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Infested soil as a potential resource

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When soil becomes heavily infested with plant pathogens such as Fusarium, Phymatotrichum, Pythium, Rhizoctonia, Thielaviopsis, and Verticillium, it is customary to try to control the infestation by fallow, crop rotation, soil fumigation, chemical seed treatment, or planting resistant varieties. This report is to suggest that for each pathogen there may be several plant species, including crop plants, which are not only resistant to the pathogen, but stimulated by it.

Trials were done to detect plant species that benefit from soil infestation with *Thielaviopsis basicola* (syn. *Chalara elegans*). Under greenhouse conditions carrot, cauliflower, hedge nettle, lettuce, and radish grew better in infested than in noninfested soil. No claim of immediate practicality is implied, since no field trials have been conducted.

The logic of such trials is (1) some fungi and bacteria once considered to be pathogens (for example, *Endogone* and *Rhizobium* sp.) have since been found to be beneficial to plant growth, and more remain to be recognized; (2) most pathogenic fungi are nonpathogenic to most crops, and the margin between nonpathogenic, slightly pathogenic, neutral, and stimulatory, may be narrow and variable; (3) it is expected that in the course of evolution, plants adapt to most habitats, including infested soil; (4) in the Salinas Valley, a major lettuce and carrot producing area, the soil is commonly infested with *Thielaviopsis*, but no field disease caused by *Thielaviopsis* in lettuce or carrot has been reported; and (5) *Thielaviopsis* is widespread, without recognized disease, throughout the environs of San Francisco Bay, California; Kansas City, Missouri; Vancouver and Lethbridge, Canada; London, England; Munich, Germany; and Moscow, Russia.

Plants were grown in 8-cm-diameter pots of virgin and cultivated soil from the San Francisco Bay Area, or in a sand:peat:fertilizer mixture. The soils used were initially free of *T. basicola*. Half the pots were infested with *T. basicola*, mostly from a virgin site in Taylor Park, where the soil was heavily infested. Spores produced on slices of carrot root or infected roots of cowpea were used as inoculum.

About 4 weeks after planting, the green weight of the plants was measured. Of some 85 species of plants tested in over 500 trials, most showed no clear effect of soil infestation with *T. basicola*, even in tests where highly susceptible cowpea (*Vigna sinensis*) or cotton (*Gossypium hirsutum*) were included. The table gives results with those species that showed the greatest increase or decrease in green weight associated with *T. basicola*.

The environment, soil, and strain of *T. basicola* can logically have important effects in such trials, but none of these factors has been adequately studied. The greenhouse environment was relatively constant at about 20° C and 50 percent relative humidity, and tests were conducted at all times of the year. Many soils have been tested, and addition of *T. basicola* to soil from Muddy Hollow, Pt. Reyes National Seashore, has given given greater increases in green weight of cucumber and cauliflower than several other soils. There are many strains of *T. basicola*, and a strain from cherry has given greater increases in green weight than any other.

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Response of Plants to the Presence of *Thielaviopsis basicola* in Soil

Common name	Latin name	No. of trials	No. of replications	Green weight in infested soil: green weight of controls*
Cowpea	*Vigna sinensis*	68	387	0.61
Cotton	*Gossypium hirsutum*	23	90	0.68
Fireweed	*Erechtites hieracifolium*	10	36	0.62
Sedge	*Cyperus eragrostis*	5	29	0.67
Lettuce	*Latuca sativa*	65	171	1.22
Radish	*Raphanus sativus*	59	257	1.16
Cauliflower	*Brassica oleraceae*	35	120	1.25
Carrot	*Daucus carota*	33	252	1.22
Hedge nettle	*Stachys californica*	20	41	1.58

*Figures are decimal fractions derived by dividing the green weight of plants in the infested soil by the green weight of plants in noninfested soil.