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Effect of Organic Manure and Potassium Fertilizer on Productivity and Quality of Fodder Beet (*Beta vulgaris. L.*) at South West Suez Canal

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ABSTRACT

Two field experiments were carried out during 2015 / 2016 and 2016 / 2017 winter seasons in the Kabret El-Bahara area - Suez Governorate, Egypt to study the response of fodder beet (Beta vulgari, L.) Rotta cultivar to the combination between four levels organic manure fertilizer treatments at a rates of 10, 20, 30 and 40 m^3 / fed and application with four levels of potassium fertilizer treatments (24, 36, 48 and 60 kg k_2O / fed. Using the split- plot design which, the organic manure treatment were distributed in the main plots, whereas, the potassium fertilizer treatments in sub-plots in four replicates.The obtained results could be summarized as follows:The results showed that the higher levels of organic fertilizer gave the highest values and the best was the level of 40 m^3 / fed Compared to the level of 10 m^3 / fed In all the characteristics of the study at 100 and 150 days from sowing and also the characteristics of the yield and its components at harvest in both seasons.The increase of potassium fertilization added to soil at a rate of 60 kg k_2O / fed resulted in the highest values of growth traits at (100 and 150 days from planting), yield and its components at harvests compared to the levels of potassium fertilization at the levels of 24, 48, 60 kg k_2O / fed, respectively in both seasons.The results also showed that the addition of organic fertilization at a rate of 40 m^3 / fed along with potassium fertilization at a rate of 60 kg K_2O / fed gave the highest values in the studded characteristics of growth, yield and its components in both roots and tops. It was also found that the increase in the protein content of the top and roots as well as total carbohydrates was detected due to the treatment 40 m^3 / fed organic fertilizer plus 60 kg K_2O / fed added to the ground, respectively, in both seasons.Likewise the results revealed that the content of the top of nitrogen and potassium was highest in the roots and reached to the using the 40 m^3 / fed organic fertilizer along with 40 m^3 / fed potassium fertilization of 60 kg K_2O/ fed.The results of the calculation of the economic yield of the crop showed that the cultivation of beet crop by using organic fertilization at a rate of 40 m^3 / fed plus potassium fertilization at a rate of 60 kg / K_2O/ fed proved to be is the best experimental economic experiment for the farmers.

INTRODUCTION

The increasing needs for the growing population in Egypt, for live- stock as a source for animal proteins to cover the demands of consumption is handicapped through the shortage of the carbohydrate components in animal feeds. Also, the horizontal expansion of new reclaimed areas requires the cultivation of crops offering source for satisfying income to the farmers in their areas In Egypt, production and distribution of fodder crops have become one of the most problem which leads to shortage in available quantities of forage throughout the year. So, the increase of cultivated new lands and reclaimed soils can be improved by using developed the agricultural practices, which reflected positive increase on crop productivity under unfavorable conditions. Newly reclaimed soils in Egypt are generally sandy in texture of low contents of available nutrient elements, organic matter and water holding capacity. Such characteristics are suitable for plant growth. Hence, incorporation of organic matter such as plant residues, cattle manure as well as composted plant materials can enhance water holding capacity of sandy soil and its nutrient availability status as stated by many investigators. Of them Dhanushkodi and Subrahmaniyan (2012) as they showed that the application of compost fertilizer led to increase of the available N, P and K and organic carbon content in the soil. Moreover, the reduction of soil bulk density and pH revealed that application of organic matter led to an increase of nutrients in plant parts and soil in comparison with no organic matter applied (Rashad *et al.,* 2015). Nitrogen has been proved to be the most yields limiting nutrient factor. Fodder beet greatly responses to nitrogen levels applied and this crop is successfully grown on a wide range in North Sinai, particularly in Rafah and Al-Arish, where the crop absorbs an abundance of winter precipitation to represent a good source of fodder for cattle (Niazi *et al*., 2000). As a matter of fact, high water level and sugar in fodder beet increase milk production and is suitable for dairy cows and by this way the wide gap in beef cattle production that has been recently appeared, can be narrowed. The crop, which has extremely has high yield potential, requires large amounts of nitrogen. Results of Zaki (1999) and Zamfir *et al*., (2001) reported that increasing nitrogen fertilization increased dry matter yield and crude protein in fodder beet.

Potassium is an important element in plant nutrition, especially those having carbohydrate storage such as sugar beet and fodder beet, Also, K is a co-factor activating a number of important enzymes which are involved in many processes in plants such as photosynthesis, respiration and carbohydrate metabolism and translocation. Many investigators reported that K-fertilizers had progressive effect on fodder or sugar beet growth and yield criteria Hassanin, 2001) and Gamal, and Ragab (2003). The influence of soil fertilization on nutrient content in crops has been studied and different results have been recorded. Some authors show that the application of organic amendment improves soil nutrient content, but does not always increases plant nutrient concentration.

At last the aim of this work was conducted to investigate the response of growth, yield and its components, chemical composition and mineral contents of fodder beet four levels of organic manure fertilizers with four levels of potassium fertilizer levels in the Kabret El-Bahara area - Suez Governorate of, Egypt.

MATERIALS AND METHODS

Two field experiments were carried out during 2015 / 2016 and 2016 / 2017 winter seasons in the Kabret El-Bahara area - Suez Governorate of, Egypt to study, response of fodder beet (Beta vulgaris, L.) Rotta cultivar to the combination between four levels of organic manure fertilizers (10, 20, 30 and 40 m^3 / fed) and application of four levels of potassium fertilizers (24, 36, 48 and 60 kg K_2O / fed.

A split plot design with four replicates was used. The main plots contained to the organic manure treatments and sub- plots were devoted to the potassium fertilizers treatments. Each experimental unit contained 10.5m^2 1/400 fed (3.5m length x 3.0m width). The general agricultural practices were used for seeding the fodder beet crop. The seeds were sowing on November five both seasons.

At soil preparation it the 31 kg P_2O_5 / fed as calcium super phosphate (15.5% P_2O_5). Three samples were taken after 100 and 150 days from sowing to study shown the root and top characters as well as at harvest to determine the yield and some chemical contents.

Physical and chemical of soil prosperities were determined as outlined by piper (1950) Table(1).The meteorological data of Kabret El-Bahara area was shows in Table (2 and 2a) Chemical analysis of used manures. Five plants for each sample were washed and separated into roots and tops to determine the following characters.

I: Growth characters:

A: Root parameters:

Root length (cm). Root diameter (cm).
Root fresh and dry weight/plant (g).

B: Top parameters:

Top fresh and dry weight/plant (g).
Leaf area index (LAI).

II: At harvest time:

The following data were determined at harvest time.
Root fresh yield (ton/fed). Root dry yield (ton/fed).
Top fresh yield (ton/fed). Top dry yield (ton/fed).
Total fresh yield (ton/fed). Total dry yield (ton/fed).

III: Chemical composition:

Crude protein content was determined by multiplying was estimated by micro-kjldahl (Koch and mc-meekin, 1924).nitrogen percentage by 6.25,while Potassium was determined using Flame photometer .Total carbohydrate percent was determined according to the method mentioned by A.O.A.C. (1990).

The mean values were compared according to the procedures of analysis of variance (ANOVA) by using LSD at the level of 5% of significance according to Snedecor and Cochran (1982). All statistical analyses of the studied traits were performed using analysis of variance technique by means of "IRRISTAT" computer software package.

Economic Assessment:

A comprehensive economic assessment of the experiment (for both inputs and outputs of the experiment) is performed

Table 1. Physical and chemical analysis of soil AL-Frafra Oasis –New Valley.

Physical analysis				
Soil depth(Cm)	**Coarse sand**	**fine sand**	**Silt**	**Clay**	**Textural class**
			2015 /2016		
0-30	10.8	12.6	24.2	52.4	sandy clay loam
30-60	11.4	17.0	20.0	51.6	sandy clay loam
			2016 /2017		
0-30	11.4	13.8	23.8	51.0	sandy clay loam
30-60	13.6	15.8	21.9	49.6	sandy clay loam

chemical analysis											
Soil depth(Cm)	pH	EC (dS/m)	Soluble cations (me/L)				Soluble anions (me/L)				O.M. (%)
			Ca++	Mg++	Na+	K+	Co_3^-	HCO_3^-	Cl^-	SO_4^-	
					2015 /2016						
0-30	8.07	1.82	3.50	1.74	2.46	0.50	0.00	2.95	4.92	0.33	0.55
30-60	8.05	1.91	3.60	2.37	2.61	0.56	0.00	3.30	5.30	0.50	0.66
					2016 /2017						
0-30	8.04	1.79	3.57	1.75	2.41	0.52	0.00	2.89	4.88	0.36	0.52
30-60	8.01	1.92	3.64	2.39	2.63	0.59	0.00	3.34	5.34	0.49	0.69

Chemical analysis of the irrigation water of AL-Frafra Oasis –New Valley.

Well (ppm)	**pH**	**EcdS/m**	**Soluble anions (meq /L)**				**Soluble cations (meq / L)**			
			Co^-_3	**HCo^-_3**	**So^-_4**	**Cl^-**	**Ca^{++}**	**Mg^{++}**	**Na^+**	**K^+**
691	7.00	1.08	0.00	2.50	61.24	36.26	43.89	32.43	1.33	22.35

Table 2. Chemical analysis of used manures

Kind of manure	**Farm yard manure (FYM)**	
Type of analysis	**1***	**2***
PH	7.26	7.35
Organic matter %	33.32	30.38
Organic carbon %	18.79	17.66
Total elements (%)		
Nitrogen	0.63	0.56
Phosphorus	0.36	0.31
Potassium	0.83	0.86
Calcium	4.74	4.52
Magnesium	0.16	0.14
C /N ratio	29.83	31.54
EC in dS /m (1:10)	3.28	3.41
Soluble ions ($Cmol_c$\l)		
Phosphorus (P)	3.2	2.4
Potassium (K)	11.9	14.8
Calcium (Ca)	11.4	9.2
Magnesium (Mg)	3.1	3.6
Sodium (Na)	6.2	5.3
SD kg /m^3	738	752

1*, 2* means first, second growing seasons SD means specific density

Table 2a. The nitrogen content in 1 m^3 of each of used organic manure.

Kind of manure	2015 /2016	2016/2017
1 m^3 FYM	4.65 kg. N	4.21 kg. N
1 m^3 ChM	10.40 kg. N	10.62 kg. N
1 m^3Sh D	6.60 kg. N	6.26 kg. N

Table 3. Meteorological data under South West Suez Canal conditions.

Growing methods	Temperature (C)			Relative Humidity (%)	Wind Speed (km/h)	Precipitation (mm)
	Max	Min	Mean			
			2015 /2016			
November	27.3	15.7	21.5	64	11.63	0
December	23.4	11.6	17.5	58	6.18	15
January	22.2	9.6	15.9	62	6.25	25
February	20.5	8.5	14.5	52	2.44	22
March	23.4	10.4	16.9	53	5.84	22
April	27.4	13.4	20.4	46	4.22	8
			2016 /2017			
November	27.2	13.7	20.5	61	11.20	0
December	22.0	10.8	16.4	60	6.34	16
January	21.6	8.8	14.9	60	3.61	25
February	21.8	10.0	15.8	61	6.00	19
March	23.5	10.7	17.1	51	6.82	15
April	29.2	14.2	21.7	47	9.55	6

RESULTS AND DISCUSSION

A: Growth characters:

1-Effect of organic manure treatments:

The effect of organic manure levels on fodder beet on growth measurements, i.e. root length, root diameter, root fresh weight and root dry weight as well as above ground parts i.e. top fresh weight, top dry weight and leaf area index (LAI) after 100 and 150 days from sowing has shown in Tables (4 and 5). It is clear that the addition of 40 m^3organic fertilizers / fed resulted in significant differences in such traits compared to the levels of other organic fertilizers of 30, 20, 10 m^3 / fed. These results are in accordance to those obtained by Abo-Deya (2004), El-Moneim *et al*. (2005), Abd El- Dayem and Ismaeil, (2007), Hasanzadeh *et al*.(2012), Mahmoud *et al*.(2012), Rashad *et al*.(2015), and Khatab *et al.* (2016).

2: Effect of potassium fertilization:

Also, data in the same Tables (4 and 5) show that potassium treatments had a significant effect on fodder beet growth characters. In general, potassium as soil application treatments, surpassed the foliar application, The highest values at 100 and 150 days after sowing were obtained by using 60 kg K_2O/fed . These results may be due to the importance role of potassium in the function of enzymes needed for vital processes and its beneficial effect in the translocation of carbohydrates to the storage oranges (roots). Similar results are in similar trend with those obtained by El- Moneim *et al*.(2005), Hasanzadeh *et al*.(2012), Hussein and Siam- Hanan, (2012), Bogdevich *et al*.(2013) and Khatab *et al*. (2016).

Table 4. Effect of organic manure and potassium fertilization on fodder beet growth characters at 100 days old of 2015/2016 and 2016/2017 seasons.

Characters treatments	Root length (cm)		Root diameter(cm)		Root fresh weight (g)		Root dry weight (g)		Leaf area index		Top fresh weight (g/plant)		Top dry weight (g/plant)	
	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
K_2o1	12.36	12.55	7.32	7.35	377.67	376.25	33.19	33.10	35.44	35.41	578.14	584.59	13.27	13.51
K_2o2	13.87	13.10	7.58	7.64	385.48	387.12	35.54	35.01	35.78	35.99	615.29	620.34	13.58	13.67
K_2o3	14.36	14.55	7.73	7.81	401.22	403.22	37.62	37.99	36.45	36.98	696.38	700.12	13.86	13.91
K_2o4	15.48	15.65	8.03	8.21	410.77	413.58	38.65	38.88	36.96	37.54	728.26	735.24	14.25	14.65
LSD 5%	0.277	0.279	0.164	0.165	8.490	8.512	0.84	0.84	0.742	0.746	24.325	23.154	0.721	0.723
organic manure 1	11.62	11.71	7.84	7.92	408.82	4.06.65	36.94	36.85	28.87	29.02	624.36	625.12	12.93	13.01
organic manure 2	13.54	13.68	8.15	8.18	429.72	428.37	38.46	38.79	36.56	36.83	665.76	668.59	13.71	13.84
organic manure 3	14.13	14.32	8.62	8.65	447.12	449.34	39.87	40.11	38.85	39.12	691.82	697.15	13.88	14.02
organic manure 4	15.83	15.97	9.19	9.26	462.64	465.21	41.52	41.87	43.92	44.21	726.57	731.00	14.03	14.25
LSD 5%	1.88	1.88	1.84	1.84	22.64	22.59	1.18	1.19	4.231	4.245	22.157	22.051	0.986	0.988

Table 5. Effect of organic manure and potassium fertilization on fodder beet growth characters at 150 days old of 2015/2016 and 2016/2017 seasons.

Characters treatments	Root length (cm)		Root diameter (cm)		Root fresh weight (g)		Root dry weight (g)		Leaf area index		Top fresh weight (g/plant)		Top dry weight (g/plant)	
	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
K_2o1	24.75	24.77	9.67	9.22	1373.52	1370.21	152.28	151.24	19.35	19.34	419.7	420.29	22.35	22.33
K_2o2	25.64	25.73	10.34	10.32	1412.11	1414.55	156.44	157.92	20.24	20.32	425.22	428.98	22.87	22.94
K_2o3	26.89	26.93	10.84	10.98	1470.88	1487.69	160.56	162.34	21.26	21.36	459.56	467.25	23.38	23.34
K_2o4	27.59	27.85	11.59	11.86	1512.35	1522.02	165.98	168.97	22.61	22.89	472.39	479.91	23.97	24.12
LSD 5%	0.751	0.752	0.352	0.361	43.254	42.421	3.659	3.645	0.618	0.611	10.543	10.342	0.086	0.086
organic manure 1	26.63	26.56	10.28	10.39	1437.52	1433.14	160.66	161.52	20.77	21.08	441.56	444.25	22.97	22.95
organic manure 2	27.77	27.68	11.15	11.11	1540.41	1537.59	166.52	167.39	21.62	21.78	470.47	475.31	23.47	23.64
organic manure 3	28.86	28.75	12.24	12.64	1620.63	1621.88	169.62	172.27	22.26	22.68	493.28	495.78	23.72	23.86
organic manure 4	29.97	29.89	13.19	13.29	1696.19	1697.08	174.71	176.69	23.28	23.59	515.14	519.73	23.98	24.21
LSD 5%	2.658	2.655	1.658	1.589	65.870	65.787	6.548	6.654	4.083	4.088	25.387	24.328	1.014	1.012

3: Effect of interaction effect of organic manure and potassium fertilization.

The interaction effect between organic manure levels and potassium treatments was significantly observed on growth characters.(Tables 6 and 7) being root length, root diameter, root fresh weight, root dry weight, top fresh weight, top dry weight and leaf area index after (100, 150 days as well as at harvest) It is clear that organic manure at a rate of 40 m^3 / fed addition of two and potassium as soil application treatments by using 60 kg k_2O /fed was superior to the other treatments. Similar results were obtained by Abo-Deya (2004), who found that potassium fertilizer at the rate of 48kg K2o as soil application and 4.0% foliar as potassium sulphate and organic matter were superior to the other organic matter levels and other potassium levels. Similar results are in similar trend with those obtained by Niazi *et al*.(2000), Zamfir *et al*.(2001), Gamal and Ragab(2003), El-Moneim *et al*. (2005), Hasanzadeh *et al*. (2012), Kassab *et al*.(2012), Bogdevich *et al*.(2013) and Khatab *et al*. (2016).

B: Yield and its components.

1-Effect of organic manure treatments:

The effect of organic manure levels on yield and its components of fodder beet shows in (Table 8), The results reported that root fresh and dry yields, top fresh and dry yields and total fresh and dry yields/ fed were significantly affected by such manure levels. The level of 40 m^3organic fertilizers / fed resulted in significant differences in compared to the other organic fertilizers being 30, 20, 10 m^3 / fed, respectively, which caused increases in total fresh yield by 40.435, 38.127, 35.416 and 33.366 (ton/fed) in the first season, as well as 40.520, 38.178, 35.571 and 33.433 (ton/fed) in The second are respectively, Such level of gave sign increases total dry yield by dry weight estimated by 2.783, 2.661, 2.511 and2.366(ton/fed) in the first season while, 2.817, 2.685, 2.581 and 2.408 (ton/fed) in The second one respectively, with organic manure treatments i.e., organic fertilizers is 40 ,30, 20, 10 m^3 / fed., respectively. Similar results were obtained by Gamal and Ragab (2003), Abo-Deya (2004), El-Moneim *et al*.(2005), Hasanzadeh *et al*.(2012), Mahmoud *et al*.(2012), Rashad *et al*.(2015) and Khatab *et al*.(2016).

2: Effect of potassium fertilization:

Concerning the effect of different rates of potassium as foliar and soil applications on fodder beet plants, it could be observed from (Table 8) that root yield (fresh and dry), top (fresh and dry) and total (fresh and dry) were significantly affected. The highest values were obtained by application of 60 kg K_2o/fed as soil application. In this respect, the response of fodder beet to potassium fertilization in these soils could be attributed to the relatively the poor soil in available potassium (Table 1) and to the high need of is crop to supplementary source of potassium. Therefore, it is considerable that root yield / fed was consequence to positive response of root diameter, root length, leaf area index (L.A.I) and dry matter accumulation to foliar and soil applications. Similar results were obtained by El- Moneim *et al*. (2005), Hasanzadeh *et al*.(2012), Hussein and Siam - Hanan,(2012), Bogdevich *et al*. (2013), Rashad *et al*. (2015), and Khatab *et al*. (2016).

Table 6. The interaction effect of organic manure and potassium fertilization on fodder beet growth characters at 100 days old during 2015/2016 and 2016/2017 seasons.

Characters treatments		Root length (cm)		Root diameter (cm)		Root fresh weight (g)		Root dry weight (g)		Leaf area index		Top fresh weight (g/plant)		Top dry weight (g/plant)	
		1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
	K_2o1	12.54	12.32	7.65	7.66	305.18	310.21	30.47	31.51	2.81	2.84	457.28	455.01	29.67	28.78
organic	K_2o2	13.18	13.07	7.81	7.82	329.22	334.88	32.59	33.42	2.95	2.92	511.08	518.37	31.08	32.10
manure 1	K_2o3	14.71	14.75	8.53	8.54	339.54	345.01	33.89	34.68	3.29	3.45	534.29	534.87	33.12	33.44
	K_2o4	15.36	15.55	8.74	8.69	354.59	360.21	34.08	35.55	3.42	3.51	542.09	541.09	33.87	33.92
	K_2o1	14.57	14.43	8.17	8.21	379.28	384.12	32.67	33.34	3.39	3.49	528.90	534.82	31.59	32.56
organic	K_2o2	15.51	15.48	8.53	8.61	391.57	395.78	33.89	34.78	3.56	3.68	569.41	577.01	33.48	34.28
manure 2	K_2o3	15.96	16.08	9.01	9.35	411.37	416.38	35.69	36.49	3.61	3.75	589.31	599.00	36.28	37.43
	K_2o4	16.76	16.89	9.82	9.99	447.48	451.08	39.27	41.00	3.69	3.78	608.37	611.11	37.89	38.11
	K_2o1	14.84	14.78	8.24	8.35	427.35	435.87	37.38	38.87	3.46	3.65	598.34	602.20	35.39	36.02
organic	K_2o2	15.87	15.80	8.69	8.78	430.53	436.18	38.27	39.77	3.64	3.84	645.37	654.32	37.50	37.95
manure 3	K_2o3	16.59	16.87	9.11	9.45	442.67	449.99	39.45	41.12	3.79	3.86	693.62	700.00	38.12	38.83
	K_2o4	17.08	17.35	9.67	9.89	451.09	461.00	39.93	42.09	3.93	4.11	714.71	713.18	39.37	40.00
	K_2o1	15.11	15.12	8.94	9.05	431.49	440.01	39.25	41.00	3.73	3.84	687.25	680.47	36.89	36.78
organic	K_2o2	15.87	15.87	9.26	9.45	457.38	466.88	40.28	42.11	4.07	4.15	699.12	711.11	38.88	39.25
manure 4	K_2o3	16.85	17.04	9.75	9.89	466.85	475.68	41.92	42.87	4.12	4.25	741.07	755.49	40.66	41.36
	K_2o4	17.88	17.96	10.38	10.69	483.73	496.37	43.18	44.13	4.22	4.39	778.22	788.64	43.27	44.19
LSD 5%		1.985	1.983	1.093	1.094	43.289	43.321	2.859	2.798	1.067	1.066	45.383	44.998	3.064	3.063

Table 7. The interaction effect of organic manure and potassium fertilization on fodder beet growth characters at 150 days old of 2015/2016 and 2016/2017 seasons.

Characters treatments		Root length (cm)		Root diameter (cm)		Root fresh weight (g)		Root dry weight (g)		Leaf area index		Top fresh weight (g/plant)		Top dry weight(g/plant)	
		1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
	K_2o1	22.56	23.21	8.64	8.61	1244.60	1231.54	137.29	136.18	1.93	1.93	348.39	345.01	17.55	16.85
organic	K_2o2	23.58	23.68	9.54	9.55	1294.31	1286.24	145.37	144.21	2.11	2.13	368.02	366.25	17.71	17.56
manure 1	K_2o3	24.38	24.44	10.01	10.22	1354.28	1362.78	159.37	160.22	2.23	2.24	375.78	377.46	18.35	18.45
	K_2o4	25.69	25.88	10.68	10.69	1379.31	1382.07	166.28	167.10	2.39	2.41	384.08	385.99	18.67	18.79
	K_2o1	24.87	24.81	9.21	9.34	1311.09	1322.05	148.24	149.67	2.12	2.15	368.25	370.01	18.12	18.88
organic	K_2o2	25.69	25.72	9.68	9.79	1354.87	1369.71	159.39	160.57	2.60	2.62	379.55	381.08	18.54	18.69
manure 2	K_2o3	27.06	27.18	10.56	10.74	1431.20	1436.25	161.00	161.85	2.91	2.97	391.08	392.39	18.91	19.12
	K_2o4	28.33	28.64	10.78	10.94	1489.78	1491.20	163.08	164.12	3.07	3.15	403.28	405.56	19.87	20.32
	K_2o1	25.08	25.22	9.56	9.78	1384.29	1386.90	161.68	162.02	2.43	2.49	376.91	377.59	18.39	18.84
organic	K_2o2	27.62	27.60	10.64	10.77	1469.89	1472.00	163.36	164.18	2.69	2.75	398.12	400.00	19.74	20.11
manure 3	K_2o3	28.67	28.76	11.37	11.81	1534.18	1538.19	164.88	165.22	3.54	3.65	412.34	415.21	20.38	20.89
	K_2o4	29.75	29.67	12.64	12.73	1621.21	1623.84	166.66	167.94	3.76	6.81	435.29	436.28	21.64	22.00
	K_2o1	26.84	26.55	10.98	11.61	1588.88	1591.20	169.14	170.30	3.19	3.34	408.37	410.00	20.97	21.41
organic	K_2o2	29.07	29.37	12.45	12.70	1626.72	1629.08	173.22	174.01	3.81	3.96	448.39	451.09	22.68	23.11
manure 4	K_2o3	30.13	31.22	13.17	13.56	1660.11	1663.44	175.7	176.02	4.15	4.31	463.28	465.66	23.16	23.77
	K_2o4	31.36	31.84	14.25	14.33	1695.66	1698.98	181.22	181.56	4.28	4.45	471.28	473.25	24.18	24.82
LSD 5%		2.028	2.027	1.242	1.233	84.121	84.333	9.225	9.224	1.059	1.057	33.298	33.333	1.032	1.034

Table 8. Effect of organic manure and potassium fertilization on fodder beet yield of 2015/2016 and 2016/2017 seasons.

Characters treatments	Root fresh yield (ton/fed)		Root dry yield (ton/fed)		Top fresh yield (ton/fed)		Top dry yield (ton/fed)		Total fresh yield (ton/fed)		Total dry yield (ton/fed)	
	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
K_2o1	27.084	27.154	1.822	1.839	4.962	4.985	0.338	0.349	32.046	32.135	2.160	2.188
K_2o2	27.646	27.723	1.937	1.953	5.014	5.094	0.347	0.367	32.660	32.817	2.284	2.320
K_2o3	28.819	28.898	2.089	2.138	5.156	5.214	0.356	0.378	33.975	34.112	2.445	2.516
K_2o4	29.413	29.541	2.217	2.276	5.374	5.426	0.369	0.385	34.787	34.967	2.586	2.661
LSD 5%	0.841	0.846	0.062	0.066	0.127	0.130	0.012	0.012	0.642	0.644	0.065	0.066
organic manure 1	28.252	28.265	2.021	2.057	5.114	5.168	0.345	0.351	33.366	33.433	2.366	2.408
organic manure 2	30.024	30.142	2.145	2.209	5.392	5.429	0.366	0.372	35.416	35.571	2.511	2.581
organic manure 3	32.498	32.526	2.284	2.301	5.629	5.652	0.377	0.384	38.127	38.178	2.661	2.685
organic manure 4	34.649	34.689	2.391	2.416	5.786	5.831	0.392	0.401	40.435	40.520	2.783	2.817
LSD 5%	5.182	5.194	1.234	1.225	0.847	0.853	0.065	0.064	1.968	1.966	0.089	0.089

3: Effect of interaction between organic manure and potassium fertilization.

The result indicated that the interaction between fodder beet organic manure levels and potassium fertilizer treatments had a significant(Table 9) effect on root yield (fresh and dry) top yield (fresh and dry) and the total yield (fresh and dry). The heaviest yield and its components were obtained by the interaction between 40 m^3 organic fertilizers / fed level and potassium fertilizers treatment of 60kg K_2o /fed as soil application. These results clearly appeared that adding potassium fertilizers have a favorable effect on soil physical, chemical and biological properties which are reflected on growth and yields of fodder beet. Similar results were given by Niazi *et al.*(2000), Zamfir *et al.*(2001), Gamal and Ragab(2003)), El-Moneim *et al.* (2005), Hasanzadeh *et al.* (2012), Kassab *et al.*(2012), Bogdevich *et al.* (2013), Rashad et.al.(2015), and Khatab et. al. (2016).C: Chemical compositions.

According to the data given in (Tables 10 and 11) the four organic manure levels and potassium fertilizer levels showed significant responses in crude protein content for either roots or tops. The maximum values were obtained by adding 40 m^3organic fertilizers / fed level and 60 kg K_2o/fed. potassium sulphate as soil application treatment. These results are in harmony with those obtained by Boghdevch, et. al. (2013) who found that adding 120 kg N/ha add 96 kg K2o/ha on fodder beet plants increased protein content and mineral contents of N, P and K in roots and tops. However, the data showed that total carbohydrate content of root was greater than that of tops. Such observation was expected due to translocation of more carbohydrate from leaves to source sink (roots). Similar results were recorded by El- moneim et.al.(2005), Hasanzadeh *et al.* (2012), Hussein and Hanan- Siam,(2012), Bogdevich *et al.*(2013),Rashad *et al.*(2015) and Khatab *et al.*(2016).

D: Mineral contents:

The results in (Tables 10 and 11) recorded that application of four potassium treatments as soil application and the four organic manure levels affected significantly nitrogen and potassium contents in both roots and tops .The maximum values of K and N contents were obtained by adding (60 kg $_2$O/fed as soil application and adding 40 m^3organic fertilizers / fed level) for both roots and tops. Regarding potassium content, it was noticed that potassium content of roots and tops was sign increased due to both soil and foliar application of potassium treatments increased K by soil and foliar application treatments. These results are in harmony with those obtained by Niazi *et al.* (2000), Zamfir *et al.*(2001),Gamal and Ragab(2003), El-Moneim *et al.* (2005), Hasanzadeh *et al.* (2012), Kassab *et al.*(2012),

Bogdevich *et al*.(2013),Rashad *et al*. (2015), and Khatab *et al*. (2016).

Table 9. The interaction effect between organic manure and potassium fertilization on fodder beet yield of 2015/2016 and 2016/2017 seasons.

Characters treatments		Root fresh yield (Ton/fed)		Root dry yield (Ton/fed)		Top fresh yield (Ton/fed)		Top dry yield (Ton/fed)		Total fresh yield (Ton/fed)		Total dry yield (Ton/fed)	
		1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
	K_2o1	22.332	22.340	1.459	1.462	4.364	4.377	0.277	0.270	26.696	26.717	1.736	1.732
organic	K_2o2	23.684	23.694	1.543	1.557	4.431	4.459	0.305	0.311	28.115	28.153	1.848	1.868
manure 1	K_2o3	25.108	25.153	1.638	1.652	4.589	4.633	0.336	0.328	29.742	29.786	1.974	1.980
	K_2o4	26.093	26.178	1.711	1.751	4.688	4.742	0.367	0.369	30.781	30.920	2.078	2.120
	K_2o1	24.674	24.729	1.641	1.668	4.538	4.572	0.335	0.329	29.212	29.301	1.976	1.997
organic	K_2o2	26.849	26.909	1.835	1.879	4.680	4.762	0.369	0.379	31.529	31.671	2.204	2.258
manure 2	K_2o3	28.880	28.937	1.937	2.005	4.804	4.881	0.381	0.399	33.684	33.818	2.318	2.404
	K_2o4	31.757	31.837	2.009	2.079	4.912	4.989	0.394	0.401	36.669	36.826	2.403	2.480
	K_2o1	27.926	28.069	1.892	1.960	4.725	4.810	0.372	0.361	32.651	32.875	2.264	2.321
organic	K_2o2	29.681	29.780	1.967	2.012	4.839	4.939	0.383	0.380	34.071	34.719	2.350	2.392
manure 3	K_2o3	31.010	31.142	2.247	2.290	4.954	5.078	0.397	0.389	35.964	36.220	2.644	2.679
	K_2o4	33.879	33.960	2.297	2.367	5.128	5.207	0.400	0.393	39.007	39.167	2.697	2.760
	K_2o1	31.620	31.700	2.110	2.230	4.999	5.153	0.392	0.390	36.619	36.853	2.502	2.620
organic	K_2o2	33.727	33.850	2.394	2.444	5.218	5.343	0.429	0.456	38.946	39.193	2.823	2.900
manure 4	K_2o3	34.438	34.534	2.433	2.499	5.566	5.646	0.439	0.449	40.004	40.180	2.877	2.948
	K_2o4	36.639	36.681	2.497	2.554	5.742	5.777	0.453	0.465	42.381	42.458	2.950	3.019
LSD 5%		0.9861	0.9835	0.3294	0.3284	0.0851	0.0850	0.0124	0.0122	0.852	0.856	0.0754	0.0744

Table 10. Effect of organic manure and potassium fertilization on nitrogen, potassium, crude protein and total carbohydrates in roots and tops of fodder beet of 2015/2016 and 2016/2017 seasons.

Characters treatments	Nitrogen (%)				Potassium (%)				Crude Protein (%)				Total carbohydrate (%)			
	Root		Top		Root		Top		Root		Top		Root		Top	
	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
K_2o1	1.332	1.377	2.318	2.311	7.432	7.441	10.82	10.79	7.868	8.124	13.676	13.634	44.59	45.32	16.64	16.59
K_2o2	1.397	1.399	2.331	2.334	7.785	7.795	10.89	10.93	8.242	8.254	13.752	13.770	48.67	49.28	18.20	18.68
K_2o3	1.465	1.460	2.364	2.370	7.419	7.434	10.96	10.98	8.643	8.614	13.947	13.983	53.89	54.39	19.76	20.35
K_2o4	1.498	1.507	2.387	2.392	5.010	5.093	11.21	11.28	8.838	8.891	14.083	14.112	58.61	59.37	21.33	22.01
LSD 5%	0.049	0.049	0.079	0.079	0.115	0.113	0.335	0.336	0.274	0.275	0.242	0.242	2.451	2.455	2.032	2.033
organic manure 1	1.431	1.441	2.357	2.361	7.770	7.775	11.06	11.11	8.442	8.501	13.906	13.929	45.38	45.98	17.29	17.88
organic manure 2	1.499	1.521	2.417	2.434	8.083	8.055	11.17	11.29	8.844	8.973	14.260	14.360	49.28	50.01	19.38	20.01
organic manure 3	1.574	1.587	2.458	2.456	8.266	8.289	11.27	11.37	9.286	9.363	14.502	14.490	55.69	55.66	21.08	21.77
organic manure 4	1.616	1.642	2.483	2.488	8.414	8.487	11.37	11.44	9.534	9.687	14.649	14.679	63.47	63.89	23.58	23.88
LSD 5%	0.185	0.185	0.214	0.214	0.918	0.917	1.082	1.081	0.482	0.488	0.288	0.289	3.514	3.502	2.183	2.188

Table 11. The interaction effect between organic manure and potassium fertilization on nitrogen, potassium, crude protein and total carbohydrates in roots and tops of fodder beet of 2015/2016 and 2016/2017 seasons.

Characters treatments		Nitrogen (%)				Potassium (%)				Crude Protein (%)				Total carbohydrate (%)			
		Root		Top		Root		Top		Root		Top		Root		Top	
		1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
	K_2o1	1.161	1.164	2.129	2.135	6.36	6.42	10.32	10.36	6.617	6.634	12.135	12.169	55.68	55.62	21.55	21.42
organic	K_2o2	1.201	1.210	2.168	2.168	6.48	6.48	10.46	10.58	6.845	6.897	12.357	12.357	56.34	56.54	22.12	22.18
manure 1	K_2o3	1.221	1.119	2.198	2.200	6.62	6.65	10.59	10.68	6.959	7.221	12.528	12.540	56.97	56.91	22.46	22.58
	K_2o4	1.279	1.267	2.219	2.233	6.94	6.91	10.75	10.89	7.290	7.221	12.648	12.728	57.38	57.57	22.89	22.93
	K_2o1	1.230	1.233	2.184	2.211	6.76	6.79	10.66	10.79	7.011	7.028	12.448	12.602	57.80	57.92	22.11	22.35
organic	K_2o2	1.289	1.295	2.233	2.285	6.98	7.02	10.84	10.95	7.347	7.381	12.728	13.024	57.46	57.65	22.84	22.98
manure 2	K_2o3	1.345	1.354	2.276	2.277	7.28	7.35	10.96	11.12	7.666	7.717	12.973	12.978	57.68	57.77	23.45	23.64
	K_2o4	1.394	1.401	2.295	2.298	7.45	7.51	11.10	11.23	7.945	7.985	13.081	13.098	58.46	58.56	23.78	23.89
	K_2o1	1.385	1.409	2.288	2.293	7.24	7.38	10.89	11.08	7.894	8.031	13.041	13.070	59.68	59.78	23.68	23.77
organic	K_2o2	1.455	1.451	2.342	2.354	7.67	7.77	11.21	11.35	8.293	8.270	13.349	13.417	60.57	60.86	23.91	23.92
manure 3	K_2o3	1.537	1.533	2.394	2.412	7.89	7.93	11.34	11.48	8.760	8.738	13.645	13.748	61.59	61.85	24.38	24.49
	K_2o4	1.544	1.555	2.482	2.499	8.15	8.35	11.45	11.57	8.800	8.863	14.147	14.244	62.37	62.67	24.68	24.88
	K_2o1	1.532	1.543	2.389	2.423	8.11	8.29	11.19	11.34	8.732	8.795	13.617	13.811	63.08	63.54	24.56	24.42
organic	K_2o2	1.581	1.595	2.458	2.478	8.29	8.45	11.49	11.56	9.011	9.091	14.010	14.124	63.67	63.78	25.38	25.66
manure 4	K_2o3	1.641	1.639	2.499	2.522	8.34	8.54	11.58	11.68	9.353	9.342	14.244	14.375	64.04	64.24	25.98	26.35
	K_2o4	1.672	1.677	2.533	2.554	8.55	8.67	11.69	11.78	9.530	9.558	14.438	14.557	64.57	64.58	26.49	26.84
LSD 5%		0.0956	0.0961	0.0759	0.0761	0.128	0.129	0.0871	0.0874	0.149	0.148	0.224	0.223	0.522	0.524	0.234	0.236

III: - The economic assessment of the experiment:

Data in table (12 and 13) reveal assessment of the experimental inputs and outputs as well as the ratio between outputs and inputs for each treatment introducing investment ratio (IR) under the condition under South West Suez Canal conditions, The results indicated the progressive increment in IR by increasing of fodder beet crop Rota cultivar to combination

between of potassium four treatments as soil application and the four organic manure levels.

Found from the calculation of the economic yield and its components of crop and, the use of the high rate of soil additive for organic manure level at the rate of 60 kg K_2o/fed as soil application and adding 40 m^3organic fertilizers / fed level for both roots and tops, is the best experimental economic transaction for the farmer under South West Suez Canal conditions, with the presence of other factors gave an investment rate higher than the national average, which gives a wide range of selection of transactions according to the conditions of the farmers economically.

Table 12. The prices of all agricultural management inputs under the condition of field experiment according to market price.

Economic item	Management type	Unit	Price (L.E.)
	Bio- fertilizers	Liter/ fed.	150
	Mineral fertilizationP_2O_5	Bag (50 kg./ fed.)	90
	N. fertilization	Bag (50 kg./ fed.)	150
	K_2O	Bag (50 kg./ fed.)	300
Input	Management operation		750
	Irrigation water	M^3	0.95
	Seeds	kg. / fed.	375
	Pesticides	Fed.	
	Agricultural rent	Fed.	2100
Output	Seed yields	kg. / fed.	250

Table 13. The economic assessment of the experiment treatments of organic manure and potassium fertilizer application of fodder beet yields

potassium fertilizer/ organic manure	Economic item	fodder beet			
		K_2O- 1	K_2O- 2	K_2O- 3	K_2O- 4
organic manure 1	Input	7296.1	6958.2	6865.2	6734.0
	Output	5448.2	5012.0	5269.0	4883.0
	Investment*	0.74	0.72	0.72	0.69
organic manure 2	Input	7455.2	7014.0	7113.2	6884.1
	Output	5546.0	5158.1	5111.1	4972.1
	Investment*	0.73	0.72	0.72	0.71
organic manure 3	Input	7669.1	7168.0	7258.1	6973.1
	Output	7601.2	6324.0	6124.1	6014.1
	Investment*	0.98	0.88	1.02	0.86
organic manure 4	Input	7632.0	7011.0	7222.1	7002.0
	Output	7800.1	7811.0	7892.2	7.983
	Investment*	1.15	1.18	1.32	1.34

***Investment ratio = output / input** ****National IR = 1.284 LE output / LE input**

CONCLUSION

The results of this trial revealed that fodder beet crop is considered the favorable and economic one under South West Suze Canal conditions, Egypt and to boost its yield and its components, the use of 40 ^{3} / fed organic manure along with using 60 kg / fed added as potassium soil application is considered worthwhile in this regard, respectively by cultivating high yielding the Rota cultivar under such circumstances.

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تأثير التسميد العضوى والبوتاسى على إنتاجية وجودة بنجر العلف بجنوب غرب قناة السويس

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قسم الإنتاج النباتي – شعبة البيئة وزراعات المناطق الجافة - مركز بحوث الصحراء – المطرية – القاهرة.

اقيمت تجربتان حقليتان خلال موسمى ٢٠١٥/٢٠١٦، ٢٠١٦/ ٢٠١٧ فى منطقة كبريت البحارة – محافظة السويس- مصر. وذلك لدراسة استجابة محصول بنجر العلف الصنف(روتا) اربع مستويات من التسميد العضوى (١٠، ٢٠، ٣٠ ، ٤٠ م٣ / فدان) واربعة مستويات من التسميد البوتاسى (٢٤ ، ٣٦ ، ٤٨ ، ٦٠ كجم بو٢ أ / فدان) وذلك على صفات النمو (عند ١٠٠- ١٥٠ يوم من الزراعة) والمحصول ومكوناتة وكذلك التركيب الكيماوى). واستخدم تصميم القطع المنشقة مرة واحدة حيث وزعت معاملات التسميد العضوى فى القطع الرئيسية ، بينما شغلت القطع الشقية مستويات التسميد البوتاسى، وذلك فى أربع مكرارات.ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي:- دلت النتائج ان زيادة مستويات التسميد العضوى اعطت معنويا اعلى القيم للصفات تحت الدراسة وكان مستوى ٤٠ م٣ / فدان مقارنة بمستوى ١٠ م٣ / فدان وذلك عند المستوى العمرى ١٠٠-١٥٠يوم من الزراعة وايضا المحصول ومكوناتة عند الحصاد فى كلا الموسمين.نتج عن زيادة التسميد البوتاسى كاضافة ارضية بمعدل ٦٠ كجم بو٢ أ / فدان الى الحصول على اعلى القيم فى صفات النمو والمحصول ومكوناتة وكذلك المكونات الكيماوية مقارنة بالمستوى ٤٨ ، ٣٦ ، ٢٤ كجم بو٢أ /فدان على التوالى فى كلا الموسمين.اظهرت النتائج أيضا ان اضافة التسميد العضوى بمعدل ٤٠م٣ /فدان بالأضافة الى التسميد البوتاسى بمعدل ٦٠ كجم بو٢أ / فدان كانت الاعلى قيما وذلك فى صفات النمو والمحصول ومكوناتةفى كل من محصولى الجذور والعرش. كما وجد من البيانات زيادة محتوى العرش والجذور من البروتين على التوالى والكربوهيدرات الكلية ، وتحصل على اعلى محتوى من البروتين والكربوهيدرات الكلية من المعاملة بضافة التسميد العضوى ٤٠ م٣ / فدان + ٦٠ كجم بو٢أ / فدان كتسميد بالبوتاسيوم اضافة ارضية على التوالى فى كلا الموسمين.بينت النتائج ان محتوى العرش من النيتروجين والبوتاسيوم كان اعلى فى الجذور وقد وصلت اعلى القيم باستخدام معاملة التسميد العضوى ٤٠ م٣ / فدان + التسميد البوتاسى ٦٠ كجم بو٢أ / فدان فى كلا الموسمين.اوضحت نتائج حساب العائد الاقتصادى للمحصول ان زراعة محصول بنجر العلف والتسميد العضوى بمعدل ٤٠ م٣ / فدان + والتسميد بالبوتاسيوم بمعدل ٦٠ كجم بو٢أ / فدان هو افضل المعاملات التجريبية اقتصاديا للمزارع.