

APPLICATION OF THE PLANT GROWTH REGULATOR-PALISADE ON HRSW PERFORMANCE - *PI: Dr. Joel Ransom*

INTRODUCTION

Lodging in wheat in NW MN seems to be something that is unavoidable especially in years where the conditions favor high yield and when wind and rain occur late in the season. As farmers you do not want to set yourself up for having to deal with extensive lodging, but intensive managements tends to favor greater lodging with most HRSW varieties. Practices that promote increases in yield tend to increase lodging potential, starting with variety selection. Increased plant height is often associated with higher grain yield, though there are exceptions. Growth regulators have been used to shorten plants that are prone to lodging because of their height. Applying a plant growth regulator such as Syngenta's Palisade may be a useful tool to reduce the degree and severity of lodging and the implications that follow.

Plant growth regulator use is commonplace in parts of Europe and South America for small grains and are now being considered in the wheat regions of the U.S. Plant growth regulators decrease the internode distance in wheat and can thicken the stems of the plant, successfully shortening the plant. Currently in the USA, few chemicals are registered as plant growth regulators.

The objective of this research is to understand the effects of the plant growth regulator Palisade EC (Syngenta), on yield, height, lodging, and ease of combining of Hard Red Spring Wheat (HRSW). Specifically, the hypothesis is that a plant growth regulator application will protect yield and increase the ease of combining when an environment for severe lodging is encountered. See Table 4 for site descriptions.

MATERIALS AND METHODS

There were 11 locations in 2017 and six in 2016. See Table 4 for a description of the 2017 locations. The trial consisted of an application of Palisade EC growth regulator compared with no chemical application. The participants applied Palisade at a rate of 12 fl oz per acre, which is in the middle of the labeled rate of 10.5-14.4 fluid oz per acre of product. Ten gal of water per acre (GPA) is the minimum rate for good coverage. All growers used at least this amount; one of the growers who participated in this study made the application with 15 GPA of water. Palisade was sprayed as close to the Feekes 7 growth stage as conditions allowed. Feekes 7 is the growth stage where two stem nodes are visible above the ground.

Plant height measurements close to maturity were collected within each plot or treatment. Producer machinery was used to harvest the trials and plot weights were taken mostly with a weigh wagon that was provided by MN Wheat. MN Wheat owns one weigh wagon and borrows

three others. Yields were adjusted to 13.5% grain moisture. We collected sub-samples of the grain from each plot for grain protein analysis only when it was feasible because previous research has shown that this treatment had no effect on grain protein. The sub-samples that were collected were analyzed for test weight and percent moisture content with a Dickey John mini-GAC plus. Collection of these samples is done with an attachment to the weigh wagon's auger as the grain is augured out of the weigh wagon and into a truck. The attachment takes a small stream of continuous grain. There were some instances that the growers preferred using the scale on their grain cart to get the weights and sub-samples were again only taken when feasible.

RESULTS AND DISCUSSION

In most locations there was minimum observed response to the application of Palisade this year. (See Table 5 for results.) To quote one of the participants, "Was there anything in that jug?" When combined over all 11 locations, the application of Palisade did not have a significant effect on test weight, yield or grain protein. The result of an increase in test weight with Palisade has been observed in other Palisade trials, however not in all years or locations, such as in our research this year. Plant height was reduced in seven of the 11 locations. On average, however, this reduction was just less than one inch. In the most responsive site, plant height was reduced by nearly four inches. The impact of Palisade on plant height was not as pronounced this year as it was in our research in 2016.

When looking at the cost-benefit analysis, two trials made a return on their investment, suggesting that in a year like 2017 it would be risky from a financial point of view to use this technology (See Table 6 for cost-benefit analysis). Plants tended to be shorter in general and lodging less common. One thing that is not included in the cost-benefit analysis is the increased speed and ease of combining that growers have experienced. It is hard to add this effect to the analysis but anecdotal information from growers would say there are other opportunities for a financial gain in addition to greater yield and grain quality. Faster and easier combining is another possible benefit.

Every year climatic conditions during the growing season are different. This year the drier than average conditions for much of NW MN tended to reduce plant height and minimized the need and effect of a plant growth regulator (PGR). As can be seen from this year's data, Palisade or other PGRs registered for use to shorten spring wheat are not a sure deal. They may have no positive effect on the crop, but they may also hurt the yield if applied to an already stressed crop, though we have not observed significant yield reduction. This is not our only year of research

with this product, however, and it is still a tool for high management growers to use when the conditions look to stay conducive for lots of vegetative growth and lodging potential. There are also growers who value strong wheat straw more than the average grower, for example when it is used as a nurse crop, as lodging on the underseeded crop can be devastating. When looking at an input that has a cost attached to it, a cost-benefit analysis is useful for determining if the input makes economic sense. When looking at a 3 bu ac⁻¹ increase with Palisade compared to the untreated check, the yield increase does not pay for the application cost (Table 6).

CONCLUSIONS

Within the farms where research was conducted in 2017, the application of the plant growth regulator Palisade did not improve yield and grain quality. Although the Palisade application generally shortened the crop, the amount of lodging this year tended to be minimal and the shorter plants offered little advantages over the untreated plants. When looking at the economic analysis over the last two years, it shows it is not far off from a positive return to discourage its use entirely. In a more lodging-prone environment, the benefit of wheat that has lodged less would add into the financial outcome significantly. Therefore, an additional year of research is planned for this trial to conclude on whether the use of Palisade to prevent lodging is an economically viable practice.

Table 4. Agronomic details for all 11 locations of the Palisade growth regulator trial in 2017.

	Location				
	1	2	3	4	5
	Beltrami	Beltrami	Stephen	Hendrum	Drayton
Planting Date	4/29	4/29	5/2	4/7	5/11
Harvest Date	8/14	8/14	8/30	8/10	9/2
Previous Crop	Soybean	Soybean	Sugarbeet	Sugarbeet	N/A
Soil Type	Fine Sandy Loam	Fine Sandy Loam	Silty Clay Loam	Fargo Silty Clay	Silty Clay Loam
Variety	Lang	Bolles	Shelly	Shelly	Shelly
Palisade Date/Stage	6/1 Feekees 6-7	6/1/2017 Feekees 7	6/9 Feekees 7	6/3 Feekees 7	6/16 Feekees 7
Rain Total (in)	10.73"	10.73"	8.93"	11.91"	8.27"

	Location				
	6	7	8	9	10
	Drayton	Baudette	Dorothy	Red Lake Falls	Fosston
Planting Date	5/11	5/5	5/5	5/4	4/22
Harvest Date	9/2	8/5	8/21	8/15	8/10
Previous Crop	N/A	Soybean	Soybean	N/A	N/A
Soil Type	Silty Clay Loam	Loam	Fine Sandy Loam	Loam	Loam
Variety	Lang	SY Valda	Digger	Shelly	Prosper
Palisade Date/Stage	6/16 Feekees 6	6/9 Feekees 6-7	6/7 Feekees 6-7	6/12/2017 Feekees 7	6/5/2017 Feekees 7
Rain Total (in)	8.29"	7.36"	8.78"	8.29"	10.77"

Table 5. Effect of the plant growth regulator Palisade EC (Syngenta) applied at the two nodes above ground growth stage in HRSW on test weight, grain protein, and yield, at 11 environments throughout NW.

Treatment	1	2	3	4	5	6	7	8	9	10	11	Combined
-----Height (in)-----												
No Palisade	36.5	37.6	30.8	24.7	34.4	32	31.2	35.6	35.9	36.2	31.4	33.3
Palisade	34.6	33.9	31.5	21.8	35.7	31.3	31.6	34.3	34.2	37.1	30.8	32.4
LSD (0.05)	0.8	3.4	NS	2.1	1.3	NS	NS	NS	2	0.5	NS	2
LSD (0.10)	0.6	2.5	NS	1.5	1	NS	NS	NS	1.4	0.3	NS	1.6
-----Test Weight (lb bu ⁻¹)-----												
No Palisade	63.35	60.3	N/A	62.48	61.03	61.3	62.4	N/A	61.63	N/A	63.48	61.95
Palisade	62.25	59.28	N/A	62.38	61.3	61.33	61.63	N/A	62.3	N/A	63.58	61.75
LSD (0.05)	3.76	1.94	N/A	1.54	1.18	1.05	0.77	N/A	0.72	N/A	0.51	0.46
LSD (0.10)	2.55	1.54	N/A	1.23	0.94	0.83	0.59	N/A	0.56	N/A	0.41	0.37
-----Protein (%)-----												
No Palisade	N/A	N/A	N/A	N/A	12.875	14.3	N/A	N/A	N/A	N/A	N/A	13.59
Palisade	N/A	N/A	N/A	N/A	12.95	14.15	N/A	N/A	N/A	N/A	N/A	13.55
LSD (0.05)					0.41	0.27						1.43
LSD (0.10)					0.33	0.22						0.71
-----Yield (bu ac ⁻¹)-----												
No Palisade	89.69	87.69	83.42	75.47	83.75	73.59	82.26	89.79	85.97	89.90	87.82	84.49
Palisade	97.49	88.85	82.77	75.35	82.1	71.5	80.17	95.95	87.52	93.06	89.07	85.80
LSD (0.05)	12.82	1.33	12.12	3.72	1.93	1.13	1.88	8.95	5.58	8.21	6.15	2.04
LSD (0.10)	8.7	1.05	9.31	2.95	1.53	0.9	1.45	7.10	4.28	6.31	4.92	1.66

NS – non-significant difference at the 95% and 90% confidence level.

LSD – least significant difference, if the means differ by more than the LSD number the numbers are statistically different.

Table 6. Economic analysis of the Palisade application of all locations individually and the combined analysis, NW MN, 2017.

	Location					
	1	2	3	4	5	6
No Palisade	89.69	87.69	83.42	75.47	83.75	73.59
With Palisade	97.49	88.85	82.77	75.35	82.1	71.5
Yield gain/loss	7.80	1.16	-0.65	-0.12	-1.65	-2.09
\$ Yield gain/bu	46.8	6.96	-3.9	-0.72	-9.9	-12.54
Application Costs¹	\$26.00	\$26.00	\$26.00	\$26.00	\$26.00	\$26.00
Financial outcome	\$20.80	(\$19.04)	(\$29.90)	(\$26.72)	(\$35.90)	(\$38.54)

	Location					
	7	8	9	10	11	Combined
	82.26	89.79	85.97	89.90	87.82	84.49
No Palisade	80.17	95.95	87.52	93.06	89.07	85.80
With Palisade	-2.08	6.16	1.55	3.15	1.25	1.31
Yield gain/loss	-12.5	36.975	9.3	18.92	7.503	7.888182
\$ Yield gain/bu	\$26.00	\$26.00	\$26.00	\$26.00	\$26.00	\$26.00
Application Costs¹	(\$38.50)	\$10.98	(\$16.70)	(\$7.08)	(\$18.50)	(\$18.11)

¹ December wheat price of \$6.00. Considering 1 bu/ac lost due to tire tracks from application. Palisade cost of \$1 per ounce at a \$12 oz per acre rate.



Calibrating the on-combine protein analyzer (Page 28)