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Effect of Compost Alone or in Combination with some Substances Against White-Rot Disease of Onion.

Morsy, S. M.[1] and Azza R. Emara.[2]
[1] Plant Pathology Institute. A.R.C. Giza, Egypt.
[2] Central Agricultural Pesticides Lab. A.R.C. Giza, Egypt.

ABSTRACT

This study was carried out to control the onion white-rot disease by using compost alone or in combination with some other treatments such as Humic acid, sulfer, *Trichoderma viride* and gool herbicide. Six isolates of *Seclerotium cepivorum* (the causal fungus of the onion white – rot disease) were tested in this experiments. Isolate No. 1 was the most aggressive as it incited white – rot disease on three onion cultivars (Giza 20, Giza 6 and Italy). The soil application with compost which added at planting gave the lowest mean disease incidence under greenhouse conditions. However compost application alone or in combination with other amendments on infection with *Sclerotiomum cepivorum* (isolate Sc_1) on onion (cvs. Giza 20 and Giza 6) significant decreased in the disease incidence(percentage of infection) as compared with the infected untreated control. Treatments of compost with gool was the most effective treatment and reduced percentage of infection with white rot on Cv. Giza 20 and Cv. Giza 6, to 3.9% and 6.95% compared to 44.6% and 53.75% for the untreated control for both Cvs. respectively, with 89.1% mean disease reduction under field conditions. Investigating of the chemical characteristics associated with onion tolerance to *S. cepivorum* reveald that he total phenolic content in most tolerant non-inoculated cv. Italy was obviously higher than that the most susceptible cv. Giza 20. being 9.8 mg/g. f.w. and 10.9 mg/g.f.w, respectively. Also, planting of onion plants in soil infested with S.*cepivorum* isolates significantly increased mean total phenolic content in bulbs reach 17.32 mg/g. f.w. in the most resistant cv. Italy of onion compared to the susceptible cv. Giza 20 reached to 13.8 mg/g.f.w.. Also, the application of compost alone or in combination with other substances significantly increased shoot length, number of leaves / plant and yield.

INTRODUCTION

Onion *(Allium cepa* L.) is one of the most important crops in many countries of the world including Egypt. It is used in preparation of different foods, and is the most reputable medicine in the world. It is rich in flavonoids and sulfur compounds that have been perceived benefits to human health (Mohammed *et al*, 2014).

Total area for onion cultivated in Egypt reached 68053 hectar in 2017 which yielded about 2397035 tons (FAO 2018). The Egyptian onion is desirable in the foreign markets for its good quality. Unfortunately, onion is attacked by several diseases at all stages of growth, where white rot disease is the most destructive one causing tremendous quantitative and qualitative losses (Hussein *et al*, 2014).

White rot of onion caused by the soil borne fungus *Sclerotium cepivorium*, is one of the most important diseases wherever *Allium* crops are grown and is an economically limiting factor in production areas around the world (Coley- Smith 1990). Primary inoculum of the pathogen resulted from the spherical, small black sclerotia in infested soil. Soil remain infested for many years though *S. cepivorium* does not infect plants other than *Allium* spp. and persistence apparently is due to the survival of sclerotia. (Crowe and Hall 1980).

The control of this disease has been situated as difficult both technically and economically and has posed a challenge to researchers. In several countries, including the United States and Egypt; management of the white rot disease has been based mostly on the use of chemical fungicides (Davis *et al.*, 2007). However, application of fungicides do not always provide satisfactory disease control beside their deleterious effects on the environment and humans (Slade *et al.* 1992). Qunsequantly use of fungicides is becoming more and more contraversal. Several alternative methods have been proposed for the control of white rot including compost application alone or in combination with other chemicals substances in order to decrease the disease incidence.

MATERIALS AND METHODS

1- Causal organism:

Six isolates of *Saclerotium cepivorum* were obtained from survey in different localities in Egypt.

Identification of the isolated fungus was earned out in Plant Pathology Research Institute, Agricultural Research Center. Giza, Egypt according to Walker (1952).

2.Pathogenicity tests and varietal reaction:

Three cultivars seed of onion (Giza 6, Giza 20 and Italy) were obtained from Agricultural Research Center. Giza, Egypt.

Six of the most good growing isolates, recovered in the survey, were tested in the present study for their virulence and varietal reaction.

Inocula of the analyzed isolates were prepared by the methods of (Abd-EI-Rehim, 1984) and incubated at 18 - 20 °C for 15-20 days. Plastic pots (30- cm in diameter) were sterilized by immersing in 5 % formalin solution for 15 minutes then left 15 days to dry.- Four sterilized pots for each isolate were filled with autoclaved soil, watered and mixed thoroughly with 5 g inoculum / kg soil, each pot contain 5 kg soil.

One week after inoculation, five healthy seedlings of 40 days old of each onion cultivar *i.e,* (Giza 6, Giza 20, and Italy) were transplanted in each pot. Plants were watered and mineral fertilized as usual, but no fungicides were applied. Plants were uprooted 90 days after transplanting and graded for disease severity based on 0-100 scale described by Abd El-Moity (1976) and Shatla *et al,* (1980).

Degree of virulence was estimated as mean of percentage disease severity incited by each isolate on the tested plants, as follows^

Number of plants*Numerical value/Total Number of plants.

3. Effect of compost application to control white rot of onion.

Agricultural residues effect of onion and garlic which widely abundant in the Egyptian farms were used as raw materials for compost production according to the rapid composting methods described by Cuevas (1993).

The residues of onion and garlic were mixed with fresh animal manure 3: 1 (w/w) as a nitrogen source to speed up decomposition and to get good compost quality. Completion of composting was determined by the pleasant odors, reduction of the produced heat, the change into dark brown color and the crumbling texture type of the mixture (Cuevas 1993). Compost pH was determined by suspending 5.0 g of compost in 10 ml deionized water, then the pH of the supernatant was measured after 1 hour and adjusted with NaoH. Compost was sun dried until 10-20% moisture and applied at the rate of 20 m^3/ fed. *i.e.* $3.3x10^{-4}$ m^3/ plastic pot **(**El-Gizawy, 2005).

Some chemical and physical properties of some compost used are present in Table (1). The analyzed - values for the compost were conducted at the soils and water Res. Lab. at Giza, Agric. Res. Center, Giza, Egypt.

Table 1. Some chemical and physical properties of the used compost.

Compost type characterized	Content
PH	6.0
Electrical conductivity (ds m"^{1})	3.1
C :N ratio	7.12
Organic matter (%)	42.9
N (%)	2.80
P (%)	0.62
K (%)	2.5
Bulk density (gem ^{3})	0.88

1. Effect of time of application:

Pots (30- cm in diameter) were prepared and filled with soil mixture as previously mentioned in the pathogenicity test. Compost was applied to pots in greenhouse, at planting, one week, 2 weeks, and one month after transplanting. No compost was applied to the control treatment. No fungicides were applied and all pots were inoculated with *S. cepivorum* Sc_1 or Sc_3 inoculum prepared as previously mentioned in pathogenicity test. Four seedlings of onion (cv. Giza 20 and cv. Giza 6) were planted in pot representing one replicate. Five replicates were assigned for each treatment. At the end of the growing season 90 days after planting, white rot disease incidence (percentage of infection) was recorded. The data obtained were statistically analyzed using Complete Randomized Block Design (Sendecor and Cochran 1973).

2.Effect of different amendments to compost.

Trichoderma viride fungus as a bio-agent which amended to compost was obtained from the Agricultural Research Center, Giza, Egypt and was growing on sterilized medium of wheat and maize flakes (10: 1 w/w). The colonized substrate was mixed with horticultural perlite to produce *Trichoderma viride* inoculum of 7.67 X 10^6 (CFU/ g) for amending compost.

Humic, Sulfur and Gool are Kafr-El-Zayat company products (Egypt). Humic was added at the rate of 10 kg/ fed ($1.6xl0^{-4}$k g/pot), while, sulphur was added at the rate of 30 kg/ feddan, $5xl0^{-4}$ kg/pot before sowing, Gool (the best herbicide which uses in onion cultivations) was added at the rate 750 mm/ feddan (.0125 mm/ pot), while compost was added as 10 m^3/fed ($1.6xl0^{-4}$ m^3/pot). Compost and all amendments were applied at transplanting (5 kg /pot).

1. Greenhouse experiment:

Pot experiment was conducted in greenhouse at Etay El-Baroud Research Station during 2017 / 2018 winter season to evaluate potential of compost application alone and /or in combination with certain amendments on the incidence of white-rot on onion (cvs. Giza 6 and Giza 20).

The most aggressive *S. cepivorum* isolate revealed in pathogenicity test, *i. e.* Sc_1 was used in this experiment. Inoculum of the tested *S. cepivorium* isolate as well as pots preparation and inoculation were conducted as previously mentioned under the pathogenicity test. White rot disease incidence (percentage of infection was recorded 90 after planting).

2- Field experiment:

Field experiment was earned out during the two winter seasons 2017/2018 and 2018/2019 in field with back history of intensive white-rot disease in Nigrig region, Gharbia governorate. Compost and all amendments used in the greenhouse experiment were tested under field conditions in this experiment.

The experiment was designed as complete randomized block Desgin. Four replicate plots (3.0m X 3.5m) were used for each treatment and the control. All treatments received the same normal agricultural practice but no fungicides were applied. Percentage of infection with white rot was determined 90 days after planting.

4- Biochemical characteristics associated with onion resistance - to *S. cepivorum.*

1-Determination of total phenolic content:

Pot experiment was conducted under greenhouse conditions where pots were prepared inoculated and planted as previously mentioned under the pathogenicity test. The most resistant cv. Italy as well as the most susceptible cv. Giza 20 were used in this experiment for comparison. Six *S. cepivorum* isolates representing the different surveyed regions were used. Oinion seedlings were planted one week after inoculation with the tested isolates. (Ten) days later, seedlings 40 days old were uprooted and chemical assessments were conducted in fresh bulbs of both the resistant and the susceptible onion cultivars tested to reveal chemical characteristics associated with onion tolerance to *S. cepivorum* the causal fungus of white rot disease of onion. This was conducted according to Johnson and Schal (1957).

5- Growth characteristics :

Ten plants at the end of seasons growth were obtained in each replicate to estimate plant height, length, number of leaves and weight of bulbs.

Statistical analysis:

The obtained data were statistically analyzed using the STAT statistical program (ver. 6). Comparison between means were conducted according to Duncun test 0.05 of probability.

RESULTS AND DISCUSSION

Results

1- The causal fungus: ,

Isolation trials were conducted for the causal fungus of the white rot of onion from the collected diseased samples showed the white rot symptoms.

Identification was conducted by using standard methods for identification of the fungal pathogens. Microscopic and cultural characteristics of the developed pathogen on PDA confirmed the association of *S. cepivorum* with the developed symptoms.

2-Pathogenicity tests and varietal reaction

Six of the most of good growing *S. cepivorum* isolates were tested for their virulence on three of the widely grown onion cultivars, *i.e.* Giza 6, Giza 20 and Italy.

Data present in Table (2) show that the tested six isolates of *S. cepivorum (i.e.* Sc_1 , Sc_2 , …….. Sc_6), were all virulent to the tested onion cultivars to different degrees and incited disease severity ranged between 28% and 96% on the tested cultivars.

The Sc_1 isolate was the most aggressive isolate as incited mean severity of 73.33% on the tested cultivars. Rest of the isolates, however, showed moderate virulence as incited mean disease severity ranged between 40.0% for Sc_6 to 54.6% for Sc_3.

On the other hand, all the tested onion cultivars were susceptible to the infection with the analyzed *S. cepivorum* isolates. However, cv. Italy of onion showed the highest tolerance as exhibited mean disease severity of 32.3%, with the tested isolates. Meanwhile cv. Giza 20 showed the lowest tolerance as exhibited disease severity ranged between 48 % and 96 % while cv. Giza 6 showed 44% - 72 % disease severity (Table 2).

3- Effect of compost application to control white rot of onion.

1. Effect of time of application:

This study was carried out to determine the effect of compost application on incidence (percentage of infection) of white-rot on two onion cultivars (Giza 20 and Giza 6) in pots inoculated with *S. cepivrum* (Sc_1, SC_3 isolates) and amended with compost at different times of application. Data in (Table 3*)*, and illustrated in (Fig. 1), indicate that compost application significantly decreased, percentage of infection with *S.cepivorum* on both cultivars and at all times of application. The highest mean reduction of infection however, was obtained when compost was added at planting time as mean disease incidence (percentage of infection) were the lowest being 12% and 20% for cv. Giza 6 and cv. Giza 20, respectively. However, when compost was applied 7 days after planting, the mean percentages of infection were increased to be 34 and 42 in cvs. Giza 6 and 20, respectively. With over mean of 38 % compared to 98.75% disease incidence in the un amended control. Also, when compost was applied 15 days after planting, 58 % overall mean disease incidence was recorded while application of compost 30 days after planting showed the highest overall mean disease incidence being 78 % compared to 98.75 % for the untreated control.

Table 2. Virulence (%) of *Sclerotium cepivorum* isolates recovered in the survey from six different regions on three cultivars of onion, 90 days after transplantation.

Isolate	Disease incidence (%) Cultivar			Mean *
	Giza 20	Giza 6	Italy	
Sc_1	96 a	72 a	52 a	73.33A
Sc_2	52 c	60 c	32 d	48.00 B
Sc_3	60 b	56 d	48 b	54.6 B
Sc_4	52 c	56 d	44 c	50.67 B
Sc_5	48 d	64 b	32 d	48.00 B
Sc_6	48 d	44 e	28 e	40.00 C
Mean	50.8 A	50.3 A	32.3 B	

***Combined analysis**

Virulence was estimated as means of disease severity incited by isolate on onion plants.

Means followed by different letter for each parameter are significantly different at p = 0.05 of probability.

Table 3. Effect of compost application at different times on percentage of infection with *Sclerotium cepivorum* isolates (Sc_1 and SC_3) on cvs. Giza 6 and 20 of onion, in pot experiment, under greenhouse conditions.

Time of compost application	Infection % Giza 6		Mean	Giza 20		Mean *	Overall Mean *
	Sc_1	Sc_3		So	Sc_3		
At planting time.	16 e	8 e	12E	28 e	12 e	20 E	16E
7 days after planting	24 d	44 c	34 D	32 d	52 d	42 D	38 D
15 days after planting	64.0 c	40 d	52 C	68 c	60 c	64 C	58 C
30 days after planting	72.0 b	68.0 b	70.0 B	80.0b	92.0b	86 B	78 B
Control (untreated)	95 a	100a	97.5 A	100.0 a	100.0 a	100.0 A	98.75 A
Mean	35.2	32.0		41.6	46.2		

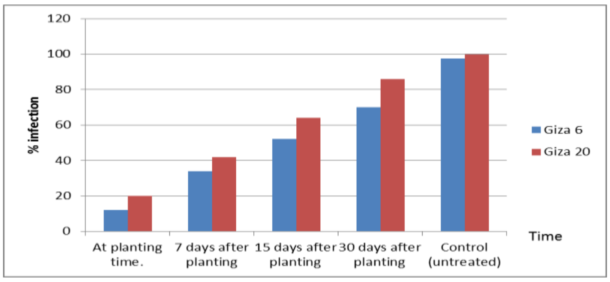

Fig . 1. Effect of compost application at different times on mean percentage of infection with *Sclerotium cepivorum* isolates (Sc1, SC_3) on cvs. Giza 6 and 20 of onion in pot experiment under greenhouse conditions.

2- Effect of different amendments to compost:

1- Greenhouse experiment:

Data in Table (4) show the effect of compost alone and/or in combination with some amendments *i.e.* humic, *T. viride*, sulfur and gool herbicide against *S. cepivorum* (isolate Sc_1) in pot experiment under greenhouse condition. All treatments exhibited significant decrease in disease incidence (percentage of infection) when compared with the infected untreated control. Application of compost amended with gool herbicide before sowing was the most effective treatment and reduced percentage of infection with *S. cepivorum* on cvs. Giza 20 and. Giza 6 to 5% and 10% compared to 75 % and 80 % for the untreated control cultivars, respectively, which achieved 90.3% mean disease reduction. This was followed by sulfur application with compost which reduced percentage of infection to 10 % and 25 % on the two cultivars Giza 20 and Giza 6 respectively, with 77.4% mean disease reduction. However application of compost amended with the bio-agent *T. viride* decreased percentage of infection to 15 % and 30 % for both cultivars with 70.9 % mean disease reduction while the compost + humic reduced the mean percentage of infection by 67.7 %. On the other hand, application of compost alone reduced mean disease incidence to 32.5 % compared to 77.5 % for the untreated inoculated control.

Table 4. Effect of compost application alone or in combination with other amendments on infection with *Sclerotium cepivorum* (isolate Sc_1) on onion (cvs. Giza20 and 6) in pot experiment under greenhouse conditions:

Treatment	Infection (%)		Mean	
	Giza 20	Giza 6	Infection (%)	Reduction (%)
Compost	30b	35 b	32.5 b	58.06 e
Compost +Humic	20 c	30 c	25.0 c	67.7 d
Compost + *Trichoderma viride*	15 d	30 c	22.5 d	70.9 c
Compost + Sulfur	10e	25 d	17.5 e	77.4 b
Compost + Gool	5f	10e	7.5 f	90.3 a
Control (untreated)	75 a	80 a	77.5 a	

*** Combined analysis**
Mean followed by different letter are significantly different at 0.05 of probability

2- Field experiment

Results in Table (5) clear the effect of the compost application alone and /or in combination with humic acid, *Trichoderma*, sulfur and gool amendments on white rot incidence (percentage of infection) on onion cultivars (Giza 20 and Giza 6) in the two winter seasons (2017 and 2018). Treatment of compost with gool was the most effective treatment and reduced percentage of infection with white rot on cv. Giza 20 and cv. Giza 6, to 3.9 % and 6.95 % compared to 44.6 % and 53.75 % for the untreated control of both cvs. Respectively, with 89.1 % mean disease reduction (Table 4). This was followed by compost + sulfur with disease incidence of 7.7 % and 10.3 %, for the two cvs, respectively which constituted 81.6% mean disease reduction. Meanwhile, compost + humic and compost + *T. viride* were also effective and reduced the mean white rot disease incidence by 78.04 % and 64.96 %, respectively. Treatment with compost alone exhibited the least effect where it decreased mean disease incidence to 21.0 % and 22.6 % for the two cultivars respectively with 55.6 % mean disease reduction over the two seasons of the investigation.

Table 5. Effect of compost application alone or in combination with other amendments on the incidence (percentage of infection) of white-rot disease on onion (Cvs. Giza 6 and Giza 20) under field condition during 2017 and 2018 winter seasons.

Treatment	Percentage of infection				Mean		Overall mean*	Reduction (%)
	Season 2017		Season 2018					
	Giza 20	Giza6	Giza 20	Giza 6	Giza 20	Giza 6		
Compost	20.20 b	23.1 b	21.8b	22.2 b	21.0 b	22.6 b	21.3 B	55.6 e
Compost + Humic	7.95 d	13.0 d	8.5 d	13.7 d	8.23 d	13.3 d	10.79 D	78.04 c
Compost + *Trchoderma viride*	13.50 c	17.7 c	17.4 c	20.3 c	15.45 c	19.0 c	17.22 C	64.96 d
Compost + sulfur	6.5 e	10.4 e	8.9 d	10.2 e	7.7 d	10.3 e	9.0 E	81.6b
Compost + gool	4.10 f	6.1 f	3.7 e	7.8 f	3.9 e	6.95 f	5.4 F	89.1 a
Control ntreated)	45.40 a	52.8 a	34.8 a	54.7 a	44.6 a	53.7 a	49.15 A	0.0 f

*** Combined analysis Mean followed by different letter are significantly different at 0.05 of probability.**

4- Biochemical characteristics associated with onion resistance to *S. cepivorum.*

1- Total phenolic content:

Data tabulated in Table (6) indicate that planting of onion plants in soil previously infested with *S. cepivorum* isolates, significantly increased mean total phenolic content in bulbs of both tested onion cultivars compared to the non-inoculated control. However the increase in mean total phenolic content was significantly higher (17.32 ug/g f.w) in the most tolerant cv. Italy of onion compared to the susceptible cv. Giza 20 (13.86 ug/g f.w). Meanwhile, the phenolic content in the non-inoculated most tolerant onion cv. Italy was obviously higher than that the most susceptible cv. Giza 20.

5. Growth characteristics and yield :

Data present in Table (7) clear that, the compost applications alone or in combination with humic, sulphur, *Trichoderma viride* and Gool (as herbicide) of them enhanced significantly all growth characteristics.

According to the mean value of two seasons, the best treatment increased plant height was compost combined with humic that gave 55.6 cm followed by compost combined with sulphur gave 54.6 cm compared with non-treated gave 49.5 cm in two growing seasons.

As for number of leaves /plant; compost treatment combined with Humic gave high number (11.3 leaves / plant) followed by composed alone or combined with sulphur gave 10.3 leaves/ plant for each treatment compared with 8.6 leaves / plant for non-treated.

Also, compost combined with Humic exhibited the highest value (4.6 Ton/ Fed.) of bulb yield / fed in the combined data as shown in Table (7), followed by compost combined with sulphur (4.4 ton/ fed.) compared with non-treated (3.7 ton/ fed.) in two growing seasons.

Table 6. Total Phenolic contents in the most tolerant cv. Italy and the most susceptible cv. Giza 20 of onion bulbs grown in soil infested with *S. cepivorum* isolates.

Isolate	Phenolic content (Mg/g) fresh weight		Mean *
	Giza 20	Italy	
Sc_1	14.36 b	16.07 e	15.21 C
Sc_2	11.96c	17.63 c	14.79 D
Sc_3	15.73 a	18.07 b	16.6 B
Sc_4	11.13 d	17.04 d	14.09 D
Sc_5	14.23 b	15.90 e	15.06 C
Sc_6	15.80 a	19.23 a	17.57 A
Non-inoculated control	9.80 e	10.96 f	10.28 E
Mean without control	13.86 B	17.32 A	—

*** Combined analysis**
Means followed by different letter for each parameter are significantly different at p = 0.05 of probability.

Table 7. Effect of compost combined with some substances on growth characterizes and yield on onion during two seasons 2017 and 2018.

Treatments	Plant height (cm)		Mean	No. of leaves /plant		Mean	Bulbs yield (ton. / fed.)		Mean
	2018	2019		2018	2019		2018	2019	
Compost	52.6	50.5	51.6	9.8	10.5	10.3	4.0	4.2	4.1
Compost + Humic	55.6	55.5	55.6	11.0	11.5	11.3	4.5	4.6	4.6
Compost + Sulphur	54.9	54.9	54.6	105	9.8	10.3	4.4	4.3	4.4
Compost + *Trichoderma viride*	51.8	51.4	51.7	9.3	9.3	9.3	4.2	4.4	4.3
Compost + Gool	52.1	51.8	51.9	9.2	9.5	9.4	4.0	4.1	4.1
Control	49.6	49.4	49.5	8.8	8.3	8.6	3.8	3.6	3.7
L.S.D 0.05			2.02			0.87			0.28

Discussion

In Egypt, the commercial production area of onion crop has been condensed in middle and southern governorates where the causal agent of white rot disease *Sclerotium cepivorum* was widely established. Due to the widespread cultivation of onion, this soil-borne sclerotium -forming pathogen was also spread. Always, Nile Delta governorates, such as Gharbia and Monofia showed strong harmful effects of white rot disease which considered the main limiting factor of onion production there (EL-Khateeb, 2004 and EI- Diehi, 2012).

Reasons of spreading the disease in new places of Nile-Delta governorates may be due to the extension of onion plantation areas since the onion is considered a major crop for local consumption and exportation. Therefore, several studies were concerned about white rot disease of onion and its causal fungus in Egypt (Shaheen *et al,* 2011, El-Diehi, 2012 and Abd- Elfattah and Naglaa 2015).

Meanwhile, the analyzed recovered isolates were variable for their cultural characteristics. Isolate Sc_1 was the most aggressive one as incited disease severity ranged between 52 % and 96 % on the tested cultivars (Giza 20, Giza 6 and Italy). Rest of the isolates, however showed moderate virulence as incited disease severity ranged between 28 % and 64 %. These results supported findings obtained in Egypt and other parts of the world**.** (Sallam *et al.,* 2009 and El-Diehi, 2012)

In the present study all the onion tested cultivars were susceptible to *S. cepivorum* to different degrees. However, cv. Italy was most tolerant as exhibited 32.3% mean disease severity when infected with the tested *S. cepivorum* isolates recovered in the survey. Meanwhile both Giza 6 and cv. Giza 20 cvs . were more susceptible and exhibited 50.3 % and 50.8 % mean disease severity, respectively. These findings were in harmony with Cho *et al.* (1994). Somkuwar *et al.* (1997) and Sallam *et al*. (2009)

Soil amendment with compost is an agronomically increasing practice as well as an ultra-active waste management strategy. The addition of mature compost to the soil favors plant development and improves soil quality, as well as having a suppressive effect on many soil borne plant pathogens (Cotxarrera *et al.* 2002**).** Results of the present study showed the effect of compost alone or in combination with some amendments, *ie.* humic, *Trichoderma viride,* sulphur and gool (herbicide) against *S. cepivorum* isolates under greenhouse and field conditions. All treatments exhibited significant reduction in disease incidence (percentage of infection) compared with the infected untreated control plants. Application of compost with gool as a herbicide before sowing was the most effective treatment to reduced mean disease incidence (on Giza 20 and Giza 6) to 7.5 %. compared to 77.5 % for the untreated control under greenhouse condition. This was followed by compost + sulfer where mean disease incidence was 17.5 % while with compost + *Trichoderma,* compost + humic and compost only, resulted mean white rot disease incidence as 22.5 %, 25% and32.5 % respectively. Besides it was found that compost application at planting time was the most effective against the disease both under greenhouse and field conditions. These results were in agreement (Abd El-Fatah and Naglaa 2015).

Disease suppression by compost on soil borne diseases was often related to biotic rather than abiotic factors (Garbeva *et al* 2004). Compost amendments to soil can modify the microbial community composition and as a result, enhance the competition for nutrients or antagonism and or mycoparasitism among microbes (Steinberg *et al,* 2004 and Perez - Piqueres *et al,* 2006).

Humic substances are mixtures of high-molecular organic compounds. They are created by natural processes in soil organic matter. The formation of defined humic substances depends on chemical soil properties that are determined by a parent material character, the soil forming process, direction, and climate. Humic substances have specific chemical structure and contain various functional groups that determine the role of the humus in the environment, Tolpa *et al*., 1976. Thus, humic substances also, influence the growth of plants, including their germination and nourishment on the presence of microorganisms especially the phytopathogenic ones. (Abdel-Monaim *et al*., 2011 and Abdel-Kader *et al*., 2012b.)

Sulfur is a constituent of amino acids, such as cysteine and methionine. Thiamine, biotin, ferredoxines and coenzyme A are examples of S compounds. Protein also contains N and S. Therefore, S deficiency in plants results in lower contents of essential proteins and carbohydrate. Sulfur mainly comes from organic sources and acts as natural biocide which increases resistance of plants against pathogens. However, sulfur application significantly influenced the growth, yield attributing characters, yield control regardless of the sources and levels of sulfur Rao *et al*., 2013.

The antagonistic microorganism(s) could suppress the activity of a plant pathogen through the enzymatic digestion of the pathogen cell walls (Elad *et al.,* 1983) and / or production of inhibitory volatile substances (Sankar and Sharma 2001)

Several investigators indicated the correlation between the phenolic content as well as activity of the defense related enzymes with resistance of host plants against plant pathogens Zhang and cheng (2008), Zhang *et al.*, 2008 and Moustafa *et al.* , 2013).

On the other hand, the present study showed that the use of fungicides is still an important component in the integrated disease management (IDM) where it should be used as the last resort (Dent, 1995).

In the present study mean total phenolic content in the bulbs of the most tolerant cv. Italy of onion was significantly higher (17.32 ug /g. f. w) than the most susceptible cv. Giza 20 (13.86 ug/g.f.w). Meanwhile, rate of increase in phenolic content after inoculation with S.*cepivorum* isolates in the most tolerant cv. Italy was evidently higher than in the most susceptible cv. Giza 20. From these results, it can be concluded that phenolic contents of bulbs are major chemical constituents that could determine the resistance or susceptibility of onion cultivars to white rot disease. The level of these compounds may play a significant role in disease resistance. Therefore, Phenolic compounds could be used as an indicator for plant breeders in screening programs for selecting cultivars resistance to white rot disease. These results are in agreement with Zhang *et al.* (2008) and Moustafa *et al.* (2013).

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تأثير الكمبوست منفردًا أو مضافاً إليه بعض المواد ضد مرض العفن الأبيض فى البصل

صابر محمد مرسى[١] و عزة رسمى عمارة[٢]

[١] معهد بحوث أمراض النباتات – مركز البحوث الزراعية – الجيزة .

[٢] المعمل المركزي للمبيدات – مركز البحوث الزراعية – الجيزة .

أجريت هذه الدراسة في محطة البحوث الزراعية بإيتاي البارود - مركز البحوث الزراعية. وكانت نتائج هذه الدراسة كما يلى : تم عزل الفطر المسبب لمرض العفن الأبيض من نباتات البصل المصابة والتي تم جمعها من المناطق المختلفة وتم تعريف المسبب المرضى بناء على خواصة المورفولوجية ووفقا للمراجع التقسيمية المتخصصة على أنه فطر *Sclerotium cepivorum* Berk تم اختيار ستة عزلات جيدة النمو وأخذت أرقام من ١ : ٦ . تم اختبار القدرة المرضية للعزلات الستة على نباتات البصل أصناف جيزة ٦ وجيزة ٢٠ وإيطالي كلا على حدة تحت الظروف الزراعية بالصوبة في أصص معقمة حيث ظهرت اختلافات في القدرة المرضية بين العزلات، وكانت العزلة Sc_1 أكثر قدرة على أحداث المرض حيث كان متوسط شدة الإصابة ٧٣.٣% على الاصناف الثلاثة أما العزلة Sc_6 فأحدثت أقل شدة اصابة نسبة مرضية (٤٠%) بينما تراوحت القدرة المرضية لباقي العزلات بين ٥٤.٦% و ٤٨% تم اختبار حساسية ثلاث من أصناف البصل الشائعة للاصابة بالعزلات الستة المختبرة من فطر سكليروشيوم سيبيفوريوم حيث أظهرت الأصناف الثلاثة قابلية للإصابة بدرجات متفاوتة وكان الصنف الايطالي الأكثر مقاومة حيث أظهر شدة اصابة بلغت ٣٢.٣% في مقابل ٥٠.٨% و ٥٠.٣% لصنفى جيزة ٢٠ و جيزة ٦ ؛علي التوالي . أدى إضافة الكمبوست؛ في مواعيد مختلفة للأصص المعقمة والمعداه بالفطر سكليروشيوم سيبيفوريوم والمنزرعه بالصنفين جيزة ٦ وجيزة ٢٠ كلا على حدة إلى تقليل الإصابة فكانت أفضل المعاملات عند إضافة الكمبوست عند الزراعة حيث كانت متوسط نسبة الإصابة ١٦ % على الصنفين في مقابل ٩٨.٧٥ % في الكنترول المعدى الغير معامل بينما عند اضافة الكمبوست بعد اسبوع من الزراعة كانت نسبة الإصابة ٣٨%، بينما بلغت ٥٨% ٧٨% بعد ١٥ يوم و ٣٠ يوم من الزراعة على التوالى. كانت لمعاملة التربة المعداه بفطر سكليروشيوم سيبيفوريوم قبل الزراعة في الأصص بالكمبوست مضافاً إليه التريكودرما فيردي أو الكبريت الزراعي أو الجول (مبيد حشائش) إلى انخفاض نسبة الإصابة مقارنة بالكنترول حيث أظهرت المعاملة بالكمبوست والجول أقل متوسط نسبة إصابة 7.5 % على الصنفين المختبرين (جيزة ٢٠ وجيزة ٦) بينما كانت متوسط الاصابه عند إضافة الكمبوست بمفردة ٣٢.٥% في مقابل ٧٧.٥% للكنترول المعدى الغير معامل كذلك ادى اضافة الكمبوست خلطا مع الكبريت او ترايكودرما فيردى او هيومك إلى انخفاض متوسط نسبة الإصابة الى ١٧.٥ % و ٢٢.٥% و ٢٥% على التوالى. في تجربة حقلية خلال موسمي النمو ٢٠١٧ / ٢٠١٨ و ٢٠١٨/٢٠١٩ كان لإضافة الكمبوست منفردا أو خلطه مع هيومك أو تريكودرما فيردي أو الكبريت الزراعي أو مبيد الحشائش (جول) في الحقل وقبل الزراعة في حقول مصابة بالعفن الأبيض إلى نقص معنوي في نسبة الإصابة مقارنة بالمعدي وغير معامل (الكنترول) وكانت النتائج متوافقة مع تجربة الاصص بالصوبة الا أن نسبة الإصابة كانت اقل في قيمها. أدت العدوى بعزلات الفطر سكليروشيم سيبيفورم إلى زيادة في المحتوى الفينولي لقواعد الأوراق ومقارنة بالكنترول الغير معدي ، و اظهر الصنف الاكثر مقاومة للعفن الابيض وهو الصنف الايطالى اعلى محتوى من الفينولات (١٧,٣٢ ميكروجرام /جرام وزن رطب) بينما كان محتوى الفينولات اقل في الصنف جيزة ٢٠ الأكثر قابلية للاصابة (١٣,٨٦ ميكروجرام /جرام وزن رطب). كان لإضافة الكمبوست منفرداً أو إضافة بعض المركبات إليه أدى إلى زيادة في صفات النمو (طول النبات وعدد الوراق لكل نبات) وأيضاً إلى زيادة المحصول مقارنة بالكنترول الغير معامل . التوصيات : ١- التسميد بالكمبوست المكون من مخلفات البصل والثوم بالمعدلات الموصي بها مع الروث الحيواني سواء كان الكمبوست منفردا أو مضافا إليه إضافات مثل الجول كمبيد حشائش أو الكبريت الزراعي أو فطر الترايكوديرما أو الهيوميك كمخصب للتربة أدي ذلك إلى إنخفاض نسبة الإصابة بمرض العفن الأبيض في البصل وكانت أفضل معاملة عند استعمال الكمبوست مع الجول وذلك عند الشتل .

٢- يعتبر صنف البصل الإيطلي أكثر الأصناف المختبرة في مقاومة فطر العفن الأبيض مقارنة بالأصناف الأخرى جيزة ٢٠ و جيزة ٦.