Studies on the suppression of transmission of anthracnose with covering method and environment friendly agricultural materials (EFAM) in pepper field

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Key words: Anthracnose, Covering materials, Environment friendly agricultural materials, Pepper.

Abstract

We studies a model for management of pepper anthracnose based covering method and spraying system in field.

1. *Among 82 organic fungicides, 42 materials showed most effective inhibition against mycelia growth of the Colletotrichum acutatum* in vitro. *23 formulated biocontrol agents were chosen to control the disease from 42 biocontrol agents in greenhouse. In the end, five kinds (2 plant extracts, 2 biopesiticides, 1 Bordeaux mixture) were selected from 23 materials in the field.*
2. *The mulching materials of bed covering in fruit season were thin non-woven fabric sheet and black plastic. The use of a fabric sheet was reduced the spread of anthracnose as compared to the plastic covering.*
3. *The application with the chosen materials was reduced 34% of anthracnose for 7 times sprays to planting 70 days as compared to the untreated control. In yield, nonwoven fabric sheet with formulated biopesticides was increased 17% than black plastic.*
4. *This result indicated that the developed biocontrol strategy could be an effective and economic crop protection system in organic pepper cultivation field.*

Introduction

Several species of plant pathogenic fungi in the genus *Colletotrichum* cause anthracnose in pepper. All growth stages may be affected, including postharvest stages. Symptoms occur primarily on ripening fruit often where fruit is touching the soil or plant debris. On ripe fruit there are small, sunken circular depressions up to 30 mm in diameter. The center of the lesions becomes tan in color while the tissue beneath the lesion is lighter-colored and dotted with many dark-colored fruiting bodies of the fungus that form concentric rings in the lesion. Foliage and stem symptoms appear as small, irregularly shaped gray-brown spots with dark brown edges.

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Materials and methods

This study was carried out in organic pepper cultivation field located at Naju in Jeonnam province, which is located in the South region of Korea. Both experiments were conducted with three replications in a randomized block design.

Covering experiments. Disease development was compared under different mulching materials. The mulching materials of bed covering were thin nonwoven fabric sheet and black plastic.

Fungicides experiments. For testing the control efficacy of non-chemical organic materials against to pepper anthracnose, 82 materials compared between plant growth and spraying system in greenhouse and field. The plot was sprayed with formulated fungicides with 7 –10 days intervals 7 times sprays to planting 70 days as standard farming practices. The EFAM was applied Chitosan+Seaweed extracts (1,000 dilution concentration), *Streptomyces griseofuscus* 200401(500 dilution), *S. rimosus*(100 dilution), Bordeaux mixture(40 dilution), Oriental plant extracts(500 dilution), Garic extracts+chitosan+chitooligosaccharide(1,000 dilution) on control of pepper anthracnose in field.

Data analysis. Disease incidence was counted on the number of infected fruit (water-soaked and sunken lesions, sometimes reaching 4 cm in diameter, develop on mature fruits). The infected fruit was investigated 200 fruit of 20 plants with 3 repetitions. Analysis of variance (ANOVA) was performed, and differences between means of treatments were determined by Duncan's test and t-test using the Statistical Analysis System (SAS Institute, Cary, NC).

Results

Tab. 1: Effect of environment friendly agricultural materials (EFAM) on control of pepper anthracnose in field.

Treatment	DLA(%)[x]	Control value(%)[y]
Chitosan+Seaweed extracts	10.0 a[z]	72.2
Streptomyces griseofuscus 200401	11.5 a	68.0
S. rimosus	16.7 b	53.6
Bordeaux mixture	16.6 b	53.9
Oriental plant extracts	16.7 b	53.6
Garic extracts+chitosan+chitooligosaccharide	21.0 c	41.6
Water(control)	35.9 d	-

[x] DLA means Index of diseased leaf area for total leaves.

[y] The control value (%) was calculated by the following equation : [(diseased fruit severity of untreated plants – diseased fruit of treated plants)/diseased fruit of untreated plants]×100.

[z] Mean separation within columns by Duncan's multiple range test at P=0.05.

Tab. 2: Comparison of anthracnose development between different covering materials and spraying system in open field.

Treatment	Diseased incidence of Fruit (%) EFAM application		
	3 times	4 times	7 times
Nonwoven fabric sheet	23.4 a[z]	19.9 a	8.2 a
Black plastic	34.8 b	21.0 a	10.7 b
No covering	35.9 b	32.7 b	42.0 c
F pr	0.038*	0.003**	<.001***
CV	13.4	8.6	2.9

[z] Mean separation within columns by Duncan's multiple range test at P=0.05.
*, **, *** significant at P≤0.05, 0.01 or 0.001, respectively.

Tab. 3: Average fresh yield of pepper between covering materials and spraying system in open field.

Treatment	Fresh yield(g/plant) EFAM application		
	3 times	4 times	7 times
Nonwoven fabric sheet	373.8***	389.1**	611.5***
Black plastic	288.3	301.7	438.1

, * significant at 1% and 0.1% levels by t-test.

Discussion

In the mulching material and fungicide application experiment in the pepper fields, nonwoven fabric sheet was the effective materials to anthracnose than black plastic (polyethylene) film. The sheet application maintained consistent humidity and lowered the temperature from the rhizosphere of plants in comparison to the plastic covered method (data not shown), indicating that humidity may be more important than local temperature in the spread of the fungus.

Conclusions

A thin non-woven fabric sheet significantly reduced anthracnose in pepper growth season. The use of a fabric sheet reduced more the spread of anthracnose than the plastic method. This sheet with fungicide application suppressed anthracnose even more. The application of fungicide in non-woven fabric sheet was reduced 34% of anthracnose and increased 17% of yield than black plastic and untreatment. We are recommended for mulching of nonwoven fabric sheet because this sheet promotes fruit yield and reduces pepper anthracnose.

Acknowledgments

This work was supported by funding from Jeollanamdo Agricultural Research and Extension Services

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