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Impact of Mineral, Organic and Bio Fertilizers on Growth, Yield and Quality of Fodder Beet under Sandy Soil Conditions in North Sinai

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ABSTRACT

A field experiments was carried out at a private farm a; (Yamit village). Rafah in Governorate of North Sinai (31^o 16' 27" N. 34^o 10' 07" E at an altitude 7m) in two successive winter seasons of 2013/2014 and 2014/2015 to study the effect of some nitrogen sources viz.(60 kg Nfed^{-1} as NH_4NO_3 + 2t Compost fed^{-1}), (60 kg N fed^{-1} + biofertilizer mixed with seeds, BF as N_2 fixation), (2 t Compost fed^{-1} + BF) and (120 Kg N fed^{-1} only, as a recommended level) and three P fertilizer levels 15, 30, 45 kg P_2O_5 fed^{-1}, as single superphosphate on fodder beet growth attributes, yield and its components and quality under drip irrigation system prevailing in the region. The results showed that application of (60 kg N fed^{-1} + 2t compost fed^{-1}) produced the highest significant level of chlorophyll contents in leaves of fodder beet whereas the other N sources came in this order: (120 kg N fed^{-1}) > (2 t compost fed^{-1} + BF) > (60 kg N fed^{-1} + BF). Also, this treatment significantly surpassed the other treatments in respect of fresh and dry top weights plant^{-1} and dry root weight plant^{-1} of fodder beet. The significant promotive effect of (60 kg N fed^{-1} + 2t compost fed^{-1}) treatment extended to include dry top and root yields ton fed^{-1}as well as N, P and K nutrients content in leaves and roots. Application of 45 kg P_2O_5fed^{-1} brought about the highest significant fresh top yield (ton fed^{-1}) whereas application of 30 kg P_2O_5 fed^{-1} significantly yielded the best fresh root yield and there were no significant differences among P levels in dry top and root yields. The promotive significant effect of application of 45 kg P_2O_5 fed^{-1} extended to include NO_2, NO_3 and total carbohydrate contents in leaves and roots of fodder beet; respectively. Also, application of 45 kg P_2O_5 fed^{-1} gave the highest significant effect on N, P and K content in leaves and roots of fodder beet.
Keywords: mineral fertilizers, compost, biofertilizer, fodder beet, growth attributes, yield.

INTRODUCTION

Newly reclaimed soils in Egypt are generally sandy in texture, low content of available nutrient elements, organic matter and water holding capacity. Such characteristics are not favorable 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. Data recorded by Dhanushkodi and Subrahmaniyan (2012) showed that the application of compost led to increase the available N, P and K and organic carbon content in the soil, moreover the reduction of soil bulk density and pH. Rashad *et al.*,(2015) revealed that application of organic matter led to an increase of nutrients in plant parts and soil in comparison with no organic matter applied. Nitrogen has been proved to be the most yield-limiting nutrient factor. Fodder beet (*Beta vulgaris L.*) 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 Zamfir *et al*., (2001) and Zaki (1999) reported that increasing nitrogen fertilization increased dry matter yield and crude protein in fodder beet.

Phosphorus deficiencies lead to a reduction in the rate of leaf expansion and photosynthesis per unit leaf area (Rodriguez *et al.*, 1998). Therefore, it was advisable to include different rates of phosphorus fertilization in the current investigation.

The objective of this study is to investigate the effect of mineral, organic and bio fertilizer treatments on fodder beet plant growth attributes, yield and its components and quality under sandy soil conditions of North Sinai.

MATERIALS AND METHODS

A field experiment was conducted on a newly reclaimed sandy loam soil at Yamit village, Rafah (31^o 16' 27” N. 34^o 10’ 07” E at an altitude 7m) in Governorate of North Sinai, Egypt during the two successive winter seasons of 2013/2014 and 2014/2015.

Field experiment layout:

Fertilizer N treatments were arranged within P treatment in three replicate in split-plot design, N treatment as the main plot and P treatment as the sub plot.

The N fertilizer was applied as follow

1. 60 kg N fed^{-1} as NH4NO3 (33.5% N) combined with 2t compost fed^{-1}.
2. 60 kg N fed^{-1} combined with nitrogen fixing biofertilizer, as N_2 fixation.
3. 2t compost fed^{-1} with biofertilizer.
4. 120 kg N fed"^{1} as NH_4NO_3 (33.5% N) recommended dose.

The P fertilizer levels were applied at rates (15, 30, 45 kg P_2O_5 fed^{-1}) as single superphosphate (15% P_2O_5) on fodder beet growth attributes, yield and its components and quality under drip irrigation system prevailing in the region. Soil surface samples (0 -30 cm) were collected from the experimental fields in each season to determine some physical and chemical properties of the soil according to standard methods and procedures illustrated by Black *et al*.,(1965) as shown in Table 1.

A representative sample of compost was taken to determine the main chemical characteristics and nutrient status and then they obtained results were presented in Table 2.

Table 1: Some physical and chemical properties of the experimental soil in Rafah

Properties	Values	
	2013/2014	**2014/2015**
Particle size distribution (%)		
Coarse sand	24.30	27.30
Fine sand	73.85	70.75
Silt	0.75	0.80
Clay	1.10	1.15
Texture class	Sandy loam	
$CaCO_3$ (%)	5.70	4.25
Organic matter (%)	0.10	0.14
EC (dSm^{-1}, Soil paste ext.)	2.37	2.28
pH (1:2.5 soil water susp.)	7.33	7.52
Soluble ions $mmol_c$ L^{-1}		
Ca^{+2}	5.47	6.65
Mg^{+2}	4.40	5.10
Na^+	12.73	10.12
K^+	0.56	0.71
HCO^-_3	4.30	4.63
Cl^-	11.15	12.28
SO^{-2}_4	7.71	5.67
Available N ($mgkg^{-1}$)	12.85	13.20
Available P ($mgkg^{-1}$)	4.05	4.18
Available K ($mgkg^{-1}$)	122.60	123.15

Table 2: Some characteristics of the used compost crop residues

Characters		**Values**
Weight of $1m^3$ (kg)		400
Moisture (%)		30
Water holding capacity (%)		33.5
pH (1:10 water suspension)		7.05
EC(dSm^{-1}, 1:10 soil: water extract)		4.35
C/N ratio		18
Organic carbon (%)		38
Organic matter (%)		65
Total macronutrients (%)		
N	**P**	**K**
1.85	0.57	0.97

The compost was applied at the rate of 2 t fed-1 in the experiment in each season. The experimental treatments involved biofertilizer inoculum represented by free living N2 fixing bacteria called Azospirillum brazilense. It was kindly provided by Biofertilizer Production Unit, Soils, Water and Environment Institute, Agric. Res. Center (ARC) Giza, Egypt.

The experiment was carried out with three replicates and each plot measured (3 m x 3.5 m) comprising 7 irrigation hoses, 50 cm apart and space between drippers was 50 cm. The main plots were allocated for nitrogen fertilizer sources, while the sub plots were devoted to phosphorus fertilizer rates. Seeds of fodder beet (*Beta Voroshenger Cv.)* were sown in mid November 2013 and 2014 at the rate of 3 kg fed^{-1} and seedlings were thinned to one seedling per hill after 45 days from sowing. Compost was incorporated into the main plots by labor hands in hill bottoms one time before sowing. Biofertilizer inoculum suspension was mixed with seeds thoroughly using Arabic gum as an adhesive material on the day of sowing while the inorganic nitrogen fertilizer was banded in three equal splits after 50, 70 and 90 days from sowing. In sub plots P fertilizer treatments were banded during preparing seed bed. All experimental plots received K fertilizer equally in two doses with the first and the second nitrogen doses as potassium sulphate (48% K_2O) at the rate of 100 kg K_2O fed^{-1}

Photosynthetic pigments in leaves were determined and calculated after 100 days from sowing according to Moran (1982). Fresh and dry weights of tops and roots per plant were also recorded.

Fodder beet plants were harvested by mid June in both seasons and fresh and dry yield of tops and roots were assessed. Meanwhile, N, P and K were evaluated in dry leaves and roots as outlined in A. O. A. C. (1990). Nitrite and nitrate were determined in the two parts of the plant in line with Sing (1988). Total carbohydrate was evaluated in leaves and roots according to the method described by Miller (1959). Analysis of variance was computed for each trait as combined means of the two growing seasons according to Snedecor and Cochran (1980) and treatment means were compared using LSD at 5% level of probability.

RESULTS AND DISCUSSION

1- Effect of mineral, organic compost and bio fertilizers on growth attributes:

Data in Table 3 show that application of N fertilizer to fodder beet plants at the rate of 60 kg N fed^{-1} + 2t compost fed^{-1} produced the highest significant level of chlorophyll a, chlorophyll b and chlorophyll a + b in leaves of fodder beet whereas other N forms came in this order: 120 kg N fed^{-1} > (2t compost fed^{-1} + BF) > (60 kg N fed^{-1} + BF). Similarly the application of the same treatment yielded the highest significant fresh top and root weights plant^{-1} and dry root weight plant^{-1} and in the same order. Results also showed that the combination of 2t compost fed^{-1} and BF had significantly better effect than the combination of 60 kg N fed^{-1} and BF on all growth attributes with the exception of fresh root weight plant^{-1}. The significantly favorable effect of N_2 fixing bacteria contained in biofertilizer could be related to its capability to enrich availability of N and other essential plant nutrients that helped in increasing meristemic activities responsible for cell elongation and division as well as dry matter accumulation. Similar findings were confirmed by Al-Gamal (1996) while working on the response of tomato in new reclaimed areas to mineral nitrogen fertilizer levels and N_2 fixing biofertilizer. Larimi et al., (2014) found that used of biofertilizer treatment increased significantly chlorophyll (a) and (b) in leaf of sweet basil.

Table 3: Growth attributes of fodder beet plants of 100 days from sowing in Rafah at different N sources and P levels as combined means of two growing seasons 2013/2014 and 2014/2015.

Treatments		Leaves chlorophyll contents (mg dm^{-2})			Fresh top wt. g plant^{-1}	Dry top wt. g plant^{-1}	Fresh root wt. kg plant^{-1}	Dry root wt. g plant^{-1}
N Sources		a	b	a + b				
60 kg N fed^{-1} + 2t compost fed^{-1}		3.45	1.07	4.52	441.37	36.63	1.64	288.07
60 kg N fed^{-1} + BF		3.20	1.03	4.23	337.50	25.65	1.34	205.80
2t compost fed^{-1} + BF		3.25	1.04	4.29	376.54	29.36	1.48	230.19
120 kg N fed^{-1}		3.29	1.06	4.35	406.36	33.04	1.52	245.74
LSD$_{.05}$		0.043	0.010	0.037	12.12	1.79	0.061	3.96
P levels (kg P_2O_5 fed^{-1})								
15		3.23	1.02	4.25	369.44	28.98	1.42	226.27
30		3.30	1.05	4.35	389.40	31.03	1.49	240.43
45		3.36	1.08	4.44	412.50	33.50	1.58	260.65
LSD$_{.05}$		0.033	0.007	0.034	10.59	2.27	0.043	3.97
N Sources* P levels interaction								
	15	3.33	1.03	4.36	407.72	33.51	1.51	261.68
60 kgN fed^{-1} + 2tcompost fed^{-1} x	30	3.45	1.08	4.53	448.53	37.12	1.63	284.53
	45	3.56	1.10	4.66	467.85	39.27	1.78	317.99
	15	3.16	1.01	4.17	319.92	23.70	1.29	193.40
60 kg N fed^{-1} + BF x	30	3.19	1.02	4.21	337.88	25.60	1.33	202.79
	45	3.25	1.05	4.30	354.71	27.65	1.41	221.20
	15	3.19	1.02	4.21	364.81	27.88	1.42	215.24
2t compost fed^{-1} + BF x	30	3.26	1.05	4.31	376.35	29.37	1.49	229.86
	45	3.29	1.06	4.35	388.47	30.83	1.53	245.48
	15	3.24	1.02	4.26	385.29	30.84	1.47	234.76
120 kg N fed^{-1} x	30	3.30	1.06	4.36	394.83	32.03	1.51	244.55
	45	3.34	1.09	4.43	438.96	36.24	1.59	257.92
LSD$_{.05}$		N.S	0.055	0.068	N.S	N.S	N.S	7.95

The combination treatment of 60 kg N fed^{-1} and 2t compost fed^{-1} could provide relatively considerable amount of available nitrogen in the vicinity of plant roots and the compost as an organic material could increase soil water holding capacity with the result that fodder beet plants absorbed more nitrogen and water leading to increase photosynthetic pigments that represent chlorophyll a and b and consequently the rate of assimilation of photosynthetic carbon was increased and in turn fresh and dry top and roots of fodder beet plant^{-1} were also increased. This suggestion was confirmed by Sheng and Bao (2006) who found that nitrogen supply accelerated photosynthetic carbon assimilation due to increasing photosynthetic pigments. Application of N fertilizer at the rate of 60 kg N fed^{-1} together with 2t compost fed^{-1} helped in increasing water holding capacity of sandy soil and improved availability of essential nutrients for fodder beet plants with the result that growth characters superseded those under other treatments. Rashad *et al.,* (2015) revealed that application of organic matter led to an increase of nutrients in both plant parts and soil in comparison with no organic matter application.

Data in the same Table 3 show that increasing application of phosphorus fertilizer levels up to 45 kg P_2O_5 fed^{-1} increased significantly all chlorophyll contents in leaves of fodder beet plants besides fresh and dry tops and roots plant^{-1} (100 days from sowing). The significantly promotive effect of phosphorus on such characteristics could be related to the increase of phosphate energy demand as the rate of photosynthesis increased for plant growth (Armstrong, 1999) and to improvement of N and S absorption by P fertilization (Graciano *et al*., 2006).

Concerning interactions of the studied fertilizer treatments, data in Table 3 reveal that the effect of interaction of (60 kg N fed^{-1} + 2t compost fed^{-1}) x 45 kg P_2O_5 fed^{-1} and 30 kg P_2O_5 fed^{-1} on chlorophyll b, chlorophyll (a + b) and dry root weight $plant^{-1}$ only were significant. The best interaction values were 1.10, 4.67 mg dm^{-2} and 317.99 g $plant^{-1}$, respectively.

2-Effect of mineral, organic compost and bio fertilizers on yield components:

Data in Table 4 reveal that application of (60 kg N fed^{-1} + 2t compost fed^{-1}) significantly gave 9.07 and 0.747 t fed^{-1} of fresh and dry fodder beet foliage out yielding other N treatments that came in this order: 120 kg N fed^{-1} > (2t compost fed^{-1} + BF) > (60 kg N fed^{-1} + BF) and significantly gave 8.30, 7.79 and 6.90 t fed^{-1} and 0.670, 0.603 and 0.520 t fed^{-1} of fresh and dry fodder beet foliage, respectively. Application of (2t compost fed^{-1} + BF) had significantly better effect than that obtained with 120 kg N fed^{-1}. Also, application of (60 kg N fed^{-1} + 2t compost fed^{-1}) gave significantly 32.15 t $fed^{-1}$and 5.65 t fed^{-1} of fodder beet fresh and dry root yields that surpassing significantly other N treatments that were in this order: 120 kg N fed^{-1} > (2t compost fed^{-1} + BF) = (60 kg N fed^{-1} + BF) and giving 30.52, 27.65 and 29.67 t $fed^{-1}$and 4.93, 4.23 and 4.62 t fed^{-1} of fresh and dry root yields, respectively. Meanwhile, the results in Table 4 show that (2t compost fed^{-1} + BF) combination significantly brought about better fresh and dry tops and fresh roots of fodder beet than that of (60 kg N fed^{-1} + BF) combination.

Table 4: Yield components of fodder beet plants in Rafah at different N sources and P levels as combined means of two seasons 2013/2014 and 2014/2015.

Treatments N Sources		Top fresh yield ($t\ fed^{-1}$)	Top dry yield ($t\ fed^{-1}$)	Root fresh yield ($t\ fed^{-1}$)	Root dry yield ($t\ fed^{-1}$)
60 kg N fed^{-1} + 2t compost fed^{-1}		9.07	0.747	32.15	5.65
60 kg N fed^{-1} + BF		6.90	0.520	27.65	4.23
2t compost fed^{-1} + BF		7.79	0.603	29.67	4.62
120 kg N fed^{-1}		8.30	0.670	30.52	4.93
$LSD_{.05}$		0.361	0.051	1.592	0.452
P levels (kg $P_2O_5 fed^{-1}$)					
15		7.55	0.588	28.73	4.57
30		8.00	0.633	30.12	4.86
45		8.50	0.685	31.13	5.14
$LSD_{.05}$		0.304	N.S	1.594	N.S
N Sources* P levels interaction					
	15	8.34	0.680	30.26	5.24
60 kg N fed^{-1} + 2t compost fed^{-1} x	30	9.24	0.760	32.58	5.70
	45	9.63	0.800	33.62	6.00
	15	6.53	0.480	26.91	4.03
60 kg N fed^{-1} + BF x	30	6.91	0.520	27.66	4.21
	45	7.25	0.560	28.37	4.45
	15	7.48	0.570	28.35	4.31
2t compost fed^{-1} + BF x	30	7.74	0.600	29.97	4.62
	45	8.16	0.640	30.68	4.92
	15	7.85	0.620	29.41	4.71
120 kg N fed^{-1} x	30	8.10	0.650	30.29	4.90
	45	8.97	0.740	31.86	5.18
$LSD_{.05}$		N.S	N.S	N.S	N.S

The significant promotive effect of (60 kg N fed^{-1} + 2 t compost fed^{-1}) combination could lead to increase N availability in fodder beet root vicinity with the result that N absorption was increased leading to increase the rate of photosynthesis and metabolic processes, physiological activities of meristemic tissues and dry matter accumulation, consequently, fresh and dry top and root yields of fodder beet got significantly increased. This explanation is supported by (Salem, 2000 and Antoun *et al.,* 2010). The positive effect of compost on fresh and dry top and roots of fodder beet could be associated with its lowering soil pH that could enhance some nutrient availability in the soil and its improving soil physical characteristics in favor of plant root development. This suggestion is in full agreement with that of Gamal and Ragab (2003), Ayeni *et al.,* (2010) and Hoda *et al.,* (2015). The enhancement of fodder beet yield due to inoculation with N_2 fixing bacteria could be attributed to the capability of such organisms to produce growth regulators such as auxins, cytokinines and gibberillins that affect the production of fodder beet root biomass and nutrients uptake. This suggestion has previously been emphasized by Abd El-Naby and Gomaa (2000) and Van Loon (2007).

Data in Table 4 show that raising the rate of phosphorus fertilizer up to 45 kg P_2O_5 fed^{-1} increased significantly fresh top yield, whereas increasing P level up to 30 kg P_2O_5 fed^{-1} brought about significant fresh root yield of fodder beet. The significant effect of P fertilizer could be associated with its role in generating energy for photosynthesis, energy transfer (ATP) to support cell walls (phospholipids) as stated by (Armstrong, 1999).

Concerning N sources x P rates interaction data in Table 4 revealed that these interactions were not significant.

3- Effect of mineral, organic compost and bio fertilizers on chemical constituents in leaves and roots of fodder beet.

Data in Table 5 indicate that application of 120 kg N fed^{-1} exceeded significantly all other treatments in respect of (NO^-_2 and NO^-_3) concentration in fodder beet leaves and roots, whereas application of (60 kg N fed^{-1} + (BF) produced the highest significant total carbohydrate in fodder beet leaves and roots. In the meantime, applying (60 kg N fed^{-1} + BF) produced significantly more (NO^-_2) than the treatment of (2 t compost fed^{-1} + BF) in leaves and roots of fodder beet.

The significantly promotive effect of synthetic N fertilizer (120 kg N fed^{-1}) in producing (NO^-_2 and NO^-_3) in fodder beet leaves and roots could be explained on the basis that the whole amount of synthetic N fertilizer in this treatment was applied in the form of ammonium nitrate which contains (NO^-_3) by 50% that reduced to NO^-_2 by nitrogen reeducates in the presence of adenine triphosphate (ATP) as confirmed by Solomonson and Barber (1990) while investigating properties and regulation of assimilatory nitrate reeducates.

The combination of (60 kg N fed^{-1} and BF) gave the highest significant percentage of total carbohydrate in leaves and roots of fodder beet could be explained that the activity of N_2 fixing microorganisms releases available N and other essential nutrients from the soil containing phosphorus for fodder beet plants that used as a source of energy to produce carbohydrate through photosynthesis process as confirmed by Abd El-Naby and Gomaa (2000).

Table 5: Nitrite, nitrate and total carbohydrate in leaves and roots of fodder beet plants in Rafah at harvest versus different N sources and P levels as combined means of two growing seasons 2013/2014 and 2014/2015

Treatments		Leaves			Roots		
N Sources		NO_2 ppm	NO_3 ppm	Total carbohydrate %	NO_2 ppm	NO_3 ppm	Total carbohydrate %
60 kg N fed^{-1} + 2t compost fed^{-1}		14.76	29.46	6.99	20.29	42.40	67.00
60 kg N fed^{-1} + BF		13.11	28.75	7.73	18.42	33.72	68.13
2t compost fed^{-1} + BF		11.56	24.25	7.36	14.08	24.47	67.69
120 kg N fed^{-1}		26.18	48.11	7.26	33.82	70.93	67.29
$LSD_{.05}$		0.19	1.67	0.43	0.20	0.17	0.25
P levels (kg P_2O_5fed^{-1})							
15		16.00	32.37	7.30	21.20	42.43	67.29
30		16.37	32.63	7.38	21.62	42.85	67.50
45		16.85	32.94	7.33	22.14	43.37	67.80
$LSD_{.05}$		0.14	N.S	N.S	0.13	0.18	0.18
N Sources* P levels interaction							
	15	14.32	29.17	6.89	19.83	42.12	66.61
60 kg N fed^{-1} + 2t compost fed^{-1} x	30	14.80	29.42	6.97	20.27	42.37	66.97
	45	15.17	29.80	7.11	20.78	42.71	67.42
	15	12.68	28.43	7.60	18.02	33.52	68.14
60 kg N fed^{-1}+ BF x	30	13.02	28.78	7.72	18.38	33.69	68.03
	45	13.63	29.05	7.87	18.86	33.96	68.21
	15	11.25	24.05	7.28	13.78	24.35	67.48
2t compost fed^{-1} + BF x	30	11.53	24.22	7.35	14.05	24.41	67.71
	45	11.90	24.47	7.44	14.40	24.65	67.89
	15	25.73	47.81	7.41	33.15	69.73	66.91
120 kg N fed^{-1} x	30	26.12	48.08	7.47	33.78	70.91	67.28
	45	26.68	48.45	6.91	34.53	72.15	67.67
$LSD_{.05}$		N.S	N.S	N.S	0.27	0.35	N.S

4- Effect of mineral, organic compost and bio fertilizers on N, P and K content in leaves and roots of fodder beet.

Data in Table 6 emphasiz that application of (60 kg N fed^{-1} + 2t compost fed^{-1}) produced significantly the highest values of N, P and K content in leaves and roots of fodder beet and the other treatments came in this order: (120 kg N fed^{-1})>(2t compost fed^{-1} + BF)> (60 kg N fed^{-1} + BF) for the content of N and K and N, P and K in leaves and roots; respectively but there was no difference among (120 kg N fed^{-1}), (2t compost fed^{-1} + BF), (60 kg N fed^{-1} + BF) in their effect of P content in leaves of fodder beet.

The significant effect of (60 kg N fed^{-1}+ 2 t compost fed^{-1}) could be related to the existence of compost that played an effective role in providing plants with N besides its favorable effect on modifying soil pH in the vicinity of roots of fodder beet that made essential nutrients available for the plant and increasing water holding capacity of the soil, consequently, plants absorbed more water and nutrients than those in other treatments. These results are confirmed by Ayeni *et al.*, (2010) and Umesha *et. al.*, (2014)

Also, data in Table 6 demonstrate that the application of phosphorus fertilizer at the rate of 45kg P_2O_5 fed^{-1} surpassed significantly the other phosphorus treatments in respect of N, P and K uptake in leaves and roots of fodder beet with the exception of P_{15} and P_{30} treatments that had the same effect on P uptake in leaves of fodder beet.

The significant effect of increasing the rate of P fertilizer level on nutrient uptake in leaves and roots of fodder beet could be attributed to the increase of P availability in the vicinity of roots of fodder beet by increasing the rate of P fertilization, which enhanced the rate of absorption of such nutrients and accelerated the rate of photosynthesis and in turn the dry matter accumulation got increased. This explanation was supported by Armstrong (1999) who made a detailed study on functions of phosphorus in plants.

Table 6: N, P and K content in leaves and roots of fodder beet at harvest versus different N sources and P levels as combined means of two seasons 2013/2014 and 2014/2015

Treatments		Leaves N	Leaves P	Leaves K	Roots N	Roots P	Roots K
		Total content ($kgfed^{-1}$)			Total content ($kgfed^{-1}$)		
N Sources							
60 kg N fed^{-1}+ 2t compost fed^{-1}		17.46	1.78	22.99	50.18	14.77	74.67
60 kg N fed^{-1}+ BF		11.26	1.00	14.69	33.46	9.06	50.15
2t compost fed^{-1}+ BF		13.34	1.19	17.57	37.31	10.37	57.43
120 kg N fed^{-1}		15.23	1.40	20.02	41.14	11.73	63.58
$LSD_{.05}$		0.956	0.414	0.672	1.724	0.690	2.506
P levels (kg P_2O_5 fed^{-1})							
15		12.56	1.10	16.59	36.38	9.56	53.47
30		14.34	1.30	18.67	40.52	10.89	60.95
45		16.07	1.62	21.19	44.67	13.99	69.95
$LSD_{.05}$		0.968	0.215	0.644	1.607	0.766	1.999
N Sources* P levels interaction							
	15	15.16	1.43	20.13	44.02	12.05	61.84
60 kg N fed^{-1}+ 2t compost fed^{-1}x	30	17.94	1.82	23.33	50.73	14.25	76.38
	45	19.28	2.08	25.52	55.80	18.00	85.80
	15	9.89	0.82	12.72	30.63	7.66	45.54
60 kg N fed^{-1}+ BF x	30	11.28	0.94	14.72	33.26	8.84	48.84
	45	12.60	1.23	16.63	36.49	10.68	56.07
	15	11.91	1.03	15.73	33.19	8.62	50.00
2t compost fed^{-1}+ BF x	30	13.26	1.14	17.40	37.42	9.70	56.36
	45	14.85	1.41	19.58	41.33	12.79	65.93
	15	13.27	1.12	17.79	37.68	9.89	56.52
120 kg N fed^{-1}x	30	14.89	1.30	19.24	40.67	10.78	62.23
	45	17.54	1.78	23.01	45.07	14.50	72.00
$LSD_{.05}$		N.S	N.S	N.S	N.S	N.S	4.00

Concerning the effect of N sources x P levels on N, P and K nutrients uptake in leaves and roots of fodder beet data in Table 6 reveal that this interaction had insignificant effect on the uptake of such nutrients with the exception of K uptake in roots and application of (60 kg N fed^{-1} + 2t compost fed^{-1}) in the presence of 45 kg P_2O_5 fed^{-1} recorded the highest significant effect on K uptake in roots of fodder beet.

Recommendations

In the light of the current research objectives, soil testing data and the nature of materials used, the following recommendations could be outlined:

1- The on-farm man made composted material is considered as a good safe method to clear plant residues and to change them to useful organic fertilizer for growing plant.
2- This study could play an important role in treating rice straw, which create yearly severe environmental problem called the black cloud on Cairo.
3- Applying (60 kg N fed^{-1} + 2t compost fed^{-1}) can get benefits from compost that enriches plant root vicinity with different nutrients, improves the availability of native plant nutrients by modifying soil pH and increases soil water holding capacity particularly in sandy soil.
4- It is helpful to add biofertilizer containing N_2 fixing bacteria to compost to provide plants with nitrogen and other different plant nutrients as well as auxins and growth hormones to increase yield and its quality.

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تأثير التسميد المعدني , العضوي والحيوى على نمو ومحصول وجودة بنجر العلف تحت ظروف الأراضي الرملية في شمال سيناء

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أقيمت تجربة حقلبة في مزرعة خاصة بقريةياميت ، رفح ، محافظة شمال سيناء في الموسمين الشتويين 2014/2013-2015/2014 لدراسة تأثير بعض مصادر النيتروجين هي: (60 كجم ن للفدان + 2 طن كمبوست للفدان) ، (60 كجم ن للفدان + سماد حيوي) ، (2 طن كمبوست للفدان + سماد حيوي) ، (120 كجم ن للفدان كمعدل موصى به) وثلاث مستويات من السماد الفوسفاتي 15، 30، 45 كجم فو$_2$أ$_5$ للفدان لدراسة صفات نمو ومحصول ومكونات وجودة بنجر العلف تحت نظام الري بالتنقيط السائد في المنطقة، وقد أظهرت النتائج أن إضافة (60 كجم ن للفدان + 2 طن كمبوست للفدان) قد أنتج أعلى مستوى معنوي من الكلوروفيل في أوراق بنجر العلف بينما جاء ترتيب تأثير مصادر النيتروجين الأخرى كما يلي (120 كجم ن للفدان) > (2 طن كمبوست للفدان + سماد الحيوي) > (60 كجم ن للفدان +سماد الحيوي) كما تفوقت هذه المعاملة على بقية معاملات مصادر النيتروجين فيما يتعلق بالوزن الطازج والوزن الجاف للنبات كما امتد التأثير المنشط لهذه المعاملة ليشمل محصولي الأوراق والجذور الجافين بالطن للفدان وكذلك المحتوى الكلي لعناصر النيتروجين والفوسفور والبوتاسيوم كجم للفدان في الأوراق والجذور وقد أدى إضافة 45 كجم فو$_2$أ$_5$للفدان إلى حدوث أعلى زيادة معنوية في محصول الأوراق الطازج بالطن للفدان بينما أدى إضافة 30 كجم فو$_2$أ$_5$للفدان إلى إنتاج أعلى محصول معنوي طازج من جذور بنجر العلف ولم تكن هناك فروق معنوية بين معدلات السماد الفوسفاتي في الوزن الجاف للأوراق والجذور بالطن للفدان وقد إمتد التأثير المنشط لمعدل السماد الفوسفاتي 45 كجم فو$_2$أ$_5$للفدان ليشمل محتوى الأوراق من النتريت ومحتوى الجذور من النترات والكربوهيدرات الكلية وأعلى محتوى كلي لعناصر النيتروجين والفوسفور والبوتاسيوم في أوراق وجذور بنجر العلف.