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Biocides as an Alternative Control Method of Garlic Purple Blotch Caused by *Alternaria porri*

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The four biocides, Bio Arc 6% WP, Bio Zeid 2.5% powder, Blight Stop and Plant Guard liquid in addition to the fungicide Galben Copper 69.8% WP were tested against the fungus *Alternaria porri* (Ellis) Cifferi under laboratory, greenhouse and field conditions. The tested biocides were classified into three groups according to their efficiency against mycelial growth of *A. porri*. The first group contains Plant Guard liquid and Bio Zeid 2.5% powder, which gave low inhibitory activity against *A. porri* growth. The second group contains Blight Stop only with moderate reduction in mycelial growth. The high inhibition in mycelial growth was found in the treatment of Bio Arc 6% WP which lies in the third group. Galben Copper 69.8% WP gave inhibition in the mycelial growth reached to 84.42%. Under greenhouse conditions, Galben Copper 69.8% WP gave the highest efficiency against garlic purple blotch followed by Bio Arc and Blight Stop. Data indicated that *Trichoderma. album* was more effective than *T. harzianum* in controlling garlic purple blotch. Mostly, Bacillus megaterium was more efficient than the fungus *Trichoderma* species in controlling garlic purple blotch. In the open field, the experiments were conducted for two successive growing seasons, 2016/2017 and 2017/2018. Galben Copper 69.8% WP was more effective than the other tested biocides. Bio Arc 6% WP was superior among biocides against purple blotch disease on garlic, while Plant Guard liquid was the inferior one. The resulted efficiency of treatments against purple blotch disease on garlic in the field was compatible with those obtained under greenhouse conditions. There is a positive relationship between the efficiency against purple blotch and the obtained garlic yield of all treatments.

Keywords: Garlic (*Allium sativum*), Purple blotch disease, *Alternaria porri*, Galben copper 69.8%, Biocides.

Garlic (*Allium sativum* L.) is one of the most widely cultivated bulb crops in Egypt. It is cultivated for both local consumption and exportation. It is commonly used as a spice as well as in medical purposes. Several factors have been identified for the low productivity of garlic in Egypt, some of which are the purple blotch, downy mildew, stemphylium blight, basal rot as well as storage rot diseases and non-availability of varieties resistant to biotic and biotic stresses (Woudenberg *et al.*, 2014). Among the foliar garlic diseases, purple blotch that cause blight and prematurely die of garlic leaves. The destructiveness of this disease widely varies with locality and season, depending on how often and how long garlic foliage is wet by dew, fogs, and showers (Tripathy *et al*., 2013). Blighted and prematurely died leaves are often covered later by secondary olive green to black molds diseases (Uddin *et al*., 2006 and Tripathy *et al*., 2013). Rising the garlic consumption within the country and the emphasis laid on exportation, there is a greater need to increase the garlic production. As a result of increasing health consciousness among the people and strict norms in the export of vegetables in recent years, especially to Europe and Asia especially to Gulf countries, therefore, the focus has been shifted in finding out safer alternatives to chemical fungicides for managing the plant diseases. Although, chemical control is still so far the main control tactic against plant pests and diseases, harmful side effects of chemical fungicides were reported on humans and environment (Garcia, 1993). Thus, the development of nontoxic alternative fungicides, such as biocides, would be useful in reducing these undesirable effects. Biological control using the antagonistic microorganisms is a potential non-chemical means of plant disease control by reducing inoculum levels of pathogens. Such management would help to prevent the pollution and health hazards (Kumar, 2007). Several researchers have reported biological control and effective antagonistic potential of both fungal and bacterial antagonistic microorganisms for controlling downy mildew and purple blotch diseases caused by Peronospora destructor and A. porri (Abd El-Moity *et al*., 1997; Chincholkal and Mukerji, 2007; Kumar, 2007; Fayzalla *et al*., 2011 and Sadoma *et al*., 2011).

The present work was undertaken to evaluate the effectiveness of four biocides; Bio Arc 6% WP (Bacillus megaterium 25 x 106 cells/g), Bio Zeid 2.5% powder (Trichoderma album 10 x106 spore/g), Blight Stop (*Trichoderma* spp. 30 x 106) and Plant Guard liquid (T. harzianum 30 x 106 spore/g) in addition to the fungicide Galben Copper 69.8% WP (benalaxyl + copper oxychloride) against the fungus *Alternaria porri* (Ellis) Cifferi under laboratory, greenhouse and field conditions. Moreover, the influence of tested treatments on garlic yield thought the two successive seasons 2016/2017 and 2017/2018 was investigated.

Materials and Methods

I. Source of the tested fungus:

A pure culture of the pathogenic fungus of garlic, A. porri was obtained from onion and oiliness Crops, Dis. Res. Dept., Plant Pathol. Res. Inst., ARC, Giza, Egypt.

II. Tested Biocides and fungicide:

Three registered biocides; Bio Arc 6% WP (*Bacillus megaterium* 25 x 10^6 cells/g), Bio Zeid 2.5% powder (*Trichoderma album* 10 x10^6 spore/g), and Plant Guard liquid (*T. harzianum* 30 x 10^6 spore/g) in addition to Blight Stop (*Trichoderma* spp. 30 x 10^6) were selected comparing with the fungicide Galben Copper 69.8% WP (benalaxyl + copper oxychloride) for controlling pathogenic garlic fungus, *A. porri.* The commercial formulation of the fungicide was used in this study. Bio Arc 6% WP is recommended against chocolate spot, powdery mildew, fruit rots and early blight diseases on broad bean, cucumber, strawberry and tomato at the rate of 250 g/100 L water, respectively. Bio Zeid 2.5% powder is recommended against chocolate spot disease on broad bean and against powdery mildew disease on cucumber and mango at the rate of 250 g/100 L water. Plant Guard liquid is recommended against late blight on potato. Galben Copper 69.8% WP is recommended against early and late blight diseases on potato and tomato at the rate of 250 g/100 L water. The recommended rates of application for the tested compounds were used in the greenhouse and field trials. In laboratory studies, Galben Copper 69.8% WP was used at 0.1 g/ L against mycelial growth of *A. porri,* while the tested biocides were used at 5 g or ml per one liter.

III. Laboratory experiments:

The inhibitory effect of the tested biocides in addition to the fungicide Galben Copper on the mycelia growth of *A. porri* was estimated on potato dextrose agar medium (PDA). Concentrations of the tested materials were prepared using sterilized distilled water. Poisoned food technique (PFT) of Schmitz (1930) was followed for studding the efficiency of the tested compounds against mycelia growth of *A. porri*. Different quantities of the tested materials were mixed with sterilized PDA medium after cooling before pouring. After solidification of the medium, the fungus was seeded in the center of each Petri dish using 5 mm agar disc bearing active mycelia growth of *A. porri*. Each treatment was replicated four times in addition to a check treatment, which was free from any fungicide or biocide. All inoculated plates were incubated at 25±2^{o}C until the fungal growth filled the plates. The inhibition of mycelia growth in different treatments was determined in relation to those of the control treatment using Abbott's formula (Abbott, 1925).

IV. Greenhouse experiments:

This experiment was conducted in the greenhouse of Plant Pathology Institute, ARC, Giza, Egypt. Two cloves of garlic were planted in each pot (25-cm diameter) filled with autoclaved clay soil. Garlic (cultivar Sids-40) was used in this study. Potential inoculate of *A. porri* was prepared by growing on PDA medium in Petri-dishes at 25°C. Then ten ml of sterile distilled water were added to each plate and after that, obtained colonies were carefully scraped with a sterile needle. The resulting conidial suspension of the fungus was adjusted to $5x10^4$ propagules according to El-Ganaieny *et al.* (1998) and used for spraying garlic plants. After inoculation, plants were covered with polyethylene bags for 48 hours to maintain a high level of humidity. After that, the bags were removed and plants were kept under normal greenhouse conditions (20°C and 75-80% R.H.).

The candidate biocides; Bio Arc 6% WP, Bio Zeid 2.5% powder, Plant Guard liquid and Blight Stop in addition to the reference fungicide Galben Copper 69.8% WP were applied at the rate of application (250 ml or g/100 L water). All treatments were sprayed as a foliar spraying to run-off. Super film was mixed before spraying with each treatment at the rate of 0.5 ml/1.0 L as surfactant and sticker material and replicated for four times. Garlic plants were sprayed after 85 days of planting using a hand sprayer. Four replicate pots of garlic plants inoculated with the tested pathogen and sprayed with water served as a check treatment. Data were scored 15 days after spraying as disease severity according to the equation developed by El-Ganaieny *et al.* (1999),

$$P = \frac{\sum(n \times v)}{5N} \times 100$$

Where,

n = number of leaves within infection grade

v = numerical value of each grade

N = total number of leaves examined

IV. Field trials:

The experiments were carried out in the two growing seasons, 2016–2017 and 2017–2018 to evaluate the efficiency of the candidate biocides; Bio Arc 6% WP, Bio Zeid 2.5% powder, Plant Guard liquid and Blight Stop in addition to the reference fungicide Galben Copper 69.8% WP against garlic purple blotch in a commercial field of garlic cv. Sids-40 at Etay Elbarowd district, Behera governorate. The experiment was set in a randomized complete block design with six treatments and three replicates. Each experimental plot included six rows (each one was 3.0 m length and 50 cm width). Experimental plot area was 3.0 x 3.5 m^2 (10.5 m^2=1/400 fed). The selected cloves (uniformly in shape) were planted on the 5^{th} and 7^{th} of October in the first and second seasons. These cloves were planted on both sides of each ridge at 10 cm apart. Treatments were applied as a foliar spray using a back sprayer to run-off three times at 70, 90 and 110 day after planting and before sunset Control treatment was sprayed with water. All recommended agricultural practices and irrigation needed for garlic crop were applied. A super film was mixed before spraying on the plants at the rate of 5 ml/10 L as a surfactant and sticker material. The candidate biocides and the reference fungicide were applied at their recommended rates of application 250 g or ml/100 L water. The garlic leaves were classified into categories 15 days after the last spray, where the disease severity was then calculated according to the equation developed by El-Ganaieny *et al*. (1999). Crop harvest was conducted after 180 days of planting in both seasons. The garlic yield from each plot was collected and the total yield (ton/fed) was calculated.

Statistical analysis:

All obtained data were subjected to the proper statistical analysis using the MSTAT statistician software (MSTAT-C Program, 1991) and the comparison between means in each experiment was done using L.S.D. test ($P \leq 0.05$).

Results

Effect of the tested biocides and Galben Copper on mycelial growth of Alternaria porri in laboratory:

Inhibitory activity of the tested biocides, Bio Arc 6% WP, Bio Zeid 2.5% powder, Plant Guard liquid and Blight Stop in addition to the reference fungicide Galben Copper 69.8% WP against *A. porri* mycelium is presented in Table (1). The tested biocides were used at the rate of 5 g or ml per one liter, while Galben Copper 69.8% WP was used at 0.1 g/L. Galben Copper gave a considerable inhibition in the mycelial growth of *A. porri* reached to 84.4%. On the other hand, the tested biocides were classified to three groups according to their efficiency against mycelial growth of *A. porri*. The first group contained Plant Guard liquid and Bio Zeid 2.5% powder which gave a low inhibitory activity to *A. porri* growth ranged between 22.2% and 33.3%, respectively. The second group contained Blight Stop only with moderate reduction in mycelial growth (66.6%). The high inhibition in mycelial growth, being 83.3% was found in the treatment of Bio Arc 6% WP, accordingly it lies in the third group. The results indicated that Bio Arc was the superior biocide against the growth of *A. porri*, while Plant Guard liquid was the inferior one.

Table 1. **Effect of the tested fungicide Galben Copper and biocides, Bio arc, Bio Zeid, Blight stop and Plant Guard on growth inhibition of *Alternaria porri***

Treatment	Average growth inhibition % in mycelia growth of *Alternaria porri*
Plant Guard (*T. harzianum* 30 x 10^6 spore/g)	22.2
Bio Zeid (*T. album* 10 x10^6 spore/g)	33.3
Blight Stop (*T.* spp. 30 x 10^6)	66.6
Bio Arc (*Bacillus megaterium* 25 x 10^6 cells/g)	83.3
Galben Copper (benalaxyl + copper oxychloride)	84.4
L.S.D. at 5%	0.92

Effect of biocides and Galben Copper on garlic purple blotch under greenhouse conditions:

Greenhouse experiment was conducted for evaluating the tested four biocides and Galben Copper 69.8% WP against purple blotch under artificial inoculation with *A. porri* spores. All the candidate biocides and fungicide were used at the rate of application 250 g or ml/100 L water as foliar spray. The biocides were effective in reducing the disease severity on garlic. Purple blotch was developed extensively on garlic plants of the check treatment in comparison with the treatments of biocides and fungicide. Disease severity in the check treatment reached to 75.33% as shown in Table (2).

Table 2. Effect of the tested biocides and the fungicide Galben Copper 69.8% WP on garlic purple blotch caused by *Alternaria porri* under greenhouse conditions

Treatments	Disease severity %	Efficiency %
Plant Guard liquid	67.33	10.62
Bio Zeid 2.5% powder	50.22	33.33
Blight Stop	40.33	46.46
Bio Arc 6% WP	39.55	47.49
Galben Copper 69.8% WP	25.32	66.38
Control	75.33	--
L.S.D. at 5%	3.51	--

Significant differences were found between disease severity of purple blotch in all treatments and control. All tested biocides were effective at different levels in reducing the severity of garlic purple blotch disease. Disease severity percentages in treatments of Plant Guard liquid, Bio Zeid 2.5% powder, Blight Stop and Bio Arc 6% WP were 67.33, 50.22, 40.33 and 39.55% comparing with 75.33% in the check treatment. The corresponding values of efficiency percentages of the tested biocides were 10.62, 33.33, 46.46 and 47.49%, respectively. Plant Guard liquid and Bio Zeid 2.5% powder gave low efficiency against garlic purple blotch, while Blight Stop and Bio Arc 6% WP have approximately similar efficiency (46.46% and 47.49%). The highest efficiency was found when plants were treated with Galben Copper 69.8% WP, which gave 66.38% reduction in garlic purple blotch (Table 2).

Moreover, data indicated that Blight Stop and Bio Arc 6% WP were satisfactory in controlling garlic purple blotch compared to Galben Copper 69.8% WP. Compatible results in efficiency of biocides and Galben Copper were found when they were used against the mycelial growth of *A. porri* in laboratory and or garlic purple blotch in the greenhouse. The present results clearly showed that *T. album* was more effective than *T. harzianum* in controlling garlic purple blotch. Mostly, data showed that the bacterium of *Bacillus megaterium* was more efficient than *Trichoderma* spp. in controlling garlic purple blotch.

Effect of biocides and Galben copper on garlic purple blotch under field conditions:

This trial was carried out in winter season for garlic purple blotch, which resulted in a high natural infection in check treatment. Results of disease severity percentages of purple blotch on garlic 14 days after the last spray with the tested biocides and Galben Copper 69.8% WP during the two successive seasons 2016/2017 and 2017/2018 and the mean of efficacy percentages for the two seasons are shown in Table (3). High infection rate of purple blotch disease on garlic was found in the control treatment (80.0 and 83.3%) during the two seasons, respectively. There is a harmony in the infection of garlic plants with purple blotch through both seasons. The disease severity percentages in the first season reached 65.66, 55.55, 41.44, 35.55 and 25.55% when plants were treated with Plant Guard liquid, Bio Zeid 2.5% powder, Blight Stop, Bio Arc 6% WP and Galben Copper 69.8% WP, respectively. The corresponding values in the second season averaged 70.00%, 60.02%, 55.55%, 37.77% and 26.66%, respectively. Therefore, a slight increase in disease severity was found in the second season. There were significant differences in disease severity percentages among all treatments. Results of both seasons indicated that Plant Guard was the least efficient material against purple blotch on garlic, which its disease severity reached 67.83%.

Generally, efficiency of Galben Copper 69.8% WP against garlic disease was more than the other tested biocides. The efficiency percentages of Plant Guard, Bio Zeid, Blight Stop, Bio Arc and Galben Copper through both seasons reached 16.93, 29.25, 40.62, 55.10 and 68.02%, respectively. These results indicated that Bio Arc was the superior biocide against purple blotch on garlic, while Plant Guard was the inferior one. The treatments were arranged according to their efficiency values in the following descending order; Galben Copper 69.8% WP, Bio Arc 6% WP, Blight Stop, Bio Zeid 2.5% powder and then Plant Guard liquid. The efficiency of treatments against purple blotch disease on garlic in the field was compatible of those previously obtained in the greenhouse.

Concerning the effect of treatments on garlic yield, it was observed that they significantly increased the yield compared with untreated one. There were significant differences in garlic yield among the tested treatments within the first and second agricultural season as shown in Table (4). High increasing in garlic yield was obtained in 2016/2017, where it ranged between 8.66 and 11.11 ton/fed in the treatments of biocides compared with 6.66 ton/fed in control. The increase in garlic yield represented around 30.03 and 66.82 %. The same trend of garlic yield in biocide treatments was found in the second season, which ranged between 13.64 and 57.57 ton/fed compared with 7.33 ton/fed in untreated control and represented 13.64 and 57.57% increase in garlic yield. Garlic yield in the treatment of Galben copper caused 88.44 and 81.86% increase in garlic yield which was 12.55 and 13.33 ton/fed during the first and second seasons, respectively. On the contrary, Plant Guard was the least efficient biocide where it caused only 21.84% increase in garlic yield as an average of the two seasons.

Table 3. Effect of the tested biocides and the fungicide Galben Copper 69.8% WP on garlic purple blotch caused by *Alternaria porri* under field conditions during 2016/2017 and 2017/2018 growing seasons

Treatments	Disease severity %		Mean	Efficiency %
	2016-2017	2017-2018		
Plant Guard liquid	65.66	70.00	67.83	16.93
Bio Zeid 2.5% powder	55.55	60.02	57.77	29.25
Blight Stop	41.44	55.55	48.49	40.62
Bio Arc 6% WP	35.55	37.77	36.66	55.10
Galben Copper 69.8% WP	25.55	26.66	26.11	68.02
Control	80.0	83.33	81.66	--
L.S.D. at 5%	2.25	3.44S	--	--

Table 4. Garlic yield (tons/fed.) and increase% due to biocides and Galben Copper 69.8% WP treatments during 2016/2017 and 2017/2018 growing seasons

Treatments	Garlic yield (tons/fed) and increase (%) through the two seasons				Mean	
	2016-2017	Increase (%)	2017-2018	Increase (%)	Tons/ Fed	Increase (%)
Plant guard liquid	8.66	30.03	8.33	13.64	8.50	21.84
Bio Zeid 2.5% powder	9.93	49.09	9.2	25.78	9.58	37.44
Blight Stop	10.11	51.80	10.55	43.92	10.33	47.78
Bio Arc 6% WP	11.11	66.82	11.55	57.57	11.33	62.08
Galben Copper 69.8% WP	12.55	88.44	13.33	81.86	12.94	85.12
Control	6.66	---	7.33	---	6.99	--
L.S.D. at 5%	0.33	---	0.55	---	---	---

Discussion

The development of nontoxic alternatives to fungicides such as biocides would be useful in reducing the undesirable effects of chemical fungicides. Such materials would help in reducing the pollution and also health hazards (Kumar, 2007). Garlic plants are liable to infection by many fungal diseases, however purple blotch caused by *A. porri* has been a serious problem worldwide and has caused important economic losses to the crop yield especially in Egypt. The obtained results revealed that, *in vitro*, the different concentrations of Galben Copper 69.8% WP resulted in different degrees of inhibition to the linear growth of *A. porri*. The obtained results are in accordance with those obtained by Sastrahidayat (1995). Meanwhile, it was mentioned before that the inhibitory effect of the tested fungicide on *A. porri* may be due to its effect on of the fungal cell (Fayzalla *et al*., 2011). On the other hand, Bio

Arc 6% WP and Blight Stop showed a considerable antagonistic effect on the mycelial growth of *A. porri in vitro*. These results are in harmony with those of Fayzalla *et al*. (2011).

Under greenhouse conditions, Galben Copper and Bio Arc were the best materials in suppressing disease severity caused by *A. Porri* on garlic followed by Blight Stop. These results agree with those obtained by Fayzalla, *et al*. (2011) who suggested that 5 fungicides containing mancozeb and other active ingredients such as azoxystrobin, benalaxyl, dimetomorf, metalaxyl were very effective and caused more than 85% control of onion purple blotch. Ahmed and Shaheen (2016) explained that the effect of these biocides may be due to their dual effects which produce growth regulators in addition to the chemical effect of antioxidants, that can play a role in improving plant physiology, metabolism and induce systemic resistance. Therefore, data of the present work clearly showed that the efficiency of the tested materials in reducing disease severity significantly decreased from 67.33% in case of Plant Guard to 50.22%, 40.33%, 39.55 and 25.32% when plants were treated with Bio Zeid, Blight Stop, Bio Arc and Galben Copper, respectively. Similar observations were mentioned by Ahmed and Shaheen (2016) who suggested that this positive effect of the biocides may be attributed to the induction of resistance in the host plant by biocontrol agents *Trichoderma* spp. or *Bacillus* spp. Biological control of plant diseases can also occur through different mechanisms, which are generally classified as antibiosis, competition, suppression, direct parasitism, induced resistance, hypovirulence as well as predation (Moyer and Peres, 2008). Silva *et al.* (2001) also demonstrated that the antagonistic activity of biocides has been often associated with production of secondary metabolites.

Under field conditions, it was observed that the highest level of reduction in disease severity was caused by using Galben Copper and Bio Arc followed by Blight Stop as compared with untreated control, while conversely Plant Guard was the lowest. Accordingly, the efficiency of the tested materials in reducing disease severity was increased from 16.93% in case of Plant Guard to 29.25%, 40.62%, 55.10% and 68.02% when garlic plants were treated with each of Bio Zeid, Blight Stop, Bio Arc and Galben Copper, respectively.

On the other hand, Galben copper and Bio Arc recorded the highest total garlic yield during the two successive seasons followed by Blight Stop. On the contrary, garlic plants treated with Plant Guard gave the lowest average of total yield as compared with other treatments. Similar results were reported by Abd El-Moity *et al.* (1997), El-Shehawy (2009) and Sadoma *et al.* (2011) who observed that downy mildew of grain sorghum could be effectively controlled by foliar spray with the bioagents, *i.e. T. viride*, *T. harzianum* and *B. subtilis*. Also, Metwally *et al.* (2010) revealed that Bio Arc and Bio Zeid led to a maximum reduction in severity of chocolate spot disease. Nevertheless, Morsy *et al*. (2011) found that using Bio Arc and Bio Zeid, as biotic inducers, offered a considerable degree of protection against alfalfa downy mildew, rust, root rot and wilt diseases when applied as spray treatment or seed soaking under field conditions. The increase in total garlic yield may be also due to the host plant where it may be more susceptible, as the bulb formation started, when the host plant becomes highly susceptible to invasion by the pathogens and there was a progressive increase in disease incidence and disease severity with the increase in the age of host plant. This also indicates that the pathogen is a low sugar fungus. When translocation from the source to sink increased, the disease incidence and severity rates also increased. These results agree with those obtained by Kumar (2007) who recorded an increase in disease severity as the age of the plant increased. Among the tested antagonists (fungi and bacteria), the commercial formula was used in the present study. The commercial formula of bacterial antagonists *i.e.* Bio Zeid and Bio Arc especially at the lowest rate (125 g/100 L) were found to be less effective in controlling garlic diseases. Also, the increase in total yield may be due to the increase in vegetative growth and high photosynthesis capacity expressed in leaf pigment. Higher photosynthesis accumulation in the clove would ensure higher clove/bulb, large bulb diameter and finally higher bulb weight. These results are in agreement with those obtained by Nasreen *et al*. (2009); Chanchan *et al.* (2013); Khan (2013) and Eisa and Ali (2014). In general, the present data confirmed that there is a positive relationship between the efficiency values of biocides and the obtained garlic yield of all treatments.

Accordingly, it is highly recommended to use certain biocides such as Bio Arc 6% WP (*Bacillus megaterium* 25 x 10^6 cells/g), Blight Stop (*T.* spp. 30 x 10^6) and Bio Zeid 2.5% powder (*T. album* 10 x10^6 spore/g) as alternative control compounds to reduce the hazards of chemical fungicides normally used to control purple blotch of garlic.

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تأثير بعض المستحضرات الحيوية على تطور مرض اللطخة الإرجوانية الذي يسببه الفطر *Alternaria porri* على نباتات الثوم

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يُعتبر الثوم أحد أهم محاصيل الحقل، ولكنه يصاب بالعديد من الأمراض الهامة مثل مرض اللطخة الإرجوانية الذي يسببه الفطر ألترناريا بوراي. في هذه الدراسة تم اختبار كل من المبيد الفطري جالبن نحاس ٦٩.٨ % WP والمستحضرات الحيوية بيو أرك ٦% WP وبلايت ستوب وبيو زيد مسحوق ٢.٥% وبلانت جارد السائل ضد الفطر المسبب لهذا المرض *Alternaria porri* تحت ظروف المعمل والصوبة والحقل في مركز ايتاي البارود بمحافظة البحيرة. أوضحت نتائج اختبارات المعمل أن المبيد الفطرى والمركبات الحيوية قد أحدثت انخفاضاً معنوياً لنمو ميسليوم الفطر المسبب للمرض. وبناء على ذلك تم دراسة فعالية المركبات الحيوية والمبيد الفطري في مكافحة مرض اللطخة الإرجوانية وتأثير المعاملة بها على كمية محصول الثوم تحت ظروف الصوبة والحقل. وقد استخدم كل من المركب الحيوي بيو أرك وبيو زيد بمعدل ٥٠٠ جرام/١٠٠ لتر ماء لكل فدان والمركب الحيوي بلايت ستوب وبلانت جارد بمعدل واحد لتر/١٠٠ لتر ماء لكل فدان والمبيد الفطري جالبن النحاس بمعدل ٢.٥ جرام/ لتر ماء. كما تم تقدير كل من نسبة وشدة الإصابة بالمرض تحت ظروف الصوبة والحقل. أوضحت النتائج أن المبيد الفطري جالبن نحاس قد أعطى أعلى نسبة خفض في شدة الإصابة مقارنة بالكنترول. كما أعطى المركب الحيوي بيو آرك وبلايت ستوب نتائج ممتازة في خفض نسبة وشدة الإصابة مقارنة ببقية المعاملات بالمستحضرات الحيوية الأخرى تحت ظروف العدوى الطبيعية للثوم وذلك خلال موسمي النمو ٢٠١٦/٢٠١٧ و٢٠١٧/٢٠١٨. كما أوضحت النتائج أن جميع المعاملات أدت إلى خفض ملحوظ في شدة الإصابة بالمرض مقارنة بالكنترول غير المعامل. وبصفة عامة كان كل من المبيد الفطري جالبن نحاس والمركبات الحيوية بيو آرك وبلايت ستوب الأفضل في خفض شدة الإصابة بالمرض مقارنة بالكنترول. وبملاحظة كمية محصول الثوم أظهرت النتائج أن المبيد الفطري جالبن نحاس وجميع المستحضرات الحيوية أدت إلى زيادة ملموسة في كمية المحصول مقارنة بالكنترول، حيث بلغ متوسط الزيادة في المحصول خلال موسمي الدراسة ٢١.٨٤ و٣٧.٤٤ و٤٧.٧٨ و٦٢.٠٨ و٨٥.١٢% عند استخدام مركب البلانت جارد وبيو زيد وبلايت ستوب وبيو آرك ومركب النحاس على الترتيب. من هذه النتائج نوصي باستخدام المبيد الفطري جالبن النحاس والمستحضرات الحيوية بيو آرك وبلايت ستوب في مكافحة الفطر *A. porri* المسبب لمرض اللطخة الأرجوانية في الثوم.