INFLUENCE OF CHEMICAL SEED AND SOIL TREATMENTS ON *VERTICILLIUM*-INDUCED YIELD REDUCTION AND TUBER DEFECTS

H. COLE 2, W. R. MILLS 3, AND L. B. MASSIE 2

ABSTRACT

Experiments were conducted in 1969 and 1970 to determine the influence of chemical treatments of seed pieces and soil on the development of *Verticillium* wilt as measured by tuber yield increases and reduction in severity of tuber defects. The influence of storage on *Verticillium*-induced tuber defects was evaluated. Seed treatment chemicals tested included zinc ion maneb, maneb, maneb-chloroneb, Polyram, benomyl, and thiabendazole. Soil treatment chemicals included O-Diethyl (O-methyl-sulfinyl) phenyl phosphoro-thioate, disulfoton, phorate, carbofuran, aldicarb, ethyl 4 (methyl-thio)-m-tolyl isopropyl phosphor amidate, benomyl, and thiabendazole. Inoculated seed pieces and artificially infested plot areas were used the first year while the second year natural inoculum from a previous crop was the source of infection. Kennebec and Katahdin cultivars were tested in 1969 and Kennebec alone in 1970.

*Verticillium*-induced yield reductions and tuber defects were more severe in all respects with Kennebec than with Katahdin. With Katahdin the only significant evidence of infection was stem end discoloration. Seed treatments, with the exception of benomyl or thiabendazole, which were erratically phytotoxic, resulted in consistent yield increases and reduction in pink eye severity. In 1969 seed treatments reduced stem end browning in Kennebec. Soil treatment with disulfoton, carbofuran, and aldicarb, both alone and in combination with seed treatments resulted in consistent yield increases with Kennebec. The seed piece and soil treatment combinations tested in 1970 appeared to have an additive effect on yield increase from combination treatments equivalent to the gain from soil treatment alone plus seed treatment alone. The nematicide soil treatment materials did not influence yield. Tuber stem-end browning and pink eye defects in Kennebec did not increase in severity over a five month storage period.

INTRODUCTION

Kennebec is the major late season potato variety used for chips in Pennsylvania. It is very susceptible to *Verticillium* wilt and in many seasons the pathogen causes premature yellowing and death of vines in large portions of the Kennebec acreage. In addition to yield reduction, tuber stem end discoloration is associated with the disease. This results in discolored, low quality chips from affected potatoes and may result in the inability of the grower to sell his crop. The pink eye symptom in some instances with *Verticillium* wilt has also been implicated in storage breakdown problems.

1Contribution No. 622, Department of Plant Pathology, The Pennsylvania Agricultural Experiment Station. Authorized for publication as Paper No. 4003 in the Journal Series. Accepted for Publication July 29, 1971.
2Professor and Graduate Assistant, Department of Plant Pathology and Pesticide Research Laboratory. The Pennsylvania State University, University Park, Pennsylvania 16802.
3Professor, Department of Plant Pathology. The Pennsylvania State University, University Park, Pennsylvania 16802.
Resistant varieties suitable for production in Pennsylvania for processing markets are not yet available. High land values and lack of profitable alternative crops have shortened rotations so that potatoes may be grown one year in two, or even two years in three in the same fields on many farms. Due to these facts Verticillium wilt remains a severe problem once the pathogen is introduced into the production site.

In 1965 Hoyman and Dingman (4) reported that certain systemic insecticides including disulfoton (Di-syston) increased the total yield and US No. 1 yield of Russet Burbank potatoes grown in soil infested with *Verticillium albo-atrum*. The disulfoton treatments also delayed onset of wilt symptoms. The authors discussed reports of other observers who had noted similar effects in other areas of Washington and Oregon and that these effects appeared to be independent of insect control benefits.

Busch (1), in Ontario reported that disulfoton did not control *Verticillium* wilt in Kennebec; he obtained no yield increase or inhibition of symptom development with dosages of either 3 or 6 lb. active ingredient per acre.

In 1967 Hoyman and Dingman (5) presented results of an extensive series of experiments with disulfoton both banded and side dressed at various intervals and dates. The site was infested with root knot nematode (*Meloidogyne hapla*) and *Rhizoctonia solani* as well as *Verticillium albo-atrum* R. and B.: disulfoton treatment delayed wilt symptom development as well as reduced root knot tuber galls and significantly increased tuber yields.

Cole et al (2) also in 1967 reported that disulfoton incorporated in steam treated soil in the greenhouse increased the green and dry weights of corn and bean plants.

Massie et al (6) reported in 1970 that applications of a granular disulfoton formulation to bentgrass turf areas suppressed development of *Sclerotinia homoeocarpa* infection centers. Similar results were also obtained in the greenhouse in steam treated soil in pots where disulfoton treatment suppressed infection of *Poa pratensis* by *Helminthosporium*.

Most recently, after the experiments to be reported here had been completed, Easton (3) presented the results of a series of experiments beginning in 1966 using disulfoton, aldicarb and Telone-Chloropicrin mixtures for *Verticillium* control with Russet Burbank in infested soils. No yield increases were obtained with either disulfoton or aldicarb in any experiment although at one location the number of plants exhibiting wilt systems was reduced by certain treatments with disulfoton or aldicarb.

Previous to the disulfoton reports, Robinson, Larson, and Walker (8) in an extensive series of investigations dealing with *Verticillium* wilt symptoms, epidemiology, and variability of the pathogen concluded that surface contamination of tuber stocks was extremely important in epidemiology of the disease. They also concluded that if potatoes could be kept out of an infested field for two consecutive seasons and replaced with non-susceptible crops, soil infestations could be almost eliminated. Surface treatment of seed pieces was very effective in preventing re-infestation of clean fields.

Because of the increasing Pennsylvania losses, in light of all available information, experiments were initiated in 1969 to: i) evaluate the potential