EFFECT OF FOLIAR SPRAY OF POTASSIUM AND ZINC ON QUALITATIVE QUALITIES OF OKRA SEEDS

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ABSTRACT

A field experiment was carried out at the College of Agriculture / University of Baghdad to study the effect of spraying different concentrations of potassium sulphate 44%K as a source of potassium element in four concentrations (0,2000,4000,6000) mg $K.l^{-1}$ and refer to them K_0, K_1, K_2 and K_3 respectively and zinc sulphate 22% Zn as a source of zinc element in three concentrations (0, 30, 60) mg $Zn.l^{-1}$ and refer to them Zn_0, Zn_1 and Zn_2 respectively for the spring season 2017. Split plot experiment in Randomized Complete Block Design (RCBD) with three replicates was adapted where potassium factor represented main plot and zinc factor in sub-plot .The means were compared at least significant difference (L.S.D) at 0.05 probability level. Resulted showed that spraying of potassium K_3 significantly increased germination percentage to 92.22%, speed germination to 10.28 day, Specific gravity to 98.09 $seed.5g^{-1}$, oil percentage to 21.82%, carbohydrate percentage to 33.98% protein percentage to 22.01%. While Zn_2 significantly increased germination percentage to 90.67%. Speed germination to 9.99 day, Specific gravity to 97.93 $seed.5g^{-1}$, oil percentage to 20.66%, carbohydrate percentage to 33.42% protein percentage to 21.70% compare to control.

Key words: Potassium, Zinc, Foliar spray.
Part of M. Sc. thesis of the first author.

تأثير رش البوتاسيوم والزنك في الصفات النوعية لبذور الباميا

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الخلاصة:

نفذت تجربة حقلية في كلية الزراعة / جامعة بغداد لدراسة تأثير رش تراكيز مختلفة من كبريتات البوتاسيوم K%44 بتركيز (0،2000،4000،6000) ملغمK.لتر$^{-1}$ ويرمز لها K_0,K_1,K_2,K_3 بالتتابع وكبرتيات الزنك Zn%22 بتركيز (0،30،60) ملغمZn.لتر$^{-1}$ ويرمز لها Zn_0,Zn_1,Zn_2 بالتتابع في نمو وحاصل نبات الباميا للموسم الربيعي2017. نفذت التجربة وفق نظام القطع المنشقة (split plot Design) وفق تصميم القطاعات العشوائية الكاملة (RCBD) وبثلاث مكررات حيث اعتبر البوتاسيوم معاملات رئيسية والزنك معاملات ثانوية. قورنت متوسطات المعاملات على مستوى احتمال 0.05. واظهرت النتائج تفوق معاملة الرش بالبوتاسيوم K_3 في زيادة نسبة الانبات الى 92.22% وسرعة الانبات 10.28 يوم والوزن النوعي 98.09 بذرة.5غرام$^{-1}$ ونسبة الزيت 21.82% ونسبة الكاربوهيدرات 33.98% ونسبة البروتين 22.01%. بينما تفوقت معاملة الزنك Zn_2 معنويا في زيادة نسبة الانبات 90.67% وسرعة الانبات 9.99 يوم والوزن النوعي 97.93 بذرة.5غرام$^{-1}$ ونسبة الزيت 20.66% ونسبة الكاربوهيدرات 33.42% ونسبة البروتين 21.70% مقارنة مع معاملة القياس.

كلمات مفتاحية: بوتاسيوم ، زنك ، الرش الورقي.
البحث مستل من رسالة ماجستير للباحث الاول.

Introduction:

Abelmoschus esculentus L. (Moench) is one of the summer vegetable crops belong to Malvaceae family and cotton one of the important plant which belong to this family. Central Africa, Eritrea, Ethiopia, Egypt and Sudan considered as their original region (8).

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Foliar spray of nutrients is a success method in Iraq due to high pH soil, calcareous soil, and a dry hot climate in summer season, which leads to a loss nutrients, many of nutrients are not available due to sedimentation, adsorption, oxidation and volatilization mobilization that are not ready to be absorbed by the root, In addition to the loss by leaching in the sandy soils, like what happens to potassium element, which is important in the process of regulating the osmosis potential and increase the plant ability to save water by controlling the element to opening and closing the stomata and it also stimulates the process of photosynthesis in addition to the relationship of potassium in the process of protein composition and increase the oil formation, and it is enter as a catalyst in chlorophyll formation, potassium is used as assistant factor in chlorophyll formation, so it lacks reduces the rate of photosynthesis. Also it is increases the carbohydrates concentration because of its function in absorption nitrogen element by the plant and converted it to proteins, the zinc is important in cells division and producing of secondary meristem cells so it is necessary to increase the thickness of cells, zinc is one of essential elements which considered important in activate number of enzymes also it is needed by plant in formation tryptophan which consists of the hormone indole acetic acid which is necessary to elongate cells. The lack of zinc effects on pollen producing as its important in the division of cells and producing of secondary meristem cells so it is necessary to increase the thickness of the cells (2). The lack of zinc will effects on the vital processes including the manufacture of carbohydrates by preventing to build RNA and in photosynthesis process in addition to the manufacture of proteins and it has a significant role to produce auxin (9).Okra seeds contains percentage range of protein 22.30-37.02%, oil 2.65-23.99% and carbohydrate 29.44-44.03% (7).

Sawan (12) found that spraying potassium 1200 $mg.l^{-1}$ on cotton plant increased oil percentage to 19.83% and protein percentage to 22.37%. Bhende et al. (4) reported that potassium fertilization in okra plant led to increase germination percentage to 72.76%. Zaver (16) reported that spraying concentration of 0.5% zinc sulfate was significantly increased germination percentage to 82.89% and protein percentage 22.96%. Rahman et al. (10) found that fertilization Zinc 4 $kg.h^{-1}$ increased oil percentage 17% and protein percentage 19.08% in okra plant. Sawan et al. (13) reported that cotton plant respond to 60 ppm zinc which gave 19.78% oil percentage and 22.26% protein percentage. Therefore, the study aimed to show the best level effect of potassium, zinc and their Interaction, which achieves the highest result on okra seeds.

Material and Methods:

The experiment was carried out in one of the scientific research station in collage of agriculture/ University of Baghdad (Jadriya) for spring season 2017 to study the effect of foliar spray of potassium and zinc in seeds qualitative qualities of okra. The experiment was carried out according to split plot design in Randomized Complete Block Design (RCBD) with three replicates each one contained 12 treatment, to study the effect of spraying potassium sulphate 44%K as a source of potassium element in four concentrations (0,2000,4000,6000) $mg.l^{-1}$ and refer to them K_0, K_1, K_2 and K_3 respectively and were considered as main plot and zinc sulphate 22% Zn as a source of zinc element in three concentrations (0, 30, 60) $mg.l^{-1}$ and refer to them Zn_0, Zn_1 and Zn_2 respectively and were considered as sub-plots. The experiment was carried out in area 300 m^2 dimensions 20m x 15m and was divided in form of lines with 3m length and 0.75m between lines , area experimental unit 2.25 m^2 dimensions 3 x 0.75 m contained 10 plant for each unit. Petra okra seeds were soaked for 24 hours before planting, the seeds were planted in

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25/3/2017 distance between each plant was 0.30 m. Potassium fertilization had been blocked from soil fertilization thus the source of potassium was only by foliar spray. The plants were sprayed four times with the solutions mentioned during the growth period. The first spray was when plant height reached 15cm, 15 day in between each spray. Potassium sulfate sprayed first. Three days later, zinc sulphate was sprayed. The obtained data analyzed according to Genstat. The means were compared at least significant difference (LSD) at 0.05 probability level (3). All agronomic practices were carried out uniformly for whole experiment when needed. At the maturity ten plants from each experiment units were selected randomly to study following plant parameters: Specific gravity (seeds.$5g^{-1}$) seeds number collected from 5 gram weight (8). Germination speed (day) which determined according to Maguire (6) using (CRD) design. Germination percentage which determined according to Sultan (14) using (CRD) design. Protein percentage nitrogen where analyzed in seeds than multiplied by 6.25 (1). Carbohydrate percentage determined according to Joslyn (5). Oil percentage determined according to Razon (11)

Results and discussion:

The results in Table 1 showed significant effect of zinc, potassium and their Interaction treatments in increasing oil percentage, protein percentage and carbohydrate percentage. The analysis showed that K_3 treatment was superior significantly in increasing oil percentage to 21.82%, protein percentage to 22.01% and carbohydrate percentage to 33.98% compare to control treatment K_0 which gave the less oil percentage 18.30%, while K_1 gave the less protein percentage 19.25%, and gave the less carbohydrate percentage 31.79%. The analysis showed that Zn_1 treatment was superior significantly in increasing oil percentage to 20.66%, protein percentage to 21.70%, and carbohydrate percentage to 33.42% compare to control treatment Zn_0 which gave the less oil percentage 19.57, protein percentage 19.42% and carbohydrate percentage 31.75%. The analysis showed that Interaction K_3Zn_2 treatment was superior significantly in increasing oil percentage to 22.25%, protein percentage to 23.31% and carbohydrate percentage to 34.54% compare to control treatment K_0Zn_0 which gave the less oil percentage 17.25 , while K_1Zn_0 gave the less protein percentage 18.76% and treatment K_0Zn_0 gave the less carbohydrate percentage 30.50%. Plants that are well nutrition by potassium delay the aging of leaves and increase their leaf area and thus increase the preparation of materials produced by photosynthesis which provide it to meristem texture that used it mainly in proteins formation, potassium also important in separation proteins from the ribosome thus providing an opportunity to create a new protein as it is necessary for a resultant transmission of photosynthesis products for filling stored parts. The most important deficiency mark of potassium is its negative effect on the process of protein synthesis and amino acids and the accumulation of compounds nitrogenous two-amino which causes a toxic material that kills cells, potassium leads to give a rich carbohydrate seeds as a result of stimulating the transfer of carbohydrates from leaves to the stored parts, there is also a positive relationship to the potassium element in stimulating photosynthesis and transmission of their products (2). These findings were accordance with results founding by Sawan (12) who observed that spraying potassium rates significantly effects on oil percentage 19.83% and protein percentage 22.37% on cotton plants. Zinc acts as a pH regulator thus it protects proteins from loss as it plays an important role in formation a new proteins, high oil content may be due to the effect of zinc in reducing nitrogen percentage in plant, high nitrogen levels lead to reduce oil percentage, the increase of carbohydrates percentage when spraying zinc may be due to the help of the elements

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in chlorophyll formation through direct effects on the processes of carbohydrates composition, amino acids and energy compounds (2). These findings were accordance with results founding by Zaver (16) who observed that spraying Zinc rates significantly effects on protein percentage 22.96% on okra plant also were accordance with results founding by Rahman et al. (10) who observed that spraying Zinc rates significantly effects on protein percentage 19.08% on okra plant.

Table 1. Effect of foliar spray of Potassium, Zinc and their Interaction on qualitative qualities of okra seeds for the spring season 2017.

	Oil percentage (%)				Protein percentage (%)				Carbohydrate percentage (%)			
Treat.	**Zn 0**	**Zn 1**	**Zn 2**	**Mean**	**Zn 0**	**Zn 1**	**Zn 2**	**Mean**	**Zn 0**	**Zn 1**	**Zn 2**	**Mean**
K 0	**17.25**	**19.14**	**18.52**	**18.30**	**18.80**	**20.03**	**21.36**	**20.06**	**30.50**	**32.72**	**33.59**	**32.27**
K 1	**19.86**	**20.74**	**21.59**	**20.73**	**18.76**	**19.27**	**19.72**	**19.25**	**30.73**	**32.05**	**32.58**	**31.79**
K 2	**19.60**	**19.67**	**20.28**	**19.85**	**19.79**	**19.86**	**22.40**	**20.68**	**32.04**	**32.31**	**32.95**	**32.43**
K 3	**21.56**	**21.64**	**22.25**	**21.82**	**20.31**	**22.40**	**23.31**	**22.01**	**33.72**	**33.68**	**34.54**	**33.98**
Mean	**19.57**	**20.30**	**20.66**		**19.42**	**20.39**	**21.70**		**31.75**	**32.69**	**33.42**	
L.S.D 0.05	**K**	**Zn**	**Interaction**		**K**	**Zn**	**Interaction**		**K**	**Zn**	**Interaction**	
	0.78	**0.43**	**0.97**		**1.56**	**0.55**	**1.68**		**1.20**	**0.54**	**1.38**	

The results in Table 2 showed significant effect of potassium, zinc and their Interaction treatments in increasing germination percentage, germination speed and specific gravity. The analysis showed that K_3 treatment was superior significantly in germination percentage to 92.22%, Germination speed to 10.28 day and specific gravity to 98.09 seed.$5g^{-1}$, compare to control treatment K_0 which gave the less germination percentage 82.00 %, germination speed 11.01 day and specific gravity 106.22 seed.$5g^{-1}$. The analysis showed that Zn_1 treatment was superior significantly in increasing germination percentage to 90.67%, germination speed to 9.99 day, and specific gravity to 97.93 seed.$5g^{-1}$, compare to control treatment Zn_0 which gave the less germination percentage 81.17 %, germination speed 11.40 day and specific gravity 104.88 seed.$5g^{-1}$. The analysis showed that Interaction K_3Zn_2 treatment was superior significantly in increasing germination percentage to 96.67%, germination speed to 9.86 day, and specific gravity to 95.60 seed.$5g^{-1}$, compare to control treatment Zn_0 which gave the less germination percentage 75.33, specific gravity 109.60.48 seed.$5g^{-1}$, while K_1Zn_0 gave less germination speed 12.20 day.

May be the high rate of germination effected by the participation of zinc and potassium in provision the nutritional status of the plant which is positively reflected seeds filling with nutrients such as carbohydrates and protein, which decomposes after seeds absorb water to glucose, amino acids and phosphate ions are easily absorbed by the embryo, also the role of zinc in the manufacture of tryptophan, which is a source of oxyin formation in plant tissues, especially in endosperm and embryo (15).

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Table 2. Effect of foliar spray of Potassium, Zinc and their Interaction on qualitative qualities of okra seeds for the spring season 2017.

	Germination percentage (%)				Germination speed (day)				Specific gravity (seeds.5g)			
Treat.	**Zn 0**	**Zn 1**	**Zn 2**	**Mean**	**Zn 0**	**Zn 1**	**Zn 2**	**Mean**	**Zn 0**	**Zn 1**	**Zn 2**	**Mean**
K 0	**75.33**	**86.67**	**84.00**	**82.00**	**12.13**	**11.08**	**9.82**	**11.01**	**109.60**	**105.60**	**103.47**	**106.22**
K 1	**84.00**	**83.33**	**86.00**	**84.44**	**12.20**	**10.52**	**10.01**	**10.91**	**105.07**	**101.33**	**96.40**	**100.93**
K 2	**81.33**	**87.33**	**96.00**	**88.22**	**11.25**	**10.66**	**10.26**	**10.72**	**102.67**	**98.53**	**96.27**	**99.16**
K 3	**84.00**	**96.00**	**96.67**	**92.22**	**10.03**	**10.94**	**9.86**	**10.28**	**102.20**	**96.47**	**95.60**	**98.09**
Mean	**81.17**	**88.33**	**90.67**		**11.40**	**10.80**	**9.99**		**104.88**	**100.48**	**97.93**	
L.S.D	**K**	**Zn**	**Interaction**		**K**	**Zn**	**Interaction**		**K**	**Zn**	**Interaction**	
0.05	**3.81**	**3.29**	**6.59**		**0.51**	**0.52**	**0.94**		**0.16**	**0.17**	**0.30**	

References:

1. A. O. A. C. 1980. Official Methods of Analysis Association of Official analytical Chemists, 13th ed. Washington. USA.
2. Abu Dhahi, Y. M. and M. A. Al Yunis, 1988, Guide to Plant Nutrition, Dar Al Kutab for Printing and Publishing, Mosul University, Ministry of Higher Education and Scientific Research, Iraq.
3. Alsahuki, M. and K. M. Wahib. 1990. Applications in the Design and Analysis of Experiments. Dar Al Hekmah for Printing and Publishing. Baghdad University. Ministry of Higher Education and Scientific Research. Iraq.
4. Bhende S.K., Deshmukh H. K., Nimbolkar P. K., Dewangan R. K, Nagone A.H. 2015. Effect of phosphorous and potassium on quality attributes of okra cv. (Arka Anamika). International Journal of Environmental Sciences.6 (2).
5. Hassan M. A. M. and H. M. Ali. 2015. The nutritional composition of three cultivars of okra (*Abelmoschus esculentus* L.) seeds flour**.** World Journal of Dairy & Food Sciences. 10 (2): 122-131.
6. Joslyn, M. A. 1970. Methods in Food Analysis Physical, Chemical and Instrumental Methods of Analysis. 2nd. Academic Press, New York and London.
7. Maguire, J.D. 1962. Speed of germination - aid in selection and evaluation for seedling emergence and vigor. Crop Science 2:176-177.
8. Matlub, A. N., I. S. Mohamed and K. S. Abdoul, 1989, Production of Vegetables, Part one, Directorate of Dar Al Kutb and Publishing, Mosul University, Ministry of Higher Education and Scientific Research, Iraq
9. Mengel, K, E. A. Kirkby, H. Kosegarten and T. Appel. .2001. Principles Plant Nutrition. Kluwer Academic Publishers.
10. Rahman M.H., I. Hossain, M.U. Ahmad and M.A.Rahim, 2017, Effects of boron and zinc on yield and quality of okra seed, advances in bioresearch, 8(1):202-211.
11. Razon L. F., R. L. Bacani, R. L. Evangelista, and G. Knothe, "Fatty acid profile of kenaf seed oil," *Journal of the American Oil Chemists' Society*, vol. 90, pp. 835–840, 2013.
12. Sawan, Z. M., S. A. Hafez and A. E. Basyony. 2006. cottonseed, protein, oil yields and oil properties

ISSN 2072-3875

as affected by nitrogen fertilization and foliar application of potassium and a plant growth retardant, World Journal of Agricultural Sciences, 2 (1): 56-65.

13. Sawan, Z. M., S. A. Hafez and A. E. Basyony. 2006. Cottonseed, protein, oil yields and oil properties as influenced by potassium fertilization and foliar application of zinc and phosphorus. World Journal of Agricultural Sciences. 2 (1): 66-74.
14. Sultan, E. E. M., 1983, Vegetable Seed Production, Ministry of Higher Education and Scientific Research, University of Mosul, Iraq.
15. Tisdale, S. L.; W. L. Nelson; J. D. Beaton, and J. L. Havlin. 1997. Soil Fertility and Fertilizers. Prentice-Hall of India, New Delhi. India.
16. Zaver, V. M., 2007, Effect of gibberellic acid, zinc and iron on seed production of okra [Abelmoschus esculentus (L.) Moench]. Doctora of philosophy in Horticulture, Junagadh agricultural University, College of agriculture, Department of horticulture. Registration no. 04-04738-2000.

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