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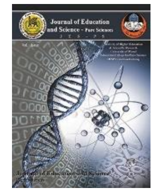

Effect of Potassium Fertilization on The Field Soil Characters And Productivity of Yellow Maize Plant

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Abstract

This study was conducted in the fields of Nineveh Research Department (animal wealth) in the fall season to study the effect of different levels of potassium fertilization on the growth of maize plant Zea myas class 106, a completely randomized design was used with three replications. Each of the treatments included three levels of potassium sulfate fertilizer (K0, 0, K_1, 20, K_2, 30, K_3 50) kg/D. The results of adding potassium fertilizer at its levels showed a significant effect on the studied traits (potassium K_3 concentration showed a significant effect on the length of (the plant, leaf, ear, number of ears, the weight of ear leaves, number of ear rows, weight of (calcareous, and whole plant), which amounted to 195.5, 78.3, 10.5, 32.7, 2.50, 0.030, 16.8, 0.177, 0.30, compared with other concentrations of fertilizer and comparison treatment, which amounted to 176.6, 70.9, 9.5, 30.0, 1.75, 0.02, 14.7, 0.08, 0.29, gm/kg soil on The addition of potassium K3 level gave the highest value in terms of ash and water absorption of maize grains, which amounted to 0.420 and 61.23, respectively, compared with other concentrations and treatment, which amounted to 0.416 and 60.23 gm/kg soil, as well as an increase in the value of both dissolved and available potassium and phosphorous percentage. Which amounted to 22.0, 422.7, 26.67, gm/kg soil compared with other concentrations of fertilizer and control treatment, which amounted to 332.3, 14.07, and 23.91 gm/kg soil respectively compared to other concentrations of potassium fertilizer, and give significant effect to Both available-made ammonium, Ph. , electric conductivity but no significant nitrate content in the soil.

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1. Introduction:

Maize is one of the important cereal crops and comes in third place after wheat and barley. It has a high nutritional value for humans and animals because it contains proteins, carbohydrates, oils, fibers, minerals, and vitamins. It was used in the manufacture of concentrated feed and is considered a basic material in food industries such as the oil industry, especially poultry feed, for this reason, attention was paid to its cultivation practices and study of the fertilization effects on its productivity [1][2]. Since the yellow corn crop suffers from a decline in the production rate, a number of methods must be used that help in increasing production, and the most important of these methods is the use of chemical fertilizers, especially potassium fertilizers for this Potassium (K) is one of the important and necessary elements for plants, it stimulates and activates plant enzymes and contributes to the achievement of many vital activities of plants [3][4]. As the vegetative phase requires large amounts of potassium, and with the completion of the formation of the vegetative system, the efficiency of the root system decreases in covering the requirements of the newly formed parts of these nutrients in building the top of the plant, which means that the plant tissue enters the stage of aging and early death [5]. potassium helps in the transfer of carbohydrates from the areas of their synthesis to the other parts of the plant. Moreover, it maintains the building of proteins, permeability of membranes; control of cell pH and utilization of water by regulating the opening of stomata as well as it encourages the growth of roots and increases resistance to diseases It improves the quality of the fruits and helps the plant to tolerate soil and water salinity, drought tolerance and frost resistance[6][7]. Consequently, it improves the growth and yield of field crops and vegetable plants**.** Potassium, also, has a fundamental importance in the cycle of carbon, nitrogen, sulfur, phosphorous, and most metal ions.Potassium is considered one of the necessary macronutrients that play an important role with nitrogen and phosphorous in plant growth, [8] [9] [10] [11] [12] [13] [14], therefore potassium improves nitrogen absorption and helps in increasing the nitrogen use efficiency. It is found in the plant in a free ionic form and does not enter into the composition of any free compound. The addition of potassium has been neglected in many developing countries and thus led to the depletion of potassium from the ecological agricultural systems and this prevented an increase in the grain yield of maize. Therefore, [15] suggested feeding with potassium fertilizer at the stage of the formation of the ear and the stage of the beginning of female flowering (the emergence of the silk) to raise the efficiency of the maize plant to benefit from this element and reduce the waste with its fertilizers added to the soil and maintain the environmental and physiological balance of the plant alike.

The research aims to improve the productivity of the maize crop by using potassium fertilization through the effect of several levels of fertilizer, as well as studying its effect on the morphological characteristics studied in maize.

2. Materials and Methods

A field experiment was carried out in one of the fields of the Nineveh Research Department (animal wealth) in the autumn season (2021) in a clayey alluvial mixture classified. A soil sample was randomly taken before planting from the surface layer (0-30 cm depth), air-dried ground, and passed through a sieve with holes diameter of 2 mm, and a representative sample of field soil was taken to conduct some chemical and physical analyzes according to the methods presented in [16] and [17] as shown in Table (1).

Soil service operations were carried out from plowing, smoothing, and leveling; the field was divided into plots according to a Randomized Complete Block Design (CRBD) with three Blocks. Organic manure was added 50kg, which included a source of organic manure (poultry and sheep), and was added to the soil as a mixture before planting. The main treatments included potassium fertilizer, which included three levels of potassium sulfate fertilizer (48% K, K_2SO_4) (0, 20, 30, 50) kg/D. Potassium fertilizer was added two times, the first time in the germination stage and the second in the flowering stage, while it was added in two parts, the first after 10 days of cultivation and the second part after 40 days of the first addition. Nitrogen fertilizer was added at an amount of 50 kg nitrogen in the form of urea fertilizer (46% N), half of the amount was added before planting and the second half during the germination stage.

As for the phosphate fertilizer, it was added by 50 kg/D. mixed with the soil before planting and in the form of triple calcium superphosphate fertilizer. Soil samples were taken from the layer 0-30 cm in the phases of germination and harvest to be a composite sample and the soil samples were dried to determine the different potassium forms.

a. Chemical analyzes

were carried out in the laboratory of the University of Mosul, as the degree of soil reaction, soil electrical conductivity, a soil suspension was made: water (1:1) and the soil reaction number (pH), electrical conductivity (EC), and total dissolved salts were estimated in its extract as follows: The soil reaction number (pH) was estimated using the pH-meter and the electrical conductivity (EC) using the EC-meter., The organic matter was estimated according to the method of wet digestion mentioned in [16] available nitrogen was extracted with a solution of Kcl (2N) and ammonium was determined by the Kjeldahl Apparatus according to the method of Keeney and Bremner [18] and as mentioned in and after ammonium extraction the nitrate was determined by the Kjeldahl Apparatus according to the Bremner method and as mentioned in [18], and according to the Olsen method Available phosphorus was extracted and estimated by the spectrophotometer at a wavelength of 882 nm, as mentioned in [19] using a flame photometer, Soluble Potassium. It was determined in a soil extract: water (1:1) using a photometer flame according to the previously suggested method Knudsen contained in [20] non-exchanged potassium was extracted using a (1M) solution of boiled nitric acid Then was calculated from the difference between the amount extracted with (1M) nitric acid and the amount extracted with (0.05M) calcium chloride. Exchange potassium was extracted by the method of calcium chloride solution (0.05 M) and sodium acetate solution (1M) according to the method of [21], and total potassium It was estimated after digesting the soil sample using an acid mixture (nitric + sulfuric + pyrochloric), while the mineral potassium was determined mathematically according to the mathematical formula proposed by [21], and the protein percentage was calculated according to what was mentioned [22] after calculating the amount of organic nitrogen in seeds, to determine the proportions of the soil separations, the hydrometer method was used, as the percentage (sand, silt, clay) was calculated, and the organic matter was removed by hydrogen peroxide(H_2O_2) at a concentration of 30%) with the addition of the dispersive substance (Sodium hexa meta phosphate) to disperse these separations, then watering is done. These ratios are on the texture triangle to determine the type of soil texture according to [23].

b. Characteristics studied

Plant height, leaf length, leaf width, Ears length(cm), Number Cob, Cob Grains Number (Grain), sheet Weigh, Grains Weight, f Cob weight, Corn silk weight, whole plant weight (gm), Cob rows(row), The values of these variables were calculated from taking an average of 15 random samples for each experimental unit [24] [25].

Table (1) some chemical and physical properties of field soil before planting

Unit	value	Parameters
____	7.5	pH
decisemns. cm-1	1.320	electrical conductivity (EC)
gm/kg	2.62%	organic matter (OM)
mg/kg		Potassium Pictures
	5	Soluble
	423	Available
	2.0	Non-Exchangeable
	11.10	Mineral
	428	total
mg/kg	8.2	Ammonium release
	18	nitrates
	23.95	available Phosphorus
		Physical properties
mg/kg	51.05%	sand
	28.5%	silt
	20.45%	clay
Sandy clay loam		Textures

3. Results and discussion:

a. Vegetative growth of maize harvest stage

Table (2) shows the effect of potassium fertilizer on vegetative growth at the harvest stage of yellow corn, as the results showed that there were significant differences between treatments as a result of adding the potassium fertilizer, as the level of K3 fertilizer exceeded its value in plant length, leaf width, leaf length, leaf number, weight of leaves and number of rows corns, stalk weight and the weight of the whole plant, which amounted to (195.5, 78.3, 10.5, 32.7)cm, 2.50 grain, , 16.85row, (0.146,16.12, 0.177) gm/kg soil, compared with other fertilizer levels and control treatment, which amounted to (176.6, 70.0, 9.5 , 30.0) cm, 1.75grain, 14.7 row, (0.075, 6.4 ,0.086) gm/kg soil, respectively, non-significant differences on concentration of K3,in leaf and number of geraniums, grain weight which amounted, (0.30,0.39) gm/kg soil, 0.516grain compared with control treatment(0.029,0.29) gm/kg soil,0.438 grain, also on concentration of K_2 fertilizer was superior to the weight , and, and crop weight, which amounted to (0.20, 27.24) gm/kg soil, compared with control treatment (0.18, 6.40)gm/kg soil on the straight. There were no statistically significant differences in the concentration of the second and third fertilizer levels and the comparison treatment in the values of the follicle weight, which amounted to 0.005 g/kg. In general, also note that potassium fertilizer is superior to K_3 concentration in some vegetative characteristics over other concentrations in vegetative growth at the harvest stage, the results shown in the table, the cause of Plant height, due to the fact that spraying potassium on yellow corn plants has a role in increasing cell division and elongation, stimulating the growth of the developing top and plant growth, and thus increasing the elongation of the stem [26], and the reason for increasing the leafy area due to the role of adding potassium in process of cell division and increasing the plant's ability to absorb nitrogen, which in turn works to increase the length of the plant's survival capable of photosynthesis, led to an increase in the(length and width) leaf', while the reason of increase of the number of rows in the ear, due to an increase in cell division and thus an increase in the circumference of the ear, or to effect of potassium by increasing the division of the silk cells in the upper peripheral region of the ear and at the time when the pollen grains are ready for pollination And thus leads to an increase in grains formed on the rows of ear. [27]. The reason of increase the number of grains in the row, also due to potassium has an effect in increasing the division and elongation of cells, which leads to an increase in the elongation of the pin and thus an increase in the number of grains in the leaf area in the row, or due to the superiority in the characteristics of plant height, giving a good increase in the number of leaves and chlorophyll content which made it more able to give flower initiators and more rows in the ear due to the increase in photosynthetic products, and this made it excel in the number of grains in the row[28], the reason due to the role of potassium in the growth of the pollen tube in the characteristic of the number of grains in the ear, and the reason for the increase also due to the role of potassium in increasing cell division and increasing growth, which leads to an increase in the size of the ear and thus an increase in the number of grains in the ear in the characteristic of the length of the ear, and the reason for this is To the effect of potassium in increasing cell division and thus increasing the length of the head.

Table (2) The effect of potassium fertilization on the vegetative growth of yellow corn at the harvest stage

whole plant weight (kg)	Corn silk weight (gm)	Cob Weight (gm)	crop weight (gm)	Grains Weight (gm)	Grains Cob (grain)	Cob rows (row)	sheet Weight (gm)	Cob weight (gm)	No. Cob (grain)	Ears length (cm)	leaf width (cm)	leaf length (cm)	plant length (cm)	Type treatment
0.29 a	**0.005a**	**0.086c**	**6.4c**	**0.075c**	**438.0 a**	**14.75c**	**0.029a**	**0.18a**	**1.75 ab**	**30.02 b**	**9.5b**	**70.0b**	**176.6 b**	**KO**
0.26 b	**0.005a**	**0.080c**	**26.05a**	**0.139a**	**506.8 a**	**15.8 b**	**0.025a**	**0.19a**	**1.25 b**	**30.05 b**	**9.3b**	**69.3b**	**163.8c**	**K1**
0.20 c	**0.005a**	**0.097 b**	**27.24a**	**0.124a b**	**506.8 a**	**15.0a b**	**0.o27a**	**0.20a**	**1.75 ab**	**28.7 b**	**8.7 b**	**69.6 b**	**184.8 ba**	**K2**
0.39 a	**0.005a**	**0.177a**	**16.12 b**	**0.142a**	**516.2a**	**16.85a**	**0.030a**	**0.17a**	**2.50 a**	**32.7 a**	**10.5a**	**78.3a**	**195.5a**	**K3**

Letters are significantly different from each other at the 5% probability level.

b. Chemical components of maize grains at the harvest stage

Table (3) shows the effect of potassium fertilizer on some chemical variables in yellow corn grains. It was observed that there was no significant effect on a number of these variables such as protein, gluten, and ash compared with the treatment, as the highest percentage of protein and ash at concentration K3 was 29.10,0.42 % compared to other concentrations, while significant differences were observed between the three concentrations of potassium fertilization and the treatment for each of moisture, granularity, hardness and water absorbency, as the highest percentage of moisture, granularity and hardness at concentration K2 reached 0.79, 54.0%, 89.0%, respectively, compared with the treatment 0.60 %,44.03%,80.20 %, while the highest value of water absorption at concentration K3 reached 61.20%, compared with the treatment60.23% and other concentrations of potassium.

It is concluded that the reason may be due to the activation of potassium for some enzymes in the formation of nucleic acid RNA[4]. Also, the increase in plant height and leaf area gives a good increase in the number of leaves, which leads to an increase in protein in grains and chlorophyll content[29], while the increase in the percentage of other characteristics shown in the table may be attributed to the role of potassium fertilization in increasing the rates of Growth, which caused an increase in metabolic and carbon metabolism, which led to the provision of nutrients, and then their transmission and storage in the seeds and filling them with materials manufactured through the process of photosynthesis, which caused an improvement of these characteristics in the plant [30].

Table No. (3) Shows the percentage of some variables yellow corn grain, harvest stage, mg/kg Letters are significantly different from each other at the 5% probability level

water absorption %	Hardness %	Granularity %	Moisture %	Ash %	Gluten %	Protein %	Treatment
60.23 b	80.20c	44.03 c	0.6 b	0.41a	31.00a	20.23b	KO
60.b	84.13 b	49.03b	2.23 d	0.27c	31.20a	21.40a	K1
60.17b	89a	54.00 a	0.79 a	0.32b	31.13a	20.77ab	K2
61.20 a	84.57 b	49.00b	0.40 c	0.42a	30.10a	29.10 a	K3

c. Soil texture and content of potassium and phosphorus

Table (4) shows the effect of potassium fertilizer on the content of nitrogen and phosphorus in the soil at the stage of harvesting yellow corn. The Highest percentage was found in yellow corn grains, amounting to 0.087 mg/kg, compared with other fertilizer concentrations and the control treatment, which amounted to 0.052 mg/kg soil. The concentration of K3 fertilizer was superior in the value of both dissolved and ready potassium, and the phosphorus ratio, which amounted to 22.0, 422.7, 26.67, and 22.0 mg/kg. Soil compared with other concentrations of fertilizer and the control treatment, which amounted to 14.07, 332.3, and 23.91 mg/kg soil, while there were significant differences in the percentage of organic matter, as the concentration of fertilizer K2 was higher and its value amounted to 3.92 compared with other concentrations of fertilizer and the control treatment, which amounted to 2.62 mg/kg. kg of soil and with regard to the texture of the soil, it was observed that the highest elevation of the level of clay was at concentration K3 and the percentage of silt at concentration of fertilizer K1, while the percentage of sand was significantly higher at concentration of fertilizer K2 and its value was 25.41, 58.20, 61.08 mg/kg,

This may be due to an increase in the levels of potassium fertilization, which led to an increase in the amount of nitrogen absorbed, which helps to increase the amount of protein synthesized in the plant [31], as well as the positive effect of potassium, which led to an increase in the amount of absorbed phosphorus For the role of potassium in stimulating the formation of ATP Which contributes to filling the sieve tubes with materials resulting from the process of photosynthesis, as well as increasing the rate of photophosphorylation. [32], while the organic matter increased with an increase in the levels of potassium due to the role of potassium in improving the chemical and physical properties of yellow corn and soil, Also it was noted that the clay soil has superiority over the sandy soil, due to the ability of the clay soil to retain a greater amount of potassium on the surface of the exchange complex due to its increased content of clay compared to the sandy soil [33].

Table (4) The effect of potassium fertilizer on the content of nitrogen and phosphorus in the soil at the harvest stage of yellow corn

Soil Texture	Sand mg/kg	Silt mg/kg	Clay mg/kg	Organic Matter mg/kg	Phosphorus mg/kg	Available Potassium mg/kg	Soluble Potassium mg/kg	Nitrogen mg/kg	Treatment
Sandy Loam	51.05b	28.13 c	20.41b	2.62c	23.91c	332.3 c	14.07 b	0.052d	KO
Sandy silty Loam	28.55d	58.20 a	12.91c	1.24d	21.92b	252.3 b	12.07 d	0.087a	K1
Sandy Loam	61.08a	26.00 b	12.91c	3.92a	12.32d	270.3a	19.03c	0.071c	K2
Sandy Clay Loam	58.55c	16.00d	25.41a	1.93b	26.67a	422.7a	22.00 a	0.062b	K3

Letters are significantly different from each other at the 5% probability level

d. PH and electrical conductivity and their effect on ammonium and nitrate

Table (5) shows the effect of potassium fertilizers on the degree of salinity PH, electrical conductivity, TDS, and available ammonium in the soil at the harvest stage of yellow corn.

It was observed that there were no significant differences in the percentage of total dissolved salts and the level of nitrates, the concentration of potassium fertilizer exceeded K3 gave the highest value of 697mg/L, and 9.9mg/kg, respectively, compared with the control treatment, while significant differences were observed in the values of electrical conductivity and available ammonium, and it reached the highest value at K3 concentration of 2.76 dS.m-1, 8.36mg/kg, respectively, compared with the control treatment And there are no clear differences in the value of the interaction degree pH, compared with the control treatment and the other concentration, this may be due to the fact that the potassium fertilizer caused a slight increase in the PH value by increasing the concentration of potassium [34].

The reason for a change in the electrical conductivity (EC) of the soil is due to the liberation of soluble ions as a result of the decomposition of organic matter and its mixing in the soil. A slight difference was observed in the increase in the pH values, and the reason may be due to the complete oxidation of the organic matter [35].

It is noted that potassium fertilization increases the available ammonium in the soil, perhaps due to the competition of the potassium ion (K + 1) for the ammonium ion (NH4 + 1) on the sites of the exchange complex, mentioned that the liberation of ammonium adsorbed on the inner surfaces of clay minerals depends on the presence of high concentrations of potassium ions in the soil[36].

Table No. (5) Effect of Potassium fertilizers on salinity and electrical

nitrate mg/kg	available ammonium mg/kg	total dissolved salts mg/l	electrical conductivity dS.m-1	pH	Treatment
8.9a	7.24 b	613 a	3.10a	7.3b	K0
9.7a	8.0 a	229 b	2.13 b	7.7a	K1
9.6a	7.93 ab	388 b	1.90 b	7.5a	K2
9.9a	8.36a	697a	2.76 b	7.6a	K3

Letters are significantly different from each other at the 5% probability level.
I is a must to strengthen the presentation of results and write a discussion

4.Conclusions

We conclude from this that the best level of potassium fertilizer for yellow corn plants is 50 kg / D, and this is in the location in which the research was conducted to give it the highest yield in terms of plant length, leaf area, weight, size and the number of ear rows, as well as the rest of the studied vegetative growth characteristics, as well as an increase in the percentage of protein, nitrogen, and phosphorus And ready ammonium and nitrates in the grain and soil, with slight changes in the proportions of the degree of reaction, electrical conductivity, and total dissolved salts, so we recommend giving the studied potassium fertilizer concentration to which the yellow corn showed a response and gave the best results, as well as working on the use of new combinations and other crops and varieties.

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It is so omportant update the reference and strength them by contected and relevant ones.
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تأثير التسميد البوتاسي على خصائص التربة الحقلية وإنتاجية نباتات الذرة الصفراء

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الخلاصة

أجريت هذه الدراسة في الحقول التابعة لقسم بحوث نينوى الموسم الخريفي بهدف دراسة تأثير اختلاف مستويات التسميد البوتاسي في نمو نبات الذرة الصفراء *Zea myas* صنف 106 ,ا ستخدم التصميم ا العشوائي الكامل بثلاث مكررات. اشتملت كل من المعاملات على ثلاث مستويات من سماد كبريتات البوتاسيوم**(** K3,50 , K2,30, K1,20, K0,0**)** كغم\دونم. اظهرت نتائج اضافه السماد البوتاسي بمستوياته تأثيرا معنويا في الصفات المدروسة (اظهر تركيز البوتاسيوم K3 تأثير معنويا في طول (النبات, الورقه, العرنوص, عدد العرانيص, وزن أوراق العرنوص, عدد صفوف العرنوص, وزن الكالح, والنبات كاملا), بلغت 195.5 ,78.3, 10.5, 2.50,32.7 , 0.030, 16.8, 0.177, 0.30, مقارنه مع التراكيز الأخرى من السماد ومعاملة المقارنة والتي بلغت 176.6, 70.9 , 9.5, 30.0, 1.75, 0.02, 14.7, 0.08, 0.29, غم\كغم تربة على التوالي كما اعطى اضافه مستوى البوتاسيوم K3اعلى قيمه بنسبه الرماد وامتصاصيه الماء لحبوب الذرة الصفراء اذ بلغت0.420, 61.23 على التوالي مقارنه مع التراكيز الأخرى و المعاملة اذ بلغت 0.416و60.23 غم\كغم تربة . وكذلك زياده في قيمه كل من البوتاسيوم الذائب والجاهز ونسبه الفسفور التي بلغت 22.0، 422.7، 26.67، غم\كغم تربة مقارنه مع التراكيز الأخرى من السماد ومعاملة المقارنة والتي بلغت 332.3, 14.07 , 23.91 غم\كغم تربة على التوالي مقارنه بالتراكيز الأخرى للسماد البوتاسي. ومعامله المقارنة كما اعطى التسميد البوتاسي بتركيز K3 تأثيراً معنوياً في كل من الامونيوم الجاهزودرجه التفاعل والتوصيلية الكهربائية وغير معنويا في محتوى النترات في التربة.