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PASTEURIZED HUMOBAVTER-A COMPOST AND SPRAYS OF LIQUID FERTILIZER TO SUPPRESS RHIZOCTONIAL DAMPING-OFF

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ABSTRACT

Integrated management using organic peat – mix (Humobacter-A) plus NPK mineral fertilizer at 10, 20, and 30 mg kg^{-1} and spraying a full emergence seedlings with ALGIDEX; (organic liquid fertilizer plus extract of marine herb (*Ascophilum nudosum*) were applied for reducing the occurrence and severity of radish damping – off caused by *Rhizoctonia solani* Kuhn. NPK fertilization of incubated soil for 28 days reduced diseased seedlings to 27-35% and 23 - 37 % when used at 20 and 10 mg kg^{-1} respectively, prolonged incubation reduced disease occurrence to 27- 40 % when seedlings sprayed with 5 ml ALG. or by 20 mg NPK plus 20 ml ALG. Most of necrotic seedlings could be survived indicate that the compost and amendments suppressed post – emergence damping – off, since complete healthy seedlings were resulted when the soil incubated for 14 and 28 days and amended with 30 mg NPK kg^{-1} and 10 ml ALG. compared to 13.72 % and 7.84 % in the control. Heating of peat – mix at 50 ^{0}C for 5 days and incubated for 14 days suppressed the occurrence of damping – off to 27.45 % compared to 45 and 47 % when incubated for 28 and 7 days respectively. Necrotic seedlings restricted to only 5.88 % in the heated peat– mix incubated for 14 days with 20 ml ALG. Furthermore, disease severity reduced to the lowest rate (0.1) on seedlings grown in heated media under the same conditions. Thermophilic fungi of *Aspergillus* spp., *Alternaria alternata, Humicola grisea, Penicillium* spp. and *Rhizopus stolonifer*, was recovered incubated peat – mix for 28 or 14 days as 7.7 and 6.1 cfu g^{-1}, respectively.

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INTRODUCTION

Since the 1950s, several authors (Bunt 1988; Handreck and Black 1991) have shown the different requirements of plants growing in soil from those growing in a container and the importance of the physical (air and water relationship) and physicochemical properties (nutrient availability, E.C., pH). The low biological activity of peat (Borrero *et al.*, 2004, 2009; Castano *et al.*, 2011) used alone or as the sole organic component in mixtures has been shown to be generally conducive to several plant diseases (Noble and Coventry 2005; Bonanomi *et al.*, 2010).

The idea of using compost instead of peat comes from Hoitink *et al.*, (1975). Those authors suggest using compost made from bark in order to control root rot in ornamentals (Hoitink *et al.*, 1977),this strategy is widely extended for pot plants in the USA, but not in Europe (Litterick *et al.*, 2004).Worthily, not all composts suppress plant diseases and also the range of pathogens and level of suppression are variable.

Disease suppression by composts is mainly attributed to the microbial populations linked to the source of the organic matter in the composts. This fact has been pointed out from the very beginning by Nelson and Hoitink (1983) and Trillas *et al.*, (1986) who observed that the suppression phenomenon was eliminated or reduced by heating (60°C) the compost or irradiating it with gamma radiation . As with soils, the suppressive potential of composts can be restored by reintroducing a mixture of microorganisms, a specific microorganism, or amendments of suppressive soil/composts (Hoitink *et al.*, 1997; Cotxerrera et al., 2002; Weller *et al.*, 2002; Dukare et al., 2011; Noble, 2011).

Nutrition for antagonistic or beneficial organisms, is provided by organic matter or waste products released by other soil organisms (Haggag, 2002). There are instances where composts can increase disease severity to one pathogen but not to another. Krebs (1990) found

spruce bark compost enhanced the incidence of *Fusarium* wilt of cyclamen but in other studies, decreased the incidence of *Phytophthora* root rot of poinsettias (Erhart *et al.,* 1999; Hoitink *et al*., 2001).

In another example, highly saline composts enhanced diseases caused by *Pythium* spp. and *Phytophthora* spp., while municipal sewage sludge compost and ammonium-nitrogen-releasing sludge compost enhanced *Fusarium* wilt due to their low C: N ratio (Hoitink et al., 1996).This work aimed to emphasis the evidences suggest that peat mix has natural disease suppressive components of *R. solani* that reappear in pasteurized substrates during and after incubation.

MATERAL AND METHODS

Pasteurization of Peat-mix: To determine whether the mechanism by which the peat mix suppressed damping-off was biological in nature, peat mix was pasteurized by heating in an oven at 50±2°C for 5 days. Control treatments included non-heating substrates. Moisture lost during pasteurization was restored by the addition of sufficient sterile water to restore the mass to that prior to heat treatment.

Rhizoctonia solani soil inoculum was added using 5g/kg soil, and bags were incubated for 7, 14, or 28 days in the dark (24 ± 2). Radish seeds cultivated and liquid fertilizer of ALGIDIX 20ml L^{-1}distilled water sprayed on seedlings after 14 days (full emergence).

A radish – *Rhizoctonia* bioassay was performed after 21 days for damping-off and Plants were rated using a 0–4 scale reported by (Abbasi et al., 2004) for assessment of disease severity, in which 0 = healthy, 1 = small lesion, 2 = large lesion, 3 = post-emergence damping-off, and 4 = pre-emergence damping- off. Disease severity was calculated using this formula;

$$\%\ \textbf{Dis. Severity} = \frac{\text{No. of plant in class (1)} * \text{disease indicator} + \text{No. of plant in class (2)} * \text{dis. indicator} + + +}{\text{Total No. of plant} * \text{The highest disease indicator}}$$

Before planting samples from control heated and non-heated peat mix were taken for thermophiles fungi counts based on dilution plating 10^{-4}. Total fungi were enumerated colony forming units (cfu) on PDA media and identified as described by (Rajankar et al., 2007). The trials were arranged in factorial completely randomized design with 3 replicates.

RESULTS AND DISCUSSION

Damping – off was significantly reduced in heated container media , particularly when incubated for 14 days and seedlings sprayed using 20 ml ALG. after full emergence, since only 15.68% were infected to 60.78% in the control (non – heating) (Table, 1).

In general, incubation of heating peat – mix decreased disease occurrence though non–amended by ALG. sprays, since comparable reduction of *R. solani* (39.21%) resulted when substrates incubated for 14 days. Thus, the impact mean for each factor, i.e. incubation 14 days, heating, and ALG. spray were significant ($p \leq 0.05$). The biological nature of disease suppression was further evident from our experiments and also similar with different pasteurized peat – mix of composted bark, fish emulsion, composted manures, or cereal straw and other plant products (Nelson and Hoitink., 1983; Tenuta *et al.,* 2002; Abbasi *et al.,* 2004).

Table (1): Effect of pasteurized compost, incubation period and ALGIDEX spray on the occurrence of damping – off

Incubation periods (day)	Heating	ALG ml L^{-1}		Incubation × Heating	Incubation	Heating
		0ml	20 ml			
7	Non	74.46 a*	64.70 abc	69.58 a		
	Heat	54.90 c	39.21 d	47.05 b		
14	Non	68.62 ab	60.78 bc	64.70 a		
	Heat	39.21 d	15.68 e	27.45 c		
28	Non	74.46 a	64.70 abc	69.58 a		
	Heat	54.90 c	35.29 d	45.09 b		
Incub.× ALG	7	64.68 a	51.96 b		58.32 a	
	14	53.92 b	38.23 c		46.07 b	
	28	64.68 a	49.99 b		57.34 a	
Heat×ALG.	Non	72.52 a	63.39 b			67.95 a
	Heat	49.67 c	30.06 d			39.86 b
ALG.		61.09 a	46.73 b			

*Within each independent factor and interaction the means followed by the same letters aren't significantly different ($p \leq 0.05$). Each value of triple interaction is the mean of 3 replicates.

This evidence suggests that peat – mix has some natural disease suppressive components of different soil – borne pathogens that begin to reappear in pasteurized peat – mix during and also after 7 , 14 , or 28 days of incubation . However, the reduction of disease incidence was coincided by fungi and bacteria decolonized the heated peat – mix after incubation, and thereafter promoting the seedlings growth vigorously by spraying 20 ml of ALG. after full emergence. Further studies are also require to determine whether peat components favor any specific kinds of microorganisms or structural and biochemical defenses generated in / or root exudates and rhizosphere zone, that enhance a successive growth of seedlings to escape or avoid the aggressive pathogen's attack (Abbasi *et al.*,2004).

The effect of incubation × heating was confirmed when heated peat – mix gave a comparable disease suppression after 14 days of incubation because of 27.45% of seedlings were infected , compared to that of 45 and 47% when grown for 28 or 7 days, respectively ; this may be due to high pathogenic inoculum potential after a week and their strong recolonization after 28 days. It's very likely that nitrogen transformation products such as ammonia and nitrous acid (Tenuta and Lazarovis , 2002) or volatile fatty acids (Tenuta *et al* ., 2002) had a role in disease suppression since , generation these toxic compounds are sufficient to kill or inhibit the reproduction of *R. solani* , in addition high organic matter content of peat- mix and availability of several macro and micro minerals necessary for plant growth in each of Humobacter-A and ALG.

Occurrence of Symptomatic Necrotic Seedlings

The results of necrotic radish seedlings shown in (Table, 2) revealed that initial symptoms of Rhizoctonial damping – off showed as necrotic tissues of crown or at junctures of rootlets. These symptoms were decreased to only 5.88% in the heated peat – mix incubated for 14 days and seedlings sprayed with 20 ml ALG. However, heating × ALG. were decreased infected seedlings to 22.87%, whereas the definitive impacts of incubation × heating were noticeable, since only 17.65 % of necrotic seedlings resulted in heated and incubated peat – mix for 14 days compared to 38.23% when incubated for 7 and 28 days. However, 20 ml of ALG. spraying was restricted the disease progress to 34.64 % compared to 45.75 % in control. Our results indicated that colonized *R. solani* and its development in the heated and decomposed media were disturbed at least immediately after radish seeding and showing the symptoms of necrotic lesions. This greatly may be due to poor ability of *R. solani* to increase its inoculum density in that medium, because of cellulose decreasing that used as a substrate, compared to fresh medium (Chung et al., 1988).Thus, invasion and penetration of a pathogen depend upon the succulent degradation tissues or weak plants, this suggest that cellulase activity produced by a pathogen was declined; loss of strongest enzymatic weapons for invasion. Apparently the host plants of radish serve as a preferred food base for the pathogen in conducive medium though glucose released as radish root exudates into the container medium

may have repressed cellulase synthesis by *R. solani* (Eriksson and Wood , 1985).

Table (2): Effect of pasteurized compost, incubation period and ALGIDEX spray on the necrotic radish seedlings

Incubation periods (day)	Heating	ALG ml L^{-1}		Incubation × Heating	Incubation	Heating
		0ml	**20 ml**			
7	**Non**	54.90 a*	45.09 a	49.99 a		
	Heat	45.09 a	31.37 b	38.23 b		
14	**Non**	47.05 a	47.05 a	47.05 a		
	Heat	29.41 b	5.88 c	17.65 c		
28	**Non**	52.94 a	47.05 a	49.99 a		
	Heat	45.09 a	31.37 b	38.23 b		
Incub. ×ALG	**7**	49.99 a	38.23 b		44.11 a	
	14	38.23 b	26.47 c		32.35 b	
	28	49.02 a	39.21 b		44.11 a	
Heat×ALG.	**Non**	51.63 a	46.40 ab			49.01 a
	Heat	39.87 b	22.87 c			31.37 b
ALG		45.75a	34.64b			

*Within each independent factor and interaction the means followed by the same letters aren't significantly different ($p \leq 0.05$). Each value of triple interaction is the mean of 3 replicates.

Disease Severity

Heating of peat – mix reduced disease severity regardless of incubation periods with/with no spraying 20ml of emulsion organic fertilizer of ALG. The lowest infection rating was 0.1 for seedlings grown in heated and incubated medium for 14 day and sprayed with ALG. In contrast, non – heating container medium increased the disease rate to 0.28–0.38 in different examined treatments. Heating × ALG. demonstrated that disease rating of heated peat – mix with 20 ml ALG. achieved to 0.13 compared to 0.21 in control non – sprayed plants (Table, 3).

Table (3): Effect of pasteurized compost, incubation period ALGIDEX spray on the disease severity

Incubation periods (day)	Heating	ALG ml L^{-1}		Incubation × Heating	Incubation	Heating
		0 ml	**20 ml**			
7	**Non**	0.38 ab*	0.33 ab	0.35 a		
	Heat	0.23 cd	0.14 de	0.18 b		
14	**Non**	0.38 a	0.28 bc	0.33 a		
	Heat	0.18 de	0.1 e	0.14 b		
28	**Non**	0.38 ab	0.33 ab	0.35 a		
	Heat	0.23 cd	0.15 de	0.19 b		
Incub.× ALG	**7**	0.30 a	0.23 bc		0.27 a	
	14	0.28 ab	0.19 c		0.23 a	
	28	0.3 a	0.24 abc		0.27 a	
Heat×ALG.	**Non**	0.38 a	0.31 b			0.34 a
	Heat	0.21 c	0.13 d			0.17 b
ALG		0.29 a	0.22 b			

*Within each independent factor and interaction the means followed by the same letters aren't significantly different ($p \leq 0.05$). Each value of triple interaction is the mean of 3 replicates.

Nutrient competition was the mechanism responsible for the decreased disease severity in composted substrates. Adequately, nutrients after full emergence created healthy and tolerant seedlings that persist and prevent a pathogen attack at least at post emergence. Thus, the effect of ALG. was comparable that disease rating was 0.22 , raised to 0.29 in control. Worthwhile, a liquid organic fertilizers such as fish emulsion and ALG. used as a substrate for plant growth promoting rhizobacter (El – Tarabily et al., 2003) with great success of vegetable production and to reduce the pathogens inoculum (Hadar et al., 1992; Gagnon and Berrourad ,1994).

However , the concentration and availability of carbohydrates in lingo- cellulosic substances , chitin, lipid …etc. within the peat – mix organic matter, moisture content, salinity and C/N ratio play a critical role in regulating activities each of the host and soil – borne pathogens (Quarless and Grossmann, 1995 ; Hassan and Yousif ,2013) .

This work indicated that organic matter, a major component of Humobacter – A (85 – 92 %) is a major factor that can be manipulated to improve seedlings health by moisture retention, infiltration , and nutrient retention and release (Weil and Magdoff , 2004).

Effect of Incubation Period and Heating on the Community of Thermophilic Fungi Colonized Peat – Mix

To determine whether thermotolerant or thermophilic species can maintain their metabolic rates during temperature fluctuations of the environment, serial dilution plate method employed after heating of peat-mix at 50 ± 2^0C for five days followed by incubation in dark for 7, 14, and 28 days. This range of temperature was chosen to select the growth of thermophiles species, which may behave as opportunistic organisms since, they are considered to be thermophilic if they grow at or above of 50 ^{0}C and fail to grow at or below 20 ^{0}C. From this trail *Aspergillus niger, A. terreus, Alternaria alternata, Humicola grisea, Penicillium spp.* and *Rhizopus stolonifer* were detected.

The increasing of temperature encourage the decomposition of lignocellulosic material " the major content of peat-mix" by microorganisms provide the succession from mesophilic, thermotolerant, and thermophilic microorganisms and a number of thermophilic cellulolytic and hemicellulolytic fungi specimens could be found. The prevalence of *Aspergillus* spp. in the samples is consistent with the reports of (Wareing, 1997 and Ghatora *et al.,* 2006), these results possible due to the technical approach used, once representatives of this genus are fast growing and easily obtained from many substrates.

Data provided in (Table 4) showed that heating × incubation peat-mix for 28 days was recovered with significant abundant of these fungi, because of 7.7×10^4 cfu g^{-1} soil was isolated, incubation of 14 days of heated compost was also colonized by 6.06 cfu but was insignificant from that of non-heated peat-mix when incubated for 28 days. The lowest microbial population was observed when substrate incubated for 7 days. Therefore, prolonged incubation of pasteurized peat-mix for 14-28 days was activated the predominance of these fungal species. The contents of the microorganisms in compost is affected by several factors such as pH, moisture, and accumulation of organic matter where in warm, humid and aerobic environment provides the basic physiological condition, in these habitats of composts, wood chip piles, nesting material of birds and animals, and municipal refuse, thermophiles may occur either as resting propagules or as active mycelium depending on the availability of nutrients and favorable conditions (Kushaldas, 2009). *penicillium* spp. was significantly recovered from heated peat – mix in addition to *A. terreus*, *A. niger* and *R. stolonifer* . *Penicillium* spp. were also highly distributed in the non- heated compost. Genera of *Aspergillus* and *Penicillium* were strong fungal associations and have dominant adaptive features as primary colonizers probably due to their capacity for the rapid invasion of the available substrate(Wahegaonkar et al., 2011).However, common fungal species from different compost were isolated dominated by *Penicillium* spp. and *Aspergillus* in summer and winter (Chutia and Ahmed,2012).

Table (4): Effect of incubated and heated peat- mix compost on the population of thermophilic fungi.
*Within each independent factor and interaction the means followed by the same letters aren't significantly different ($p \leq 0.05$). Each value of triple interaction is the mean of 3 replicates.

Heating	Incubation Period (day)	Thermophiles fungi (cfu × 10^4 g^{-1} peat-mix)						Heating × Incub.	Heating	Incubation
		1**	**2**	**3**	**4**	**5**	**6**			
Non	**7**	6.00 e*	2.33 i-k	2.0 jk	2.33 i-k	2.0 jk	1.67 kl	2.72 d		
	14	9.33 d	3.33 g-k	4.0 f-i	3.67 f-j	3.67 f-j	2.67 h-k	4.44 c		
	28	13.33 c	4.67 e-g	5.33 e-g	4.33 e-h	4.33 e-g	3.67 f-j	5.94 b		
Heat	**7**	10.67 d	3.67 f-j	2.33 i-k	3.67 f-j	0.0 L	0.0 L	3.39 d		
	14	21.33 b	4.67 e-g	5.0 e-g	5.33 e-g	0.0 L	0.0 L	6.06 b		
	28	29.67 a	5.33 e-g	5.33 e-g	5.67 ef	0.0 L	0.0 L	7.67 a		
Heating × Fungi	**Non**	9.56 b	3.44 ef	3.78 de	3.44 ef	3.33 g-k	2.67 f		4.37 b	
	Heat	20.56 a	4.56 ed	4.22 cde	4.89 c	0.0 g	0.0 g		5.70 a	
Incub. × Fungi	**7**	8.33 c	3.00 fg	2.17 gh	3.0 fg	1.0 h	0.83 h			3.06 c
	14	15.33 b	4.00 ef	4.50 de	4.50 de	1.83 gh	1.33 h			5.25 b
	28	21.50 a	5.0 de	5.33 d	5.0 de	2.17 gh	1.83 gh			6.81 a
Fungi		15.06 a	4.00 b	4.0 b	4.17 b	1.67 c	1.33 c			

** 1=*Penicillium* spp. 2= *R.stolonifer* 3= *A. terreus* 4= *A. niger* 5= *A. alternata* 6= *H.grisea*

Furthermore, results of incubation × fungi confirmed that *Penicillium* was the most dominant fungi regardless of incubation period and showed good growth by 8.33, 5.33, and 21.5 cfu g^{-1} from peat – mix incubated for 7, 14, and 28 days, respectively. Thus, the heated peat – mix and thereafter, incubation for 28 days, was the most favorable substrate as a source of thermophiles fungi that fungal community recovered by 6.81 cfu g^{-1}. Opportunists of thermophilic fungi may also behave as endophytics that live in the spaces of tissues of apparently healthy host plants without causing definitive symptoms of disease and most of them have a beneficial effect of the host organisms. Often a single woody plant will harbor dozens to genera of *Aspergillius* , *Penicillium*, *Caetomium*, *Humicola*, *Rhizopus* and others (Li et al ., 2001). This specific ecology of processed compost consists of metabolism and bioactivities make them an important source for structurally novel bioactive natural products such as antifungal, antifeedant and toxins against pathogens (Scherlach et al., 2010).

Finally, we conclude that pasteurization and incubation of peat – mix in the dark may result of increasing fungistasis through predominance and alternation diversity of the soil microbial community (De Boer et al., 2003) grown at heating temperature and incubated compost for 14-28 days. Subsequently, this process usually happens in the presence of microbial competition, nutrients aren't available for most plant pathogens such as *Pythium* spp., *Phytophthora* spp., and *R. solani* (Hoitink and Boehm, 1999),and this promotes seedlings growth vigorously by spraying 20 ml ALGEDIX.

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ب کارئینانا پەینێ ئەندامی یێ ستریلکری ژ جورێ Humobacter-A و رەشاندنا پەینێ روون بو پاراستنا نەماما ژ مرنێ ب کەروویێ رایزوکتونی

پوختە

ب رێڤەبرنا گشتگیر و تەمام هاتیە بکارئینان ب کارئینانا پەینێ ئەندامی Humobacter-A و پەینێ NPK ب رێژەییێن 10 و 20 و 30 ملگم \ ککگم و پەینێ روون ALGIDEX (پەینێ ئەندامی + گیراوێ گیایێ دەریایی Acophilum mudosum) ژ بوو کێمکرنا دژواری و رێژا مرنا نەمامێن تفران ژ ئەگەرێ R. solani .پشتی 28 روژان ژ کوگەهکرنا پەینێ NPK دناڤ ئاخێ بو ئەگەرێ کێمکرنا نەخوشیێ بو رێژا 27 – 35 % و 23 – 37 % ل دەمێ بکارئینانا هەردوو رێژێن 20 و 10 ملگم \ ککگم دیڤ ئێکدا ، هەمان کوگەهکرن بو ئەگەرێ کێمبوونا نەخوشیێ کو گەهشتە 27 – 40 % پشتی نەمام هاتینە رەشاندن ب رێژا 5 % ژ ALG. یان ژی 20 ملگم NPK + 20 مل ALG. .

ب کارئینانا کوگەهکرنا ئاخێ ژ بوو 14 و 28 روژان بو ئەگەر هەمی نەمامێن سەرەدەریکری دساخلەم بن ئەوژی بکارئینانا 30 ملگم NPK + 10 مل ALG. بەراوردکرن دگەل 13.72 و 7.84 % دگەل سەرەدەریا کونترولی . گەرمکرنا پەینێ ئەندامی ل 50 س◦ بو ماوێ 5 روژان و کوگەهکرنا 14 روژی بو ئەگەرێ کێمبوونا نەخوشیێ بو ریژا 27.45 % بەراوردکرن ب 45 و 47 % پشتی هاتینە چاندن دناڤ پەینێ ئەندامی یێ کوگەهکری بوماوێ 28 و 7 روژان دیڤ ئێکدا.

دیاربوونا نەخوشیێ لسەر نەمامان گەهشتە 5.88 % لسەر خارنا کوگەکری بوماوێ14 روژا دگەل بکارئینانا 10 مل پەینێ ALG. هەروەسا بو ئەگەرێ کێمکرنا دژواریا نەخوشیێ بو 0.1 ژبوو وان نەمامێن هاتینە گەرمکرن دناڤ هەمان کەش دا . کەروییێن هاتینە تومارکرن لسەر پلەییێن گەرمێ یێن بلند (Aspergillus spp. , Alternaria alternata , Humicola grisea , Penicillium spp. , Rhizopus stolonifer) ل دەمێ کوگەهکرنا پەینێ ئەندامی 28 و 14 روژان ب رێژەییێن 7.7 و 6.1 cfu \ گم دیڤ ئێکدا .

استخدام السماد العضوي المعقم نوع Humobacter-A و رشات السماد السائل لمنع موت البادرات الرايزوكتوني

الخلاصة

استخدمت الأدارة المتكاملة باستعمال السماد العضوي Humobacter-A والسماد المعدني NPK بتراكيز 10 ، 20 ، 30 ملغم \ كغم والسماد السائل ALGIDEX (سماد عضوي + مستخلص العشب البري *Ascophilum mudosum*) لخفض نسبة و شدة موت بادرات الفجل المتسبب عن *R. solani* . ادى السماد NPK بعد 28 يوم من التحضين الى اختزال المرض بنسبة 27 – 35 % و 23 – 37 % عند استخدامها بتراكيز 20 و 10 ملغم \ كغم على التوالى ، وادى التحضين لمدة 28 يوم الى خفض ظهور المرض لتبلغ 27 – 40 % عندما رشت البادرات ب 5 % ALG. او باستخدام 20 ملغم NPK + 20 مل ALG. .

ان معظم البادرات التى اظهرت اعراض التنخر الموضعى بقيت حية فظهرت البادرات سليمة تماماً عند تحضين التربة لفترة 14 يوم و 28 يوم عند تسميدها ب 30 ملغم NPK + 10 مل ALG. مقارنتاً ب 13.72 و 7.84 % فى معاملة المقارنة . ان تدفئة السماد العضوي عند 50 س◦ لفترة 5 ايام و تحضينها 14 يوم منع ظهور المرض لتبلغ 27.45 % مقارنة ب 45 و 47 % عندما زرعت فى السماد العضوي المحضن لفترة 28 و 7 ايام على التوالي.

انحصرت البادرات المتنخرة الى 5.88 % فى الوسط المحضن 14 يوماً مع 10 مل سماد ALG. كما واختزلت شده المرض الى 0.1 للبادرات الناميه في الوسط المدفأ و تحت نفس الضروف. سجلت الفطريات التاليه المحبة للحرارة *Aspergillus* spp. , *Alternaria alternata* , *Humicola grisea* , *Penicillium* spp. , *Rhizopus stolonifer* . خلال فترة تحضين السماد العضوي 28 و 14 يوم بنسب 7.7 و 6.1 cfu \ غم على التوالى .