Growth and Yield Response of Four Chickpea Verities to Phosphorus Fertilizer Levels under Sulaimani Condition

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Abstract:

A field study initiated in the winter of 2017 in Sulaimani region to investigate the P fertilizer requirements of chickpea, a factorial split-plot experiment; within a randomized complete block design with three replications was used. cultivars (V1=Flip O1-43C, V2= Flip 99-34C, V3=Hazardmerd, V4=Flip 93-55C), were allocated to main plots. Sub-plot treatments were three levels of phosphorus applied as triple of (tri super phosphate) % 46 P_20_5 (T1= 0kg/ha, T2= 10kg/ha, T3= 20kg /ha) to study their effects on growth performance and yield of chickpea (*Cicer arietinum*) during winter season. Results showed that V2 recorded maximum value for number of branches /plant ,number of pods /plant , weight of pods /plant , number of seeds /plant and weight of seed /plant and V3 recorded maximum value for weight of seed /pod and 100 seed weight ,while V1 recorded maximum value only for plant height .It was found that the application of 20 kg P_20_5 /ha recorded highest value of plant height , number of pods /plant ,weight of seed /pod , number of seeds /plant and weight of seed /plant .The interaction between V2 and 20 kg P_20_5 /ha recorded maximum value for number pods /plant and number of seed /plant and interaction between V3 and 10 kg P_20_5 /ha recorded the maximum value for weight of seed /plant .

Key words: Chickpea, fertilizer application, yield parameters

Introduction:

Chickpea (Cicer arietinum *L.*) is an important source of protein, carbohydrates, vitamins, and certain minerals. While this legumes crop is an important source of dietary protein for human consumption, it is also important for the management of soil fertility due to its nitrogen-fixing ability Maiti, R.K. (2001) . Most chickpea producing areas are located in the arid and semi-arid zones, and approximately 90% of world's chickpea is grown under rain fed conditions - Kumar, J. and Abbo, S. (2001).

Phosphorus (P) is a key nutrient element required for high and sustained productivity of grain legumes such as chickpea (*Cicer arietinum*). For instance, low native soil phosphorus availability and poor utilization efficiency of added P is a major constraint limiting the productivity of most grain legumes Aulakh, M. S., et al (2003). The phosphorus requirement is greater for healthy crop growth with efficient root system and profuse nodulation. Phosphorus also plays a key role in pod filling and ultimately enhances the grain yield. Gupta et al. (1998) and Reddy et al(1993). The supply of phosphorus to legumes is more important than of nitrogen because, later being fixed by symbiosis with rhizobium bacteria. The beneficial effects of phosphorus on nodulation, growth, yield and general behavior of legume crop have been well established because it plays an important role in root development. Phosphorus application to legumes plays a key role in the formation of energy rich phosphate bonds, phospholipids and

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for development of root system Tisdale et al., (1985). The objective of this study was to assess the effect of verities and P fertilizer rates on biomass accumulation, seed yield and yield components of winter chickpea in one location that is ecologically representative of the semi - dry environments of Sulaimani .

Material and Methods:

A field experiments was conducted at 14th December 2017, at Experimental Farm of the Faculty of Agriculture, University of Sulaimani at Bakrajo located in the southwest of Sulaimani city. The experimental area plots were ploughed twice, harrowed and well leveled. During the growing season cultural operations and weed control was accomplished according to normal field practice .The experiment was arranged as Split-Plot in RCBD with three replicates to investigate the organic performance of four cultivars chickpea [V1=Flip O1-43C, V2= Flip 99-34C, V3=Hazardmerd,V4= Flip 93-55C] with three level of P_2O_5 [0, 10.20 kg h^{-1}]. The different cultivars of chickpea were distributed in the main plots that were arranged as (RCBD), the P_2O_5 fertilizer level were placed in the subplots. Each sub plot consists of 4 rows of 2 m long space between each plant was 10 cm, space between each line was 30 cm, and planting patterns comprised of 1 m space between replications and also main plots were 3.7 m long. Samples were harvested manually, for agro –morphological characters yield assessments in 19th July 2018.Soil sample were analyzed at laboratory of Soil and Water Science Department, College of Agricultural Science , University of Sulaimani as shown in Table (1) .The Metrological data obtained from Sulaimani metrological stations during the growing season from December 2017 to June 2018 were shown in Table (2) .

Studied Traits:

At harvesting time five pants were selected randomly from each sub- plot and tagged for recording the following traits : plant height (cm) , number of branches /plant , pod weight (g), pod weight /plant(g) ,number of seeds /pod , weight of seed /pod (g),number of seeds /plant , 100 seed weight (g) and weight of seeds/plant (g)

Statistical Analysis:

The data were statistically analyzed according to the methods of analysis of variance as general test: all possible comparisons among the means were carried out by using Least Significant Difference (L.S.D) test at significant level of 5% and 1% after they show their significance in the general test using JMP, version 7.

Table 1: Physical and chemical properties of the studied soil:

Soil properties	***Values***
Soil texture (P.S.D)	Soil Texture
Sand ($g.kg^{-1}$)	48.5
Silt ($g.kg^{-1}$)	449.8
Clay ($g.kg^{-1}$)	501.7
E.C. ($dS.m^{-1}$)	0.33
pH	7.44
O.M. ($g.kg^{-1}$)	21.02
CaCO3 ($g.kg^{-1}$)	337.6
Total N (ppm)	19.93
K+ ($g.kg^{-1}$)	2.67
Na+ (ppm)	27.66
Ca++ ($Meq.l^{-1}$)	2.66
Mg++ ($Meq.l^{-1}$)	1.98

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Table 2: Average air temperature and rainfall during the growing seasons of 2017-2018 at Bakrago Location

Months	*Average Air Temperature (°C)*		*Rainfall (mm)*
	Max.	*Min.*	
October	33.1	10.4	10.0
November	23.9	7.6	114.6
December	17.8	-2.5	22.2
January	15.6	1.4	72.4
February	20.9	-2.3	323.0
March	24.4	1.O	44.6
April	31.6	2.2	98.6
May	38.1	13.0	70.4
Total			755.8

Results and Discussions:

Table 3:

Data in table 3 represent the means of some growth and seed weight with its components ,which conformed that the difference among varieties were highly significant for the traits plant height , number of pods /plant ,weight of pods/plant ,weight of seed /pod ,number of seeds /pod ,100 seed weight and weight of seed /plant ,while the differences were significant for number of branch /plant and not significant difference were present among varieties for the traits number of seeds /pod. It was observed that the V1 produced maximum value for the character plant height reached 74.044 cm ,while it produced the lowest value for the characters weight of pod /plant ,weight of seeds /pod ,number of seeds /pod and weight of seed/plant recording 20.031g ,0.304 g,39.963 seed and 12.492 g respectively .V2 recorded the highest value for number of branches /plant , number of pods /plant ,weight of pods /plant , number of seeds /plant and weight of seed /plant reached 3.50 branches , 69.074 pod, 28.871g ,63.333 seeds and 20.642 g respectively ,while the same variety recorded the lowest value for plant height with 54.056 cm . V3 produce maximum value for the characters weight of seed/pod and 100 seed weight reached 0.379 g and 37.36 g respectively and also exhibited the lowest value for the character number of pods/plant with 47.518 pods. V4 produced the lowest value for the characters number of branches /plant and 100 seed weight with 2.300 branches and 31.838 g respectively , results based on values L.S.D .

Table (3): Means of some growth characters, seed weight and its components:

Variety	Plant height (cm)	No. branches /plant	No. of pods / plant	Wt. of pod (g)	No. seeds /pod	Wt of seed /pod(g)	No. seeds / plant	100 seed weight	wt. seeds /plant (g)
V1	74.044	2.778	51.518	20.031	0.944	0.304	39.963	36.048	12.492
V2	54.056	3.500	69.074	28.871	0.989	0.337	63.333	33.272	20.642
V3	63.944	2.833	47.518	21.529	1.011	0.379	41.629	37.360	15.657
V4	71.556	2.300	53.647	22.231	1.022	0.348	46.222	31.838	14.518
LSD .05	3.280**	0.729*	2.554**	1.853**	n.s	0.0261**	1.944**	1.945**	1.399**

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Table 4:

Data in table 4 illustrate the characters effect of phosphorus fertilizer on some growth and seed weight with its components, confirming that the effect of phosphorus fertilizer was highly significant on the characters number of pods /plant, weight of seed /pod, number of seeds /plant and weight seed /plant, but it was significant for the characters plant height, while for other characters this effect was not significant. The application of 20kg P_2O_5 /ha recorded the highest value for the characters plant height, number of pods /plant , weight of seed /pod , number of seeds /plant and weight of seed /plant reached 67.646 cm ,60.43 pods , 0.356 g ,52.667 seeds and 17.506 g respectively . The lowest value due to number of pods /plant was 50.722 pods produced by the treatment of control, while the same treatment produced the lowest value for weight of seed /pod and plant height recorded 63.271 cm, 0.324 g respectively .The lowest value for number of seeds /plant and weight of seed /plant were 44.889 seed and 14.941 g produced by the application of 10 kg P_2O_5 /ha , results based on values L.S.D .

Table (4): Effect of P_2O_5 on some growth characters, seed weight and its components:

P_2O_5 fertilizer level kg/ha	Plant height (cm)	No. branches /plant	No. of pods / plant	Wt. of pod (g)	No. seeds /pod	Wt of seed /pod(g)	No. seeds / plant	100 seed weight	wt. seeds /plant (g)
0	63.271	2.958	50.722	22.888	0.925	0.324	45.805	35.194	15.035
10	66.783	2.792	55.166	21.987	0.992	0.346	44.889	34.693	14.941
20	67.646	2.808	60.430	24.622	1.058	0.356	52.667	34.001	17.506
LSD.05	3.092*	n.s	2.388**	n.s	n.s	0.0143**	2.749**	1.619	1.628**

These results agree with Seid H. (2015),Bahadar et al.(2002) , Jain.(2005) ,Meena et al (2004),Sunder et al (2003), Choudhary and Goswwami (2005),Kushwaha(2007) ,Ahmad and Badar (2009), Kumar et al (2009) and Singh et al (2010) this significant increase of plant height with the application of P_2O_5 fertilizer enhances plant vigor and strength of the stalk .Previous studies also observed in chickpea such results with application of phosphorous; they reported that increase in number of pods /plant with the application of P_2O_5 might have resulted from more pronounced growth of plant which in turn had increase number of pods /plant Siga R.K (1995), Meena et al.(2004) and Arya et al (2002). Khourgami and Farnia (2009), Basir et al (2008) and Arya et al (2002) reported that application of P2O5 cause to increase number of seeds /pod which in agreement with our results.

Table 5:

Data in table 5explain the interaction effect between varieties and phosphorus levels on some growth traits and seed weight with its components .The analysis of variance conformed that the characters plant height, number of pods /plant, weight of seeds/pod and number of seeds/plant responded high significantly to this interaction effect, while the other characters responded non significantly. The interaction between V1 with not application produced the highest value for plant height 76.633 cm and the lowest value for pods / plant and weight of seed /pod 43.668 and 0.268g respectively . The interaction between V1 and the application of 10 kg P_2O_5 /ha produced the lowest value for number of seeds/plant 35.666 .The interaction of V2 with the application of 20 kg P_2O_5 /ha produced the higher value for number of pods/plant and number of seeds /plant reached 82.444 pod and 73.000 seeds respectively .The maximum value for the character weight of seeds/pod was 0.408

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g produced by the interaction between V3 and the application of 10 kg P_2O_5 /ha , results based on values L.S.D to compare between treatments .

Table (5): Effect of the interaction between variety and P_2O_5 levels on some growth characters, seed weight and its components:

Varieties	P_2O_5 fertilizer level kg/ha	Plant height (cm)	No. branches /plant	No. of pods / plant	Wt. of pod (g)	No. seeds /pod	Wt of seed /pod(g)	No. seeds / plant	100 seed weight (g)	wt. seeds /plant (g)
V1	0	76.633	3.000	43.668	21.921	0.833	0.268	36.333	36.430	11.822
	10	76.500	3.000	49.777	17.252	0.900	0.294	35.666	37.927	10.930
	20	69.000	2.333	61.110	20.921	1.100	0.349	47.888	33.787	14.725
V2	0	50.167	3.833	60.777	27.319	0.967	0.312	63.333	33.180	20.138
	10	57.750	3.000	64.000	28.225	0.933	0.323	53.667	32.750	18.103
	20	54.250	3.667	82.444	31.069	1.067	0.376	73.000	33.887	23.684
V3	0	64.083	2.500	43.222	21.783	0.933	0.351	38.667	38.560	14.754
	10	61.500	2.667	50.665	22.573	1.067	0.408	44.777	36.640	16.524
	20	66.250	3.333	48.665	20.232	1.033	0.377	41.444	36.880	15.693
V4	0	76.250	2.500	55.222	20.529	0.967	0.365	44.889	32.607	13.425
	10	74.833	2.500	56.221	19.896	1.067	0.358	45.444	31.457	14.206
	20	63.583	1.900	49.499	26.268	1.033	0.322	48.333	31.450	15.923
LSD.05		6.185**	n.s	4.775**	n.s	n.s	0.0286**	5.499**	n.s	n.s

Conclusion:

From the study it could be concluded that V2 had superiority on other varieties for most studied characters and the interaction between application 10 kg/ha of phosphorus fertilizer with V2 exhibited maximum value for number of pods /plant and number of seeds/plant. According to our result we recommend use of V2 with the application 10 kg/ha P_2O_5 for our region.

References:

Ahmed, M.A. and Badr, E.A. (2009). Effect of bio and mineral phosphorus fertilizer on the growth, productivity and nutritional value of some chickpea cultivars (Cicer arietinum L.)

in newly cultivated land. Australian J. Basic Appl. Sci. 3: 4656-4664

Arya RL , Kushwaha BL, Singh BN (2002).Effect of phosphorus management on chickpea cropping system .India.J.Pulseres. 15:161-165.

Aulakh, M. S., Pasricha, N. S. and Bahl, G. S. 2003. Phosphorus fertilizer response in an irrigated soybean-wheat production system on a subtropical, semiarid soil. Field Crops Res. 80:99–109.

Bahadur,M.M.; M. Ashrafuzzaman;M.F.Chowdhury;D.N. Mazumder. 2002. Response of chickpea (Cicer arietinum) varieties to different levels of phosphorus. Crop Research Hisar. 23(2):293-299

Basir, A., Shah, Z., Naeem, M., Bakht, J., 2008. Effect of phosphorus and farm yard manure on agronomic traits of chickpea (Cicer arietinum L.). Sarhad J. Agric. 24(4), 567-572.

Chaudhary, V.K. and Goswami, V.K. (2005). Effect of phosphorus and sulphur fertilization on chickpea (Cicer arietinum L.) cultivar. Ann. Agri. Res. New Series 26: 322-325.

Gupta, S.C., Sukhlal, Namdeo and K.K. Paliwal. 1998. Effect of phosphorus levels and microbial inoculants on symbiotic traits, N and P uptake, quality and yield of rainfed chickpea. All India Coordinated Project Improvement of Pulse. R.A.K. College of Agric. Sehore. 3rd Europ. Conf. in Grain Legumes. 418-419.

Jain, P. C. and S. K. Trivedi. 2005. Response of chickpea to phosphorus and bio-fertilizers, Legume Res. 28(1):30-33.

JMP, Version 7. "SAS Institute Inc.", Cary, NC, (1989-2007).

Khourgamy A., Farnia A., 2009 - Effect of phosphorus and zinc fertilization on yield components of chickpea cultivars. African Crop Sci. Conference Proc., 9:205-208

Kumar, J. and Abbo, S. (2001) Genetics of Flowering Time in Chickpea and Its Bearing on Productivity in Semiarid Environments. In: Spaks, D.L., Ed., Advances in Agronomy, Vol. 2, Academic Press, New York, 122-124.

Kushwaha, V.S. (2007). Response of chickpea to biofertilizer, nitrogen, phosphorus fertilization under rainfed environment. J. Food legumes 16 : 179-181.

Maiti, R.K. (2001) The Chickpea Crop. In: Maiti, R. and Wesche-Ebeling, P., Eds., Advances in Chickpea Science, Science Publishers Inc., Enfield, 1-31.

Meena, L.R., Singh, R.K. and Gautam, R.C. (2004). Response of chickpea (Cicer arietinum L.) to moisture conservation practices, phosphorus levels and bacterial inoculation under rainfed condition. Indian J. Trop. Agri. 22: 49-60.

Reddy, Y., S.G. Bheemaiah, M.V. Shantaram and A.S. Raju 1993. Phosphorus nutrition of red gram in red sandy loam soil under intercropping condition. Fertilizer News. 38(5):37-43

Seid H., Yirga F., Tibebu F. . 2015. Effect of Phosphorus Fertilizer on Yield and Yield Components of Chickpea / Cicer aritenum) at Kelemeda, South Wollo , Ethiopia. International Journal of Agricultural Extension and Rural Development Studies. Vol.1,No.1,pp.29-35

Siag, R.K. 1995. Response of Kabuli chickpea to genotypes phosphorus. Indian J. Agron. 40(3): 431- 433.

Singh, G., Sekhon, H.S., Ram, H. and Sharma, P. (2010). Effect of farmyard manure, phosphorus and phosphate solubilizing bacteria on nodulation, growth and yield of kabuli chickpea. J. Food Legumes, 23: 226-229.

Sunder, S., Pareek, B.L. and Sharma, S.K. (2003). Effect of phosphorus and zinc on dry matter, uptake of nutrients and quality of clusterbean (Cyamopsis tetragonoloba L.). Ann. Agri. Rese. New Series 24: 195-196.

Tisdale, S.L., Nelson, W.L. and Beaton, J.D. (1985) Soil Fertility and Fertilizers. 4th Edition, Macmillan Publishing Company, New York.