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EFFECTIVENESS OF MINERAL AND ORGANIC FERTILIZERS AND ITS IMPACT ON FODDER BEET PRODUCTION, QUALITY, CONTROL ROOT ROT DISEASE AND IMPROVING SOME SANDY SOIL PROPERTIES

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ABSTRACT

To alleviate the problems of sandy soil, some possible manipulation of soil were evaluated. Two separate experiments were carried out to achieve the main objective of this research. The first Expriment was a laboratory experiment, using four isolates of *Fusarium solani* previously isolated from fodder beet, sugar beet, soybean and guar to estimate the efficiency of compost tea on the linear growth of different isolates of *Fusarium solani*. Compost tea pronounced a reduction in mycelial growth of *Fusarium solani* isolates. Organic and mineral fertilizers,individually or in combination , affected root rot disease incidence. The superior treatment, T2 (75% mineral and 25% organic) recorded the least disease incidence. This treatment not only reduced disease incidence, but also increased crop parameters.

The second experiment was a field experiment, carried out on a sandy soil located at Ismailia Research Station, Ismailia Governorate, Egypt, during two successive winter seasons of 2012/2013 and 2013/2014 ,to study the effect of different levels of mineral and organic fertilizers (alone or in combination) on root rot disease, yield ,quality of Fodder beet. (*Beta vulgaris* cv.Vorochenger and improving some sandy soil properties . The study included five combinations treatments of organic and inorganic fertilizers, *i.e.*T1 control (Recommended dose of N.P.K. 100 %), T2 (75% of N.K.+ 5 m^3 fed^{-1} compost) ,T3 (50% of N.K. + 10 m^3 fed^{-1} compost),T4 (25%of N.K. +15 m^3 fed^{-1} compost) and T5 (0 % of N.K. + 20 m^3 fed^{-1} compost). The experimental design was a randomized complete block design with four replicates. Significant differences were recorded among different treatments and T2 treatment gave superiority of growth traits than other treatments of fodder beet plants, *i.e.* root length, root diameter, shoot length , number of leaves, fresh root , shoot, dry root and shoot, biological yield(fresh and dry). The same treatment was superior in quality characteristics, *i.e.* crude protein, ash, crude fiber and carbohydrate. Furthermore, the incorporation of both N and K. mineral and organic caused substantial increases of content shoot and root (%) from N,P. and K. uptake of fodder beet plants, in both vegetative stages and harvesting time. On the other hand, different application of compost improved the soil properties , where reduced soil pH, ECe., bulk density (Mgm^{-3}), quickly drainable pores and hydraulic conductivity .On the contrary, total porosity(%), available N.P.K. ,fine capillary pores and organic matter content were increased .

Key words: *Compost, fodder beet, mineral fertilizers, physical and chemical properties,root rot disease, sandy soil, yield and quality.*

1. INTRODUCTION

In Egypt, production and distribution of fodder crops have become one of the problems which lead to shortage in available quantities of these crops around the year. Production of more green fodder has become the most promising solution to close up the gap between production and consumption especially under the limited area of the Nile Valley. Fodder beet is a new winter forage crop in Egypt. Animal production is severely limited by marked seasonal feed deficits. There is a shortage of fresh forages particularly during summer. Its whole yield, *i.e.* above and under – ground parts, can directly be used in animal feedings, especially dairy cows or may be processed as qualitative silage. The roots can also be stored in the soil for a period without great damage to be used when it is needed .Thus, its cultivation may help in overcoming the problem of animal feeding in the summer season. Also, the horizontal expansion in new reclaimed areas requires the cultivation of crops offering a source for satisfying income to the farmer in theire areas. Fodder beet can easily fulfill both aims through its high content of carbohydrate which reached about 72% dry matter(DM). Moreover, its production ranged between 25-30 tons/fed. in some new regions. Fodder beet is successfully grown as a fodder crop in many European countries and in Egypt. The plant is used as a valuable source of fodder for cattle (Niazi *et al*., 2000). Since fodder beet contains high water and sugar, it increases milk product and is suitable forage for dairy cows. The fodder beet is used by mixing with straw in European and other countries. It is also reported that the plant is suitable to make silage. Fodder beet has extremely high yield potential when grown on high fertile soils. Fodder beet requires large amounts of nitrogen. Nitrogen fertilizers are one of the major costs for the production of the crop (Abdel-Gwad *et al.,* 2008). Considerable areas in Sinai, at the northern coast and new reclaimed soils are land available where forage production could be expanded. These newly reclaimed lands are mostly sandy soils which are characterized by limited available nutrients and poor water holding capacity as well as a rapid turnover of organic materials (Antoun, 1978). Incorporation of organic materials to sandy soils could greatly improve soil properties and productivity (Antoun *et al.*, 1991). The production of forage crops is very important for livestock production. In the fodder plants, the economical yield is the biological yield, so the growing conditions must be optimum and carefully determined to obtain better growth and hence higher biomass yield. The above and below soil growth parts (leaves and roots) are used to feed the animals but, the main fodder is tuberous roots. Therefore, the optimum population which produces maximum leaves and roots growth and hence productivity must be carefully determined. Fodder beet tops and roots are succulent, palatable, and easily digestible and liked by most livestock. Geweifel and Aly (1996) reported that root dry matter yield and crude protein (CP) content of fodder beet increased directly with the level of fertilization. Fertilization decreased crude fiber content of roots. Abdel-Gwad *et al.* (1997) found that fresh yield and crude protein of roots generally increased with increasing fertilizer rate for all fertilizers, while fiber concentration decreased. Sarhan and Ismail (2003) reported that root dry matter yield and crude protein yield of fodder beet were significantly increased by increasing nitrogen fertilizer level. Nawar (2008) found that the beneficial effects of compost may be due that compost containing different microorganisms which have antifungal effects against soil borne diseases. Pandey *et al*. (2011) found that compost increased plant growth by supplying nutrients to the plants through mineralization and improvement in physic-chemical properties of the soil. Sherif *et al*. (2012) found that compost application increased roots and sugar yields of sugar beet cultivated in saline calcareous soil at Ras sudr. Application of organic fertilizer (compost) and mineral fertilizer , alone or in combination, to control soil borne diseases and increase yield and quality have been reported by different researchers (Dosani *et al*., 1999, Bulluck and Ristaino, 2002 and Morsy, 2012). El-Serag (2013) showed that fodder beet Rotta cultivar could give economic growth and forage yield as plants irrigated with 75% of soil water field capacity and fertilized by nitrogen fertilizer level of 286 kg $N.ha^{-1}$ under semi-arid conditions in North Sinai Governorate and similar regions. Abbas *et al*., (2014) found that the incorporation of both mineral and organic fertilizers increased growth traits and forage yield in fodder beet and organic matter content ,available N.P and K.in soil and addition of (75%NPK + $5m^3$ fad^{-1}.compost) gave the highest values of fresh and dry forage yields.The crop is attacked by different soil borne diseases which resulted in yield losses (El-Nagdi *et al*., 2011 and Postma *et al*., 2014).

The main objective of the present study was to evaluate the effectiveness of organic and inorganic fertilizers on fodder beet rot disease, production , quality, soil fertility and improving some sandy soil properties.

2. MATERIALS AND METHODS

To achieve the main objective of this research, two experiments were carried as follows:

2.1. Experiment (1)

2.1.1.Laboratory experiment

Four isolates of *Fusarium solani* previously isolated from fodder beet, sugar beet, soybean and guar, respectively, were used. The isolates were identified according to their microscopically characteristics according to Booth (1977) and Singh (1982).

2.1.2.Effect of compost tea(compost water extract) on linear growth of different isolates of *F.solani*.

Sterilized Petri dishes containing potato dextrose agar(PDA) medium were inoculated at one side with individual discs taken from 8 day old culture of tested *F.solani transferred into puted in* isolates. Fifty µl of compost tea were put in a well (5mm diameter) made in the opposite side of the plate. Also, Petri dishes containing PDA medium and inoculated only with discs of each *F.solani* isolate were used as check treatment. Three plates were used for each isolate. All Petri dishes were incubated at 25^{0}C. When mycelil growth covers the entire medium surface in the check treatment, plates were then examined and linear growth was measured. The reduction percentage in mycelial growth was calculated using the following

formula :$R\% = \frac{C-T}{C} \times 100$

R=Reduction of fungal growth.
C=Fungal growth in check.
T=Fungal growth in treatment.

2.1.3. Greenhouse experiment

This experiment was conducted at the Soil, Water and Environmental Research Institute, Agric. Res. Center, ARC.Giza, Egypt. Glass bottles (500 ml in volume) containing corn meal – sand medium (3:1w/w) were autoclaved at 121 ^{0}C for 30 min. The sterilized bottles were then inoculated with discs (5 mm) of 7 day –old culture of *F.solani* which previously isolated from fodder beet. Then the bottles were incubated at 25^{0}C for 15 days. Soil infestation was carried out by mixing fungal inoculums with sterilized potted – soil at the rate of 5% (w/w), then transferred into pots (30-cm - diameter). The infested soil was watered for 5 days to enhance growth and distribution of the fungal inoculum. Compost and mineral fertilization(NPK), alone or in combinations, were added to the infested soil before sowing at the rate of the recommended doses The treatments were:-

T1: Pots containing infested soil and 100% mineral fertilizer.
T2: Pots containing infested soil and 75% mineral and 25% organic.
T3: Pots containing infested soil and 50% mineral and 50% organic.
T4: Pots containing infested soil and 25% mineral and 75% organic.
T5: Pots containing infested soil and 100%organic fertilizer.

Pots containing infested soil only were used as control. All the pots were sown with fodder beet seeds (cv. Vorochenger). Three replicates were used for each treatment and seven seeds were sown in each pot. The growing seedlings were examined periodically and root rot disease incidence was recorded 80 days after sowing.

2.2. Experiment (2)

A field experiment was carried out in a naturally infested field located at Ismailia Research Station, Ismailia Governorate, Egypt, during two successive winter seasons (2012\ 2013 and 2013\ 2014) under sprinkler irrigation,

Table (1): Some physical and chemical properties of the experimental soil.

Soil characteristic		Value
Particle size distribution		
Coarse sand	**%**	12.6
Fine sand	**%**	76.1
Silt	**%**	5.1
Clay	**%**	6.2
Soil texture		Sand
Bulk density	**($Mg\ m^{-3}$)**	1.76
Hydraulic conductivity	**($cm\ h^{-1}$)**	37.1
$CaCO_3$	**($g.kg^{-1}$)**	2.10
Organic matter	**($g.kg^{-1}$)**	0.23
pH (1:2.5 soil-water suspension)		7. 9
EC	**(dSm^{-1})**	2.20
Available N	**($cmol.c^{-1}..kg^{-1}$)**	32.9
Available P	**($cmol.c^{-1}..kg^{-1}$)**	5.30
Available K	**($cmol.c^{-1}..kg^{-1}$)**	75.3

to study the effectiveness of organic and inorganic fertilizers on root rot incidence, fodder beet production and quality and improving sandy soil properties. Data in Table (1) represent some physical and chemical properties of the experimental soil. Also, the analysis of applied compost is presented in Table (2).

Table (2): Chemical characteristics of compost used

Characteristic	Value
PH (1:10 soil water extract)	7.1
EC (dSm^{-1})	5.12
Moisture content ($g.kg^{-1}$)	162
Organic matter ($g.kg^{-1}$)	464
Organic Carbon ($g.kg^{-1}$)	270
C\N ratio	19.2
Total Nitrogen ($g.kg^{-1}$)	14.0
P ($g.kg^{-1}$) Total	19
k ($g.kg^{-1}$) Total	31
Density (Mgm^{-1})	0.54
Ash ($g.kg^{-1}$)	185
Weight of 1 m^3(Kg)	530

Five treatments, were involved;

To fulfill this experiment, five treatments, were involved:

T1: 100% Recommended does of mineral N.P.K. (280:250: 150) (Check).

T2: 210 Kg $Nfed^{-1}$ + 112.5 Kg K/fed + 5 m^3 fed^{-1} compost. (75 % mineral of N. and K. + 25% organic).

T3: 140 kg $Nfed^{-1}$ +75 kg K fed^{-1} + 10 m^3 fed^{-1} compost. (50 % mineral of N. and K. + 50 % organic).

T4 : 70 kg $Nfed^{-1}$ + 37.5 kg $Kfed^{-1}$ + 15 m^3 fed^{-1} compost. (25% mineral of N. and K. +75 % organic).

T5: 0% mineral of N and K + 20 m^3 $fed.^{-1}$ compost (100% organic).

The experiment was designed as a randomized complete block with four replicates having plot area of 10.5 m^2 (3x4) and included 5 rides 3.5 m long and 60cm apart.. Basic application of phosphorus fertilizer, as calcium super phosphate (15.0 % P_2O_5) was added at the rate of (250 kg fed^{-1}) in two equal doses, the first before planting and the second at 30 days after sowing.Ammonium nitrate (33.5%N) was added in three equal doses, at 30,60 and 90 days after sowing as every treatment desired at the rate of (280 kg fed^{-1}). Potassium sulphate (48% k_2O) at the rate of (150 $kgfed^{-1}$)was added at 30 and 60 days after sowing as every treatment desired.The amount of compost, as needed quantitative inorganic nitrogen in fertilization was calculated as the following:

$$Amount\ of\ Compost = \frac{Amount\ of\ mineral\ Nitrogen}{Nitrogen\ percentage\ in\ Compost} \times 100$$

Organic fertilization in form of compost was added before planting as every treatment desired without check. Seeds of Beta Voroshenger variety was planted on 19/10/2012 and 3/11/2013 in the first and second seasons, respectively.

2.2.1.Sampling and analyses

Cultural practices were practiced according to the methods being used for growing fodder beet crop as recommended. The growing seedling were examined periodically and root rot disease incidences were recorded 80 days after sowing. After 125 days from sowing. random samples of 10 plants were taken from guarded rows of the four replicates to measure growth parameters, *i. e*. root length/plant (cm), root diameter/plant (cm), shoot length /plant (cm) and the number of leaves/plant.

At harvesting time, 10 individual guarded plants were taken from the central row in each plot to determine, the chemical analysis of shoots and roots were done during vegetative and harvesting stages. At the end of each season, disturbed and undisturbed soil samples were taken from 0-30 cm. depth and prepared to determine the physical and chemical properties according to the standard methods described in the following Table:-

Property	Auther
Particle size distribution (%).	**Gee and Bauder (1986)**
Bulk density (Mgm^{-3}).	**Vomocil (1965)**
Available N,P,K (%).	**Chapman and Pratt (1961) and Wolf (1971)**
Saturated hydraulic conductivity.	**Klute and Dirksen (1986)**
Soil reaction (pH), EC (dS m^{-1}) **Organic matter content (%).** **Soluble cations (m.mol L^{-1}).**	**Page *et al*., (1982)**
***Statistical analysis.**	**Snedecor and Cochran (1980)**
Crud Protein and Fiber.	**A.O.A.C. (1990)**
T. Phosphorus (%).	**A.O.A.C. (1965)**
T. Potassium (%).	**Brown and Lilliand (1964)**
Pore size distribution.	**De Leenheer and De Boodt (1965)**
Total porosity.	**Stakman and Harst. (1962)**

3. RESULTS AND DISCUSSION

3.1. Laboratory studies

3.1.1.Effect of compost tea on the linear growth of different isolates of *Fusarium solani*:

Data presented in Table (3a) show that compost tea effectively reduced the linear growth of the tested isolates compared to untreated control (check). The reduction ranged between 38.55-16.67%. Isolates No.1 and 2 (isolated from sugar beet and fodder beet, respectively) recorded the highest reduction. The reduction in the linear growth of the pathogen may be due to the production of antifungal materials screted by microorganisms inhabiting compost. (Chen *et al*. (1988). obtained results which are in agreement with those reported by Mikhail *et al*. (2005), Kavroulakis *et al* .(2010) and Pane *et al*. (2012) who found that compost extract showed antagonistic potential against *Fusarium oxysporum , F solani and Rhizoctonia solani*.

Table (3-a): Effect of compost tea on the linear growth of different isolates of *Fusarium solani.*

Treatment	Linear growth (cm)	Reduction%
Isolate -1	**5.53**	**38.55**
Isolate -2	**5.75**	**36.11**
Isolate -3	**6.15**	**31.67**
Isolate -4	**7.50**	**16.67**
Check	**9.00**	**-**

L.S.D. at 5% =1.028

3.1.2 Effect of different levels of organic and inorganic fertilizers on fodder beet root rot disease incidence caused by *Fusarium solani* under greenhouse conditions:

Data presented in Table (3-b) show that all treatments significantly reduced disease incidence compared to untreated infected control. T2 was the most effective treatment; it recorded the highest reduction (72.71% reduction). While, T5 was the least effective one (39.08 % reduction). Other treatments were moderately effective.

Table(3-b):-Effect of different levels of organic and inorganic fertilizers on fodder beet root rot disease incidence caused by *Fusarium solani* under greenhouse conditions.

Treatment	Disease incidence (%)	Reduction (%)
T1	28.57	**45.46**
T2	14.29	**72.71**
T3	19.05	**63.63**
T4	22.14	**57.73**
T5	31.91	**39.08**
Control	52.38	-
L.S.D.5%	5.76	

Field experiment

Data presented in Table (3-c) show that in both seasons fodder beet root rot disease incidence was affected by the levels of organic and inorganic fertilizers. Again, T2 recorded the lowest disease incidence (mean 2.50% reduction), followed by T3 and T4, respectively, (mean 3.83 and 5.50% reduction),whereas T1(100 % mineral) and T5 (100% compost) recorded the least effective (6.83 and 8.08 reduction). The suppressive effect of compost under greenhouse and field conditions is due to a combination of biotic and abiotic factors. The biotic factor including the inhabiting bio agents which might be partly responsible for the efficacy of compost in decreasing soil borne diseases. The abiotic factor is probably related to fungistatic compounds occurring in the compost (Carlile and Coules, 2009).On the other hand, Szymczak-Nowak and Tyburski (2006) and Thilagavathi *et al*. (2012) indicated that application of compost alone significantly reduced root rot disease of *Beta Vulgaris*. Obtained results were similar to that reported by Bulluck and Ristaino (2002) and Morsy (2012). They found that the combined application of compost and mineral fertilizers effectively reduced root rot diseases of tomato and sunflower.

Table (3-c): **Effect of different levels of organic and inorganic fertilizers on fodder beet root rot disease incidence under fieldconditions in seasons 2012/2013and2013/2014.**

Treatment	Disease incidence (%)		Mean
	Season 2012/ 2013	Season 2013/ 2014	
T1	7.50	6.17	6.83
T2	2.50	2.50	2.50
T3	2.67	5.00	3.83
T4	5.67	5.33	5.50
T5	8.83	7.33	8.08
L.S.D. at 0.05	2.14	1.38	-

3.1.3. Effect of mineral and organic fertilization on N.P.K content shoot and root% of fodder beet plants at vegetative stages and harvesting time

Data presented in Fig. (1) and Table (4) show that the effects of organic and inorganic fertilization on the vegetative stage and harvest time were significant. Some crops will show a yield response to nitrogen even in the presence of adequate amounts of potassium,*i.e.*, sugar beet, red beet and fodder beet, nitrogen is essential and cannot be substituted completely by potassium. Data in Table (4) show that the more enough to have face the requirements of fodder beet plants. Such increase in root and shoot could be due mainly to favorable effect of K and N elements on the vegetative stage and harvesting time in treatment T2. Potassium percentage was insignificantly increased by nitrogen application in both seasons. These findings are in harmony with those recorded by Mustafa (2007). Application of N and K fertilizers increased root, shoot and whole fresh weight/ plant and these increases were more than that obtained by N and K application. Moreover, application of N and K pronouncedly increased root, and shoot as well as the whole plant fresh weight to reached about 2-3 fold of that of check treatment. This was fairly true for dry weight of whole plant or root and shoot dry weight.

3.2. Growth traits

Data presented in Table (5) show that root length, root diameter, shoot length and the number of leaves /plant recorded a significant effect. The maximum values of such traits were obtained when fodder beet plants were treated by T2(75%mineral N.K. +5 m^3/fed Compost), followed by T3 (50% mineral N.K. +10 m^3/fed Compost) and T4 (25% mineral N.K. +15 m^3/fed Compost). Such finding revealed the importance of the balance between mineral and organic fertilization. It is worthy to mention that root length, root diameter, shoot length and the number of leaves /plant increased by 19.27, 13.89,34.75 and 17.87, respectively, when the plants were treated by T2 compared to T1. The minimum values of such traits were obtained when plants received T5(20 m^3/fed Compost, 100 % organic). The maximum values of such traits which received T2 attributed to, can compost modify soil physical properties and strongly affects its chemical and biological ones(Martin and Gershuny, 1992; Mekail,1988 and Fontaine *et al*.,2003)., Also, Abdo *et al*.(2002) explained the roll of nitrogen in plant growth due to the function of N in plant metabolism; *i.e*. constituent of amino and nucleic acids, many cofactors and celluer compounds reflected on plant growth. Devlin and Witham (1983) pointed out that potassium metabolism through its role as an activator of several enzymes involved in metabolic reactions. These results are in harmony with those obtained by Albayrak and Camas (2006); Parlak and Elkiz (2008).

3.3.Yield of fodder beet

3.3.1.Fresh yield (ton/fad)

Fresh root, shoot and biological yields (ton/fed) as affected by mineral and organic fertilization are presented in Table (6). Results scored a significant effect. The highest values of such traits were obtained when plants were treated by T2 (75% mineral N.K.+5 m^3/fed compost) by the values reached 59.7,16.6 and 78.2 ton/fed, respectively, followed by the treatment T3(50% mineral N.K.+ 10m $^{3/}$fed compost). and T4 (25% mineral N.K. +15 m^3/fed compost) .Such findings due to the roll of compost, nitrogen and potassium fertilization on fodder beet growth reflected on fresh yield. These results are in agreement with those obtained by Grzes *et al*., (1996), Prokopenko *et al*., (1997); Zaki (1999) and Abdel-Gwad *et al*., (2008). They reported that fertilization increased root yield of fodder beet. It can be noteiced that insignificant differences between T2 and T3 with respect to fresh weight of shoot. The least values of fresh root, shoot and biological yields were obtained from T5 (20 m ^{3}/fed, compost, 100% organic) by values reached 36.8, 12.7 and 49.5 ton/fad respectively. The treatments could be arranged in the order: T2>T3 >T4 >T1 >T5.

3.3.2. Dry yield (ton/fed)

Dry root, shoot and biological yields expressed as ton/fad are presented in Table (7). Results are significantly affected by two factors under study. Data revealed that the maximum values of such traits obtained from treated plants by T2 (75% mineral N.K.+ 5 $m^{3/}$fed compost) followed T3(50% mineral N.K. +10 $m^{3/}$fed compost) and T4 (25% mineral N.K. +15m $^{3/}$fed compost) . The maximum values of such traits obtained by T2 treatments were 8.46, 3.00 and 11.40 ton /fad, respectively. These results are in harmony with those obtained by Ceglarek and

Fig. (1): Effect of fertilization on root rot (tonfad^{-1}) of fodder beet. Symptoms of natural infection root rot disease on fodder beet roots.

Table (4): Effect of mineral and organic fertilization on NPK contents in shoots and roots % of fodder beet plants at vegetative stage and harvesting time.

Treatment	Vegetative stage						Harvesting time					
	shoot			Root			shoot			Root		
	N	P	K	N	P	K	N	P	K	N	P	K
T1	1.69	o.22	2.46	1.77	o.19	2.84	0.37	0.25	2.73	0.23	0.29	o.93
T2	2.91	0.33	4.31	3.44	0.28	4.52	0.61	0.40	3.29	0.46	0.43	1.41
T3	2.78	0.30	3.66	2.95	0.26	3.92	0.54	0.35	3.08	0.40	0.36	1.28
T4	2.35	0.26	3.35	2.85	0.21	3.75	0.41	0.31	2.91	0.34	0.33	1.21
T5	1.22	0.16	1.45	1.45	0.13	1.95	0.25	0.22	2.11	0.18	0.24	0.77

Table (5): Root length,diameter,shoot length , the number of leaves and area of leaves (cm) of fodder beet as affected by mineral and organic fertilization in sandy soil for two seasons(combined analysis).

Treat.	Root length /plant (cm)			Root diameter /plant (cm)			Shoot length /plant (cm)			Number of leaves per/plant)			Area of Leaves (cm)
	2012 /13	2013 /14	Com b	2012 /13	2013 /14	Com b	2012 /13	2013 /14	Comb	201 2/13	2013/ 14	Com b	
T1	38.1	38.8	38.4	10.5	11.1	10.8	31.0	30.1	30.5	27.8	30.5	29.1	5069
T2	45.5	46.2	45.8	12.6	12.0	12.3	40.7	41.5	41.1	33.3	35.3	34.3	6610
T3	41.6	42.6	42.1	11.6	11.8	11.7	33.3	35.5	34.4	32.0	33.3	32.6	5740
T4	39.0	41.3	40.2	11.4	11.6	11.5	32.9	34.1	33.5	31.0	32.5	31.8	5568
T5	34.2	35.7	34.9	10.2	10.5	10.3	28.8	30.0	29.4	22.8	24.0	23.4	4040
L.S.D. at0.05	1.43	1.14	0.98	0.26	0.46	0.29	3.59	1.38	2.06	1.98	1.32	1.28	984
C.V	3.21	2.47	2.86	2.08	3.64	2.97	9.59	3.59	7.17	6.01	3.77	4.95	

Table (6): Fresh root, shoot and biological yield of fodder beet as affected by mineral and organic fertilization in sandy soil for two years (combined analysis)

Treatment	Fresh weight (Ton fad^{-1})								
	Root			Shoot			Biological yield		
	2012/13	2013/14	comb	2012/13	2013/14	Comb	2012/13	2013/14	Comb
T1	38.5	38.3	38.4	13.1	14.1	13.6	51.9	53.1	52.5
T2	58.4	61.1	59.7	18.4	18.8	16.6	76.6	79.9	78.2
T3	40.7	51.3	50.5	15.4	16.4	15.9	65.1	67.7	66.4
T4	40.0	41.3	40.7	13.5	14.9	14.2	53.1	55.4	54.2
T5	35.5	38.0	36.8	12.1	13.3	12.7	47.7	51.3	49.5
L.S.D.at 0.05	2.0	1.3	1.3	1.2	1.0	0.8	2.7	1.9	1.8
C.V.	4.0	2.7	3.4	7.3	5.6	6.4	4.2	2.8	3.4

Table(7): Dry root ,shoot and biological yield of fodder beet as affected by mineral and organic fertilization in sandy soil for two years (combined analysis)

Treatment	Dry weight (Ton fad^{-1})								
	Root			Shoot			Biological yield		
	2012/13	2013/14	Comb	2012/13	2013/14	comb	2012/13	2013/14	Comb
T1	5.29	6.65	6.11	1.18	1.89	1.54	6.84	8.38	7.73
T2	8.26	8.65	8.46	2.98	3.03	3.00	11.0	11.8	11.4
T3	6.12	7.53	7.10	1.80	2.04	1.92	8.64	9.60	9.12
T4	5.58	7.03	6.58	1.70	1.97	1.88	7.57	8.62	7.97
T5	2.66	5.95	5.62	1.03	1.31	1.17	6.54	7.45	6.99
L.S.D.at 0.05	0.81	0.49	0.51	0.23	0.15	0.15	1.05	0.79	0.70
C.V.	11.3	6.07	8.77	11.5	6.52	9.00	11.5	7.64	9.56

Gasiorowska (1997). Anton *et al.* (1995) concluded that potassium is one of the essential elements in the plant nutrition and it is commonly insufficient in the soil which affects plant growth. Thus, it offen needs to be added regulary as a fertilizer. Crops store carbohydrates like fodder beet need an ample supplies of potassium for good production. This result may be due to the effect of N, K and compost on the function of plant vegetative growth through enhancing photosynthesis which consequently stimulates accumulation of dry matter in plant. The least values of such traits were scored when plants treated by T5(20 m^3 fed compost, 100% organic), which recorded 5.62, 1.17 and 6.99 ton /fed, respectively. The treatments could be arranged in the order: T2>T3 >T4 >T1 >T5.

3.4. Effect of mineral and organic fertilizer on soil properties

3.4.1. Effect of mineral and organic fertilizer on soil salinity (ECe) and pH

The movement of soluble salts in the soil depends mainly on soil texture, structure, total porosity and permeability. Data in Table (8) demonstrated that the values of ECe and pH of the studied soil were influenced by the application of compost with mineral N and k fertilizers. Slight decrease of the ECe and pH values occurred as compared with the check. Increasing K in the soil media of fodder beet plant enhanced plant absorption of more N and hence protein synthesis improved and its percentage increased in plant tissues. These results are similar to those found by El-Khawaga and Zeiton (1993). Data indicate that the mean values of soil ECe after harvesting during two seasons decreased with the application treatments as compared with the check. This may be attributed to the improvement of soil physical properties and enhance the leaching process of salts, as well as to the high adsorption of ions by the growing plant. (Khafagy *et al.*, 2015). Concerning the effect of the used treatments on pH values, data showed similar trend with ECe .

3.4. 2. Effect of mineral and organic fertilizers on organic matter (%)

Organic matter content (%) as affected by the application of compost and mineral N and K at harvest of fodder beet during two seasons are presented in Table (8).Organic matter content (%)

Table(8): Effect of mineral and organic fertilizers on soil salinity (ECe) ,pH, organic and available macronutrients in the soil after harvesting in two seasons (combined analysis)

Treatment	ECe (dSm^{-1})	pH	N	P	K	O.M (%)
			(ppm)			
T1	2.39	7.52	132.1	52.3	82.3	0.21
T2	2.10	7.44	133.6	54.7	85.0	0.56
T3	2.18	7.40	133.4	54.3	84.7	0.63
T4	2.22	7.38	133.1	53.3	84.5	0.65
T5	2.28	7.33	130.4	50,1	80.4	0.69
L.S.D. at o.o5	0.01	0.01	1.38	0.51	0.83	0.01

showed superiority in the soil that received compost 20 m^3 fad^{-1} compared with other treatments. The highest values were recorded in the treatment T5 followed by treatment T4, respectively, while the minimum values were obtained from T1. The efficiency of the studied compost on increasing the values of organic matter content (%) could be arranged in the following descending order: T5 >T4 >T3 >T2 >T1. (Ouedraogo *et al* ., 2001).

3.4.3. Effect of mineral and organic fertilizers on available N.,P. and K

Data presented in Table (8) show that the availability of NP and K was affected by the application of compost and mineral N and K at harvest of fodder beet for two seasons. With regard to available NP and K in the soil ,results indicate that the incorporation of compost with mineral fertilizers increased available NP and K as compared to the application of each fertilizer solely (Monndini *et al*., 1996).The combined application of organic and N and K .mineral fertilizers with T2 treatment, showed superiority for available NP and K. The efficiency of the studied compost on available NP and K could be arranged in the following descending order: T2 >T3>T4 >T1 >T5. These results are in agreement with those of Mahmoud *et al*. (2006).

3.4.4. Effect of mineral and organic fertilizers on soil bulk density and total porosity

It is well known that soil bulk density and total porosity are mostly affected by soil structure. Total porosity provides also valuable information about soil structure and is inversely correlated with bulk density. Mean values of soil bulk density (Mgm^{-3}) and total porosity (%) after fodder beet harvesting are presented in Table (9). Data reveal that increasing the applied rate of compost treatments to the light soil led to reduce the values of soil bulk density, and, consequently, caused an increase in total porosity compared with T1 (untreated soil). The efficiency of the studied compost on reducing the values of bulk density could be arranged in the following descending order: T5 >T4 >T3 >T2 >T1. These results may be attributed to the addition of compost treatments low specific gravity of organic material and their decomposition material which enhanced the formation of large soil aggregates and, subsequently, decrease soil bulk density. These results are in agreement with those of Mansour (2007).

3.4.5. Effect of mineral and organic fertilizers on pore size distribution

Pore size distribution is responsible for the limitation of water retention and movement in the soil and it is strongly affected by soil texture and structure mean values of pore size distribution of soil harvesting, as affected by of the different applied compost treatments are shown in Table (9).Data indicate that the quickly drainable pores in the control represented the greatest percentage of total pores by volume in the soil. On the other hand, the fine capillary pores are progressively increased with applied any rate of compost treatments. Generally, the data show

that applying any rate of compost led to increase the total porosity and decrease of quickly drainable pores. The treatments could be arranged the following ascending order: T5>T4>T3>T2>B2>T1. This result may be attributed to the increase of the solubility of Ca^{2+} that enhanced soil aggregation and the percentage of stable aggregates (P.S.A). These results are in agreement with those obtained by Miyamoto and Stroehlein (1986) and Mansour (2007).

3.4.6. Effect of mineral and organic fertilizer on hydraulic conductivity (K)

Data in Table (9) reveal that the values of soil hydraulic conductivity decreased with the compost treatments as compared with the T1. The hydraulic conductivity were decreased from 35.2cm h^{-1} in the untreated soil to 33.6 cm h^{-1} in T5. The treatments could be arranged in the following ascending order:
T5<T4<T3<T2<T1. This could be attributed to the effect of any rate of compost treatments increasing the micro pores and decreasing the macro pores. Similar results were obtained by Mansour (2007) and Mariano *et al*. (2009).

3.5. Effects of mineral and organic fertilizers applications on dry yield, and quality parameters of common fodder beet

Data presented in Table (10) show that the effect of compost and N, K on crude protein, dry yield and quality parameters of common fodder beet roots and shoot were increased considerable upon the combined application. The above treatment T2 could be attributed to the improvement in physical, chemical and biological properties of the soil by the addition of organic fertilizer. However, T2 could prove the proper supply of the required nutrients through the integrated two sources of N.K. fertilizer which facilitated a balanced nutrition of crop fodder. These results are in agreement with those obtained by Karczmarczyk *et al*. (1995) and Prokopenko *et al*. (1997). Abdel-Gwad *et al*. (2008) reported that crude protein content of fodder beet significantly increased by increasing nitrogen fertilizer level, while crude fibers took an opposite trend. Abdel-Gwad *et al.* (1997) found that fresh and dry matter yield and crude protein and the total carbohydrate concentration of roots generally increased with increasing fertilizer rate for all fertilizers, while fibre concentration decreased. Geweifel and Aly (1996) reported that fertilizers decreased crude fiber content of roots. These results are consistent with the present results. These effects may be owing to the effect of these nutrients in different metabolic processes in plants (nitrogen effects on protein building, enzymes and antioxidants). Phosphorus affect nucleic acid and ATP energy compound and potassium in cell water adjustment and carbohydrate translocation from source to sink (Zaki, 1999). Zamfir *et al*. (2001) and Marschner (2012) reported that increasing nitrogen fertilization increased dry matter yield and crude protein content of fodder beet. Fodder beet under study differed significantly in CP., Fiber, Ash and C.C forage yield under the probability of 5% as shown in Table (10).

Table (9): Effect of mineral and organic fertilizers on bulk density (B.D), hydraulic conductivity (K), total porosity (T.P) and pore size distribution(%) in the soil after harvesting two years (combined analysis).

Treatment	B.D ($Mg\ m^{-3}$)	K (cmh^{-1})	T.P (%)	Pore size distribution (%)			
				Q.D.P	S.D.P	W.H.P	F.C.P
T1	1.65	35.2	33.7	31.6	3.6	1.41	1.14
T2	1.63	34.8	35.2	28.3	3.9	2.52	2.62
T3	1.62	34.2	36.5	26.8	5.3	3.73	3.74
T4	1.60	33.9	38.4	25.2	6.9	4.91	3.89
T5	1.58	33.6	40.6	24.7	7.6	5.47	4.63

Q.D.P=quickly drainable pores S.D.P=slowly drainable pores
W.H.P=water holding pores F.C.P= fine capillary pores

Table (10): Effects of mineral and organic fertilizer applications on dry yield and quality parameters of common fodder beet .

Treatment	CP (%)		Fiber (%)		ASH (%)		C.C. (%)	
	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
T1	13.5	9.25	2.23	2.05	11.2	8.11	40.6	66.5
T2	17.2	11.0	3.00	2.54	12.5	9.19	44.6	69.2
T3	15.6	10.5	2.87	2.30	12.2	8.91	43.0	68.6
T4	14.7	9.77	2.56	2.24	11.8	8.65	41.6	67.7
T5	12.6	8.84	2.07	1.88	10.9	7.88	30.2	65.5
L.S.D. at 0.05	0.51	0.29	0.20	0.17	0.17	0.15	0.43	0.67
C.V.	1.83	1.57	4.14	4.19	0.77	0.91	0.54	0.52

CP (%)= crude protein , C.C (%).= carbohydrates

Conclusion

Based on the aforementioned discussion, it could be concluded that the application of any different rate of compost and harvest times applied in fodder beet in Mediterranean conditions of Egypt can be summarized as follows:

1- Increasing compost rates increased root yield of fodder beet.

2- The highest root dry matter and crude protein yields were obtained from T2 (75%N. K. +5 $m^3 fed^{-1}$ Compost) treatment.

3-Considerable variation exists among forage crops, indicating the potential for selecting of superior and better adapted forage crops for both their production and their quality.

4-Increased forage production of Egyptian clover and fodder beet could enhance ruminant livestock production substantially without requiring additional inputs of resource-poor livestock farmers.

5- Fodder beet production and its quality, it could be maximized by applying 75%NK mineral fertilizer + 5 $m^3 fed^{-1}$ compost under the condition of the light soil at Ismailia Governorate.

6- Improved soil properties occurred due to treatments increased total porosity, fine capillary pores, organic matter and available NPK .On the contrary, bulk density, hydraulic conductivity, quickly drainable pores, ECe and pH values were decreased.

7- Organic and mineral fertilizers, individually or in combination, affected root rot disease incidence. In this concern, the superior treatment was T2 (75% mineral and 25% compost), when it's recorded the lowest disease incidence

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كفاءة الاسمدةالمعدنيه والعضوية وتأثيرها على إنتاجية وجودة محصول بنجر العلف ومكافحة مرض عفن الجذور وتحسين بعض خواص الاراضى الرملية

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ملخص

فى مسعى جاد لتخفيف مشاكل الأراضى الرمليه أجريت بعض المعالجات المتاحة على التربة من خلال تجربتين منفصلتين **فى التجربة الأولى** أجريت تجربة معملية باستخدام اربع عزلات من الفيوزاريوم سولانى من بنجر العلف وبنجر السكر وفول الصويا والجوار وتاثير مستخلص الكمبوست (المستخلص المائى للكمبوست)على النمو الميسليومى على هذه العزلات وتبين من النتائج ان استخدام المسخلص الكمبوست تحت ظروف المعمل أدى الى انخفاض ملحوظ فى ميسليومى الفطر الممرض *F.solani* كما لوحظ ان اضافة كل من مستويات السماد العضوى والمعدني للتربة بصورة منفردة او مشتركة اثرت على الاصابة بمرض عفن الجذور ولقد سجلت المعاملة T2 (75% سماد معدنى + 5م^3 سماد عضوى) اقل نسبة اصابة باعفان الجذور. بالاضافه الى زيادة معنوية فى صفات المحصول وجودته.

و فى التجربة الثانيه إمتد البحث بإجراء تجربة لدراسة تأثير إضافة السماد العضوي والمعدنى على محصول بنجر العلف وجودتة فى محطة البحوث بالإسماعيلية –خلال موسمي 2012| 2013و 2013| 2014 لتقييم كفاءة إحلال السماد العضوي كمصدر للعناصر النتروجينيه والبوتاسيه واستبدالها بنظائرها من نفس العناصر من التسميد المعدني فى صورة معاملات مشتركه على إنتاجية وجودة بنجر العلف صنف (فورشينجر) وتأثير ذلك على التربة. اشتملت الدراسة على خمسة مستويات من السماد العضوي (بدون إضافة و5 و 10 و 15 و 20 متر مكعب كمبوست /فدان) و خمسة مستويات من التسميد المعدني (100% و75% و 50% و25% وصفر % من عنصري النتروجين والبوتاسيوم) اتبع تصميم القطاعات الكاملة العشوائية . أشارت النتائج المتحصل عليها الى وجود اختلافات معنوية بين المعاملات المختلفة وان معاملة إضافة السماد العضوي بمعدل 5 م3 للفدان والمعدنى بمعدل 75 % أدى الى زيادة معنوية فى صفات النمو الخضري لبنجر العلف والمتمثلة فى (طول الجذر - قطر الجذر - وزن العلف الأخضر والجاف للجذر - طول وعدد الأوراق). بالاضافه الى وجود زيادة معنوية لصفات المحصول العلفى من حيث (نسبة البروتين الخام و الرماد و الألياف والكربوهيدات) بزيادة معدل السماد العضوي الى 20 م3 للفدان . كما أشارت النتائج إلى ان إضافة النتروجين والبوتاسيوم فى صوره معدنية مع الكمبوست ادى الى زيادة كبيرة فى وجود النتروجين والفوسفوروالبوتاسيوم فى المجموع الخضري والجذري لنبات بنجر العلف فى مرحلتي النمو الخضري والحصاد. ومن ناحية أخرى وجد ان الإضافات المختلفة من الكمبوست ادى الى تحسن فى خواص التربة حيث انخفضت قلوية وملوحة التربة وكذا الكثافة الظاهرية والمسام سريعة الصرف ونفاذية التربة وعلى النقيض حدث زيادة فى قيم كلا من المسام الكلية والمسام الدقيقة ومحتوى التربة من الماده العضوية وتيسر العناصر الغذائية الثلاث النتروجين والفوسفوروالبوتاسيوم .