

Interactive effect of phosphorus and potassium on some properties of barley plant growth

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الملخص:

دراسة التأثير المتداخل للفوسفور بتركيز (0،75،100،125) جزء من المليون بشكل فوسفات ثنائي الامونيوم ($48\%P_2O_5$) والبوتاسيوم بتركيز (0، 50، 50، 125) جزء من المليون بشكل كبريتات البوتاسيوم ($50\%K_2O$) في نمو بعض صفات نبات الشعير. أجريت تجربة اصص في قسم التربة والمياه - جامعة عمر المختار. وضعت 5 كجم تربة في كل أصيص، أضيفت أسمدة الفوسفور والبوتاسيوم المذكورة أعلاه. ارتفاع النبات و الوزن الجاف لكل من المجموع الخضري والجذري والحاصل البيولوجي كانت مدروسة. بينت النتائج وجود فروقات معنوية حيث أثرت تراكيز الفوسفور معنوياً في زيادة جميع الصفات المدروسة أعلاه وتنفوق التراكيز 125 جزء من المليون فوسفور في ذلك (39.10سم و 20.0جم و 9.45جم و 29.34جم/اصيص). أثرت تراكيز البوتاسيوم معنوياً في زيادة جميع الصفات المذكورة أعلاه وتنفوق التركيز 125 جزء من المليون بوتاسيوم في ذلك (38.9سم، 20.39جم، 11.63جم و 32.01جم/اصيص). أثر التدخل معنوياً في زيادة تلك الصفات وتنفوق المعاملة $P_{125}K_{125}$ جزء من المليون بأعلى القيم وكانت 42.9سم، 22.73جم، 13.59جم و 36.32جم/اصيص. الكلمات الدالة: ارتفاع النبات - الشعير - الحاصل البيولوجي - فوسفور - بوتاسيوم.

Abstract

To study the interactive effect of phosphorus concentration (0,75,100 and 125) ppm P of soil as diammonium phosphate ($48\% P_2O_5$) and potassium concentration (0,50,100 and 125)ppm K of soil as potassium sulfate ($50\% K_2O$) on growth some properties of barley plants growth. Plastic pots experiment was conducted at Omar Al-mukhtar Univ, soil and water dept. Plant height, shoots dry weight, roots dry weight and biological yield were determination. Results were showed that, P concentrations were significantly effect in increasement of all above properties. P_{125} superior at values of (39.10cm, 20.0g, 9.45g and 29.39g) per pot. K concentrations were significantly effect increasement of all above properties, K_{125} superior at values of (38.9cm, 20.39g, 11.63g and 32.01g) per pot. The interaction between concentrations of P and K increased all above properties significantly. The treatment $P_{125}K_{125}$ was superior on all treatments at values of (42.9cm, 22.73g, 13.59g and 36.32g) per pot.

Key words : plant height, barley, biological yield, phosphorus, potassium

INTRODUCTION

Barley (*Hordeum vulgare*) is recognized as one of the most economic and important cereals in the world [1]. The area in which this crop is grown in the world estimated 70 million hectares with a productivity 60 million tons [5]. Cultivated areas of barley in Libya were 260 thousand hectares in 2005 with a productivity estimated 1.3 thousand tons [9]. Barley can be grown in a wide range of environmental conditions and give satisfactory yields in areas that are not suitable for growing most of the others cereals crops due to problems of abiotic and biotic stress [8]. Phosphorus (P) and potassium (K) are the most important nutrients for barley production. P contributes in the complex of the nucleic acid structure of plants. The nucleic acid is essential in protein synthesis regulation. Therefore, P is important in cell division and development of new plant tissue [10]. K is the most important inorganic cation for plant and is recognized as a limiting factor for crop yield and quality [11]. It is used as a major active solute to maintain turgor and drive irreversible and reversible changes in cell volume, K also plays an important role in numerous metabolic processes such as by serving as an essential cofactor of enzymes [7]. The present research was conducted to determine the optimum levels of phosphorus and potassium for growth early stage of barley plants

MATERIALS AND METHODS:

A pot experiment was conducted to study the interactive effect of phosphorus and potassium on growth some properties of Rahan variety at Omar AL-mukhtar Univ, soil and water department. 5kg of soil per pot were put, soil samples were taken from the 0-30 cm depth from Al- mazraa Al- nomothajia Al-jable Alakder. The soil characteristics were: pH 7.2, EC.0,38 dS/m, organic matter 0.2% and soil texture was sandy clay. The crop also received recommended amount of nitrogen (25Nmg/kg soil) as urea (N 46 5) were added to all treatments randomized. Plants height were measured after 60 days of germination then they cut. Oven drying at 70°C dry weight of shoots and roots and biological yield were determination. A complete randomized design was used in a factorial arrangement and the treatments replicated three times were statically analyzed according to the method reported by [4].

RESULTS AND DISCUSSION

1- Interactive effect of phosphorus and potassium on plant height (cm)

The results of statistical analysis showed that each of the levels of P and K and interaction between them, had a significant effect on plant height . Data presented in table (1) indicated that all P levels had a significant effect on this characteristic . The highest height was recorded at 125 ppm P was 39.10 cm compared with 0 ppm P was 32.22cm by increasing its amount 17.60%. And that these K levels had a significant effect on the characteristic of plant height. The highest was recorded at 125 ppm K was 38.9 cm compared with 0 ppm K was 32.60cm by increasing its amount 16.20% .Concerning the interaction effect between P and K levels. Data in table (1) reveled significant different in plant height the highest height recorded by P₁₂₅ K₁₂₅ and the lowest value recorded by P₀ K₀.

This finding was in harmony with the results obtained by [3] and [4] who found that with the increase of phosphorus and potassium application promotes plant height as compared to low rate of phosphorus and potassium .

Table1. interactive effect of phosphorus and potassium on plant height (cm)

Phosphorus levels (p) (ppm)	Potassium levels (k) (ppm)				Mean
	0	50	100	125	
0	29.50	29.67	34.40	35.30	32.22
75	31.20	33.40	35.90	37.20	34.43
100	34.60	36.70	38.10	40.20	37.40
125	35.10	38.30	39.90	42.90	39.10
Mean	32.60	34.52	37.10	38.90	
LSD at 5%	(p) 0.11	(k) 0.12	P*k 0.209		

2- Interactive effect of phosphorus and potassium on shoots dry weight (g/pot)

Data in table (2)revealed that, irrespective of potassium levels, increasing phosphorus levels up to 125 ppm P significantly increased dry matter accumulation of shoots. The magnitude of the increase in shoots dry weight resulted from phosphorus application of 125 ppm P was 20.0 (g/pot) compared with 0 ppm P was 16.25 (g/pot). By increasing its amount

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18.8%. Significant differences were observed in dry matter accumulation amongst potassium levels regardless of phosphorus levels. Generally 125 ppm K recorded the highest shoot dry weight was 20.39 (g/pot) compared with 0 ppm K was 14.39 (g/pot) by increasing its amount 29.43 %

Concerning the interaction effect of P and K on shoots dry weight. Data in table (2) revealed significant different in shoots dry weight between the different P levels at each K level in shoots dry weight. The highest shoot dry weight recorded by P₁₂₅ K₁₂₅ and the lowest value recorded by P₀K₀.

This was in accordance with the findings of [13] who found that potassium had beneficial effects on nutrient uptake by plant and was particularly important for the transport and availability of micronutrients needed for optimal plant growth and development.

Table2 . interactive effect of phosphorus and potassium on shoot dry weight (g/pot)

Phosphorus levels (p) (ppm)	Potassium levels (k) (ppm)				
	0	50	100	125	Mean
0	12.72	15.87	17.67	18.71	16.25
75	13.31	17.33	17.99	19.35	17.00
100	15.35	18.90	19.90	20.75	19.10
125	16.18	19.99	20.90	22.73	20.00
Mean	14.39	18.10	19.12	20.39	
LSD at 5%	(p) 0.070	(k) 0.04	P*k 0.11		

3- Interactive effect of phosphorus and potassium on roots dry weight (g/pot)

Data presented in table (3) revealed that, irrespective of K levels , increasing P levels significantly increased dry matter accumulation of roots. The magnitude of the increase in roots dry weight resulted from P application of 125 ppm P was 9.45 (g/pot) compared with 0 ppm P was 7.12 (g/pot) by increasing its amount 24.7 % .significant differences were observed in dry matter accumulation amongst K levels the magnitude of the increase in roots

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dry weight resulted from K application of 125 K was 11.63 (g/pot) compared with 0 ppm K was 4.14 (g/pot) by increasing its amount 64.4%. Concerning the interaction effect of P and K levels data in table (3) revealed significant differences in roots dry weight. The highest roots dry weight recorded by P125 K125 was 13.59 (g/pot) compared with P0 K0 was 3.30 (g/pot)

This finding was in accordance with [1] who stated that potassium alone or in combination with phosphorus had a significant effect on growth and yield.

4- Table 3. Interactive effect of phosphorus and potassium on root dry weight (g/pot)

Phosphorus levels (p) (ppm)	Potassium levels (k) (ppm)				
	0	50	100	125	Mean
0	3.30	6.21	8.25	10.71	7.12
75	3.71	8.51	9.11	10.98	8.08
100	4.55	8.99	9.56	11.23	8.58
125	4.98	9.21	9.99	13.59	9.45
Mean	4.14	8.32	9.32	11.63	
LSD at 5%	(p) 0.056	(k) 0.041	P*k 0.140		

5- Interactive effect of phosphorus and potassium on biological yield (shoots and roots) (g/pot)

Data presented in table (4) revealed that, irrespective of K levels. Increasing P levels significantly increased biological yield. The magnitude of the increase in biological yield resulted from P application of 125 ppm P was 29.36 (g/pot) compared with 0 ppm p was 23.36 (g/pot) by increasing its amount 20.44%. Significant differences were observed in biological yield amongst K levels, regardless of P levels. The magnitude of the increase in biological yield resulted from K application of 125 ppm K was 32.01 (g/pot) compared with 0 ppm K was 18.44 .4%(g/pot) by increasing its amount 42.4%.

Concerning the interaction effect of P and K levels data in table (4) revealed significant differences in biological yield between the different P levels at each K level. The

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highest biological yield recorded by P₁₂₅ K₁₂₅ while recorded the lowest value at P₀ K₀. This was confirmed by the results obtained by [12] who illustrated that phosphorus and potassium was significant higher with higher level of phosphorus and potassium on biological yield .

Table 4. Interactive effect of phosphorus and potassium on biological yield (g/pot)

Phosphorus levels (p) (ppm)	Potassium levels (k) (ppm)				Mean
	0	50	100	125	
0	16.03	22.08	25.92	29.42	23.36
75	16.65	25.84	27.10	30.33	24.98
100	19.90	27.89	29.46	31.98	27.31
125	21.16	29.20	30.89	36.32	29.39
Mean	18.44	26.25	28.34	32.01	
LSD at 5%	(p) 0.065	(k) 0.041	P*k 0.140		

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