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Impact of Vermicompost Tea and *Tagetes erecta* Extract to Control Onion Purple Blotch Disease

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Vermicompost tea (VCT) and extract of *Tagetes erecta* L. (TE) were used to study their effect on onion purple blotch caused by *Alternaria porri* (Ellis) Cif, under laboratory and field conditions in comparison with the recommended fungicide Luna Experience. *In vitro*, efficacy of TE extract at 0.25, 0.50, 1.0, 2.0 and 3.0 ml/L PDA medium on linear growth of *A. porri* was estimated. The inhibitory effect of TE on *A. porri* was increased by increasing the TE concentrations, as the 3 ml/L caused 51.3% growth reduction. Under field conditions, at Etay El-Baroud Agricultural Research Station, Beheira governorate, Egypt, seven sprays with VCT at 12.5 and 25 ml/L and TE at 2 and 3 ml/L were used on Italy red and Giza 20 cvs. onion plants during 2015/2016 and 2016/2017 growing seasons to evaluate their effect on disease severity, no. of leaves, plant height, onion bulb yield, chlorophyll a and b content and activity of peroxidase and polyphenoloxidase enzymes. TE extract at 3 ml/L was the most effective comparing with VCT and Luna Experience to reduce purple blotch severity with efficacy of 66.2 and 72.5% on Italy red and Giza 20 plants, respectively. Leaves number, plant height and onion bulb yield were increased positively with treatment concentrations. VCT at the rate of 25 ml/L gave 49.6, 50.4 kg/plot for cv. Italy red and 47.9, 47.3 kg/plot for cv. Giza 20 as the best tested treatment to increase onion bulb yield in the two successive seasons. All treatments increased contents of chlorophyll a and b and activity of peroxidase and polyphenoloxidase in onion plant leaves.

Keywords: *Alternaria porri*, onion purple blotch, *Tagetes erecta* and vermicompost.

Onion (*Allium cepa* L.) is one of the oldest known and most important field crops grown all over the world. In Egypt, onion is used for local consumption in different ways, exportation and also as a medicinal plant. Foliar, bulbs and root diseases are of the most important factors causing low productivity of onion yield and quality (Cramer, 2000). Purple blotch caused by *Alternaria porri* (Ellis) Cif is one of the most destructive common diseases prevailing in almost all onion growing areas of the world. Losses mainly result from reduced bulb size and poor storage quality (Surviliene *et al.*, 2008). The disease is more severe on onion seed yield than on bulb yield, where it sometimes causes 100% loss of onion seed production (Abdel-Rahim *et al.*, 2016). Vermicompost is a low-cost technology for processing organic

waste through interactions between earthworms and microorganisms (Hand *et al*., 1988 and Edwards and Arancon, 2004). Vermicompost aqueous extracts could be aerated or non-aerated and much easier to handle and apply than solid compost (Yardim *et al*., 2006). Vermicompost tea was recommended to be applied as foliar spray or soil drench to improve plant health, yield and nutritive quality (Ingham, 2005). The genus *Tagetes* is a native to Americas but some of its members, in particular *T. erecta* L. and *T. patula* L. commonly known as marigolds were naturalized in the old world, i.e., India, North Africa, and Europe (Nahak and Sahu, 2017). *Tagetes erecta* is a multipurpose plant having ornamental, medicinal, insecticidal, colorant, food, forage applications and enormous researches demonstrated its effect on plant diseases (Dunkel *et al*., 2010 and Devika and Justin, 2014).

This investigation aimed to control onion purple blotch, improve vegetative growth and onion bulb yield through foliar sprays with different concentrations of vermicompost tea and *Tagetes erecta* extract in comparison with Luna Experience fungicide.

Materials and Methods

Isolation and identification of the causal organism:

Onion plants showing typical symptoms of purple blotch disease were collected from a field located at Beheira governorate. Infected leaves were thoroughly washed with tap water, air dried, cut into small pieces, each piece contained single lesion, surface disinfected with sodium hypochlorite (5% active chlorine) for 2 minutes, washed with sterilized distilled water and dried between two sterilized filter papers. Pieces were placed in Petri dishes containing water agar medium and incubated at 25±0.1°C for 3-5 days. Hyphal tip or single spore technique (Riker and Riker, 1936) were used to purify the growing fungal isolates on potato dextrose agar medium (PDA). The isolated fungi were identified according to their cultural, morphological and microscopical characteristics as described by Woudenberg *et al*. (2014). The isolates were kept in PDA slants at 4°C for further studies.

Vermicompost tea:

Vermicompost tea (VCT) was obtained from Central Laboratory for Agricultural Climate, ARC, Giza, Egypt. Vermicompost was mixed with tap water as 1:10 (w/v) in 19 L plastic bucket. The mixture was left open for 7 days at 20-21°C and stirred once on the fourth day after preparation. The resulted VCT was filtered through a nylon membrane and stored at 4ºC for further use (Weltzien, 1991).

Tagetes erecta extract (TE):

Extracts of *Tagetes erecta* plants (marigold), collected by steam system were purchased from KATO Aromatic Co., Giza, Egypt.

Luna Experience:

The fungicide Luna Experience SC, consists of Fluopyram 17.6% and Tebuconazole 17.6%, is recommended against onion purple blotch by the Approved Recommendations to Control Agricultural Pests, Agricultural Pesticides Committee, Ministry of Agriculture, Egypt (2015) was used in this investigation for comparison with the other tested treatments. The fungicide is manufactured by Bayer, Crop Science, Germany.

Effect of Tagetes erecta extract on linear growth of Alternaria porri:

Each liter of fusible autoclaved PDA medium was amended with any of 0.25, 0.5, 1.0, 2.0 and 3.0 ml TE extract and 0.05% tween 20 and gently homogenated. The whole mixture was poured just before solidification in 9 cm Petri dishes at the rate of 10 cc for each. Periphery fungal discs (5 mm) of 7 days old *Alernaria porri* culture were used to inoculate the center of each plate after medium solidification. Five plates were used as replicates for each concentration and the control (untreated medium). The plates were incubated at 25±0.1ºC till mycelial growth covered the medium surface in any plate. Reduction in linear growth was calculated according to the following formula:

$$\text{Reduction of linear growth (\%)} = \frac{\text{Treatment - control}}{\text{Control}} \times 100$$

Field application:

Field experiments were carried out during 2015/2016 and 2016/2017 seasons at Etay El-Baroud, Agricultural Research Station, Beheira governorate, Egypt. Experiments were designed as complete randomized blocks. Four plots were used as replicates for each treatment and control. The area for each plot was 10.5 m^2 (3.0 × 3.5 m). Italy red and Giza 20 cvs. onion transplants of sixty days old were transplanted on 15 of November. All treatments received the same recommended agricultural practices until harvest in May. VCT was used at the concentrations of 12.5 and 25 ml/L, while TE extract was used at the concentrations of 2 and 3 ml/L, while Luna Experience fungicide was used at the rate of 1 ml/L. Super Film at 0.5 ml/L was used as spreader and adhesive material. Foliar sprays of all treatments were applied every other week starting from January 15th until April 15th, as seven foliar sprays.

Chlorophyll contents:

Chlorophyll (Chl.) a and b contents in onion leaves were determined at the end of April for both seasons according to Moran (1982). Absorbance was measured at 647 and 664 nm using spectrophotometer (Jenway 6105 UV-VIS), and the following equations were used for calculation:

$$\text{Chl. a } (\mu g\ mL^{-1}) = 12.46\ A_{664} - 2.49\ A_{647}$$

$$\text{Chl. b } (\mu g\ mL^{-1}) = 5.6\ A_{664} + 23.26\ A_{647}$$

Peroxidase and polyphenoloxidase activity:

At the end of April, activity of peroxidase (POD) and polyphenoloxidase (PPO) as unit/mg protein was determined using spectrophotometer (UV-Vis 9100 B, LabTech) as described by Hammer Schmidt *et al*. (1982) and Benjamin and Montgomery (1973) respectively.

Disease severity (DS) and plant parameters:

After the last spray, representative twenty-five plants of such plot were randomly tagged for DS assessment using the scale described by Sharma (1986) and disease severity was determined according to Wheeler (1969) as follows:

$$\text{Disease severity (\%)} = \frac{\text{Sum of all disease ratings}}{\text{Total no. of ratings} \times \text{maximum disease grade}} \times 100$$

At the end of each season, number of leaves/plant, plant height (cm) and onion bulb yield (Kg/plot) were determined.

Statistical analysis:

The obtained data were statistically analyzed and significance of differences among treatments was assessed by the least significant difference (LSD) at 5% probability using SAS ANOVA program V.9 (Anonymous, 2014).

Results and Discussion

Isolation and identification of the causal organism:

The typical symptoms of purple blotch disease on onion plants were observed. Small, sunken, oval to eye shaped lesions were found with brown to purple color surrounded by a light brown area. In severe cases, blotches were enlarged up to 10 cm long and were covered with conidia. On agar media fluffy creamy white colony was noticed, changed to greenish grey and finally turned light olivaceous with distinct light green zonation with time. Mycelium is initially hyaline and becomes later pale brown to olivaceous brown. The hyphae are septate and irregularly branched. The conidiophores arise singly or in groups, cylindrical straight or flexuous pale to mid brown, septate and blunt at the tips. Conidia are solitary, straight or curved with the body of conidium ellipsoidal tapering to the beak and having 7 to 9 transverse septa and 1 to 3 longitudinal septa. With the mentioned characteristics, the isolated pathogen was identified as *Alternaria porri* (Ellis) Cif. according to Woudenberg *et al*. (2014).

Effect of T. erecta extract on linear growth of A. porri:

Effect of different concentrations of *T. erecta* extract to inhibit *A. porri* mycelium growth *in vitro* is demonstrated in Table (1). All tested concentrations reduced fungus linear growth. The reduction of fungal growth was increased with increasing the extract concentration. The most effective concentration was 3 ml/L followed by 2 ml/L, caused 51.3 and 50.0% reduction in linear growth, respectively. This finding was also found by Shafique *et al*. (2011) who reported that aqueous

extract of *T. erectus* reduced the growth of *Ascochyta rabiei* by 55-73%. Mehmood *et al*. (2014) also found that aqueous root, shoot and flower extracts of *T. erectus* suppressed the growth of *Alternaria alternata* by 90, 44 and 57%, respectively. Wavare *et al*. (2017) similarly reported that aqueous extract of *T. erecta* completely inhibited the growth of *Sclerotium rolfsii* at 1 ml/50 ml liquid medium, while treated filter paper disks by 100 mg/ml gave 19.7 mm inhibition zone. The antagonistic effect of *T erecta* may be due to presence of suppressive bioactive materials as distinguished by Devika and Justin (2014) who found 19 and 31 bioactive compounds in leaves and flowers of *Tagetes*, respectively, including Tetrad ecannoic acid, Hexadecanoic acid, 9,12 and15 Octadecatrienoic acid, Stigmasterol, Phytol and Celidoniol.

Table (1): Effect of *Tagetes erecta* extract on the linear growth of *A. porri* after incubation at 25±0.1ºC.

Concentration (ml / L)	Reduction in linear growth (%)
0.25	28.4
0.50	35.2
1.0	36.8
2.0	50.0
3.0	51.3
Control (untreated)	0.0
L.S.D at 0.05	1.0

Effect of VCT and T. erecta extract on onion purple blotch in vivo:

Under field conditions, different concentrations of VCT and TE extract were used to study their effect on controlling onion purple blotch on Italy red and Giza 20 onion cvs. in comparison with Luna Experience fungicide. Data presented in Table (2) show that purple blotch severity on Giza 20 was more than on Italy red. All tested treatments significantly decreased disease severity compared with the control during the two growing seasons 2015/2016 and 2016/2017. Higher concentrations of VCT and TE caused lower purple blotch severity. TE extract was more effective than VCT and Luna Experience to control purple blotch, while Luna Experience was more effective than VCT. The highest reduction was achieved with TE at 3 ml/L followed by 2 ml/L concentration, which gave 66.2 and 61.3% efficacy on Italy red and 72.5 and 67.9% on Giza 20 in the two seasons, respectively.

The antifungal activity of *Tagetes* sp. (marigold) was also observed by Thembo *et al*. (2010) against certain mycotoxigenic fungi including *Fusarium verticillioides, F. proliferatum, Aspergillus flavus and A. parasiticus.* Nahak and Sahu (2017) found that the use of aqueous extract of marigold flowers on tomato plants reduced early blight, fusarium wilt, fruit spot, blossom end rot, sun scald by 61.53, 18.42, 27.41, 50.43 and 26.44%, respectively, compared to the untreated tomato plants. The antifungal and antimicorbial properties of *Tagetes* species could be attributed to its

content of aromatic compounds including monoterpene hydrocarbons such as ocimenes, limonene, terpinene, myrcene and in acyclic monoterpene ketones (tagetone, dihydrotagetone, and tagetenone), in addition to lower amounts of sesquiterpene hydrocarbons and oxygenated compounds (Salehi *et al*., 2018).

On the other hand, application of VCT resulted significant efficacy against purple blotch in onion comparing with the control treatment. These results are in harmony with numerous scientific reports shown up during the past two decades to reduce severity of several foliar diseases including apple scab, powdery mildew, and gray mold (Weltzien, 1991; Elad and Shteinberg, 1994 and Cronin *et al*., 1996). In field experiment, VCT reduced percentage of onion white rot (Amin *et al*., 2016). Edwards *et al*. (2006) reported that VCT produced from cattle waste vermicompost suppressed tomato Verticillium wilt significantly. Solid vermicompost also can suppress a range of plant pathogens such as *Pythium* sp. in radishes and *Rhizoctonia* in cucumbers. Low field application rates of vermicompost suppressed Verticillium wilt in strawberries, *Phomopsis* sp. and powdery mildew in grapes and bacterial rot in cucumbers. Foliar sprays with compost water extract significantly reduced the incidence of bacterial spot in tomato fruit. The inhibitory effect may back to antibiosis, competition, antibiotic metabolites and low molecular weight, heat stable, non-protein metabolite produced by micro-organisms during fermentation, (Al-Dahmani *et al*., 2003).

Table (2): Effect of vermicompost tea, *Tagetes erecta* extract and fungicide Luna Experience as foliar spray* on disease severity of purple blotch on cvs. Italy red and Giza 20 onion plants under field conditions at Beheira governorate, during 2015/16 and 2016/17 growing seasons.

Treatments	Conc.	Disease severity							
		Italy red cv.				Giza 20 cv.			
		2015/16	2016/17	Mean	Efficacy (%)**	2015/16	2016/17	Mean	Efficacy (%)**
VCT	12.5ml/L	14.0	12.5	13.3	43.6	15.3	14.2	14.7	55.4
	25 ml/L	12.3	10.5	11.4	51.4	13.7	12.8	13.3	59.9
TE	2 ml/L	9.7	8.5	9.1	61.3	11.0	10.2	10.6	67.9
	3 ml/L	8.3	7.6	8.0	66.2	9.3	8.8	9.1	72.5
Luna	1 ml/L	10.3	9.2	9.8	58.5	11.7	10.7	11.2	66.2
Control		26.0	21.0	23.5	-	34.3	31.7	33.0	-
LSD at 0.05		2.8	1.1	-	-	1.4	1.5	-	-

* Spray every two weeks beginning from January 15th to April 15th (Seven sprays)

$$**\text{Efficacy (\%)} = \frac{\text{Control-treatment}}{\text{Control}} \times 100$$

Effect of VCT and T. erecta extract on some agronomic onion characteristics and onion bulb yield:

Data presented in Table (3) show that all treatments increased number of leaves, plant height and onion bulb yield of Italy red and Giza 20 onion cultivars in both successive seasons compared to untreated plants. Increased concentration of such treatment caused a positive increase of the tested agronomic characteristic values. Significant differences between the tested treatments and the control regarding number of leaves was not consistent across the growing seasons and onion cultivars. Luna Experience fungicide increased plant height more than other treatments and control. Luna Experience at the recommended dose and VCT at 25 ml/L. followed by TE extract at 3 ml/L significantly resulted in the highest bulb yield. This increment in yield could be attributed to the control of purple blotch disease as well as greater leaf number and plant height.

Plant height of Italy red onion cv. was the highest when plants were sprayed with TE at 3 ml/L where it gave 68.5 and 69.5 cm in both successive seasons, while VCT at 25 ml/L was the most effective treatment on Giza 20 onion cv. with 76.5 and 75.8 cm, respectively without significant differences with Luna experience treatment.

Table (3): Effect of vermicompost tea, *Tagetes erecta* extract and fungicide Luna Experience as foliar spray* on some agronomic characteristics on cvs. Italy red and Giza 20 onion plants under field conditions at Beheira governorate, during 2015/16 and 2016/17 growing seasons.

Cultivars	Treatments	Concentrations	Some agronomic characteristics of onion plants					
			No. of leaves/plant		Plant height (cm)		Onion yield (kg/plot)	
			2015/16	2016/17	2015/16	2016/17	2015/16	2016/17
Italy red	VCT	12.5 ml / L	11.4	11.8	59.5	60.0	46.9	48.2
		25 ml / L	11.6	12.2	60.5	62.0	49.6	50.4
	TE	2 ml / L	11.0	11.6	60.8	64.8	46.4	46.8
		3 ml / L	11.6	12.2	68.5	67.3	48.4	49.2
	Luna	1 ml / L	11.8	12.6	68.8	69.5	49.8	51.2
	Control	-	10.4	11.0	57.8	59.8	42.7	44.2
L.S.D. at 5%			2.2	1.1	5.8	4.8	1.4	1.7
Giza 20	VCT	12.5 ml / L	12.4	11.4	74.0	75.3	45.5	46.3
		25 ml / L	11.4	11.8	76.5	75.8	47.9	47.3
	TE	2 ml / L	11.0	11.6	71.3	72.3	44.4	45.0
		3 ml / L	11.8	12.0	72.0	70.8	47.5	47.0
	Luna	1 ml / L	12.6	12.0	76.8	76.3	48.6	49.1
	Control	-	10.8	10.6	64.0	64.8	43.5	42.4
LSD at 0.05			2.7	2.0	5.3	3.7	1.1	1.1

* Spray every two weeks beginning from January 15th to April 15th (Seven sprays)

Similar findings were obtained by Nahak and Sahu (2017) who found that foliage application of tomato plants by *T. patula* aqueous extract increased shoot lengths (75.87%), branches (27.42%), leaf numbers (17%), bud numbers (42.71%), flower numbers (54.96%) and fruit numbers (66.21%) compared to untreated. The promotive effect could be due to flavonoids patuletin, quercetagetin, carotenoid lutein and quercetin and their derivatives which act as a strong anti-oxidative and cyto-protective (Hooks *et al*., 2010). On the other hand, VCT treatment at the rate of 15 L/fed. four times with irrigation water increased onion bulb yield, plant height, no. of leaves/plant, onion fresh and dry weight (Amin *et al*., 2016). Also, values of growth, flowering, and yield of tomato, cucumber, and other crops were increased as response for VCT treatment (Mistry and Mukherjee, 2015). Pant *et al*. (2009) stated that use of VCT increased the above-ground fresh and dry weights, leaf area and extractable mineral element concentration in pak choi tissue. Keeling *et al*. (2003) reported that applying VCT to oilseed rape plants at the initial stage of growth increased both root development and plant growth. The plant responses may be due to the plant growth regulators such as indole acetic acid, kinetin, or gibberellins associated with humic and fulvic acids (Mistry and Mukherjee, 2015) which extracted or produced by microorganisms. Improved root growth or nutrient uptake per unit by root might be one of the mechanisms involved in stimulating plant growth. Soluble and available nutrients during composting, enhancing beneficial microbial communities especially plant growth promoting rhizobacteria (Allison and Janice, 2006 and Pant *et al*., 2009).

Effect of VCT and TE extract on leaves chlorophyll of onion plants:

Onion leaves contents of chlorophyll a and b were increased with spraying either of all tested treatments compared to the control plants as shown in Table (4). Chlorophyll contents were increased with increasing of treatment concentrations. VCT foliar sprays particularly at 25 ml/L increased chlorophyll a and b contents in cv. Italy red onion plants more than other treatments in both seasons, while TE at the rate of 3 ml/L followed by VCT at 25 ml/L were the most effective treatments to increase chlorophyll a and b contents in cv. Giza 20 onion leaves.

Sundraraju and Kiruthika (2009) found that Tagetes extract was one of the best treatments for increasing chlorophyll contents in banana leaves. The increased chlorophyll content due to the application of vermicompost in lettuce was recorded by Ali *et al.* (2007). Increase of chlorophyll contents was due to the presence of microorganisms in the vermicompost, which colonize in the rhizosphere and stimulate the plant growth and biochemical content. Subler *et al.* (1998) mentioned that increase in chlorophyll content in response to vermicompost was observed at early stages of marigold. Topical sprays with salicylic acid had the same effect, which led them to propose the probability of induced systemic resistance by compost water extract via the same mechanism. Also, Vijayalakshmi and Karthiyayini (2018) found that treatment of *Solanum nigrum* and *Trigonella foenum-*

graecum seedlings with vermicompost alone or combined with *Azospirillum* increased chlorophyll, protein, carbohydrates and amino acid content.

Table (4): Effect of vermicompost tea, *Tagetes erecta* extract and fungicide Luna Experience as foliar spray* on chlorophyll content in cvs. Italy red and Giza 20 onion plants grown under field conditions at Beheira governorate, during 2015/16 and 2016/17 growing seasons.**

Cultivars	Treatments	Concentrations	Chlorophyll A (µg mL^{-1})		Chlorophyll B (µg mL^{-1})	
			2015/16	2016/17	2015/16	2016/17
Italy red	VCT	12.5 ml / L	2.43	2.40	3.59	3.30
		25 ml / L	3.95	3.70	3.63	3.50
	TE	2 ml / L	2.29	2.17	2.73	2.47
		3 ml / L	2.65	2.63	3.06	2.93
	Luna	1 ml / L	2.82	2.70	1.69	1.50
	Control		2.52	2.50	2.79	2.33
L.S.D. at 5%			0.53	0.39	0.29	0.36
Giza 20	VCT	12.5 ml / L	2.72	2.80	2.51	2.68
		25 ml / L	2.78	2.87	2.84	2.88
	TE	2 ml / L	2.45	2.60	2.55	2.70
		3 ml / L	2.98	3.10	2.98	3.10
	Luna	1 ml / L	1.83	1.80	2.88	2.97
	Control		2.41	2.43	2.33	2.27
LSD at 0.05			0.32	0.25	0.38	0.34

* Spray every two weeks beginning from January 15th to April 15th (Seven sprays)
** Estimated at the end of April for each season (five months after transplantation)

The activity of both peroxidase and polyphenoloxidase in the two tested onion cultivars during the two seasons was affected by most of the tested treatments compared to untreated plants as shown in Table (5). In all treatments, increase of VCT and TE extract concentrations led to increase of PO and PPO activity. Also, all treatments increased the activity of the tested enzymes more than Luna Experience except PPO on cv. Giza 20 at the second growing season with TE at the rate of 2 ml/L. VCT at 25 ml/L was the best treatment to enhance PO and PPO activity for both onion cultivars during both seasons.

These results in agreement with Goel *et al*. (2015) who found that aqueous extract from *T. erecta* leaves stimulated the activity of PO, PPO, lipoxygenase and catalase in tomato as induced defense enzymes. Also, activity of PO and PPO was increased in the tested plants as a response to *T. erecta* treatment (Sundraraju and Kiruthika, 2009). Regarding VCT effects, Zhang *et al*. (1998) demonstrated that compost tea applied to the foliage of Arabidopsis plants stimulated 1,3-glucanase

activity. Increases in total phenols, protein, carbohydrates and amino acids were also recorded in plants treated by vermicompost extracts according to Pant *et al*. (2009).

Table (5): Effect of vermicompost tea, *Tagetes erecta* extract and fungicide Luna Experience as foliar spray* on peroxidase and polyphenoloxidase activity on cvs. Italy red and Giza 20 onion plants grown under field conditions at Beheira governorate, during 2015/16 and 2016/17 growing seasons.**

Cultivars	Treatments	Concentrations	Enzymatic activity (unit/mg protein)			
			Peroxidase		Polyphenoloxidase	
			2015/16	2016/17	2015/16	2016/17
Italy red	VCT	12.5 ml/L	6.13	5.27	2.74	2.50
		25 ml/L	6.69	6.07	3.01	3.09
	TE	2 ml/L	6.30	5.23	2.67	2.27
		3 ml/L	6.82	5.87	2.74	2.53
	Luna	1 ml/L	4.23	4.20	2.09	2.00
	Control	-	5.43	4.67	2.73	2.67
L.S.D. at 5%			1.43	0.39	0.46	0.36
Giza 20	VCT	12.5 ml/L	5.65	5.70	2.42	2.50
		25 ml/L	5.87	5.97	2.65	2.73
	TE	2 ml/L	5.10	5.23	2.04	1.72
		3 ml/L	5.13	5.30	2.08	2.20
	Luna	1 ml/L	4.08	4.03	1.66	1.80
	Control	-	4.23	3.83	1.87	1.73
LSD at 0.05			0.78	0.53	0.55	0.45

* Spray every two weeks beginning from January 15th to April 15th (Seven sprays)
** Estimated at the end of April for each season (five months after transplantation)

Based on the previous results, it is possible to recommend cross-spraying between VCT at 25 ml / L with TE at 3 ml / L, until a future study clarify the best possible treatment regime that could be used effectively.

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تأثير شاى الفرميكومبوست و مستخلص نبات القطيفة *Tagetes erecta* فى مقاومة مرض اللطعة الإرجوانية على البصل

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تم إستخدام شاي الفرميكومبوست و مستخلص نبات القطيفة *Tagetes erecta* لدراسة تأثيرهم على اللطعة الإرجوانية فى البصل المتسبب عن الفطر *Alternaria porri* (Ellis) Cif ، تحت ظروف المعمل و الحقل مقارنةً بمبيد لونا إكسبرينس. في المعمل، إستُخدِمت خمسة تركيزات من مستخلص القطيفة، هم ٠,٢٥ ، ٠,٥٠ ، ١,٠ ، ٢,٠ و ٣,٠ مل/لتر بيئة مستخلص البطاطس لدراسة تأثيرها على النمو الطولى لفطر *A. porri*. زاد معدل إنخفاض النمو الطولى مع زيادة التركيز لمستخلص القطيفة، كما إختزل تركيز ٣ مل/لتر نمو الفطر بنسبة ٥١,٣ ٪. تحت الظروف الحقلية بمحطة إبتاي البارود للبحوث الزراعية، محافظة البحيرة و خلال موسمى النمو ٢٠١٥/٢٠١٦ و ٢٠١٦/٢٠١٧ تم رش صنفى البصل الإيطالي الأحمر و جيزة ٢٠ سبع رشات بشاى الفرميكومبوست بمعدل ١٢,٥ و ٢٥,٠ مل/لتر و كذلك مستخلص القطيفة بمعدل ٢,٠ و ٣,٠ مل/لتر لدراسة تأثير كلٍ منهم على شدة الإصابة بالمرض، عدد الأوراق، إرتفاع النبات، محصول الأبصال، محتوى الأوراق من الكلوروفيل أ و ب ونشاط إنزيمى البيروكسيديز و البوليفينول أكسيديز. كان مستخلص القطيفة أكثر فعالية من شاى الفرميكومبوست و مبيد لونا إكسبرينس فى التقليل من شدة اللطعة الإرجوانية حيث أعطى كفاءة ٦٦,٢٪ للإيطالي الأحمر و ٧٢,٥٪ لجيزة ٢٠ عند تركيز٣ مل/لتر. إزدادت قيم كلٍ من عدد الأوراق ، إرتفاع النبات و محصول الأبصال بشكل طردى مع تركيز المعاملات. أعطى شاى الفرميكومبوست بمعدل ٢٥,٠ مل/لتر ٤٩,٦ و ٥٠,٤ كجم/قطعة تجريبية للصنف الإيطالي الأحمر و ٤٧,٩ و ٤٧,٣ كجم/قطعة تجريبية للصنف جيزة ٢٠ كأفضل معاملة لزيادة محصول الأبصال في موسمى النمو على الترتيب. زادت قيم كلً من محتوى الكلوروفيل أ و ب ونشاط البيروكسيديز والبوليفينول أكسيديز فى النباتات المعاملة.