

Eradication of *Helminthosporium maydis* Inside Popcorn Seed

David W. Pritchard

Post-doctoral Fellow, Ohio Agricultural Research and Development Center, Wooster 44691.

Supported in part by Agricultural Research Service, United States Department of Agriculture, under Cooperative Agreement No. 12-14-100-11,207(34).

Published with the approval of the Director, Ohio Agricultural Research and Development Center as Journal Article 137-73.

I thank J. D. Farley and T. D. Miller for their support.

ABSTRACT

Eradication of *H. maydis* from internally-infected popcorn seed was accomplished by treating with a mixture of steam and air for 17 min at 54-55 C. Although some infected seedlings were detected on V-8 juice agar, none emerged in soil. Steam-air treatments increased seedling blight due to other fungi, but this could be effectively controlled with Manzate 200 treatments; a combination of the two treatments eliminated all post-emergence seedling blight. Stands were increased by 22% with steam-air compared to fungicide alone, and it is suggested that these treatments would reduce secondary infections by *H. maydis* through elimination of potential sources of inoculum.

Phytopathology 64:757-758.

Additional key words: steam-air, seed treatment, southern corn leaf blight.

Helminthosporium maydis Nisik. & Miyake (*Cochliobolus heterostrophus* Drechs.) Race T can attack the ears of corn (*Zea mays* L.) and become established internally in the kernels. Virtually 100% of infected seeds fail to germinate or die from postemergence seedling blight (1). The fungus sporulates profusely on blighted seedlings which serve as sources of inoculum for secondary infections (2). Infected seeds, i.e. those in which the fungus is internal, often cannot be visually differentiated from healthy ones. Percentage of infected seed (determined by plating samples on PDA) was highly correlated with stand losses (1). Fungicide seed treatments did not significantly decrease stand losses due to *H. maydis*.

This paper describes a method of treating corn seed with a mixture of steam and air which effectively eradicates *H. maydis* from internally infected seed; not only are stands thereby increased, but sources of secondary inoculum are minimized.

The popcorn seeds used in this study were part of a lot collected in 1970 in a field on The Ohio State University farm where symptoms of *H. maydis* ear infections were abundant. Percentage of internally borne *H. maydis* was determined by plating (10 seeds/plate on 10% V-8 juice agar, pH 5.0) 120 surface sterilized seeds (0.5% NaOCl for 10 min and rinsed in sterile H₂O) and 120 untreated seeds. Data were collected on the number of infected seeds and on the percentage of seeds that had germinated 7 days after plating. The seed lot was found to be essentially free of fungi, externally or internally, except for *H. maydis*, which was found in ca. 65% of the seeds. About 75% of

seeds infected with *H. maydis* germinated, whereas essentially 100% of the healthy seeds did.

In preliminary tests seed lots were treated with a mixture of steam and air at 2 C intervals over a temp range of 47-61 C for 5-25 min at 5 min intervals. Air and steam were mixed in a Lindig Model 150 steam-aerator (Lindig Mfg. Co., St. Paul, Minn.), and the mixture was passed through 100 seeds/treatment; treatment temp variations did not exceed ± 1 C. Temperatures were monitored by placing a thermocouple, which responded nearly instantaneously, in the center of treatment lots. Each treatment lot was plated (10 seeds/plate) on V-8 juice agar. The percentage infected seeds was reduced from 65% to about 9% by treatments of 56-57 C for 20 min; of those seeds in which the fungus remained viable, three-fourths failed to germinate. Thus, the number of germinable infected seeds was reduced to about 2.5% compared to 49% in the original lot. There was a 15-20% loss in the viability of uninfected seeds with this temp-time combination, however, but it was superior to all other time-temp combinations for producing the maximum number of *H. maydis*-free seedlings.

Treated seed were planted in soil to test the hypothesis that the low percentage of infected seeds that did germinate following heat treatments would succumb before emergence and therefore would not serve as sources of inoculum. A temp of 54-55 C was selected; this was a compromise between eradicating *H. maydis* and not killing the embryo. Lots of 100 seeds were treated for 15, 20, or 30 min and planted in steamed composted soil in flats. Treatments for 20 min at 54-55 C resulted in both the greatest percentage emergence (80%) and also the largest number of survivors 4 weeks after planting (77%). The small percentage (3%) of seedlings that died from postemergence blight were found to be infected not with *H. maydis*, but mostly with *Fusarium* spp. This finding was further tested by planting lots of 100 seeds in soil subsequent to the following treatments: (i) no treatment, (ii) coated with Manzate 200 (manganese ethylenebisdithiocarbamate) (E. I. duPont de Nemours & Co., Wilmington, Delaware), (iii) treated with steam-air for 18 min at 54-55 C, and (iv) steam-air treatment followed by coating with Manzate 200. The percentage seedling blight was 7.7%, 15.2%, 5.0%, and 0.0% for untreated, steam-air treated, Manzate 200 treated, and

TABLE 1. Effect of steam-air, Manzate 200, or a combination of the two seed treatments on stands derived from a popcorn seed lot in which 65% of the seeds were internally infected by *Helminthosporium maydis*

Seed treatment	Mean number mature plants/72-seed replicate ^a
No treatment	19.77
Steam-air (54-55 C for 17 min)	26.34
Manzate 200	32.95
Steam-air + Manzate 200	48.59

^aMeans are from a total of 11 replicates from two experiments which did not significantly differ. All treatments were significantly different. LSD ($P = 0.05$) = 5.12.

steam-air plus Manzate 200 treatments, respectively. Thus, steam-air treatments completely eliminated the development of *H. maydis* infected seedlings, although susceptibility of the seedlings to infection by other pathogens residing in the soil was increased. However, seedling blight due to soil residents could be prevented by treating the seed with Manzate 200. It was therefore possible, by using a combination of steam-air treatments and coating the seeds with Manzate 200, to completely eliminate blight of seedlings.

Field plots, using the same four treatments as above, were planted in a randomized block. Each treatment consisted of five 20-ft rows with three seeds planted at 26-cm intervals. Two such plots were established and were planted 3 wk apart. Data from bi-monthly stand counts corroborated earlier experiments in that no postemergence seedling losses were recorded for seedlings from steam-air treated seeds. The mean number of seeds yielding mature plants was statistically analyzed for

significant differences between treatments (Table 1). An analysis of variance for each treatment also showed that each was significantly different at the 0.05 level. Stands were increased 44% by steam-air plus Manzate 200 as compared with stands from untreated seed and 21% as compared to those treated with Manzate 200 alone. It is surmised that losses due to *H. maydis* infections during the growing season would also be significantly reduced due to the elimination of inoculum sources within the stand.

LITERATURE CITED

1. BOOTHROYD, C. W. 1971. Transmission of *Helminthosporium maydis* Race T by infected corn seed. *Phytopathology* 61:747-748.
2. WHITE, D. G., and C. W. ELLETT. 1971. *Helminthosporium maydis* seedling blight of popcorn. *Plant Dis. Rep.* 55:382-384.