

Control of Asian Soybean Rust (*Phakopsora pachyrhizi*) With Azoxystrobin-Based Fungicide Products Applied With or Without Spray Adjuvants.

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ABSTRACT:

Two trials were conducted in Brazil (2005 growing season) to study control of Asian soybean rust (*Phakopsora pachyrhizi* Sydow) with Azoxystrobin (AZO) based fungicide products applied with or without spray adjuvants. Treatments included three fungicides (Syngenta Crop Protection, Greensboro NC): AZO (Quadris® 2.08 SC), AZO + propiconazole (Quilt® 200 SE), and AZO + cyproconazole (Quadris® Xtra 2.34 SC). Two applications were made with or without a spray adjuvant at: 1) soybean (*Glycine max* (L.) Merr.) growth stage R2-R3, when disease was at < 2% incidence; and 2) 21 days later. Disease severity was estimated over time by sampling 8 leaves each from the middle canopy and the upper canopy. Fisher's Protected LSD ($p=0.05$) was used to compare area under the disease progress curve values. Data also were collected on yield (kg/ha) and 1000-seed weight.

The addition of 0.25% v/v non-ionic surfactant (Activator 90, Loveland Industries, Inc., Greeley CO) improved disease control only for AZO 113 g a.i./ha in the mid-canopy in one trial. In both trials, AZO 113 g a.i./ha + 1% v/v crop oil concentrate (Agri-dex®, Helena Chemical Co., Collierville, TN) improved disease control compared to AZO 113 g a.i./ha alone, and in one trial the addition of 1% crop oil concentrate also improved disease control of AZO 167 g a.i./ha and of AZO + propiconazole 200 g a.i./ha. At this location, the addition of 1% v/v crop oil concentrate to AZO 113 g a.i./ha decreased premature defoliation compared to AZO 113g a.i./ha alone, and resulted in higher yield and 1000-seed weight than AZO alone at either 113g or 167 g a.i./ha. These results show a significant benefit to using crop oil concentrate at 1% v/v for improved performance of AZO-based fungicide products, except for the AZO + cyproconazole product.

OBJECTIVE:

The objective of this work was to study the possible impact that spray adjuvants have on the performance of Azoxystrobin-based fungicide products applied for control of Asian soybean rust (ASBR).

MATERIALS AND METHODS:

Because of the lack of ASBR in the United States, this work was carried out in Brazil during the 2004-2005 cropping season. Two trials were conducted: one was located in Holambra at a Syngenta research site in central São Paulo state (the Central site), and the other was conducted in a commercial soybean field near Vargem Grande do Sul in North-central São Paulo state (the North-central site). The Central site used the soybean cultivar 'Explendor,' and the North-central site included the cultivar 'Monsoy 8001.' Both cultivars exhibit determinate-type growth.

Field plots were 12 m long and 3 m wide (six rows, 50 cm apart, 16 plants/m). Plots were arranged in a randomized complete block design with four repetitions. The treatment list was identical for both trials (Table 1.). Three AZO-containing fungicide products were included. Two types of adjuvants were tested: a crop oil concentrate (Agri-dex®) was tested at a 0.5% v/v rate and a 1% v/v rate; a non-ionic surfactant (Activator 90) was tested at a 0.25% v/v rate. Treatments were applied with a 6-nozzle hand boom (flat fan nozzles, size 11002, spaced 50 cm apart), and compressed air at 250 KPa pressure. Two applications of each treatment were made: the first was at soybean growth stage R1-R2, when disease was at < 2% incidence; and the second was made 21 days after the first application.

Assessments of disease severity were made in the four middle rows of the plot. Eight leaves from the middle canopy and eight leaves from the upper canopy were observed at each assessment period, and the estimates for disease severity (mean % leaf area affected) were recorded per canopy section. At the Central site, disease severity data were collected five times at approximately seven-day intervals. Disease severity data at the North-central site were collected seven times at about seven-day intervals. Yield data (kg/ha) were collected from the four middle rows of the plot. In addition, the weight of 1000 seeds from each sample was recorded (1000-seed weight).

Area under the disease progress curve (AUDPC) values were calculated for the disease severity data (Shaner and Finney, 1977). Both the AUDPC values and the yield data were subjected to analysis of variance and subsequent means separation testing with Fisher's Protected LSD ($p=0.05$).

RESULTS:

In the upper canopy at the Central site, Azoxystrobin (AZO) at 113 g a.i./ha applied without an adjuvant resulted in a higher AUDPC than when the crop oil concentrate (COC) Agri-dex® was added to the AZO spray solution at either the 0.5% or the 1% v/v rate (Fig. 1. A). The addition of the non-ionic surfactant (NIS) Activator 90 at 0.25% v/v to AZO 113 g a.i./ha did not result in a lower AUDPC, nor did the addition of COC to AZO 167 g a.i./ha, AZO + Cyproconazole (Quadris® Xtra), or AZO + Propiconazole (Quilt®) 200 g a.i./ha. There were no differences in yield (kg/ha) or in 1000-seed weight detected at the Central site (data not presented).

Data from the middle canopy at the Central site show that adding COC at 1% v/v to AZO at either the 113 g a.i./ha rate or the 167 g a.i./ha rate decreased AUDPC compared to AZO without COC (Fig. 1. B). There was no significant reduction in AUDPC when COC was added at 0.5% v/v, nor when NIS was used. Also, the addition of COC to the spray solution of AZO + Cyproconazole or to AZO + Propiconazole did not result in a reduction in AUDPC.

At the North-central site, both AZO (at either 113 g a.i./ha or 167 g a.i./ha) and AZO + Propiconazole had reduced AUDPC values in the upper and middle canopies when they were combined with COC at 1% v/v, but not when COC was at 0.5% v/v (Fig. 2. A and B). There was no reduction in AUDPC in either the upper or middle canopies with the addition of the NIS to AZO 113 g a.i./ha. No significant difference was detected in AUDPC values when comparing AZO + Cyproconazole without COC to AZO + Cyproconazole with COC.

All treatments at the North-central site had significantly higher yield compared to the check, except AZO at 113 g a.i./ha and 167 g a.i./ha without adjuvants (Fig. 3.A). All treatments had increased 1000-seed weights compared to the check (Fig. 3.B). Yield increase was significant when COC at 1% v/v was combined with AZO 113 g a.i./ha compared to AZO 113g a.i. used without COC. None of the other fungicide product-adjuvant combinations led to increased yields compared to the respective fungicide products used without an adjuvant.

DISCUSSION:

The performance of AZO 113 g a.i./ha was consistently improved when COC 1% v/v was added to the spray solution. The same was true for the 167 g a.i./ha rate as well, except for in the upper canopy at the Central site. In general, disease development was delayed and disease pressure was lower in the upper canopy compared to the middle canopy. The higher rate of AZO (167g a.i./ha) was providing excellent disease control by itself in the upper canopy; thus, the addition of COC to the spray solution could not provide additional benefit to the fungicide. Combining AZO 113 g a.i./ha with 0.5% COC did not provide a significant benefit over AZO alone. Therefore, the addition of COC at the 1% v/v to the AZO spray solution is recommended.

Application of AZO + Propiconazole with COC at 1% v/v led to lower AUDPC only at the North-central site. Because of the lower disease pressure at the Central site, AZO + Propiconazole without COC was able to keep disease levels low, but at the North-central site disease pressure was greater, and the additional control provided by adding COC to the spray solution was needed to keep the disease under control. Although the reduction in AUDPC was not always significant when COC was added to the AZO + Propiconazole spray solution, it is likely to be beneficial if disease pressure is expected to be high.

AZO + Cyproconazole provided excellent disease control that was consistent at both locations and at both levels in the canopy regardless of whether a spray adjuvant was used or not. Thus, it is not necessary to use a spray adjuvant with AZO + Cyproconazole.

CONCLUSION:

The results of these two trials demonstrate a significant benefit to using COC for improved performance of AZO-based fungicide products, except for the AZO + Cyproconazole product (Quadris® Xtra). We recommend that the COC be added to the spray solution at the rate of 1% v/v. The benefit to adding COC was especially evident in the case of the product that contains just AZO (Quadris®).

Quadris® and Quilt® are registered trademarks of Syngenta Crop Protection, Greensboro, NC. Agri-dex® is a registered trademark of Helena Chemical Company, Collierville TN. Activator 90 is a product of Loveland Industries Inc., Greeley CO.

Reference:

Shaner, G., and R. F. Finney. 1977. The effect of nitrogen fertilization on the expression of slow-mildewing resistance in Knox wheat. *Phytopathology* 70: 1183-1186.

Table 1. Treatment list for two trials conducted in São Paulo state, Brazil during the 2004-2005 soybean cropping season: study of the effect of spray adjuvants on performance of Azoxystrobin-based fungicides applied for control of Asian soybean rust.

Treatment	Active Ingredients (a.i.)	Rate
1 Non-treated Check	---	---
2 Quadris® 2.08 SC	Azoxystrobin	113 g a.i./ha
3 Quadris® 2.08 SC + Agri-Dex®	Azoxystrobin Crop oil concentrate	113 g a.i./ha 0.5 % v/v
4 Quadris® 2.08 SC + Agri-Dex®	Azoxystrobin Crop oil concentrate	113 g a.i./ha 1 % v/v
5 Quadris® 2.08 SC + Activator 90	Azoxystrobin Non-ionic surfactant	113 g a.i./ha 0.25 % v/v
6 Quadris® 2.08 SC	Azoxystrobin	167 g a.i./ha
7 Quadris® 2.08 SC + Agri-Dex®	Azoxystrobin Crop oil concentrate	167 g a.i./ha 1 % v/v
8 Quadris® Xtra 2.34 SC	Azoxystrobin + Cyproconazole	84 g a.i./ha
9 Quadris® Xtra 2.34 SC + Agri-Dex®	Azoxystrobin + Cyproconazole Crop oil concentrate	84 g a.i./ha 1 % v/v
10 Quilt® 1.67 SC	Azoxystrobin + Propiconazole	200 g a.i./ha
11 Quilt® 1.67 SC + Agri-Dex®	Azoxystrobin + Propiconazole Crop oil concentrate	200 g a.i./ha 1 % v/v
12 Quilt® 1.67 SC	Azoxystrobin + Propiconazole	301 g a.i./ha

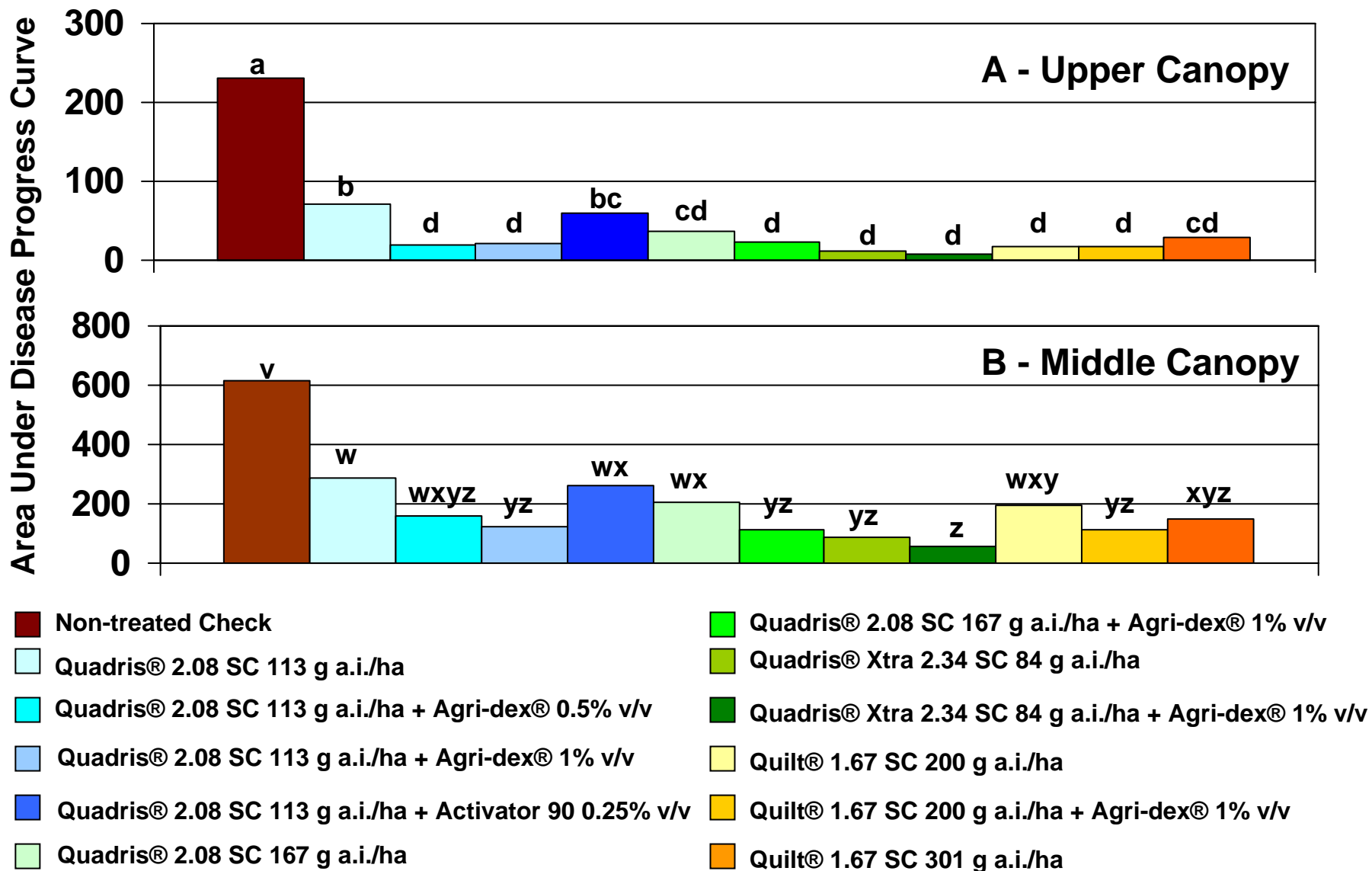


Figure 1. Central site: comparisons of area under the disease progress curve (AUDPC) values. **A.** AUDPC values for upper canopy. **B.** AUDPC values for middle canopy. AUDPC values were calculated from seven rating events. Percent disease severity in the non-treated check was 100% in the middle canopy and 49% in the upper canopy at the time of the final rating. Bars marked with the same letter are not significantly different (Fisher's Protected LSD, $p=0.05$). See Table 1. for fungicide product information.

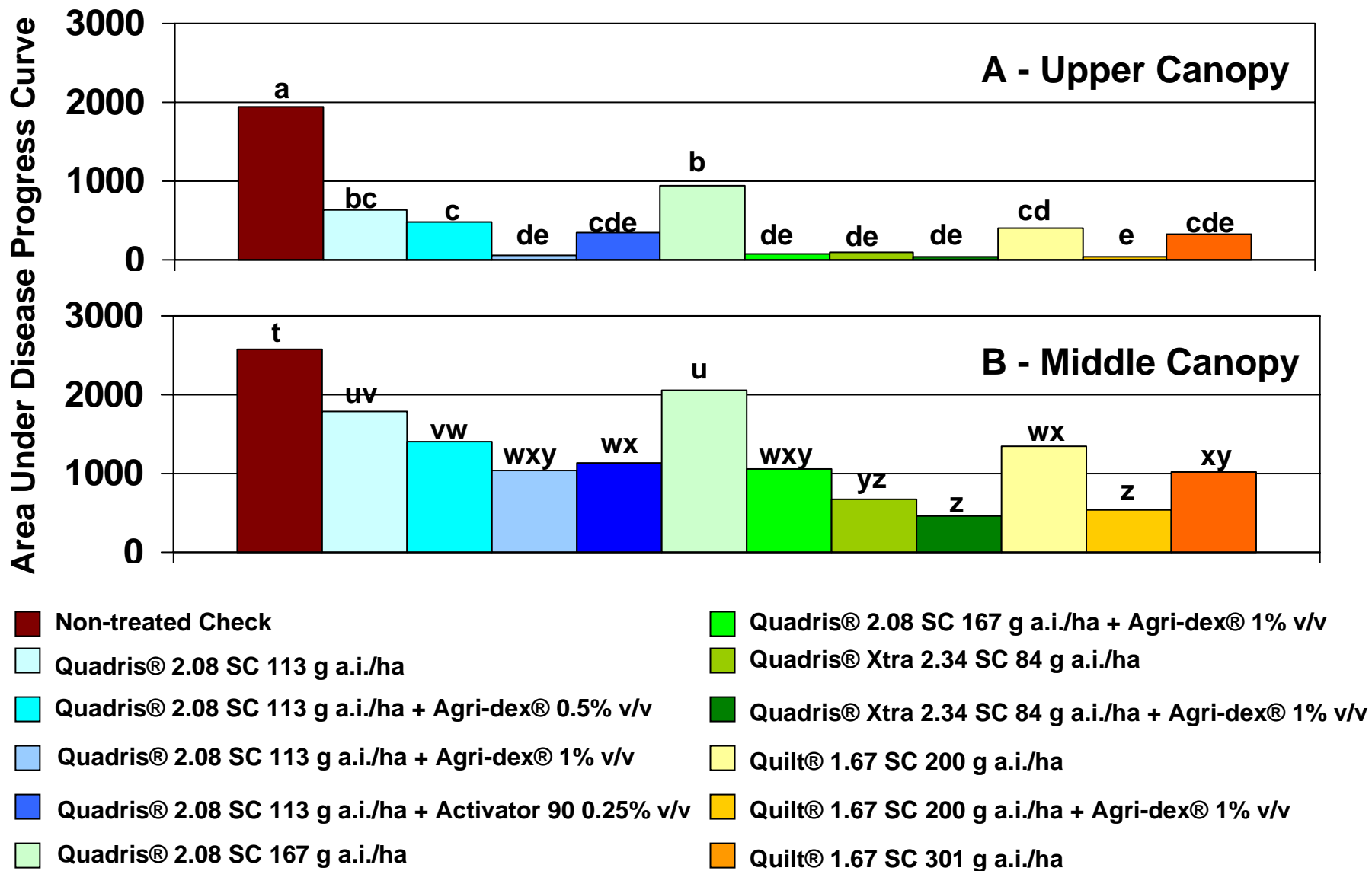


Figure 2. North-central site: comparisons of area under the disease progress curve (AUDPC) values. **A.** AUDPC values for the upper canopy. **B.** AUDPC values for the middle canopy. AUDPC values were calculated from seven rating events. Percent disease severity in the non-treated check was 100% in both the middle and upper canopies at the time of the final rating. Bars marked with the same letter are not significantly different (Fisher's Protected LSD, $p=0.05$). See Table 1. for fungicide product information.

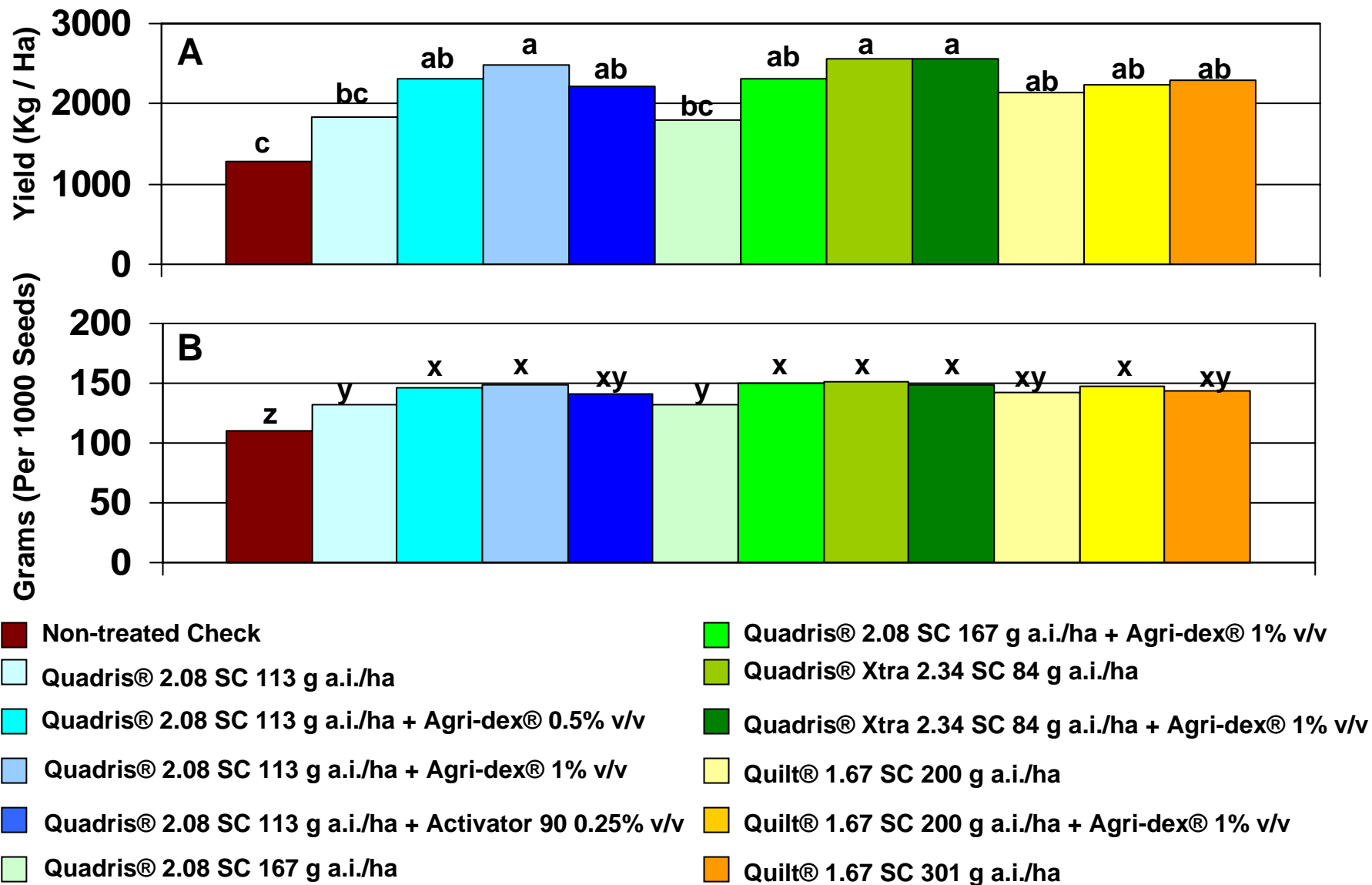


Figure 3. North-central site: Yield effects of fungicide treatments, with and without spray adjuvants, for control of Asian soybean rust. **A.** Grain yield (Kg/ Ha). **B.** Weights (in grams) per 1000 seeds. Bars marked with the same letter are not significantly different (Fisher's Protected LSD, $p=0.05$). See Table 1. for fungicide product information.