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GROWTH RESPONSE AND MINERAL UPTAKE OF TOMATO AND CUCUMBER TRANSPLANTS GROWN IN IRRADIATED COMPOSTED WASTE

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ABSTRACT

Recycling organic wastes such as sugar cane bagasse and Nile water hyacinth was carried out at Nuclear Research Center in 1996 and 1997. Bagasse and water hyacinth were composted by windrow composting techniques, screened and piled out doors (cured) for 5 months. The effect of irradiated bagasse or hyacinth compost on tomato and cucumber transplant production was investigated compared with the conventional peat mix at Protected Cultivation, Ministry of Agriculture, Dokki, Cairo. Irradiated bagasse compost (IBC) and irradiated hyacinth compost (IHC) were obtained by exposing bagasse compost (BC)and hyacinth compost (HC) to gamma irradiation at 6 Kgy. Except for media containing 75 % vermiculite or 75 % composted water hyacinth, plant growth was equal to conventional peat mix. Tomato and cucumber transplants had no toxic levels of Cd, Pb, Ni and contained adequate N, P, K, Mn, Fe, Cu and Zn as compared to plants grown in the check medium. Irradition is a recognized method to eliminate pathogens in composted materials. No significant response was recorded among the irradiated agricultural media concerning the transplant growth, nutrients and heavy metals. It was concluded that many types of organic plant residues (such as bagasse or hyacinth), composted by windrow composting methods, can be used as a peat substitute in a conventional peat-vermiculite potting media.

Keywords: bagasse, hyacinth, compost, tomato, cucumber, transplant, root media, gamma rays, heavy metals.

INTRODUCTION

Sphagnum peat moss has long been used as a primary component in horticultural media. The nursery and greenhouse industries use significant quantities of peat (P) in the formulation of artificial substrates for production of bedding plants. Peat is potentially the most expensive media component because its high cost and the large quantities used. Peat availability can also be limited by weather conditions. Environmental concerns, associated with the current peat harvesting practices, specially strip mining, and increasing prices, have generated interest in the development of alternatives to peat (Evans and Stamps, 1996). So, recycled organic wastes such as rice hulls (Laiche and Nash, 1990), sewage and fully mature domestic refuse (Bragg *et al.*, 1993), broiler litter (Flynn *et al.*, 1995), yard waste consisting of leaves, grass and ground tree components (Beeson, Jr. 1996), sawdust (Sawan and Eissa, 1996) and municipal solid waste and shredded rubber-tires (Calkins *et al.*, 1997), might be used as a peat substitute in container media. Reliable supplies of consistent, high quality and low cost compost would be necessary for compost to become a viable peat substitute (Jarvis *et al.*, 1996). Besides, the composting of organic wastes, in part, helps reducing the environmental pollution through obtaining cheap substrates of good quality as an alternative to the sphagnum peat.

The influence of irradiated compost on transplant production has not been well documented. The composting process should be carried out at high temperatures (> 55 °C) for an extended period to eliminate pathogens (USEPA, 1993), however, composting is more rapid at temperatures lower than that required for pathogen elimination (Kawakami and Hashimoto, 1981). This research investigated, therefore, peat replacement with two irradiated local composts (bagasse or hyacinth). In addition, the chemical and physical characteristics of root media that influence transplant growth were recorded.

MATERIALS AND METHODS

These studies were carried out at the Protected Cultivation, Ministry of Agriculture, Dokki, Giza for both growing seasons. Sugar cane bagasse was obtained from the Sugar Factory, Gerga City, Souhag Governorate, whereas water hyacinth plants were collected from El-Kanater, Kalubia Governorate. Sheep manure was obtained from Inshas farm, NRC for both 1996 and 1997 seasons to determine and compare the growth and mineral uptake of tomato and cucumber transplants in different irradiated compost treatments and check medium (50% peat with vermiculite v\v).

These experiments were carried out in an illuminated (16h day at 26 C° – 8h night at 18 C°) glsshouse for investigating seedling emergence and transplant growth of tomato and cucumber in different irradiated compost mixes. Each experiment consisted of treatments which represented both irradiated composts and different irradiated compost mixes used for growing seedlings. The irradiated compost mixes including three ratio of compost to vermiculite in the media (1:3, 1:1, 3:1 by volume, respectively) in addition to recommended peat moss medium (P:V/ 1:1 by vol.) as a check treatment. The experiment was replicated four times. The growing media were placed in separate 84 eyes foam tray. Each tray was filled with a single medium and 84 seeds were sown in each tray, during September and October. All other agricultural practices were made as recommended.

All studies were conducted using the same greenhouse facilities and compost described by Abdallah *et al.* (2000). The analysis of the two local composts, sphagnum peat moss and vermiculite in the two seasons are shown in Table (1).

Gamma rays treatment:

The bagasse compost and hyacinth compost were packed in well sealed plastic barrels (100 L) during transporting and irradiation . The irradiation treatment was carried out at the National Center for Radiation Research and Technology (NCRRT using 60Co source of gamma radiation.

Irradiated bagasse compost and irradiated hyacinth compost were obtained by exposing BC and HC to gamma irradiation at 6 Kgy (an adequate dose to eliminate pathogens is 5-6 Kgy according to Watanabe and Takehisa, 1984; Wen *et al.*, 1995).

Table (1): Chemical characteristics of the two composts (after 5 months), peat moss and vermiculite.

Constituents	BC	HC	Peat	V
Organic carbon (%)	30.8	27.6	39.6	0.0
Total N (%)	1.70	1.69	1.10	0.0
C/N ratio	18:1	16:1	36:1	0.0
PH	6.1	7.3	4.3	7.1
EC (dS.m-1)	2.4	4.6	0.26	0.24
P (%)	0.59	0.67	0.05	0.8
K (%)	0.67	1.74	0.08	4.50
Fe (mg.Kg-1)	10847	13113	1250	37200
Mn (mg.Kg-1)	228	314	56	343
Cu (mg.Kg-1)	167	177	5	12
Zn (mg.Kg-1)	273	382	27	53
7Ni (mg.Kg-1)	37	51	1.1	117
Cd (mg.Kg-1)	6.5	9.0	0.9	0.3
Pb (mg.Kg-1)	61	111	17	4
Moisture content (%)	52	54	33	8
Total solids (%)	48	46	67	92

BC: bagasse compost. HC: hyacinth compost. V: vermiculite.

Data recorded:

1- Transplant characters: after one month for tomato and fifteen days for cucumber the following measurements were recorded: transplant height, stem diameter, fresh and dry weight of shoot, dry weight of root, and root length.

2- Chemical analysis: total chlorophyll in the leaves was measured using Minolta Chlorophyll Meter (Spad-501). Nitrogen was determined by macro Kjeldahl distillation (Black, 1983). Phosphorus was colorimetrically determined by ammonium molybdate (Chany et al., 1980). Potassium was determined using Flame Photometer Model PFP7 (Chapman and Pratt, 1964). Determination of Fe, Zn, Cu, Mn, Ni, Cd, and Pb were carried out according the proceduers described by Chapman and Pratt (1964), using Atomic Absorption Spectrophotometer Model GBC 932.

Total solids and moisture content were measured according to the standard methods of Black (1983). Total water, aeration and total pore space of root media were determined using the methods described by Wilson (1983). Bulk density was determined using the methods described by Tripepi *et al.* (1996).

Statistical analysis:

The data were statistically analyzed as factorial experiments according to Snedecor and Cochran (1980) and significant differences among the means of various treatments were established using Duncan multiple range test according to Waller and Duncan (1969).

RESULTS AND DISCUSSION

Compost as a peat substitute for transplants production:

A- Physical and chemical characteristics of composted media:

Data in Table (2) presented physical and chemical characteristics of growing media amended with irradiated compost at different ratios in comparing with standard peat-medium.

Bulk density is a measure of soil, or in this case container growing media, mass per unit volume. The media consisted of bagasse or hyacinth compost: vermiculite (1:3 by volume) had the highest average bulk density compared to the other media (Table 2). As the amount of composted bagasse or hyacinth increased in the medium, the bulk density generally decreased, although hyacinth-based media had higher bulk density compared to the bagasse-based media. The bulk densities of 1 : 1 bagasse media or 1 : 1 and 3 : 1 hyacinth media were similar to the peat-based control medium (Table 2). Bulk densities between 1.25 and 1.65 g/cm^3 have been shown to restrict plant growth (Grimes *et al.*, 1978; Alberty *et al.*, 1984). All 75 % vermiculite media significantly increased media bulk density compared to the check medium, however, bulk densities were well below the range where plant growth could be negatively influenced. The recorded data of bulk density for composts, peat and vermiculite were in agreement with finding of Tripepi *et al.* (1996), who found that the bulk density generally decreased as the amount of peat or composted paper sludge increased in the medium, and were in agreement with Klock (1997), who suggested that the standard bulk density for foliage plant media ranged from 0.3 to 0.75 g/cm^3.

Data in Table (2) show that aeration porosity (pore space occupied by air at container capacity) was highest for media consisted of bagasse or hyacinth : vermiculite (1 : 3 by vol.) followed by media containing bagasse or hyacinth : vermiculite (1 : 1 and 3 : 1 by vol.) and the check treatment. Bugbee *et al.* (1991) also observed increased media aeration porosity when compost was used, however, Jarvis *et al.* (1996) reported reductions in aeration porosity to levels considered less than optimum (<10 %) for all media amended with compost. This opposite trend may be partially due to the differences in compost type (they used three yard waste composts, one municipal solid waste compost and shredded rubber tire chips).

Data presented in Table (2) show that media water- holding capacity (pore space occupied by water at container capacity) was conversely accompanied with aeration porosity. In other words, WHC was the highest for the peat-based control medium and the bagasse : vermiculite media (1 : 1 and 3 : 1 by vol.) followed by the hyacinth : vermiculite (1 : 1 or 3 : 1 by vol.) media and was the lowest for media consisted of bagasse or hyacinth : vermiculite (1 : 3 by vol.). These data agreed with the findings of beeson, Jr. (1996), Evans and Stamps (1996), Jarvis *et al.* (1996) and Klock (1997). They suggested that water-holding capacity increased as the percentage of compost increased.

Table (2): Physical characteristics of composted growing media compared to a standard peat-based medium.

Growing Media	Bulk Density (g.cm-3)	Aeration Porosity (%)	Water-holding capacity (%)	Total porosity (%)
Check				
P : V				
1 : 1	0.620b	21.1b	63.4a	84.6a
IBC : V				
1 : 1	0.613b	21.4b	60.6a	82.a
3 : 1	0.505c	18.9b	64.9a	83.7a
1 : 3	0.728a	25.5a	41.9c	67.1cd
IHC : V				
1 : 1	0.658ab	20.6b	53.0b	73.6bc
3 : 1	0.590b	21.4b	53.2b	74.6b
1 : 3	0.713a	26.4a	35.5d	61.9d

BC = Bagasse compost. P = Peat moss. HC = Hyacinth compost. V = Vermiculite.
Means in each column followed by the same letter are not significantly different at the 5 % level.

Total media porosity (pore space occupied by air and water at media saturation) was the highest for the standard control medium and the bagasse: vermiculite media (1 : 1 and 3 : 1 by vol.) followed by the hyacinth : vermiculite (1 : 1 or 3 : 1 by vol.) media. While hyacinth substrates (1 : 1 or 3 : 1 by vol.) and bagasse substrates (1:3 by vol.) contained, in general, similar amounts of total porosity (Table 2). The bagasse or hyacinth : vermiculite (1 : 3 by vol.) mix had the lowest total porosity. The recorded data of total porosity agreed with finding of Bunt (1983), who found that total pore space of substrates decreased as the bulk density increased. These results are, also, in agreement with those of Beeson, Jr. (1996), logan and Lindsay (1996) and Evans and Stamps (1996) who found that total pore space increased as the percentage of organic matter increased. Concerning pH and EC of growing media, analysis showed that mixing compost with vermiculite by equal volumes improved both properties. The recorded pH for bagasse : vermiculite media varied from 6.47 to 6.62, while pH for HC with Vermiculite was in the neutral range (7.11- 7.26). It is worthy to notice that the pH of check treatment, i. e., peat moss : vermiculite (1 : 1 by vol.) was, 6.7 after adding limestone. Soluble salt concentrations increased as the percentage of compost in the medium increased from 25 % compost to 75 %. But such increases in salt concentrations were below the levels considered to affect plant growth, except for the IHC and NIHC : V media (3 : 1) which had an initial EC of 3.90 and 4.12, respectively. On the other hand, soluble salts may be altered favorably by modifying the composting process. . These results agree with those reported by Brady (1990), Warnck (1990), Jespersen and Willumsen (1993), Nappi and Barberis (1993) and Mohy EL-din (1997).

B- Tomato and cucumber transplants growth under compost application levels:

The growth of tomato and cucumber seedling in media of mixed bagasse compost with vermiculite by equal volumes or more was similar to that in peat / vermiculite (check treatment) (Table 3 and 4).

Table (3): Effect of kind of compost and application level to growing media and their interactions effects on one month tomato transplants characters (combined analysis of 1996 and 1997).

Transplants		Tomato				
		Media mix. Level (v/v)				
Character	Kind of Compost	P:V 1:1 check	C:V 1:3 (25%)	C:V 1:1 (50%)	C:V 3:1 (75%)	Mean
Shoot Length (cm)	IBC	12.63a	10.30b	12.41a	12.17a	11.88A
	IHC	12.63a	10.42b	11.89a	12.28a	11.80A
	Mean	12.63A	10.36B	12.16A	12.22A	
Stem Diameter (mm)	IBC	3.42a	2.88c	3.31ab	3.45a	3.27A
	IHC	3.42a	2.81c	3.21b	3.28ab	3.19A
	Mean	3.42A	2.84C	3.26B	3.37AB	
Shoot fresh Weight (g)	IBC	3.74a	3.22b	3.24b	3.38ab	3.39A
	IHC	3.74a	3.18b	3.14b	3.56ab	3.40A
	Mean	3.74A	3.20b	3.19B	3.47AB	
Shoot Dry weight (g)	IBC	0.35b	0.27d	0.34bc	0.42a	0.35A
	IHC	0.35b	0.27d	0.34bc	0.31c	0.32B
	Mean	0.35A	0.27B	0.34A	0.36A	
Root Length (cm)	IBC	6.44c	6.84ab	6.43c	6.36c	6.51A
	IHC	6.44c	6.86a	6.53bc	6.57abc	6.59A
	Mean	6.44B	6.85A	6.48B	6.46B	
Root Dry weight (mg)	IBC	91.79a	90.94a	91.69a	90.70a	91.28A
	IHC	91.79a	97.20a	92.14a	93.13a	93.56A
	Mean	91.79A	94.07A	91.91A	91.91A	
Total Chlorophyll (Spad)	IBC	37.38a	32.99c	35.78ab	36.00ab	35.53A
	IHC	37.38a	32.64c	35.58ab	34.25bc	34.96A
	Mean	37.38A	32.81C	35.68B	35.13B	

IBC = Irradiated Bagasse compost IHC= Irradiated Hyacinth compost
P = Peat V = VermiculiteC = Compost

The results in Table (3) showed no significant differences regarding the effect of bagasse and hyacinth composts on tomato transplant's shoot length, stem diameter, shoot fresh weight, root length, root dry weight and chlorophyll content. On the other hand, bagasse compost increased significantly dry weight in tomato than hyacinth compost. As to cucumber (Table 4) transplant grown in bagasse had higher shoot length, stem diameter, shoot dry weight and chlorophyll content compared to hyacinth compost. Whereas, no significant differences in shoot fresh weight and root dry weight among the effect of bagasse and hyacinth compost on cucumber transplants. Transplants produced in 50% and 75% composted media with vermiculite v/v (tomato) and 50% (cucumber) were of similar shoot dry weight, root length and root dry weight, as transplants grown in the check treatment (50% peat with vermiculite v/v), during the two experiments (Table 3 and 4).

Table (4): Effect of kind of compost and application level to growing media and their interactions effects on two weeks cucumber transplants characters (combined analysis of two experiments).

Transplants		Cucumber				
		Media mix. Level				
Character	Kind of compost	P:V 1:1 check	C:V 1:3 (25%)	C:V 1:1 (50%)	C:V 3:1 (75%)	Mean
Shoot Length (cm)	IBC	13.41a	10.34d	12.73ab	13.09a	12.39A
	IHC	13.41a	9.98d	12.13bc	11.78c	11.83B
	Mean	13.41A	10.16C	12.43B	12.44B	
Stem diameter (mm)	IBC	4.58a	3.83bc	4.58a	4.61a	4.40A
	IHC	4.58a	3.70c	4.48a	4.10b	4.22B
	Mean	4.58A	3.77B	4.53A	4.35A	
Shoot fresh weight (g)	IBC	3.92a	2.89b	3.84a	3.78a	3.91A
	IHC	3.92a	3.07b	3.66b	3.69a	3.58A
	Mean	3.92A	2.98B	3.75A	3.73A	
Shoot dry weight (g)	IBC	0.40ab	0.28d	0.39ab	0.41a	0.37A
	IHC	0.40ab	0.27d	0.37b	0.34c	0.35B
	Mean	0.40A	0.28C	0.39AB	0.37B	
Root Length (cm)	IBC	7.64b	8.44a	7.45b	7.34b	7.72A
	IHC	7.64b	8.25a	7.54b	7.50b	7.73A
	Mean	7.64B	8.35A	7.49BC	7.42C	
Root dry weight (mg)	IBC	105.71b	116.46a	102.79b	101.29b	106.56A
	IHC	105.71b	114.83a	103.55b	103.46b	106.89A
	Mean	105.71B	115.64A	103.19B	102.38B	
Total Chlorophyll (Spad)	IBC	38.76a	32.90c	37.99a	38.48a	37.03A
	IHC	38.76a	33.99b	37.93a	34.71b	36.34B
	Mean	38.76A	33.44D	37.96B	36.59C	

IBC = irradiated Bagasse compost IHC = irradiated Hyacinth compost
P = Peat V = Vermiculite C = Compost

Compost application at 25% in the growing medium decreased significantly tomato and cucumber transplants shoot characters as compared with check peat medium or other application rates (50 and 75%), but increased root characters (Table 3 and 4). Decreased growth for 25% composted media was often related to increased aeration porosity to levels considered detrimental for most plant species (greater than 25 %). This result was similar to that reported by Bugbee and Frink (1986) and Jarvis *et al.* (1996) where growth was reduced when media aeration porosity was greater than 25 %. These results are, also, in agreement with those of Bunt (1983), Verdonck *et al.* (1983), Beeson (1996) and Klock (1997). They reported that media aeration porosity is considered to be the most important physical characteristic of a container medium.

Moreover, plant growth was reduced when composts was mixed with vermiculite (1 : 3 by vol.) which resulted in a medium with low water holding capacity (Table 2) that was susceptible to drought. This effect was similar to that reported by Jarvis *et al.* (1996) where growth was reduced when peat replacement with 100 % tire chips that was decreased media water holding capacity. Also, they are in agreement with Tilt *et al.* (1987); Wootton *et al.* (1981). They stated that there was a positive correlation coefficients between increased top growth and water-holding capacity while, the decrease in growth with increasing pore space might be attributed to water stress. Moreover, Decreased dry weight for HC : V (3 : 1 by vol.) medium was often related to increase (EC). This result agrees with those reported by Mohy EL-din (1997).

From the aforementioned results on growth features, it could be concluded that using bagasse based media resulted in producing transplants similar to those obtained by growing in the check medium (peat moss : vermiculite 1:1 v/v), except for media containing 75 % vermiculite. Hyacinth based media (HC:V 1:1 or 3:1 by vol.) were less favorable for producing tomato and cucumber transplants. Raising transplants in bagasse or hyacinth based media containing 75 % vermiculite resulted in reduced plant growth compared to the other investigated root media.

C- Macronutrients, micronutrients and heavy metals concentrations in transplant's shoot tissues:

C-1: Macronutrients concentrations:

Tables (5 and 6) show that there were no significant differences in tissue N concentrations among the kind of composts or their rate of application for either species except for tomatoes grow in 75 % V media.

Phosphorus concentrations were generally lower in tomato transplants grown in media containing hyacinth compost as compared with check or bagasse media, although the levels were similar to the check and bagasse treatment in cucumber transplants grown in hyacinth media. On the other hand, phosphorus concentrations were similar to the check in both tomato and cucumber transplants grown in bagasse composted media at 50% and 75% application rates (Tables 5 and 6).

Data in Tables (5 and 6) show that higher concentration of K in tissues of transplant grown in HC media reflects the high levels of K in the hyacinth compost (Table 1). Moreover, tissue K levels were significantly increased by using media containing 75% Vermiculite in the two composts; this might be attributed to the highest content of K in vermiculite (Table 1). This supports the results of Falahi Ardakani *et al.* (1988) that vermiculite is capable of supplying some elemental K to the plants.

Table (5): Effect of kind of compost and application level to growing media and their interactions on macro and micro nutrients and heavy metal content in shoot tissues of one month tomato transplants (combined analysis of 1996 and 1997).

Transplants			Tomato				
Character		Kind of compost	Media mix. Level (v/v)				Mean
			P:V 1:1 check	C:V 1:3 (25%)	C:V 1:1 (50%)	C:V 3:1 (75%)	
Macronutrients (%)	N	IBC	3.66a	3.14b	3.48a	3.58a	3.46A
		IHC	3.66a	2.98b	3.55a	3.56a	3.44A
		Mean	3.66A	3.06B	3.52A	3.57A	
	P	IBC	0.77a	0.53c	0.77a	0.77a	0.71A
		IHC	0.77a	0.49c	0.61b	0.61b	0.62B
		Mean	0.77A	0.51C	0.69B	0.69B	
	K	IBC	5.70b	7.16a	5.86b	5.61b	6.08B
		IHC	5.70b	7.19a	6.62a	7.19a	6.68A
		Mean	5.70C	7.17A	6.24B	6.40B	
Micronutrients (ppm)	Fe	IBC	153.84a	118.09b	144.89a	153.93a	142.69A
		IHC	153.84a	114.41b	124.85b	120.63b	128.43B
		Mean	153.84A	116.25C	134.87B	137.28B	
	Mn	IBC	75.21a	59.00b	72.86a	72.99a	70.02A
		IHC	75.21a	58.98b	57.99b	57.64b	62.46B
		Mean	75.21A	58.99C	65.43B	65.32B	
	Cu	IBC	20.39ab	22.48a	19.11b	18.41b	20.09A
		IHC	20.39ab	21.75a	18.40b	21.55a	20.52A
		Mean	20.39B	22.11A	18.76C	19.98BC	
	Zn	IBC	76.60ab	80.05ab	74.92b	78.51ab	77.52A
		IHC	76.60ab	79.43ab	81.86a	82.10a	79.99A
		Mean	76.60A	79.74A	78.39A	80.31A	
Heavy metal (ppm)	Ni	IBC	2.03a	2.14a	2.02b	2.02a	2.05A
		IHC	2.03a	2.11a	2.12a	2.09a	2.09A
		Mean	2.03A	2.12A	2.07A	2.06A	
	Cd	IBC	0.64ab	0.64ab	0.69a	0.61a	0.65A
		IHC	0.64ab	0.65ab	0.69ab	0.72a	0.67A
		Mean	0.64A	0.65A	0.69A	0.67A	
	Pb	IBC	3.42b	3.31b	3.25b	3.49b	3.37B
		IHC	3.42b	4.86a	5.03a	5.23a	4.63A
		Mean	3.42C	4.09B	4.14Ab	4.36A	

IBC = irradiated Bagasse compost IHC = irradiated Hyacinth compost
P = Peat V = Vermiculite C = Compost

Table (6): Effect of kind of compost and application level to growing media and their interactions on macro and micro nutrients and heavy metal content in shoot tissues of two weeks cucumber transplants (combined analysis of1996 and 1997).

Transplants			Cucumber				
Character		Kind of compost	Media mix. Level (v/v)				Mean
			P:V 1:1 check	C:V 1:3 (25%)	C:V 1:1 (50%)	C:V 3:1 (75%)	
Macronutrients (%)	N	IBC	4.01	3.68	3.98	3.84	3.88A
		IHC	4.01	3.68	3.96	4.01	3.92A
		Mean	4.01A	3.68B	3.97A	3.93A	
	P	IBC	0.93a	0.79b	0.91a	0.90a	0.88A
		IHC	0.93a	0.73b	0.88a	0.92a	0.87A
		Mean	0.93A	0.76B	0.89A	0.91A	
	K	IBC	5.61b	7.36a	5.48b	5.66b	6.03B
		IHC	5.61b	7.35a	7.27a	6.98a	6.80A
		Mean	5.61C	7.35A	6.38B	6.32B	
Micronutrients (ppm)	Fe	IBC	188.71a	161.83c	182.28a	188.93a	180.44A
		IHC	188.71a	156.12c	171.13b	158.45c	168.60B
		Mean	188.71A	159.00C	176.71B	173.69B	
	Mn	IBC	86.87	86.76	85.98	86.47	86.52A
		IHC	86.87	89.96	86.93	86.45	87.56A
		Mean	86.87	88.36	86.45	86.46	
	Cu	IBC	22.29	22.46	22.08	22.38	22.30A
		IHC	22.29	22.28	21.99	23.51	22.52A
		Mean	22.29	22.37	22.03	22.94	
	Zn	IBC	68.78	69.20	72.08	70.45	70.43A
		IHC	68.78	69.66	71.74	69.67	70.19A
		Mean	68.78B	69.43AB	71.91A	70.06AB	
Heavy metal (ppm)	Ni	IBC	2.13	2.10	2.13	2.14	2.13A
		IHC	2.13	2.15	2.32	2.28	2.22A
		Mean	2.13	2.13	2.22	2.21	
	Cd	IBC	0.43c	0.45c	0.43c	0.43c	0.43B
		IHC	0.43c	0.54b	0.63a	0.65a	0.56A
		Mean	0.43C	0.49B	0.53A	0.54A	
	Pb	IBC	4.68b	4.72b	4.82b	4.69b	4.73B
		IHC	4.68b	5.78a	5.92a	5.83a	5.55A
		Mean	4.68b	5.25A	5.37A	5.26A	

IBC = irradiated Bagasse compost IHC = irradiated Hyacinth compost
P = Peat V = Vermiculite C = Compost

C-2: Micronutrients concentrations:

Growing tomato and cucumber in the check and bagasse treatments (1:1 and 3:1 by vol.) had higher levels of Fe, while Fe concentration was generally lower in the seedlings grew in hyacinth mixes, or media contained 75 % Vermiculite (1 compost : 3 V by vol.) than the check treatment (table 5,6). HC had higher pH (Table 1) which probably accounts for lower Fe concentration in the tissues of seedling grown in these media.

No clear trend was noticed for Cu,Zn concentrations of tomato tissue for all treatment. As to cucumber Mn, Cu, Zn concentrations were not affected by media treatments.

C-3: Heavy metal concentration:

Both compost and their media treatment combinations had no significant effect on Ni and Cd tissue concentrations for tomato and Ni only for cucumber. Concerning lead concentrations in tomato and cadmium and lead in cucumber tissue, data in Tables (5 and 6) showed higher contens when using hyacinth compost than bagasse from all application rates reflecting the high levels of Pb in the hyacinth compost (Table 1). But no hyacinth medium contained Pb at a concentration likely to be toxic to plants. These obtained results agreed with that of Bugbee and Frink (1989), Sawan and Eissa (1996), and Walkr (1996). They found that the total concentrations of lead were lower than the ceiling concentrations limit.

The chemical analysis of shoot tissues for tomato and cucumber transplants indicated that chlorophyll, N, P, K, Fe, Mn, Cu, Zn, Cd, Pb and Ni contents of transplants grown in bagasse based medium, except for those containing 75 % vermiculite, were similar to those grown in check medium. In other words, the satisfactory results of transplant growth characteristics of bagasse based media might be attributed to this chemical analysis which was similar to those of check transplants.

GENERAL CONCLUSION

It could be concluded from these experiments that bagasse based media, described in these studies, could be used as a peat moss substitute for producing tomato and cucumber transplant. However, hyacinth compost was a suitable peat substitute when mixed with vermiculite at equal parts by volume (HC : V 1:1 by vol.) in container medium. Seventy-five percent vermiculite with any compost is not recommended because of negative effects on physical properties of media that was decreased transplant growth. Irradiated compost (bagasse or hyacinth) with Gamma rays (6 Kgy) had no effect on growth of both tomato and cucumber transplant.

REFERENCES

Abdallah, M. M. F., A. A. G. Abdallah, I. I. El-Oksh and M. F. El-Sherif. (2000). Production of tomato and cucumber transplants in greenhouse using local bagasse and hyacinth composts as a substitute for peat moss. J. Agric. Sci. Mansoura Univ., 25 (9): 5851 – 5866.

Beeson, Jr. R. C. (1996). Composted yard waste as a component of container substrates. J. Environ. Hort., 14 (3): 115 - 121.

Black, C. A. (1983). Methods of soil analysis part 1 and 11. Amer. Soc. Agron. Inc. Pupl. Madison, Wisc, USA.

Brady, N. C. (1990). The nature and properties of soils. 10th ed. Macmillan, New York, NY.

Bragg, N. C., J. A. R. Walker, and E. Stentiford. (1993). The use of composted refuse and sewage as substrate additives for container grown plants. Acta Hort. 432 : 155 - 165.

Bugbee, G. J. and C. R. Frink. (1989). Composted waste as a peat substitute in peat-lite media. HortScience. 24 (4) : 625 - 627.

Bugbee, G. J. and C. R. Frink (1986). Aeration of potting media and plant growth. Soil Science., 141(6): 438 - 441.

Bunt, A. C. (1983). Physical properties of mixtures of peats and minerals of different particle size and bulk density for potting substrates. Glasshouse Crops Research Institute, Little Neamption, Acta.Hort., 150: 143 - 153.

Calkins, J. B.; B. R. Jarvis and B. T. Swanson (1997). Compost and rubber tire chips as peat substitute in nursery container media: Growth effects. J. Environ. Hort., 15 (2): 88 - 94.

Chaney, R. L.; J. B. Munns and H. M. Cathey. (1980). Effectiveness of digested sewage sludge compost in supplying nutrients for soil less potting media. J. Amer. Soc. Hort. Sci., 105 (4) : 485 - 492.

Chapman, H. D. and F. Pratt. (1964). Method of analysis of soil, plant and water. Univ. of Calif. Division of Agric. Sci., Calif. U. S. A.

Evans, M. R. and R. H. Stamps (1996). Growth of bedding plants in sphagnum peat and coir dust-based substrates. J. Environ. Hort., 14(4): 187 - 190.

Falahi-Ardakani, A.; J. C. Bouwkamp; F. R. Gouin and R. L. Chaney. (1988). Growth response and mineral uptake of lettuce and tomato transplants grown in media amended with composted sewage sludge. J. Environ. Hort., 6 (4):130 - 132.

Flynn, R. P.; C. W. Wood and E. A. Guertal (1995). Lettuce response to composted broiler litter as a potting substrate component. J. Amer. Soc. Hort. Sci., 120 (6): 964 - 970.

Jarvis, B. R.; J. B. Calkins and B. T. Swanson (1996). Compost and rubber tire chips as peat substitutes in nursery container media: Effects on chemical and physical media properties. J. Environ. Hort., 14 (3) : 122-129.

Jespersen, L. M.; and J. willumsen (1993). Production of compost in a heat composting plant and test of compost mixture as growing media for greenhouse cultures. Acta Hort., 342: 127-142.

Kawakami, W. and S. Hashimoto (1981). Enhanced composting of radiation disinfected sewage sludge. Radiat. Phys. Chem., 24 (1): 29 - 40.

Klock, K. A. (1997). Growth of Dianthus and Petunia in media amended with composted urban waste. J. Environ. Hort., 15 (3):135 - 137.

Laiche, Jr. A. J. and V.E. Nash (1990). Evaluation of composted Rice Hulls and a lightweight clay aggregate as components of container-plant growth media. J. Environ. Hort., 8 (1): 14 - 18.

Logan, T. J. and B. J. Lindsay (1996). Growth of three Bedding plant species in soil-lees mixes with alkaline stabilized sewage sludge. J. Environ. Hort., 14 (3): 160 - 162.

Mohy El-Din, A. O. (1997). Using of greenhouse wastes as soil substrate. M. Sc. Thesis, Institute of Environmental Studies and research. Ain Shams University. pp. 27- 31.

Nappi, P. and R. Barberis (1993). Compost as growing medium: chemical, physical and biological aspects. Acta Hort. 342 : 249 - 256.

Sawan, M. M. and A. M. Eissa (1996). Sawdust as an alternative to peat moss media for cucumber seedlings production in greenhouses. Acta Hort., 434: 127 -137.

Snedecor, G. W. and W. Cochran (1980). Statistical methods 7th Ed., Aiwa State Univ., press. Ames. Aiwa, USA. pp. 507.

Tilt, K. M., T. E. Bilderback and W. C. Fonteno (1987). Particle size and container size effects on growth of three ornamental species. J. of Amer. Soc. Hort. Sci., 112 : 981 - 984.

Tripepi, R. R., M.W. George; A. G. Campell and B. Shafii (1996). Evaluation pulp and paper sludge as a substrate for peat moss in container media. J. Environ. Hort., 14 (2): 91 - 96.

USEPA. (1993). Environmental regulations and technology: Use and disposal of municipal wastewater sludge. USEPA 503. 48 U.S. Gov. Print. Office, Washington, DC.

Verdonck, O.; R. Penninck and M. De Boodt (1983). The physical properties of different horticultural substrates. Acta hort., 150 : 155 - 166.

Walker, J.M. (1996). U.S. Environmental protection agency regulations for compost production and use. In: M. de Bertoldi, P. Sequi, B. Lemmes, and T. Papi. (eds), The Science of composting. Chapman AND Hall, pp: 357-369.

Waller, P. A., and D.B. Duncan. (1969). A basic rule for the symmetric multiple comparison problem. Amer. Statis. Assoc. J.,1485 - 1503.

Warncke, D. D. 1990. Testing artificial growth media and interpreting the results. In: R. L. Westerman. (ed), Soil testing and plant analysis. Soil science society of america, Inc. 3rd ed. P. 337 – 357.

Watanabe, H. and M. Takehisa. (1984). Disinfection of sewage cake by gamma- irradiation. Radiat. Phys. Chem., 24 (1): 41 - 54.

Wen, G.; T. E. Bates and R. P. Voroney (1995). Evaluation of nitrogen availability in irradiated sewage sludge, sludge compost and manure compost. J. Environ. Qual., 24 : 527 - 534.

Wilson, G. C. S. (1983). The physic-chemical and physical properties of horticultural substrates. Acta. Hort., 150 : 19 - 32.
Wootton, R. D.; F. R. Gouin and F. C. Stark (1981). Composted digested sludge as a medium for growing flowering annuals. J. Amer. Soc. Hort. Sci., 106 (1): 46 - 49.

إستجابة شتلات الطماطم والخيار للنمو و امتصاص العناصر النامية فى المكمـورة المعاملة بالاشعاع

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اجريت تجارب لدراسة تأثير بيئة مكمورة مصطبة قصب السكر وكذلك بيئـة مكمـورة ورد النيل المعامله بالاشعاع والمنتجه محلياً بقسم البحوث النباتية بمركز البحوث النوية (انشـاص) باستخدام طريقة كمر المصفوفات وذلك خلال عامى ١٩٩٦، ١٩٩٧ م على نمو وانتـاج شـتلات الطماطم و الخيار مقارنه بالبيئه المستورده شائعة الاستخدام فى إنتاج شـتلات الخضـروات فـى الصوب (بيت موس : فيرميكوليت ١:١ حجما). حيث تركت مصفوفات المكمورة للنضـج لمـدة خمسة أشهر فى كل من عامى التجارب قبل إستخدامها كبديل محلى ، ثم تم تعريضها بعد نضجها الى جرعه تعقيميه من اشعة جاما مقدارها ٦ كيلو جراى .

وقد أجريت تجارب إستخدام المكموره فى نمو و إنتاج شتلات الطماطم و الخيـار فـى صوب الزراعة المحمية بالدقى والتابعة لوزارة الزراعة .وقد أوضحت أهم النتائج انه لـم يكـن للبيئات المختلفه تأثير معنوى على النمو لكلا النوعين من الشتلات مقارنة بالبيئه المقارنه فيما عـدا البيئه المحتويه على ٧٥ % فيرميكوليت او ٧٥ % مكمورة ورد نيل حيث سجلت اقل استجابة فى النمو . كذلك لم تحتوى شتلات الطماطم و الخيار على تركيز سام من العناصر الثقيله – الكادميوم و الرصاص و النيكل ، وايضا سجلت محتوى مناسب من عنـاصر النيـتروجين و الفسـفور و البوتاسيوم و المنجنيز و الحديد و النحاس و الزنك . كما وجد ان البيئات التى تم معاملتها بأشـعة جاما لم يكن لها تأثير معنوى على كلا من الصفات الخضريه ، وكذلك المحتوى الكيمـاوى مـن العناصر المغذيه لكلا النوعين من الشتلات .