46(21.25)	3.83(15.75)
SEm±	0.01	0.20	0.21
CD (0.05)	0.29	0.58	0.60
Weed control measures			
W_0	6.59(44.25)	7.84(63.75)	6.45(44.25)
W_1	5.21(27.50)	4.10(17.50)	3.56(13.25)
W_2	5.49(30.75)	4.90(24.50)	4.25(18.50)
W_3	5.69(33.00)	6.97(51.25)	5.81(35.75)
SEm±	0.10	0.20	0.21
CD (0.05)	0.29	0.58	0.60

Table-2: Effect of phosphorus and weed control measures on weed dry weight accumulation (g m^{-2})

	Crop growth stage (DAS)		
Treatment	60	90	At harvest

Phosphorus (Kg P_2O_5/ha)			
P_0	9.65	10.98	12.41
P_1	8.06	9.13	10.34
P_2	7.80	8.90	10.14
P_3	7.44	8.48	9.94
SEm±	0.36	0.44	0.54
CD (0.05)	1.03	1.27	1.56
Weed control measures			
W_0	9.82	11.13	12.49
W_1	7.73	8.49	9.77
W_2	7.67	8.72	10.00
W_3	7.67	9.16	10.57
SEm±	0.36	0.44	0.54
CD (0.05)	1.03	1.27	1.56

Table-3: Effect of phosphorus and weed control measures on yield contributing character of chickpea.

Treatment	Number of pod^{-} plant^{-1}	Number of grains pod^{-1}	Grain weight plant^{-1}	Test weight (100 grain weight (g)
Phosphorus (Kg P_2O_5/ha)				
P_0	35.04	1.40	9.30	19.25
P_1	39.42	1.54	10.15	19.25
P_2	44.00	1.55	10.50	19.35
P_3	50.42	1.70	11.44	19.62
SEm±	1.25	0.04	0.24	0.18
CD (0.05)	3.62	0.12	0.68	NS
Weed control measures				
W_0	30.17	1.39	10.17	19.22
W_1	49.92	1.65	10.48	19.59
W_2	46.42	1.61	10.40	19.41
W_3	42.37	1.54	10.34	19.37
SEm±	1.25	0.04	0.24	0.18
CD (0.05)	3.62	0.12	NS	NS

Table-4: Effect of phosphorus and weed control measures on grain and straw yield and harvest index of chickpea.

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
Phosphorus (Kg P_2O_5/ha)			
P_0	16.19	24.09	40.01
P_1	19.26	26.94	41.21
P_2	21.28	30.75	41.74
P_3	22.93	31.42	42.61
SEm±	0.67	0.93	
CD (0.05)	1.94	2.67	
Weed control measures			

W_0	17.15	24.5	40.21
W_1	22.24	31.52	41.99
W_2	20.88	29.38	41.06
W_3	19.38	27.8	40.86
SEm±	0.67	0.93	
CD (0.05)	1.94	2.67	

P_{0-0} kg P_2O_5, P_{1-} 40 kg P_2O_5, P_{3-} 60 40 kg P_2O_5,
W_{0-} weedy check, W_{1-} Hand weeding 30 DAS, W_{2-}Pendimethalin 1.0 kgha^{-1} (pre-Em.),W_{4-} Rice straw mulch 5 cm thick (post Em.)DAS- Days After Sowing.

CONCLUSION

It may be concluded that for achieving higher yield and better weed management of the chickpea, the crop may be fertilized with 40 kg P_2O_5 ha^{-1} and weeded manually at 30 days after sowing.

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