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Impact of Using Compost Bokashi Resulting from Recycling Kitchen Waste on Head Lettuce *(Lactuca sativa var. capitata* L.*)*Grown Organically at Home

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ABSTRACT

A pot experiment was conducted at the Experimental Farm of Environment& Bio-Agriculture Dept., Fac. Agric., Al-Azhar Univ., Nasr City, Cairo, Egypt, during the winter season of 2015 to study the impact of using compost bokashi resulting from recycling kitchen waste on head lettuce*(Lactuca sativa L. var. Capitata L.)*grown organically at home. After 30 days from add compost bokashi to pots filled with soil. Pots were cultivated with head lettuce plant. The experiment consisted of 4 treatments the full dose of fertilizer mineral T1 and three other treatments for compost bokashi : (1volume of compost bokashi : 4 volumes of soil T2) , (1volume of compost bokashi : 6 volumes of soil T3) , and (1volume of compost bokashi : 8 volumes of soil T4) . The use of these treatments once without spraying bokashi juice (liquid produced during the fermentation processand again with bokashi juice at a rate of 1 bokashi juice to 300 cm from water free of chlorine. Spraying was twice, the first after three weeks from transplanting, the second after seven weeks from transplanting.Results could be summarized as follows: The Treatment T2 led to increase the nitrogen, phosphorus, iron, copper, zinc and manganese soil content, while the Treatment T3 led to increase the potassium soil content which it was estimated after the addition of compost for 30 days and before planting directly.For the total number of aerobic bacteria outperformed all treatments on control, it was recorded 29.86 , 30.66and 29.70X 10^{5}C.F.U /g^{-1} of soil for each of the T1, T2 and T3, respectively.While the control treatment T1 recorded 16.93 X 10^{5} C.F.U/ g^{-1} of soil.As for the total number of fungi T4 recorded the highest value 170 x 10^{4} C.F.U/g^{-1} of soil. For the number of actinomycets. T2 recorded the highest value 166.3 X 10^{4} C.F.U/g^{-1} of soil. The treatment T2 (1 bokashi : 4 compost soil)without bokashi juice gave the highest value for each of the(plant fresh weight (g), head fresh weight (g), number of leaves / $head^{-1}$, head diameter (cm), and head dry weight (g/100g head fresh weight) over the control (full dose of mineral fertilizer). The foliar spray with bokashi juice decreased all vegetative growth, except number of leaves there was no significant difference between sprayed and non-sprayed plants. The treatment T2 without and with foliar application gave the highest value nitrate and chlorophyll content of head lettuce. The T1 Full dose of mineral fertilizer (control) was higher than all treatments for the head and the outer leaves of total count of aerobic bacteria without, with foliar application. With regard to the fungi counts of head lettuce plants results showed that there no significant differences as a result of spray or not to spray, as well as the interaction effect between them. The T1 full dose of mineral fertilizer (control) was higher than all treatments for the head and the outer leaves of total count coliform bacteria without, with foliar application. The results indicated that the absence both of salmonella and shigella bacteria on head and out leaves lettuce plants.
Keywords: EM Bokashi; kitchen waste; head lettuce;home cultivation and organic farming

INTRODUCTION

Food waste is an easily decomposed organic substance with high water, fat and sodium chloride content. Generally food wastes produce offensive odor and putrid juices that attract pests such as rodents, ants, cockroaches and flies (Powell, 2013). The kitchen waste include vegetable peels, plate waste, leftover foods, fruit peels and egg shells (Saravanan *et al.*,2013) . Egyptian Environmental Affairs Agency (EEAA) estimated the generation of Egyptian municipal solid waste with 0.3 to 0.8 kg a day per capita, with an annual growth of 3.4 % (Elfeki and Tkadlec, 2015). The main portion of the Egyptian solid waste is organic (kitchen waste) which forms about 56% of the total solid waste(Elfeki and Tkadlec, 2015). Sending food waste to landfill, where it is burned increases the environmental risks and reduce nutrients being recycled for agronomic use. It is also release methane into the atmosphere (Barnes, 2009). The improper disposal of these wastes in opened dump sites, water stream and drains has led to the contamination of water supplies which hinders Egypt's natural resources, the health and welfare of its people (Elfeki and Tkadlec ,2015) . On the other hand, the domestic level can recycle organic household waste into feed for small birds, as happens in some rural areas, or recycled through easy ways to compost and bokashi used in domestic agriculture (Barnes, 2009).

Bokashi is a Japanese term means 'fermented organic matter made by fermenting most of organic materials (such as solid olive waste and rice husks as Japanese standard) using effective microorganisms (EM), molasses and water for about two weeks and dried. (Xiaohou *et al.*, 2008). Bokashi Composting, using Effective Microorganisms, has been used at a household scale in a number of communities, with high levels of user satisfaction (Pontin *et al.,* 2002).Developed in the mid-1980's by Dr. TeroHiga, a Japanese Professor at the University of Ryukyus in Okinawa. His objective was to decrease the amount of chemicals being used in farming. This method has been used by many Asian countries for centuries in natural farming by culturing indigenous microorganisms (IM) or wild cultures. It is highly sustainable contributing to sequestering C in the soil and building soil rather than losing it to the air as CO_2. Bokashi composting system is a simple, decentralized organic waste treatment option that could play a significant role in reducing the volumes of food waste currently disposed of to landfill.

Recently, organic farming, has gained popularity toeliminate the negative impactsof chemical fertilizers on human health. Crops grown organically usually fertilized solely with organic fertilizers, such as green manures, farmyard manure, crop residues, commercial organic fertilizers or organic wastes. These components keep soil productivity, supply plant nutrients and help in combination with biological pest management to control insects, weeds and other pests (Polat *et al*., 2008; Hammad *et al*., 2011; Talgre *et al.,* 2012).

Vegetables are important source of food for the household. Although the actual quantity of carbohydrates, protein and fats may be limited in some cases, the real value of vegetables lies in minerals, vitamins and fiber present in fresh vegetables. (Nichols and Hilmi, 2009). Large volumes of crops can be obtained from very small areas of land, in the backyard (with good management practices), for example, onion yields 5kg m^{-2} and cabbage yields 4kgm^{-2} (90 days from planting) are achievable. Fresh vegetables are important part of the human diet and surplus vegetables usually find a ready market, and have the potential to provide a valuable new source of family income. (Nichols and Hilmi, 2009).

Head lettuce (*Lactuca sativa. L.)* is one of the most popular salad Vegetable crops in Egypt. It gains its important nutritive value from its high contents of particular vitamins such as A, B, B2, K, E and C, and of certain minerals such as Ca, Mg, K and Fe, in its edible leaves (Edrees, 2001).The nutritive value of lettuce is very high but rests largely upon a good content of minerals and a moderate storage of vitamins to the humane diet plus substantial amount of fiber and that of water. It is also contain protein, carbohydrate and vitamin C. Per hundred gram of edible portion of lettuce contains moisture 93.4 g, protein 2.1 g, fat 0.3 g, minerals 1.2 g, fibre 0.5 g, carbohydrates 2.5 g, calcium 310 mg, phosphorous 80 mg, iron mg, vitamin A 1650 I.U., thiamine 0.09 mg, riboflavin 0.13 mg and vitamin C 10 mg. It is usually used as salad with tomato, carrot, cucumber or other salad vegetables. It is often served alone or with dressing. Its nutritive value is not spoiled. Moreover, it is anadyne, sedative, diuretic and expectorant (Afroz, 2007).

The aim of this work is to investigate the impact of using compost bokashi resulting from recycling kitchen waste on head lettuce grown organically at home.

MATERIALS AND METHODS

A pot experiment was conducted at the Experimental Farm of Environ. & Bio-Agriculture Dept., Fac. Agric., Al-Azhar Univ., Nasr City, Cairo, Egypt, during the winter season of 2015to evaluate the impact of using compost bokashi resulting from recycling kitchen waste on head lettuce (cv.s. Dark Green) grown organically at home.

Seedlings

Seedlings of head lettuce*(Lactuca sativa L. var. Capitata L.)* (cv.s. Dark Green) were obtained from Horticultural Research Institute, Agric. Res. Center, Giza, Egypt. Seeds were sown on October 30, 2015. After 30 days from seed sowing healthy and uniform transplants were selected in the nursery to be transplanted into the pots. Physical and chemical analyses results of the experimental soil are presented in Table 1which were carried outaccording to Jackson (1973) and Page *et al*. (1982).

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

Parameters	Values
Particle size distribution	
sand %	69.90
Silt %	22.00
Clay %	8.08
Texture class	Sandy clay loam
Chemical properties	
pH 1:2.5 raw material: water (W/V)	7.60
EC (ds.m^{-1})	0.64
Soluble anions (meq/L)	
HCO_3^-	4.03
CL^-	1.00
SO_4^{-2}	1.37
Soluble cations (meq/L)	
Ca^{++}	2.73
Mg^{++}	1.23
Na^+	1.58
K^+	0.86
Micronutrients (ppm)	
Cu	0.75
Fe	5.20
Mn	12.20
Zn	3.03

Fertilization

- Mineral fertilizers(control treatment):

Recommended dose of NPK was added to the soil (control). Nitrogen was added as ammonium sulphate (20.5% N) at a rate of 200 kg fed.$^{-1}$,in two equal does after 3 and 7 weeks from transplanting. Phosphorus was applied as super phosphate 15 % P_2O_5 during soil preparation at a rate of 250 kgfed^{-1}.Potassium was added as potassium sulphate (48% K_2O) at a rate of 50 kg fed^{-1}.in two equal does after 3 and 7 weeks from transplanting.

- Bokashi Composting

The bokashi composting system includes three stages: preparation of the initiator (EM bokashi), fermentation food waste and fermented food waste buried in soil.

1- EM bokashi

EM bokashi prepared from adding water without chlorine (500 mL), molasses (8 mL) and EM (8 mL) to (4.7 kg) mixture 1:1 ratio of rice bran and animal manure. The Components are placed in garbage bag thick completely airtight, and left in a dark place for 15 days until ferments.Some properties of EM bokashi are shown in Table 2.

Table 2. Some chemical properties of EM bokashi (starter):

Parameters	Values
pH 1:10 raw material : water (W/V)	6.10
EC1:10 raw material:water(dSm-1)	5.00
Total N %	1.68
Organic matter (O.M) %	35.60
Organic carbon %	20.70
C/N ratio	12.3 : 1
Total phosphorus %	0.55
Total potassium %	1.17

2- Fermentation of food wastes

The steps were :

a -Food waste was divided into small pieces.

b -The food waste was mixed with EM Bokashi. The EM Bokashi: food ratio is 1: 33.
c -The mixture was added and compacted into a 30 L plastic bucket with a leachate collection system on the bottom, which has a tapto allow the liquid produced during fermentation to be drainedoff. The food waste was contained in an enclosed bucketfor a minimum 15 days in a low oxygen condition.
d - Excess liquid was regularly drained off. This liquid called abokashi juice.
e -The full bucket was sealed and left to ferment in a warm place out of direct sunlight for 14 days.

The bokashi juicewas used in spraying the leaves of the plant at a rate of 1: 300 liter of water in the two dates after 3 and 7 weeks from transplanting. Some properties of bokashi juice are shown in Table 3.

Table 3. Some chemical properties of bokashi juice

Parameter	Values
pH	4.80
Electrical conductivity (EC) µS/cm	22.00
Available N %	0.52
N-NH4 %	0.11
N-NO3 %	0.41
Available P %	0.28
Available K %	0.68

3- fermented food waste buried in soil

After 2 weeks , the fermented food waste (FFW), added to soil (Pot its capacity 10 kg. soil) at different rates are as follows (1 volume of compost bokashi : 4 volumes of soil T2) ,(1 volume of compost bokashi : 6 volumes of soil T3) and (1 volume of compost bokashi : 4 volumes of soil T4).

Experimental design:

Apot experiment was carried out in winter season of 2015.The treatments were arranged in a complete randomized pot design (each pot diameter was 25 cm and field with10 kg air dried soil) with five replicates as the following:

Without foliar application

T1 control, full dose of mineralfertilizer
T2 1 volume of bokashicompost : 4 volumes of soil
T3 1 volume of bokashicompost: 6 volumes of soil
T4 1 volume of bokashi compost: 8 volumes of soil

With foliar application

T1 control full dose of fertilizer mineral & Spray with bokashi juice
T2 1 volume of bokashi compost: 4 volumes of soil & Spray with bokashi juice
T3 1 volume of bokashicompost: 6 volumes of soil& Spray with bokashi juice
T4 1 volume of bokashicompost : 8 volumes of soil& Spray with bokashi juice

Harvesting:

After 75 days from transplanting heads were harvested at marketable stage.

Measurements:

weight g/ plant^{-1} , plant fresh weight (g), head dry weight (g/100g head The studied parameters were: number of leaves / head^{-1}, head diameter (cm), head fresh fresh weight), chlorophyll content in head lettuce leaves (Spad) using chlorophyll meter (Spad-501, Minolta co., Japan),Nitrate content (%) as reported by (Holty and Potworowski 1972).

The microbial load was count on samples collected of heads (edible part) and outer leaves for density estimation of colony forming units (CUF) of total count mesophilic aerobic bacteria using nutrient agar medium according to (Atlas, 2004), total counts of mesophilic fungi using Potato- dextrose agar medium after according to (Allen 1950), total counts of coliform group using Mac-Conekey's medium according to (Atlas, 2004) and total count of Salmonella and Shigella using Salmonella and Shigella agar medium according to (Atlas, 2004).

Statistical analysis:

The obtained results were statistically analyzed using analysis of variance (ANOVA) for the randomized complete block design (RCBD) according toGomez and Gomez (1984) by using means of “SAS” computer software package (2006). Means of treatments were compared using Duncan's multiple range tests at 5 % level of probability as described by Duncan (1955).

RESULTS AND DISCUSSION

Data in Table 4 showthe effect of addition bokashi compost a month before sowing on soil content of N, P and K. The highest values of nitrogen and phosphorus soil content were obtained in T2 (1 bokashi compost :4 soil) , while the highest value of potassium soil content was recorded in T3 (1 bokashi compost :6 soil).

Concerning the presented micro elements Fe ,Cu, Zn and Mn (ppm) content in soil before sowing , the data in Table 4 showThat treatment T2 (1bokashi compost :4 soil) gave the best values of the Fe,Cu,Zn and Mn (ppm) content in soil before sowing .As they recorded 5.4, 2.1, 4.3 and 13.4 ppm, respectively.These results are may be due to the compostcontain a considerable variety of macro and micronutrients. Although often seen as a good source of nitrogen, phosphorous, and potassium. Compost also contains micronutrients essential for plant growth. Also, compost contains relatively stable sources of organic matter; these nutrients are supplied in a slow-release form(US Composting Council 2008).On the other hand bokashi compost will also improve the cation exchange capacity of soils, enabling them to retain nutrients longer. It will also allow crops to more effectively utilize nutrients, while reducing nutrient loss by leaching. For this reason, the fertility of soils is often tied to their organic matter content. Improving the cation exchange capacity of sandy soils by adding compost can greatly improve the retention of plant nutrients in the root zone. These findings are in accordance with those obtained by (Wijayanto *et al.* 2016).

Table 4. Effect of using bokashi compost on total N; available P;availableK and some micro elements content in soil (before sowing):

Treatment	N (ppm)	P (ppm)	K (ppm)	Fe (ppm)	Cu (ppm)	Zn (ppm)	Mn (ppm)
T_1(before mineralfertilization)	57.3 d	4.2 c	469 d	5.2 b	0.75 c	3.03 c	12.2 b
T2(1compost bokashi : 4 soil)	125.0 a	7.7 a	772 b	5.4 a	2.16 a	4.30 a	13.4 a
T_3(1 compost bokashi : 6 soil)	83.3 b	7.7 a	789 a	5.3 ab	1.20 b	3.43 b	12.1 b
T_4(1 compost bokashi : 8 soil)	78.3 c	6.3 b	725 c	5.3 ab	1.13 b	3.20 c	10.4 c

At the column, mean with the same letter are not significantly differences from one another at 5%level of probability.

Data in Table 5 show the effect of addition bokashi compost a month before sowing ontotal counts of soil microflora (bacteria ,fungi and actinomycetes) before sowing .For total count of bacteria, the results indicated that the treatments T1, T2 and T3 overtaken treatment T1 (control) but there were no significant differences between the three treatments. While, the treatment T4 gave the highest count of fungi (170×10^4 CUF/g^{-1} of soil).On the other hand the treatment T2 it is best for total actinomycetesnumber ((205.3×10^4 CUF/g^{-1} of soil).

These results could be to the Effective Micro-organisms (EM) that are present in the bokashi ensure the following : increase the level of microbial diversity in the soil which play their roles in decomposition process and mineralization of organic matters of the soil, so that they can increase essential nutrients availability in the soil (Yuliana *et a*l., 2015) and provide plants with bioactive foodstuffs such as growth hormones, antibiotics, vitamins and amino acids (Xiaohou *et al*., 2008 and Wijayanto *et al*., 2016).

Table 5. Effect of using bokashi compost on total counts of soil microflora (before sowing):

Treatment	Total bacteria. C.F.U* × 10^5	Total fungi C.F.U × 10^4	Total actinomycetes C.F.U × 10^4
T1(full dose of fertilizer mineral)	16.93 b	6 d	27 c
T2(1compost bokashi : 4 soil)	29.86 a	160 b	205.3 a
T3(1 compost bokashi : 6 soil)	30.66 a	106 c	166.6 b
T4(1 compost bokashi : 8 soil)	29.70 a	170 a	166.3 b

At the column, mean with the same letter are not significantly differences from one another at 5%level of probability.

The some vegetative growth ofhead lettuce plants*(Lactuca sativa* L. var. Capitata L.) referred Table (6), the treatment T2 (1 bokashi : 4 compost soil) gave the highest value for each of the(plant fresh weight (g), head fresh weight (g), number of leaves / head, head diameter (cm), and head dry weight (g/100g head fresh weight) over the control (chemical fertilizer).These results could be to the add bokashi compost to soil increase organic matter and nutrients in the plants .Application of bokasi can improve soil conditions that favor plant growth, increase soil biological life and optimize the availability and the balance of nutrient cycling through nitrogen fixation, nutrient absorption (Yuliana *et al*., 2015 &Wijayanto *et al*., 2016).

The interaction effect between addition bokashi compost and using bokashi juice decreased all vegetative growth, except number of leaves there was no significant difference between sprayed and non-sprayed plants.

Table 6. Effect of using bokashi compost and bokashi juice on head lettuce vegetative properties

Foliar application	Addition rates Treatments	plant fresh weight(g)	head fresh weight(g)	no. of leaves/ head	Head diameter(cm)	plant dry weight(g/100g)
Without	T1(full dose of fertilizer mineral)	498 f	371 f	31 c	13.6 d	4.16 cd
	T2(1compost bokashi : 4 soil)	716 a	554 a	33.6 a	16.7 a	4.51 a
	T3 (1 compost bokashi : 6 soil)	573 c	420 c	33 ab	15.4 b	4.61 a
	T4(1 compost bokashi : 8 soil)	513 e	395 e	31.8 bc	14.4 bcd	4.28 bc
	Mean	575.35 a	435.15 a	31.80 a	15.02 a	4.39 a
With	T1(full dose of fertilizer mineral)	440 g	316 h	31 c	13.5 d	3.85 e
	T2(1compost bokashi : 4 soil)	645 b	500 b	32 ab	14.8 bc	4.13 d
	T3(1 compost bokashi : 6 soil)	545 d	413 d	32 ab	14.8 bc	4.13 d
	T4(1 compost bokashi : 8 soil)	502 f	360 g	31.4 bc	14.1 cd	4.05 d
	Mean	533.25 b	397.4 b	31.80 a	14.32 b	4.09 b

At the column, mean with the same letter are not significantly differences from one another at 5%level of probability.

Data in Table 7 show the effect of using bokashi compost and bokashi juice on total nitrate and chlorophyll content of head lettuce. The treatment T2 without and with foliar application gave the highest value nitrate and chlorophyll content of head lettuce. It was recorded 6782and 6802 ppm without and with foliar application,respectively for total nitrate.As for total chlorophyll it was recorded 32.8 and 31.6(Spad) without and with foliar application, respectively. Increased organic fertilization may increase the surplus of nitrate in soil which creates problems such as increasing the plant uptake and accumulation in the leaves. In all cases, the moderate organic fertilization lead to better plant absorption of nitrates, and its presence in the plant leaves the permissible limits, as explained with T3 (1 compost bokashi : 6 soil) & T4 (1 compost bokashi : 8 soil) .

On the other hand, increase heads lettuce chlorophyll content is significantly correlated to add compost bokashi to the soil, which works to increase the number of beneficial microbes in soil that lead to the availability of nutrients such as nitrogen, which enters in the composition of chlorophyll.These findings are in agreement with those obtained by Gutierrez- Micelli *et al.,* (2007) and Myint *et al .,* (2010) .

Table 7. Effect of using bokashi compost and bokashi juice on total chlorophyll and nitrate content of head lettuce

Foliar application	treatment	N-No3 (ppm)	Chlorophyll SPAD
Without	T1(full dose of fertilizer mineral)	6381^{b}	27.8^{cd}
	T2(1compost bokashi : 4 soil)	6782^{a}	32.8^{a}
	T3(1 compost bokashi : 6 soil)	4459^{c}	30.4^{abc}
	T4(1 compost bokashi : 8 soil)	4263^{c}	$30 .0^{abcd}$
	Mean	5471^{a}	30.2^{a}
With	T1(full dose of fertilizer mineral)	6447^{b}	27.4^{d}
	T2(1compost bokashi : 4 soil)	6802^{a}	31.6^{ab}
	T3(1 compost bokashi : 6 soil)	4473^{c}	29.6^{bcd}
	T4(1 compost bokashi : 8 soil)	4381^{c}	29.6^{bcd}
	Mean	5413^{a}	29.5^{a}

At the column, mean with the same letter are not significantly differences from one another at 5%level of probability.

Data in Table 8 show the effect of using bokashi compost and bokashi juice on total aerobic bacteria and fungi counts of head lettuce. The T1 Full dose of mineral fertilizer (control) was higherthan all treatments for the head and the outer leaves of total count of aerobic bacteria without & with foliar application. With regard to the fungi counts of head lettuce plants results show that there no significant differences as a result of spray or not to spray bokashi juice. These results may be due to the fresh produce at harvest has a natural epiphytic micro flora much of which is non-pathogenic. Also, during any of the steps in the farm-to-consumer continuum (growth, harvest, processing, packaging, transportation, handling, retail) further microbial contamination can occur from a variety of sources, e.g. environmental, animal or human. There is a risk that this may include pathogenic microorganisms(FAO 2008).

Table 8. Effect of using bokashi compost and bokashi juice on total aerobic bacteria and fungi counts of head lettuce plants

Foliar application	treatment	Bacteria C.F.U × 10^{4}		Fungi C.F.U × 10^{3}	
		head	out leaves	head	out leaves
Without	T1(full dose of fertilizer mineral)	49.00^{c}	116.60^{c}	2.13^{a}	48.60^{a}
	T2 (1compost bokashi : 4 soil)	41.00^{d}	63.60^{de}	2.06^{a}	46.00^{ab}
	T3 (1 compost bokashi : 6 soil)	30.40^{e}	58.00^{e}	2.16^{a}	49.3^{a}
	T4(1 compost bokashi : 8 soil)	37.60^{d}	69.00^{d}	2.26^{a}	48^{a}
	Mean	39.60^{b}	76.83^{b}	2.15^{a}	44.58^{a}
With	T1(full dose of fertilizer mineral)	67.60^{a}	184.30^{a}	2.03^{a}	45^{ab}
	T2 (1compost bokashi : 4 soil)	60.30^{b}	125.60^{b}	2.03^{a}	44^{ab}
	T3 (1 compost bokashi : 6 soil)	49.60^{c}	68.00^{d}	2.10^{a}	44.3^{ab}
	T4(1 compost bokashi : 8 soil)	62.60^{c}	125.60^{b}	2.16^{a}	45.6^{ab}
	Mean	60.00^{a}	125.08^{a}	2.08^{a}	44.58^{a}

At the column, mean with the same letter are not significantly differences from one another at 5%level of probability.

Data in Table 9 show the effect of using bokashi compost and bokashi juice on total coliform, salmonella and shigellanumbers of head lettuce plants. The T1 Full dose of mineral fertilizer (control) was higher than all treatments for the head and the outer leaves of total count coliform bacteria without & with foliar application. It was recorded 46.60 ×10 ^{2} C.F.U ,33.30 ×10 ^{2} C.F.U and 20.08 ×10 ^{2} C.F.U for the total count coliform bacteria on head lettuce plants without foliar application and interaction effect between addition bokashi compost and using bokashi juice , respectively and 170 × 10 ^{2} C.F.U and 166 × 10 ^{2} C.F.U for the total count coliform bacteria on out leaves lettuce plants without foliar application and interaction effect between addition bokashi compost and using bokash juicefoliar, respectively. On the one hand results indicated the absence both of salmonella and shigella bacteria on head and out leaves lettuce plants.These results may be due to the effective microorganisms (EM) exists within compost bokashi has a unique composition contains many important microbial groups such as lactobacilli (*Lactobacillus plantarum, L. casei, and Streptococcus lactis*), yeasts (*Saccharomyces spp*.), and actinomycetes (*Strptomyces spp*.), fermenting fungi (*Aspergillusoryzae*, *Mucorhiemalis*) as well as photosynthetic bacteria (*Rhodopseudomonasplastris*and*Rhodobactersphacrodes*). The actinomycetes such as Strptomyces spp. is able to inhibit pathogenic microorganisms through the so is produced from antibiotics. Also, the lactic acid is a strong sterilizing compound, and suppresses harmful microorganisms (Packialakshmi and Yasotha., 2014 &Yuliana et al., 2015)

Table 9. Effect of using bokashi compost and bokashi juice on total coliform, Salmonella and shigellaof head lettuce plants.

Foliar application	treatment	total coliform C.F.U × 10 ^{2}		(Salmonella and shigella	
		Head	out leaves	head	out leaves
Without	T1(full dose of fertilizer mineral)	46.00 ^{a}	170.00 ^{a}	nd	nd
	T2 (1compost bokashi : 4 soil)	43.30 ^{ab}	166.00 ^{ab}	nd	nd
	T3 (1 compost bokashi : 6 soil)	42.00 ^{ab}	156.00 ^{c}	nd	nd
	T4(1 compost bokashi : 8 soil)	40.00 ^{b}	163.00 ^{b}	nd	nd
	Mean	42.83 ^{a}	163.75 ^{a}	nd	nd
With	T1(full dose of fertilizer mineral)	33.30 ^{c}	166.00 ^{ab}	nd	nd
	T2 (1compost bokashi : 4 soil)	24.00 ^{d}	133.00 ^{d}	nd	nd
	T3 (1 compost bokashi : 6 soil)	23.30 ^{d}	136.00 ^{d}	nd	nd
	T4(1 compost bokashi : 8 soil)	23.60 ^{d}	136.00 ^{d}	nd	nd
	Mean	26.08 ^{b}	142.75 ^{b}	nd	nd

At the column, mean with the same letter are not significantly differences from one another at 5%level of probability.

REFERENCES

Afroz, R.(2007).Effect of nitrogen and potassium on the growth and yield of lettuce (*Lactuca sativa L.).*M.SC. Thesis, Fac. of Agri. Univ. of Alex.120p.

Allen, O.N. (1950). Experiment in Soil Bacteriology M. Burgs Publishing. Co. England.

Atlas, R. M. (2004). Handbook of Microbiological Media, 3rd ed., CRC Press LLC, Boca Raton, Florida, USA. 2056 – 2080

Barnes, S. P. (2009). Bokashi Composting: Performance Monitoring to Assess the Potential of Commercial Level Applicaions.Project File Wasteminz Paper.

Duncan, D.A. (1955). "Multiple Rang and Multiple F- tests". Biometrics; 11:1-42.

Edrees, A. A. (2001).Studies on the effect of planting dates,population density and nitrogen fertilization on the improvement of growth and seed production of lettuce. M.SC. Thesis, Fac. of Agri. Univ. of Alex.120p.

Elfeki, M. and Tkadlec, E. (2015) Treatment of municipal organic solid waste in Egypt. J. Mater. Environ. Sci. 6 (3): 756-764.

FAO (2008) Microbiological Hazards in Fresh Leafy Vegetables and Herbs. Meeting report world health organization& Food and Agriculture Organization of United Nations. http://www. fao. org/ 3/a-i0452e. pdf

Gomez, K. A. and Gomez, A. A. (1984)."Statistical Procedures for Agricultural Research" .2 ndEd.Pp 680 -702. John Willey and Sons. Inc. NewYork, USA.

Gutierrez,F.A.; Santiago, J.; Montes, A. and Nafate , C.C. (2007)Vermicompostas a Soil Supplement to Improve Growth,Yield and Fruit Supplement to Improve GrowthYield and Fruit Quality of Tomato (*Lycopersicumesculentum*) Bio.Tech. 98 (15): 2781 -2787.

Hammad, H. M.; Khaliq, A.; Ahmad, A.; Aslam, M.; Malik, A. H. and Farhad, W. (2011). Influence of different organic manures on wheat productivity. International Journal of Agriculture and Biology 13:137-140.

Holty, J. G. and H. S. Potworowski.(1972).Brucine analysis for high nitrate concentrations. Environ. Sci. Technol. 6:835-837.

Jackson, M.L. (1973). Soil Chemical Analysis, Prentice-Hall of India Private Limited, New Delhi.

Myint, A; Yama K. T.; Kajihara, Y.andZenmoy, T. (2010) Application of different organic and mineral fertilizers on the growth, yield and nutrient accumulation of ricein a japaneseordinary paddy field. Sci. Word. J. 5 (2): 47- 54.

Nichols, M. and Hilmi, M. (2009).Growing vegetables for home and market.Food and Agriculture Organization of the United Nations. Diversification booklet number 11:102.

Packialakshmi, N. and Yasotha, C. (2014) Role of effective microorganism in unfertile soil .International Journal of Phytopharmacy .4 (1):25-27.

Page, A. L.; Miller, R. M. and Keeney, D. R. (1982). Methods of Soil Analysis.L chemical and Microbiological properties. Soil Sci. Amer., Madison Wisconsin,USA.

Polat, E.; Demir, H. and Onus, A. N. (2008).Comporison of some yield and quality criteria organically and conventionally-grown lettuce. African Journal of Biotechnology 7:1235-1239.

Pontin, G.; Daly, M. and Duggan, C. (2002).Disposal of organic kitchen food waste in the Canterbury/ Christchurch Region of New Zealand with an EM-bokashi composting system. In: Seventh International Conference on Kyusei Nature Farming, Christchurch, New Zealand.

Powell, T. (2013). On-Site Compoting atUniversity of Canterbury, UC Summer Sustainability Research Scholarship 2012-2013.

Saravanan, P.; Sathish, K. S.; Ignesh, A. and Ajithan, C. (2013) Eco-friendly practice of utilization of food wastes. International Journal of Pharmaceutical Science Invention. 2(1): 14-17.

SAS (2006). Statistical Analysis System, SAS User‘s Guide Statistics.SAS Institute Inc., Editor, Cary, N.C.

Talgre, L.; Lauringson, E.; Roostalu, H.; Astover, A. and Makke, A. (2012).Green manure as a nutrient source for succeeding crops. Plant Soil and Environment 58: 275-281.

US Composting Council(2008) .Compost and Its Benefits www. compostingcouncil.org

Wijayanto,T.; Zulfikar;Tufaila, M.; Sarman, A.M. and Zamrun, M.F.(2016) Influence of bokashi fertilizers on soil chemical properties, soybean (Glycine max (L.) Merrill) yield components and production .WseasTransactions on Biology and Biomedicine 13: 134-141.

Xiaohou, S.; Min, T.; Ping, J. and Weiling, C. (2008).Effect of EM bokashi application on control of secondary soil salinization.Water Science and Engineering. 1(4): 99-106.

Yuliana, A.I.; Sumarni,T. and Islami,T.(2015) Application of bokashi and Sunn Hemp (*Crotalaria juncea L.)* to Improve Inorganic Fertilizer Efficiency on maize (*Zea mays L.).*Journal of Degraded and Mining Lands Management. 3(1): 433 –438.

Markiwicz R.; Omietsanuik, N.; Pawlowska, I.; Witkowaskaa, A. and Borawska (1995). Concentration of nitrates frozen vegetables. Bromatologia Chemia- Toksyko- Eogicznal. 28(2):

تأثير استخدام كمبوست البوكاشي الناتج من تدوير مخلفات المطبخ علي نبات خس الرؤوس المنزرع عضويا بالمنزل

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أجريت تجربة أصص بمزرعة قسم البيئة والزراعة الحيوية كلية الزراعة جامعة الأزهر- القاهرة خلال الموسم الشتوي 2015 لدراسة تأثير استخدام كمبوست البوكاشي الناتج من تدوير مخلفات المطبخ علي نبات خس الرؤوس المنزرع عضويا بالمنزل تمت زراعة نبات خس الرؤوس بعد 21 يوم من اضافة كمبوست البوكاشي الي الاصص المحتوية علي التربة , وتم المقارنة بين الجرعة الكاملة للسماد المعدني T1 وثلاثة معاملات اخري لكمبوست البوكاشي هي : (1كمبوست بوكاشي : 4 حجم من التربة T2) , (1حجم كمبوست بوكاشي : 6 حجم من التربة تربةT3) , (1حجم من كمبوست بوكاشي : 8 حجم من التربة T4) , وتم استخدام هذة المعاملات مرة بدون رش عصير البوكاشي (سائل ينتج عند عملية التخمير) , ومرة أخري مع عصير البوكاشي بمعدل ١ من عصير البوكاشي الي ٣٠٠ سم من الماء الخالي من الكلور , وحيث تم الرش مرتين الاولي بعد ٣ اسابيع من الشتل , الثانية بعد ٧ اسابيع من الشتل . وكانت اهم النتائج المتحصل عليها : أدت المعاملة T2 الي زيادة محتوي من عنصري النتروجين والفوسفور, بينما أ أدت المعاملة T3 الي زيادة محتوي من البوتاسيوم , وأدت المعاملة T2 الي زيادة محتوي التربة من العناصر الصغرى مثل الحديد , النحاس , الزنك , المنجنيز, وحيث تم تقديرها قبل الزراعة مباشرة . بالنسبة للعدد الكلي للبكتريا الهوائية فقد تفوقت كل المعاملات T2, T3, T4 , علي T1(الكونترول) , وقد سجلت 29.86, 29.70 X 10^{5} 30.66, C.F.U لكل من T1, T2, T3, علي التوالي , بينما سجلت المعاملة الكونترول T1 16.93C.F.U X 10^{5} . وبالنسبة للفطريات فقد سجلت المعاملة T4 وكانت C.F.U ^{4} 170 X10 , وبالنسبة لأعداد الاكتينوميستات فقد سجلت المعالة T2 أفضل قيمة وكانت C.F.U ^{4} 166.3 X 10. كما المعاملة T2 افضل قيمة لكل من الوزن الطازج للنبات (جم) , الوزن الطازج للرؤوس (جم) , عدد الاوراق بالرأس , قطر الرأس (سم) , الوزن الجاف للنبات (جرام 100 / جرام). ومع استخدام كمبوست البوكاشي للنباتي والرش بعصير البوكاشي بمعدل 1 سم 300 / لتر ماء أعطت المعاملة T2 قيمة لكل من الوزن الطازج للنبات (جم) , الوزن الطازج للرؤوس (جم), بينما اعطت كل من المعاملتين T2 , T3 أفضل قيمة لكل من عدد الاوراق بالرأس , قطر الرأس (سم), ولم تكن هناك فروق معنوية للمعاملاتT2, T3, T4 علي الوزن الجاف للنبات (جرام /١٠٠ جرام) وان تفوقت علي المعاملة T1 الكونترول. أيضا سجلت المعاملة T2 اعلي قيمة لمحتوي نبات خس الرؤوس من النترات مع استخدام كمبوست البوكاشي دون الرش بعصير البوكاشي وكذا مع الرش به , وكانت 6782, 6802ppmعلي التوالي بينما سجلت المعاملتين T3 , T4 اقل قيمة لمحتوي النبات من النترات ولم تكن هناك فروقا معنوية بينهما , واعطت المعاملة ايضا T2 افضل قيمة مع استخدام كمبوست البوكاشي دون رش بعصير البوكاشي , ومع الرش بعصير البوكاشي . وبالنسبة للعدد الكلي للبكتريا الهوائية علي رؤوس الخس والاوراق الخارجية له مع عدم استخدام الرش بعصير البوكاشي ومع استخدام الرش به , أعطت المعاملة T1 الكونترول اعلي قيمة لعدد البكتريا الهوائية علي الرؤوس والاوراق الخارجية في حين سجلت المعاملة T3,T4 اقل قيمة . وفيما يتعلق ببكتيريا الكوليفورم سجلت المعاملة T1 اعلي قيمة للعدد الكلي منها علي رؤوس النبات , وعلي الاوراق الخارجية مع استخدام الكمبوست بوكاشي وعدم الرش بعصير الكمبوست وكذا مع الرش في حين سجلت كل من المعاملات T2, T3, T4 اقل قيمة للعدد الكلي لبكتريا الكوليفورم علي رؤوس واوراق الخس.