Heterodera Schachtii in Relation to Damage from Root Rot of Sugar Beets

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Introduction

Damping-off is one of the principal causes of poor stands of sugar beets in some areas. The suddenness of damping-off attack is often impressive, inasmuch as one day the seedlings may look healthy and the next day they may be dying in large patches in the field. Damping-off fungi are almost universally present in the soil and early planted sugar beets are subject to attack, especially in wet soil. Preemergence damping-off is perhaps the most serious aspect of the disease because seedlings are attacked before they reach the surface of the soil and nothing can be done to remedy the situation except to replant.

In commercial sugar beet production postemergence rotting of sugar beets also causes serious losses because rotting sometimes continues throughout the entire period of growth resulting in low quality or final death of the plant. It has been observed by the senior author that the incidence of root rot is greater and the disease more severe in fields of sugar beets in which the sugar beet cyst nematode is also present in the soil than when the pathogen is absent. It is concluded, therefore, that there is a relationship between injury by *Heterodera schachtii* and infection by soil-borne fungi that causes damping-off and root rotting of sugar beets. The increased damage may in part be due to openings of infection courts to the fungi by the feeding punctures of the nematode.

Powell (1) cites proven examples of association between plant parasitic nematodes and root-rotting fungi.

In connection with breeding sugar beets for resistance to *Heterodera schachtii* it has been observed in greenhouse tests at Salinas, California, that damage to sugar beets from root-rotting fungi is greatly increased if grown in soil infested with the nematode. It was, therefore, important to determine the amount of reduction in root weight caused by the nematode alone and in combination with root-rotting fungi. This paper reports results of experiments with sugar beets grown under controlled conditions. A vigorous program is in progress at the

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U. S. Agricultural Research Station at Salinas, California, in which sugar beets are being bred for tolerance to combination of root-rotting fungi and *Heterodera schachtii*.

Plan and Procedure

The variety US 41 was used in these tests. Damage caused by the nematode and root-rotting fungi was measured on the basis of root weights of the sugar beets. Seeds of sugar beets were planted in sterile sand and the seedlings were transplanted to the soil in three-gallon crocks with one seedling to each crock. There were 3 replications of each of the four treatments and 10 crocks in each replication. Each individual sugar beet root was weighed and the average weight was taken as basis for assessment of the relative damage of the treatments. The treatments were as follows: Treatment 1) sugar beets were grown in soil in which nematode cysts were added; Treatment 2) pathogenic fungi added; Treatment 3) both nematodes and pathogenic fungi added; and Treatment 4) untreated (control). The light-texture soil used in this test was steam sterilized.

Heterodera schachtii cysts which were produced on sugar beets growing in sterilized soil were added to the sterilized soil in crocks of treatments 1 and 3. Small amounts of soil known to contain root-rotting fungi were added to the sterilized soil in crocks of treatments 2 and 3. The fungus most commonly associated with root rot of plants grown in soil infested with *Heterodera schachtii* and root rotting fungi (Treatment 3) was *Rhizoctonia solani*, although other fungi were also associated to a lesser degree. The fungi isolated from pieces of diseased roots that were surface disenfected and planted out on prune agar included:

Fungus genus	Number of plants yielding each fungus genus
Rhizoctonia	111
Fusarium	11
Pythium	5
Unidentified	24
Total number of plants bioassayed	130[a]

[a] Some plants yielded more than one fungus genus, therefore sum of plants yielding fungi exceeds total number of plants bioassayed.

Results

Results given in the following table show comparisons between sugar beets grown in nematode-free soil and soil infested with

Heterodera schachtii and root-rotting fungi. The reduction in root weight was 12.74% for those grown in soil with root-rotting fungi alone, 26.9% in soil with *H. schachtii* alone, and 45.8% in soil in which both nematodes and root-rotting fungi were added.

Table 1.—Relation between *Heterodera schachtii* and root rot of sugar beets.

Treatment Sugar beets grown	Avg. wt. of beets	Difference between control and disease	Loss due to disease
	Grams	Grams	Percent
In soil with root-rotting fungi alone	586.0	85.6	12.74
In soil infested with *H. schachtii* alone	491.0	180.6	26.9
In soil with both *H. schachtii* and root-rotting fungi	364.0	307.6	45.8
No disease (control)	671.6	-----	-----
LSD 5%	6.7		
LSD 1%	8.8		

Summary

In this test it is evident that reduction in weight of the sugar beet roots was lowest in the sugar beets grown in soil with root-rotting fungi alone, next lowest with the nematode alone and highest with both nematodes and root-rotting fungi present. Sugar beets exposed to both nematode and root-rotting fungi suffered more damage than the sum of losses due to nematodes alone and root rot alone.

Literature Cited

(1) POWELL, N. P. 1963. The role of plant parasitic nematodes in fungus diseases. Phytopathology 53 (1): 28-35.