

Management of powdery mildew and leaf mould on tomato organically cultivated under controlled structured condition

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Abstract

Powdery mildew and leaf mold were major diseases in organic cultured tomatoes. NaHCO₃ and KH₂PO₄ were selected as control agents for controlling tomato powdery mildew. Control effect of the selected control agents was increased when they were treated with oil-egg yolk mixtures (OEYO). Also four organic materials used commercially including copper hydroxide and sulfur, showed high control effect more than 90% in green house. Also two organic matters, copper hydroxide and sulfur showed high control effect in farmer's field. When tomatoes were cultivated in plastic house installed with circulation fan, incidence of powdery mildew and leaf mold was reduced by 56% and 60%, respectively. .

Introduction

Leaf mould and powdery mildew mould caused heavy economic losses on tomato cultivated organically under controlled structure in the farm house. Therefore various control measures have been used to control the diseases. Because synthetic chemicals can't be used in organic culture system, alternatives for the chemical have been used including environmental friendly organic materials. Until now alternatives for chemicals with high control efficacy to control the two diseases have not been reported yet. This study was conducted to select environmental friendly organic materials and to investigate effect of installation of circulation fan for controlling powdery mildew and leaf mould in the farmhouse.

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Materials and methods

Selection of inorganic salts and and organic materials for controlling tomato powdery mildew and evaluation of their control effect In other to select environmental-friendly control agents(EFCA) for controlling tomato powdery mildew, calcium salts, potassium salts, sodium salts were treated at different concentration against tomato powdery mildew caused by *Erysiphe chichoracearum*, their control effects were investigated. Control effect was evaluated by investigating diseased leaf areas by 7days after EFCA treatment. In addition additive effects of OEYO were investigated by comparing control effect in mix-treating with each EFCA and control effect in single-treating each EFCA. Finally control effect of commercial products of microbial pesticides and two EFCA were investigated against tomato powdery mildew.

Suppressive effect of installation of circulation fan on development of powdery mildew and leaf mould of tomato In order to investigate effect of installation of circulation fan on disease development, disease incidence of powdery mildew and leaf mould were investigated in the plots installed with circulation fans and installed without circulation fans, respectively.

Results

Selection of inorganic salts and organic materials for controlling tomato powdery mildew NaHCO_3 , $\text{Ca}(\text{NO}_3)_2$, KH_2PO_4 showed high control values(more than 90%) for controlling tomato powdery mildew. When they were treated with OEYO, their control effects were increased comparing to single treatments of each inorganic salts (Table 1).

Table 1. Suppression of tomato powdery mildew by sodium and potassium salts, and oil-egg yolk mixture in green house

Treatment	Concentration	Diseased leaf area (%)		Control value (%)	
		Only	OEYO added ^{x)}	Only	OEYO added ^{a)}
NaHCO_3	0.11%	2.6 a ^{y)}	1.0 a	92.3	97.0
KHCO_3	0.1%	5.3 a	8.0 bc	84.4	76.4
NH_4HCO_3	0.1%	25.2 c	1.1 a	25.8	96.7
Na_2CO_3	0.1%	4.5 a	2.9 a	86.7	91.4
Baking soda(a.i. 20%)	0.1%	12.6 b	3.0 a	62.9	91.1
Cooking soda(a.i. 40%)	0.1%	2.4 a	5.3 a	92.9	84.4
Oil-egg yolk mixture	200 times diluted	7.2 bc	-	78.8	-
Untreated check	-	34.0 d	-	-	-

^{x)} 200 times diluted-OEYO.

^{y)} Values represent the means of three replicates.

Finally control effect of commercial products of microbial pesticides and two EFOM were investigated against tomato powdery mildew. Two microbial pesticides, copper hydroxide and sulfur showed high control effect more than 90%. The other microbial pesticides showed control effect about 50%.

Environmental-friendly organic materials, two kind of copper hydroxide and one sulfur formulations showed also high control efficacy in the farmhouse condition (Table 2).

Table 2. Suppression of tomato powdery mildew by organic materials used commercially in farmer's house (field test)

Treatment	Diseased leaf area (%)				Control efficacy (%)
	Rep. 1	Rep. 2	Rep. 3	Average	
Copper hydroxide	0.8	0.7	1.5	1.0	82.8
Sulfur 1	0.6	2.3	0.3	1.1	81.0
Sulfur 2	10.8	6.0	1.3	6.0	-
Untreated check	9.1	4.2	4.2	5.8	-

Suppression of tomato powdery mildew and leaf mould by installation of circulation fan When circulation fan was operated to reduce relative humidity under plastic film house in the night time, incidence of tomato powdery mildew and leaf moulds was reduced by 56% and 60%, respectively, compared to those in plastic film house in which circulation fans were not installed.

Discussion

In this study tomato powdery mildew could be controlled easily by copper or sulfur formulation, but tomato leaf mold could not be controlled easily. Therefore in order to control tomato leaf mould, preventive control measures, such as disease forecasting, circulation fan installation, planting resistant varieties and using cultural methods, must be developed. Small (1930) reported that temperature and relative humidity are important factors for controlling tomato leaf mould. Palmela (2009) reported that plant disease incidence can be reduced by raising ambient temperature and reducing relative humidity in the controlled structure. Cerkauska (2004) also reported similar research results. Kang (1988) developed disease forecasting model for controlling tomato leaf mould. Afterward control scheme against major tomato diseases using cultural, physical, biological methods, should be established that tomato may cultivated organically.

Conclusion

Our research results showed that the selected calcium, potassium and sodium salts can control tomato powdery mildew and installation of circulation fan reduces a little the incidence of tomato powdery mildew and leaf mould.

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