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EFFECT OF RICE STRAW BIO-COMPOST ON GROWTH AND CHEMICAL COMPOSITION OF LETTUCE PLANTS AND CHEMICAL AND BIOLOGICAL PROPERTIES OF RECLAIMED SANDY SOIL

Selim , A. E. I.[1] ; W.I. A. Saber[2] and E.G.A. Kedra[1]
1-Mansoura Univ. Fac. Agric. Microbiology Dept.
2-Microbial activity Unit, Microbiol. Res. Dept., Soils, Water and Environ. Res. Inst., Agric. Res. Center (ARC), Giza, Egypt.

ABSTRACT

A pot experiment was conducted at EL-Zafaran village, Kafr El-Sheikh Governorate, Egypt in reclaimed sandy soil collected from Baltim city at North Nile River region, to study the effect of bio-organic fertilizer (bio-compost) and mineral nitrogen fertilizer, both applied in different rates either each alone or both in combination, on the growth, NO_3 concentration and biochemical composition of lettuce plants (*Lactuca sativa* L. c.v. Alcapucci and to evaluate their effect on the soil chemical and biological properties as well. All results were evaluated after 10, 20 and 30 days from transplanting. Results revealed that bio-compost addition (100%) caused the highest values in fresh and dry weight, head diameter of lettuce plants as well as in total microbial counts. Acquired information demonstrated that the most astounding estimations of N, P and K components following 30 days recorded 4.13, 0.467 and 3.76% under 100% rice straw compost treatment compared to mineral fertilizer control (3.53, 0.353 and 3.26 % respectively), Chemical properties of sandy soil such as available elements (N,P,K) and chemical analysis are greatly affected by addition of bio-compost. The best values (pH, EC and OM) were recorded in treatments received 100% compost. Plants treated with 50% mineral + 50% rice straw compost recorded the highest value of nitrogenase activity being 400.78 µmole C_2H_4 100 g^{-1} day^{-1} at 10 days from sowing as compared to the other treatments, however these values decreased to 24.96 µmole C_2H_4 100 g^{-1} day after 30 days. Therefore, the application of 100% rice straw compost is recommended for farmers to get higher yields of lettuce and reduce sources of ecological pollution and keep up human health.

Keywords: lettuce, rice straw compost, mineral fertilizer, nitrogenase activity, microbial counts.

INTRODUCTION

The effect of using agricultural waste composts to fertilize agricultural land has been positive from the perspective of a recycling economy and because of their valuable characteristics and ingrdients. Compost and bio-compost as organic and biofertilizer play an important role in maintaining soil fertility with releasing nutrients in the soil. Several studies point out that the organic fertilizer has a positive effect on the soil fertility (El-Etr, 2004). Compost is considered as suitable mean for disposal and recycling such a large quantity of the wastes. Moreover, compost defined as the biological degradation of organic material to a humus-like substance by natural microbiological processes. In Egypt, the rice straw is one of the main agricultural wastes, which produced in 3.5 million tons annually, this cellulosic waste causing ecological problem unless it's not well exploited. The bioconversion strategy of these wastes into compost could be a beneficial method for its utilization. Lettuce (*Lactuca sativa* L.) is the most popular among the salad crops. It is rich in vitamins and minerals (Choudhury, 1967). Also, lettuce grown in Egypt for local consumption and export.

Herein, this investigation was established to study the effect of bio-organic fertilizer (bio-compost) and mineral nitrogen fertilizer, both applied in different rates either each alone or both in combination, on the growth, NO_3 concentration and biochemical composition of lettuce plants and to evaluate their effect on the soil chemical and biological properties as well.

MATERIALS AND METHODS

A pot experiment was conducted at EL-Zafaran village, Kafr El-Sheikh Governorate, Egypt in reclaimed sandy soil (Table 1) collected from Baltim city at North Nile River region, to study the effect of bio-organic fertilizer (bio-compost) (Table 2) and mineral nitrogen fertilizer, both applied in different rates either each alone or both in combination, on the growth, NO_3 concentration and biochemical composition of lettuce plants (*Lactuca sativa* L. c.v. Alcapucci), which are kindly supplied by Sakha Agricultural Research Station, Agric. Res. Center, Egypt, and to evaluate their effect on the soil chemical and biological properties as well.

Pots with 30 cm in diameter and 35 cm height were filled each with 6kg pot^{-1} to be transplanted with one healthy lettuce plant seedlings of 20 day old. Prior to lettuce plant seedlings transplanting, soil was thoroughly mixed with both organic and mineral nitrogen fertilizers according to the rates decided for each treatment. The soil in each pot was then watered before transplanting process and the moisture was kept at 40% of the soil water holding capacity through the compensating the daily loss of soil water by evaporation.

Nitrogen, phosphorus and potassium mineral fertilizers were applied in the form of urea (46 % N), Calcium super phosphate (15 % P_2O_5) and potassium sulphate (48 % K_2 O), respectively. The applied organic fertilizer was applied as rice straw compost enriched with *Penicillium* sp. and *Aspergillus* sp. as cellulytic fungi and *Azotobacter chroococcum* as nitrogen fixing bacteria. The enriched compost is called bio-organic fertilizer.

The experiment comprises the following treatments each in six replicates arranged in complete randomized design:

1- Control (Sandy soil only).

2- 100% N, P and K (0.6, 1.2 and 0.3 g/pot respectively) dose of nitrogen (0.2 g/pot) + full dose of phosphorus + full dose of potassium

3- 75% N, P and K (0.45, 0.9 and 0.3 g/pot respectively) and 25% compost (15 g/pot respectively) dose of nitrogen +$^3/_4$ of the full dose of phosphorus (0.6 g/pot) + full dose of potassium.

4- 50% N, P and K (0.3, 0.6and 0.15 g/pot respectively) and50% compost (30 g/pot respectively)dose of nitrogen + $^1/_2$ of the full dose of phosphorus (0.6 g/pot) + full dose of potassium.

5- 25% N, P and K (0.3, 0.15and 0.15 g/pot respectively) and75% compost(45 g/pot respectively) dose of nitrogen + $^{1}/_{4}$ of the full dose of phosphorus (0.6 g/pot) + full dose of potassium.
6- 100 % compost (60 g/pot) only organic fertilizer.

Table (1): Some physical, chemical and biological properties of the used soil

Property			Value
Particle size distribution (%)		Sand	99.61
		Silt	0.37
		Clay	0.02
Textural grade			Sandy
pH 1:2.5 (Soil: Water Susp.)			9.02
Organic matter (%)			0.08
EC (dSm^{-1})			0.43
Soluble ions ($meq\ l^{-1}$)	Cations	Ca^{++}	4.14
		Mg^{++}	2.36
		Na^{+}	1.14
		K^{+}	0.07
	Anions	CO_3^{--}	--
		HCO_3^{-}	0.35
		Cl^{-}	0.30
		SO_4^{--}	7.06
Soluble N, $mg\ kg^{-1}$			105.00
Soluble P, $mg\ kg^{-1}$			5.50
Soluble K, $mg\ kg^{-1}$			46.80
Total count Bacteria (log cfu g^{-1} dry soil)			2.56
Total count fungi (log cfu g^{-1} dry soil)			2.08
Count of N_2- fixing bacteria (log cfu g^{-1} dry soil)			2.20
Count of phosphate dissolving bacteria (log cfu g^{-1} dry soil)			1.60
Count of cellulytic fungi (log cfu g^{-1} dry soil)			0.90

Table (2): Chemical and microbiological properties of the used value compost

Parameter		After two months
pH (1: 10 extract)		7.3
Carbon (%)		19.26
Organic matter (%)		33.20
Total nitrogen (%)		1.45
P %		0.72
K %		1.33
E.C ($dS\ m^{-1}$) (1: 10 extract)		5.41
C/N ratio		13.28
Bacterial count (log CFU/g dry compost)	Total	19.146
	Cellulolytic	2.204
	P-dissolvers	5.602
	Azotobacter	8.398
Fungal count (log CFU/g dry compost)	Total	13.176
	Cellulolytic	6.013
	P-dissolvers	7.021

Plants samples were collected at 10, 20 and 30 days from transplanting to determine plant diameter (cm), fresh and dry weight (g), N, P & K contents (Black, 1965) and NO_3 accumulation (Keeney and Nelson, 1982). At the same periods, soil samples were collected to determine soil available N, P & K (Jackson, 1967), Organic matter content (Walkley and Black, 1934), Ph & EC (Jackson, 1967). Also at the same periods, rhizosphere soil samples were collected to determine some biological characters in terms of Nitrogenase activity (N_2-ase) (Somasegaran and Hoben, 1985), total count bacteria (Allen, 1959), free living nitrogen fixing bacteria (Norris, 1959), phosphate solubilizing fungi (Pikovskaya, 1948), total fungi count (Okon *et al.,*1977), count of cellulolytic bacteria (Mandel's *et al*., 1976) and count of *Azotobacter* (Cochran, 1950).

All obtained results were exposed to ANOVA analyses to be compared through the least significant difference nificance at $P< 0.05$ according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Data in Table (3) showed that nitrogen, phosphorus and potassium percentages as well as fresh and/or dry weight and diameter of lettuce were significantly affected by compost fertilizer and mineral nitrogen combination treatments after 10, 20 and 30 days from sowing.

Effect on NPK concentrations:

The highest nitrogen, phosphorus and potassium percentages of lettuce were obtained with the application of 100 % compost fertilizer alone after 10, 20 and 30 days from transplanting. It is of worth to mention that the treatment of 75 % mineral nitrogen + 25 % compost ranked after the treatment of 100 % compost with little differences. Application of 50 % mineral nitrogen + 50 % compost fertilizer ranked after previously mentioned treatments followed by application of 25 % mineral nitrogen + 75 % compost fertilizer after 10, 20 and 30 days from transplanting. On the other hand, the lowest nitrogen, phosphorus and potassium percentages as well as lowest values of dry weight and diameter of lettuce resulted from the application 100 % mineral nitrogen alone after 10, 20 and 30 days from sowing. These increases in nitrogen, phosphorus and potassium percentages as well as dry weight and diameter of lettuce due to increasing ratio of compost fertilizer in the combined nitrogen/compost treatments might be due to the favorable impact of compost fertilizer on soil hydrophysical, physical-chemical, biological and nutritional properties of the treated soil, consequently improvement in chemical composition and growth of lettuce.

The availability of nutrients in organic fertilizers does not depend on its total content in the material but on the dynamics of the process; thus, some elements can become more available because of pH, moisture, and aeration, or in composting for the temperature allowing the development of specialized organisms (Castellanos *et al*., 2000). Furthermore, organic matter decomposition rate and nutrient regeneration are regulated by a series of factors including environmental conditions, hydrological regime, substrate quality, soil microbial biomass, and electron receptor availability (Reddy *et al.,* 1998). Moreover, compost must be "mature" to decrease the risk of crop growth and yield reduction due to N immobilization caused by a high C/N ratio.

Effect on Dry weight and Diameter:

The highest of dry weight and diameter of lettuce were obtained due to the application of 100 % compost alone after 10, 20 and 30 days from transplanting. It is of worth to mention that application of 75 % mineral nitrogen + 25 % compost fertilizer ranked after application of 100 % compost fertilizer with little differences. Application of 50 % mineral nitrogen + 50 % compost fertilizer ranked after previously mentioned treatment followed by application of 25 % mineral nitrogen + 75 % compost fertilizer after 10, 20 and 30 days from transplanting. Maftoun *et al.* (2004) and Mohamed and Hussein (2005) pointed out that the mineralization of N from compost during its composed and might be due to the biological fixation of atmospheric N and its reflection on soil fertility. On the other hand, dry weight and head diameter of plant are agreement with Ahmed, and Ali, (2005). Also, these results agreed with those reported by who reported that the effect of organic supplement is a long term trait. However, Stancheva and Mitova (2002) determined a significant increase in total dry weight for lettuce in response to compost application. The application of an NPK starter fertilizer solution increased mean trimmed head weights and resulted in a considerably higher percentage of head in the iceberg size grade of lettuce plant (Stone *et al.*, 1997).

Effect on fresh weight

Data in Table (3) showed that the values of fresh weight of lettuce were significantly affected by compost fertilizer and mineral nitrogen combination treatments after 10, 20 and 30 days from transplanting. The highest values of fresh weight was obtained when application of 100 % mineral fertilizer alone after 10, 20 and 30 days from transplanting. It was worth to mention that application of 75 % mineral nitrogen + 25 % compost fertilizer ranked after application of 100 % compost fertilizer with little differences. Application of 50 % mineral nitrogen + 50 % compost fertilizer ranked after previously mentioned treatment followed by application of 25 % mineral nitrogen + 75 % compost fertilizer after 10, 20 and 30 days from sowing. On the other hand, the lowest fresh weight of lettuce were resulted from application control followed by 100% compost alone after 10, 20 and 30 days from sowing. These increases of fresh weight of lettuce due to increase ratio of mineral fertilizer in combination treatments which might be due to the favorable impact of mineral fertilizer on soil hydro physical, physico - chemical, biological and nutritional properties of the treated soil, consequently improvement chemical composition and growth of lettuce. Sanchez *et al.* (1989) reported that the increases in yield in lettuce plants related to bio-fertilizer due to the beneficial effects of the bacterial not only due to their N_2-fixation capacity, but also because of their ability to produce antibacterial and antifungal compounds, growth hormones and siderophores. Also, there are many workers presented the increases in yield obtained as a results of different biofertilizers inoculation such as Azcon *et al*., (1996) on lettuce; El-Gamal (1996) on potatoes and Wange (1996) on carrot.

NO_3 concentration

Data in Table (3) showed that the values of NO_3 in lettuce were significantly affected by compost fertilizer and mineral nitrogen combination treatments after 10, 20 and 30 days from transplanting. The highest value of NO_3 was obtained when application of 100 % mineral fertilizer alone after 10, 20 and 30 days from transplanting. It is of worth to mention that application of 75 % mineral nitrogen + 25 % compost fertilizer ranked after application of 100 % compost fertilizer with little differences. Application of 50 % mineral nitrogen + 50 % compost fertilizer ranked after previously mentioned treatment followed by application of 25 % mineral nitrogen + 75 % compost fertilizer after 10, 20 and 30 days from transplanting. On the other hand, the lowest values of NO_3 of lettuce were resulted from application control followed by 100% compost alone after 10, 20 and 30 days from transplanting. These increases of NO_3 of lettuce due to increase ratio of mineral fertilizer in combination treatments which might be due to the favorable impact of mineral fertilizer on soil hydrophysical, physico – chemical, biological and nutritional properties of the treated soil, consequently improvement chemical composition and growth of lettuce.

Ahmed *et al*. (2000) found that significant decreases in nitrate accumulation when the lettuce plant treated with bio-fertilizers, specially those plants treated with nitrobien, biogien and rizobactrein. Also, Hosseny and Ahmed (2009) had the same results using nitrogen sources, organic and biofertilizationon productivity of lettuce (cv. romaine) in sandy soil.Williams (2002) reported lower nitrate content in organically fertilized crops, particularly leafy vegetables and Vogtmann *et al.* (1993) showed lower nitrate concentration in cabbage withorganic fertilization compared with mineral fertilized crops . Hajislova *et al.* (2005) and Malmauret *et al*. (2002) reported lower nitrate concentration in organic potato and tomato, compared with mineral fertilized crops. The same results were confirmed by Ahmed (1997) who reported that biofertilizer treatments can lower nitrate concentration in Jew's mallow and radish plants while sugars, amino acids and several lower nutrient concentrations were higher. Maynard *et al*. (1976) showed that low nitrate content in edible part of the plants is very important for human health, due to its potential transformation to nitrites which have the highest possibility to interact with hemoglobin and affect blood oxygen transportation (Causeret, 1984

Table (3): Nitrogen, phosphorus and potassium percentages, head diameter, dry and fresh weight and NO_3 contents of lettuce as affected by compost fertilizer in single or with mineral nitrogen fertilizer at different periods from transplanting

Characters / Treatments	N	P	K	Dry weight (g)	Diamter (cm)	Fresh weight (g)	NO_3 Contents (mg/Kg)
	(%)						
10 days							
Control	1.70	0.167	1.90	13.66	4.10	27	131.0
100 % mineral	2.13	0.210	2.13	14.63	18.66	86	446.8
25 % mineral + 75 % compost	2.26	0.233	2.30	16.31	21.50	74	152.1
50 % mineral + 50 % compost	2.53	0.280	2.56	17.48	24.80	69	224.4
75 % mineral + 25 % compost	2.66	0.280	2.66	18.12	21.83	81	341.8
100 % compost	2.93	0.303	2.93	18.82	18.56	79	145.2
F. test	*	*	*	*	*	**	**
LSD at 5 %	0.21	0.016	0.13	0.39	4.33	12.41	4.81
20 days							
Control	2.46	0.267	2.70	15.61	14.83	44	462.0
100 % mineral	3.00	0.287	2.73	19.37	45.33	147	161.2
25 % mineral + 75 % compost	3.16	0.310	2.86	20.05	41.00	133	240.0
50 % mineral + 50 % compost	3.53	0.327	3.00	23.47	45.66	137	354.2
75 % mineral + 25 % compost	3.66	0.380	2.96	24.45	54.33	127	157.9
100 % compost	3.80	0.390	3.10	28.00	62.00	114	462.0
F. test	*	*	*	*	*	**	**
LSD at 5 %	0.19	0.015	0.10	0.47	10.55	10.01	11.65
30 days							
Control	3.53	0.353	3.26	22.27	19.66	62	133.0
100 % mineral	3.60	0.370	3.36	24.37	46.33	244	499.2
25 % mineral + 75 % compost	3.80	0.410	3.50	26.16	68.00	213	178.8
50 % mineral + 50 % compost	3.93	0.420	3.56	29.38	59.66	222	252.6
75 % mineral + 25 % compost	3.96	0.453	3.66	31.44	61.33	211	369.8
100 % compost	4.13	0.467	3.76	35.27	71.33	217	168.0
F. test	*	*	*	*	*	**	**
LSD at 5 %	0.16	0.022	0.14	0.42	10.77	18.86	5.93

Effect on Nitrogenase activity:

Nitrogenase (N_2-ase) activity was determined in rhizosphere area of lettuce roots after 10, 20 and 30 days from transplanting as an indication of N_2-fixers activity. Data in Table 4 showed that application of 50 % mineral nitrogen + 50 % compost fertilizer had the highest records of N_2-ase activity after 10 days from transplanting than other studied treatments. It is clear that, N_2-ase activity was decreased and registered the lowest value when application of 50 % mineral nitrogen + 50 % compost fertilizer after 30 days from sowing. Lower values of N_2-ase activity may be due to the inhibition of N_2-ase activity by application of 50 % mineral nitrogen + 50 % compost fertilizer and delay time from application.

High records of N_2-ase activity were observed as a resulted of early time (10 days from sowing) of application 100 % mineral, 25 % mineral + 75 % compost, 50 % mineral + 50 % compost and 75 % mineral + 25 % compost fertilizer. This result proved the importance of early time of application which supports the N_2-fixers in composting process. In general, the obtained data showed that increase percentage of compost in combined fertilization treatments caused decreases in N_2-ase activity.

This result is in agreement with Anne-Sophie *et al*. (2002) who found that the addition of NH_4NO_3 decreased the nitrogenase activity. Zaghloul *et al*. (2007) found that inoculation with *Azotobacter chroococcum* individually or in combination with biocontrol agents *Trichoderma harzianum* and *Bacillus subtilis* significantly increased N_2-ase activity compared to un-inoculated under organic treatments. Also, Ahmed (2012**)** showed that organic matter plays an important role in protecting and maintaining compost enzymes in their active forms.

Table (4): Nitrogenase activity (µmole C_2H_4 100 g^{-1} day^{-1}) addition in rhizosphere area of lettuce roots as affected by compost fertilizer in single or with mineral nitrogen fertilizer after 10, 20 and 30 days from transplanting

Treatments \ Characters	After 10 days from transplanting	After 20 days from transplanting	After 30 days from transplanting
Control	104.07	177.05	386.41
100 % mineral	337.76	107.79	115.29
25 % mineral + 75 % compost	305.61	127.08	193.56
50 % mineral + 50 % compost	400.78	79.30	24.96
75 % mineral + 25 % compost	240.65	61.34	99.12
100 % compost	170.12	178.70	105.22

Effect on total microbial counts:

Data in Table (5) showed the densities of total count of bacteria, fungi, phosphate dissolving fungi, cellulolytic fungi and *Azotobacter* chrococcum after 10, 20 and 30 days from transplanting.

After 10, 20 and 30 days from transplanting as shown in Table 5, the obtained results revealed that application 100 % compost gave the highest values of all microbial counts. On the other hand, control treatment gave the lowest records of the total microbial counts. Data showed that increasing compost percentage in combined fertilization treatments increased the total count of bacteria, fungi, phosphate dissolving fungi, cellulolytic fungi and *Azotobacter* chroococcum , hence higher records were observed by application of 100 % compost treatment. On the other side, the lowest records were resulted from control treatment after 10, 20 and 30 days from transplanting. The increases in microbial counts are due to the releasing nutrients in soil by bio-compost addition. The positive effect may be due to the decrease of various nutrients in the used sandy soil, organic matter favored content the reproduction of bacteria and other organisms, it serve as a source of energy for the development of microorganisms and supply certain essential nutrients elements and compounds required by microorganisms. Data are in harmony with those obtained by Hawka et al., (2010). These results are in agreement with those recorded by Ishii *et al*. (2000), As well as

Rynk and Richard (2001) and Beck - Friis *et al.* (2003) revealed that the adding of inocula to compost is intended to eliminate the native microbial population to grow and develop.

Table (5): Log number of total count of bacteria, fungi, phosphate dissolving fungi, cellulolytic fungi and *Azotobacter* as affected by compost addition in single or with mineral nitrogen fertilizer in rhizosphere of lettuce plants

Treatments \ Characters	Total count of bacteria (cfu $^{g-1}$ soil)	Total count of fungi (cfu $^{g-1}$ soil)	Count of phosphate dissolving fungi (cfu $^{g-1}$ soil)	Count of cellulolytic fungi (cfu $^{g-1}$ soil)	Count of Azotobacter chroococcum (cfu $^{g-1}$ soil)
10 days					
Control	3.230	4.477	1.477	1.301	2.204
100 % mineral	4.342	5.000	2.602	1.447	2.204
25 % mineral + 75 % compost	4.491	5.204	3.301	1.505	3.301
50 % mineral + 50 % compost	5.518	5.602	3.903	2.204	3.447
75 % mineral + 25 % compost	5.662	6.380	4.204	2.556	3.491
100 % compost	5.799	6.380	3.602	3.612	3.544
20 days					
Control	3.819	4.903	2.301	2.204	3.301
100 % mineral	5.176	5.176	2.204	3.556	3.301
25 % mineral + 75 % compost	5.113	6.301	4.380	3.612	3.491
50 % mineral + 50 % compost	6.176	6.4913	3.447	3.612	3.544
75 % mineral + 25 % compost	6.230	6.556	2.602	4.361	3.602
100 % compost	6.041	6.602	2.681	4.431	4.602
30 days					
Control	4.740	5.079	3.903	2.301	3.361
100 % mineral	5.886	5.301	2.380	3.568	3.431
25 % mineral + 75 % compost	5.819	6.447	2.491	3.653	3.556
50 % mineral + 50 % compost	7.361	6.531	3.690	3.653	3.568
75 % mineral + 25 % compost	7.568	5.602	1.806	4.602	4.653
100 % compost	7.785	6.681	1.706	4.653	4.653

Effect on chemical and physical properties of soil:

Data presented in Table (6) revealed that, using a combinations between mineral fertilizers and compost increased all physical and chemical properties of the soil such as available macro-elements (N, P and K) and chemical analysis (pH, E.C and O.M %) as compared with the control treatment (without fertilization) at all stages of growth. Data showed that the best values of pH, EC and O.M were obtained in treatments received 100% bio-compost. Moreover, the highest values of physical and chemical properties of the soil were obtained with compost treatment. Compost as organic fertilizer plays an important role in maintaining soil fertility with releasing nutrients in the soil. Several investigators reported the positive effect of applying organic fertilizer on the soil (El-Bordiny *et al.* 2003, El-Etr, 2004 and Mohamed and Hussein, 2005). They also, ascribed to the mineralization of N from compost during its composition and might be the biological fixation of atmospheric N and its reflection on soil fertility.

Such increase causes an enhancement of plant growth and mineral nutrients uptake and translocation or partially due to that sugar acts as an osmoregulator in plant cell, the process that participates in enhancing mineral uptake and translocation in plants and consequently the higher concentration of mineral in plant tissues (Brown *et al.,* 1993).

Table (6): Chemical properties of the sandy soil as affected by compost fertilizer in single or with mineral nitrogen fertilizer at different periods from transplanting

Characters / Treatments	Available (mg/kg)			O. M%	pH (1:2.5)	E.C (dS m^{-1})
	N	P	K			
10 days						
Control	105.0	5.50	46.80	0.08	9.02	0.43
100 % mineral	113.8	7.4	50.47	0.08	9.01	0.46
25 % mineral + 75 % compost	111.2	6.3	49.66	0.13	9	0.49
50 % mineral + 50 % compost	114.1	6.9	50.2	0.18	8.55	0.53
75 % mineral + 25 % compost	110.8	7.1	50.3	0.23	843	0.58
100 % compost	112.1	7.2	50.2	0.28	8.21	0.63
20 days						
Control	103.0	4.50	44.80	0.07	9	0.41
100 % mineral	115.63	7.3	50.6	0.14	8.55	0.48
25 % mineral + 75 % compost	116.98	8.1	50.8	0.17	8.44	0.57
50 % mineral + 50 % compost	117.32	9.4	53.2	0.22	8.11	0.66
75 % mineral + 25 % compost	117.88	7.9	54.1	0.23	8.01	0.71
100 % compost	117.89	9.2	54.7	0.27	8.00	0.81
After harvest						
Control	101.0	3.50	38.80	0.07	09.02	0.44
100 % mineral	117.23	9.33	55.32	0.47	8.21	0.81
25 % mineral + 75 % compost	118.38	11.41	56.24	0.53	8.11	0.78
50 % mineral + 50 % compost	119.21	12.43	58.38	0.49	7.97	0.84
75 % mineral + 25 % compost	119.55	13.78	61.81	0.39	8.01	0.58
100 % compost	119.87	14.21	62,03	0.61	7.63	0.78

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تأثير الكمبوست الحيوى لقش الأرز على النمو والتركيب الكيماوى لنبات الخس وعلى الخواص الكيميائية والحيوية للتربة الرملية المستصلحه .

عبدالله العوضي ابراهيم سليم[1]، وسام الدين إسماعيل على صابر[2]و المعداوى جمعه عطوة قدرة[1]
قسم الميكروبيولوجيا - كلية الزراعة- جامعة المنصورة [1].
وحدة النشاط الميكروبي قسم بحوث الميكروبيولوجيا الزراعية- ا معهد بحوث الأراضى والمياه والبيئة ، مركز البحوث الزراعية- الجيزة- مصر [2].

أجريت هذه التجربة في قرية الزعفران محافظة كفر الشيخ (شمال الدلتا) , مصر في ظل ظروف طبيعية باستخدام تربة رملية من أراضي بلطيم لدراسة تأثير السماد الحيوى (كمبوست قش الأرز المحسن بإضافة البكتريا المثبتة للنيتروجين الجوي والفطريات المحللة للسليولوز وكذا المذيبة للفوسفات) المنفرد أو المضاف مع السماد النيتروجيني على التركيب والنمو الكيماوي لنبات الخس الكابوتشى وايضاعلي صفات التربة الكيميائية والبيولوجية حيث تم إضافة الكمبوست والأسمدة المعدنية للتربة أثناء إعدادها للزراعة و زرعت الشتلات في أكياس واستمرت التجربة لمدة 30 يوم وتمت دراسة تأثير تلك الأسمدة بعد 10 و 20 و 30 يوما من الشتل، أيضا درس التركيب الكيميائي والبيولوجي للتربه الرملية.

أظهرت الدراسة أن عناصر النيتروجين والفسفور و البوتاسيوم وأيضا المادة العضوية ودرجة الملوحة ودرجة الحموضة بإضافة 100% كمبوست سجلت أعلى النتائج كما أظهرت الدراسة أن إضافة 100% كمبوست أعلى قيمة للوزن الطازج والوزن الجاف وقطر نبات الخس وأيضاً أعلى قيمة للمجاميع الميكروبية فى التربة. أظهرت الدراسة أن أعلى قيمة لعناصر النيتروجين والفسفور و البوتاسيوم فى التربة بعد 30 يوما سجلت 4.13 ، 0.467 و3.76 ٪ عند اضافة 100 ٪ كومبوست قش الأرز مقارنة بالأسمدة المعدنية (3.53 ، 0.353 و 3.26 ٪) على التوالي ، كما أظهرت الدراسة أن النباتات المعاملة 50 ٪ تسميد معدنى + 50 ٪ كمبوست قش أرز سجلت أعلى قيمة من نشاط انزيم النتروجينيز بعد 10 أيام من الزراعة مقارنة بالمعاملات الأخرى ، انخفضت هذه القيم بعد 30 يوم من الشتل.

ومن هذه الدراسة يمكن التوصية باستخدام 100 % كمبوست قش الأرز لتحسين التركيب الكيميائي وزيادة الإنتاج لنبات الخس، ولتحسين خواص التربة الكيميائية والبيولوجية و الحد من استخدام التسميد المعدنى حماية للبيئة من التلوث ومحافظة على صحة الإنسان.