

Project Title: Effect of Plant Growth Regulators (PGRs) and Fungicides on the Performance of Winter Wheat Varieties.

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Objective: To evaluate the effects of PGRs and fungicides on the agronomic performance of winter wheat varieties.

Lodging and stripe rust are recurring problems in winter wheat. This study was designed to determine which production issue has the most negative effect on winter wheat performance. The study consisted of seven winter wheat varieties which varied in height and susceptibility to stripe rust. The varieties included Bynum, Curlew, Decade, Jagalene, Promontory, Whetstone, and Yellowstone. These varieties were then either treated with the fungicide Quilt, the PGR Palisade, or the combination of Quilt plus Palisade. A non-treated control was also included for each variety. The treatments were applied on May 25 when the crop was in the mid-boot stage and plant height varied from 18 to 26 inches.

Plant height averaged 40 inches and ranged from 37 inches for Decade to over 43 inches for Bynum (Table 3). Not surprisingly, there was a relationship between height and lodging, with the tallest varieties expressing the greatest degree of lodging. Palisade applied alone, or in combination with Quilt, reduced plant height on average by 2.5 inches and reduced lodging an average of 14 percent. However, Palisade applied alone did not improve yields compared to the non-treated check (Table 2). In short, lodging did not adversely impact yields.

Wheat varieties varied in susceptibility to stripe rust. Decade demonstrated the greatest susceptibility, and averaged 96% infection on July 15, while Whetstone demonstrated the highest degree of resistance, with an average infection level of 35.4 percent (Table 3). Quilt applied alone, or with palisade, reduced the severity of stripe rust at the July 15 rating by an average of more than 20 percent. However, fungicide effects were no longer detectable at the July 23 rating. There was a strong relationship between stripe rust infection and yield. Accordingly, quilt treatments improved yields an average of 14 bu/A (Table 2). The impact of quilt on yield did vary by cultivar, with Bynum, Decade, Jagalene and Whetstone realizing the greatest benefit (Table 4). Overall, stripe rust had the greatest negative effect on yield. Consequently, fungicide applications had the greatest impact on yield and grain quality.

Table 1. Materials and Methods - Winter wheat inputs (mwbc) - 2013

Seeding Date:	9/25/12	Fertilizer:	10-35-90-8.5-0.85/ TD 60-0-0
Julian Date:	269	Herbicide:	4/26/13 @ 3-4 tiller
Seeding Rate:	80 lb/A		Rimfire 3 OZ/A, Affinity
Previous Crop:	Peas		TankMix 0.6 FL OZ/A, NIS 0.25%
Tillage:	Conventional		
Irrigation:	None	Harvest Date:	8/8/13
Soil Type:	Creston Sil	Julian Date:	220
Soil Test:	264-6-166		

Table 2. Main effect of fungicide and PGR inputs on agronomic performance of winter wheat. Kalispell, 2013.

Input	Stripe rust		HD Julian	HT in	LOD %	YLD bu/A	PRO %	TWT lb/bu	TKW g	FN sec	MC %
	15-Jul %	23-Jul %									
Check	42.6	71.3	159	41.1	15.0	109.1	12.7	58.3	32.4	321.4	13.2
Palisade	37.7	72.7	160	38.5	3.2	112.7	12.7	59.4	33.2	315.3	13.5
Quilt	20.2	59.0	160	41.4	18.5	123.7	12.7	60.3	35.1	322.0	14.0
Palisade & Quilt	15.9	66.0	160	39.1	3.5	123.2	12.8	60.9	35.7	315.9	13.9
LSD	5.2	12.2	0.8	1.0	7.6	10.7	NS	0.9	1.5	NS	0.5
Pr>F	0.0001	0.1104	0.0327	0.0009	0.0052	0.0345	0.5515	0.0021	0.0049	0.4580	0.0206

HD: heading, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, MC: moisture. NS: nonsignificant.

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Table 3. Main effect of cultivars on agronomic performance of winter wheat. Kalispell, 2013.

Cultivar	Stripe rust		HD Julian	HT in	LOD %	YLD	PRO %	TWT lb/bu	TKW g	FN sec	MC %
	15-Jul %	23-Jul %									
Bynum	42.5	94.5	159	43.3	33.0	101.5	13.6	60.2	33.7	376.0	12.7
Curlew	11.8	47.5	160	43.0	27.3	125.3	12.9	60.8	32.9	310.7	14.4
Decade	71.2	96.1	160	37.0	0.2	72.9	13.0	51.9	25.1	373.2	11.9
Jagalene	27.8	74.6	158	38.6	0.3	121.4	12.4	60.9	37.3	352.7	12.6
Promontory	10.5	82.1	160	39.7	1.9	135.2	11.7	62.6	38.1	147.0	14.4
Whetstone	14.3	35.4	157	37.7	1.7	128.7	13.2	60.7	34.5	367.8	12.7
Yellowstone	25.6	40.4	162	41.0	6.1	135.1	12.3	60.8	37.0	303.3	17.0
LSD	8.5	12.6	0.8	0.9	11.1	5.8	0.2	1.0	1.1	11.2	0.4
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

HD: heading, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, MC: moisture. NS: nonsignificant.

Table 4. Effect of fungicide and PGR inputs on winter wheat agronomic performance. Kalispell, 2013

Cultivar	Stripe rust		HD Julian	HT in	LOD %	YLD bu/A
	7/15 %	7/23 %				
Check						
Bynum	66.0	97.0	157	45.0	55.7	93.0
Curlew	13.3	45.0	160	44.4	38.7	120.7
Decade	98.0	97.0	159	37.8	0.0	57.8
Jagalene	51.7	80.0	158	38.9	0.0	110.2
Promontory	16.0	83.3	159	40.4	3.3	132.7
Whetstone	23.0	38.3	155	38.9	2.3	117.3
Yellowstone	30.0	58.3	161	42.6	5.0	131.9
Palisade						
Bynum	58.3	97.7	159	40.0	1.0	98.3
Curlew	16.0	55.0	160	41.9	18.7	126.3
Decade	99.0	97.7	161	36.1	0.0	55.7
Jagalene	38.3	76.7	158	38.1	0.0	117.1
Promontory	9.7	96.7	161	38.6	0.0	130.7
Whetstone	18.0	36.7	157	36.2	1.3	127.1
Yellowstone	24.7	48.3	163	38.7	1.3	133.6
Quilt						
Bynum	25.3	90.0	159	47.1	66.0	106.3
Curlew	10.7	28.3	160	43.6	38.7	122.9
Decade	50.0	96.3	160	38.2	0.7	91.3
Jagalene	11.7	66.7	159	39.7	1.0	129.4
Promontory	8.7	68.3	160	40.4	4.3	138.2
Whetstone	9.0	36.7	157	38.5	1.7	136.9
Yellowstone	26.3	26.7	162	42.1	17.0	140.7
Palisade & Quilt						
Bynum	20.3	93.3	160	40.9	9.3	108.2
Curlew	7.3	61.7	161	42.1	13.0	131.4
Decade	37.7	93.3	161	35.9	0.0	86.8
Jagalene	9.7	75.0	158	37.9	0.0	129.1
Promontory	7.7	80.0	160	39.3	0.0	139.0
Whetstone	7.3	30.0	158	37.3	1.3	133.4
Yellowstone	21.3	28.3	162	40.5	1.0	134.2
Grand Mean	29.1	67.2	159	40.0	10.1	117.2
CV	35.50	22.73	0.59	2.77	133.77	6.05
LSD	17.05	NS	NS	1.83	22.18	11.69
Pr>F	0.0001	0.6791	0.4397	0.0101	0.0078	0.0094

HD: heading, HT: height, LOD: lodging, YLD: yield

Table 5. Effect of fungicide and PGR inputs on winter wheat agronomic performance. Kalispell, 2013.

Cultivar	PRO %	TWT lb/bu	TKW g	FN sec	MC %
Check					
Bynum	13.4	59.4	32.6	373.4	12.5
Curlew	12.9	59.9	31.6	312.5	13.8
Decade	13.3	47.5	21.1	380.9	11.4
Jagalene	12.2	58.8	35.4	351.8	12.3
Promontory	11.4	61.8	36.7	162.3	13.9
Whetstone	13.0	60.0	33.3	357.3	13.0
Yellowstone	12.4	60.5	36.1	311.9	15.8
Palisade					
Bynum	13.2	60.4	32.4	361.6	12.7
Curlew	12.9	61.1	33.2	310.2	14.3
Decade	13.3	49.0	22.1	380.4	11.8
Jagalene	12.3	61.5	36.7	346.5	12.8
Promontory	11.7	62.6	37.5	144.4	14.1
Whetstone	13.2	60.5	34.0	372.2	12.2
Yellowstone	12.2	60.6	36.7	291.5	16.5
Quilt					
Bynum	14.1	59.9	35.0	384.2	12.6
Curlew	12.9	60.7	32.9	316.7	14.9
Decade	12.6	54.7	28.2	371.5	11.8
Jagalene	12.3	62.0	38.3	346.4	12.7
Promontory	11.8	62.9	38.5	152.7	14.9
Whetstone	13.2	61.0	35.2	370.6	13.0
Yellowstone	12.3	60.6	37.5	311.9	17.9
Palisade & Quilt					
Bynum	13.7	61.1	35.0	384.7	12.9
Curlew	12.9	61.5	33.8	303.5	14.7
Decade	12.7	56.4	29.2	359.9	12.4
Jagalene	12.7	61.5	38.9	365.9	12.4
Promontory	11.9	63.2	39.7	128.6	14.6
Whetstone	13.4	61.1	35.4	371.2	12.7
Yellowstone	12.2	61.3	37.8	297.8	17.6
Grand Mean	12.7	59.7	34.1	318.7	13.7
CV	1.73	2.04	3.87	4.26	3.89
LSD	0.36	2.01	2.18	NS	NS
Pr>F	0.0001	0.0001	0.0042	0.0900	0.0993

PRO: protein, TWT: test wt, TKW 1000 kernal wt, FN: falling No., MC: moisture