Effects of water drainage rates on *Fusarium oxysporum f. sp. vasinfectum* and *Rotylenchulus reniformis* pathogenicity in cotton

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Abstract

The pathogens *Fusarium oxysporum f. sp. vasinfectum* and *Rotylenchulus reniformis* are two highly pathogenic and devastating diseases to commercial cotton crops in the United States[3]. These two pathogens were examined under experimental conditions to determine if water drainage rates play a role in disease variability when all other environmental factors are constant. Results have shown that *Rotylenchulus reniformis* variability has a smaller standard deviation as drainage hole size increases. The results of *Fusarium oxysporum f. sp. vasinfectum* have shown that the fungus prefers a drainage size of 5/16". With these results, an optimum drainage rate can be determined to reduce variability in experiments and produce results in a shorter time.

Introduction

Cotton is a major crop in almost all regions of the world, surpassed only by wheat, rice, and American corn [1]. This makes cotton a major cash crop for many countries. However, cotton is not free of pathogens that reduce the global yield. *Fusarium oxysporum f. sp. Vasinfectum (F.o.v)* is one pathogen that has shown to be devastating to cotton crops in Australia. A new strain emerged in 1992 and quickly spread through growing areas. The losses were heavy, with some reports ranging >90% [4]. Other strains of *F.o.v.* are here in the United States which are common in many areas in the south, and are commonly carried by root-knot nematodes.

Another emerging pathogen in the United States is the nematode *Rotylenchulus reniformis.* Studies have shown that this nematode is beginning to replace *Meloidogyne incognita*, a major nematode of cotton in many states [1]. Although the rates of nematode replacement in the United States is under scientific review, it is already known that this emerging nematode has destroyed annual crop yields by an estimated $130 million [1].

Experimental Design

To test the hypothesis that drainage rates directly affected experimental variability, five flats of fifteen cups were created with varying drainage hole size. These sizes ranged from 2/16" – 6/16" with each flat increasing in size by 1/16". A set of five flats were created for both fungal and nematode inoculation.

Fig 1. The design layout. Fifteen cups per flat. The same design was used for both pathogens.

Experimental Approach

Design an experiment with adequate environmental factors and control groups

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Isolate the desired pathogens and create an inoculum

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Inoculate the desired cultivars and observe symptoms over six weeks

⇩

Collect data and determine the size used with the least variability

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Implement new protocols in future experimental design using the size with the lowest variability

Rotylenchulus reniformis

Disease symptom assessments included plant height measurements, leaf counts, and nematode extraction counts. Nematode extraction counts resulted in the most accurate data.

Size	Nematode Avg.	Std. Deviation	% Variability
2/16"	2.48	2.08	0.84
3/16"	2.76	2.38	0.86
4/16"	2.8	3.07	1.10
5/16"	6.17	3.58	**0.58**
6/16"	4.5	1.95	**0.43**

Fig. 2. Average number of nematodes recovered from cups with different size of drainage holes. Two largest drainage sizes resulted in the lowest variability.

Fusarium oxysporum f. sp. vasinfectum

Disease symptom assessment was determined solely on plant weights. Weights were taken from the entire plant except for the roots. The variability results from the two fungal strains were compared against the control.

Size	Control	F.o.v. 12	F.o.v. 14
2/16"	0.17	1.003	0.603
3/16"	0.136	0.402	1.056
4/16"	0.054	0.3	0.5
5/16"	**0.249**	**0.293**	**0.376**
6/16"	0.127	0.676	0.728

Fig 3. Average weights of plants inoculated with two different strains of F. oxysporum f. sp. vasinfectum. 5/16" resulted in the lowest variability

Conclusions

The project had moderately successful results. The nematode averages for the 5/16" and 6/16" were considerably higher, thus showing the indication that the larger drainage hole size contributes to a larger number of nematodes. The percent variability was also considerably lower in the two greatest sizes. The fungal results also followed the same pattern. The size 5/16" showed the lowest percent variability, followed by 4/16".

References

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