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To Study the Effect ofdiffrent Spacing and Phosphorus level on Growth and Yield of Chickpea (Ciceraeritinium Var. Kabulium L)

Siddharth Patel

Author's Affiliation: Student, Agronomy, ICAR, Sam Higginbottom University of Agricultural Technology and Sciences, Naini, Allahabad, Harda, Madhya Pradesh 461331, India.

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Abstract

A field experiment was carried out to study the effect of different spacing and levels of phosphorus on growth and yield of kabuli chickpea (Ciceraeritinium Var. kabulium L) variety KAK-2 at the Crop Research Farm of SHUATS, Allahabad, during winter season in 2018. The results revealed that different Spacing (20cm, 30cm, and 40cm) and phosphorus levels (25 kg ha-1, 40 kg ha-1, 55 kg ha-1, and 70 kg ha-1) significantly affected plant height, no. of root nodules and number of pods per plant. The maximum plant height (28.22 cm) was recorded from treatment no. 8 (55 kg P ha-1 and 30 cm spacing) at 60 DAS. Similarly, higher number of root nodules (23.62) per plant was recorded from the treatment no. 12 (40 cm spacing and 70 kg Phosphorus ha-1) at 60 DAS. The maximum number of pods per plant (24.33) was observed from the treatment no. 8 (55 kg P ha-1 and 30 cm spacing). Generally the results revealed that treatment no. 8 (55 kg P ha-1 and 30 cm spacing) gave better performance in approx all the parameters studied.

Keywords

Phosphorus; Spacing; Yield Attributes; Ciceraeritinium Var. Kabulium L.

Corresponding Author: Siddharth Patel, Student, Agronomy, ICAR, Sam Higginbottom University of Agricultural Technology and Sciences, Naini, Allahabad, Harda, Madhya Pradesh 461331, India.

E-mail: Sidinaniya14@gmail.com

Introduction

Kabuli chickpea (Ciceraeritinum Var. Kabulium L) is one of the most important pulse crops. India has the largest area under pulses. The pulses are integral part of the cropping system of the farmers all over the country because these crops fit well in the crop rotation and crop mixture. Vegetarian people mostly depend on pulses, which are major constituents of Indian diet. Chickpea and kabuli chickpea are the main source of dietary protein for the majority of Indians and-are grown as grain legume. The legumes are not only important source of human diet but also occupy an important place to keep the soil productive because these crops enrich the soil through symbiotic nitrogen fixation (Panwaret al., 1980). Kabuli chickpea (Ciceraeritinum Var. Kabulium L) is mainly used for preparation of chhola dish and other table purposes. It is also used as dal, besan, flour, crushed whole gram, boiled or roasted or cooked, salted or sweet preparation and green foliage as vegetables. Chickpea (Kabuli and Desi) has 17–20% protein and 60–64% carbohydrate (Sindhuet al. 1974), During 2015-16 India grows chickpea on about 81.71 lakh ha area producing 59.40 lakh tonnes, productivity 727kg/ha (DACNET, 2015). In M.P. chickpea was grown in 26.21 lakh ha area producing 22.97 lakh tonnes, productivity 877 kg/ha. (Source– State Concern Agriculture Department).

Materials and Methods

The experiment was carried out during Rabi season of 2017-2018 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam higginbottom university of agriculture technology and sciences, Allahabad (U.P.) which is located at geographical coordinates of 25 24' 42" N latitude, 810 50' 56" E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Allahabad Rewa Road about 6 km away from Allahabad city. The soil of experimental field was sandy loam in texture having organic carbon 0.39%, available N (186 kg ha^{-1}), available P (17.81 kg ha^{-1}), available K (250.73 kg ha^{-1}), the phand EC of the soil was recorded as 7.6 and 0.13ds m- 1, respectively. The experiment was laid down in Randomized Block Design comprising of 12 treatments replicated thrice. The treatment comprises different spacing (20 cm, 30 cm, 40 cm) along with levels of Phosphorus (25, 40, 55 and 70 kg P ha^{-1}). Phosphorus application is done at the time sowing. Uniform dose of Nitrogen 20kg ha^{-1} as urea and potassium 25kg ha^{-1} as a muriate of potash were applied in 12 treatments as a basal dose and P_2O_5 @ 25, 40, 55, 70 kg ha^{-1} in the form of single super phosphate, we applied in a single dose as per the treatments. The chickpea crop was harvested at fully maturity stage and yield attributes and yield were recorded following normal standard procedures.

Results and Discussion

Plant height

Plant height (cm) as affected by various levels of P_2O_5 and $ZnSO_4$ is shown in Table 1. Statistical analysis revealed that Different spacing and application of P_2O_5 significantly (P>0.05) affected plant height (Table1). Maximum plant height (cm) was recorded from those plots that had 30cm spacing and received 55 kg P_2O_5 ha^{-1}, Plant height varied significantly due to row spacing and phosphorus levels and the tallest plants were recorded 17.18, 28.22, 35.97 and 49.55 cm at the 40, 60, 80, and 100 DAS interval respectively in treatment no.8 (30 cm +55 kg Phosphorus ha-1), (Basir, et al 2008 And singh, et al 1993) reported similar findings. The interactive effect of Spacing and P_2O_5 on plant height was significant (Table 1).

No. of Nodules Plant–1

The results presented in (Table 1) have demonstrated that number of root nodules per plant was influenced by different spacing and application of P_2O_5, significantly (Table 1). Also, interaction effect was significant at 0.05 probability level. The data showed that the highest no. of root nodules were recorded 23.62, 31.82, and 41.09 in treatment no. 12 (40 cm + 55 kg Phosphorus ha^{-1}) at 60, 80 and 100 DAS interval respectively except 40 DAS where no. of root nodules was significantly different and highest (11.79 plant–1). These results are in close conformity with the findings of Sonboiret al. (2017) and khan, et al (2005).

Number of pods plant-1

Data regarding number of pods plant-1 as affected by various spacing and levels of P_2O_5 is presented in (Table 1). Statistical analysis of the data revealed that both P_2O_5 application had significantly ($p<0.05$) affected the number of pods plant-1. The maximum number of pods plant-1 (24.33) was recorded with the treatment T_8 (30 cm + 55 kg Phosphorus ha^{-1}) which was significantly superior among all the treatment, and the similar finding was reported by Jitendraet al., (2005), Sonboiret al. (2017) and Singh, et al (2005).

Hundred grains weight (Seed index)

Data concerning 100-grains weight as affected by various spacing and levels of P_2O_5 are presented in (Table 1). Statistical revealed that P_2O_5 application and its interaction with various spacing had significant (P>0.05) effect on 100-grains weight (Table 1).The data presented in Table showed that the test weight of 100 seeds was slightly increased with the increasing P levels. Highest test weight of 100 seeds was found (41.19 g) with T_8 (30 cm + 55 kg Phosphorus ha^{-1}) which was numerically superior to other treatments andIncrease in row spacing resulted in increasing 100 seed weight in general. This is because of efficient utilization of nutrient, water and solar radiation at wider row spacing as compared to narrow row spacing. Similar findings was reported by Chaudhary, et al (2005).

Grain yield

Data regarding grain yield ha^{-1} as affected by various spacing and levels of P_2O_5 are presented in (Table 1). Statistical analysis of the data revealed that the application of P_2O_5 and its interaction with spacing had a significant (P>0.05) effect (Table 1). Our results showed that on average, the maximum grain yield of 2.35 t ha^{-1} was obtained with the 30 cm spacing and application of 55 kg P_2O_5 ha^{-1}, which was significantly greater than the other treatments; The results confirm the findings of Sarawgiet al. (2000), Kumar et al. (2001), Siddiquiet al. (2003), Shamsiet al. (2010). It combinely showed significantly positive influence on seed yield and other yield attributes.

Economics

It was evident from Table 2 that highest gross return (106726.67 ha P_20_5 ha^{-1}) and net profit (73857.56 ha P_20_5 ha^{-1}) were recorded with treatment no. 8 (30 cm + 55 kg Phosphorus ha^{-1}) and lowest gross return was recorded with T_4 (40 cm+40 kg Phosphorus ha^{-1}) (75431.33 ha P_20_5 ha^{-1}) and net profit (44063.02). The B: C ratio was found maximum (3.25) with treatment no. 8 (30 cm + 55 kg Phosphorus ha^{-1}). 30 cm and 55 kg Phosphorus ha^{-1} gave highest gross return (106726.67 ha P_20_5 ha^{-1}) with net profit (73857.56/ha) and was given highest B: C ratio (3.25). The result confirms the finding of Abdul et al, (2008) and Vikramet al., (2018).

Table 1: Mean values of agronomic traits of Kabuli Chickpea as affected by different spacing and levels of phosphorus.

No.	Treatments	Plant height (cm)	Root Nodules (No.)	No.of Pods plant-1	Seed Index (100 seed weight) in gm.	Grain yield (Tonnes ha-1)
T_1	20 cm + 25 kg Phosphorus ha^{-1}	21.50	17.87	20.00	38.07	1.92
T_2	30 cm +25 kg Phosphorus ha^{-1}	24.07	20.10	19.00	38.85	1.79
T_3	40 cm +25 kg Phosphorus ha^{-1}	23.99	19.13	20.00	39.39	1.74
T_4	20 cm + 40 kg Phosphorus ha^{-1}	24.60	20.29	20.33	39.99	1.94
T_5	30 cm + 40 kg Phosphorus ha^{-1}	23.87	18.93	18.67	37.59	1.66
T_6	40 cm + 40 kg Phosphorus ha^{-1}	25.00	20.28	19.33	38.78	1.81
T_7	20 cm + 55 kg Phosphorus ha^{-1}	23.33	20.00	19.26	40.33	1.88
T_8	30 cm + 55 kg Phosphorus ha^{-1}	28.22	23.04	24.33	41.19	2.35
T_9	40 cm + 55 kg Phosphorus ha^{-1}	27.02	21.31	21.33	40.46	2.20
T_{10}	20 cm + 70 kg Phosphorus ha^{-1}	26.10	20.53	22.00	38.65	2.13
T_{11}	30 cm + 70 kg Phosphorus ha^{-1}	26.27	22.95	22.67	39.95	2.22
T_{12}	40 cm + 70 kg Phosphorus ha^{-1}	26.73	21.29	21.67	41.06	2.22
	F test	S	S	S	S	S
	SEd (±)	1.57	1.03	1.93	0.92	0.12
	CD (P=0.05)	3.26	2.14	3.95	1.89	0.25

*Nitrogen and Potassium where applied at 20 and 25 kg ha^{-1}

Table 2: Economics of different treatment combinations of Kabuli Chickpea.

No.	Treatments	Gross return (₹ ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net return (₹ ha^{-1})	B : C ratio
T_1	20 cm + 25 kg Phosphorus ha^{-1}	87051.33	31187.31	55864.02	2.79
T_2	30 cm +25 kg Phosphorus ha^{-1}	81420.67	29867.31	51553.36	2.73
T_3	40 cm +25 kg Phosphorus ha^{-1}	79322.67	29427.31	49895.36	2.70
T_4	20 cm + 40 kg Phosphorus ha^{-1}	87934.00	32688.31	55245.69	2.69
T_5	30 cm + 40 kg Phosphorus ha^{-1}	75431.33	31368.31	44063.02	2.40
T_6	40 cm + 40 kg Phosphorus ha^{-1}	82167.20	30928.31	51238.89	2.66
T_7	20 cm + 55 kg Phosphorus ha^{-1}	85018.00	34189.11	50828.89	2.49
T_8	30 cm + 55 kg Phosphorus ha^{-1}	106726.67	32869.11	73857.56	3.25
T_9	40 cm + 55 kg Phosphorus ha^{-1}	99725.33	32429.11	67296.22	3.08
T_{10}	20 cm + 70 kg Phosphorus ha^{-1}	96570.00	35688.31	60881.69	2.71
T_{11}	30 cm + 70 kg Phosphorus ha^{-1}	100796.67	34368.31	66428.36	2.93
T_{12}	40 cm + 70 kg Phosphorus ha^{-1}	100575.33	33928.31	66647.02	2.96

*Sale rate of Chickpea @ ₹ 4500 (q^{-1}), Sale rate of chickpea straw @ ₹ 180 (q^{-1}).

*Data on economics are not subjected to statistical analysis.

Conclusion

It is clear from the present study that application of phosphorus with a proper spacing manipulates the growth of chickpea, resulting in beneficial changes in yield and yield components. The present findings also indicate that soil application (band placement) of phosphorus has a great effect in enhancing the uptake of nutrients and also results in increasing of root nodules which ultimately enhance the nitrogen fixation in a positive manner, combine effect of spacing and proper nutrient management can give a good profit to a farmer.

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