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Effect of Combinations of Pathogenic Organisms at Different Temperatures on the Cotton Seedling Disease

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SUMMARY

Deltapine 15 cotton was grown at 64.4°, 69.8°, 75.2° and 80.6° F. in soil infested with three fungi pathogenic to cotton seedlings, alone and in combination with a species of root-knot nematode. Damage was greater when a fungus and the root-knot nematode were combined than when either acted alone. Damage was more than an additive effect of the pathogens and was greatest at the cooler temperatures.

Field evidence in Texas has indicated that nematodes may be a factor in the early reduction of stands in cotton similar to those reported for Fusarium wilt and nematodes in Alabama by Smith (4) and for soreshin and nematodes in Arizona by Reynolds and Hanson (3). The fungi involved in these situations are important seedling disease pathogens in Texas and include species of *Pythium* (2). The following investigations were initiated to obtain more information concerning the interaction of these organisms at different soil temperatures.

METHODS

Individuals of the root-knot nematode, *Meloidogyne incognita acrita Chitwood,* 1949, were handpicked from a single egg mass originally obtained from cotton and increased on the Straight-8 cucumber variety. Fungi isolated from diseased cotton were increased on corn meal-sand medium for one test and in a liquid medium for another. Monosporus cultures of *Fusarium oxysporum* f. *vasinfectum* (Atk.) Sny. and Han. were used while single hyphal tip and mass hyphal tip cultures of *Rhizoctonia solani* Kuhn and *Pythium debaryanum* Hesse were employed respectively. Two tests were conducted in constant temperature tanks as devised by Ranney (1). Infested root-knot soil was diluted 1 part to 3 parts sterilized Lufkin fine sandy loam soil to which were added separate cultures of the fungi. In the first test, the inoculum was grown on corn meal-sand medium. In the second, the fungi were grown for 2 weeks in yeast-extract solution cultures. The mycelial mats then were rinsed in sterile water, chopped finely and added to the soil. In both tests, the fungus inoculum was added about 1 inch below the level at which the seed was to be planted. Twenty-four Deltapine 15 cottonseed were planted in each tray for each treatment. The treatments were as follows:

1. Sterilized soil
2. Root-knot nematode, *Meloidogyne incognita acrita*
3. *Rhizoctonia solani*
4. *Pythium debaryanum*
5. *Fusarium oxysporum* f. *vasinfectum*
6. *Meloidogyne incognita acrita* plus *R. solani*
7. *M. incognita acrita* plus *P. debaryanum*
8. *M. incognita acrita* plus *F. oxysporum* f. *vasinfectum*

Each treatment was replicated three times at 64.4°, 69.8°, 75.2° and 80.6° F. Stand counts were taken daily.

TABLE 1. PERCENT TOTAL STAND OF DELTAPINE 15 COTTON SEEDLINGS GROWN 21 DAYS IN SOIL WITH VARIOUS COMBINATIONS OF ORGANISMS AT FOUR TEMPERATURES.

	Percent total plants surviving			
	64.4° F	69.8° F.	75.2° F.	80.6° F.
Sterilized soil	79.2	82.1	83.8	84.6
M. incognita acrita	66.7	70.8	70.8	75.0
P. filamentosa	65.4	83.3	86.3	88.8
P. debaryanum	16.7	22.1	54.2	90.4
F. oxysporum f. vasinfectum	75.0	82.1	91.7	84.6
M. incognita acrita + R. solani	5.4	9.6	54.2	45.8
M. incognita acrita + P. debaryanum	12.5	5.4	25.0	30.4
M. incognita acrita + F. oxsporum f. vasinfectum	0.0	15.4	30.4	44.8
L. S. D. .05	14.2	32.5	17.9	10.0
L. S. D. .01	20.0	45.0	25.0	13.8

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RESULTS

With the exception of more damping-off from *Pythium debaryanum* in the test using the corn meal inoculum the results of the two tests were similar. Only the results of the second test are given, Table 1. These results and Figures 1, 2 and 3 show that the damage was much greater at the lower temperature when mixed nematode-fungus cultures were used than when a single organism was employed. There was a nonsignificant but definite decrease in seedling stand when the root-knot nematode was used alone. When nematodes are increased over a period of time in the manner reported, pathogenic organisms may gain entrance into the inoculum. Although isolations were made to recover such fungi from seedlings killed in the root-knot treatments, all such attempts failed. This reduction in stand from nematodes alone possibly may be due to an excess of inoculum.

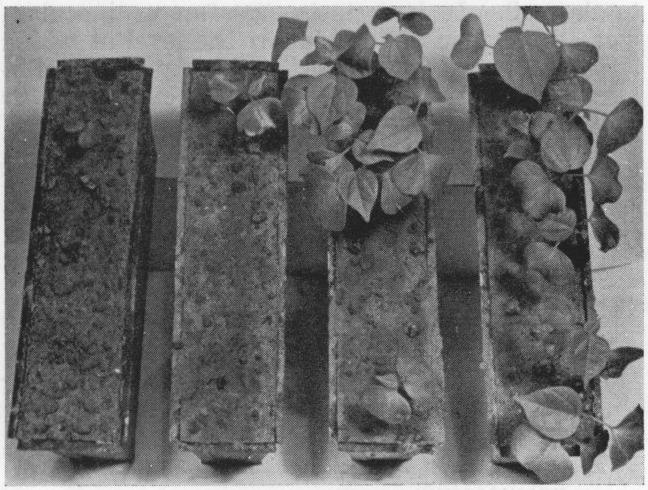

Figure 1. The effect on cotton grown at 64.4°, 69.8° 75.2° and 80.6° F. (left to right) in soil infested with the root-knot nematode and Rhizoctonia solani after 21 days.

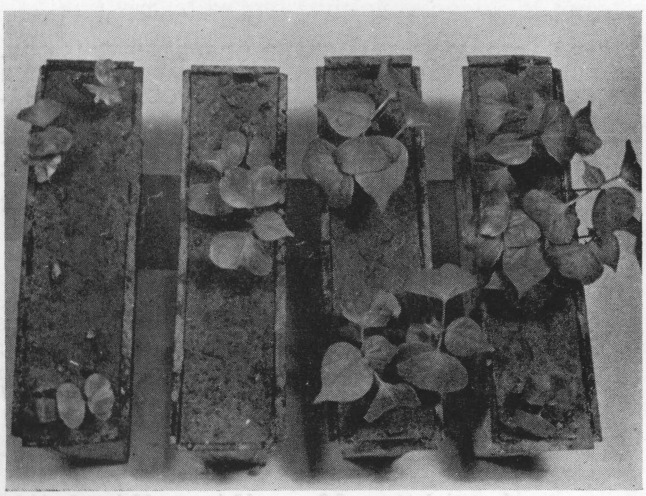

Figure 2. The effect on cotton grown at 64.4°, 69.8°, 75.2° and 80.6° F. (left to right) in soil infested with the root-knot nematode and Pythium debaryanum after 21 days.

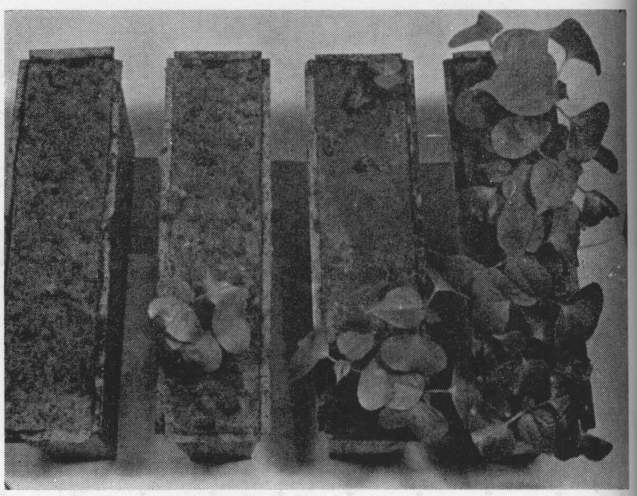

Figure 3. The effect on cotton grown at 64.4°, 69.8°, 75.2° and 80.6° F. (left to right) in soil infested with the root-knot nematode and Fusarium oxysporum f. vasinfectum after 21 days.

DISCUSSION

It is well known that the fungi used in this test can cause severe post-emergence damping-off. Suppression of this phase of the disease apparently was accomplished by placing the inoculum below the seed. The results demonstrate that when damping-off is reduced or eliminated, the same causal fungi, when associated with this species of root-knot nematode, may produce severe pre-emergence killing to cotton seedlings. Even though the greatest damage occurs at cooler temperatures, losses of over 50 percent may occur at comparatively warm soil temperatures. Although the reduction in stand was great where mixed cultures were used, these results agree with the field results of Reynolds and Hanson (3) and Smith (4) as evidenced by the data and photographs in their respective papers.

LITERATURE CITED

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