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EFFECT OF SOME NATURAL BIOFERTILIZERS SUBSTITUTES OF PEATMOSS ON RHIZOSPHERE MICROFLORA AND GROWTH PROMOTION OF CANTALOUPE SEEDLINGS

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ABSTRACT: ***Rice straw compost (IRC) inoculated with selected strains of plant growth-promoting rhizobacteria (PGPR) and its un-inoculated form (URC) substitutes of peatmoss were used as growing media for cantaloupe seedlings. Prepared tea of both compost types (IRCt and URCt) alternatives to the mineral nutrients were also applied for foliar spraying. Effect of these natural biofertilizers on rhizosphere microflora and growth of cantaloupe seedlings were investigated during two successive seasons under greenhouse conditions. Results indicated that the seeds sowing in IRC were induced to earlier emergence; it was done only after 4 and 5 days from planting time during both seasons, respectively. On contrary, germination was shifted and started too late for the seeds sowing in URC and peatmoss. Moreover, percentages of the emergence were clear enhanced and reached to 95 and 96 % due to use of IRC medium during 2007 and 2008 seasons, respectively. It was contributed to the beneficial role of PGPR for plant growth-promoting and for reducing counts of Fusarium oxysporum and Pythium ultimum which caused the well known damping-off symptoms of different plants. After 4 weeks from planting time, seedlings which were sprayed with IRCt and its rhizosphere represented by IRC induced more formations of bacterial biomass reached 18.1 x 10^7 cfu g^{-1} in comparison with 8.2 x 10^7 cfu g^{-1} for control.***

The beneficial effects of the superior treatment (IRC + IRCt) were clear extended to produce healthier cantaloupe seedlings. Due to this treatment, earlier production of the first true leaf; great percentages of dried matter and chlorophyll formation reached 24.35 mg cm^{-2} were obtained. Shoot and root lengths, as well as shoot fresh weights were significant increased due to use both compost types and foliar spraying with compost tea or the mineral nutrients. Accumulation of great amounts of N, P and K in cantaloupe seedlings tissues was also resulted by using the superior treatment. Therefore, rice straw compost, inoculated or un-inoculated, could be successfully used substitutes of peatmoss, as well as compost tea as natural and environmentally safe could be applied for foliar spraying alternative to

the mineral nutrients to produce earlier, healthier and economic cantaloupe seedlings.

***Key words:** Cantaloupe, Compost and Compost tea, PGPR, Peatmoss, Rhizosphere microorganisms.*

INTRODUCTION

Cantaloupe (*Cucumis melo* L.) is a favorite and popular consuming crop in Egypt, it is a very good source of vitamins A, C and ß-carotene and can be used as fresh, dried and juice fruit. The total cultivated area in Egypt was about 77084 feddans, which yielded 829779 tons (according to the statistics data of Ministry of Agriculture, 2007). The world's total production of cantaloupe is 27 x 10^6 tons per year (Ghanbrian *et al.,* 2008). Cantaloupe considered as a profitable crop when all management practices are met. Nowadays, transplanting of cantaloupe is considered the most important factor during stages of cantaloupe production. In addition, the growers suffered from different problems during transplanting of cantaloupe. The problems included damping-off pathogens, too late production of the seedlings as well as the more expensive cost required to import peatmoss as a major media needed for seedlings production. The relative cost of 100 seedlings trays filled with imported peatmoss was 41.74$, while the parallel price was 15.65$ for 100 seedlings trays filled with rice straw compost (Bayoumi *et al*, 2008). Moreover, preparation of peatmoss needs to organic additives to be suitable for seedlings. Accordingly, it seems more economic if we could find out some local and effective substitutes of peatmoss for this purpose. The local production of such materials particularly, if they were efficient and dependent essentially on the natural and local resources, does not only save some of the national income but also to reduce the environmental pollutions. However, with increasing chemical fertilizer coasts, cantaloupe growers are seeking alternative cultural practices that reduce production costs without reducing fruit yield or quality (Studstill *et al.*, 2006). Generally, natural fertilizer plays an important role among the environmental influences on crop production (Rashid and Khan, 2008).

Composting of the agricultural wastes represents the most effective biological technique available to overcome these problems. Compost or its extracts are the most promise bio-products recently responsible for developing different management programs as plant pest, disease and fertility (Sheuerell and Mahaffee, 2002). Several authors reported that compost application, as growing media, can improve their physical and chemical properties as well as increasing the availability of macro and micronutrients needed for seedlings to be grown (Abdallah *et al.,* 2000 and Badran *et al*., 2007). Compost contains all the essential micro and macro elements required for plant growth. It has beneficial effects such as increasing the cation exchange capacity of soils that increasing the

availability of certain nutrients as Ca, Mg and K. Decomposition processes of compost was actually enhanced via inoculation by beneficial microorganisms acted, themselves or their metabolites, as plant growth-promoting rhizobacteria (PGPR) (Brinton, 1995). Walker (1988) and Bowen and Rovira (1999) reported that PGPR strains benefit the plants through production of antibiotics, siderophores, cyanide and hormone-like substances, or through antagonistic activity against the soil-borne pathogens. On the other hand, effect of compost, as alternative to peatmoss, on rhizosphere microflora and on the incidence of PGPR of tomato plants was successfully investigated by Alvarez *et al*. (1995).

Therefore, the objective of this study is to investigate the potential impact of the natural local rice straw compost, un-inoculated and inoculated with some PGPR strains, as alternative to peat moss and usage of their aqueous extracts (teas) for foliar spraying instead to mineral nutrients to obtain earlier and strongly seedlings of cantaloupe.

MATERIALS AND METHODS

This investigation was carried out in experimental transplanting trays during two successive seasons of 2007 and 2008 in the greenhouse of Sakha Agricultural Research Station.

Microorganisms:

Two groups of microorganisms were successfully used for preparing the rice straw compost. The first one is application of *Trichoderma viridi* as cellulose decomposer which cultivated on potato dextrose agar (PDA) media and added to compost as liquid culture grown on PD medium at rate of 750 ml ton^{-1}, to accelerate the decomposition rate. Selective PGPR strains comprised of *Azotobacter chroococcum, Azosperillum brasilense* and *Paenibacillus polymyxa* were also added to enrich compost with available nutrients, growth promoting substances and to provide compost with bio-protecting potency against the phytopathogens. These rhizobacteria were grown on nutrient broth media and mixed with solid carrier (vermiculite + peat moss at ratio of 75:25 w/w). Bacterial inoculants were added to compost at maturity stage at rate of 400 g ton^{-1} from each bacterial inoculant.

Inoculated and un-inoculated compost:

As a substitution to peatmoss, inoculated (IRC) and un-inoculated (URC) rice straw composts were compared in this study. Rice straw was chopped and collected in heap form. The chopped rice straw was incorporated with farmyard manures, bentonite, rock phosphate, urea and elemental sulfur at rates of 10, 15, 10, 2.5 and 1%, respectively. Compost heaps constructed at dimensions of 2 x 3 x 1.5 m for width, length and height, respectively by stowing the rice straw in successive layers. Each layer was supplemented

with equal portion from the different amendments and received suitable water. Turning process was done every 30 days with keeping the moisture within the range of 40-60 % along the composting process. After the first turning, fungal inoculant of *T. viridi* was spreaded on the compost heap to accelerate the decomposition rate. Heaps left without inoculation were acted as un-inoculated compost. After elapsing the composting process (three months), heaps collapsed and moisten to the suitable range. At maturity stage, heaps which inoculated with *T. viridi* were also inoculated with the rhizobacteria Badawi (2003). After maturation, main chemical characteristics of the inoculated and un-inoculated compost were compared in Table 1.

Table 1: Main chemical characteristics of the inoculated and un-inoculated compost.

Property	IRC	URC
Acidity (pH)	7.28	7.39
EC (ds m^{-1} at 25 ^{o}C)	4.63	4.72
Organic carbon (%)	21.35	21.96
Total nitrogen (%)	1.52	1.40
C/N ratio	14.05	15.69
Total phosphorus (%)	0.84	0.78
Total potassium (%)	1.01	0.95
NO3 / NH4	4.86	4.21
Cross seed germination test (%)*	92.4	91.00
Calcium (mg L^{-1})	22.00	28.50
Manganese (mg L^{-1})	105.00	131.30
Magnesium (mg L^{-1})	4.90	5.90
Zinc (mg L^{-1})	44.20	58.90
Copper (mg L^{-1})	12.70	10.60

*** Cross germination test was carried out using *Eruca sativum* seeds after 72 h.**

EC and pH were estimated in diluted soil water suspension (1:2.5) and nitrogen content was determined according to micro-kjeldahl method (Jackson, 1973). Total phosphorus was determined calorimetrically based on the methods described by Tandon *et al*. (1968). Other elements were determined by atomic absorption spectrophotometer (Gains and Mitchell, 1979). Both compost types were compared with the imported peat moss as growing media for transplanting of cantaloupe in this study. Imported peat moss is the common growing medium for transplanting of different ornamental and vegetable nursery plants. The well known characteristics of peat moss were reported according to Ali *et al*., (2008).

For foliar spraying, aqueous extracts of both compost types were also used in comparison with the spraying using combinations of some mineral elements. To prepare compost tea, maturated inoculated and un-inoculated compost were immersed in water for about 1 kg: 10 L and then filtered for foliar spraying. Minerals of the nutrient solution consist of different macro- and microelements. Macronutrients (g L^{-1}) included 0.2 K_2HPO_4, 0.3 NH_4SO_4, 0.2 $MgSO_4.7H_2O$, 0.1 $FeCl_2$, 0.376 Ca Cl_2 and 0.845 K_2SO_4. In mg L^{-1}, micronutrients were represented by 1.855 H_3BO_3, 2.23 $MnSO_4.4H_2O$, 0.25 $CuSO_4.5H_2O$, 0.412 $NaMO_4$ and 0.288 $ZnSO_4.7H_2O$. Acidity of the nutrient combination was adjusted at pH = 6.9 ± 0.2 using standard KOH solution.

Enumeration of the microbial populations:

To enumerate the microorganisms of both compost types, soil extract agar (Page *et al*., 1982), Martin's rose Bengal and actinomycetes isolation agar were the main media used for counting the bacteria, fungi and Actinomycetes, respectively. So, erlenmeyer flasks containing media were sterilized, inoculated and incubated at 28 ºC. 0.5 ml (7 days old cultures) for each strain was spread on agar plates of each medium by using glass driagalsky triangle. The plates were incubated at 28-30 ºC and examined daily. Individual colonies were again streaked to obtain pure cultures and viable counts were done in triplicate. As well as, *Fusarium oxysporum* and *Pythium ultimum* which causing damping-off symptoms of most plants were isolated, purified and enumerated in both IRC and URC using PDA medium under laboratory conditions. On the other hand, viable count of the rhizosphere bacterial populations of each treatment were also enumerated at time periods of 0 and 4 weeks from planting time using soil extract agar medium.

Germination and vegetative growth:

Seeds of cantaloupe (*Cucumis melo* L.) were sown in transplanting trays filled individually with inoculated, un-inoculated compost and imports peat moss. After germination, vegetative growth was sprayed individually with mineral nutrients, un-inoculated and inoculated compost tea. Treatments were grouped, as dual treatments, as follows:

a) **Peatmoss (Peat) + mineral nutrients (Mineral) (control).**
b) **Un-inoculated compost (URC) + un-inoculated compost tea (URCt).**
c) **Peat moss (Peat) + un-inoculated compost tea (URCt).**
d) **Inoculated compost (IRC) + inoculated compost tea (IRCt).**
e) **Peat moss (Peat) + inoculated compost tea (IRCt).**
f) **Un-inoculated compos (URC) + mineral nutrients (Mineral).**
g) **Inoculated compost (IRC) + mineral nutrients (Mineral).**

Each treatment was represented by three randomly replicates, one tray for each replicate. Trays were sown manually, one seed per cell and then put in

plastic house with temperature ranging of 20-30 ^{0}C until germination. Seedling trays kept in greenhouse and watered when needed to maintain the substrate at the field capacity. The cultural practices, i.e. irrigation and pest control were also carried out. Emergence defined as a seedling with cotyledons visible above the media surface and started after 4 and 5 days from sowing in both seasons. Percentages of emergence were calculated at 12 days from sowing, Percentages of seedlings which produce the first true leaf after 14 days. At the end of seedling stage (26 days from sowing time), vegetative growth parameters such as root and shoot lengths (cm), shoot fresh weight (g) and shoot dry matter (%) were determined. According to Moran (1982), second leaf from plant tip was taken to estimate photosynthetic pigments (total chlorophyll) using Spectrophotometer (Jenway 6105 UV/VIS). As well as, percentages of total nitrogen (Jackson, 1973), phosphorus (Tandon *et al*., 1968) and potassium (Gains and Mitchell, 1979) contents were also determined in the seedling shoots.

Statistical analysis:

Data were statistically tested for analysis of variance (ANOVA) using Irristat version 3/93. A complete randomize block design was applied in this study. Duncan's multiple range was used for comparing means (Duncan, 1955).

RESULTS AND DISCUSSION

Germination parameters:

In comparison with peatmoss, rice straw compost inoculated (IRC) with selected PGPR strains and its un-inoculated form (URC) were used for cantaloupe transplanting in this study. Data obtained in Table 2, clearly indicate that cantaloupe seeds were germinated after 4 and 5 days from planting time due to the IRC medium during both seasons, respectively. While, the emergence time was shifted to be after 11 and 12 days as a result of the URC during 2007 and 2008 seasons respectively.

Table 2: Emergence time of cantaloupe seeds during 2007 and 2008 seasons.

Growing media	Growing seasons (days after planting)	
	2007	2008
Peatmoss (Peat)	12	12
Inoculated compost (IRC)	4	5
Un-inoculated compost (URC)	11	12

For peatmoss, seeds were germinated after 12 days from planting for each season. Accordingly, percentages of the germination were calculated after 12 days from planting time and plotted in Fig. 1. It shows clear enhancement of seed emergence reached to 95 and 96 % due to use the IRC medium during

2007 and 2008 seasons, respectively. On contrary, lower values were obtained with peatmoss (83 and 85 %) and with URC (86 and 80 %), respectively. Obtained results are also in agreement with Ali (2008), who found enhancement number of germinated seeds and the germination rates of the ornamental plants were clear increased with the palm leaves compost in comparison with peatmoss. The results agree also with those of Burger *et al*. (1997), who stated that seed germination was better in green plants compost. Obtained reduction of cantaloupe seed germination in peatmoss was also obtained with cucumber seeds (Ells *et al*., 1991). They reported that the low germination of cucumber seeds in peatmoss might due to high available ammonium.

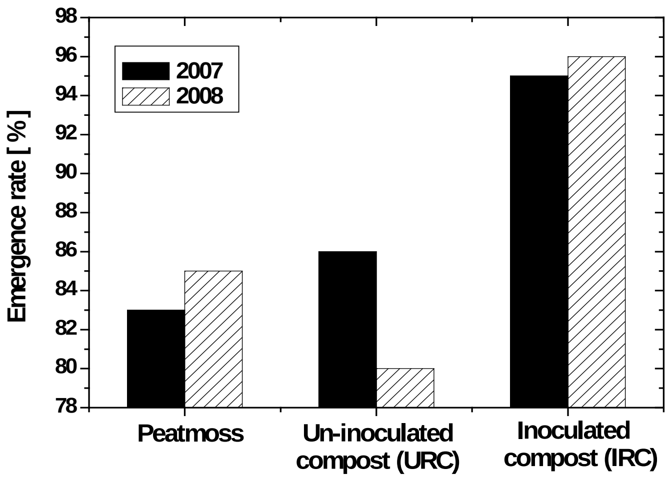

Fig.1. Percentages of cantaloupe seed emergence sowing in inoculated (IRC) and un-inoculated rice straw compost (URC) in comparison with peatmoss media during 2007 and 2008 seasons.

Microbial enumeration:

To investigate effect of the selected PGPR application on the rhizosphere microflora, total counts of the microbial populations were firstly tested in both inoculated (IRC) and un-inoculated compost (URC). Total counts of bacteria, fungi and actinomycetes, as well as enumeration of both *Fusarium oxysporum* and *Pythium ultimum*, causing severs damping-off symptoms of the seedlings were determined in IRC and URC and recorded in Table 3. Data indicate remarkable increases of the total counts of bacteria, fungi and actinomycetes established the IRC in comparison with the URC. On the other hand, numbers of the soil-borne pathogenic *F. oxysporum* and *P. ultimum*

were sharply decreased in the inoculated compost (IRC), indicating production of antifungal metabolites by the selected PGPR strains seeds the IRC. This was in agreement with the data obtained by Nielson and Sorensen (1999) and Egamberdiyeva, (2007). They found that some PGPR rhizobacteria produce hydrolytic enzymes and inhibitory substances suppress growth of damping-off fungi such as *Fusarium culmorum*, *F. oxysporum*, *Rhizoctonia solani* and *Pythium ultimum*.

Table 3. Microbial populations of the inoculated (IRC) and un-inoculated rice straw compost (URC).

Parameters / Characters	Rice straw compost	
	IRC	URC
Total count of bacteria (cfu/ml)	8.4×10^7	1.3×10^7
Total count of fungi (cfu/ml)	2.1×10^6	1.2×10^6
Total count of actinomycetes (cfu/ml)	9.8×10^6	5.9×10^6
<u>Damping-off fungi:</u>		
Fusarium oxysporum (cfu/ml)	14.3×10^5	25.0×10^5
Pythium ultimum (cfu/ml)	4.9×10^5	5.4×10^5

These results illustrate a great potential of IRC in comparison with the URC. However, potential use of the IRC, even after seed planting, was also tested in comparison with URC and peatmoss. Total counts of the bacterial populations were enumerated in the rhizosphere represented by the studied biofertilizers in comparison with control in Table 4.

Table 4. Effect of different bio-fertilizers on the rhizospere bacterial populations immediately and after four weeks from planting time of cantaloupe seeds.

Treatments / Characters	Bacterial counts x 10^7 cfu g^{-1}	
	immediately after planting	4 weeks after planting
Peat + Mineral (control)	5.0 a	8.2 a
URC + URCt	12.9 c	13.1 c
Peat + URCt	5.2 a	8.2 a
IRC + IRCt	16.2 d	18.1 d
Peat + IRCt	6.2 a	10.4 b
URC + Mineral	10.2 b	17.5 d
IRC + Mineral	11.5 bc	12.5 c

Results obtained of all treatments showed increasing in the bacterial populations from 0 times to 4 weeks later after planting time. However, treatment contains IRC and IRCt induced higher bacterial populations reached 16.2 x 10^7 cfu g^{-1} immediately after planting of cantaloupe seeds in comparison with control. On contrary, lower bacterial enumerations were obtained with the rhizospheres represented by peat moss associated with either URCt (5.2 x 10^7 cfu g^{-1}) or with IRCt (6.2 x 10^7 cfu g^{-1}) in comparison with control (5.0 x 10^7 cfu g^{-1}). After four weeks from planting, same trend was also given, that highest biomass formation reached 18.1 x 10^7 cfu g^{-1} was recorded with rhizosphere included IRC and the seedlings sprayed with its tea. It indicates that the seeded (inoculated) compost and its tea have potential impact towards rhizosphere microflora. Substantially, more microorganisms are present near plant root surface than in bulk soil. This rhizosphere effect is caused by release of exudates from growing root tissues and the lyses of cells of older root parts (Lynch and Whipps, 1991).

Bacteria rapidly colonize growing root tips, using simple sugars, organic acids and amino acids as nutrients. However, release of selected nutrients from roots that are preferentially utilizable by specific bacterial strains favors selective colonization by the latter (Bowen, 1991 and Flores *et al*., 1999). The lake of differences in the total number of bacterial rhizosphere confirms previous reports that composts do not stimulate the growth of microorganisms in the rhizosphere. They do affect the species composition of the rhizosphere (Boehm *et al*., 1993), thus causing a shift in specific groups of microorganisms, such as antagonists to pathogens in suppressive composts (Chen *et al*., 1987) and/or functional groups of rhizobacteria (Pera *et al.*, 1983). On the other hand, Microbial activity in a peat moss-based growing medium, but highest in media prepared from composted materials (Carlile *et al*., 2004) and this is consistent with our findings. Reduction of the bacterial populations of the certain peat moss media is perhaps due to decrease of its nutritive value in comparison with composts. Particularly, inoculated compost devised better environmental conditions in plant rhizosphere beside its role in increasing the level of supply in available form of nutritional elements required at trace levels both by the plant and by microorganisms.

Vegetative growth parameters:

Some vegetative growth parameters such as seedlings produce the earliest first true leaf (%), shoot height (cm), root length (cm), shoot fresh weight (g) and dry matter of the shoots (%) were recorded in Table 5..

Table 5. Effect of different bio-fertilizers on some vegetative growth parameters of cantaloupe seedlings during 2007 and 2008 seasons.

Characters / Treatments	Seedlings with 1st true leaf %	Shoot height Cm	Root length cm	Shoot fresh wt. (g)	Shoot dry matter %
	2007				
Peat + Mineral (control)	1.40 e	5.03 d	7.40 a	1.00 d	31.00 abc
URC + URCt	8.30 d	5.50 c	7.53 a	1.40 ab	29.29 bc
Peat + URCt	0.30 e	4.33 e	7.30 a	1.10 cd	24.87 d
IRC + IRCt	66.70 a	6.43 b	7.50 a	1.43 a	32.40 a
Peat + IRCt	3.54 e	4.57 e	6.93 b	1.22 bc	29.14 c
URC + Mineral	21.87 c	7.03 a	7.33 a	1.43 a	31.45 ab
IRC + Mineral	37.80 b	7.13 a	7.33 a	1.35 ab	30.43 abc
	2008				
Peat + Mineral (control)	2.00 e	5.00 bc	7.33 a	0.98 c	30.02 bc
URC + URCt	10.00 d	5.37 b	7.40 a	1.37 a	29.00 cd
Peat + URCt	1.37 e	4.50 c	7.17 a	0.99 c	26.64 e
IRC + IRCt	59.00 a	6.32 a	7.43 a	1.36 a	32.05 a
Peat + IRCt	5.70 de	4.43 c	6.77 b	1.19 b	28.42 d
URC + Mineral	22.00 c	6.73 a	7.27 a	1.37 a	30.50 b
IRC + Mineral	40.00 b	7.07 a	7.33 a	1.32 a	30.02 bc

It illustrates that 66.7 and 59.0 % of the seedlings treated with IRC+IRCt produced the first true leaf earlier in comparison with 1.4 and 2 % for control during both seasons, respectively. The same behavior was observed with the metric parameters. The longest shoots and roots were obtained with the treatments included the substitutes biofertilizers with their teas (IRC, IRCt, URC, URCt). So, growth of the seedlings grown in IRC and sprayed with IRCt was clear induced compared with the seedlings grown in IRC and sprayed with the mineral nutrients (Fig. 2).

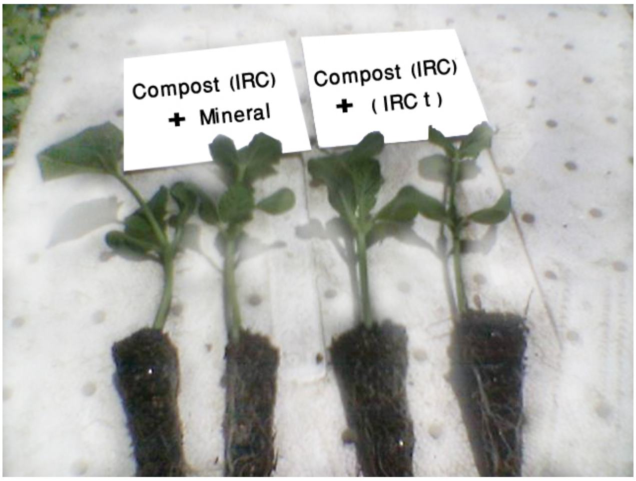

Fig. 2. Seedling grown in trays filled with IRC and foliar spraying with either mineral nutrients (left) or IRCt (right).

On contrary, shorted measurements of the seedlings grown in peatmoss were observed, seedlings grown in peatmoss and sprayed with IRCt showed longer shoots and roots in comparison with these sprayed with mineral nutrients (Fig. 3).

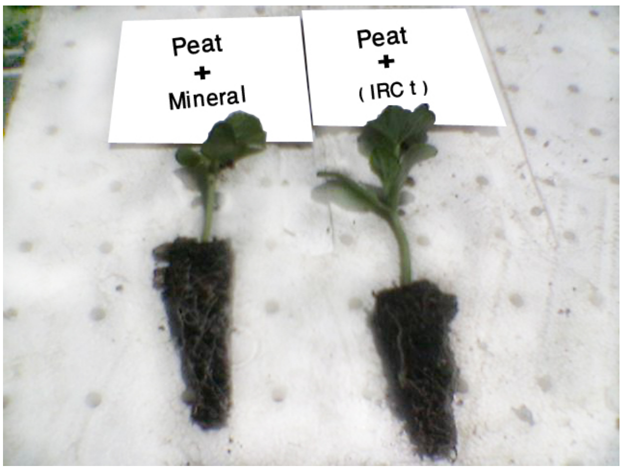

Fig. 3. Seedling grown in trays filled with peatmoss and foliar spraying with either mineral nutrients (left) or IRCt (right).

The beneficial effects of the inoculated compost and its tea were also extended to obtain higher fresh biomass during both seasons. Significant increases in the dried tissues due to the superior treatment (IRC + IRCt) were also obtained and reached to 32.4 and 32.05 % during 2007 and 2008 seasons, respectively. Effect of the superior treatment was also extended to enhance formation of total chlorophyll in the seedling cells (Fig. 4). It illustrates more pronounced effect of the treatment consists of IRC + IRCt in comparison with control. Such increase in photosynthetic pigments formation (24.35 mg cm^{-2}) could be attributed to increase the nitrogen content of the seedlings as a result of the high potentiality of the inoculated composts and its tea.

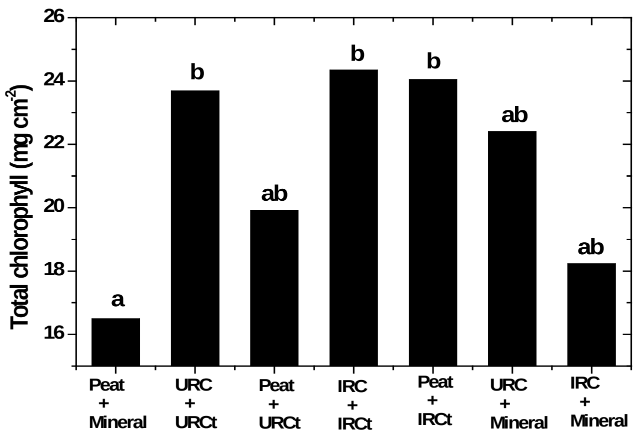

Fig. 4. Effect of different biofertilizers on the total chlorophyll formation of cantaloupe seedlings.

Therefore, rice straw compost and compost tea could be considered as effective bio-fertilizers consists of essential components required to cell division, cell elongation and photosynthetic pigments formation due to its enriched in macro-and microelements, vitamins and phytohormones (Höflich and Kühn, 1996). Kloepper (1993) stated that application of plant growth-promoting rhizobacteria (PGPR) seeded compost and its tea is often associated with increased rates of plant growth. Such bio-fertilizers, natural and local production, can improve their physical and chemical properties as well as increasing the availability of macro and micronutrients needed for cantaloupe seedlings to be grown as more suitable alternate media to peatmoss. In tomato nursery, compost replacement as partially or totally of peatmoss in growing media, moreover seedling quality was similar or better than peat moss (Bayoumi *et al*, 2008).

Chemical compositions:

Table 6. illustrates that both compost types (IRC and URC) and their teas (IRCt and URCt) significantly affected N, P and K uptake by cantaloupe seedlings, in comparison with control. The highest N values were occurred with treatment consists of URC with mineral spraying reached to 3.50 and 3.70 % , followed by treatment consists of IRC with mineral nutrient reached to 3.47% and 3.6% during 2007 and 2008, respectively. The superior treatment obtains higher P values of 0.29 and 0.33 % was inoculated compost with spraying using its tea (IRC + IRCt) during both seasons, respectively. Seedling growing in the IRC and spraying with mineral nutrients were characterized by the great K values reached 1.86 and 1.95 % during both seasons, respectively. On contrary, the results refer also to remarkable losses in NPK contents in the transplants grown in peatmoss were achieved, indicating sever reduction in the metabolic activity lower than those of both types of compost.

Table 6. Effect of different bio-fertilizers on N, P and K uptake of cantaloupe seedlings during 2007 and 2008 seasons.

Characters / Treatments	N %		P %		K %	
	2007	2008	2007	2008	2007	2008
Peat + Mineral (control)	3.21 de	3.27 c	0.24 b	0.24bc d	1.77 c	1.86 c
URC + URCt	3.25 de	3.30 c	0.24 b	0.22 cd	1.82 b	1.90 bc
Peat + URCt	3.31 cd	2.96 d	0.20 c	0.21 d	1.75 cd	1.81 d
IRC + IRCt	3.39 bc	3.47 b	0.29 a	0.33 a	1.82 b	1.93 ab
Peat + IRCt	3.18 e	3.03 d	0.26 ab	0.27 b	1.75 d	1.90 bc
URC + Mineral	3.50 a	3.70 a	0.26 ab	0.27 b	1.82 b	1.94 ab
IRC + Mineral	3.47 ab	3.60 ab	0.25 b	0.25 bc	1.86 a	1.95 a

The superiority of IRC over the URC with respect to NPK content of cantaloupe seedlings may be due to the PGPR bacterial inoculation. These results are in agreement with the findings of Biswas and Narayanasamy (2002) and Tengerdy and Szakaces (2003) who stated that enrichment the rice straw compost with *Trichoderma* strains greatly increased the availability of different nutrients in comparison with non-inoculated compost.

However, our results showed that every compost possessed microorganisms with PGPR attributes not only to increase counts of the rhizosphere microflora but also enhancement earlier growth and vigor properties of cantaloupe transplants. Kloepper (1993) stated that application of plant growth-promoting rhizobacteria (PGPR) is often associated with increased rates of plant growth. The postulated mechanisms of plant growth stimulation by associative bacteria are stimulation of root growth by

production of phytohormones (and Kloepper *et al*., 1980 and Bothe *et al.,* 1992) and production of siderophores with their possible role in the biological control of soil borne plant pathogens (Leong, 1986). The obtained results indicate that compost may benefit seedlings through the effects of its humic fraction on the soil microflora and the plants. The same effect might be done due to tea compost. Vallini *et al*. (1993) reported that the increase in the number of total aerobic bacteria and actinomycetes in the rhizosphere of laurel caused by humic acid treatments. Additionally, humic substances may affect on the biochemical process of plants (Vaughan *et al*., 1985) and/or bacteria (Visser, 1985). In conclusion, Inoculated and un-inoculated rice straw compost and their teas could be used successfully as natural biofertilizers, environmentally safe, substitutes to the imported peatmoss and the mineral nutrients for producting earlier healthier cantaloupe seedlings.

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تأثير بعض المخصبات الحيوية الطبيعية كبدائل للبيتموس على الكائنات الحية الدقيقة فى محيط الجذور وعلى تشجيع نموبادرات الكنتالوب

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الملخص العربى

تم أستخدام كمبوست قش الأرز الملقح (IRC) ببعض العزلات المختارة من الريزوبكتيريا المشجعة لنمو النبات (PGPR) وكذلك كمبوست قش الأرز الغير ملقح (URC) كبيئات بديلة للبيتموس فى تنمية شتلات الكانتالوب . وكذلك أستخدم الشاى المجهز من كلا نوعى الكمبوست (URCt و IRCt) كبدائل للمغذيات المعدنية المستخدمة فى الرش الورقى . وقد درس تأثير مثل هذه المخصبات الحيوية الطبيعية على الكائنات الحية الدقيقة فى محيط الجذور وعلى نمو بادرات الكنتالوب خلال موسمين متعاقبين ٢٠٠٧/٢٠٠٨ تحت ظروف الصوبة بقسم الميكروبيولوجي بمركز البحوث الزراعية بسخا . وقد دلت النتائج على أن البذور المنزرعة فى الكمبوست الملقح قد أستحثت للأنبثاق المبكر بعد أربعة و خمسة أيام فقط من الزراعة خلال كلا الموسمين ، على التوالى . على النقيض ، قد بدأ الإنبات متأخرا للبذور المنزرعة فى الكمبوست الغير ملقح وفى البيتموس خلال الموسمين . علاوة على ذلك ، قد تحسنت بوضوح نسبة الأنبثاق ووصلت الى ٩٥ و ٩٦ % نتيجة لأستخدام بيئة الكمبوست الملقح خلال موسمى ٢٠٠٧ و ٢٠٠٨ على التوالى . ويرجع ذلك الى الدور النافع لـ PGPR فى تشجيع نمو النبات وفى خفض أعداد *Fusarium oxysporum* و *Pythium ultimum* المسببين لأعراض موت البادرات المعروفة فى نباتات مختلفة . وبعد أربع أسابيع من الزراعة ، فأن الشتلات التى رشت بشاى الكمبوست الملقح (IRCt) ومحيط جذرها ممثل ببيئة IRC قد أستحثت تكوينات أكثر من الكتلة الحية البكتيرية وصلت الى 18.1×10^7 cfu g^{-1} مقارنة بـ

8.2×10^7 cfu g $^{-1}$ للكنترول . ولقد أمتدت التأثيرات النافعة للمعاملة المتفوقة (IRC + IRCt) الى تحسن ملحوظ في جوده شتلات الكنتالوب المنتجه مع تحقيق أكبر نسبه تبكير فى انتاج الشتلات للورقه الحقيقيه الأولي و كذلك أكبر نسبه مادة جافة ، علاوة على تحقيق أكبر محتوى من الكلوروفيل بلغ ٢٤.٣٥ مجم سم $^{-٢}$. بينما كانت أفضل نتائج طول الشتلة وطول الجذورو زيادة الوزن الطازج نتيجة معاملتي الكمبوست الملقح و الغير ملقح مع إستخدام طرق الرش الورقى بالشاى المجهزأو المغذيات المعدنية . كما أدت المعاملة المتفوقة الى تراكم كميات كبيرة من عناصر النيتروجين والفسفور والبوتاسيوم فى أنسجة بادرات الكنتالوب مقارنة بالكنترول . وعلى ذلك يمكننا التوصية بإستخدام كمبوست قش الأرز خاصه الملقح منه كبيئة بديلة للبيتموس كما يمكن إستبدال شاي الكمبوست كمنتج طبيعي آمن بدلا من المغذيات الورقية المعدنية في المشاتل بغرض تحقيق الإنتاج الإقتصادي لشتلات كنتالوب مبكرة وقوية.