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MAXIMIZING UTILIZATION OF COMPOST ADDITION USING FOLIAR COMPOST EXTRACT AND HUMIC SUBSTANCES IN ALLUVIAL SOIL

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ABSTRACT

Two field experiments were carried out in clay soil at the experimental farm of Gemmeiza Agriculture Research Station (Middle Delta, Egypt). during the two successive winter seasons of March 2007 and March 2008, to investigate the possibility of spraying compost extract and humic substances as foliar appliocation for maximizing the soil compost addition. For that purpose, kidney bean (*Phaseolus vulgaris*, L.) was planted in two successive seasons. The compost was added to all treatments except the control (100% mineral nitrogen fertilizer). Both compost extract and humic substances were added each alone twice or alternatively. The results clearly showed a positive effect of compost extract and humic substances on all plant growth parameters. The superior treatment was when compost extract was sprayed alternatively with humic in present of 75% of mineral nitrogen fertilizer with 10 Ton/fed of compost as soil addition, the following treatment was spraying of compost extract alone with 75% of mineral nitrogen fertilizer plus (10 Ton/fed) of compost addition. Generally, results pointed that usage of compost extract and humic as foliar application maximized the utilization of soil compost addition.

Keywords: Compost, compost extract, humic, nitrogen fertilizer level, *(Phaseolus vulgaris, L.).*

INTRODUCTION

The most important goal of agriculture is the production of high quantity and quality, safe and nonexpensive food for an ever increasing worldwide population. With the increasing problems associated with the use of synthetic chemicals in agriculture (impacts on health and the environment, resistance development in plant pathogens and pests, etc.) there has been an ever –increasing interest in the use of beneficial microorganisms to improve plant health and productivity while ensuring safety for human consumption, and protection of the environment, particularly for the developing countries (Avis *et al.*, 2008).

Natural and organic products rapidly developed as human awareness and need in healthy life increase. Recently, there are a lot of organic products has been produced by organic farmers such as organic rice and organic vegetables. This food product can be an alternative for modern life to change food pattern from chemical substance into organic one to decrease its negative impact caused by chemical substance. In organic agriculture

nutrients returned to the soil in manures and composts have to be cycled via the biological life of the soil before they become available to crops (Hodges, 1981).

Composting is a biological process in which organic biodegradable wastes are converted into hygienic, humus rich product (compost) for use as a soil conditioner and an organic fertilizer (Fatmaa, 2008). These are also used to provide biological control against various plant pathogens (Hoitink and Grebus, 1994). Compost extract is a centuries old technique in which compost is suspended in a barrel of water for 7 to 14 days, usually soaking in a sack (Diver, 2002). The primary benefit of the extract is to provide a supply of nutrients that can be used as a liquid fertilizer. Compost tea has been defined simply as a liquid extract from composted material that contains organic and soluble nutrients and a large number of organisms including bacteria, fungi, protozoa and nematodes (ROU, 2003b).

Compost tea is a compost extract that is brewed with a microbial food source such as (molasses, kelp, rock dust, humic-fulvic acids and others). The compost tea brewing technique (aerobic or anaerobic) extracts and grows populations of beneficial microorganisms (Ingham, 2005;Scheuerell, 2003 and Scheuerell, 2002).

Humic substances are an operationally defined, heterogeneous mixture of organic materials (MacCarthy *et al.*, 1990). They are soluble components of soil humus extracted in an alkaline solution. These materials are found in all terrestrial and aquatic environments (Aiken *et al.*, 1985), and are formed as plant and animal residues decompose. Different organic materials and compounds combine during the formation of these molecules, making their formation variable and misunderstood. Because of humic substances abundance and variability of formation in the environment their chemical nature can be dependent on a number of factors, often making them long chained molecules with their shape and solubility dependant on pH of the ecosystem (Piccolo *et al.*, 1996)

The present investigation aims to maximizing the soil compost utilization by spraying compost extract and humic substances on kidney bean plants.

MATERIALS AND METHODS

This investigation was conducted to evaluate particularly replacement of mineral nitrogen fertilizer by addition of compost to soil. In the same time, spraying compost extract or humic substances alone or alternatively for maximizing the utilization of compost. For that purpose, kidney bean (*Phaseolus vulgaris*, L.) was planted in the two successive seasons.

Compost preparation: The compost production was conducted at the farm of Agricultural Research Center, Gimmeza. Rice straw was obtained from Agricultural Research Center, Gimmeza and chopped into segments of 2-5 cm in length by using the thrashing machine. Farm yard manure was collected from Animal Research Center, Gimmeza. 1 ton of rice straw was taken for preparation the heap. Farmyard manure was used as source of nitrogen and carbon was calculated to give a C/N ratio of about 20:1. 1 ton of

compostable material (on dry weight basis) for each treatment was thoroughly mixed and moisture was adjusted to 60% of water holding capacity (WHC). The material was allowed to decompose. The contents were turned weekly and moisture was maintained to 60% of WHC throughout the decomposition period.

Chemical analyses including organic matter (O.M), total carbon (T.C), total nitrogen (T.N), C/N ratio, pH and E.C were carried out, Table (1).

Table (1): Chemical analysis of produced compost:

Compost properties	1st season	2nd season
pH (1:10)	7.1	7
EC (1:10), dS m-1	2.01	2.2
Total moisture %	32.5	33
BD (g/cm3)	0.61	0.61
Total nitrogen %	2.1	2.3
Total phosphorus %	0.73	0.77
Total potassium %	0.84	0.87
Organic matter %	47	48
Organic carbon %	27.3	27.85
C/N ratio	13:1	12.1 : 1
Ash %	52	53

Compost extract preparation:

1 Kg of maturing compost was taken and blended with tap water in dilution ratio 1: 10 (w/v), one kilogram of compost was put in plastic tanks and soaked into 9 liter of tap water. Then the mixture was turned daily and filtrated after 10 days. One liter of this compost extract was diluted by tap water in 1:10 ratio (v/v). Main characters of compost extract used are shown in Table (2).

Table (2): Main characters of compost extract used:

Properties	1st	2nd
pH (1:10)	7.42	7.55
Ec (1:10), dS m-1	1.01	1.11
Total nitrogen %	2.04	2.30
Total phosphorus %	0.71	0.77
Total potassium %	0.75	0.79
Organic carbon %	19.58	22.32
Organic matter %	33.76	38.48
C/N ratio	9.59	9.70

Humic substances used:

Humic is active ingredient of actosol product, the natural organic fertilizer used contain 1: 5: 6 (%) N, P, K and 20% humic acid, commercially known as potash actosol® and manufactured by Arctick Inc., chentilly, VA, USA.

Field experiments:

Kidney bean (*Phaseolus vulgaris*, L.) experiment:

Kidney been (*Phaseolus vulgaris*, L.) was planted at a private farm at Aiaash, El-Mahalla El-Kobra, El-gharbia Governorate, Egypt, during the two

successive winter seasons of March 2007 and March 2008. Physical and chemical properties of experimental soil were determined and recorded in Table (3).

Table (3): Some physical and chemical properties of the kidney bean soil experimental:

Soil characteristics	Values	
	1st season	2nd season
Particle size distribution		
Coarse Sand %	3.5	4.0
Fine Sand %	13.67	9.1
Silt %	22.7	25.3
Clay %	60.13	61.6
Texture Class	Clay	Clay
Physico properties		
pH (on suspension)	7.6	7.4
EC dSm^{-1} (extract 1:5)	2.0	1.2
CEC meq/100g soil	50.7	51.0
$CaCO_3$ %	4.5	3.84
OM %	1.94	2.00
SP (saturation %)	98	98
Bulk Density (g/cm^3)	1.13	1.23
Real Density (g/cm^3)	2.62	2.62
Soluble Cation (meq/L soil past)		
Ca^{++}	2.0	3.3
Mg^{++}	1.5	1.1
K^+	0.4	0.4
Na^+	10.9	6.4
Soluble Anion (meq/L soil past)		
CO_3^-	0.00	0.00
HCO_3^{--}	3.0	4.0
Cl^-	7	4.0
SO_4^{--}	2.84	3.2
Available nutrients (ppm)		
Nitrogen (N)	21.7	29.7
Phosphorus (P)	14.6	15.8
Potassium (K)	414	490

Fertilizers used:

- Ammonium sulfate (21% N) was used as a source of nitrogen (200 kg N /fed).
- Potassium sulfate (48%K_2O) was used as a source of potassium (100 kg K / fed).
- Super-phosphate (15.5% P_2O_5) was used as a source of phosphate (200 P_2O_5/ fed).
- Compost was added in two rates, 10 and 5 ton/fed before 15 days from planting seeds.
- Both of compost extract or humic substances was sprayed twice, the 1st one after full growth plants, the 2nd one after 2 weeks from first spray. But the treatment which recieved compost extract and humic substances alternatively, with compost extract applied after full grown plants, whereas

humic substances was applied after 14 days from applying compost extract.

Sowing and Harvesting processes:

Kidney bean (*Phaseolus vulgaris*, L.) variety Giza 6 was planted in March 1, 2007, and harvested in July 8, 2007, that in 1st season. Whereas in 2nd season seeds were planted in March 3, 2008, and harvested in July 5, 2008.

Compost and soil analyses:

pH value was determined in the compost water mixtures of (1:10), using a pH glass electrode according to Jodice *et al.* (1982). Electrical conductivity (EC) was measured in (1:10) compost extract as described by Richards (1954). Total carbon (TC%) was determined by Walkly and Black method as described by Hesse (1971). Organic matter (OM%) was calculated by the determination of total carbon (C%) according to Walkly and Black method as described by Hesse (1971) and multiplying the result by 1.724. Total nitrogen (TN%) was determined using the conventional method of Kjeldahal (Jackson,1967). C/N ratio was calculated molecularly by dividing each determination on its molecular weight, *e.g.*, C/12 and N/14,then the obtained values of both C and N were divided (C/N). Total phosphorus (%) was estimated colorimetrically using the chlorostannus-reduce molybdo phosphoric blue colour method and determined at the wave length of 650 nm using spectrophotometer as described by Jackson (1967). Total Potassium (%) was determined using a flame photometer as described by Jackson (1967). Bulk densities of compost and soil were determined using the core method according to Vomocil (1965).

Statical design and analysis:

A complete randomized blocks plot design with three replicates was adopted and data were statistically analyzed.

RESULTS AND DISCUSSION

The discussion will include the effect of compost application and foliar application of compost extract and humic substances on yield and chemical constituents of N, P and K and their uptakes.

1- Plant Growth parameters:

Plant fresh weight and shoot heights:

Data in Table (4) showed that the superiority of fertilizer treatment for fresh weight and plant height of kidney bean was associated with 75% of recommended does of mineral nitrogen fertilizer combined with 10 ton/fed of compost and compost extract alternatively with humic substances spraying on plants, followed by application of compost extract by spraying on plants. Also, the addition of humic substances spray on plants resulted in a positive effect on fresh weight .These results are agreeable with those obtained by Ouda (2000); Youssef *et al.* (2001); Radwan and Awad (2002); Dakhly *et al.* (2004); Shaban (2005); Vega *et al.* (2005) and Selim *et al.* (2007) who reported that the increases in the dry weight of tomato noticed with application of chicken manure having beneficial effects on physical, chemical

and biological properties of the soil which in turn increases plant growth and production. On the other hand, Zhang and Ervin (2004) reported that foliar application of humic substances contain cytokinins and their application resulted in increasing endogenous cytokinin and auxin levels which possibly leading to improve yield. Also, Abd-Elhameed (2008) reported that the plant growth of pea which treated with compost tea was positively affected due to spraying compost tea compared with the control treatment.

Table (4): Effect of mineral nitrogen fertilizer, compost, humic substances and compost extract on total fresh weight and plant height of kidney bean in first and second season:

Treatments			Fresh weights (g/plant)		Plant height (cm)	
			1st season	2nd season	1st season	2nd season
Control (100%mineral N)			277.60 h	319.61 d	64 f	66.67 h
75% mineral	10 Ton/fed compost	Humic	513.09 c	742.56 a	75.67 b	82 b
		Extract	563.46 b	798.45 a	78 a	82.67 b
		*Humic/ Extract	596.23 a	816.76 a	79.33 a	84.67 a
	5 Ton/fed compost	Humic	424.03 de	572.72 bc	68.33 d	71.67 de
		Extract	428.5 de	581.85 bc	69.33 d	73 d
		Humic/ Extract	437.48 d	628.09 b	73.67 c	78.67 c
50% mineral	10 Ton/fed compost	Humic	395.49 f	533.19 bc	67.67 de	69.67 efg
		Extract	405.86 ef	551.65 bc	68.33 d	69.67 efg
		Humic/ Extract	429.55 de	566.81 bc	68.33 d	71 def
	5 Ton /fed compost	Humic	365.05 g	429.29 cd	65.33 ef	67.67 gh
		Extract	370.11 g	477.38 bc	66.67 de	67.67 gh
		Humic/ Extract	394.83 f	509.75 bc	67.33 de	69 fgh
LSD 5%			8.715	53.428	0.943	0.889

*** Humic substances were alternated with compost extract.**

Fresh and dry weights of shoots:

The obtained results in Table (5) indicate that, the highest fresh and dray weight was recorded by using humic substances plus compost extract spraying on plants with 10 ton/fed in case of addition 75% of recommended dose of mineral nitrogen fertilizer as compared with control. The obtained results are closely between foliar application effect of humic substances and compost extract on plants. Similar results were reported by El-Dossoky (2005); Tartoura *et al.* (2005) and Abd El-Wahab *et al.* (2007) who demonstrated that foliar application of compost tea gave increasesing effect on shoot dry weight of chick pea plants as compared with the control treatment.

Fresh and dry weight and number of pods per plant:

It is evident from data in Table (6) that, fresh, dry weight and number of pods were affected by the addition of various sources of fertilizers. Data obtained revealed that, addition of 75% of recommended dose of mineral nitrogen fertilizer jointly with 10 ton/fed of compost plus spraying humic substances combining with compost extract led to the superior values of fresh, dry weight and number of pods in both seasons .

These effects of organic fertilizers may be related to the important role of nitrogen, phosphorus and potassium in the decayed plant tissues that reflect on vegetative growth, which plays vital role in photosynthesis,

carbohydrate transport, protein formation, control of ionic balance, regulation of plant stomata and water use activation of plant enzymes and other processes(El-Sawy *et al.*,2000; El-Dissoky,2008 and El-Shazly,2008). Also, Abd-Elhameed (2008) revealed that, spraying compost tea significantly increased fresh pod weight of pea compared with untreated treatment. From previous data, it can be noticed that application of compost fertilizer, compost extract and humic substances spraying on plants led to reducing rate of mineral nitrogen fertilizer and also increasing the yield of kidney been crop.

Table (5): Effect of mineral nitrogen fertilizer, compost, humic substances and compost extract on fresh and dry weight (g/plant) of kidney bean shoot in the first and second seasons.

Treatments			Fresh weight of shoot		Dry weight of shoot	
			1st season	2nd season	1st season	2nd season
Control (100%mineral)			160.02 h	177.52 h	42.39 g	56.87 h
75% mineral	10 Ton/fed compost	Humic	271.81 c	457.17 bc	70.55 b	121.33 b
		Extract	305.82 b	498.78 b	73.30 b	128.08b
		Humic/ Extract	378.09 a	565.70 a	92.53 a	164.20 a
	5 Ton /fed compost	Humic	246.20 cd	363.22 def	62.55 cd	94.66 de
		Extract	248.14 cd	380.55 de	65.82 bc	100.33 cd
		Humic/ Extract	270.18 c	399.35 cd	69.92 b	106.76 c
50% mineral	10 Ton/fed compost	Humic	209.77 efg	263.58 gh	55.54 de	80.68 f
		Extract	220.03 ef	287.2 fg	57.81 de	86.24 ef
		Humic/ Extract	232.14 de	308.95 efg	58.84 cde	90.63 e
	5 Ton /fed compost	Humic	164.06 h	239.91 gh	42.19 g	61.29 gh
		Extract	184.80 gh	244.72 gh	46.36 g	66.33 g
		Humic+ Extract	195.52 fg	248.75 gh	50.85 ef	68.91 g
LSD 5%			10.029	30.225	2.873	3.366

Table (6): Effect of mineral nitrogen fertilizer, compost, humic substances and compost extract on fresh and dry weight, and number of pods (pod/plant) of kidney bean in the first and second season:

Treatments			Fresh weight of pods, g		Dry weight of pods, g		Number of pods	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
Control (100%mineral)			78.17 h	99.52 d	59.43 e	68.22 k	11.66 f	12.66 d
75% mineral	10 Ton /fed compost	Humic	167.91 c	207.52 bc	70.77 bc	94.11 bc	16 ab	17.66 ab
		Extract	185.40 b	218.41 b	72.42 b	95.02 ab	16.33 a	18 a
		Humic/ Extrac	203.12 a	290.10 a	76.73 a	96.81 a	16.66 a	18.66 a
	5 Ton/fed compost	Humic	138.89 e	171.83 bc	69.12 bcd	89.52 e	15.33 abc	16 bc
		Extract	150.31 de	186.37 bc	69.40 bcd	90.64 de	15.33 abc	16.33 bc
		Humic/ Extrac	154.87 d	201.77 bc	69.75 bcd	92.40 cd	15.66 abc	16.33 bc
50% mineral	10 Ton /fed compost	Humic	97.38 fg	153.53 c	66.88 cd	81.43 gh	14.33 cd	15.33 c
		Extract	107.29 f	155.15 c	67.39 cd	82.94 fg	14.66 bcd	15.66 c
		Humic/ Extrac	136.14 e	162.48 c	67.85 cd	84.69 f	14.66 bcd	16 bc
	5 Ton/fed	Humic	86.83 gh	100.94 d	65.88 d	75.37 j	12.66 ef	14.33 c
		Extract	91.75 fgh	102.63 d	66.04 d	77.63 i	13.33 de	14.33 c

	compost	**Humic/ Extrac**	96.11 fg	102.77 d	66.47 cd	79.48 hi	13.33 de	14.66 c
LSD 5%			6.234	17.538	1.318	0.975	0.485	0.588

2- Chemical composition:

Nitrogen in shoot:

Data presented in Tables (7 and 8) generally show that the soil application for compost plus compost extract with humic substances treatment produced the high N content (%) and uptake (g/plant). While the lowest values were realized from the control treatment.

These positive effects of compost on N% and uptake may be due to the effect of compost on improving soil physical properties and availability of nutrients which reflected on root growth and vegetative growth and consequently on N content and its uptake by plant.

With respect to the compost extract and humic substances, foliar application of them may increased rooting, improve root strength and increase root mass by enhancing enzyme systems stimulated by the increasing respiration process and rate.

This effect was similar with that obtained by Korrany (2001) who suggested that improving N and other mineral uptakes caused by humic substances was nerely a secondary effect for improving root development, while Caco *et al.* (2000) suggested that humic substances are involved directly in switching on nitrate transport genes in the root.

Phosphours in shoot:

Data in Tables (7 and 8) indicated that the same direction of N (%) and its uptake was realized for the P (%) and its uptake. The maximum values of P (%) and its uptake (g/plant)) were obtained as a result of addition of 75% from mineral nitrogen fertilizer rate coupled with the compost as soil application at (10 t/fed) combined with the compost extract plus humic substances by foliar spry during the 1st and 2nd seasons, respectively. While the lowest values for P (%) were found in the control plants.

Data showed that the second best treatment was observed with spraying compost extract in single form followed by using humic substances as foliar spray. These results are agreeable with those obtained by Abd-Elhameed (2008) who reported that spraying of compost tea either in a single form or in combination with mineral fertilization led to a positive effect on N, P and K concentrations of pea plants and their uptakes (mg/plant).

Sinha (1972) reported that, during the decomposition of organic manure, organic acids are produced, which may influence the pH and available phosphorus or they may form complexes or chelates with other cations and thus releasing phosphorus.

Potassium in shoot:

It is obvious from data in Tables (7 and 8) that the addition of compost at rate of 10 ton/fed plus spraying compost extract alternatively with humic substances caused significant increases in K concentration and its uptake. On contrary, the lowest results were observed with entirely absence of organic fertilizer (control).

It was observed from the same table that the application of compost, compost extract and humic substances significantly increased the K% and its uptake comparing with control. Similar results were obtained by El-Dissoky (2005); El- Agamy (2006); Abd-Elhameed (2008) and Habib (2010).

Table (7): Effect of mineral nitrogen fertilizer, compost, humic substances and compost extract on N, P and K (%) of kidney bean shoot in the first and second seasons.

Treatments			N %		P %		K %	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
Control (100% mineral)			3.357 c	3.557 f	0.182 g	0.315 h	0.88 d	1.459 d
75% mineral	10 Ton /fed compost	Humic	4.134 b	5.031 abc	0.457 c	0.674 c	١.٣٣٢ab	1.713 abc
		Extract	4.137 b	5.287 ab	0.514 b	0.730 b	1.351 ab	1.749 ab
		Humic/ Extract	4.751 a	5.377 a	0.636 a	0.816 a	1.532 a	1.785 a
	5 Ton /fed compost	Humic	3.887 bc	4.744 bcd	0.312 ef	0.469 e	1.187 bc	1.622 abcd
		Extract	3.901 bc	4.977 abc	0.317 e	0.480 e	1.296 abc	1.622 abcd
		Humic/ Extract	3.964 bc	5.007 abc	0.380 d	0.583 d	1.314 abc	1.677 abc
50% mineral	10 Ton /fed compost	Humic	3.790 bc	4.529 cde	0.259 ef	0.373 fgh	1.097 bcd	1.568 bcd
		Extract	3.827 bc	4.597 cde	0.281 ef	0.391 fg	1.115 bcd	1.586 abcd
		Humic/ Extract	3.861 bc	4.687 cd	0.291 ef	0.415 f	1.115 bcd	1.604 abcd
	5 Ton /fed compost	Humic	3.461 c	4.081 e	0.234 fg	0.324 gh	1.042 cd	1.459 d
		Extract	3.567 bc	4.186 de	0.237 efg	0.333 gh	1.079 bcd	1.514 cd
		Humic/ Extract	3.575 bc	4.417 cde	0.239 efg	0.352 fgh	1.097 bcd	1.55 bcd
LSD 5%			0.178	0.187	0.024	0.024	0.080	0.059

Table (8): Effect of mineral nitrogen fertilizer, compost, humic substances and compost extract on N, P and K uptake(g/plant) of kidney bean shoot in the first and second seasons.

Treatments			N uptake		P uptake		K uptake	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
Control (100% mineral)			1.423 h	2.024 i	0.076 h	0.179 i	0.377 h	0.829 g
75% mineral	10 Ton /fed compost	Humic	2.923 bc	6.096 c	0.322 c	0.818 c	0.935 bc	2.075 b
		Extract	3.032 b	6.776 b	0.379 b	0.935 b	0.988 b	2.242
		Humic/ Extract	4.408 a	8.835 a	0.589 a	1.343 a	1.411 a	2.932 a
	5 Ton /fed compost	Humic	2.430 cde	4.488 ef	0.195 ef	0.444 ef	0.742 d	1.536 de
		Extract	2.566 bcde	4.994 de	0.208 e	0.482 e	0.851 c	1.628 cd
		Humic/ Extract	2.772 bcd	5.349 d	0.266 d	0.623 d	0.918 bc	1.791c
50% mineral	10 Ton /fed compost	Humic	2.105 efg	3.654 g	0.144 efgh	0.301 ghi	0.609 ef	1.265 f
		Extract	2.211 defg	3.968 fg	0.162 efg	0.337 fgh	0.644 de	1.369 ef
		Humic/ Extract	2.271 def	4.249 fg	0.171 efg	0.376 efg	0.655 de	1.453 def
	5 Ton /fed	Humic	1.460 h	2.502 hi	0.098 gh	0.198 i	0.439 gh	0.894 g
		Extract	1.654 gh	2.777 h	0.110 gh	0.221 hi	0.500 fg	1.0045 g

	compost	**Humic/ Extract**	1.817 fgh	3.043 h	0.121 fgh	0.242 hi	0.557 ef	1.068 g
LSD 5%			0.200	0.267	0.026	0.042	0.045	0.088

They concluded that the positive effect was due to soil organic manuring on availability and hence K concentration in plant cells because of inducing K utilization from such treated soils. Noteworthy referring that because K is not involved in plant organic compounds, it is so easy get free out of plant residues subjected to mineralization processes in soils. Similar results were obtained by Turkmen *et al.* (2004) who showed that humic applied increased nutrient contents in plants.

Nitrogen in seeds:

The influence of compost, compost extract and humic substances on N (%) and its uptake (g/plant) of kidney bean seeds was revealed in Tables (9 and 10) . It was cleared that application of 75% of mineral nitrogen fertilizer plus compost at 10 ton/fed plus compost extract jointly with humic substances gave the highest mean values of N (%).The optimum treatment for N % and its uptake was observed with control. Generally, the data showed that all organic treatments gave higher values than control (100% mineral).

These positive effects of compost on N% and its uptake may be due to the effect of compost on improving soil physical properties and availability of nutrients which reflected on root growth and vegetative growth and consequently on N content and its uptake by plant. This finding was similar with that obtained by Selim *et al.* (2007). Also, compost extract have positive effect on N concentration and its uptake because of the role of organic extracts which develop the root system of plant and improved nutrient uptake. In addition, compost extract contains many of macro and micro nutrients which areinvolved in leaves and reflected on seeds. In addition, humic substances increased cell membrane and are important for the transport and availability of micronutrients, nutrient uptake, stimulates seed germination and viability, oxygen uptake, respiration (esp. in roots) and photosynthesis, El-Gohary (2010). Similar results were obtained by El-Gahdben *et al.* (2002); Eghball *et al.* (2003); Ginting *et al.* (2003) and Abd El-Monium and Massoud (2009).

Phosphorus in seeds:

Data in Tables (9 and 10) indicated that the same direction of N content was realized for the P concentration and its uptake. The highest values of P concentration and its uptake were realized for the plants received the 75% of mineral nitrogen fertilizer coupled with the addition of 10 ton/fed of compost jointly with compost extract alternatively with humic substances as foliar application, followed by application of compost extract separately plus 10 ton/fed of compost plus 75% of mineral nitrogen fertilizer.While the control plants showed the lowest values. These results are in agreement with those obtained by Abd El-Monium and massoud (2009). Increasing P concentration and its uptake could be attributed to the effect of organic matter on soil phosphate to be more available for plants.

In addition, El-Ghamry *et al.* (2009) pointed out that humic substances are extremely important component because they constitute a stable fraction

of carbon, thus regulating the carbon cycle and release of nutrients, including nitrogen, phosphorus and sulfur which decrease the need for inorganic fertilizer for plant growth. Humic substances stimulate plant growth by the assimilation of major and minor elements, enzyme activation and/or inhibition, changes in membrane permeability, protein synthesis and finally the activation of biomass production.

Table (9): Effect of mineral nitrogen fertilizer, compost, humic substances and compost extract on N, P and K % of kidney bean grains in the first and second seasons.

Treatments			N %		P %		K %	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
Control (100% mineral)			4.241 d	4.351 d	0.297 c	0.356 d	0.603 e	0.680 d
75% mineral	10 Ton /fed compost	Humic	6.267 b	6.774 ab	0.512 b	0.807 b	0.898 ab	0.988 b
		Extract	6.887 a	7.074 a	0.860 a	0.929 a	0.916 ab	0.988 b
		Humic/ Extract	7.021 a	7.151 a	0.940 a	0.979 a	0.952 a	1.133 a
	5 Ton /fed compost	Humic	5.767 bc	6.341 abc	0.43 bc	0.550 c	0.825 abc	0.952 bc
		Extract	5.817 bc	6.627 abc	0.434 bc	0.700 b	0.88 ab	0.97 bc
		Humic/ Extract	5.831 bc	6.674 abc	0.505 b	0.795 b	0.88 ab	0.97 bc
50% mineral	10 Ton /fed compos	Humic	5.507 bc	6.087 bc	0.384 bc	0.463 cd	0.716 cde	0.915 bc
		Extract	5.564 bc	6.181 bc	0.401 bc	0.485 cd	0.771 bcd	0.916 bc
		Humic/ Extract	5.621 bc	6.321 abc	0.402 bc	0.506 cd	0.789 bc	0.934 bc
	5 Ton /fed compost	Humic	5.071 c	5.787 c	0.329 c	0.406 cd	0.626 de	0.825 c
		Extract	5.224 c	5.954 bc	0.339 c	0.423 cd	0.626 de	0.88 bc
		Humic/ Extract	5.284 c	5.957 bc	0.368 c	0.428 cd	0.716 cde	0.897 bc
LSD 5%			0.235	0.266	0.041	0.053	0.050	0.044

Table (10): Effect of mineral nitrogen fertilizer, compost, humic substances and compost extract on N, P and K uptake (g/plant) of kidney bean grains in the first and second seasons.

Treatments			N uptake		P uptake		K uptake	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
Control (100% mineral)			2.520 g	2.968 l	0.176 f	0.243 f	0.358 f	0.464 g
75% mineral	10 Ton /fed compost	Humic	4.435 c	6.371 abc	0.362 c	0.760 b	0.636 bc	0.929 b
		Extract	4.988 b	6.723 ab	0.623 b	0.883 a	0.664 ab	0.938 b
		Humic/ Extract	5.386 a	6.923 a	0.721 a	0.948 a	0.731 a	1.096 a
	5 Ton /fed compost	Humic	3.986 cde	5.676 de	0.297 cde	0.492 d	0.570 bcd	0.852 bcd
		Extract	4.037 cd	6.006 cd	0.301 cde	0.635 c	0.610 bc	0.879 bc
		Humic/ Extract	4.067 cd	6.168 bcd	0.352 cd	0.734 bc	0.613 bc	0.896 bc
50% mineral	10 Ton /fed compost	Humic	3.683 def	4.958 fgh	0.257 def	0.377 def	0.479 de	0.746 de
		Extract	3.748 def	5.126 efg	0.270 cdef	0.402 de	0.519 cde	0.760 de
		Humic/ Extract	3.810 def	5.348 ef	0.273 cdef	0.429 de	0.535 cd	0.791 cde

	5 Ton /fed compost	**Humic**	3.339 f	4.364 h	0.216 ef	0.305 ef	0.412 ef	0.621 f
		Extract	3.451 ef	4.622 gh	0.224 ef	0.328 ef	0.413 ef	0.683 ef
		Humic/ Extract	3.512 def	4.735 fgh	0.244 ef	0.340 ef	0.476 de	0.714 ef
LSD 5%			0.174	0.238	0.031	0.049	0.037	0.040

Potassium in seeds:

It was evidented from data in Table (9 and 10) that the addition of compost at rate of 10 ton/fed combining with 75% of mineral nitrogen fertilizer plus compost extract with humic substances gave the superior results of K% and its uptake.

The followed treatment was the application of compost extract combined with 10 ton/fed of compost with 75% of mineral nitrogen fertilizer. On the other hand, 100% mineral nitrogen fertilizer only (control) recorded the lowest values.

Similar observation was obtained by Abd El-Monium and massoud (2009), who reported that application of compost to wheat plants increased K content (%), the increase of total K content might be due to the positive response of wheat to compost as an organic matter where organic matter amendments can improve soil properties and crop quality as well as stimulating soil microbial populations and soil biological activity. In addition humic substances may have both physiological and biochemical properties, it has been demonstrated that plant growth and its chemical composition can be stimulated by low concentration of humic substances.

Concerning the compost extract, it contains many macro and micro nutrients in available form, natural hormones, cytokines, vitamins and antioxidants which be available for plant usage and so reflect on plant growth and its composition.

Generally, from the above mentioned results, it can be concluded that the application of compost either at rate of 10 or 5 ton/fed in combination with compost extract in alternatively with humic substances or usage both of them alone led to reducing addition of inorganic fertilizers.

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تعظيم الإستفادة من إضافة الكمبوست برش مستخلص الكمبوست والمواد الهيومية في أراضي رسوبية.

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أجريت تجربتان حقليتان خلال الموسم الشتوي مارس٢٠٠٧ و مارس ٢٠٠٨ على نبات الفاصوليا في أرض طينية في محطة البحوث الزراعية بالجميزة – وسط الدلتا – مصر لدراسة امكانية رش مستخلص الكمبوست و الهيوميك كسماد ورقي على النبات لتعظيم الاستفادة من الاضافة الأرضية للكمبوست. و أضيف سماد الكمبوست كاضافة أرضية لكل معاملات التجربة ما عدا معاملة الكنترول (١٠٠% تسميد معدني نيتروجيني) و كان اضافة كلا من مستخلص الكمبوست أو الهيوميك اما بمفرده (رشتين) أو في تبادل (الرشة الأولى مستخلص كمبوست و الثانية هيوميك).

أظهرت النتائج تأثير ايجابي لرش مستخلص الكمبوست و الهيوميك على كل قياسات النبات و أعطى رش مستخلص الكمبوست بالتبادل مع رش الهيوميك عند ٧٥% من التسميد النيتروجيني المعدني و عند اضافة الكمبوست بمعدل ١٠ طن/فدان أفضل النتائج تبعها معاملة رش مستخلص الكمبوست بمفرده مع ٧٥% من التسميد النيتروجيني المعدني مع ١٠ طن/فدان كمبوست للتربة.

عموما أشارت النتائج الى أن رش مستخلص الكمبوست و الهيوميك على النبات أدى لتعظيم الاستفادة من اضافة الكمبوست كسماد أرضي.

قام بتحكيم البحث

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