Suppression of Tomato Root Rot Diseases by Compost and Compost Extracts under Greenhouse Conditions

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ABSTRACT

Seeds and seedlings cultivation methods were applied to check the effect of different types of compost and its extracts on suppression of root rot diseases under greenhouse. Reduction percentages of infection as affected by treatment with compost were significant in both cultivation methods. The highest suppression rates were detected in plants treated with sheep manure compost plus additives in both seeds and seedlings cultivation methods. Generally, the highest response of the tested root rots to compost treatment was that incited by *R. solani* in seeds and seedlings method, whereas *F. oxysporum* root rot showed the least response to compost treatment in both cultivation methods. Plants grown in soil amended with sheep manure compost with or without additives in seeds cultivation method had the highest value of leaf area, while in seedlings method treatment with mushroom and sheep manure composts with additives showed the highest leaf area index. On the other hand, plants grown in soil amended with chicken manure compost plus additives had the highest total chlorophyll content in both cultivation methods, followed by sheep manure compost plus additives. The highest significant percentages of nitrogen was observed in plants grown in sheep manure compost plus additives in both cultivation methods, followed by chicken manure compost plus additives.

INTRODUCTION

The widespread use of chemicals has become a subject of public concern and scrutiny, mainly due to their harmful effect on environment, human and animal health (Zaki *et al.* 1998). Composts have been shown to suppress soil-borne diseases, including many that affect vegetables (Cohen *et al.*, 1998). Composted organic material such as plant debris and animal manure add nutrients to the soil thereby increasing the soil fertility. This improves plant growth and makes the plant less prone to infectiom by pathogens (Schuler *et al.*, 1989; Dick and McCoy, 1993; Ayodele, 1997; Muhammad *et al.*, 2001). Previous greenhouse studies have demonstrated compost based suppression of several vegetable diseases, including club root on cabbage, lettuce drop, and Rhizoctonia root rots of pea, bean and radish Fusarium wilt of cucumbers, and Phytophthora crown rot of peppers (Lumsden *et al.*, 1983; Hoitink and Grebus 1994). Compost products are particularly effective in the suppression of soil borne diseases such as damping-off caused by *Pythium ultimum* and *Rhizoctonia solani* (El-Farnawany and Amer, 2006). On the other hand, mushroom compost and spent mushroom compost was found to inreducing infection by *F. oxysporum* f.sp. *lycopersici* on tomato plants when added to soil (Harender *et al.* 1997).

Composts are used widely by the nursery industry to suppress diseases caused by soil borne plant pathogens (Hoitink *et al.*, 1997; Cohen *et al.*, 1998). They are particularly effective for suppression of root rots caused by *Pythium* spp. and *Phytopthora* spp. in container media used for production of nursery crops (Hoitink and Boehm 1999). Microbiostasis and parasitism seems to be the key mechanisms by which these root rots are suppressed (Chen *et al.*, 1988; Mandelbaum and Hadar 1990; Boehm *et al.*, 1997). However, systemic induced resistance also played a role in the biological control of soil borne diseases provided by compost amendments (Zhang *et al.*, 1996; Pharand *et al.*, 2002). The present investigation was conducted to study the following points:

1- Effect of different types of compost and compost extracts on suppression of pre-, post-emergence damping-off under greenhouse conditions.
2- Effect of treatment with different types of compost and compost extracts on nitrogen and chlorophyll contents in tomato plants.

MATERIALS and METHODS

Compost preparation

The composts used in this experiment were spent mushroom, sheep manure compost, chicken manure, trufgrass, wheat straw, alfalfa hay, and mushroom. The exhausted compost left over after taking the last harvest of mushroom was taken as spent mushroom compost. Mushroom compost was made by using chicken manure with wheat straw. The substrates were composting with moisture 60-70% and turned two times weekly for air exchange. Sheep manure, chicken manure, garden, wheat straw and alfalfa hay were composted by two ways. The first by composting the substrates without any additives. The second, by composting the substrate by adding super phosphate and urea. Each of two ways were moistured until 60-70% and left without turning for three weeks, then the substrates turned two times weekly for air exchange. Raw material retained in production for 1-4 months. During this period the moisture was keeping enough. (Abd-El-Wahab, 1999).

In vivo experiments

This experiment was carried out under greenhouse conditions at Faculty of Agriculture (Saba-Basha), Alexandria University, Egypt. In order to evaluate the effect of both compost and compost tea either fermented or non fermented on suppression root rot pathogens on tomato, (mushroom, spent mushroom, sheep manure, sheep manure plus additives, chicken manure and chicken manure plus additives) compost were selected among the most effective compost types according preliminary laboratory investigations. Among the most frequented tomato root rot pathogens, *Fusarium oxysporum, Pythium ultimum* and *Rhizoctonia solani* were selected for greenhouse experiments. Three cultivars of tomato examined namely, Peto 86, Castle Rock and Super Strain B. Effect of compost was studied on tomato plants cultivated from seeds and seedlings of tomato.

Seeds experiment

Effect of compost and compost tea on seeds of tomato

Sterilized plastic pots (8 cm diameter) were used, throughout this study filled with compost and autoclaved soil (20% compost vol/ vol) (Widmer *et al.*, 1998). Compost tea trials arranged using autoclaved soil only. The Inocula of the tested fungi (*Fusarium oxysporum, Pythium ultimum* and *Rhizoctonia solani*) were prepared by growing each fungus on potato dextrose broth (PD) 50 ml/125ml. conical flasks. The culture were incubated at 25 ^{0}C $\pm$ 1 for 10 days and checked once every 24 hours. Later on, the fungal mat was collected, strained, rinsed by sterile distilled water and then blended with 100 ml sterilized distilled water in blender. The suspension obtained from each flask was added to four pots and covered with a thin layer of soil. The pots were watered every 2 days for a week before planting. Control pots were filled with soil without compost but inoculated by fungi.

The soil treatments were as follows:

A) Soil + pathogen (control).
B) Soil + pathogen + fresh material of compost.
C) Soil + pathogen + compost.
D) Soil + pathogen + compost tea.

The previous treatments were applied with sheep and chicken manure, while mushroom and spent mushroom compost did not had non fermented fresh materials. After 7 days from inoculation with pathogens, 8 seeds of tomato were sown in every pot. Treatments of compost tea were irrigated regularly with compost extract, while others were irrigated with water only. This experiment was carried out using three replicates and 8 seeds per pot.

Recorded data

Pre-, Post emergence damping-off

Percentage of pre-, and post emergence damping off as well as infection percentage in each treatment were determined 35 days after sowing using the next formula according to El-Helaly *et al.* (1970).

$$\text{Pre - emergence (\%)} = \frac{\text{No. of non germinated seeds}}{\text{Total No. of sown seeds}} X100$$

$$\text{Post - emergnce (\%)} = \frac{\text{No. of dead seedlings}}{\text{Total No.of sown seeds}} X100$$

$$\text{Infection percentage (\%)} = \frac{\text{No. of infected plants}}{\text{Total No. of sown seeds}} X100$$

Leaf area

A random sample from each replicate was chosen 35 days after sowing to determine leaf area index (cm^2). Leaf area was determined by the leaf area and leaf weight relationship using leaf disks from fully expanded leaves obtained by cork borer according to Wallace and Munger (1965).

Total chlorophyll

Total chlorophyll measured in leaves at 35 days after sowing in pots using Minolta chlorophyll Meter SPAD-502. according to the described method by Yadava (1986).

Total nitrogen contents

Nitrogen content was determined in plants. Fresh plant material washed with tap water then with distilled water, oven dried at 70°C for 48 hours and ground in a wily mill. Powder of dried sample (0.5 g) was digested by sulfuric acid and hydrogen peroxide (Lowther, 1980) for elemental analysis. The percentage of total nitrogen content was determined in digested material colorimetrically by Nessler's method using spectrophotometer according to Chapman and Pratt (1978).

Seedlings experiment

Effect of compost and compost tea on seedlings of tomato

An experiment was carried out to determine the effectiveness of the tested types of compost and compost tea on suppression seedlings damping-off, and on growth of tomato seedlings. The soil was amended with compost or compost tea, inoculated with the tested pathogens, planted and data was recorded as mentioned above.

Statistical analysis

The present investigation was carried out in a split-split plot design with three replications. The three tomato cultivars occupied the main plots, the three pathogens were assigned to the sub-plots, while the compost treatments were allocated to the sub-sub plots. Data of infection percentage were angular transformed before analysis. Data of these experiments were statically analyzed, and comparison between means were carried out using least significant differences (L.S.D) at 0.05 probability level according to Steel and Torrie (1984).

RESULTS

Infection percentage

A. Pre emergence damping-off (PRD)

Results obtained in Table (1) showed that, all compost types presented significant effect against PRD compared with control except chicken manure which did not significantly differ with control. However, plants grown on sheep manure compost plus additives had the least significant value of PRD (8.33%), followed by spent mushroom compost and sheep manure compost extract plus additives (11.11 and 12.04%, respectively). Differences of means among the tested pathogens were non significant, however, the least effect of PRD suppression was indicated from non fermented sheep and chicken compost manure (28.24 and 36.57 %, respectively). *R. solani* gave relatively the least value of pre-damping-off incidence (17.59%). Similarly, insignificant differences in values of pre-damping-off incidence were observed among the tested tomato cultivars (Table 2). However, cv. Peto 86 was relatively, more sensitive to tomato root rot pathogen, whereas it showed the highest value of infection (21.85%).

B. Post emergence damping-off (PED)

Generally, application of all the tested compost types and extracts significantly decreased the PED% (Table 1). The highest suppression effect was observed in treatment of sheep manure compost and its extract and sheep manure compost plus additives and their extracts had no significant differences. On the other hand, the least effective type of compost in suppressing PED was non fermented chicken manure (21.76%). Results from Figure (1) indicated that, there were significant differences between the tested pathogens. The most effective pathogen was *R. solani* (15%), followed by *F. oxysporum* (14.44 %), while *P. ultimum* was least effective (12.13%). In addition, Castle Rock cv. presented the least value of PED incidence (11.67 %), followed by cv. Super Strain B (14.35%), whereas, cv. Peto 86 tomato had the highest value of PED (15.56 %) (Table 3).

C. Total infection percentage (TI%)

Data in Table (1) generally, showed that soil amendment with compost or compost tea significantly reduced TI% of plants in both seeds and seedlings cultivation methods compared with the untreated control. Amendment with sheep manure compost plus additives was significantly more effective in reducing TI% than the other treatments. This was true in tomato plants cultivated from both seeds and seedlings (13.89 and 18.06 %, respectively). Non fermented chicken manure and sheep manure for plants cultivated from seeds were less effective (57.87 and 47.69 %, respectively), whereas, tomato plants cultivated from seedlings in soil amended with sheep manure non fermented showed the lower TI% (43.98 %).

According to the obtained results in Figure (2 & 3), the differences in the efficacy of the tested pathogens were insignificant on tomato plants cultivated from seeds, whereas, plants cultivated from seedlings showed significant differences between pathogens. The lowest TI% was observed on plants cultivated from both seeds and seedlings which inoculated with *R. solani* (32.59 and 31.48%, respectively). Plants inoculated with *F. oxysporum* showed the highest values of TI% for both planting methods (34.63 and 37.69 %, respectively). In addition to the differences in TI% among the tested tomato cultivars in both cultivation methods, were insignificant (Figure 2 & 3).

Leaf area index (LAI)

Data presented in Table (2) clearly showed that, amendment soil with any of tested types of compost or compost extracts significantly increased LAI of tomato plants compared with control. This was true for both cultivation methods except for non fermented sheep manure. Application of sheep manure compost plus additives produced plants with the highest significant LAI values compared with other types of compost (59.89 cm^2) followed by sheep manure compost and spent mushroom compost on seeds method (51.22 and 45.07 cm^2, respectively). Plants grown from seedlings gave the highest values of LAI when amended with mushroom compost and sheep manure compost plus additives (127.38 and 126.04 cm^2, respectively). On the other hand, the least values of LAI were observed on plants grown from non fermented sheep manure in both methods, while in seed the value was significant (24.39 cm^2).

The results reported in Table (3) indicate that, there were significant differences in LAI of tomato plants among the tested pathogens in both cultivation methods. The least LAI value for seeds cultivation method was observed in plants grown in soil infested with *R. solani* (32.88 cm^2), whereas, plants inoculated with *P. ultimum* gave the highest value of LAI. On the other hand, in seedlings cultivation method, a significant decrease in leaf was found in *P. ultimum* treatment (84.21 cm^2), followed by *F. oxysporum* and *R. solani* (91.57 and 97.86 cm^2, respectively). Castle Rock tomato cv. plants had the highest values of LAI for both cultivation methods (39.23 cm^2/seeds and 98.34 cm^2/seedlings), while the least index of LAI was obtained with cv. Super Strain B grown from seeds cultivation method (35.74 cm^2) and cv. Peto 86 grown from seedlings cultivation method (85.24 cm^2) (Table 4).

Total chlorophyll content (TCC)

From results in Table (2), it is clear that, TCC was significantly affected by all compost types amended and its extracts in both seeds and seedlings cultivation method compared with control treatment. In seeds cultivation method, the highest value of TCC was obtained from chicken and sheep manure compost treatments plus additives (33.04 and 32.49 mg, respectively), whereas, both chicken and sheep manure compost extract plus additives in addition to sheep manure compost and mushroom compost were resulted in acceptable chlorophyll content. On the other hand, the lowest significant effect was resulted from non fermented sheep manure (25.22 mg). Moreover, in seedlings cultivation method, the highest TCC was observed from plants treated with chicken manure compost plus additives, sheep manure compost plus additives and sheep manure compost with no significant differences among them. However, Amendment of soil with non fermented sheep manure presented plants with lowest significant TCC compared with control.

P. ultimum proved to be the most effective in decrease TCC in tomato plants in both cultivation methods. However, the lowest values of TCC was obtained in *F. oxysporum* trials in seed cultivation method and *R. solani* in seedlings cultivation method. On the other hand, insignificant difference in TCC values were observed between *R. solani* and *F. oxysporum* trials in seed method and between *F. oxysporum* and *P. ultimum* in seedlings cultivation method (Table 3).

According to data presented in Table (4), in seed cultivation method, cv. Castle Rock plants had the highest values of TCC, followed by Super Strain B, while cv. Peto 86 had the lowest value of TCC. Data reduced .

Nitrogen content (NC)

Data in Table (2) showed that, NC in tomato plants was affected by adding compost to the soil in both cultivation methods. NC significantly increased in all treatments compared with control. The highest NC were resulted from sheep manure compost plus additives treatment in both cultivation methods (2.56 and 2.76% for seeds and seedlings cultivation method, respectively), followed by both of chicken manure compost plus additives and sheep manure compost, whereas, non fermented sheep manure gave the lowest NC values in tomato plants grown from seeds cultivation method (1.74%). While the lowest significant effect on nitrogen content was resulted from spent mushroom compost extract treatment (1.82%) compared with control in seedlings cultivation method.

Plants grown in soil infested with *R. solani* had the lowest percentage of NC (1.93 and 2.02 % for seeds and seedlings cultivation methods, respectively), whereas, tomato plants grown in soil infested with *F. oxysporum* had the highest percentages of NC in both cultivation methods (2.06 and 2.10 %, respectively) (Table 3). Castle Rock cv. gave the highest values of NC in both cultivation methods, followed by cv. Super Strain B, whereas in cv. Peto 86 plants had the lowest percentage of NC. However, these differences of NC values among cultivars did not reach to significant level in both cultivation methods (Table 4).

DISCUSSION

From the obtained data, it can be concluded that the tested compost treatments significantly reduced the percentages of PRD, PED and TI, incited by *R. solani*, *F. oxysorum* and *P. ultimum* on all the tested tomato cultivars. The suppression effect of compost types against soil-borne diseases was generally confirmed by many investigators (Schuler *et al.*, 1989; Harender *et al.*, 1997 and Hoitink & Boehm, 1999).

In addition, extensive work was carried out on the specific role of compost types on the suppression of Fusarium root rot of tomato caused by *F. oxysporum* (Szczech *et al.*, 1993; Pharand *et al.*, 2002; Cheuk *et al.*, 2003; Kavroulakis *et al.*, 2005 and Borrero *et al.*, 2006). *R. solani* was roved, in the present work, to be the most sensitive to compost treatments compared with the other tested root rot and damping-off pathogens. This assured the results obtained by Alvarez *et al.* (1995), Tuitert and Bollen (1996) and Steinberg *et al.* (2004).

Suppression of soil-borne pathogens by compost may be explained by increasing biological activity of antagonistic bacteria and other soil fungistatic effect on pathogens (Alvarez *et al.* 1995; Hoitink and Boehm, 1999; and Ramona and Line, 2002). The principle protection mechanism against plant diseases seems to depend on the microbial activity of the compost (McQuilken *et al.*, 1994 and Yohalem *et al.*, 1996). Moreover, compost extracts could induce resistance in plants (Zhang *et al.*, 1998; Boulter *et al.*, 2002; Kavroulakis, 2005).

The present data showed that application of different types of compost and compost extracts with or without additives significantly increased tomato plant length, leaf area index (LAI), fresh and dry weight of shoot and root systems. This improvement of tomato plant health against the tested soil-borne pathogens may serve as an effective mechanism explaining reduction of disease incidence correlated with application of compost. Our conclusions were in harmony with those reported by many authors on tomato (Hill and James, 1995; Harender *et al.*, 1997; Stoffella and Graetz,1997; Ozores *et al.*,1999; Abd-El-Mageed *et al.*, 2000). Moreover, similar observations were recorded on eggplant (Abd-El-Rahman and Hosny, 2001) and on cotton (Kasem, 2006).

Data showed that amendment of tomato plants with any of the tested types of compost significantly increased total chlorophyll (TCC). Moreover, fermented compost amended with additives was more effective in increasing TCC. The high content of macro and micro nutrients of compost involved in the synthesis of chlorophyll seems to be the reason of TCC increase. This conclusion was partially agree by Shehata (1992).

The obtained data increase in nitrogen content due to the tested compost treatments was confirmed by similar results obtained by He *et al.* (1992) and Shiralipour *et al.* (1992). This increase may be the result of the positive effect of compost in nitrogen fertilization of plants, enhancing the activity of microorganisms in soil or of the compost itself.

Compost is successfully applied to the soil in Egypt. However, more researches are required to investigate enrichment of different types of composts, maturity and stability, suitable time of application. This may turn the application of compost more effective not only for improvement of plant health, but also for suppression of soil-borne pathogens.

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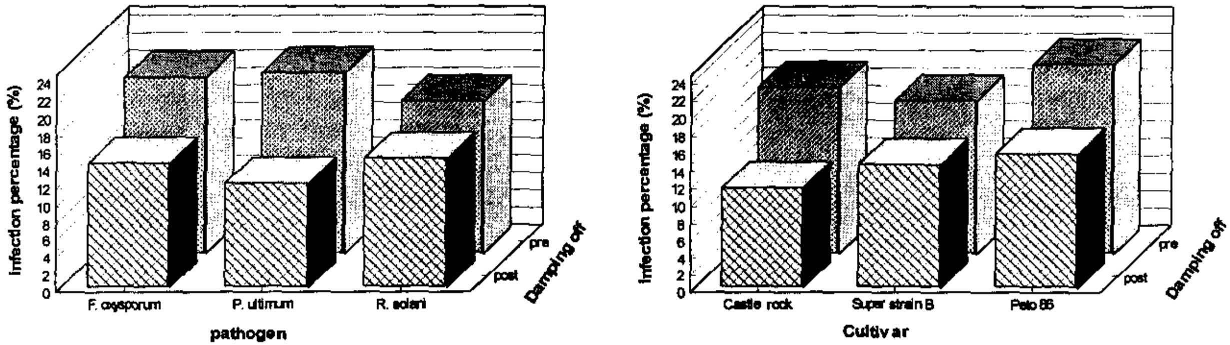
Table (1): Effect of compost types on infection percentages on tomato plants.

Compost	Pre- emergence	Post- emergence	Percentage of infection (%) Seeds	Percentage of infection (%) Seedlings
Sheep N.F	28.24^{c}	19.44^{bc}	47.69^{d}	43.98^{c}
Sheep C	12.96^{ab}	8.80^{a}	21.76^{ab}	20.37^{ab}
Sheep C.T	17.13^{ab}	6.48^{a}	23.61^{ab}	36.11^{bc}
Sheep C.A	8.33^{a}	5.56^{a}	13.89^{a}	18.06^{a}
Sheep C.T.A	12.04^{a}	5.56^{a}	17.59^{a}	26.39^{ab}
Chicken N.F	36.57^{d}	21.76^{c}	57.87^{e}	37.96^{c}
Chicken C	21.76^{bc}	14.35^{b}	36.11^{c}	28.70^{b}
Chicken C.T	23.61^{bc}	19.91^{bc}	43.52^{d}	39.82^{c}
Chicken C.A	19.44^{b}	10.65^{ab}	30.09^{bc}	23.15^{ab}
Chicken C.T.A	19.44^{b}	11.11^{ab}	30.56^{bc}	38.43^{c}
Mushroom C	13.89^{ab}	11.57^{ab}	25.46^{b}	27.78^{b}
Mushroom CT	18.52^{ab}	15.28^{b}	33.80^{c}	38.89^{c}
S.M.C	11.11^{a}	11.11^{ab}	22.22^{ab}	27.31^{b}
S.M.C.T	13.43^{ab}	10.19^{ab}	23.61^{ab}	41.67^{c}
Control	37.04^{d}	36.11^{d}	73.15^{f}	63.43^{d}
L.S.D 0.05	6.65	5.39	7.34	8.65

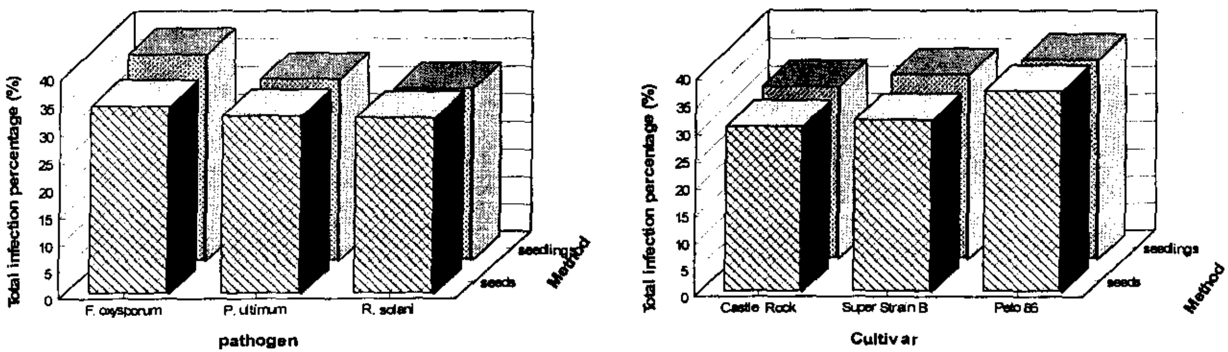
NF= Not fermented C= Compost T= Tea
A= Additives SMC= Spent mushroom compost
SMCT= Spent mushroom compost tea



L.S.D 0.05 Pre (ns)
Post 2.04

L.S.D 0.05 Pre (ns)
Post 2.88

Figure (1): Effect of pathogen and cultivar on incidence pre- and post emergence damping off on tomato plants.



L.S.D 0.05 Seeds (ns)
Seedlings 4.01

L.S.D 0.05 Seeds (ns)
Seedlings (ns)

Figure (2): Effect of pathogen and cultivar on incidence total infection percentage on tomato plants cultivated from seeds or seedlings method.

Table (2): Effect of compost types on leaf area index (cm^2), chlorophyll (mg) and nitrogen percentage (%) on tomato plants cultivated with seeds and seedlings methods.

Compost	Seeds method			Seedlings method		
	LAI (cm^2)	**Chl.(mg)**	**N (%)**	**LAI (cm^2)**	**Chl (mg)**	**N (%)**
Sheep N.F	24.39^{f}	25.22^{e}	1.74^{e}	50.80^{e}	26.96^{d}	2.15^{cd}
Sheep C	51.22^{b}	30.69^{b}	2.29^{b}	109.84^{b}	33.99^{ab}	2.39^{b}
Sheep C.T	39.97^{d}	27.10^{d}	1.88^{d}	80.43^{cd}	29.96^{c}	1.93^{e}
Sheep C.A	59.89^{a}	32.49^{a}	2.56^{a}	126.04^{a}	34.96^{a}	2.76^{a}
Sheep C.T.A	41.52^{cd}	30.80^{b}	2.10^{c}	88.42^{c}	31.04^{bc}	2.12^{cd}
Chicken N.F	25.80^{f}	27.82^{c}	1.93^{d}	65.26^{d}	27.66^{d}	1.95^{e}
Chicken C	41.13^{cd}	29.73^{b}	2.10^{c}	105.05^{b}	32.33^{b}	2.12^{cd}
Chicken C.T	30.44^{ef}	27.92^{c}	1.88^{d}	71.00^{d}	31.46^{bc}	1.87^{e}
Chicken C.A	49.10^{bc}	33.04^{a}	2.32^{b}	120.00^{ab}	35.14^{a}	2.38^{b}
Chicken C.T.A	34.68^{e}	30.89^{b}	2.11^{c}	90.50^{c}	32.10^{b}	2.09^{d}
Mushroom C	40.33^{d}	30.68^{b}	2.23^{bc}	127.38^{a}	31.47^{bc}	2.23^{c}
Mushroom CT	28.12^{f}	26.37^{d}	1.84^{de}	88.68^{c}	29.35^{cd}	1.90^{e}
S.M.C	45.07^{c}	30.24^{b}	2.01^{cd}	117.42^{ab}	30.71^{bc}	2.08^{de}
S.M.C.T	26.99^{f}	28.63^{c}	1.80^{de}	87.05^{c}	28.79^{cd}	1.82^{e}
Control	17.94^{g}	20.73^{f}	1.06^{f}	40.54^{e}	22.86^{e}	1.06^{f}
L.S.D 0.05	**4.68**	**1.08**	**0.14**	**12.40**	**1.76**	**0.14**

LAI= Leaf area index Chl.= Chlorophyll N= Nitrogen percentage
NF= Not fermented C= Compost T= Tea
A= Additives SMC= Spent mushroom compost
SMCT= Spent mushroom compost tea

Table (3): Effect of pathogens on leaf area index (cm^2), chlorophyll (mg) and nitrogen percentage (%) on tomato plants cultivated with seeds and seedlings methods.

Pathogens	Seeds method			Seedlings method		
	LAI (cm^2)	Chl (mg)	N (%)	LAI(cm^2)	Chl (mg)	N (%)
F. oxysporum	36.90^b	29.32^a	2.06^a	91.27^b	30.14^b	2.09^a
P. ultimum	41.54^a	28.03^b	1.98^b	84.21^c	29.98^b	2.07^a
R. solani	32.88^c	29.13^a	1.93^c	97.68^a	31.63^a	2.02^a
L.S.D 0.05	**2.41**	**0.63**	**0.05**	**4.50**	**0.84**	**(NS)**

LAI= Leaf area index Chl.= chlorophyll N= nitrogen percentage
NS= Not significant

Table (4): Effect of tomato cultivars on leaf area index (cm^2), chlorophyll (mg) and nitrogen percentage (%) on tomato plants cultivated with seeds and seedlings methods.

Cultivars	Seeds method			Seedlings method		
	LAI (cm^2)	Chl (mg)	N (%)	LAI (cm^2)	Chl (mg)	N (%)
Castle Rock	39.23^a	29.04^a	2.01^a	98.34^a	30.51^a	2.10^a
Super Strain B	35.74^a	28.85^{ab}	2.00^a	89.59^a	31.06^a	2.05^a
Peto 86	36.35^a	28.58^b	1.96^a	85.24^a	30.18^a	2.02^a
L.S.D 0.05	**(NS)**	**0.30**	**(NS)**	**(NS)**	**(NS)**	**(NS)**

LAI= Leaf area index Chl.= chlorophyll N= nitrogen percentage
NS= Not significant

الملخص العربى

مكافحة أمراض أعفان جذور الطماطم بإستخدام الكومبوست ومستخلصاته تحت ظروف الصوبة الزراعية

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تم إختبار بعض أنواع الكومبوست ومستخلصاتها وهى مخلفات الدواجن والأغنام المتخمرة باضافات أو بدون إضافات بالإضافة إلى كومبوست عيش الغراب ومخلفات زراعة عيش الغراب على تقليل معدل إصابة نباتات الطماطم بأعفان الجذور، وذلك لنباتات الطماطم المنزرعة من البذور أو الشتلات. تم إضافة الكومبوست الى التربة بمعدل (٢٠ %) أما مستخلص الكومبوست فتم رى النباتات به، بعد ذلك تم حساب معدل الاصابة الكلية بالإضافة الى موت البادرات قبل أو بعد الظهور. كانت الاختلافات في النسبة المئوية للاصابة نتيجة للمعاملة بالكومبوست معنوية فى كل من النباتات النباتات المنزرعة سواء بالبذرة أو الشتلات. تم تسجيل أعلى معدلات التثبيط لحدوث الاصابة نتيجة لمعاملة التربة بكومبوست مخلفات الأغنام المتخمر باضافات فى كل من طريقة الزراعة بالبذرة والشتلات. وأيضا سجلت أعلى المعدلات إستجابة من الفطريات للكومبوست هى التى تم تسجيلها من فطر *R. solani* في طريقتى الزراعة بالشتلات والبذور. بالإضافة إلى دراسة تأثير الأنواع المختلفة من الكومبوست ومستخلصاتها على مساحة الاوراق لنباتات الطماطم ومحتواها من النتروجين والكلوروفيل حيث أدت المعاملة بالكومبوست الى زيادة هذه الصفات زيادة معنوية.