Report: 2013 Uniform FHB Integrated Management Trials

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OBJECTIVE. Evaluate the integrated effects of fungicide and genetic resistance on FHB and DON in small grain crops.

INTRODUCTION. A recent summary of data from over 40 wheat trials showed that using fungicide or moderate resistance alone only provided approximately 53 and 54% control of FHB index, respectively, and 39 and 51% control of DON, respectively (Willyerd et al 2012). However, combining the two strategies (in hexaploid wheat) resulted in 76% control of index and 71% control of DON. The combination of a well-timed application of Prosaro® and moderate resistance had an additive effect on both index and DON, and was stable in terms of efficacy across environments and cropping systems. However, there was some evidence from that analysis suggesting that the efficacy of fungicide plus moderate resistance, in terms of the magnitude of index reduction, was somewhat dependent on the environment (in the generic sense, representing weather conditions, cropping systems, wheat classes, and baseline disease and toxin levels, among other factors). Therefore, further research is needed to gather data from a wider range of environments to formally quantify the effects of location-specific factors on percent control of index and DON in an integrated management program. Moreover, research is also needed for large-scale evaluation of new FHB resistant commercial cultivars in combination with an anthesis fungicide treatment for FHB and DON management.

MATERIALS AND METHODS. Trials were established in fields following a host or non-host crop of *F. graminearum*. At least three commercial small grain cultivars, classified as susceptible (S), moderately susceptible (MS) or moderately resistant (MR), were planted in three to six replicate blocks in each trial. The standard experimental design was a randomized complete block, with a split-split-plot arrangement of cultivar (whole-plot), inoculation (sub-plot) and fungicide treatment (sub-sub-plot; UT, untreated and TR, treated). Some trials used fungicide as whole-plot and cultivar as sub-sub-plot, while others used a factorial arrangement of fungicide and cultivar. Prosaro was applied at 50% anthesis at a rate of 6.5 fl.oz/A + NIS, and between 10 and 20 gpa. Trials established in fields with host crop residue were not artificially inoculated. For trials with artificial inoculations, either *F. graminearum*-colonized corn kernels were spread on the soil surface of plots prior to anthesis or plots were spray-inoculated with a spore suspension of the fungus approximately 24-36

hours following fungicide treatments. FHB index (plot severity) was assessed during the dough stages of grain development. Milled grain samples were sent to a USWBSI-supported laboratory for toxin analysis. Proc GLIMMIX of SAS was used to evaluate the effects of fungicide, cultivar, (and inoculation, when appropriate) and their interactions on index and DON (assuming a significance level $\alpha = 0.05$).

There were six resistance x fungicide management combinations:

1- Susceptible, untreated check (S_UT);
2- Susceptible, treated (S_TR);
3- Moderately susceptible, untreated (MS_UT);
4- Moderately susceptible, treated (MS_TR);
5- Moderately resistant, untreated (MR_UT); and
6- Moderately resistant, treated (MR_TR).

Percent control ($[\bar{X}_{S\_UT} - \bar{X}_{MGNT\ COMBO}]/\bar{X}_{S\_UT}$)•100) was calculated as a measure of the efficacy of each management combination (S_TR, MS_UT, MS_TR, MR_UT and MR_TR) against IND and DON, relative to the susceptible, untreated check (S_UT). For trials without cultivars designated as susceptible (S), the moderately susceptible, untreated check (MS_UT) was used as the reference for efficacy assessment.

RESULTS. Data were collected from 22 experiments, 4 each from MD and ND, 3 from IL, 2 each from SD, NY and MO, one each from AR, OH, IN, NE and WI. Fifteen of the experiments were conducted with SRWW, 4 with HRWW and 3 with HRSW. The highest levels of disease were observed in IL, MO and IN (Table 1). Trials with less that 5% index and less than 1 ppm DON in the untreated, susceptible check were omitted from data analysis. Percent index and DON control varied among trials and management combinations within each experiment (Table 1). Averaged across experiments and grain classes, mean percent control of index was 75% for MR_TR, 55% for MR_UT, 54% for MS_TR, 31% for MS_UT and 38% for S_TR. For DON, the corresponding percentages were 71, 60, 53, 37, and 24%, for MR_TR, MR_UT, MS_TR, MS_UT and S_TR, respectively (Figure 1).

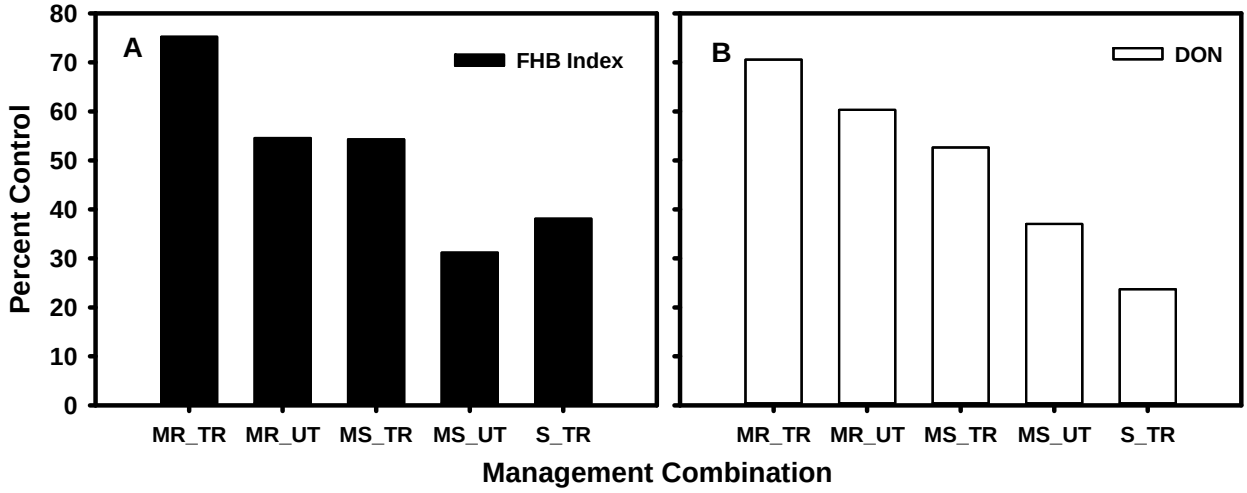

Fig. 1. Mean percent control of Fusarium head blight index (**A**) and deoxynivalenol (**B**, DON) for different fungicide x resistance management combinations, relative to the untreated susceptible check.

Table 1. Mean FHB index and DON and percent control for each management combination, relative to the untreated, susceptible check (S_UT) from trials with > 5% index and >1 ppm DON in S_UT

TRIAL	Resistance x Treatment Combination[a]						Percent Control Relative to S_UT				
	MR_TR	MR_UT	MS_TR	MS_UT	S_TR	S_UT	MR_TR	MR_UT	MS_TR	MS_UT	S_TR
Fusarium head blight index											
IL_MON	15.13	24.38	35.00	34.25	44.63	46.88	68	48	25	27	5
IL_URB	19.25	34.69	28.31	49.63	31.75	47.69	60	27	41	-4	33
IN_13	5.29	4.44	.	.	8.74	9.05	42	51	.	.	3
MD_13C2	0.13	2.77	0.87	4.58	0.83	5.53	98	50	84	17	85
MO_13C	3.08	5.46	10.98	12.03	24.33	18.12	83	70	39	34	-34
MO_13S	0.91	1.66	2.75	4.88	10.35	18.83	95	91	85	74	45
NE_13	0.00	2.50	9.76	47.42	.	.	100	95	79	.	.
NY_13C	0.19	1.24	1.28	7.82	.	.	98	84	84	.	.
NY_13S	0.08	0.28	0.23	0.61	.	.	86	53	62	.	.
OH_13	2.90	4.51	.	.	6.23	10.40	72	57	.	.	40
SD_13W	3.33	4.20	3.05	4.15	2.51	4.32	23	3	29	4	42
Deoxynivalenol (DON)											
IL_MON	3.13	4.84	7.71	8.26	16.70	17.46	82	72	56	53	4
IL_URB	1.55	2.90	2.69	4.13	5.58	8.16	81	64	67	49	32
IN_13	1.12	1.35	.	.	2.10	2.77	60	51	.	.	24
MO_13C	3.85	5.48	8.02	12.00	12.03	17.78	78	69	55	33	32
MO_13S	0.49	1.01	1.17	2.22	2.67	4.48	89	78	74	51	41
NE_13	0.44	0.85	1.20	2.14	.	.	80	60	44	.	.
NY_13C	7.32	14.18	9.10	18.83	.	.	61	25	52	.	.
NY_13S	0.66	1.08	2.29	2.91	.	.	77	63	21	.	.
OH_13	3.73	5.48	.	.	4.65	5.12	27	-7	.	.	9

[a]Resistance x treatment combinations included: susceptible, untreated check (S_UT); susceptible, treated (S_TR); moderately susceptible, untreated (MS_UT); moderately susceptible, treated (MS_TR); moderately resistant, untreated (MR_UT); moderately resistant, treated (MR_TR).