Saskatchewan AgriARM Applied Research Management

Wheatland Conservation Area Inc.
Swift Current, SK.

Plant Growth Regulators and N Rates in Durum Wheat

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Final Report

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Project Objectives

The objective of this project is to demonstrate to producers the potential positive and negative affects that plant growth regulators have on yield and harvestability of durum wheat, even when high rates of N fertilizer are used to achieve maximum yield and protein levels.

Project Rationale

Plant growth regulators (PGR) have shown considerable promise for increasing yield while decreasing lodging in wheat. Trials conducted in 2013 at Indian Head showed a yield increase of up to 14 bus/ac where plant growth regulators were applied and, in an unreplicated demonstration in 2012, wheat yields were increased by over 50% with PGR. Very little work, if any, has been done on durum wheat in the southwest part of the province.

With a strong durum wheat market and healthy premiums being paid for protein, producers are willing to push the envelope on nitrogen fertilizer rates in attempts to take advantage of these market opportunities. The downside comes when increased plant growth gives way to lodging. Lodged crop can lead to delayed maturity, improper head development, increased sprouting, missed crop and even result in reduced yield and grain quality. Lodged crops are difficult to harvest, leading to slow harvest speeds that may extend the harvest period beyond the optimum harvest window, at the expense of grain quality. In addition, to prevent significant harvest losses, lodged crops need to be cut short which increases the wear and tear on equipment, and increases fuel consumption, since significantly more material is passing through the combine at harvest.
If PGRs can reduce lodging in durum wheat, producers can significantly reduce risk when applying higher N rates to achieve maximum yield and protein. This project will demonstrate to local producers the potential yield and protein benefits that can be achieved by increasing N rates as well as potential benefits associated with applying plant growth regulators at varying N rates. Even at the lower fertility rates we may show benefits from the PGR by moving energy away from straw production to seed or protein production.

Methods

Strongfield durum wheat was planted at four different N rates, with a Plant Growth Regulator or PGR (Manipulator) applied at three different growth stages (at herbicide, 5-6 leaf, and at flag leaf) and an untreated check. Nitrogen rates ranged from lower than the recommended rate to higher than the recommended rate and replicated four times in order to create a response curve. Treatments included nitrogen rates at:

1) 0.75X soil test recommended rate
2) 1X soil test recommended rate
3) 1.5X soil test recommended rate
4) 2X soil test recommended rate

Each fertility rate above received either:

a) No PGR
b) PGR at herbicide timing.
c) PGR at 5-6 leaf stage
d) PGR at flag leaf stage

Four fertility rates x 4 Manipulator treatments (including UTC) = 16 treatments.

Plant emergence, lodging ratings, maturity, grain yield, grain protein, thousand kernel weight, and test weight were measured.

Other field note were as follows:

25-May Seeded trial with Fabro built plot drill; 9 rows x 9 inch row spacing; atomjet knife openers

Previous crop: trial seeded on field that was broke two years ago, and summer fallow last year. Was in alfalfa grass mixture 3 years ago.

Variety seeded: Transcend Durum @ 90 lb/ac

Plot size 7 feet by 30 ft. (trimmed back to 18 feet long)

Fertility: Sidebanded

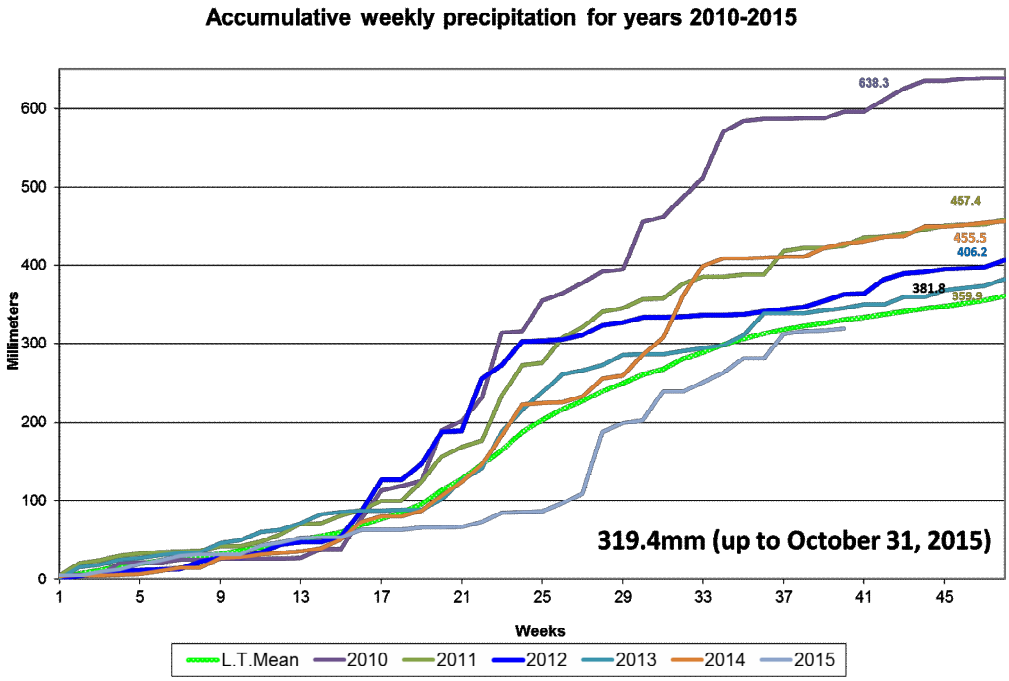
	Lbs of N/ac (30-15-0-6) blend
0.75x rate:	45N
1x rate:	60N
1.5x rate:	90N
2x rate:	120N

15-Jun Incrop with Liquid Achieve @ 200 ml/ac + Buctril M @ 0.4 l/ac + Turbocharge adjuvant. Applied Manipulator @ herbicide timing 3 to 4 leaf stage

29-Jun Applied Manipulator @ 700 ml/ac @ 5-6 leaf stage

09-Jul Applied Manipulator @ 700 ml/ac @ flag leaf

General Site Conditions



Graph 1. Accumulative weekly precipitation for years 2010-2015.

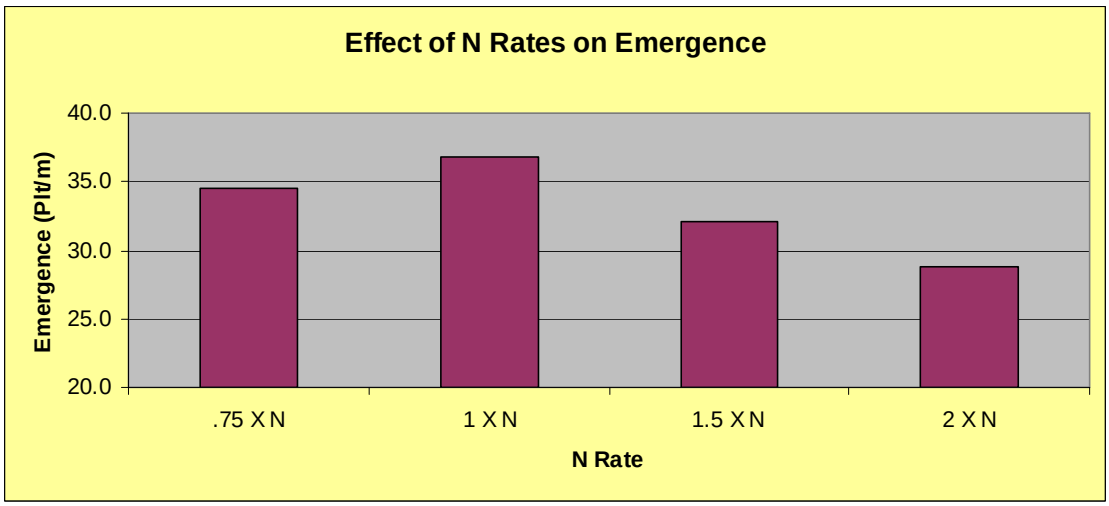
The site is situated 1 mile south of Swift Current. The soil is classified as a Swinton silty loam. For the most part in 2015, lower than average precipitation in the early growing season had a negative impact for shallow seeded crops. Severe drought like conditions continued through May, June, and July having a negative effect on yield potential and made it difficult to show treatment responses in certain trials. Overall yields for oilseed crops were lower than average due to lack of rain fall. Deeper seeded cereal crops had close to average yields. This was generally the case for area producers who experienced similar conditions resulting in similar yields.

Results

The dry weather conditions played a major role in the outcome of this project. This made it difficult to realize any treatment responses. The fertility treatments were designed to promote maximum plant growth, even to the point of crop lodging, whereas, the Plant Growth Regulator (PGR) treatments were designed to counteract excessive biomass and lodging, while at the same time retain maximum grain yield. Due to the drought conditions, the crop stand was already very short and we were not able to produce desired excessive biomass, even at very high N rates. In addition, the PGR treatments were relatively ineffective on the already stunted crop.

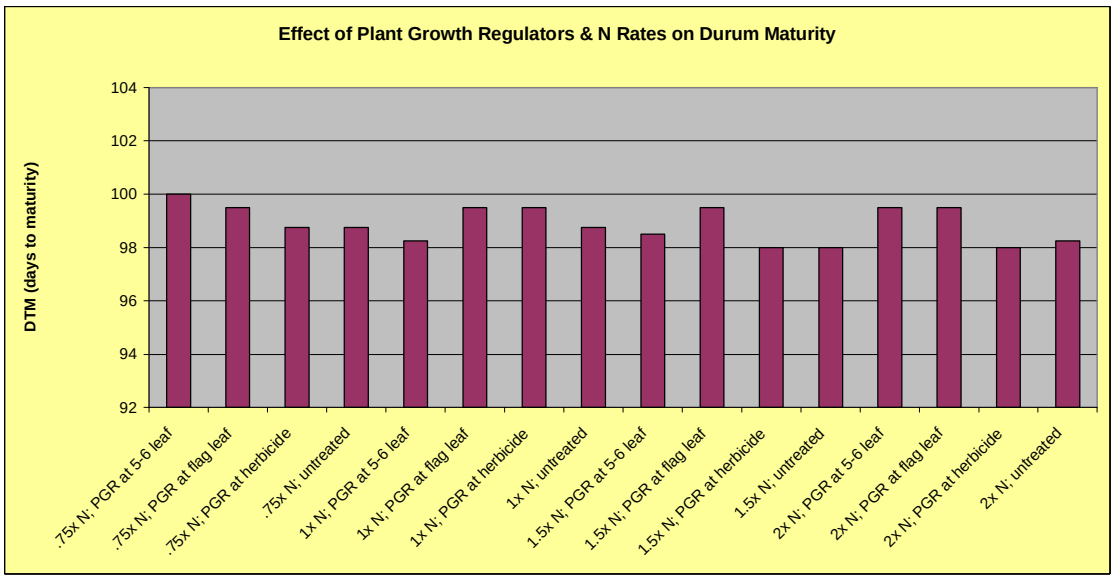
We looked at the data to see what effect the PGR timing and different N rates had on the plant emergence, lodging, maturity and yield. Since the PGR was not applied until later stages of crop development, the emergence data would have only been influenced by the different N rates. In 2015, we did observe a slight decrease in plant emergence at the higher fertility rates of 1.5x and 2x N (Graph 2.). Even though these treatments were side banded, we may have seen some slight seedling burn due to the very unforgivably dry spring conditions. This, however, did not negatively effect yield come harvest time.

Graph 2.



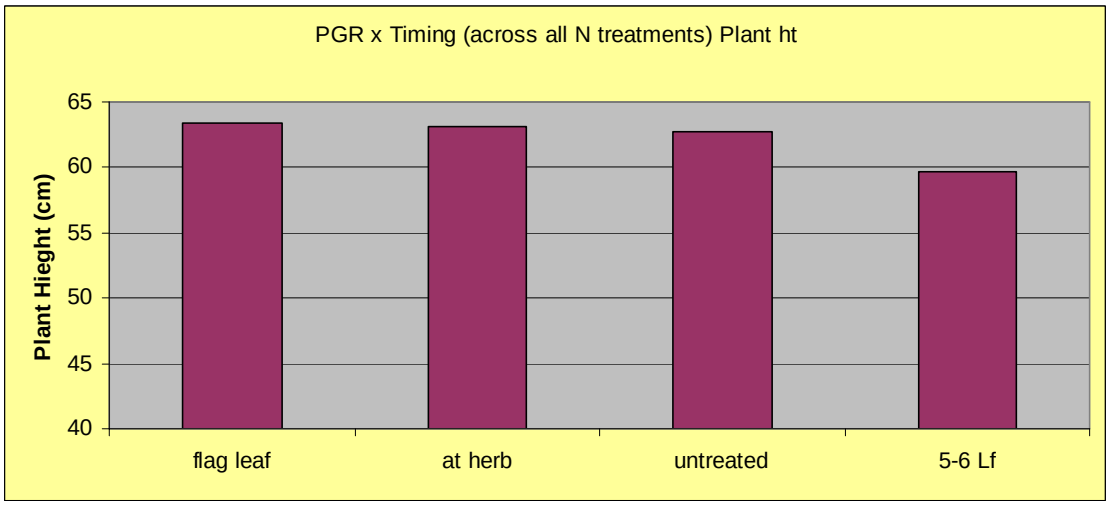
The PGR timing treatments and various N rates had little to no effect on crop maturity (Graph 3.) Days to maturity ranged from 98 to 100 days. This again, we attribute to the very dry conditions early in the growing season.

Graph 3.



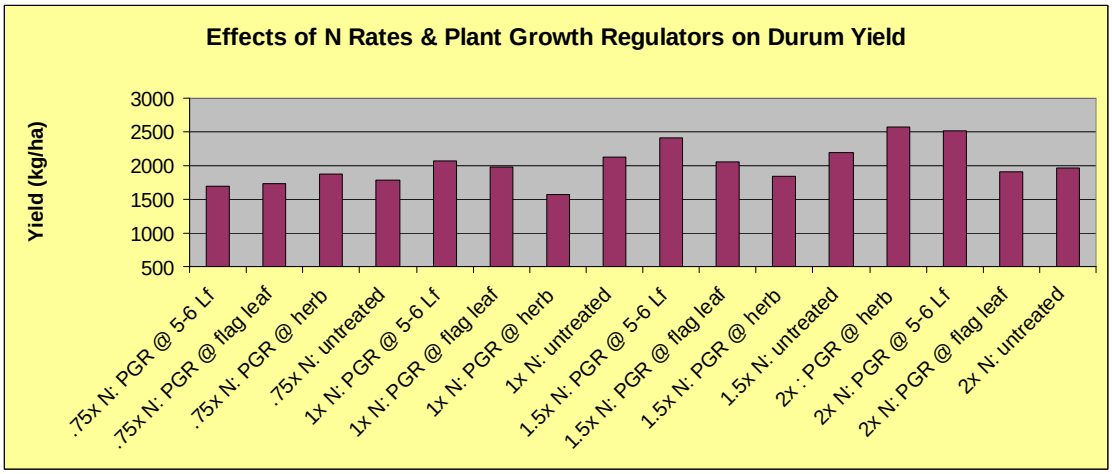
There was no lodging in any of the treatments, primarily due to the dry conditions observed in 2015 resulting in a short crop across all treatments. Plant heights were taken at physiologic maturity. The PGR application at the 5-6 leaf stage resulted in about a 3 cm reduction in plant height (Graph 4.). None of the other treatments differed from the untreated check and appeared to have little affect on crop height.

Graph 4.



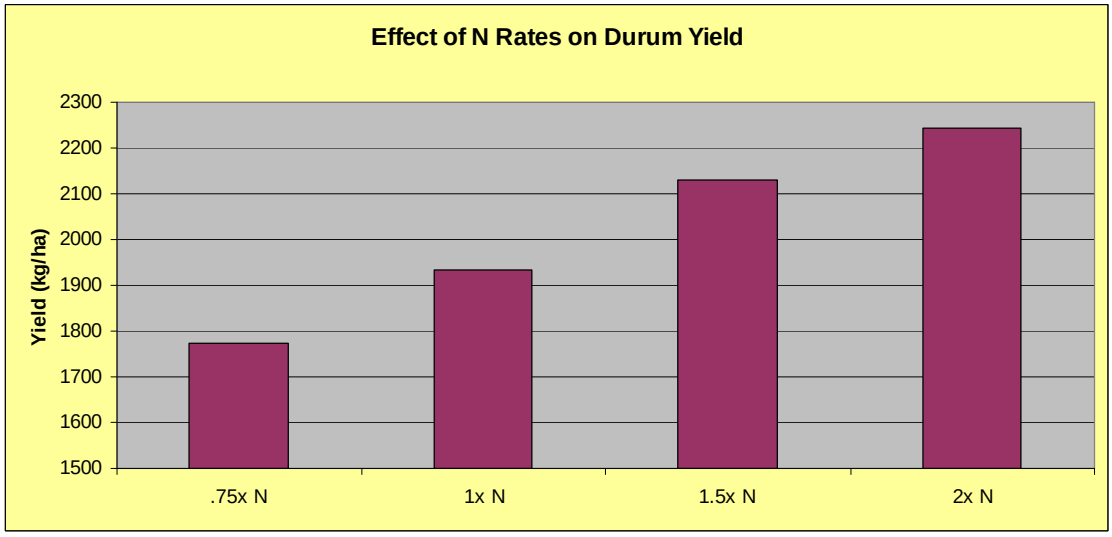
Finally, when looking at yield (Graph 5.) the highest overall yield was recorded by 2x N with PGR at herbicide timing and PGR at 5 to 6 leaf timing of 2500 kg/ha (37 bus/ac). We believe the extra N had the greatest impact on yields more so than the PGR treatments. In a year where lodging would be more prevalent we would be more inclined to see a greater benefit in yield by utilizing a plant growth regulators.

Graph 5.



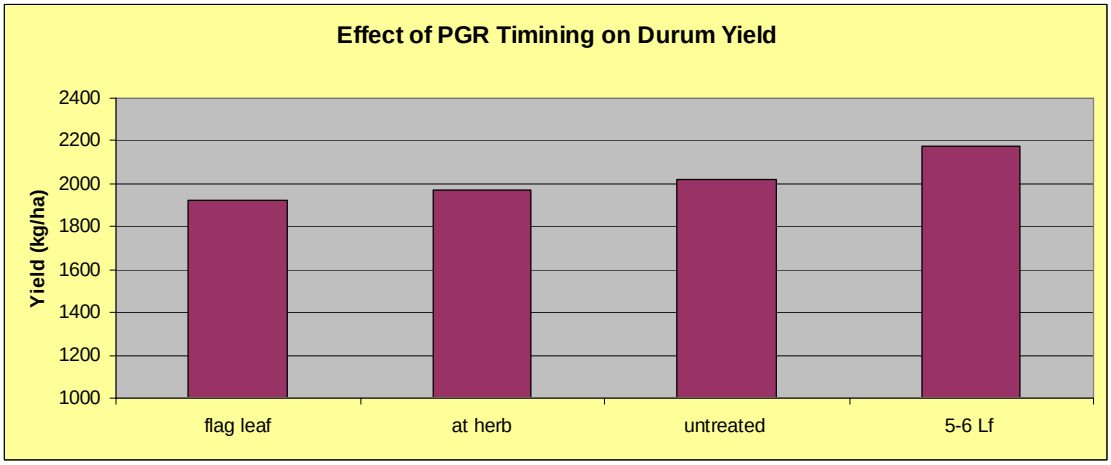
If we look at the yields from each N rates factored across all PGR timings we see significant difference between all levels of fertility with the 2x N rate providing the highest yield showing a 310 kg/ha (4.6 bus/ac) increase over the 1X rate (Graph 6.).

Graph 6.



On a similar note, if we look at yields from each PGR timing (Graph 7.) averaged across all fertility treatments we see a significant yield advantage by applying PGR at the 5 to 6 leaf stage compared to the untreated check and all the other PGR timings. This translated into a 150 kg/ha (2.2 bus/ac) increase over the untreated check. This yield increase may be explained from the fact that the PGR application at the 5-6 leaf stage was effective in shortening the crop slightly (Graph 4.) providing more energy to seed production and grain yield. The application of the PGR at the 5-6 leaf stage is an industry recommendation, however, additional years of data under a variety of growing conditions is required to fully realize potential benefits.

Graph 7.



Conclusions

Dry weather conditions definitely factored into the outcome of this trial limiting the effects of the plant growth regulator. In the absence of favorable conditions to promote excessive growth or lodging, the potential benefits from the PGR treatments were not realized. We saw no lodging in this trial and no clear maturity differences between treatments. We did see a slight reduction in crop height when applying a PGR at the 5-6 leaf stage, which is an industry recommendation. We also saw a slight yield increase from this treatment, however, additional years of data under a variety of growing conditions is required to fully realize potential benefits.

Acknowledgements

We thank the Ministry of Agriculture for all our ADOPT projects including plot signage and verbal acknowledgement at field days and on PowerPoint slides during presentations. This will continue at each venue where an extension activity occurs. We also thank Shannon Chant (Saskatchewan Ministry of Agriculture) for her help.

Summary

The objective of this project is to demonstrate to producers the potential positive and negative affects that plant growth regulators have on yield and harvestability of durum wheat, even when high rates of N fertilizer are used to achieve maximum yield and protein levels. Plant growth regulators (PGR) have shown considerable promise for increasing yield while decreasing lodging in wheat.

Lodged crops can lead to delayed maturity, improper head development, increased sprouting, missed crop and even result in reduced yield and grain quality. If PGRs can shorten the crop and reduce lodging in durum wheat, producers can significantly reduce risk when applying higher N rates to achieve maximum yield and protein. Even at the

lower fertility rates we may show benefits from the PGR by moving energy away from straw production and potentially providing additional contributions to grain production.

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This project was promoted during Crop Production Week in Saskatoon in January and will be locally at Cropportunities 2016 on March 3rd in Swift Current (200+ expected participants). This project was promoted on a CKSW radio program called "Walk the Plots" which we broadcast in the summer on a weekly basis. As well this topic was brought to the attention of the group on the Annual Field Day on July 17th (100 participants) as well as a number of smaller individual tours. This topic will also be posted on our website.