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RESPONSE YIELD OF TWO PROMISING CHICKPEA GENOTYPES TO DIFFERENT PHOSPHORUS LEVELS

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ABSTRACT

The experiment was conducted to investigate the effect of two promising chickpea genotypes at different phosphorus levels (0,23,46 and 69kgha$^{-1}P_2O_5$) at research station of Agricultural Research center. The experiment units were laid out in factorial experiment using randomize complete block design with three replications. The results indicated that asignificant effected the chickpea genotypes,phosphorus levels and their interaction on plant height, first podheight, number of nodules per plant ,number of main and secondary branches per plant, number of pods per plant,100 seed weight and seed yield. Also the result revealed that the Flip07-245C gave the highest seed yield 449.3g at 69kg ha$^{-1}P_2O_5$,while the lowest value (157.7g) at rate 0 phosphorus application was recorded by FLipo7-223, allfertilizerP_2O_5levels gave highest grain yield than thecontrol. All traits was correlated asignificant and positive correlated with yield with plant height (0.906), first pod height (0.877) and 0.935 with 100 seed weight. From the results of the study it was concluded that the application of 69kg ha$^{-1}P_2O_5$had result better performance in all of the phosphorus levels applied and FLipo7-245Cchikpea genotyperesponded better with regard to grain yield.

KEY WORD **:** phosphorus, chickpea, grain, yield.

INTRODUCTION

Chick pea is grown in many parts of the world and its belongs to family Fabaceae. Chick pea is important crop having ahigh amount of protien in its seed and also improve soil fertility by fixing atmospheric nitrogen (Merga and Haji ,2019). Phophorus is the second major nutrient element required for proper yield and growth of chick pea, its most important in efficient and early root and development ,enhanced nodulation formation,leaf size ,and main andsecondary branches, flowering,seed yield, fasting maturity. Also the phosphorus plays an important role in photosynthesis prosess and storage and transfer of energy and suger and starch utilization by being constituent of energy rich compound viz adenosine triphosphate (ATP). (Sharma *et.al*., 2014). The yield potential of chickpea genotypesdiffer according to practices given to it especially fertilization phosphurus has a key role on the yield. The application of phosphorus to chick pea plant isessential for the health of plant, vigorous all in plant some specific factor that have been associated to phosphorus are root development increasing stack , more stem strenght, improve flower information and seed production and earliar crop maturity, improve seed quality and resistant to plant diseeas (seid *et.al*., 2015). Besides limited use of fertilizer luck of hight yielding varieties is another factor of chickpea production.Selection of suitable variety plays a vital role in crop production.The choice of right variety of chickpea helps increasing crop productivity. Several researcher reported about the role of phsophorus in chickpea genotype and finding that the genotypes exhibit great variation phosphorus accumulation (Kidd *et.al*., 2016, Lyu *et.al*., 2016, Waddell *et.al*., 2017, alsoWen *et.al*., 2017; Sawers *et.al*., 2017 and Wen *et.al*., 2020) reported that the chickpea plants enhance phosphorus acquisition under its low avaliability through the evaluation of various root functional traits and these traits include increase in specific root length and increrase mobilization of inorganic and organic phsphprus. Gidago *et.al*., 2012 indicated that the phsphorus variability in optimum quantities is very important especially in the early grouth stage, development of reproductive parts, root growth,reduced disease

incidence and early maturtityand also the application of phosphorus in quantity which chickpea plant need is critically for seed yield. Therefore, the study was planned with the objective to evaluate the effect of different levels of phosphorus fertilizer on yield and yield componentsof chickpea genotypes in Kurdistan Region Iraq.

MATERIALS AND METHODS

Experiment site:

The experimant was carried out at the field Agricultural Research Center,Duhok, during seson 2020-2021. The some physical and chemical properties of the soilusedin the field Researcher Central presented in Table1.

Experimental design

The experimental unit werelaid out infactorial experiment, the factor one represnted the four phsphoure level and the second factor represented the two promising checkpea genotypes (FLipo7-223C and FLipo7-245C) using randomize complete block design with three replication and the plot size was (1.5 X 4m),each experiment unit consist of 4 rows with 5 m length and 0.30m apart between row and and 0.15m between plants.

Land preparetion

The experimental field was ploughed and land level,the seed was treated befor planting and two seeds were planted per holeson 25/ 1/ 2020-2021 and thining to one plant per stand. Handing weeding was carried out twice,and harvesting was carriedout when the stem and pods color had all change to golden and take the two middle rows.

Aplication of fertiliers

The nitrogen fertilizer in the form of urea was applied as starter dose at rate of 20kg $ha^{-1}$to all plots at planting and phosphorus fertilizer in the formof Tsp (Triple super phosphate) was applied as per the treatment at planting using four dose (0, 23, 46, 69 kg P2O5 ha^{-1})

Data collection vand analysis

Data was reported from the midlle rows on randouly ten plants on, plant height, fiest pod height huubrrot pods per plant, number of seed per pod, number of nodules per plant, thou suned seed weight and grain yield. Data were subjected to the analysis of variance (ANOVA)according to the design of the experiment using mantab analysis program 2017 and using Duncant Multiple Range Test (DMRT) to estametion the best of treatment means chickpeavariety and phosphorus levels.

Table (1): Soil properties and rainfall in season 2020-2021.

Soil	Unit	Depth (0-30)cm	Month	Rainfall mm
PH		7.97	11/2020	25.1
Ec	$Ds.m^{-1}$	0.45	12/2020	40.5
A variable N	$Mg.kg^{-1}$	105.95	01/2021	83.0
A variable P	$Mg.kg^{-1}$	4.84	02/2021	19.20
O.M.	$g.kg^{-1}$	17.4	03/2021	40.8
Sand	$g.kg^{-1}$	72.53	04/2021	2.0
Silt	$g.kg^{-1}$	430.17		
Clay	$g.kg^{-1}$	496.12		
Soil Texture		Silt clay	Mean	35.10

RESULTS AND DISCUSSION

The analysis of variance in Table 6 exhibited that the plant height and first pod height were significant effected by chickpea genotypes, phosphorus levels and their interaction between them and from the data in Table 2 showed the effect of phosphorus levels on plant height, the plant grew as tall as 66.17cm with phosphorus application of 69 kg P_2O_5 and as the short as 53.33 cm against to no phosphorusapplication, thus enhancing the plant height by 24%. For the chickpea genotype (FLipo7-245C) gave the highest value for plant height (61.42cm). Increasing the phosphorus level from 23 to 69 kg $P_2O_5ha^{-1}$, increased the plant height by 15%. The results of present investigation are in close conformity with those of Merga and Haji., 2019 and Wen *et.al.,* 2020.From the result in Table 6, the first pod height was significant effect by chickpea genotypes and phosphorus levels. The data in Table 2 revealed that first pod height, the maximum first pod height was recorded by FLipo7-245C and also the some trait recorded

the heighest value 32.0 cm at 69 kg ha^{-1} P2O5, while the highest value 45.33 cm was obtained by FLipo7-245C69 kg ha P2O5. Similar trend was noted by Seid *et.al*., 2015. From the resultsabove, the increasing of plant height and first pod height, it may be due to the role of hposphours increasing the root system, which helped improve the vegetati vegrowth (Pouresmael,. 2018).

Table (2): Effect of chickpea genotypes ,phosphorus levels and their interaction on plant height and first pod height.

Genotypes	Plant height cm					First pod height cm				
	Phosphorus levels Kg ha-1					Phosphorus levels Kg ha-1				
	0	23	46	69	Mean	0	23	46	69	Mean
FLipo7-223C	53.33 f	55.67 f	60.33 cd	64.67 Ab	58.50 B	20.3 e	24.3 d	28.0 c	31.3 ab	26.0 b
FLipo7-245C	56.33 ef	59.00 de	62.67 bc	67.67 A	61.42 A	21.3 e	25.7 d	29.7 bc	32.7 A	27.3 a
Mean	54.83 d	57.33 c	61.50 b	66.17 A	59.96	20.8 d	25.0 c	28.8 b	32.0 A	26.65

Means that do not share aletter are significantly different

The analysis of variance for main secondary branches per plant under varing levels of phosphorus were presented in Table 6,the results revelated that the chickpea genotypes ,phosphorus levels and their interaction was significant effected in main and scondary branches per plant.For the main branches per plant, the maximum number recorded by FLipo7-223C 5.93, while the minimum value for this trait (6.90) was obtained at 69kg $ha^2P_2O_5$Concering for the interaction between the chickpea genotypes and phosphorus levels the largest value recorded by FLipo7-223C at 69hg $ha^{-1}P_2O_5$and the following value(6.43)was obtained by variety FLipo7-245C and at rate 69kg $ha^{-1}P_2O_5$. The effect of chickpea genotypes, phosphoruslevels and their interaction between them in number of secondary branches per plant and also this trait was significantly affected by various factors Table 6 and Table2. For the chick pea genotypes , the FLipo7-245C gave the highly value 10.61 compared with FLipo-245C chickpea while the application of P_2O_5(69kg ha^{-1})produced higher number of branches per plant 13.52. Allother fertilizer levels varied significantly among themselves for number of branch per plant. The minimum number of secondary branches per plant 6.95 was recorded in control treatment. For the interaction between chickpea genotypes and phosphorus levels the higher value (14.4) was recorded by FLipo7-245 chickpea genotypes at 69 kg ha^{-1} P2O5. Application of phosphorus increased the variability of nitrogen and potassium which resulted in better plant growth and morenumber of branches per plant (Wen *et. al.,* 2020). Similer result where reported by Uddin *et.al*., 2014 and Merga and Haji 2019).

Table(3):- Effect of chickpea genotypes,phosphorus levels and their interaction on number of main and secondury branches per plant.

Genotypes	Number of main branches per plant					Number of secondary branches per plant				
	Phosphorus levels Kg ha-1					Phosphorus levels Kg ha-1				
	0	23	46	69	Mean	0	23	46	69	Mean
FLipo7-223C	4.16 e	5.83 c	6.40 b	7.36 a	5.93 A	7.50 G	9.17 e	11.37 c	14.4 A	10.61 a
FLipo7-245C	3.66 f	4.70 d	5.73 c	6.43 b	5.13 B	6.40 H	8.67 f	10.63 d	12.63 B	9.58 b
Mean	3.91 d	5.26 c	6.06 b	6.90 a	5.53	6.95 D	8.92 c	11.00 b	13.52 A	10.09

Means that do not share aletter are significantly different

Analysis of variance of the effect of phosphorus, chickpea genotypes and their interaction innumber of nodules per plant and number of pods per plants were given in Table 6. Analysis of variance for these traits revelated that asignificant effected phosphorus and chickpea genotypes and their interaction. For the number of nodules per plant the FLipo7-245C chickpea had the muximum value (43.92), while the application at the 69kg ha^{-1} showed maximum vaule (55.0) and the other application gave varied vaule ranged between 37.83 to 46.33 Table4. The applied of phosphorus increased the number of nudules per plant by 66%comparetion with control. For the intraction between chickpea genotypes and phosphorus levels, the higher vaule (57.33) was recorded by FLipo7-245C the chickpea genotype at rate 69 kg ha^{-1}. The difference amony chickpea genotypes were significant which had a more number of pods per plant (34.83) was obtained by FLipo-245C chickpea genotype. The effect of phosphorus application on number of pods per plant, the highest number of of this trait (43.17) was record at rate 69 kg $ha^{-1}P_2O_5$, while the minimum pods (24.67) per plant was noted in control treatment (Table 4). This might be due to the liberal avariability of plant nutrient which stimulated the plants to produce more pods per plant as compared to other treatments as phosphorus powerfully encourage flowering as fruiting (Seid *et.al.*, 2015).The results was agreed with Bandi *et.al*., 2015 who, found that increasing phosphorus levels simultaneously increased the number of pods per plant of chickpea genotypes.

Table(4): Effect of chickpea genotypes,phosphorus levels and their interaction on number of nodules and number of pods per plant

Genotypes	Number of nodules per plant					Number of pods per plant				
	Phosphorus levels Kg ha-1					Phosphoruslevele Kg ha-1				
	0	23	46	69	Mean	0	23	46	69	Mean
FLipo7-223C	32.0 e	37.0 D	47.0 c	52.67 b	42.17 b	21.07 g	28.67 ef	31.33 d	41.0 b	30.67 b
FLipo7-245C	34.0 e	38.67 D	45.65 c	57.33 a	43.92 a	27.67 f	30.33 de	36.0 c	45.33 a	34.83 a
Mean	33.0 a	37.38 C	46.33 b	55.0 a		24.67 d	29.5 c	33.67 b	43.17 a	

Means that do not share aletter are significantly different.

The analysis of variance exhibited that 100 seed weight and seed yield weight was significantly affected by the chickpea genotypes, phosphorus level and their interaction Table 6. The highest 100 seed weight 37.40 g was recorded from FLipo7-245C chickpea genotype, while the lowest 100 seed weight (33.64g) was recorded by FLipo7-223C genotype. The maximum 100 seed weight (42.17g) obtained from 69kg $ha^{-1}P_2O_5$, while the minimum 100 seed weight (29.17g) was noted in the control. For the interaction betwwen the chickpea genotypes and phosphorus levels, the highest vaule (45.37g) was recorded by FLipo7-245C chickpea genotypes and 69kg ha^{-1} P2O5. The mean 100 seed weight increasewith increased phosphorus fertilizer levels. Increasing in 100 seed weight might due to favorable climatic condition during grain filling stage as wellas the formation of strach and albumin.This result was agreed with the Findings of Seid *et. al*., 2015 and Chala *et.al*., 2020. Who reported that increasing phosphorus rates increase 100 seed weight. The results in relation to grain yield of chickpea genotypes as influenced by different phosphorus levels, chickpea genotypes and their interaction between them are indicated in Table6. Significantly higher grain yield (304.3g) was obtained from FLip07-245C chickpea genotype,while lower seed yield (217.3g) was recorded by FLipo7-223C chickpeagenotype.

For phosphorus levels the highest vaule (389.0g) was exhibited with application 69kh ha^{-1}P2O5, while the lowest vaule (168.8g) was redorded by zero phosphorusapplication. For the interaction between phosphorus levels and chickpea genotypes, the FLipo7-245C chickpea genotype gave the highest seed yield (449.3g) at 69 kg ha^{-1} P2O5, while the lowest vaule (157.7g) was recorded by FLipo7-223C chickpea genotype at zero phosphorus application. All P_2O_5 levels gave highest grain yield than the control for the two chickpea genotypes. The results showed that incresing phosphorus levels increasing seed yield and the last was more effected by the yield components such as 100

seed weight, number of pod per plants, number of main and secondary branches per plant. The result was supported by the Finding of Kidd *et.al*., 2016; Swers *et.al.*, 2017; Waddell *et.al*,. 2017; Wen *et.al*,. 2020 and Chala *et.al*,. 2020, who reported that grain yield of chickpeagenotype was significantly affected by the interaction effect of chickpeagenotypes and phosphorus fertilizer levels.

Table(5): Effect of chickpea genotypes ,phosphorus levels and their interaction on 100seed weight and seed yield weight

Genotypes	100seedweight(g)					Seed yield weight (g)				
	Phosphorus levels Kg ha-1					Phosphorus levels Kg ha-1				
	0	23	46	69	Mean	0	23	46	69	Mean
FLipo7-223C	27.37 f	32.93 d	35.3 c	38.97 B	33.64 b	157.7 f	167.3 ef	215.7 c	328.7 b	217.3 b
FLipo7-245C	30.97 e	35.67 c	37.60 b	45.37 A	37.40 a	180.0 e	249.7 c	337.7 b	449.3 a	304.3 a
Mean	29.17 d	34.3 c	36.45 b	42.17 A		168.8 d	208.5 c	276.7 b	389.0 a	

Means that do not share aletter are significantly different.

Table(6): Analysis of variance for chickpea genotypes traits under different phopsphours levels.

s.o.v	Ms								
	d.f	Plant height cm	First pod height cm	No.of nodules per plant	No .of main branches per plant	No.ofsecon dory branches per plant	No. of pods per plant	100 seed weight (g)	Seed yield weight(g)
Blocks	2	3.292	1.792	16.792	0.211	0.197	0.875	0.072	498.5
Varieties (v)	1	**51.042	*10.667	**18.375	**3.920	**6.303	**104.167	**84.750	**45240.2
Phosphorus (p)	3	**148.153	**139.889	**563.597	**9.673	**47.612	**370.500	**173.793	**55760.3
Vx P	3	0.264	0.111	*9.042	*0.118	**0.458	* 4.944	**5.090	**3280.9
Error	14	3.149	1.220	1.935	0.035	0.052	1.875	0.640	140.9
Total	23								

*significut at o.o5 level
** significut at 0.01 level

The simple correlation coefficient of agronomic traits was persented in Table7. The result indicated that the first pod height was positive correlated with plant height with vaule0.927,while the 100 seed weight was correlated with plant height and first pod height with values 0.920 and 0.907 respectively, also the results indicate that seed weight exhibited asignificant and positive correlation of plant height (0.406), first pod height (0.877) and 100 seed weight (0.935). The number of pods per plant had asignificantt and positive correletion with plant height (0.933), first pod height (0.925), 100 seed weight (0.960) and seed weight (0.934). For number of main and secondary branches was significant and positive correlation, plant height, first pod height, 100 seed weight, seed weight,number of pods per plant and number of nodules per plant.Asimilar finding was previously repoted by Agrawal *et.al*., 2018 and Sharif *et.al*., 2018.

Table(7): Simple correlation coefficient between yield and studied traits in chickpea genotypes under different phosphorus levels

	Plant height	First pod	100 seeds	Seed weight	No. pod plants	No . nodules	No of main branchs
First pod	** 0.927						
100 seeds	**0.920	**0.907					
Seed weight	**0.906	**0.877	**0.935				
No. pod plant	**0.933	**0.925	**0.960	**0.934			
No. nodules	**0.920	**0.939	**0.910	**0.880	**0.934		
No .main branches	**0.708	**0.847	**0.697	**0.594	**0.747	**0.841	
N0. Of secnd bra.	**0.814	**0.904	**0.779	**0.733	**0.836	**0.913	**954

*significut at o.o5 level
** significut at 0.01 levels

CONCLUSION

From the results of the study it was concluded that application of 69 kh ha$^2P_2O_5$ had result better performance in all of the phosphorus levels applied and FLipo7-245 Cchickpeagenotype responded better with regard to grain yield. Therefore FLipo7-235Cchickpeagenotype with applied 69kg ha P_2O_3 was recommended for higher seed yield of chickpeaat study area.However, this research was conducted in one location and one year it should be done in multiple location and years so as to assure the resuls.

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بەرسڤدانا بەرهەمێ دوو توخمێن سەرکەفتی یێن نوکێ بو دوو ئاستێن جیاواز یێن فسفوری پوختە

ڤەکولین هاتە ئەنجامدان بو هەلسەنگاندنا دوو توخمێن سەرکەفتی یێن نوکێ بن کارتێکرنا ئاستێن جیاواز یێن گوپرێ فوسفاتی (0, 23, 69, 46 کغم/هکتار) ل زەڤیێن رێڤەبەریا ڤەکولینێن چاندنێ ل دهوك. یەکێن ڤەکولینێ هاتنە دابەشکرن دڤەکولینێ بکارئینانا دیزاینا کەرتێن هەرەمەکی یێن دروست و سێ جارکێ.

ئەنجام هاتنە دیارکرن کارتێکرنا بەرچاڤ یا توخمێن نوکێ و ئاستێن فوسفاتی و تێکەلبونا توخمێن نوکێ و ئاستێن فوسفاتی لسەر بلنداهیا رووەکی و بلنداهیا ئێکەم کەلیك و ژمارا نوداێن بەکتریایی د رووەکیدا و ژمارا کەلیکا درووەکیدا و ژمارا چەقێن سەرەکی و نە سەرەکی درووەکیدا و کێشا 100 دندکا و بەرهەمێ توڤی یێ رووەکی. هەروەسا ئەنجاما دیارکر کو توخمێ (FLipo7-245C) یێ سەرکەفتی بو دبلندترین بەرهەمێ توڤی دا (449.3 گم) دبن ئاستێ گوپرێ 69 گن/هکتار , P2O2) و توخمێ (Flipo7-223c) نزمترین بەرهەم توڤی بو (157.7 گم). هەمی ئاستێن جیاواز یێن فوسفوری بەرهەمێ توڤی یێ رووەکی زێدەکرن دگەل مامەلە بەراوردی. هەرهوسا هەمی سالوخەتا دیارکر کو پەیوەندیەکا پوزەتیڤ و بەرچاڤ دگەل بەرهەمێ توڤی یاهەی 0.406, 0.877, 0.935 دگەل بلنداهیا رووەکی و بلنداهیا ئێکەم کەلیك و کێشا 100 دندکا. دڤێ ڤەکولینێدا دیاربو کو هاڤێژتنا گویرێ فوسفوری (69کگم/هکتار) دگەل توخمێ (FLipo7-245C) باشترین بەرهەم دیارکر.

استجابة حاصل تركيبين متفوقين من الحمص لمستويان مختلفة من الفسفور

الخلاصة

طبقت التجربة لتقييم تركيبين متفوقين من الحمص تحت تأثير مستويات مختلفة من السماد الفوسفاتى (0 ،23، 69،46كغم /هكتار) فى محطة البحوث الزراعية / دهوك وضعت الوحدات التجريبية في تجربة عاملية وفق تصميم القطاعات العشوائية الكاملة و بثلاثة مكررات. اشارت النتائج الى وجود تأثيرات معنوية للتراكيب الوراثية من الحمص و مستويات السماد الفوسفاتى المختلفة و التداخل بينهما على ارتفاع النبات و ارتفاع اول قرنة و عدد العقد البكتيرية في النبات وعدد القرنات فى النبات و الفروع الرئيسية والثانوية فى النبات ووزن 100 بذرة و حاصل البذور و كذلك اشارت النتائج الى تفوق التركيب الوراثى(FLipo7- 245C) فى حامل البذور (449.3 غرام) تحت مستوى السمادى 69 كغم/هكتار P2O5وسجل التركيب الوراثى (Flipo7-223c) اقل حاصل (157.7 غرام). ان جميع المستويات المختلفة من الفسفور ادت الى حصول زيادة فى الحاصل بالمقارنة مع معاملة المقارنة. كما اظهرت جميع الصفات ارتباط موجب ومعنوي مع الحاصل بلغت 0.406 و 0.877 و 0.935 مع ارتفاع النبات و ارتفاع اول قرنة و وزن 100 بذرة . من هذه الدراسة يمكن الاستنتاج ان اضافة 69كغم/هكتار P_2O_5مع التركيب الوراثى FLipo7-245C اعطى افضل حاصل للبذور.

كلمات الدالة : فسفور , حمص , حاصل البذور