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2019 Wheat Field Plot Trials Summary

Fungal and Bacterial Disease Trials

P-00161

2019 Field Plot Summaries for Wheat Disease Management Trials

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SUMMARY
Several field research experiments were conducted in the 2019 growing season whose objectives were to examine rates, application timing and combinations of several experimental and commercially available fungicides for managing various foliar diseases in small grains. Also assessed were Fusarium head blight or scab, Fusarium root, crown and foot rot and common root rot in spring wheat. The studies were implemented at Volga and Brookings research farms and Northeast research farm (NERF) near South Shore, SD.

The 2019 season was a bit uncharacteristic with a late planting start due to excess spring moisture. Summer was also cooler compared to both 2018 and 2017 July temperatures which were 1.1ºF and 4.1ºF, warmer, respectively. Early season conditions were not conducive to the development of most foliar fungal diseases. However, conditions were right for Bacterial leaf streak (BLS) and scab, especially at the Brookings location.

Low disease incidence and severity owing to unfavorable disease conditions early in the season resulted in lack of statistically significant differences among treatments for foliar fungal diseases while BLS severity was almost uniform across plots irrespective of treatment. Generally, where disease pressure was relatively high, fungicide application prevented yield loss significantly.

Most of the fungicides and bactericides used in these studies were approved for use in SD at the time of application. However, some experimental products were also used. Alternative application approaches that are not currently part of the product label such as crop, timing and/or rate were employed for research purposes. Therefore, results from these experimental or research procedures should not be considered recommendations until the research is finalized and official recommendations are made. Growers using any chemical products should always consult product labels regarding safety, application methods and rates, handling, appropriate use, pre-harvest, re-entry intervals, and any other important information.

ACKNOWLEDGEMENTS
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1.0 Foliar Fungicide I — Volga

The efficacies of new fungicides relative to common fungicides to manage early spring wheat foliar diseases such as rusts, tan spot and powdery mildew were evaluated at the Volga Research Farm. Because disease evaluation was done on the flag leaf, disease differences were not significant and most likely this was the reason for luck of significant yield difference among the treatments (Table 1.1). Early foliar fungicide is beneficial where there is high disease pressure early in the season especially under no-till wheat on wheat fields.

2.0 Foliar Fungicide II — Volga

A number of commercially available and new fungicides for managing foliar diseases in spring wheat were applied at tillering and flag leaf in sequential combinations (Table 2.1). No statistically significant yield differences were observed. However, the efficacies of the new products were comparable to existing fungicides in managing foliar diseases. Most products significantly improved test weight. The associations between yield/total foliar disease and yield/whole plot disease were statistically significant (r = -0.36, p=0.041 and r = -0.52, p=0.002, respectively). These significant relationships suggest that these products helped to reduce disease impact on yield.

3.0 Bacterial leaf streak (BLS) Effect on Yield — North Felt Farm, Northeast, Volga

This study evaluated the effect of BLS on yield in spring wheat at three locations; Brookings, North Felt and Northeast research farms. A combination of eight cultivars and breeding lines were used in a split plot arrangement whereby 50% plots for each cultivar were inoculated with BLS at tillering (Feekes 4-5) while the remaining 50% were treated with a bactericide to prevent natural infection. However, the applied bactericide did not prevent natural BLS infection in plots that were supposed to be disease free.

The North Felt location had high BLS infestation and yield loss differences between non-inoculated and inoculated plots ranged from 9 to 33%, thus 4 to 9 bu/ac, respectively (Table 3.1). A Spearman's correlation coefficient analysis revealed a significant negative association between yield and whole plot BLS severity, r = -0.48, p<.0001.

Northeast and Volga had negligible BLS infestations. Consequently, no statistically significant differences in yield were observed at either location (Tables 3.2 and 3.3).

4.0 Fusarium head blight (FHB) I — Volga

The efficacies of various fungicides for FHB management were assessed at the Brookings location. Products were applied at tillering (Feekes 4-5) and early flowering (Feekes 10.5.1). No significant differences were observed in yield among products applied (Table 4.1). However, all treatments significantly reduced FHB index and Fusarium damaged kernel percentages compared to the untreated plot.

5.0 Fusarium head blight (FHB) II — Northeast & Volga

This study investigated the efficacy of experimental and commercially available fungicides applied at early flowering (Feekes 10.5.1) to manage FHB. These studies were conducted at both the Brookings and Northeast locations.

No major differences were observed at Northeast among treatments for yield except that untreated check registered the lowest yield quantity and highest FHB incidence, severity, index and Fusarium damaged kernels (Table 5.1). A similar trend was observed at the Volga location (Table 5.2).

6.0 Fusarium head blight (FHB) III — Northeast & Volga

This study evaluated the efficacies of commercially available fungicides for FHB management applied in sequential combination and different application times, thus jointing (Feekes 6), flag leaf (Feekes 9), heading (Feekes 10.5) and early flowering (Feekes 10.5.1).

At Northeast, Miravis Ace applied at flowering or heading reduced FHB and improved yield compared to the untreated (Table 6.1). At the Volga location, a sequential combination of Trivapro (Feekes 6) and Miravis (Feekes 10.5.1) produced the highest yield and the lowest FHB disease metrics (Table 6.2).

7.0 Fusarium head blight (FHB) integrated management — Northeast & Volga

In this trial three cultivars, Brick (resistant), prevail (moderately resistant) and Samson (susceptible) were used to evaluate the efficacy of Miravis Ace (propiconazole + adepidyn) applied at Feekes 10.3 (half head visible) and at Feekes 10.5.1 (early flowering) compared with Prosaro (tebuconazole + prothiaconazole) applied at Feekes 10.5.1.

The results for Northeast suggest that Miravis and Prosaro efficacies at controlling FHB are similar when applied at early flowering. A comparison between early flowering and early heading applications of Miravis also revealed that early flowering applications effectively reduced FHB index and FDK, particularly when the cultivar is susceptible to FHB (Table 7.1). A Spearman correlation coefficient analysis revealed a significant association between yield and FHB index, r = -0.42, p=0.0002.

Generally, a similar trend was observed at Volga location (Table 7.2). However, disease intensity was low at this location and associations between yield and FHB index, FDK, incidence or severity were not statistically significant.

8.0 Uniform Fungicide Study — Northeast & Volga

Brick (resistant) and Samson (susceptible) were used to assess the efficacies of Caramba (meticonazole), Miravis (propiconazole + adepidyn) and Prosaro (tebuconazole + prothiaconazole) fungicide formulations in managing FHB applied in sequential combinations and varied timings specifically for Miravis.

Statistically significant differences were observed in FHB parameters at Northeast Research Farm (Table 8.1). In general, untreated checks performed the worst. However, within cultivar analyses showed that Miravis was more effective when applied at early flowering compared to early heading with a performance similar to Prosaro. There was a significant association between FHB index and FDK, r = 0.73, p<.0001. Yield and FHB index also demonstrated a significant negative association, r = -0.62, p<.0001. Similarly, Volga revealed that when applied at early heading, Miravis is not as effective as when applied at early flowering (Table 8.2). Associations between yield and FDK or yield and FHB index were not significant at the Brookings location, however, FDK and FHB index were significantly correlated, r = 0.51, p<.0001.

9.0 Seed Treatment I — Northeast & Volga

This study was maintained at Northeast location to evaluate the efficacies of various seed treatment products for managing soil borne diseases. Means for yield (Table 9.1) at Northeast farm did not show statistically significant differences. However, there were some statistically significant differences for stand count.

This study assessed the efficacies of seed treatment products for soil borne seedling diseases caused by fungal pathogens. There were no statistically significant differences in yield and stand count among treatments (Tables 10.1 and 10.2).

Cultivars: Prevail

Previous Crop: Wheat

Planted: 05/16/2019

Table 1.1. Foliar Fungicide Study I: Evaluation of different foliar fungicides and rates applied to hard red spring wheat at tillering at Volga Research Farm.

Product, rate, unit†	Tan spot (%)	Whole plot disease (%)	Test weight (lb/bu)	Yield (bu/ac)	Vigor (1-9)¶
Untreated	8.48 *a*‡	7 *a*	50.06 *a*	37.07 *a*	5 *a*
Priaxor, 2fl oz/ac	5.78 *a*	9 *a*	50.14 *a*	38.34 *a*	5 *a*
Nexicor, 3.5fl oz/ac	5.53 *a*	7 *a*	51.56 *a*	39.27 *a*	4 *a*
Exp-A, 3.5fl oz/ac	6.56 *a*	7 *a*	51.60 *a*	41.36 *a*	5 *a*
Exp-B, 4fl oz/ac	5.73 *a*	7 *a*	51.75 *a*	39.47 *a*	5 *a*
Tilt 3.6E, 2fl oz/ac	6.64 *a*	6 *a*	51.48 *a*	41.07 *a*	5 *a*

†Exp-A, Exp-B are experimental products

‡Means followed by the same letter are not significantly different, $p \leq 0.05$

¶Vigor scale: 1=worst, 9= excellent vigor

Cultivars: Prevail

Previous Crop: Corn

Planted: 05/16/2019

Table 2.1. Foliar Fungicide Study II: Evaluation of different foliar fungicides, rates and sequential combinations applied to hard red spring wheat at Volga Research Farm.

Product†	Rate	Unit	Timing	Tanspot (%)	Leaf rust (%)	Total leaf disease (%)	Whole plot disease (%)	Test weight (lb/bu)	Yield (bu/ac)
Untreated				12.10 *a*‡	14.65 *a*	34.50 *a*	51.25 *a*	49.92 *b*	37.98 *a*
Proline 480 SC	5	fl oz/ac	FK2-3	1.60 *b*	0.95 *a*	5.25 *b*	12.50 *b*	52.40 *a*	39.37 *a*
Proline 480 SC	5	fl oz/ac	FK 9						
Exp A	9.6	fl oz/ac	FK2-3	3.80 *ab*	1.70 *a*	6.85 *b*	12.50 *b*	52.47 *a*	41.03 *a*
Exp A	9.6	fl oz/ac	FK 9						
Exp B	12	fl oz/ac	FK2-3	4.15 *ab*	4.55 *a*	10.85 *ab*	16.25 *b*	52.20 *ab*	39.04 *a*
Exp B	12	fl oz/ac	FK 9						
Exp A	7.2	fl oz/ac	FK2-3	0.50 *b*	0.45 *a*	1.10 *b*	3.50 *b*	52.83 *a*	41.68 *a*
Exp A	7.2	fl oz/ac	FK 9						
Exp B	9.6	fl oz/ac	FK2-3						
Exp B	9.6	fl oz/ac	FK 9						
Exp A	9	fl oz/ac	FK2-3	3.05 *ab*	1.15 *a*	2.85 *b*	7.00 *b*	52.89 *a*	41.75 *a*
Exp A	9	fl oz/ac	FK 9						
Exp B	12	fl oz/ac	FK2-3						
Exp B	12	fl oz/ac	FK 9						
Trivapro	13.7	fl oz/ac	FK2-3	1.01 *b*	0.40 *a*	1.75 *b*	5.00 *b*	51.83 *ab*	39.09 *a*
Trivapro	13.7	fl oz/ac	FK 9						
QUILT XCEL	14	fl oz/ac	FK2-3	1.05 *b*	1.65 *a*	2.75 *b*	6.00 *b*	51.21 *ab*	38.04 *a*
QUILT XCEL	14	fl oz/ac	FK 9						

†Exp = Experimental product

‡Means followed by the same letter are not significantly different, p≤0.05

Cultivars: Various

Previous Crop: Corn

Planted: 05/16/2019 (North Felt Farm), 05/30/2019 (Northeast) and 06/04/2018 (Volga, P7)

Table 3.1. Bacterial leaf streak (BLS) Effect on Yield: Evaluation of the effect of BLS on yield in spring wheat at Felt Research Farm.

Cultivar	Inoculated		Yield difference (bu/ac)	P-value	Yield loss %	Whole plot disease severity difference (%)	P-value
Brick	No	Yes	4.14	*0.3256*	11.2	-13.0	*0.0531*
Faller	No	Yes	7.40	*0.0823*	15.6	-6.3	*0.2031*
Forefront	No	Yes	4.22	*0.3167*	10.1	-5.5	*0.3051*
Prevail	No	Yes	4.00	*0.3421*	9.7	-10.0	*0.0937*
SD4011	No	Yes	9.19	*0.0325*	33.5	-14.3	*0.0394*
SD4741	No	Yes	9.57	*0.0262*	25.9	-13.0	*0.0524*
Samson	No	Yes	6.24	*0.1410*	21.6	-18.8	*0.0161*
Select	No	Yes	6.42	*0.1301*	23.3	-29.0	*0.0003*

Table 3.2. Bacterial leaf streak (BLS) Effect on Yield: Evaluation of the effect of BLS on yield in spring wheat at Northeast Research Farm.

Cultivar	Inoculated		Yield difference (bu/ac)	P-value	Yield loss (%)	Whole plot disease severity difference (%)	P-value
Brick	No	Yes	1.60	*0.4974*	4.28	-2.0	*0.3612*
Faller	No	Yes	3.72	*0.1185*	9.40	-2.5	*0.2672*
Forefront	No	Yes	-0.02	*0.9932*	-0.05	-2.5	*0.2453*
Prevail	No	Yes	1.32	*0.5760*	3.17	-2.5	*0.1939*
SD4011	No	Yes	1.31	*0.5774*	3.69	-3.0	*0.1445*
SD4741	No	Yes	1.68	*0.4763*	5.12	-0.5	*0.5336*
Samson	No	Yes	0.52	*0.8250*	1.61	-5.8	*0.0130*
Select	No	Yes	4.48	*0.0618*	13.42	-5.5	*0.0061*

Table 3.3. Bacterial leaf streak (BLS) Effect on Yield: Evaluation of the effect of BLS on yield in spring wheat at Brookings location.

Cultivar	Inoculated		Yield difference (bu/ac)	P-value	Yield loss (%)	Whole plot disease severity difference (%)	P-value
Brick	No	Yes	2.44	*0.3929*	8.62	-5.25	*0.1427*
Faller	No	Yes	0.02	*0.9948*	0.07	-4.50	*0.0598*
Forefront	No	Yes	1.27	*0.6571*	3.88	-4.25	*0.0659*
Prevail	No	Yes	3.76	*0.2568*	11.05	-3.50	*0.1647*
SD4011	No	Yes	1.10	*0.6987*	4.50	-8.00	*0.0224*
SD4741	No	Yes	3.30	*0.2505*	11.44	-3.25	*0.2485*
Samson	No	Yes	1.72	*0.5477*	7.05	-5.50	*0.0657*
Select	No	Yes	1.70	*0.5821*	7.54	-6.25	*0.0464*

Cultivars: Samson

Previous Crop: Corn

Planted: 06/04/2019 (P7)

Table 4.1. Fusarium head blight (FHB) I: Evaluation of commercial and experimental fungicides at different growth stages for managing FHB at Volga Research Farm.

Product†	Rate	Unit	Time‡	Test weight (lb/bu)	Yield (bu/ac)	FHB Incidence (%)	FHB Severity (%)	FHB Index (%)	Fusarium damaged kernels (%)	Bacterial Leaf Streak (%)
Untreated				54.83 b¶	34.61 *a*	57 *a*	24.10 *a*	13.57 *a*	14.3 *a*	21 *a*
Nexicor	3.50	fl oz/ac	FK 4-5	56.11 ab	39.61 *a*	39 *b*	12.75 *b*	5.03 *b*	7.5 *ab*	20 *a*
Caramba	11.50	fl oz/ac	FK 10.5.1							
Priaxor	2.00	fl oz/ac	FK 4-5	56.29 ab	43.51 *a*	41 *ab*	14.24 *b*	5.82 *b*	7.5 *ab*	21 *a*
Caramba	11.50	fl oz/ac	FK 10.5.1							
Exp A	3.50	fl oz/ac	FK 4-5	56.41 ab	46.55 *a*	50 *ab*	15.20 *b*	7.56 *b*	7.5 *ab*	22 *a*
Caramba	11.50	fl oz/ac	FK 10.5.1							
Stratego YLD	2.00	fl oz/ac	FK 4-5	56.20 ab	43.93 *a*	36 *b*	12.31 *b*	4.58 *b*	6.3 *b*	21 *a*
Prosaro	6.50	fl oz/ac	FK 10.5.1							
Quilt Xcel	7.00	fl oz/ac	FK 4-5	56.68 ab	43.83 *a*	41 *ab*	14.18 *b*	5.65 *b*	8.0 *ab*	21 *a*
Miravis Ace	11.50	fl oz/ac	FK 10.5.1							
Trivapro	9.40	fl oz/ac	FK 4-5	57.15 a	45.64 *a*	43 *ab*	17.45 *ab*	7.39 *b*	4.0 *b*	21 *a*
Miravis Ace	11.50	fl oz/ac	FK 10.5.1							

†Exp = Experimental product

‡FK = Feekes growth stage

¶Means followed by the same letter are not significantly different, p≤0.05

Cultivars: Samson

Previous Crop: Corn

Planted: 05/30/2019 (Northeast), 06/04/2019 (Volga, P7)

Table 5.1. Fusarium head blight (FHB) II: Evaluation of commercial and experimental fungicides applied at early flowering (Feekes 10.5.1) for managing FHB at Northeast Research Farm.

Product†	Rate	Unit	Test weight (lb/bu)	Yield (bu/ac)	FHB Incidence (%)	FHB Severity (%)	FHB Index (%)	Fusarium damaged kernels (%)
Untreated			52.08 *a*‡	43.14 *b*	60 *a*	47.33 *a*	28.04 *a*	14.8 *a*
Prosaro	8.2	fl oz/ac	52.64 *a*	49.03 *ab*	46 *ab*	32.89 *ab*	15.03 *bc*	9.0 *b*
Exp A	10.3	fl oz/ac	52.83 *a*	52.46 *ab*	44 *ab*	31.42 *ab*	13.89 *bc*	10.0 *ab*
Prosaro	6.5	fl oz/ac	52.55 *a*	55.94 *a*	49 *ab*	29.81 *b*	14.38 *bc*	8.5 *b*
Prosaro	8.2	fl oz/ac	53.94 *a*	51.59 *ab*	41 *b*	26.25 *b*	10.73 *bc*	6.0 *b*
Exp A	10.3	fl oz/ac	53.83 *a*	52.26 *ab*	44 *ab*	38.57 *ab*	16.33 *b*	9.0 *b*
Exp A	13.7	fl oz/ac	52.65 *a*	49.49 *ab*	42 *b*	39.14 *ab*	15.51 *bc*	9.0 *b*
Caramba 90	13.5	fl oz/ac	53.22 *a*	47.49 *ab*	46 *ab*	23.39 *b*	10.80 *bc*	8.0 *b*
Exp B	0.62	l/ha	52.81 *a*	48.70 *ab*	49 *ab*	33.89 *ab*	16.15 *b*	10.3 *ab*
Exp C	3.622	fl oz/ac						
Exp B	0.75	l/ha	52.77 *a*	52.41 *ab*	46 *ab*	34.12 *ab*	15.67 *bc*	9.0 *b*
Exp C	4.354	fl oz/ac						
Prosaro	4.865	fl oz/ac	51.97 *a*	52.59 *a*	36 *b*	32.96 *ab*	12.19 *bc*	9.0 *b*
Proline 480 SC	2.138	fl oz/ac						
Exp D	2.053	fl oz/ac						
Prosaro	6.5	fl oz/ac	53.31 *a*	47.87 *ab*	37 *b*	24.05 *b*	9.42 *c*	8.5 *b*
Proline 480 SC	2.85	fl oz/ac						
Exp D	2.737	fl oz/ac						

†Exp = Experimental product

‡Means followed by the same letter are not significantly different, p≤0.05

Table 5.2. Fusarium head blight (FHB) II: Evaluation of commercial and experimental fungicides applied at early flowering (Feekes 10.5.1) for managing FHB at Volga Research Farm.

Product†	Rate	Unit	Test Weight (lb/bu)	Yield (bu/ac)	FHB Incidence (%)	FHB Severity (%)	FHB Index (%)	Fusarium damaged kernels (%)
Untreated			50.60 *b*‡	36.1 *b*	53 *a*	27.48 *a*	14.57 *a*	3.75 *a*
Prosaro	8.2	fl oz/ac	51.25 *ab*	45.9 *ab*	44 *ab*	13.93 *ab*	6.12 *ab*	1.50 *a*
Exp A	10.3	fl oz/ac	53.45 *ab*	45.7 *ab*	28 *b*	20.74 *ab*	6.22 *ab*	1.75 *a*
Prosaro	6.5	fl oz/ac	52.96 *ab*	43.3 *ab*	35 *ab*	23.29 *ab*	7.30 *ab*	2.00 *a*
Prosaro	8.2	fl oz/ac	54.60 *a*	46.7 *a*	32 *ab*	13.40 *ab*	4.61 *b*	2.25 *a*
Exp A	10.3	fl oz/ac	54.47 *a*	37.9 *ab*	39 *ab*	17.68 *ab*	6.89 *ab*	1.50 *a*
Exp A	13.7	fl oz/ac	53.40 *ab*	41.8 *ab*	28 *b*	10.54 *b*	2.94 *b*	2.75 *a*
Caramba 90	13.5	fl oz/ac	50.30 *b*	39.8 *ab*	30 *ab*	13.39 *ab*	4.28 *b*	3.50 *a*
Exp B	0.62	l/ha	53.35 *ab*	41.4 *ab*	37 *ab*	14.09 *ab*	5.33 *ab*	2.00 *a*
Exp C	3.622	fl oz/ac						
Exp B	0.75	l/ha	52.99 *ab*	40.2 *ab*	38 *ab*	15.46 *ab*	6.03 *ab*	1.75 *a*
Exp C	4.354	fl oz/ac						
Prosaro	4.865	fl oz/ac	53.47 *ab*	44.1 *ab*	29 *ab*	12.89 *ab*	3.82 *b*	1.25 *a*
Proline 480 SC	2.138	fl oz/ac						
Exp D	2.053	fl oz/ac						
Prosaro	6.5	fl oz/ac	52.88 *ab*	41.3 *ab*	27 *b*	12.87 *ab*	3.18 *b*	2.25 *a*
Proline 480 SC	2.85	fl oz/ac						
Exp D	2.737	fl oz/ac						

†Exp = Experimental product

‡Means followed by the same letter are not significantly different, p≤0.05

Cultivars: Brick and Samson

Previous Crop: Corn

Planted: 05/30/2019 (Northeast) and 06/04/2019 (Volga, P7)

Table 6.1. Fusarium head blight (FHB) III: Evaluation of commercial fungicides applied at different combinations and timings for FHB management at Northeast Research Farm.

Product	Rate	Unit	Time	Test weight (lb/bu)	Yield (bu/ac)	FHB Incidence (%)	FHB Severity (%)	FHB Index (%)	Fusarium damaged kernels (%)
Utreated				52.34 *bc*†	32.34 *c*	63 *a*	38.28 *a*	24.72 *a*	16 *a*
Trivapro	9.4	fl oz/ac	Feekes 5-6	55.26 *ab*	38.09 *abc*	58 *a*	21.84 *b*	12.67 *b*	7 *b*
Miravis ACE	13.7	fl oz/ac	Feekes 10.5.1						
Miravis ACE	13.7	fl oz/ac	Feekes10.5	55.73 *a*	41.05 *a*	55 *a*	20.99 *b*	11.49 *b*	8 *b*
Miravis ACE	13.7	fl oz/ac	Feekes 10.5.1	56.51 *a*	38.81 *ab*	66 *a*	27.21 *ab*	17.92 *ab*	7 *b*
Trivapro	13.7	fl oz/ac	Feekes 9	50.46 *c*	33.41 *bc*	65 *a*	28.85 *ab*	17.71 *ab*	16 *a*

†Means followed by the same letter are not significantly different, p≤0.05

Table 6.2. Fusarium head blight (FHB) III: Evaluation of commercial fungicides applied at different combinations and timings for FHB management at Volga Research Farm.

Product	Rate	Unit	Time	Test Weight (lb/bu)	Yield (bu/ac)	FHB Incidence (%)	FHB Severity (%)	FHB Index (%)	Fusarium damaged kernels (%)
untreated				52.56 *bc*†	34.93 *b*	30 *ab*	34.02 *a*	10.11 *ab*	12.50 *a*
Trivapro	9.4	fl oz/ac	Feekes 5-6	54.53 *ab*	43.81 *a*	18 *b*	9.56 *c*	1.67 *c*	8.50 *a*
Miravis ACE	13.7	fl oz/ac	Feekes 10.5.1						
Miravis ACE	13.7	fl oz/ac	Feekes 10.5	51.66 *c*	35.14 *b*	42 *a*	29.45 *a*	12.41 *a*	12.50 *a*
Miravis ACE	13.7	fl oz/ac	Feekes 10.5.1	55.37 *a*	38.33 *b*	26 *b*	14.33 *bc*	3.82 *bc*	8.50 *a*
Trivapro	13.7	fl oz/ac	Feekes 9	52.56 *bc*	34.73 *b*	30 *ab*	22.07 *ab*	6.78 *bc*	13.75 *a*

†Means followed by the same letter are not significantly different, p≤0.05

Cultivars: Brick, Prevail and Samson

Previous Crop: Corn

Planted: 05/30/2019 (Northeast) and 06/04/2019 (Volga, P7)

Table 7.1. Integrated Fusarium head blight (FHB) Management: Efficacy of Miravis at early heading (Feekes 10.3) and early flowering (Feekes 10.5.1) in comparison to Prosaro at early flowering for FHB management at Northeast Research farm.

Cultivar	Treatment	Rate	Unit	Time†	Test weight (lb/bu)	Yield (bu/ac)	FHB Incidence (%)	FHB Severity (%)	FHB Index (%)	Fusarium Damaged Kernels (%)
Brick	Untreated, inoculated				53.77 *bcde*‡	35.56 *ghi*	46 *abc*	37.77 *abcde*	17.35 *cdef*	6.0 *c*
Brick	Prosaro	6.5	fl oz/ac	FK10.5.1	55.94 *ab*	41.73 *cdefg*	7 *h*	7.00 *h*	0.63 *i*	1.3 *d*
Brick	Miravis Ace	13.7	fl oz/ac	FK10.5.1	56.81 *a*	43.20 *bcdef*	18 *gh*	16.70 *fgh*	3.20 *hi*	2.3 *cd*
Brick	Miravis Ace	13.7	fl oz/ac	FK10.3	54.25 *bcde*	37.71 *efghi*	28 *efg*	34.69 *bcde*	11.66 *efgh*	6.5 *c*
Brick	Prosaro, noninoculated	6.5	fl oz/ac	FK10.5.1	55.56 *abc*	39.33 *efg*	21 *gh*	19.18 *fgh*	8.22 *fghi*	1.3 *d*
Brick	Untreated, noninoculated				53.96 *bcde*	36.23 *fghi*	46 *abc*	35.83 *bcde*	17.07 *cdef*	6.5 *c*
Prevail	Untreated, inoculated				52.85 *e*	43.07 *bcdef*	44 *bcde*	37.02 *bcde*	16.39 *cdef*	6.5 *c*
Prevail	Prosaro	6.5	fl oz/ac	FK10.5.1	52.98 *de*	48.53 *abc*	30 *defg*	29.79 *cdef*	8.35 *fghi*	4.3 *cd*
Prevail	Miravis Ace	13.7	fl oz/ac	FK10.5.1	55.29 *abcd*	49.83 *ab*	26 *fg*	15.42 *gh*	4.12 *ghi*	3.3 *cd*
Prevail	Miravis Ace	13.7	fl oz/ac	FK10.3	52.73 *e*	44.27 *abcde*	53 *abc*	40.85 *abcd*	22.48 *abcd*	5.5 *cd*
Prevail	Prosaro, noninoculated	6.5	fl oz/ac	FK10.5.1	53.58 *cde*	50.56 *a*	39 *cdef*	27.13 *defg*	10.37 *efgh*	4.0 *cd*
Prevail	Untreated, noninoculated				52.60 *e*	47.82 *abcd*	45 *bcd*	44.83 *ab*	19.60 *bcde*	5.5 *cd*
Samson	Untreated, inoculated				49.85 *f*	30.79 *i*	57 *ab*	51.32 *a*	29.19 *a*	15.0 *b*
Samson	Prosaro	6.5	fl oz/ac	FK10.5.1	53.42 *cde*	36.74 *fghi*	51 *abc*	35.51 *bcde*	18.94 *bcde*	6.0 *c*
Samson	Miravis Ace	13.7	fl oz/ac	FK10.5.1	54.62 *abcde*	41.02 *defg*	49 *abc*	24.99 *efg*	11.63 *efgh*	5.5 *cd*
Samson	Miravis Ace	13.7	fl oz/ac	FK10.3	50.24 *f*	34.76 *ghi*	62 *a*	45.08 *ab*	28.07 *ab*	12.3 *b*
Samson	Prosaro, noninoculated	6.5	fl oz/ac	FK10.5.1	53.00 *de*	38.14 *efgh*	51 *abc*	26.11 *efg*	13.24 *defg*	6.0 *c*
Samson	Untreated, noninoculated				48.86 *f*	31.88 *hi*	62 *a*	41.28 *abc*	25.23 *ab*	20.0 *a*

†FK = Feekes growth stages: FK10.3 (early heading); FK10.5.1 (early flowering)
‡Means followed by the same letter are not significantly different, p≤0.05

Table 7.2. Integrated Fusarium head blight (FHB) Management: Efficacy of Miravis at early heading (Feekes 10.3) and early flowering (Feekes 10.5.1) in comparison to Prosaro at early flowering for FHB management at Volga Research Farm

Cultivar	Treatment	Rate	Unit	Time†	Test Weight (lb/bu)	Yield (bu/ac)	FHB Incidence (%)	FHB Severity (%)	FHB Index (%)	Fusarium Damaged Kerneled (%)
Brick	Untreated. inoculated				50.30 *b*‡	44.59 *abc*	32 *b*	35.34 *abc*	10.44 *cd*	4.0 *cdef*
Brick	Prosaro	6.5	fl oz/ac	FK10.5.1	53.87 *b*	46.28 *abc*	9 *e*	14.54 *efgh*	1.46 *gh*	2.0 *ef*
Brick	Miravis Ace	13.7	fl oz/ac	FK10.5.1	54.27 *ab*	44.93 *abc*	9 *e*	16.52 *defgh*	2.08 *gh*	2.8 *def*
Brick	Miravis Ace	13.7	fl oz/ac	FK10.3	52.53 *b*	43.65 *abc*	31 *b*	28.61 *bcdef*	9.19 *de*	4.5 *cde*
Brick	Prosaro, noninoculated	6.5	fl oz/ac	FK10.5.1	55.65 *ab*	45.61 *abc*	8 *e*	21.05 *cdefgh*	1.41 *gh*	1.3 *f*
Brick	Untreated, noninoculated				54.38 *ab*	43.60 *abc*	24 *bc*	30.18 *bcde*	7.94 *def*	4.0 *cdef*
Prevail	Untreated. inoculated				50.01 *b*	42.13 *b*	19 *cd*	20.56 *cdefgh*	3.99 *efgh*	2.8 *def*
Prevail	Prosaro	6.5	fl oz/ac	FK10.5.1	52.03 *b*	46.96 *abc*	7 *e*	9.67 *h*	0.78 *gh*	1.5 *f*
Prevail	Miravis Ace	13.7	fl oz/ac	FK10.5.1	54.12 *ab*	49.89 *a*	9 *e*	13.33 *fgh*	1.00 *gh*	1.5 *f*
Prevail	Miravis Ace	13.7	fl oz/ac	FK10.3	61.42 *a*	43.01 *abc*	14 *de*	19.97 *cdefgh*	2.62 *fgh*	3.0 *def*
Prevail	Prosaro, noninoculated	6.5	fl oz/ac	FK10.5.1	54.32 *ab*	46.23 *abc*	4 *e*	11.42 *gh*	0.48 *h*	3.3 *def*
Prevail	Untreated, noninoculated				53.15 *b*	42.37 *b*	9 *e*	26.89 *bcdefg*	2.37 *gh*	3.0 *def*
Samson	Untreated. inoculated				51.11 *b*	41.21 *c*	52 *a*	39.86 *ab*	20.19 *ab*	15.8 *a*
Samson	Prosaro	6.5	fl oz/ac	FK10.5.1	51.82 *b*	48.62 *ab*	25 *bc*	15.82 *efgh*	3.89 *efgh*	5.0 *bcd*
Samson	Miravis Ace	13.7	fl oz/ac	FK10.5.1	55.17 *ab*	48.98 *ab*	23 *bcd*	17.37 *defgh*	5.16 *defgh*	3.5 *def*
Samson	Miravis Ace	13.7	fl oz/ac	FK10.3	50.62 *b*	46.92 *abc*	47 *a*	32.95 *abcd*	15.63 *bc*	6.5 *bc*
Samson	Prosaro, noninoculated	6.5	fl oz/ac	FK10.5.1	53.07 *b*	48.29 *abc*	25 *bc*	24.18 *bcdefgh*	6.29 *defg*	4.5 *cde*
Samson	Untreated, noninoculated				51.67 *b*	43.59 *abc*	48 *a*	47.87 *a*	23.28 *a*	7.5 *b*

†FK = Feekes growth stages: FK10.3 (early heading); FK10.5.1 (early flowering)

‡Means followed by the same letter are not significantly different, $p \leq 0.05$

Cultivars: Brick and Samson

Previous Crop: Corn

Planted: 05/30/2019 (Northeast) and 06/04/2019 (Volga, P7)

Table 8.1. Uniform Fungicide: Efficacy of Miravis Ace applied at early heading (Feekes 10.3), early flowering (Feekes 10.5.1) compared with Caramba, and Prosaro applied at early flowering and in sequential combinations following Miravis Ace application to manage FHB at Northeast, SD.

Cultivar	Treatment	Rate	Unit	Time†	Test weight (lb/bu)	Yield (bu/ac)	FHB Incidence (%)	FHB Severity (%)	FHB Index (%)	Fusarium damaged kernels (%)
Brick	Untreated				51.54 *cde*‡	40.80 *f*	80 *ab*	41.08 *b*	33.68 *b*	9.3 *b*
Brick	Prosaro	6.5	fl oz/a	FK10.5.1	57.92 *a*	43.43 *def*	41 *f*	19.27 *de*	8.92 *ef*	3.3 *cde*
Brick	Caramba	13.5	fl oz/a	FK10.5.1	54.39 *abcd*	47.31 *abcd*	51 *def*	22.27 *de*	11.51 *def*	3.8 *cde*
Brick	Miravis Ace	13.7	fl oz/a	FK10.3	54.64 *abcd*	49.08 *ab*	76 *abc*	26.81 *cd*	21.61 *cd*	4.5 *cde*
Brick	Miravis Ace	13.7	fl oz/a	FK10.5.1	57.25 *ab*	48.09 *abc*	66 *bcd*	21.16 *de*	14.10 *def*	2.8 *de*
Brick	Miravis Ace	13.7	fl oz/a	FK10.5.1	57.49 *ab*	51.18 *a*	44 *ef*	12.24 *e*	5.85 *f*	1.5 *e*
Brick	Prosaro	6.5	fl oz/a	4-6D:FK10.5.1						
Brick	Miravis Ace	13.7	fl oz/a	FK10.5.1	56.42 *ab*	49.14 *ab*	59 *cdef*	21.13 *de*	12.49 *def*	2.3 *e*
Brick	Caramba	13.5	fl oz/a	4-6D:FK10.5.1						
Samson	Untreated				49.38 *e*	34.81 *g*	91 *a*	66.52 *a*	60.23 *a*	18.8 *a*
Samson	Prosaro	6.5	fl oz/a	FK10.5.1	50.80 *de*	43.86 *cdef*	78 *abc*	43.77 *b*	34.12 *b*	10.3 *b*
Samson	Caramba	13.5	fl oz/a	FK10.5.1	53.46 *bcde*	42.57 *ef*	62 *bcde*	26.97 *cd*	17.74 *de*	6.5 *bcd*
Samson	Miravis Ace	13.7	fl oz/a	FK10.3	55.95 *ab*	42.10 *ef*	80 *ab*	38.59 *bc*	30.92 *bc*	6.5 *bcd*
Samson	Miravis Ace	13.7	fl oz/a	FK10.5.1	55.64 *abc*	39.99 *f*	78 *abc*	50.39 *b*	39.43 *b*	7.0 *bc*
Samson	Miravis Ace	13.7	fl oz/a	FK10.5.1	55.44 *abc*	45.17 *bcde*	64 *bcd*	26.42 *d*	17.40 *def*	2.8 *de*
Samson	Prosaro	6.5	fl oz/a	4-6D:FK10.5.1						
Samson	Miravis Ace	13.7	fl oz/a	FK10.5.1	56.40 *ab*	43.62 *def*	69 *bcd*	24.73 *d*	17.07 *def*	3.5 *cde*
Samson	Caramba	13.5	fl oz/a	4-6D:FK10.5.1						

†FK = Feekes growth stages: FK10.3 (early heading); FK10.5.1 (early flowering); 4-6D: FK10.5.1 (4 to 6 days after early flowering).

‡Means followed by the same letter are not significantly different, p≤0.05

Table 8.2. Uniform Fungicide: Efficacy of Miravis Ace applied at early heading (Feekes 10.3), early flowering (Feekes 10.5.1) compared with Caramba, and Prosaro applied at early flowering and in sequential combinations following Miravis Ace application to manage FHB at Volga Research Farm.

Cultivar	Trt	Rate	Unit	Time†	Test Weight (lb/bu)		Yield (bu/ac)		FHB Incidence (%)		FHB Severity (%)		FHB Index (%)		Fusarium damaged kernels (%)	
Brick	Untreated				55.13	*abcd*‡	47.54	*ab*	42	*a*	14.17	*bcd*	6.32	*b*	3.3	*cde*
Brick	Prosaro	6.5	fl oz/a	FK10.5.1	53.42	*bcd*	48.28	*ab*	19	*de*	12.04	*cd*	2.45	*def*	3.5	*cde*
Brick	Caramba	13.5	fl oz/a	FK10.5.1	55.95	*abc*	48.34	*ab*	19	*de*	11.81	*cd*	2.14	*ef*	1.5	*de*
Brick	Miravis Ace	13.7	fl oz/a	FK10.3	52.56	*cd*	46.44	*ab*	28	*bcd*	20.29	*ab*	5.76	*bc*	4.0	*bcde*
Brick	Miravis Ace	13.7	fl oz/a	FK10.5.1	57.15	*ab*	48.87	*ab*	25	*bcd*	10.43	*cd*	2.51	*def*	2.0	*cde*
Brick	Miravis Ace	13.7	fl oz/a	FK10.5.1	57.99	*a*	49.23	*ab*	12	*e*	12.36	*cd*	1.61	*f*	1.0	*e*
Brick	Prosaro	6.5	fl oz/a	4-6D:FK10.5.1												
Brick	Miravis Ace	13.7	fl oz/a	FK10.5.1	55.47	*abcd*	45.91	*ab*	24	*bcde*	11.24	*cd*	2.94	*cdef*	1.5	*de*
Brick	Caramba	13.5	fl oz/a	4-6D:FK10.5.1												
Samson	Untreated				51.63	*d*	44.73	*b*	44	*a*	21.85	*a*	9.80	*a*	9.0	*a*
Samson	Prosaro	6.5	fl oz/a	FK10.5.1	53.69	*bcd*	50.44	*ab*	27	*bcd*	15.65	*abcd*	4.58	*bcdef*	5.0	*bc*
Samson	Caramba	13.5	fl oz/a	FK10.5.1	53.12	*cd*	48.52	*ab*	34	*ab*	14.87	*bcd*	5.09	*bcde*	5.0	*bc*
Samson	Miravis Ace	13.7	fl oz/a	FK10.3	52.51	*cd*	46.87	*ab*	33	*abc*	16.13	*abc*	5.39	*bcd*	7.0	*ab*
Samson	Miravis Ace	13.7	fl oz/a	FK10.5.1	53.57	*bcd*	49.54	*ab*	24	*bcde*	12.49	*cd*	3.27	*bcdef*	4.5	*bcd*
Samson	Miravis Ace	13.7	fl oz/a	FK10.5.1	55.14	*abcd*	52.30	*a*	17	*de*	9.41	*d*	1.58	*f*	3.5	*cde*
Samson	Prosaro	6.5	fl oz/a	4-6D:FK10.5.1												
Samson	Miravis Ace	13.7	fl oz/a	FK10.5.1	54.52	*abcd*	49.91	*ab*	22	*cde*	14.23	*bcd*	3.12	*cdef*	4.5	*bcd*
Samson	Caramba	13.5	fl oz/a	4-6D:FK10.5.1												

†FK = Feekes growth stages: FK10.3 (early heading); FK10.5.1 (early flowering); 4-6D: FK10.5.1 (4 to 6 days after early flowering).

‡Means followed by the same letter are not significantly different, $p \leq 0.05$

Cultivars: Boost

Previous Crop: Corn

Planted: 05/30/2019 (Northeast) and 06/04/2019 (Volga, P7)

Table 9.1. Seed Treatment I: Efficacy of various seed treatment fungicides for *Fusarium spp*. management at Northeast Research Farm.

Trt	Product	Rate	Unit	Test Weight (lb/bu)		Yield (bu/ac)		Stand count (plants/ac)	
1	Untreated non-inoculate			56.35	*a*†	45.51	*a*	911167	*abc*
	Gaucho 600 fs	0.767	oz/cwt						
2	Untreated inoculated			56.46	*a*	48.12	*a*	935000	*abc*
	Gaucho 600 FS	0.767	oz/cwt						
3	Evergol Energy	1.000	oz/cwt	55.33	*a*	49.65	*a*	958834	*ab*
	Gaucho 600 fs	0.767	oz/cwt						
4	Raxil Pro Shield	5.000	oz/cwt	55.66	*a*	48.20	*a*	749833	*c*
5	Raxil Pro MD	5.000	oz/cwt	55.71	*a*	48.60	*a*	773667	*bc*
	Gaucho 600 fs	0.767	oz/cwt						
6	Dividend Extreme	2.000	oz/cwt	56.13	*a*	46.51	*a*	925834	*abc*
	Cruiser 5fs	0.1892	oz/cwt						
7	Rancona Pinnacle	5.000	oz/cwt	56.35	*a*	42.93	*a*	936833	*abc*
	Nipsit inside	0.300	oz/cwt						
8	Dividend Extreme	3.000	oz/cwt	56.34	*a*	47.27	*a*	1010167	*a*
	Vibrance 500fs	0.080	oz/cwt						
	Cruiser 5fs	0.665	oz/cwt						
	Rancona	0.050	oz/cwt						
9	Cruiser Maxx V Cereals	5.000	oz/cwt	56.09	*a*	47.37	*a*	1001000	*a*

†Means followed by the same letter are not significantly different, $p \leq 0.05$

Cultivars: Boost

Previous Crop: Corn

Planted: 05/30/2018 (Northeast) and 06/04/2019 (Volga, P7)

Table 10.1. Seed Treatment II: Efficacy of various seed treatment fungicides for soil borne seedling disease management at Northeast Research Farm.

Trt	Product	Rate	Unit	Test Weight (lb/bu)		Yield (bu/ac)		Stand counts (Plants/ac)	
1	Untreated Non-Inoculate			55.65	a	40.91	a	950500	a
	Gaucho 600 FS	0.767	oz/cwt						
2	Untreated Inoculated			55.10	a	46.88	a	962500	a
	Gaucho 600 FS								
3	Evergol Energy	1	oz/cwt	56.29	a	44.14	a	949167	a
	Gaucho 600 FS	0.767	oz/cwt						
4	Raxil Pro Md	8	g A/100 Kg	56.15	a	45.53	a	997334	a
	Gaucho 600 FS	0.767	oz/cwt						
5	Raxil Pro Md	4.984	oz/cwt	56.53	a	44.18	a	1229000	a
	Evergol Prime	0.1598	oz/cwt						
	Gaucho 600 FS	0.767	oz/cwt						
6	Raxil Pro Md	4.984	oz/cwt	56.23	a	43.44	a	885500	a
	Evergol Prime	0.3195	oz/cwt						
	Gaucho 600 FS	0.767	oz/cwt						
7	Dividend Extreme	3	oz/cwt	55.32	a	44.70	a	1021833	a
	Vibrance 500FS	0.08	oz/cwt						
	Cruiser 5fs	0.66	oz/cwt						
	Rancona	0.05045	oz/Cwt						
8	Cruiser Maxx V Cereals	5	oz/cwt	56.97	a	42.70	a	1021834	a
9	Gaucho 600 FS	0.767	oz/cwt	55.29	a	45.42	a	955667	a

Means followed by the same letter are not significantly different, $p \leq 0.05$

Table 10.2. Seed Treatment II: Efficacy of various seed treatment fungicides for soil borne seedling disease management at Volga Research Farm.

Trt	Product	Rate	Unit	Test weight (lb/bu)		Yield (bu/ac)		Stand count (Plants/ac)	
1	Untreated Non-Inoculate			53.19	*a*	39.65	*a*	854167	*a*
	Gaucho 600 Fs	0.767	oz/cwt						
2	Untreated Inoculated			53.63	*a*	42.33	*a*	892667	*a*
	Gaucho 600 Fs								
3	Evergol Energy	1	oz/cwt	55.21	*a*	35.26	*a*	801583	*a*
	Gaucho 600 Fs	0.767	oz/cwt						
4	Raxil Pro Md	8	g A/100 kg	54.92	*a*	39.93	*a*	851556	*a*
	Gaucho 600 Fs	0.767	oz/cwt						
5	Raxil Pro Md	4.984	oz/cwt	55.19	*a*	39.98	*a*	898467	*a*
	Evergol Prime	0.1598	oz/cwt						
	Gaucho 600 Fs	0.767	oz/cwt						
6	Raxil Pro Md	4.984	oz/cwt	55.26	*a*	36.95	*a*	817417	*a*
	Evergol Prime	0.3195	oz/cwt						
	Gaucho 600 Fs	0.767	oz/cwt						
7	Dividend Extreme	3	oz/cwt	55.00	*a*	41.51	*a*	902334	*a*
	Vibrance 500fs	0.08	oz/cwt						
	Cruiser 5fs	0.66	oz/cwt						
	Rancona	0.05045	oz/cwt						
8	Cruiser Maxx V Cereals	5	oz/cwt	53.36	*a*	39.38	*a*	856667	*a*
9	Gaucho 600 Fs	0.767	oz/cwt						
				54.16	*a*	42.63	*a*	901500	*a*

Means followed by the same letter are not significantly different, $p \leq 0.05$