

Forecasting of plant disease and insect for an agricultural complex and farm in environment-friendly cultivation of Rice (*Oryza sativa* L.)

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Abstract

To investigate the forecasting of plant disease and insect for an agricultural complex and farm in environment-friendly cultivation of Rice, environment-friendly agricultural five complexes and five farms were selected in Youngam and Naju area, Jonnam, Korea. Prevention objects of plant disease and insect were leaf blast, neck blast, sheath blight, bacterial leaf blight, and hopper. Factors of sheath blight occurrence in environment-friendly agricultural complex were a fast transplanting time and a narrow planting density. Bacterial leaf blight in rice occurred severely in the area under water. Rice growth in environment-friendly agricultural complex was decreased heavy drying by hopper appearance.

Introduction

In 2000 year, the rapid increase of environment-friendly agricultural products occurs with the current of wellbeing. The important things of environment-friendly cultivation are a selection of resistant cultivar, transplanting time, planting density, seed disinfection, and rapid forecasting of plant disease and insect. Lee *et al* (2007) reported that the best problems of environment-friendly agriculture are weed control and insects such as leaf and neck blast, sheath blight, hopper, and rice leaf folder. Kang *et al* (2008) reported that neck blast was occurred in Hopyeong and Bosukchal cultivars, also sheath blight and bakanae disease occurred in rice cultivation, regardless of cultivar. Cha (1997) reported that occurrence frequency of plant disease and insect indicated with different susceptible cultivar, fertilizer amounts, transplanting time, planting density, temperature, precipitation, and hours of sunshine. The objective of this study is to apply control method to farms from the information obtained by forecasting of plant disease and insect.

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Materials and methods

1. Weather meteorological observation

Data obtained from Gwangju area including daily average temperature, daily average precipitation and daily average sunshine for Rice growth (April to October, 2007) were used compared with mean of 30 years (1971 to 2000), normal year in this study.

2. Cultural method of environment-friendly agriculture complex

Research of plant disease and insect was investigated for one non-pesticide and four low-pesticide complex at Jollanamdo Youngamgun in 2007. Seedling (var. ilme) was transplanted at 10 Jun with planting density of 60 hill per 3.3m² in non-pesticide complex. Bordesux mixture, brown rice vinegar, and chitin microorganism compost were used in non-pesticide complex. Seedling (var. ilme and woongwang) was transplanted with planting density of 70~80 hill per 3.3m² in low-pesticide complexes.

3. Cultural method of environment-friendly agriculture farm

Research of plant disease and insect was investigated for four non-pesticide and one low-pesticide farm at Jollanamdo Naju city in 2007. Seedling was transplanted at 11~20 Jun with 60~70 hill per 3.3m². Bordesux mixture, pyroligneous acid, and chitin microorganism compost were used in non-pesticide farms.

Results & Discussion

1. Weather observation for Rice growth

Daily average temperature (DAT) of May, Jun, Aug, and Oct 2007 was higher than normal year. Daily average precipitation (DAP) of Apr, May, Jun, and Jul 2007 was lower than normal year. High occurrence of plant disease and insect was caused by the high DAP of Aug, Sep, and Oct 2007. Daily average sunshine (DAS) was lower than normal year for Rice growth. The low DAS condition caused the decrease of Rice growth.

2. Forecasting of plant disease and insect in environment-friendly agriculture complex

Bakanae disease occurred in environment-friendly agriculture complex B and E from initial growth to harvesting season (Tab. 1). Leaf blast occurred at initial growth in complex D at the beginning of July. Neck blast occurred in complex A at the beginning of August, and leaf blast occurred in complex D at the beginning of July. Sheath blight occurred severely from the beginning of August to the end of August. in complex E. Factors of disease occurrence in this complex E were fast transplanting time and narrow planting density. Bacterial leaf blight occurred severely in complex B, C, and D of the area under water. Kang *et al* (2008) reported that neck blast occurred severely at Hopyeong and Bosukchal cultivars in environment-friendly agriculture complex. In our work, leaf blast occurred at susceptible Ilme variety. Environment-friendly cultivation needs an extension of transplanting time and broad planting density (Kwon *et al.* 2010). Rice water weevil not occurred in all complexes. *Panara guttata* occurred in complex A at the beginning of July. Hopper occurred severely from the beginning of Aug. to the end of Sep. in all complexes except complex E.

Tab. 1: Plant disease and insect forecasting in an agricultural complex of environment-friendly Rice cultivation

Agricultural complex	Cultivation type (variety)	Investigation Date	Bakanae disease	Leaf blast	Neck blast	Sheath blight	Bacterial leaf blight	Rice leaf folder	Farnara guttata	Hopper	
Youngam Dupo (A)	Non-pesticides (time)	Jul 06							+		
		Jul 20		+							
		Aug 01							+		
		Aug 23							+		
		Sep 13				+				+	
		Oct 04									+++
Youngam Jangam (B)	Low-pesticides (time)	Jul 06	+++	+						++++	
		Jul 20		++				+			
		Aug 01						+	++		
		Aug 23					+	++			
		Sep 13					+	+++			+++
		Oct 04									++++
Youngam Mangho (C)	Low-pesticides (time)	Jul 06									
		Jul 20		+				+	+		
		Aug 01					+	++	++		+
		Aug 23					+	+++			+
		Sep 13					++	++++			+++
		Oct 04				+					++++
Youngam Gasim (D)	Low-pesticides (time)	Jul 06		+++							
		Jul 20						+			
		Aug 01					+	++	++		+
		Aug 23					++	+++	+++		++
		Sep 13				+					+++
		Oct 04									++++
Youngam Songpyeong (E)	Low-pesticides (Wongwanng)	Jul 06	+++								
		Jul 20		+					+		
		Aug 01									
		Aug 23					++				
		Sep 13					+++	+			+
		Oct 04									

Degree of plant disease and insect: + (1~5%), ++ (6~10%), +++ (11~20), ++++ (above 21%)

3. Forecasting of plant disease and insect in environment-friendly agriculture farm

Leaf blast was occurred high the middle of Jul. in farm B and E (Tab. 2). Pyroligneous liquor and Bordeaux mixture were treated in rice field of the two farms. Sheath blight was occurred severely from the beginning of Aug. to the beginning of Sep. in all farms. Rice leaf folder was occurred very severely from the end of Jul. to the beginning of Sep. in farm B and E. Regular forecasting of plant disease and insect plays an important role in decision of control time to continue an environment-friendly agriculture.

Conclusions

In environment-friendly agricultural complex and farm, prevention objects of plant disease and insect were mainly leaf blast, neck blast, sheath blight, bacterial leaf blight, and hopper. Fast transplanting time and narrow planting density were caused by sheath blight occurrence in environment-friendly agricultural complex. Bacterial leaf blight occurred severely in the area under water. Decrease of Rice yield was caused by hopper appearance with heavy drying in environment-friendly agricultural complex.

Tab. 2: Plant disease and insect forecasting in farm of environment-friendly Rice cultivation

Farm household	Cultivation type (variety)	Invest. Date	Bakanae disease	Leaf blast	Neck blast	Rice strip virus	Sheath blight	Bacterial leaf blight	Rice white tip	Rice water weevil	Rice leaf folder	Parnara guttata	Hopper	
Naju Noan (A)	Non-pesticides (Ilme)	Jul. 09		+						+				
		Jul. 25										++		
		Aug. 07						+				++	+	
		Aug. 24						+				+++	+	
		Sep. 08						+				++		++
Naju Noan (B)	Non-pesticides (Hopyeong)	Jul. 09	++							+				
		Jul. 25		+								++		
		Aug. 07		++				+		+		+		
		Aug. 24						+				+++		
		Sep. 08				+++		++				++++		+++
Naju Bonghwang (C)	Non-pesticides (Dongjin1ho)	Jul. 09								+				
		Jul. 25		+		++						++		
		Aug. 07										++		
		Aug. 24						+				+		
		Sep. 08				+		+				+		+++
Naju Bannam (D)	Non-pesticides (Hopyeong)	Jul. 09	+							++				
		Jul. 25												
		Aug. 07		+								+	+	
		Aug. 24						++				++	+	
		Sep. 08				++		+++				+++		+++
Hanmpyeong Umda (E)	Low-pesticides (Nampyeong)	Jul. 09	+	++						++				
		Jul. 25		+								++		
		Aug. 07						+				+		
		Aug. 24						+++				++	+	
		Sep. 08				+		+++				++		+++

Degree of plant disease and insect : + (1~5%), ++ (6~10%), +++ (11~20), ++++ (above 21%)

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