Factsheet: Spring wheat response to nitrogen fertilizer with the addition of a plant growth regulator applied at various crop stages

Objective:

To determine if the plant growth regulator (PGR) "Manipulator" can reduce straw height and/or lodging and increase grain yield of spring wheat grown under various levels of N fertility in northwest Saskatchewan.

Methodology:

This demonstration was conducted at the AAFC Scott Research Farm in 2015. The demonstration was set up as a 3 x 4 factorial in a randomized complete block design with four replicates. The first factor is the application of the PGR "Manipulator" applied at optimal timing (Zadoks 31), early timing (Zadoks 21) and late timing (Zadoks 39), and no PGR (check). The second factor, nitrogen fertilizer rate, was applied at 100, 125 and 150% of the recommended rate based on soil test levels and a target yield of 50 bu/ac (Table 1). All other nutrients and pesticides were applied to optimize grain yield (Appendix A1). A lodging susceptible CWRS variety (CDC Shaw) was used to detect the potential improvement in grain yield and straw strength using a PGR with increasing nitrogen rates. Wheat was seeded at a recommended seeding rate (250 viable seeds/m2).

Table 1. Detailed treatment list for the trial "Spring wheat response to nitrogen fertilizer with the addition of a plant growth regulator applied at various crop stages" at Scott, Saskatchewan, 2015.

Treatment #	PGR Application Timing	N Fertilizer Rates
1	No PGR	100% N Rate
2	No PGR	125% N Rate
3	No PGR	150% N Rate
4	Zadoks 21	100% N Rate
5	Zadoks 21	125% N Rate
6	Zadoks 21	150% N Rate
7	Zadoks 31	100% N Rate
8	Zadoks 31	125% N Rate
9	Zadoks 31	150% N Rate
10	Zadoks 39	100% N Rate
11	Zadoks 39	125% N Rate
12	Zadoks 39	150% N Rate

Key Findings:

- PGR applications applied at Zadoks (Z) 31 and Z39 reduced plant height by 8.5% and 7%, respectively. However the early application (Z21) did not differ from the untreated check.
- A yield increase was anticipated between the significantly shortened plants (Z31 and Z39 treatments) and high N rates applications compared to the untreated check.
- However, yield was not significantly affected by either PGR application timing or N rate. A general trend was noted though, with an increase in yield with increased N rate and PGR applications compared to the untreated check.
- On average, the PGR applications produced 4043 kg/ ha (60 bu/ac) while the untreated check produced 3845 kg/ha (57 bu /ac).
- A greater yield increase may have been reported if there had been a greater difference in height, as Zhang et al. (2004) found that water use efficiency increased in shorter plants allowing the yield to be less effected by drought stress.

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- A decline in thousand kernel weights and bushel weights was highly correlated to the timing of PGR application (Figure 1), indicating that the later applications significantly reduced seed quality. The cause for this decline could be attributed to the environmental conditions (drought) or it may be a side effect of the PGR applications.
- The N rates had little effect on yield, but it did significantly influence seed protein. N rate applications of 150% and 125% resulted in a higher protein content of 4.7% and 2.7% compared to the control (100%)
- In all, it is important to note that although there was a slight yield benefit from PGR applications, the decline in seed quality may outweigh the yield benefit associated with PGR. The effect of PGR on seed quality should be further studied in order to determine its influence on seed quality.

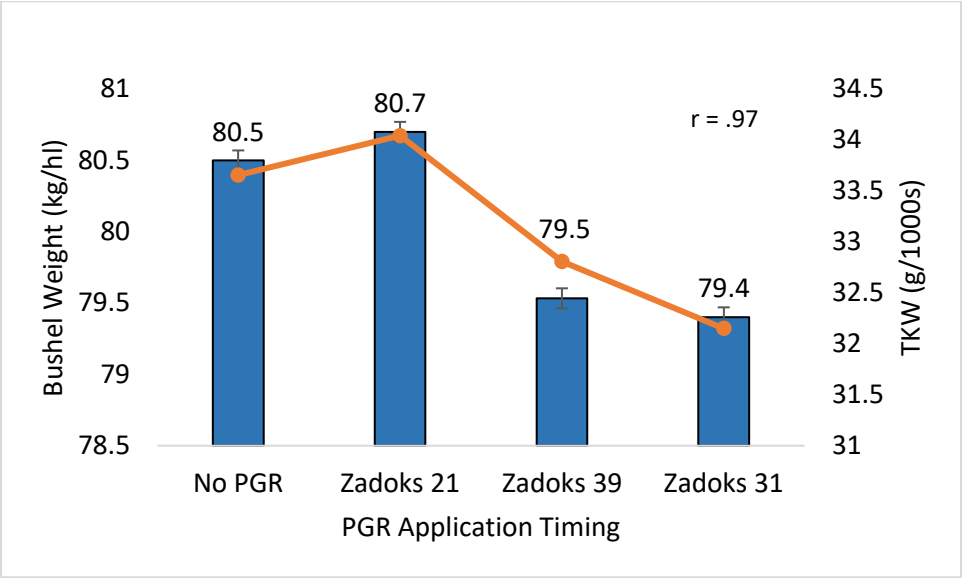

Figure 1. The effect of PGR application timing on wheat seed bushel weights (kg/hl) and thousand kernel weights (g/1000s).

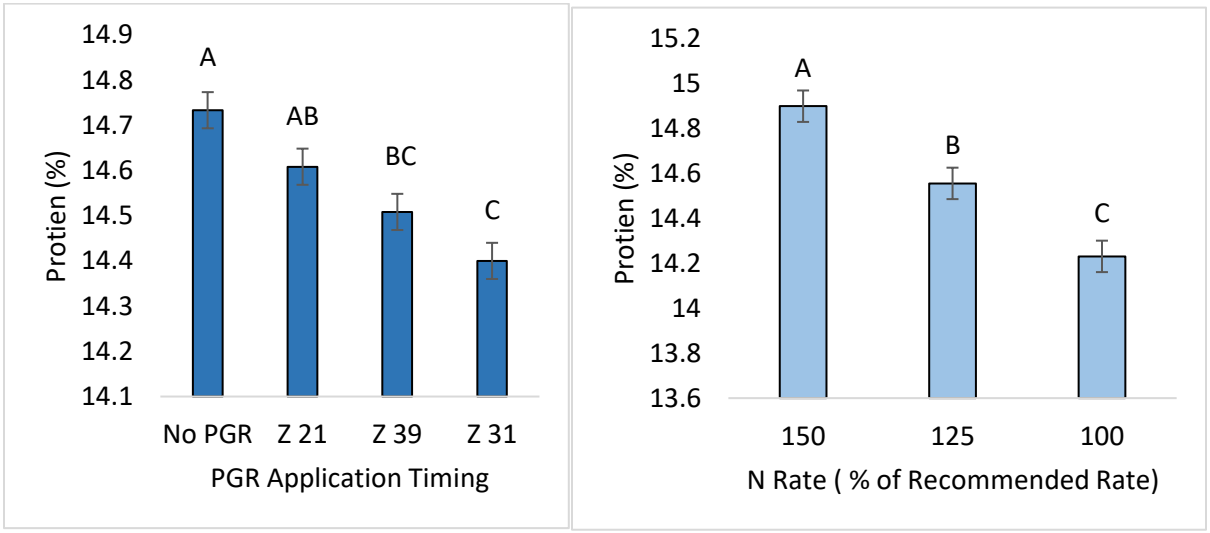

Figure 2. The effect of PGR application timing [a] and the effect of nitrogen (N) rate on wheat seed protein content (%) [b].

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