Journal of Tikrit University for Agricultural Sciences Vol(11)No(4)year(2011)

Effect of Potassium Fertilizer and Foliar Application of Nutrient Solution (Growth) on the Growth and Yield of Cowpea (*Vigna sinensis* L.) Planted in A Gypsiferous Soil

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Abstract

The field study was conducted during agricultural season of 2010 in the field of college agriculture / Tikrit university in order to determine response of cowpea to potassium fertilizer treatment in three levels 0 , 33.75 , 67.50 kg K ha^{-1} and sprying four levels of the nutrient solution (Growth) 0 , 2 , 4 , and 6 sprayings . The experiment was designed in Randomized Complete Block Design in three replications . Results had shown that the potassium fertilizer treatment in 33.75 (kg K ha^{-1}) level has significant increase in plant weight , pods number and the yield of plant . The treatment 2 sprayings of (Growth) nutrient solution caused an increase in seeds number of pod . Whereas 4 sprayings of (Growth) nutrient solution increased significantly leaves number character . In the same time the 6 sprayings of (Growth) nutrient solution gave increment in plant weight and yield . While the control treatment gave significant increment in the weight of 100 seed character . Whereas the interaction treatment between potassium fertilizer treatment of 33.75 (kg K ha^{-1}) level and 6 sprayings of (Growth) nutrient solution gave significant increase in each of plant weight , pods number , and plant yield . Whereas the potassium fertilizer treatment of 33.75 (kg K ha^{-1}) without sprayings gave significant increase in 100 seed character . The potassium fertilizer treatment of 67.50 (kg K ha^{-1}) level with 2 sprayings of (Growth) nutrient solution gives significant increase in branches number character . While the control treatment gave significant treatment increment in both leaves number and pod length characters .

Introduction

Cowpea (*Vigna sinensis* L.) is of immense importance . It is an important multipurpose grain legume extensively cultivated in arid and semiarid tropics . The green pods of cowpea is used as vegetables . In addition to grain , It is also grown for its nutrition fooder . Cowpea is grown as catch crop , Mulch crop , Intercrop , Mixed crop and green crop (Yadav , 1986)Pulses plants are among the most important protein-rich plant sources in the world , The cheapest and the most able to improve and sustain soil fertility (Pienkose et al , 1980)Potassium is the second most abundant macro-nutrient element after nitrogen in terms of amounts found in plant tissues except seeds (Bidwell, 1974 ; Marschner , 1995)

Optimum K concentrations in plant tissue usually range from 2% to 5% of plant dry weight . Even though K is not an integral part of any major plant structures . It plays a key regulatory role in many physiological processes vital to plant growth (Wyn Jones et al 1979) .

As a major inorganic osmolyte , The role of K in cell osmoregulation and turgor maintenance is crucial in processes such as stomatal opening / closing , Cell expansion , Tropisms , and leaf movements . Due to its high concentration in the cytoplasm (100 to 200 mM) and chloroplasts (100 to 200 mM) it stabilizes the pH between 7 and 8 in these organelles and optimizes enzyme activities (Marschner , 1995) .

As an activator of many enzymes , K plays a vital role in photosynthesis , protein synthesis , and oxidative metabolism . In addition to affecting photosynthesis through stomatal regulation , K is also involved as the major counterion in the establishment of a transmembrane pH gradient during synthesis of ATP (photophosphorylation) in the thylakoid memberanes (
Taster and Blatt , 1989) . It has been observed that plants dicotyledons in general contain cations with bivalent more than monovalent cations with parity when it compared to plants monocotyledons and usually cation exchange capacity of the roots of plant are dicotyledons higher than that in

monocytoledons (Al-Neaemy ,S. N. A. , 1984) Stewart and Reed (1969) observed improved plant growth and pod yield due to potash application up to 50 kg per ha to cowpea .

Narwal et al (1985) found dry matter yields of leaves , stems and roots increased in cowpea by 17 , 30 and 27 per cent over control due to application of 150 ppm K and 17 , 16 and 26 per cent by 40 ppm .

Geetha and Varughese (2001) indicated in an experiment of three levels of potassium 0 ,20 , 40 (kg K ha^{-1}) that there was not any significant deference in number of pods but 0 and 20 (kg K ha^{-1}) gave significant increased in yield .

Sangakar et al (2001) conducted experiment to determine the influence of soil moisture and fertilizer potassium on vegetative growth of cowpea . The study revealed that cowpea roots showed a greater response to potassium fertilizer .

El-Mougy et al (2004) declared in an experiment using potassium sorbate (9%) spray at four levels 0 , 0.25 , 0.50 and 1.00 (g/l) . that there was an increase in potassium (7 , 15 and 17 per cent) respectively .

JafarUllah's et al (2007) results showed that in an experiment carried out during 2001-2002 on the effect of different concentrations of potassium naphthenate (K Nap) for five levels 0 , 500 , 1000 , 1500 , 2000 ppm (K nap) applied as foliar spray on yield character of cowpea . the four concentration of K Nap had significantly positive effects on almost all reproductive parameters .

Khairo (2009) found an increase in plant dry weight and weight of 100 seeds when potassium added up to 150 kg per ha to cowpea

In an experiment for Priyadhrshini and Servan (2009) conducted to study the effect of paddy husk ash as a source of potassium on growth and yield of cowpea . The treatments included recommended rate 0.075 ton ha^{-1} of muriate of potash as a control and application of paddy husk ash at the rate of 1.5 , 2.5 , 3.5 and 4.5 (ton ha^{-1}) (mariate of potash contains 27% K . potassium content of paddy husk ash used in this experiment was analyzed , It was 0.589 % K) . Results revealed that there weight of leaves , stem and root , number of nodules , number of pods , dry weight of pod and 100 seed weight were significantly varied among treatments it was further noted that application of paddy husk ash at the rate of 4.5 (tons ha^{-1})gave high yield 1.44 (ton ha^{-1}) followed by muriate of potash 1.42 (tons ha^{-1}) and paddy husk ash 3.5 (tons ha^{-1}) 1.35 (tons ha^{-1}).

Chavan et al (2011) observed in an experiment of four levels of potassium 0 , 9 , 18 and 27 (kg ha^{-1}) on cowpea plant , that there was a significant increase in yield due to K levels

The impact of fertilization commensurate with type of soil and growth factors , and method of application and other factors . The foliar application is one of the most effective ways of processing the extra nutrients to the plant , and the leaf feeding maintain balance within the plant food , which may upset for many reasons .

Mallarino and Ul-Haq (1998) found that the addition of foliar fertilizer of (N:P:K) with low concentrations to soybean do not hurt the leaves and encourage vegetative growth and had no harmful effects on the root nodes . Salon et al (2001) stated that the period of seeds fullness legumes is a critical time for the nutrients where seed became the great reservoir for nutrients , and that the available material stored in the vegetative parts of plants , or that obtained from the immobilization of the nitrogen , may be insufficient during this period , so nitrogen is required to speed up the processing of the plant .

Mallarino (2003) also recognized that foliar fertilization of soybean during the early stages leads to increase yield winning by 15-20% even in a land with a high level of fertilizer and that the best combination of elements was 18:18:3 (N:P:K) with the amount of (3gallon/acre) .

There is a lack of studies on this subject for cowpea in salahaddin province , therefore this study had been conducted . To recognize the effect of the best level of the potassium fertilizer , the best number of foliar application of nutrient solution (Growth) and the interaction between them .

Materials and Methods

This research was conducted in the fields of college of Agriculture / Tikrit University in a gypsiferous soil during the plant season 2010 . Table (1) indicates some of physical and chemical features of the field soil . The soil was ploughed and divided in to units (3 x 3 m^2) . Then organic manure was added to the soil before planting in 20 (m^3 / ha) (Al – Khafaji and Al – Mukhtar , 1989) . Chemical fertilizers was added in 60 (kg ha^{-1}) of (N) as urea and 51.6 kg ha^{-1}) of ((P) as triple super phosphate (Al-Neaemy , 1999)

The seeds of (Ramshorn) variety were planted on 6 / 4 / 2010 . The planting was on lines , between one line and another 80 (cm) and between plant and another 30 cm) .

The experiment was organized in a Randomized Complete Block Design (R. C. B. D.) in three replications . Means were compared using Duncan's test significant range in a significant level (5%) . The (SAS) program was used in static analysis of data (SAS , 2002) .

The study contained two factors :

1) Adding K (on as potassium sulphate) .

a) control.

b) 33.75 kg ha^{-1} .

c) 67.50 kg k ha^{-1} .

2) (Growth) nutrient solution . (Is contained N:P:K 20:8.6:9 and different percentage of Fe , Zn , Mn , Cu and B , and It is made by Al-Quafel Agricultural and Industrial company , Zerqaa – Jordan)

a) control .

b) Two spraying .

c) Four spraying .

d) Six spraying .

Foliar application of Growth was achieved after (45) days from planting . It was repeated at 10 (days) from each one .

Irrigation and cultivation treatments were carried out as it was done in Cowpea field (Matloub et al , 1989) .

The measurement were taken at the end of the season on 16 / 10 / 2010 . The measurements were taken in average of 5 (plants) of experimental unit . The following measurements were carried out :

1- Plant height (cm).

2- Branch number (branch / plant) .

3- Leaves number (leaf / plant) .

4- Plant weight (gm) .

5- Dry matter vegetative percentage (%) .

6- Pods length (cm) .

7- 100 seeds weight (gm) .

8- Seeds number in a pod (seed / pod) .

9- Pods number (pod / plant) .

10- A plant yield (gm / plant) .

11- Dry matter percentage (%) .

Table (1) Field Soil Character

Characters	Sand $g.Kg^{-1}$	Silt $g.Kg^{-1}$	Clay $g.Kg^{-1}$	Texture	pH	N ppm	P ppm	K ppm	E.C. $ds.m^{-1}$	O.M. $g.Kg^{-1}$	$CaCo_3$ $g.Kg^{-1}$	Gypsum $g.Kg^{-1}$
value	600	270	180	S.L.C.	7.50	40.0	7.5	25	2.5	5.5	250	40

Results and Discussion

Table (2) indicates that the potassium fertilizer in a level of 33.75 (kg K ha^{-1}) increased significantly plant weight character . It gave the highest average of about 844.99 (gm/plant) . Whereas control treatment gave less value to this character which reaches 705.71(gm/plant) . Fertilizer level of 150 (kg K_2o/ha) had no significant difference with each of 33.75 (kg K ha^{-1}) and control treatment .

However , there wasn't any significant difference between fertilizer treatment in the characters of ; plant height , branches number , leaves number , and percentage of growth dry matter . This result is not an agreement with Narwal et al (1985) and Khairo (2009)

Table (2) Effect of Potassium Fertilizers on some Vegetative Growth Characters of Cowpea

Characters / Treatment	plant height (cm)	Leaf numbers (leaf / plant)	Branch numbers (Branch/plant)	Vegetative growth weight (gm)	Dry matter percentage (%)
Control	60.11 a	116.55 a	20.49 a	705.71 b	19.84 a
33.75 (kg K ha^{-1})	60.82 a	126.46 a	19.83 a	844.99 a	19.95 a
67.50 (kg K ha^{-1})	59.07 a	127.46 a	20.67 a	785.95 ab	19.03 a

*The used values of the same letter to each character which aren't different significantly to Duncan test of different borders in level (5%)

Table (3) indicates that the fertilizer treatment of 33.75 (kg K ha^{-1}) level increased significantly both characters ; pods and yield of a plant , while it gave the highest values of those two characters of about 59.31 (pods/plant) and 256.78 (gm/plant) , respectively , However there isn't any significant difference with fertilizer treatment 67.50 (kg K ha^{-1}) in a yield plant character .

The control treatment gave less value in the character of a yield plant of about 205.51 (gm/plant) . It has no significant difference with fertilizer treatment of a level 67.50 (kg K ha^{-1}) . Where the fertilizer treatment 67.50 (kg K ha^{-1}) gave less value in the character of pods number in a plant of about 46.01 (pod/plant) which had no significant difference with control treatment . And there wasn't any significant deference between the treatment in each character of plant height and the weight of 100 (seeds) and the number of seed in pod and percentage of the dry matter for pod . This result is an agreement with Stwart and Reed (1969) , El-Mougy et al (2004) and Chavan et al (2011) but this result is not an agreement with Khairo (2009) .

Table (3) Effect of Potassium Fertilizers on some Yield Characters of Cowpea

Characters / Treatment	pod length (cm)	Seed numbers in pod (seed/pod)	100 seed Weight (gm)	Pod numbers (pod/plant)	Plant yield (gm/plant)	pod dry matter percentage (%)
Control	14.26 a	8.54 a	13.24 a	46.59 b	205.51 b	18.52 a
33.75 (kg K ha^{-1})	13.96 a	8.53 a	14.41 a	59.31 a	256.78 a	18.30 a
67.50 (kg K ha^{-1})	13.89 a	8.66 a	13.60 a	46.01 b	246.68 ab	18.91 a

*The used values of the same letter to each character which aren't different significantly to Duncan test of different borders in level (5%)

From table (4) , it is clear that the treatment 4 sprayings of (Growth) nutrient solution increased significantly the leaves number/plant . It had no significant difference with control treatment . Whereas the treatment of 2 sprayings of (Growth) nutrient solution gave less value to this character of about 113.52 (leaf/plant) . And it has no significant difference with the control treatment and 6 sprayings treatment of (Growth) nutrient solution .

Whereas the treatment of (6 sprayings) of (Growth) nutrient solution increased significantly in plant weight character , while control treatment gives less value of this character reaching 707.21 (gm/plant) . It had no significant difference with both 2 and 4 sprayings treatment of (Growth) nutrient solution .

Similarly , there wasn't any significant difference between treatments of plant height , branches number , and the percentage of growth dry matter. This result is an agreement with Mallarino and Ul-Haq (1998) .

Table (4) Effect of Sprayings from (Growth) nutrient solution on some Vegetative Growth Characters of Cowpea

Characters / Treatment	plant height (cm)	Leaf numbers (leaf / plant)	Branch numbers (Branch/plant)	Vegetative growth weight gm)	Dry matter percentage (%)
Control	59.88 a	131.62 ab	19.88 a	707.21 b	20.02 a
2 sprayings	58.16 a	113.52 b	21.74 a	740.69 b	20.17 a
4 sprayings	60.70 a	135.00 a	19.90 a	759.74 b	18.55 a
6 sprayings	59.93 a	113.82 b	19.80 a	907.89 a	19.69 a

*The used values of the same letter to each character which aren't different significantly to Duncan test of different borders in level (5%)

Table (5) illustrates that the treatment 2 sprayings of (Growth) nutrient solution increased significantly the seeds number/pod . It gave the highest value of about 9.01 (seed/pod) which was not different significantly with the two other spraying treatments . Whereas control treatment gave less value of about 8.25 (seed/pod) which had no significant difference with the 4 and 6 sprayings treatments of (Growth) nutrient solution .

The control treatment increased significantly in the weight of 100 seed character which had no significant difference with 2 and 6 sprayings treatments of (Growth) nutrient solution . whereas the 6 sprayings treatment of (Growth) nutrient solution gave less value to this character of about 12.89 (gm) . It did not different significantly with the two other spraying treatment .

The 6 spraying treatment of (Growth) nutrient solution increased significantly plant yield which gives highest value of about 256.34 (gm/plant) . Also , it had no significant difference with the control treatment and 2 sprayings treatment of (Growth) nutrient solution .

While the 4 sprayings treatment of (Growth) nutrient solution gave less value of about 197.52 (gm/plant) which has no significant difference with control and 2 sprayings of (Growth) nutrient solution .

There wasn't any significant difference in each of the following characters : pod height , pod number , and the percentage of pod dry matter . This result is not an agreement with Mallarino (2003) .

Table (5) Effect of Sprayings from (Growth) nutrient solution on some Yield Characters of Cowpea

Characters / Treatment	pod length (cm)	Seed numbers in pod (seed/pod)	100 seed Wight (gm)	Pod numbers (pod/plant)	Plant yield (gm/plant)	pod dry matter percentage (%)
Control	14.22 a	8.25 b	14.99 a	49.39 a	243.22 ab	18.19 a
2 sprayings	13.97 a	9.01 a	13.78 ab	48.36 a	239.22 ab	18.16 a
4 sprayings	14.22 a	8.54 ab	13.34 ab	49.96 a	197.52 b	19.21 a
6 sprayings	13.75 a	8.51 ab	12.89 b	54.45 a	256.34 a	18.75 a

*The used values of the same letter to each character which aren't different significantly to Duncan test of different borders in level (5%)

Table (6) shows the interaction between fertilizer level 67.50 kg (k ha^{-1}) and 4 sprayings of (Growth) nutrient solution in the average of leaves number of the plant . It gave the highest average of about 169.38 (leaf/plant) it had not got any significant difference with control and fertilizer treatment in the level of 33.75 kg (k ha^{-1})with 4 sprayings of (Growth) nutrient solution but 6 sprayings of (Growth) nutrient solution gave only less value to this character of about 104.50 (leaf/plant) .

The fertilizer treatment of 67.50 kg (k ha^{-1}) with 2 sprayings of (Growth) nutrient solution gave highest average of branches number of about 22.92 (branch/plant) which had no significant difference with other treatments except the treatments of fertilizer of 33.75 kg (k ha^{-1}) only and of 67.50 kg (k ha^{-1}) with 6 sprayings of (Growth) nutrient solution which gave less two values of about 18.65 and 18.17 (branch/plant) , respectively .

While , the plant weight character gave significant increment of fertilizer treatment of about 33.75 kg (k ha^{-1}) with 6 sprayings of (Growth) nutrient solution which hadn't got any significant difference with fertilizer treatment of 33.75 kg (k ha^{-1})with 4 sprayings of (Growth) nutrient solution , and fertilizer treatment 67.50 kg (k ha^{-1})with 2 sprayings of (Growth) nutrient solution . The 4 sprayings treatment of (Growth) nutrient solution without adding potassium fertilizer gave less value to this character of about 582.38 (gm/plant) . It hadn't got any significant difference of 2 sprayings of (Growth) nutrient solution without adding the potassium fertilizer and with the fertilizer of 33.75 kg (k ha^{-1}) only with fertilizer treatment of 67.50 kg (k ha^{-1}) with control , 2 sprayings and 6 sprayings of (Growth) nutrient solution .

There was not also any significant differences in both characters : plant height and percentage of vegetative dry matter .

Table (6)Effect of Potassium Fertilizer and Spraying Nutrient Solution (Growth) on some Vegetative Growth Characters of cowpea

Characters / Treatment		plant height (cm)	Leaf numbers (leaf / plant)	Branch numbers (Branch/plant)	Vegetative growth weight gm)	Dry matter percentage (%)
Control	Control	59.00 a	160.25 a	20.21 ab	823.83 bcd	20.03 a
	2 sprayings	57.40 a	108.22 bc	20.73 ab	574.73 e	19.63 a
	4 sprayings	61.77 a	93.25 c	19.94 ab	582.38 e	19.09 a
	6 sprayings	60.33 a	104.50 c	21.10 ab	841.92 bc	20.62 a
33.75 kg k ha^{-1}	Control	62.32 a	116.48 bc	18.65 b	637.21 de	21.58 a
	2 sprayings	57.22 a	121.86 bc	21.58 ab	639.67 de	18.97 a
	4 sprayings	61.55 a	142.38 ab	18.98 ab	974.10 ab	18.45 a
	6 sprayings	59.36 a	125.17 bc	20.13 ab	1129.00 a	20.81 a
67.50 kg k ha-1	Control	57.53 a	118.17 bc	20.79 ab	660.61 cde	18.46 a
	2 sprayings	59.88 a	110.50 bc	22.92 a	1007.69 ab	21.92 a
	4 sprayings	58.79 a	169.38 a	20.79 ab	722.76 cde	18.11 a
	6 sprayings	60.10 a	111.81 bc	18.17 b	752.77 cde	17.65 a

*The used values of the same letter to each character which aren't different significantly to Duncan test of different borders in level (5%)

Table (7) indicate the significant increment in control in the control treatment in the character of pod length which had no significant difference between the treatment of , without adding potassium fertilizer , 4 and 6 sprayings of (Growth) nutrient solution , potassium fertilizer treatment of 33.75 (kg k ha^{-1}) level with control , 2 and 4 sprayings of (Growth) nutrient solution , treatment of 67.50 (kg k ha^{-1})with 2 and 4 sprayings of (Growth) nutrient solution . Whereas the fertilizer treatment of 33.75 (kg k ha^{-1}) with 6 sprayings of (Growth) nutrient solution gave less value to this character of about 13.20 (cm) . There was not any significant difference with the treatment of zero potassium with 2 and 4 sprayings of (Growth nutrient solution , and the treatment of of 33.75 (kg k ha^{-1}) with 4 sprayings (Growth) nutrient solution , and potassium fertilizer potassium fertilizer treatment 67.50 (kg k ha^{-1}) with control , 2 and 6 sprayings of (Growth) nutrient solution .

Whereas the potassium fertilizer of 33.75 (kg k ha^{-1}) gave significant difference in weight of 100 seeds . It has no significant difference with other treatments except the (6 sprayings) of (Growth) nutrient solution which in its role , gave less value about 11.15 (gm) which had no significant difference with all other treatments except control only and 33.75 (kg k ha^{-1}) level treatment .

The fertilizer of 33.75 (kg k ha^{-1}) level treatment with (6 sprayings) of (Growth) nutrient solution caused increase in both pods number and yield plant characters . It gave the highest value to those characters of about 85.76 (pod/plant) and 369.42 (gm/plant) , respectively , which hadn't got any significant difference with control and potassium fertilizer of 67.50 (kg k ha^{-1}) level fertilizer treatments with (2 and 4 sprayings) of (Growth) nutrient solution in the yield character of plant . Whereas the potassium fertilizer of 67.50 (kg k ha^{-1}) level only gave less value in pods number of plant character of about 22.80 (pod/plant) .It has no significant difference with (4 and 6 sprayings) of (Growth) nutrient solution treatment only and potassium fertilizer treatment of 33.75 (kg k ha^{-1}) with (2sprayings) of (Growth) nutrient solution and potassium fertilizer treatment of 67.50 (kg k ha^{-1}) level with (6 sprayings) of (Growth) nutrient solution . While the (4 sprayings) treatment of the given solution only gave less value to the yield plant character of about 142.96 (gm/plant) . Also , it haven't got any significant difference with (2and 4 sprayings) treatment of (Growth) nutrient solution only and potassium fertilizer treatment of 33.75 (kg k ha^{-1})level with (2 and 4 sprayings) of (Growth) nutrient solution and 67.50 (kg k ha^{-1}) treatment only .

There isn't any significant difference between the seeds number in a pod and the percentage of dry matter in a pod characters .

Table (7)Effect of Potassium Fertilizer and Spraying Nutrient Solution (Growth) on the some yield Characters of cowpea

Characters / Treatment		pod length (cm)	Seed numbers in pod (seed/pod)	100 seed Wight (gm)	Pod numbers (pod/plant)	Plant yield (gm/plant)	pod dry matter percentage (%)
Control	Control	14.83 a	8.17 a	15.46 a	68.94 ab	304.56 ab	17.20 a
	2 sprayings	13.61 bcd	9.11 a	12.60 ab	45.67 cde	199.90 cde	20.46 a
	4 sprayings	14.06 abcd	8.25 a	13.37 ab	33.53 ef	142.96 e	18.68 a
	6 sprayings	14.54 abc	8.64 a	11.51 b	38.23 def	174.64 de	17.78 a
33.75 kg k ha^{-1}	Control	14.41 abc	8.18 a	15.79 a	56.43 bcd	251.28 bcd	17.64 a
	2 sprayings	14.45 abc	9.03 a	14.51 ab	34.69 ef	233.09 bcde	17.99 a
	4 sprayings	13.79 abcd	8.53 a	13.93 ab	60.37 bc	173.36 de	19.00 a
	6 sprayings	13.20 d	8.40 a	13.43 ab	85.76 a	369.42 a	18.59 a
67.50 kg k ha^{-1}	Control	13.41 cd	8.41 a	13.73 ab	22.80 f	173.84 de	19.73 a
	2 sprayings	13.85 abcd	8.89 a	14.22 ab	64.72 bc	284.69 abc	16.04 a
	4 sprayings	14.81 ab	8.84 a	12.71 ab	55.97 bcd	276.25 abc	19.98 a
	6 sprayings	13.51 cd	8.49 a	13.74 ab	40.56 def	251.96 bcd	19.89 a

*The used values of the same letter to each character which aren't different significantly to Duncan test of different borders in level (5%)

The reason behind the effect of potassium fertilizer treatment dues to the active role of potassium in dividing and wideness of meristem cells and the speeded increment in the absorption of feed elements and activation of enzymes effect especially those related with the treatment of energy transformation (IPI,2000 , Tisdal et al , 1997) .

The enhancing effect of (Growth) nutrient solution is due to the solution that helps to provide the plant with nutrient elements readily in order to meet plant needs , to improve its growth , and to increase the representative equality of plant which reflects on the pod yield compared with control treatment because the deficiency of these nutrient leads to failure in the balance of nutrients in the plant and then becoming alimiting growth factor (Mengel and Kirby , 1987) .

In addition , the providing of plant with nutrient elements which participate in physiological activities are very important in making carbohydrates and movement into the growth tip which causes the increase in leaves number (Grantz and Williams , 1993) .

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تأثير السماد البوتاسي و الرش بالمحلول المغذي (Growth) في نمو و حاصل اللوبيا (*Vigna sinensis* L.) المزروعة في تربة جبسية

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الخلاصة

أجريت دراسة حقلية خلال الموسم الزراعي 2010 في كلية الزراعة / جامعة تكريت لمعرفة استجابة اللوبيا (*Vigna sinensis* L.) لمعاملة التسميد البوتاسي بثلاث مستويات صفر و 33،75 و 67،50 كغم K/ هكتار و الرش بالمحلول المغذي (Growth) بأربعة مستويات صفر و 2 و4 و 6 رشات ، صممت التجربة بتصميم القطاعات العشوائية الكاملة (R.C.B.D.) و بثلاثة مكررات .أظهرت النتائج إن التسميد البوتاسي بمستوى 33،75 (كغم K/هكتار) قد تفوقت معنوياً في كل من صفة وزن النبات و عدد القرون في النبات و حاصل النبات الواحد ، كما أعطت معاملة (رشتين) من المحلول المغذي (Growth) تفوقاً معنوياً في صفة عدد البذور في القرنة بينما تفوقت معاملة (4 رشات) من المحلول المغذي (Growth) معنوياً في صفة عدد الأوراق للنبات في حين تفوقت معاملة (6 رشة) من المحلول المغذي (Growth) معنوياً في صفة وزن النبات و الحاصل فيما أعطت معاملة المقارنة تفوقاً معنوياً في صفة وزن (100 بذرة) . أعطت معاملة

التداخل بين معاملة التسميد بمستوى 33،75 (كغمK /هكتار) مع (6 رشات) من المحلول المغذي (Growth) تفوقاً معنوياً في كل من صفة وزن النبات و عدد القرون في النبات و حاصل النبات الواحد بينما أعطت معاملة التسميد بمستوى 33،75 (كغم K /هكتار) فقط تفوقاً معنوياً في صفة وزن 100 بذرة و تفوقت معاملة التسميد البوتاسي بمستوى 67،50 (كغمK /هكتار) مع (رشتين) من المحلول المغذي (Growth) معنويا في صفة عدد الأفرع للنبات في حين أعطت معاملة المقارنة تفوقاً معنوياً في صفتي عدد الأوراق في النبات و طول القرنة .