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# Yield responsiveness of corn to foliar fungicide application in Iowa

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An estimated three million acres of corn in Iowa were sprayed mid-season with fungicides (strobilurin or a strobilurin/triazole combination) in 2007. Reasons for spraying vary and include the high price of corn, potential to control diseases, and a possibility of improved yield from "plant health" benefits. Until this year, fungicide applications to production corn fields were rarely practiced in Iowa because they were not profitable. In addition, many of the hybrids grown today have good overall tolerance to foliar diseases.

In the 2007 growing season, Iowa State University Extension personnel and Corn and Soybean Initiative partners worked together to collect data to: (1) evaluate the control of gray leaf spot (GLS), common rust, and stalk rot from a mid-season foliar fungicide application; (2) assess the grain yield response of corn to foliar fungicide application; (3) determine if foliar fungicide applications are profitable; and (4) identify agronomic characteristics (such as hybrid and previous crop) that are important in determining when to spray fields.

*Harvest of 2007 research plots. (Matt Boyer)*

Plots were located in producer fields at 26 locations across Iowa (Figure 1). Data from 10+ other locations are still being collected and will be included in later reports. Each location included in the study had one of three designs: (A) fungicide 3 hybrid (replicated) (6 locations), (B) fungicide alone (replicated) (4 locations), and (C) fungicide (side-by-side) (16 locations). In the six locations that had two hybrids evaluated, one was considered as having a high disease tolerance to GLS with the other having lower tolerance based on company ratings. Fungicide was either not applied or applied between tasseling (VT) and silking (R1) via ground application or aerial application. Lesions due to foliar disease were counted on the ear leaf and the leaf below the ear on 100 plants per treatment during late August to early September. Stalk rot was evaluated on 60 plants per treatment in early October.

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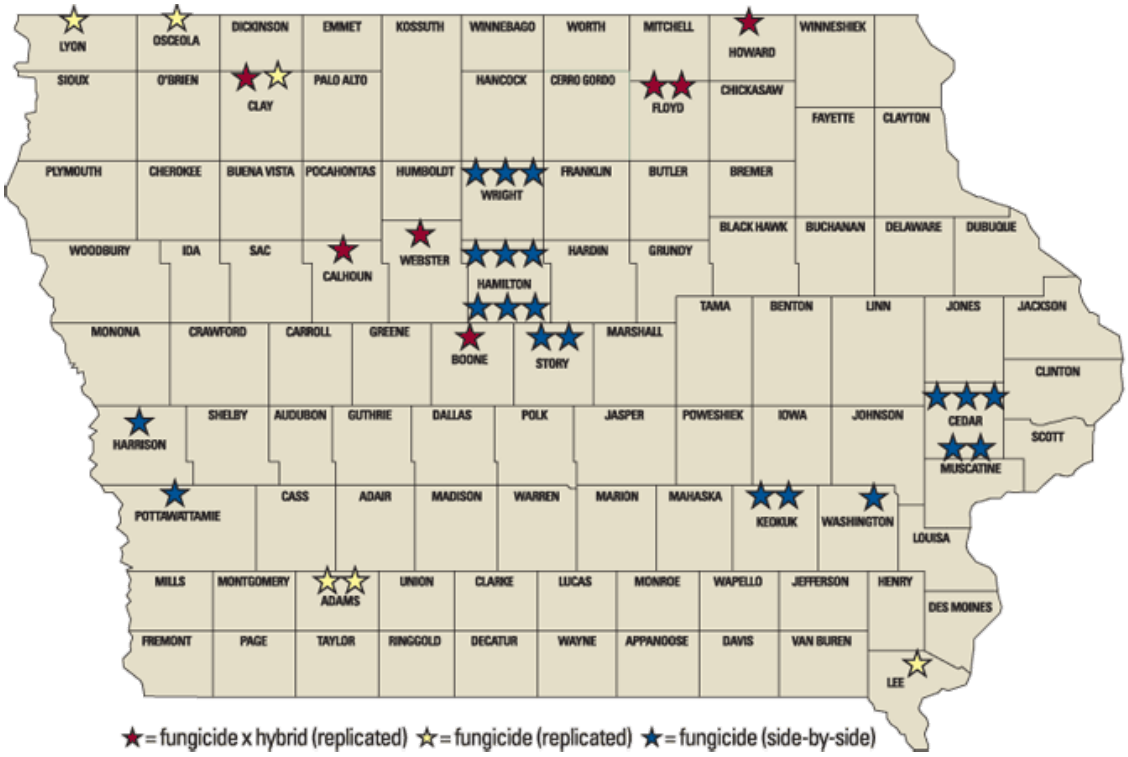


*Figure 1. Map of Iowa indicating the counties where corn fungicide trials were located (specific only to the county). Each star represents a location and the color denotes the type of trial present.*

## Results

Yield responses across all locations ranged from -15.6 bu/acre to +21.6 bu/acre. The average yield response was +3.3 bu/acre (Figure 2). Please note that only the yellow- and red-colored columns are replicated; the blue columns are side-by-side locations (i.e., not replicated). Caution must be used when interpreting data from non-replicated locations because the responsiveness may be due to other factors rather than the applied treatment. For example, the placement of a treatment in a field can significantly impact the yield even if the areas "look" the same. Therefore, in trials with only one replication, the overriding factor influencing grain yield may not necessarily be whether the strip was sprayed with fungicide or not. You will note in Figure 2 that the most responsive locations (positive and negative) also were those with only one replicate. Locations with multiple replications are more likely to show the actual treatment response and not be influenced by other factors.

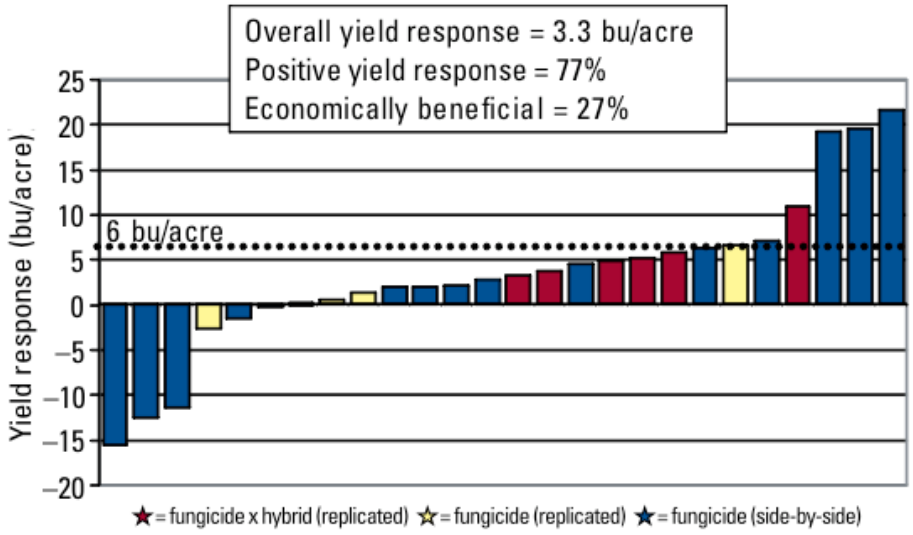


*Figure 2. Yield response of corn to foliar fungicide applications made at growth stage VT through R1 across 26 commercial field sites in Iowa. The dotted line labeled as 6 bu/acre denotes the breakeven yield response.*

A positive yield response to the foliar fungicide application occurred at 20 of the 26 locations (77%). Since the cost of a fungicide application in Iowa averaged around $22 an acre (cost of product and application), the breakeven yield response was a minimum of 6 bu/acre, assuming a corn price of $3.75. Using these values for cost and return, only 27 percent of the time (7 of the 26 locations) was a fungicide application profitable. Although a yield response was observed in many of the

trials (77%), it was not enough of an advantage to pay for applying the product. Another factor to consider is that grain moisture was 0.6 percent higher averaged across all 26 locations when fungicide was applied versus when it was not.

Foliar disease (gray leaf spot and common rust) severity and stalk rot severity data were collected at eight of the 26 locations. Analysis of these eight locations separate from the other 18 locations is extremely useful in understanding the yield responsiveness when disease pressure exists and the level of presence is well documented. Foliar disease pressure was moderate at two of the locations and low at the remaining locations. Fungicide applications at all sites reduced GLS and common rust. This was expected since the efficacy of fungicides on GLS and common rust is well documented. Severity of stalk rot also was reduced by the foliar fungicide application. This was not surprising since a reduction in stalk rot has been correlated with a reduction in foliar disease. Analysis of these eight locations showed a yield response ranging from -2.7 bu/acre to +21.6 bu/acre, with a mean yield response of +4.1 bu/acre. The greatest yield advantage occurred at the Harrison County location, which also had the highest disease pressure. This also was the only location of the eight at which the fungicide application was profitable (>6 bu/acre). However, this location was not replicated.

Details regarding cropping history, hybrid selection, and geography also were used when pooling this data to discern if overarching trends existed across all locations in terms of these factors. Cropping history could not be identified from this year's data set as a primary factor in determining yield response. Corn placed on either corn or soybean residue responded the same to fungicide application. We hypothesize that no difference was observed because of low disease pressure that occurred across much of Iowa this growing season.

Separating hybrids by their GLS severity ratings did not show a significant difference in yield response either. Hybrids from a total of 13 seed companies were evaluated in this study. Company ratings for GLS tolerance are subjective, and methodology varies among companies. Hybrid scores were converted to a scale similar to that used by Pioneer Hi-Bred (1 to 9 = poor to excellent), although this is not a foolproof method for evaluating hybrids either since companies do not evaluate their hybrids identically in terms of disease susceptibility. Thus, the lack of a difference could be associated with variations in the GLS rating scale. Or, it simply could be that disease pressure was low, and thus, susceptible hybrids fared as well as more tolerant hybrids this year.

Disease pressure is typically greater in the southern and eastern counties of Iowa due to more humid conditions. Iowa was split into three tiers, either by latitude or by longitude, and the mean yield response in locations within one tier was compared to the mean yield response of those locations in the other two tiers. A positive yield response to fungicide application was observed in all tiers except the southern tier (although this may change when the yield data for all locations in the southern tier have been received). Thus, yield response based on this set of data was not tied to geography overall.

## Summary and Recommendations

Research summarized over 26 locations to date identified an average yield increase of 3.3 bu/acre when a fungicide was applied at tasseling (VT) or silking (R1) compared to an untreated control in Iowa. Yet 3.3 bu/acre is below the yield necessary to cover fungicide and application costs. Only 27 percent of the time was a fungicide application profitable. Fungicides decreased foliar disease severity and stalk rot severity but did not always result in a positive or profitable yield response.

The 2008 growing season is several months away, but already decisions are being made regarding the purchase of fungicides. However, a decision to apply a fungicide mid-season to hybrid corn should be based on IPM management practices as it is simply a management tool that is useful only in conditions where disease pressure would be expected to significantly reduce yield potential.

Consider the following factors before spraying in 2008: hybrid susceptibility, disease pressure at VT, weather conditions at VT and during grain fill, previous crop, and the amount of crop residue present in the field. In general, a fungicide application is not recommended on resistant or moderately resistant hybrids. On susceptible or moderately susceptible hybrids, a fungicide application may be warranted if disease is present on the third leaf below the ear leaf or higher on 50 percent of the plants at tasseling. Whereas, with intermediate hybrids, a fungicide need only be applied if conditions are favorable for disease development; that is, disease is present on the third leaf below the ear leaf or higher on 50 percent of the plants at tasseling, the weather is warm and humid, the field has a history of GLS, and >35 percent corn residue is present.

## Acknowledgments

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