# Evaluating Soil Samples for Fungus Pathogens of Sugarbeet Seedlings[1]

D. L. MUMFORD[2]

*Received for publication April 5, 1968*

There are several fungi that attack sugarbeets during the early stages of seedling development. Although symptoms caused by an individual pathogen are sometimes characteristic enough for identification by an experienced observer, it is difficult, ordinarily, to determine the pathogen involved simply by observing diseased seedlings. Frequently, more than one pathogen infects a single seedling, thus increasing this difficulty.

Soilborne fungi infecting sugarbeet seedlings can be identified rapidly and with minimum effort simply by incubating all or part of the infected seedlings in water and examining them with low magnification. A combination of this procedure for identification and a plant infection test similar to that used for determining root rot potential of pea fields (1)[3] was used to evaluate soil samples from sugarbeet fields in Michigan.

## Materials and Methods

Soil samples were obtained from 10 sugarbeet fields in the area of Bay City, Michigan. Another 10 samples were obtained from rotation plots at the Ferden Farm near Oakley, Michigan. Cropping sequences at this farm are carried out by the Soil Science Department of Michigan State University in cooperation with the Farmers and Manufacturers Beet Sugar Association. Two soil samples were taken from each of five rotations, one from a plot receiving high fertilization and one from a plot receiving low fertilization. In each instance the current crop of the rotation was sugarbeet. A key to the rotations is given in Table 1.

Two soil probes, 5 or 6 inches deep, were taken from each of 20 locations per field. The soil from 40 probes which constituted the sample from the field, was placed in a large polyethylene bag. One or 2 days after sampling, the soil from each

[1] In cooperation with Michigan Agricultural Experiment Station, East Lansing, Michigan.

[2] Plant Pathologist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Logan, Utah.

[3] Numbers in parentheses refer to literature cited.

field was mixed thoroughly then transferred to five sterile 6-inch clay saucers. Two seeds of a susceptible sugarbeet variety that had been soaked in 1% sodium hypochlorite for 30 minutes were planted in each of seven locations in the soil of each saucer. Saucers were kept at a temperature of about 25 C and watered normally until emergence (4 days); then they were watered heavily until removal for examination.

Eight days after planting, five seedlings were removed from each saucer (one from each of five locations in the saucer). All seedlings were washed thoroughly and placed in petri dishes containing sterile tap water. The seedlings were examined microscopically for fungus pathogens 24 to 36 hours later.

## Results and Conclusions

*Aphanomyces cochlioides* Drechs. and *Pythium ultimum* Trow. were the predominant pathogens in the soil samples tested. Both pathogens frequently infected the same seedling. This explains the occurrence of counts totaling more than 25—the total number of seedlings examined (Table 1). The absence of *Pythium aphanidermatum* (Edson) Fitz. and *Fusarium* sp., and the infrequency of *Rhizoctonia solani* Kuehn are not readily explainable. It had been repeatedly observed, however, that infection by *Fusarium* and *Rhizoctonia* are associated with seedling injury such as wind damage. The seedlings examined in this study received little or no injury during the time they were exposed to the fungi. McKeen (2) found *P. aphanidermatum* only in more sandy soils. This may account for its absence in these tests, where only clay soils were tested.

Data on samples from rotation plots seem to support earlier reports that losses due to *Aphanomyces* are severe following alfalfa. Only in soil samples taken from fields where the rotation included 2 years of alfalfa (Samples 11 and 12) were 100% of the seedlings examined infected with *Aphanomyces*. It is surprising that samples from a continuous beet rotation should be relatively low in amount of *Aphanomyces*. The high *Pythium* count in the sample obtained from a severely diseased area of this plot may suggest that *Pythium* is more important as a seedling pathogen of sugarbeets than previously recognized. No differences were indicated in infection level in samples from high and low fertilization plots.

The combination of procedures used here with the accompanying illustrations (Figure 1) can be utilized by untrained personnel and requires little time. If only an identification of pathogens is desired, this can be accomplished, with reasonable accuracy, 24-36 hours after infected host tissue has been placed in water

at room temperature. This technique, although well known, is infrequently utilized. The data in Table 1 (Samples 1-10) indicate wide differences in abundance of pathogens in different fields. In areas where seedling diseases are serious, an evaluation of soil samples for disease potential would be helpful in choosing favorable fields for planting. Chemical seed and soil treatments differ depending upon type of pathogen involved. Determining the appropriate chemical treatment might be facilitated by a knowledge of the pathogens present.

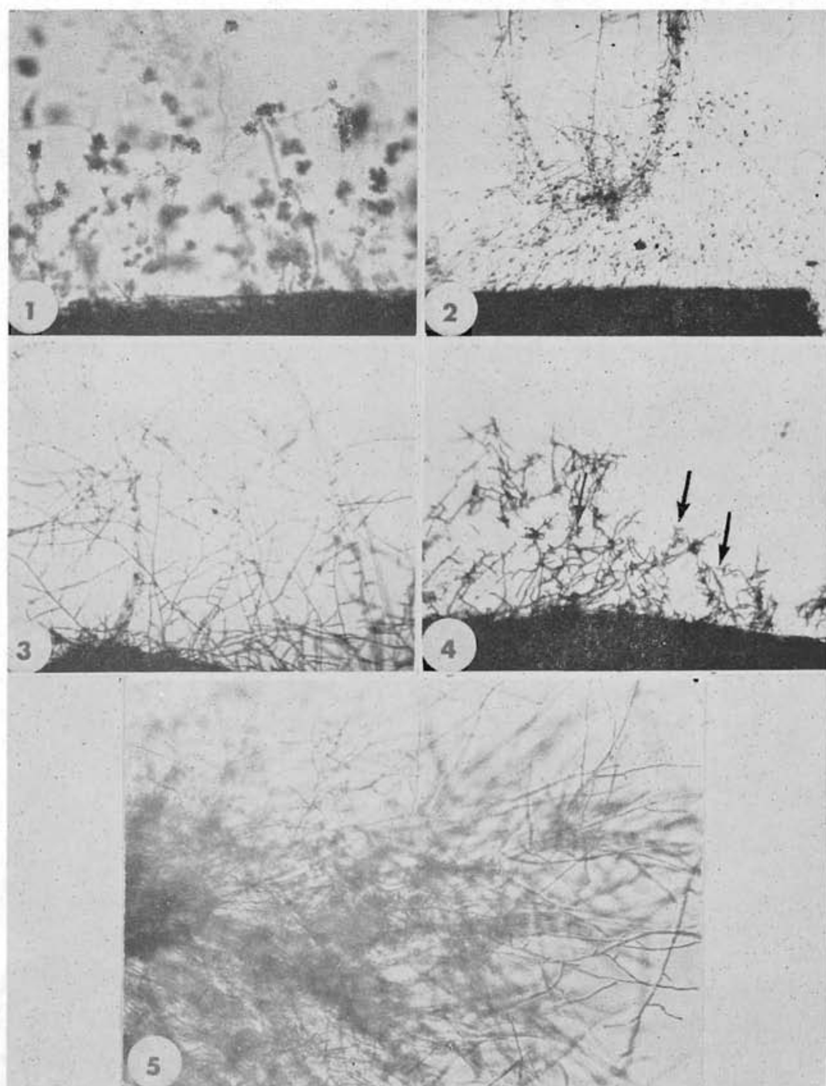

**Figure 1.—Five fungus pathogens of sugarbeet seedlings growing from infected host tissue after 48 hours incubation in water. (1) *Aphanomyces cochlioides*. Note clusters of encysted zoospores at the end of evacuation tubes. (2) *Pythium ultimum*. Note fine mycelial strands with numerous round sporangia. (*Pythium debaryanum* Hesse, which also is reported as a seedling pathogen of sugarbeet, could not be distinguished from this species at low magnification by the inexperienced observer). (3) *Rhizoctonia solani*. Note coarse mycelial strands and tendency for branches to arise at right angles. Mycelial strands commonly grow to the surface of the water. (4) *Pythium aphanidermatum*. Note irregular shaped, fingerlike sporangia (arrows) at ends of branches. (5) *Fusarium* sp. Note dense mycelial growth. Although not shown, this fungus often produces crescent-shaped spores.**

**Table 1.—Seedling infection test of soil samples for fungus pathogens of sugarbeet seedlings.**

| Soil sample | Preceding crop | Seedlings infected of 25 examined | | | Seedlings uninfected |
|---|---|---|---|---|---|
| | | *A. cochlioides* | *P. ultimum* | *R. solani* | |
| 1 | Beans | 1 | 14 | 0 | 10 |
| 2 | Wheat | 6 | 9 | 0 | 11 |
| 3 | Beans | 7 | 14 | 1 | 6 |
| 4 | Wheat | 14 | 7 | 0 | 5 |
| 5 | Beans | 1 | 17 | 0 | 7 |
| 6 | Wheat | 16 | 12 | 0 | 2 |
| 7 | Beans | 12 | 11 | 1 | 2 |
| 8 | Beets | 1 | 7 | 0 | 17 |
| 9 | Beans | 2 | 20 | 0 | 3 |
| 10 | Beans | 5 | 17 | 0 | 5 |
| 11 | [a] | 25 | 2 | 0 | 0 |
| 12 | [a] | 25 | 5 | 1 | 0 |
| 13 | [a] | 19 | 16 | 0 | 1 |
| 14 | [a] | 17 | 6 | 0 | 5 |
| 15 | [a] | 20 | 3 | 0 | 5 |
| 16 | [a] | 12 | 2 | 0 | 12 |
| 17 | [a] | 14 | 7 | 0 | 6 |
| 18 | [a] | 16 | 16 | 0 | 2 |
| 19 | [a] | 13 | 13 | 0 | 5 |
| 20 | [a] | 11 | 19 | 0 | 1 |

[a] Rotation sequences for plots sampled from Ferden Farm.

| Sample Number | Rotation |
|---|---|
| 11 and 12 | Barley, alfalfa, alfalfa, beans, beets |
| 13 and 14 | Corn, beans, wheat, sweet clover, beets |
| 15 and 16 | Soybeans, wheat, sweet clover, beans, beets |
| 17 and 18 | Barley, beans, wheat, corn, beets |
| 19 and 20 | Continuous beets. Sample 20 was taken from a local area showing severe seedling disease symptoms. |

(Plots 11, 13, 15 and 17 received ¼ fertilizer rate of plots 12, 14, 16 and 18.)

## Literature Cited

(1) SHERWOOD, R. T. and D. J. HAGEDORN. 1958. Determining common root rot potential of pea fields. Wisc. Agr. Exp. Sta. Bul. 531. 12 p.

(2) MCKEEN, W. E. 1949. A study of sugarbeet rootrot in Southern Ontario. Can. J. Res. 27: 284-311.