Minufiya J. Agric. Res. Vol.37 No. 3: 557 - 567 (2012) **"http://www.mujar.net"**

تأثير التسميد العضوي والبوتاسى على محصول الفول البلدي ومكوناته ومحتواه من بعض العناصر المغذية.

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الملخص العربي

أجريت به تجربة حقلية في محطة البحوث الزراعية – جنوب التحرير – مركز البحوث الزراعية – قرية علي مبارك منطقة البستان – محافظة البحيرة وذلك خلال الموسمين ٢٠٠٩/٢٠١٠، ٢٠١٠/٢٠١١ لإلقاء الضوء على مدى تأثير اضافة السماد العضوي (سماد المزرعة ، سماد الدواجن) مع معدلات من التسميد البوتاسى وقد أسفرت أهم نتائج الدراسة عن ما يلي :

١- لوحظ وجود اختلافات معنوية بين نوعي السماد العضوي في كل الصفات المدروسة خلال موسمي الزراعة. حيث أدى استخدام سماد الدواجن إلى زيادة معنوية ، وزن ١٠٠ بذرة ، محصول البذور للنبات وكذلك محصول البذور والقش بالفدان.

٢- أظهرت مستويات البوتاس اختلافات معنوية في الصفات المدروسة حيث سجل معدل ٦٠ كجم بو٢ أ / فدان أعلى قيم في وزن ١٠٠ بذرة وكذلك صفات مكونات محصول الفول البلدي.

٣- أدى استخدام سماد الدواجن إلى تحسين امتصاص ونسبة المغذيات الكبرى (النيتروجين ، الفوسفور ، البوتاسيوم) والصغرى (حديد ، منجنيز ، زنك ، نحاس) في بذور وقش نباتات الفول البلدي مقارنة بسماد المزرعة خلال موسمي الدراسة.

٤- سجلت أعلى قيم المغذيات الكبرى والصغرى الممتصة بواسطة بذور وقش نباتات الفول البلدي باستخدام التسميد الفوسفاتي بمعد ٦٠ كجم بو٢ أ / فدان

أظهر التفاعل بين سماد الدواجن ومعدل التسميد البوتاسي ٦٠ كجم بو٢ أ / فدان أفضل نتائج والمحصول ومكوناته وكذلك محتوى البذور والقش من المغذيات الكبرى والصغرى.

EFFECT OF ORGANIC AND K FERTILIZATION ON YIELD, ITS COMPONENTS AND SOME NUTRIENTS CONTENT IN FABA BEAN

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(Received: Jan. 29 , 2012)

ABSTRACT: *Field experiments were carried out at the south Tahrir Agric., Res. Station, Agric., Ali Mubarak Village. El Bustan Region, El Behira Governorate during 2009 / 2010 and 2010 / 2011 seasons. This study was performed to throughout some light on effect of organic fertilizer (farmyard manure and chicken manure) and K fertilizer rates (0.15 , 30 and 60 Kg K_2O / fad) as well as their interactions on yield of faba bean.*

The obtained results could be summarized as follows :

1- *100-seed weight, seed yield/plant and seed and straw yields/fad of faba bean were increased with chicken manure than farmyard manure during two seasons.*
2- *The highest values of yields and its components were obtained with application of 60 kg K_2O / fad.*
3- *Chicken manure caused an increased in macronutrients i.e (N, P and K) and micronutrients i.e (Fe, Mn, Zn and Cu) concentrations and their uptake in seeds and straw of faba bean more than farmyard manure during the two seasons.*
4- *The highest values of macronutrients and micronutrients uptake and concentration in seeds and straw of faba bean were recorded with application of 60 kg K_2O / fad.*
5- *The interaction between chicken manure and 60 kg K_2O / fad gave the best results of yield and its components and macro and micronutrients concentration and uptake in faba bean plants.*

Key words: *Faba bean, Yield, Organic, K fertilization.*

INTRODUCTION

As feba bean takes the first place among the most important legumes raised in Egypt, back-up research has been focused on this particular crop to maximize its production through increasing the efficiency of fertilization.

In the last two decades, the use of organic manure has been suggested to facilitate crop growth, yield components and nutrients uptake in newly reclaimed lands (Wassif *et al.,* 1997 and El-Shafie and El-Shikha 2003). Organic fertilizaters (farmyard manure and chicken manure) are one of the natural amendments which correct and improve both chemical and physical properties of the soils and increase the yield which planting on the soils. In this point El-Nagar *et al*., (2002) and El-Shikha *et al*., (2009). Pointed that organic manure caused increased the yield of sunflower, wheat and faba bean in sandy soil.

Potassium is very important element to plant growth and plays a key role in metabolic process such as the conversion of sugar into starch and cellulose (Mengal and Kirkby 1997). Thamposon and Troeh (1979) showed that, K is needed in cell divisions, at formation, transformation of starch seed germination, synthesis of nucleoproteins and some other vital processes Abou Hussien *et al*., (2002) El-Shikha *et al*, (2005) El-Shouny *et al*., (2008) studied the effect of K application in different soils on the growth, yield components and nutrients uptake in rice and broad bean, they found that the application of K and organic fertilization increased thy dry matter yield of roots, shoots and grains.

The objectives of the present work was to study the effect of organic fertilization K fertilizer rates and their interaction on yield and yield components of faba bean and some macro and micronutrients uptake.

MATERIALS AND METHODS

Two field experiments were carried out at the south Tahrir Agric., Res. Station, Agric., Ali Mubarak Village. El Bustan Region, El Behira Governorate during 2009 / 2010 and 2010 / 2011 seasons.

Soil samples were taken, before planting from surface layer (0-30 cm) for physical and chemical analysis according to Jakson (1973). Some physical and chemical characteristic of the soil samples and organic manure (farmyard manure and chicken manure) were shown in Table (1-a and 1-b).

Each experiment included eight treatments which were the combination of two organic manure i.e. (farmyard manure and chicken manure) and four rates of Potassium fertilizer i.e. (0.15, 30 and 70 kg K_2O/fad). The preceding crop was maize in both seasons. A split plot design with four replications was used in both seasons. Organic manure were randomly allocated in the main plots, while potassium fertilizer rates occupied in the sub plots. The plot area was 10.5 m^2 (3 m length and 3.5 m width). Seeds of Giza blank a cultivar were sown on 5th and 8th November in the first and second seasons, respectively. Nitrogen fertilizer was applied in the form of urea (46.0% N) at a rate 20 kg N/fad before the first irrigation. National cultural practices of growing faba bean plants were done.

Table (1-a) : Some physical and chemical properties of the top experimental soil during 2009/2010 and 2010/2011 seasons.

Properties	2009/2010	2010/2011
Sand %	91.15	89.75
Silt %	5.75	6.85
Clay %	3.11	3.40
Texture Class	Sandy soil	Sandy soil
O.M. %	0.13	0.14
pH	8.11	8.17
$CaCO_3$	4.65	4.62
EC, ds m^{-1}	0.73	0.74
N ppm	20.40	20.12
P ppm	1.86	1.84
K ppm	55.50	53.45
Fe ppm	0.65	0.61
Mn ppm	0.25	0.22
Zn ppm	0.18	0.19
Cu ppm	0.08	0.07

Table (1-b) : Some characteristics of two organic manure under study.

Properties	Farmyard manure	Chicken manure
pH (1:10)	7.35	8.25
EC,ds m^{-1} (1:10)	1.40	2.05
$CaCO_3$	1.30	4.65
O.M. %	35.10	48.70
Total N %	1.05	2.10
Available P %	0.06	0.13
Available K %	0.55	1.15
Available Fe ppm	38.50	82.30
Available Mn ppm	88.70	115.35
Available Zn ppm	22.30	72.50
Available Cu ppm	9.10	12.50

All the data were subjected to the analysis of variance procedure (Snedecor and Cochran , 1967) . The differences between the mean values were compared by L.S.D.

RESULTS AND DISCUSSION

Yield and yield components

Data in Table (2) present the mean values of the yield and yield components as affected by various organic manure and K fertilization during 2009/2010 and 2010/2011 seasons.

The data demonstrate that number of pods/plant were significantly increased with chicken manure than farmyard manure in the first seeson However, No. 1 pods insignificantly increased by chicken manure in the second one. This may be attributed to its high nutritive value and its effect on physiochemical properties of the soil. These results are in harmony with those obtained by El-Nagar *et al*., (2002) and El-Shafie and El-Shikha (2003). With regard to the effect of K addition on this respect, the data reveal that increasing Potassium rate to 60 significantly increased number of pods/plant. This may be attributed to the important role of K on the roles in plant metabolism, which increase nutrients absorption leading to an increase in dry matter (Mengal and Kirkby, 1987). Similar results were obtained by Abou Hussien *et al*., (2002). The interaction between the organic manure and K doses did not reach the rates of significance. This way fairly true in both seasons. However, the highest values of number of pods/plant were found with application chicken manure with 60 kg K_2O / fad. These results are agreement with those obtained by Barden *et al*., (2000), El-Shikha *et al*., (2005) .

Concerning 100-seed weight, data in the same table reveal that chicken manure recorded the highest value of 100-seed weight more than farmyard manure. Similar results had been obtained by El-Nagar *et al*., (2002) and El-Shikha *et al*., (2009). Regarding to the effect of K rates , data illustrated that there was a significant increase in 100-seed weight with increasing K up to 60 kg K_2O/fad during the two seasons. The positive effect of K on seed size might be due to its physiological role in metabolism of plant tissues. These results are agreement with those obtained by Haron and Saleh (1991) and Abo El-Soud *et al*., (2004) who reported that the application of K caused an increased in 100-seed weight of and faba been plants. With regard to the interaction between the organic manure and Potassium fertilizer, it could be noted that significant the highest value of 100-seed weight was obtained by application chicken manure with 60 kg k_2O/fad during the two seasons compared with other rates of K .

Seed yield per plant and fad were remarkably influenced by organic manure variation in both seasons. It is worth noting that, chicken manure significantly surpassed farmyard manure in this respect this was true in both seasons. Similar results were reported by Said (1998), El-Nagar *et al*., (2002). Moreover, seed yield per plant and fad were significantly affected by the different rates of Potassium application. In both seasons, application of 60 kg K_2O/fad significantly increased seed yield compared to the others levels. These results might be due to the increase in number of pods/plant and 100-seed weight. These results are agreement with those obtained by Abou Hussien *et al*., (2002), and El-skouny *et al*., (2008). Also, data in the same table indicated that chicken manure with 60 kg K_2O/fad had the highest seed wield per plant and fad more than the other K treatments.

The data present in Table (2) show that, straw yield/fad was significantly increased by application chicken manure than farmyard manure in both seasons. Potassium treatment at a rate of 60 kg K_2O/fad produced significantly the maximum straw yield/fad followed by 30 and 15 kg K_2O/fad in a descending order. However, the control treatment produced the maximum straw yield/fad. These results are agreement with those obtained by Ahmed *et al*., (2004), Magda *et al*., (2010). With regard to the interaction between organic manure and Potassium rates, the highest falya was produced when the plants were treated with

chicken manure and 60 kg K_2O/fad in both seasons.

Table 2

Macro and Micronutrients uptake

A- Macronutrients Content

Data presented in Table (3 and 4) clear that a positive effect of organic fertilizers occurred on N, P and K concentration and uptake in seed and straw of faba bean plants. Chicken manure was superior than farmyard manure on macronutrients content in seed and straw of bean plant. This emphasizes the role of the chicken manure in terms of increasing the N, P and K concentration in the seed and straw via enhancing the availability of plant nutrients, which is rendered to its role in improving some physical and microbiological properties of the sandy soils. Such results came along with those reported by El-Maghraby *et al*., (1996), Badran *et al*., (2000), Khalil *et al*., (2000) and El-Shafie and El-Shikha (2003). Regarding to the effect of K rates, data showed that there was an increase in N, P and K concentration in the seed and straw up to the highest rate i.e 60 kg K_2O/fad. These findings are in harmony with those obtained by Abou Hussien *et al*., (2002), El-Shikha *et al*., (2005) and El-shikha *et al*., (2008). The interaction among the experimental variables pointed out that, the chicken manure with 60 kg K_2O/fad significantly gave the highest values of N, P and K content in the seed and straw of faba bean during the two seasons.

B- Micronutrients Content

Differences among the two tested organic manure and mineral Potassium rates on Fe, Mn, Zn and Cu content in the seed and straw of faba bean plant in the two seasons are shown in Table (5 and 6). Most of organic manures are bulky in nature, contain small amount of nutrients and their main values lies in the supply of organic matter to the soil. Unless applied in large amounts, they do not contribute much to the nutrients supply to plants. Nevertheless, the organic matter added in the form of manure performs certain other essential function. It promotes soil structure leading to enhanced aeration and water holding capacity. Chicken manure surpassed farmyard manure treatment on elevating the plant content of micronutrients. This may conformed by the continuous biodegradation of chicken manure through out the growth period, providing such elements in easily absorbable forms. Also, improving the soil structure with chicken manure application encourages micronutrients availability to the growth plants. These results confirm the resyllty obtained by Eissa (1996) and El-Shikha *et al* (2009). Concerning the effect of Potassium fertilizer levels in this concern, the same table illustrate that there was an increase in Fe, Mn, Zn and Cu content in the seed and straw of faba bean plant with increasing the doses of K fertilizer during the two seasons. These results are in harmony with those obtained by Abou Hussien *et al*., (2002) and Magda *et al*., (2010). Moreover, application of organic manure in combination with K fertilizer levels resulted in a marked increase in micronutrients i.e. (Fe, Mn, Zn, and Cu) concentration and their uptake in seeds and straw of faba bean in the experimental treatment compared to control. This increase may be due to relatively high availability of micronutrients in the added organic manure and improving soil properties and increasing the availability uptake of these elements by plant. These findings are in harmony with those obtained by Abdel-Latif and Abdel-Fatah (1983), Abou Hussien *et al*., (2002) and El-Shouny *et al*., (2008).

Table 3

Table 4

Table 5

Table 6

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تأثير التسميد العضوي والبوتاسى على محصول الفول البلدي ومكوناته ومحتواه من بعض العناصر المغذية.

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الملخص العربي

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٥- لوحظ وجود اختلافات معنوية بين نوعي السماد العضوي في كل الصفات المدروسة خلال موسمي الزراعة. حيث أدى استخدام سماد الدواجن إلى زيادة معنوية ، وزن ١٠٠ بذرة ، محصول البذور للنبات وكذلك محصول البذور والقش بالفدان.

٦- أظهرت مستويات البوتاس اختلافات معنوية في الصفات المدروسة حيث سجل معدل ٦٠ كجم بو٢ أ / فدان أعلى قيم في وزن ١٠٠ بذرة وكذلك صفات مكونات محصول الفول البلدي.

٧- أدى استخدام سماد الدواجن إلى تحسين امتصاص ونسبة المغذيات الكبرى (النيتروجين ، الفوسفور ، البوتاسيوم) والصغرى (حديد ، منجنيز ، زنك ، نحاس) في بذور وقش نباتات الفول البلدي مقارنة بسماد المزرعة خلال موسمي الدراسة.

٨- سجلت أعلى قيم المغذيات الكبرى والصغرى الممتصة بواسطة بذور وقش نباتات الفول البلدي باستخدام التسميد الفوسفاتي بمعد ٦٠ كجم بو٢ أ / فدان

أظهر التفاعل بين سماد الدواجن ومعدل التسميد البوتاسي ٦٠ كجم بو٢ أ / فدان أفضل نتائج والمحصول ومكوناته وكذلك محتوى البذور والقش من المغذيات الكبرى والصغرى.

Table (2): effect of organic and k fertilization on yield and its components of faba bean plant.

K fertilizer rates	No of pods/plant			100 seed weight			seed yield/plant (g)			Seed yield/fed (kg)			Straw yield/fed (kg)		
	FYM	Chicken	K	FYM	Chicken	K	FYM	Chicken	K	FYM	Chicken	K	FYM	Chicken	K
	2009/2010														
0	11.50	13.50	12.50	60.60	63.40	62.00	30.50	31.50	31.00	1190.00	1230.00	1210.0	1740.00	1860.00	1800.00
15	15.30	17.70	16.50	67.80	66.20	66.00	32.40	33.50	32.90	1280.00	1310.00	1295.0	1780.00	1980.00	1835.00
30	19.70	20.50	20.20	67.30	69.00	65.15	35.60	36.20	35.90	1360.00	1380.00	1405.0	1850.00	2010.00	1930.00
60	21.50	22.80	22.15	71.20	73.00	72.10	37.85	38.20	37.85	1420.00	1430.00	1425.0	2010.00	2120.00	2065.00
mean	17.0	18.6		66.20	67.00		34.00	34.85		131.75	1337.50		1845.00	1992.50	
LSD(5%)org	0.56			0.75			0.35			22.50			27.00		
K	0.58			0.72			0.52			18.5.0			29.30		
interaction	0.62			0.78			0.72			25.00			31.50		
2010/2011															
0	14.50	15.40	14.95	65.30	68.50	65.90	33.20	33.50	33.35	1160.00	1250.00	1205.0	1820.00	1900.00	1860.00
15	16.50	17.50	17.00	69.20	72.60	70.90	35.50	35.80	35.65	1290.00	1320.00	1305.0	1910.00	1960.00	1935.00
30	21.40	21.20	21.30	72.40	73.00	72.70	38.60	38.50	37.05	1371.00	1410.00	1390.5	1960.00	2125.00	2048.50
60	22.00	22.50	22.25	73.50	75.20	74.35	38.20	40.20	39.20	1430.00	1430.00	1432.5	2120.00	2130.00	2125.00
mean	18.80	19.15		70.10	71.35		35.62	36.92		1310.2	1352.50		1950.25	2002.25	
LSD(5%)org	0.55			0.66			0.32			21.50			31.50		
K	0.45			0.55			0.56			19.30			29.00		
interaction	0.64			0.75			0.72			22.50			33.50		

Table (3): Effect of organic and k fertilization on macronutrients concentration in yield and its components of faba bean plant

K fertilizer rates	N (mg/pl)			p (mg/pl)			k (mg/pl)		
	FYM	Chicken manure	K	FYM	Chicken manure	K	FYM	Chicken manure	K
	2009/2010								
0	44.75	46.50	46.62	5.60	6.30	5.95	35.00	33.50	34.25
15	78.50	76.05	77.30	12.30	12.50	12.40	59.50	55.50	27.50
40	87.10	96.80	41.90	12.80	16.20	16.00	85.00	95.60	90.30
60	96.85	105.00	101.95	18.20	19.00	18.60	89.50	99.50	94.50
mean	76.50	81.20		12.97	13.50		72.25	70.21	
LSD(5%)org	3.25			0.20			1.35		
K	6.30			6.35			7.25		
interaction									
2010/2011									
0	52.50	55.60	54.05	7.70	12.00	9.85	32.60	35.50	34.05
15	72.50	78.20	57.35	12.50	17.50	15.00	52.60	60.30	56.04
40	98.40	103.00	101.70	17.30	18.60	17.95	95.60	98.60	97.10
60	110.60	110.00	110.30	18.80	19.80	19.30	99.80	100.50	100.15
mean	83.50	86.9		13.95	16.90		70.15	69.25	71.94
LSD(5%)org	2.35			1.30			3.28		
K	6.12			2.55			6.25		
interaction	6.24			2.80			8.20		

Table (4): Effect of organic and k fertilization on macronutrients uptake in straw of faba bean plant

K fertilizer rates	N (mg/pl)			p (mg/pl)			k (mg/pl)		
	FYM	Chicken manure	K	FYM	Chicken manure	K	Fym	Chicken manure	K
	2009/2010								
0	66.00	68.00	67.00	7.40	7.00	7.20	77.50	72.30	74.95
15	80.00	90.00	85.00	7.50	7.40	7.45	90.50	78.20	89.35
30	92.60	108.10	95.35	8.78	7.65	8.20	100.50	79.80	90.15
60	105.30	117.25	116.30	8.80	7.95	8.35	110.30	78.20	94.25
mean	85.98	96.15		8.15	7.43		94.70	77.13	
LSD(5%)org	3.35			0.25			3.15		
K	7.60			0.50			5.15		
interaction	10.20			0.95			8.05		
2010/2011									
0	70.60	71.50	71.05	7.35	7.33	7.35	75.20	72.20	73.70
15	90.20	108.00	99.10	7.38	8.55	7.45	76.50	95.00	85.90
30	100.20	108.10	104.15	7.60	8.55	8.10	79.00	102.00	95.50
60	112.20	113.00	112.60	8.55	9.15	8.85	92.00	115.60	103.80
mean	93.20	100.15		7.22	8.00		80.88	96.20	
LSD(5%)org	3.25			0.28			3.20		
K	7.15			0.55			5.32		
interaction	13.36			0.96			8.50		

Table (5): Effect of organic and k fertilization on macronutrients uptake in seed of faba bean plant.

K fertilizer rates	Fe (ug/pl)			Mn (ug/pl)			Zn (ug/pl)			Cu (ug/pl)		
	FYM	Chicken manure	K	FYM	Chicken manure	K	FYM	Chicken manure	K	FYM	Chicken manure	K
	2009/2010											
0	412.60	1120.00	1116.30	560.00	6850.20	620.10	562.00	660.10	610.05	78.10	80.20	79.15
15	1530.20	1560.30	1545.30	9850.30	1025.00	1002.65	820.10	920.00	820.15	102.50	115.60	104.15
30	1906.00	1970.60	1938.30	1250.00	1325.00	1287.50	930.60	980.30	955.45	105.40	140.60	122.50
60	2120.80	2230.60	2175.70	1380.50	1450.00	1415.25	1006.2	1050.20	1023.20	140.20	152.50	146.35
mean	1667.40	1720.43		1044.95	1120.50		829.28	905.20		106.55	122.33	
LSD(5%)org	28.60			22.80			15.30			3.45		
k	88.60			77.85			55.80			12.12		
interaction	92.60			95.40			58.6			12.70		
2010/2011												
0	1090.00	1224.60	1157.30	650.20	685.00	667.70	650.30	680.20	665.15	77.50	92.50	85.00
15	1540.20	1720.30	1630.15	1008.00	1120.30	1064.15	855.20	960.10	957.15	100.20	120.60	110.40
30	1950.00	2130.60	2444.75	1320.30	1435.80	1378.50	960.30	1120.00	1040.15	110.20	145.20	127.20
60	2329.20	2560.30	2444.25	1530.60	1610.20	1570.40	1020.2	1210.00	1115.15	145.20	165.50	122.35
mean	1713.85	1908.78		1127.28	1212.63		871.50	1212.63		108.28	130.95	4.20
LSD(5%)org	28.50			26.40			32.50			6.50		
K	114.30			72.50			56.20			12.50		
interaction	92.50			92.30			55.20			13.20		

Table (6): Effect of organic and k fertilization on macronutrients uptake in straw of faba bean plant.

K fertilizer rates	Fe (ug/pl)			Mn (ug/pl)			Zn (ug/pl)			Cu (ug/pl)		
	FYM	Chicken manure	K	FYM	Chicken manure	K	FYM	Chicken manure	K	FYM	Chicken manure	K
	2009/2010											
0	5402.00	5820.00	5611.00	2650.00	2620.10	2635.05	2815.60	2910.00	2862.30	326.10	325.60	325.85
15	6200.30	6730.00	6465.15	2870.10	3125.00	2997.58	3000.20	3425.20	3212.60	360.60	350.40	356.00
30	7450.20	7630.20	7540.20	3220.30	3350.00	3285.15	3540.20	4225.60	3732.90	385.10	485.20	435.15
60	7520.30	8215.20	7867.9	4506.00	4620.20	4513.10	4120.50	4350.20	4225.35	445.00	490.60	417.8
mean	6577.75	7123.85		33111	3403.80		3370.25	3727.50		379.20	387.90	
LSD (5%) org	40.12			45.60			55.60			4.20		
K	35.65			42.25			40.55			20.60		
interaction	48.40			57.72			61.70			19.80		
	2010/2011											
0	5700.00	6812.00	6251.00	2850.20	2850.20	2832.70	2850.20	2920.10	2885.15	3110.20	380.50	345.40
15	6100.00	6950.00	6525	3125.00	3120.20	3122.60	3060.00	3560.00	3310.55	315.00	406.5	385.75
30	7560.20	7820.00	7690.10	3720.00	3650.00	3685.00	3600.20	4220.20	3910.15	455.00	452.30	453.65
60	7855.00	9650.20	8752.60	3820.20	4250.00	4085.10	4120.00	4250.10	2185.05	460.80	482.00	471.4
mean	6778.80	7808.05		3378.85	3458.85		3407.60	3737.60		397.60	460.7	
LSD (5%) org	35.60			48.20			52.40			15.72		
K	35.55			42.50			42.00			22.50		
interaction	46.70			52.60			58.20			18.20		