

Field Spore Production of *Helminthosporium turcicum* on *Zea mays* with and without Monogenic Resistance

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ABSTRACT

Daily spore counts of *Helminthosporium turcicum* conidia were taken from near-isogenic commercial hybrid maize production fields. Seed parent inbred genotypes differed by the presence or absence of the Ht_1 allele. Analysis by the paired t -test showed that Ht and non- Ht data were significantly different ($P = 0.01$), and that counts over the fields of plants with the Ht_1 genotype were lower.

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Additional key words: corn, northern corn leaf blight, epidemiology.

A widely used monogenic dominant resistance in maize (*Zea mays* L.) to *Helminthosporium turcicum* Pass. (causal agent of northern corn leaf blight), the Ht_1 gene, slows lesion development and reduces spore production when compared to near-isogenic susceptible counterparts, (2, 4, 5, 6). This study was made to determine the effectiveness of the gene in corn grown in large field plots.

MATERIALS AND METHODS.—Two adjacent commercial maize hybrid seed production fields were selected in which seed-parent rows occupied 80% of the total planting. Each field replicated the other in general terrain and genotype, except that seed parents were near-isogenic lines differing at the Ht_1 locus as a result of genetic conversion. The seed-parent genotype not possessing the homozygous dominant allele was considered very susceptible to the naturally occurring races of *H. turcicum* (Turner and Hart, unpublished). The entire experiment was replicated in a second pair of

adjacent production fields exactly as previously described, but located 41.8 km distant. All fields were in McLean County, Illinois. The 32- and 49-hectare (ha) fields with Ht/Ht were adjacent to 49- and 26-ha fields of non- Ht plants, respectively.

Three Rotorod samplers (Metronics Associates, Inc., Palo Alto, California) (3) mounted with fixed collector sampling heads were permanently positioned in each of the four fields. The samplers and a 12-volt battery were sheltered when not in use in housing units affixed to metal posts at the sampling height of 1.5 m above the soil. Placement of the units within a field was random with minimum distance between any two samplers of 38 m. One sampler in each field was near the windward edge of the field. No maize was grown within 200 m of the production fields.

Two 64-mm clear acrylic plastic type "I" rods coated with a silicone grease were prepared in the laboratory and transported to and from the field daily in containers to prevent contamination.

Samplers had been calibrated by the manufacturer with a strobe light as a basis for determination of the volume of air sampled. Samplers were operated at the same time daily (± 10 minutes) for any given location for a 15-minute time period. They were run 6 days per week from 11 June to 4 September 1974. Days not sampled were Sundays or days when rain was falling in the field to be sampled at sampling time. Mean starting times for the samplers in the fields were: 0754, 0756, 0759; 1004, 1006, and 1008 hours for Ht ; and 0825, 0828, 0830; 0936, 0939, and 0941 hours for non- Ht . Preliminary data from a diurnal periodicity study on the spore release indicated maximum spore fly occurs at approximately 1000 hours (Turner and Hart, unpublished). Spore counts were made with a $\times 100$ magnification using transmitted light to enable differentiation of spore morphology.

RESULTS.—For all calculations, daily spore counts were totaled from Ht and non- Ht genotype fields. A graph of those data converted to spores $\times 10^{-3}$ /liter of air is given in Fig. 1. Statistical analysis of data by the paired t -test showed Ht and non- Ht data to be significantly different ($P = 0.01$). Treatment means were 15.3×10^{-3} and 42.9×10^{-3} spores/liter of air in Ht and non- Ht fields, respectively.

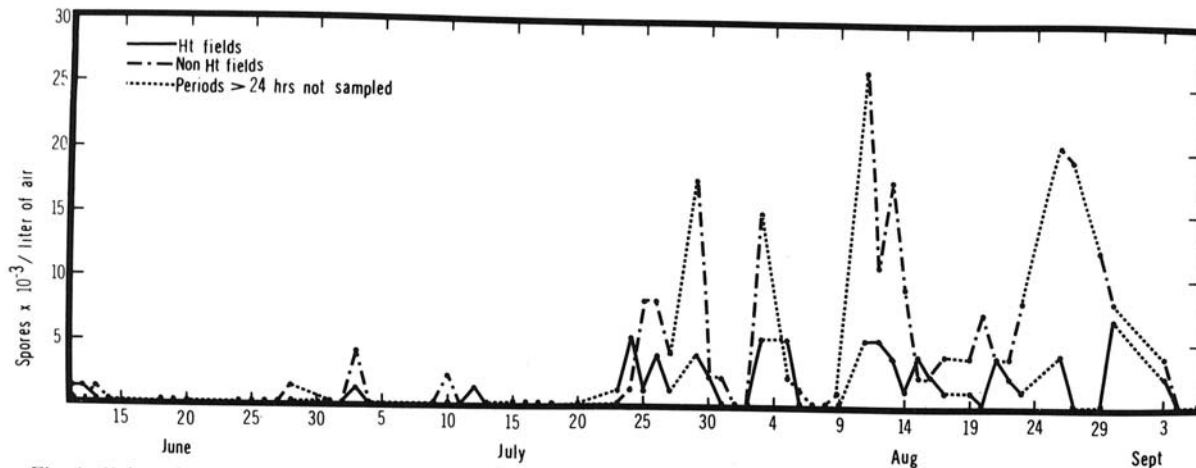


Fig. 1. *Helminthosporium turcicum* conidia ($\times 10^{-3}$ /liter of air) from maize production fields with *Ht* or non-*Ht* seed parents.

DISCUSSION.—This study indicates that the resistance determined by *Ht*₁ clearly reduces inoculum of *H. turcicum* in commercial production fields. The lack of previous field evidence is attributable to the relatively large size of test plots of near-isogenic materials necessary for comparison. On these tests only 80% of the plants carried *Ht*₁ in the *Ht* fields. In growers fields, with 100% of the plants carrying *Ht*₁, the expression of resistance should be as good or better.

The natural inoculum conditions of this study add to its credibility since increased experimental error from variation in artificial inoculum was avoided. Most spores counted within a given corn field probably arose within that field since no other maize was grown in the immediate surrounding fields. No indication was found that spores from the adjacent non-*Ht*₁ fields blew into the *Ht* fields to affect spore counts. Samplers were positioned well within field boundaries and away from the border between genotypes to avoid this possible source of error. This agrees with Meredith's findings on localized origin of spores (7). Although the time of day greatly affects number of spores released, mainly due to changes in moisture conditions (1), the sequence and timing of field sampling in this study with the concomitant totaling of spores minimize this effect. Early cool weather followed by dry conditions in July account for the low counts in the first part of the season. This is substantiated by recording

hygrothermographs operating in the sampled fields. The number of spores of *H. turcicum* over a field is significantly affected by the genotype of the plants in that field, and the *Ht*₁ gene reduces that number.

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