

Annual Ryegrass Seed Production: Fertility and PGR

Jessica Pratchler, PAg, Research Manager, NARF



Objective/Rationale: To determine the optimal N fertilizer rate(s), in combination with PGR (Plant Growth Regulator) usage, in Annual Ryegrass for seed production.

Methodology: This small plot research trial was conducted using a Randomized Complete Block Design with 4 replicates. Each plot was 2m wide by 7m long with borders on the ends of each replicate. Treatments were set up in a 2 by 4 factorial structure for a combined 8 treatments (Table 1). The first factor was PGR application as Manipulator vs. untreated. The second factor was nitrogen rates of 0, 50, 100, and 125 kg N/ha.

Table 1. Treatments used in Annual Ryegrass Seed Production: Fertility and PGR at Melfort SK 2018.

TRT #	Plant Growth Regulator	N Rate (kg N/ha)
1	Manipulator	0
2		50
3		100
4		125
5	Untreated	0
6		50
7		100
8		125

On May 29th, Annual Ryegrass (var. Surry Nova) was seeded at 15 lb/ac. This seeding rate was adjusted for a 97% germination and a 2g thousand kernel weight. The treatments were seeded with a 6-row Fabro plot seeder on 12-inch spacing, at a 0.5" depth, into canola stubble. Soil sampling was performed at a 0-12" depth to determine residual nutrient levels (Table 2). Nitrogen was side-banded as urea (46-0-0) as per protocol requirements. The amount of nitrogen was adjusted for the N provided by MAP. All plots also received side-banded phosphorus at 20 kg/ha of MAP (11-52-0). There was no need to add apply additional potassium or sulphur containing fertilizers.

Table 2. Residual nutrient levels (0-12") in Annual Ryegrass seed production: Fertility and PGR at Melfort SK 2018.

Residual Soil Levels			
Nitrogen (lb/ac)	Phosphorus (ppm)	Potassium (ppm)	Sulphur (lb/ac)
20	7	364	54

This trial received crop protection as required. Glyphosate was applied at 0.5 L/ac as a pre-emergent herbicide on June 6th. MCPA ester 600 (360 mL/ac) was applied on June 29th for broadleaf weed control. Due to unfortunate circumstances, a wild oat control herbicide application was missed and wild oats were removed by hand throughout the growing season. Manipulator (700 mL/ac) was the PGR applied at the 5 to 6 leaf stage (July 6). No fungicide, insecticide, or desiccants were used. All plots were harvested on October 5th with a plot combine.

Data collection consisted of tolerance, crop height, lodging, yield, and quality. Tolerance was determined by rating crop tolerance to Manipulator on a scale of 0-100%. Zero indicating no tolerance (complete plant death) and 100% indicating no evidence of any damage. Crop height was determined by measuring the length of a handful of plants at physiological maturity. Lodging was assessed using the Belgian Lodging Scale (area (1-10)*severity (1-5)*0.2) prior to harvesting. Yield was determined by cleaning and weighing each combined sample and converting these weights into lb/ac. Lastly, quality was assessed by sending a composite sample from treatments 2 and 6 away for % germination and TKW analysis.

Results:

May and June were warmer than normal, while July was similar, and August through October were cooler (Table 3). Every month during the growing season, received less precipitation than normal, except September (Table 3). May through August was within 10 mm of the normal total precipitation received for those months. The harvest season began earlier than in previous years, however, periodic rain and snow in September resulted in harvest delays. Overall, the growing season was near normal, albeit 43 mm (18%) less rain on average.

Table 3. Mean temperatures and precipitation collected from the Environment Canada Weather Station at Melfort, SK., for May to October 2018.

	May	June	July	August	Sept.	Oct.	AVG/Total
	Temperature						
2018	13.9	16.8	17.5	15.9	6.9	0.9	12
Long-Term^x	10.7	15.9	17.5	16.8	10.8	3.3	12.5
	Precipitation(mm)						
2018	38.5	46.6	69.5	43.2	42	8.9	248.7
Long-Term^x	42.9	54.3	76.7	52.4	38.7	27.9	292.9

^x Long-Term Climate Normal from Melfort Environment Canada Weather Station (1981-2010)

Tolerance

Annual Ryegrass was 100% tolerant to Manipulator application in Melfort 2018. There were no visually adverse effects in comparison to their no PGR application counterparts. Any visual treatment differences could be attributed to nitrogen rate differences. Furthermore, seed samples sent in after

harvest also suggested that Annual Ryegrass has excellent tolerance to Manipulator application as germination and TKW were similar with and without PGR application. Germination was slightly higher in the PGR application (54%) compared to the no PGR treatment (52%), while TKW of both treatments was 2.8 g 1000 seeds.

Height & Lodging

PGR application, nitrogen rate, and their interaction did not significantly impact the height of Annual Ryegrass in 2018 (Table 4). However, at the 90% confidence level, nitrogen rate did have an effect on crop height (Figure 1). As expected, there was a tendency for crop height to increase with nitrogen application, yet was only evident at the 50 kg N/ha rate. There is no explanation as to why height tended to be less at the 100 and 125 kg N/ha rates than 50 kg N/ha. However, this response has likely little practical or agronomic importance. Overall, it is unknown why Annual Ryegrass height was not responsive to Manipulator application in 2018. In other Manipulator trials, with other crops at NARF this year, crop heights were still reduced but not as great as in previous years. Therefore, it may be due to growing season conditions that PGR application did not exhibit its full potential this year. Lastly, as there were minimal height differences, it was not unexpected that there was minimal to no lodging recorded in 2018. There were a few plots that had slight lodging recorded, however, it was not enough to complete a full statistical analysis or make any general conclusions.

Table 4. Statistical summary for PGR and nitrogen rate effects on Annual Ryegrass height and yield at Melfort, SK 2018.

	Height (cm)	Yield (lb/ac)
		<i>Pr<f</i>
PGR	0.2564	0.5751
Nitrogen Rate	0.0815	<0.0001***
PGR * Nitrogen Rate	0.9568	0.1973
CV	6.31	14.31
		<i>Means</i>
Manipulator	85.1 a	349.3 a
No Manipulator	82.9 a	339.3 a
0 kg N/ha	81.0 b	252.5 b
50 kg N/ha	88.2 a	361.8 a
100 kg N/ha	83.6 ab	381.7 a
150 kg N/ha	83.4 ab	381.2 a

*** highly significant; means with the same letter are statistically similar.

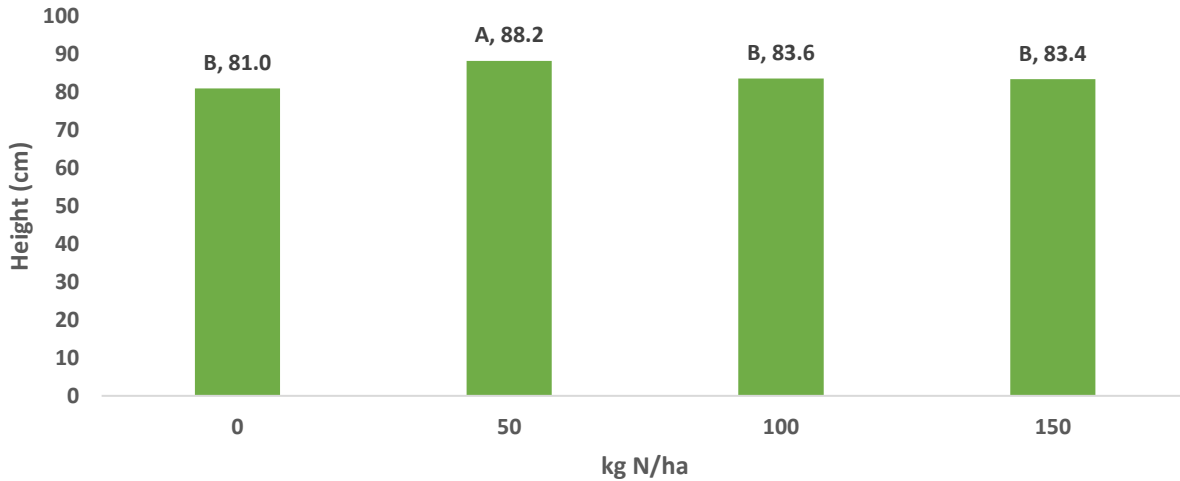


Figure 1. Nitrogen rate effects on Annual Ryegrass height at Melfort, SK 2018. Results presented at the 90% confidence level.

Yield

Nitrogen rate had a significant effect on Annual Ryegrass yield in 2018 (Table 4). Nitrogen application at any rate significantly increased yield (Figure 2). When the first 50 kg N/ha was applied, there was a 30% yield increase. When an additional 50 and 100 kg N/ha was applied (100 & 150 kg N/ha total), yield increased by an additional 5%. This suggests that 50 to 100 kg N/ha was required to optimize Annual Ryegrass yields in this trial. PGR application and the interaction between PGR and nitrogen rate did not significantly affect yields. This is somewhat expected, as there was minimal height and/or lodging differences across treatments. Furthermore, in other Manipulator trials at Melfort this year, PGR application did not always result in significant spring wheat yield increases as well.

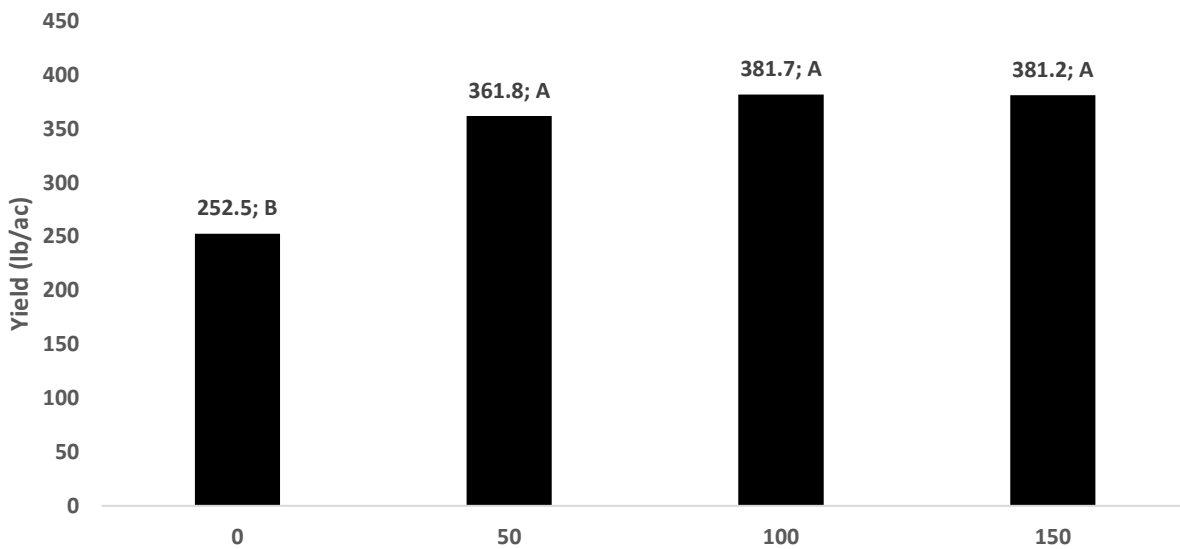


Figure 2. Nitrogen rate effects on Annual Ryegrass yield (lb/ac) at Melfort SK, 2018.

Conclusion:

Results of this research trial suggest that Annual Ryegrass is highly tolerant to Manipulator application. Although there were minimal height, lodging, yield, and quality differences attributed to PGR application, there were some trends that occurred. However, these trends were largely attributed to differing nitrogen rates. Due to the fact there was minimal height and lodging differences, we were unable to detect at what nitrogen rate PGRs should be applied, in order to prevent lodging and maintain or increase yields. As other Manipulator trials at Melfort suggest, the environmental conditions in the 2018 growing season were not conducive for large lodging events to occur. These other trials also experienced minimal beneficial effects from PGRs, as experienced in other years. Therefore, it is suggested that this trial be completed again, to determine if results differ under a potentially different environment. The largest treatment differences were attributed to nitrogen application, with 50 to 100 kg N/ha required to optimize Annual Ryegrass yields. Overall, it appears that after 1 site-year of research, there is no adverse effects of applying Manipulator to Annual Ryegrass. However, this needs to be validated with more site years of data.

This small plot trial was funded by the Saskatchewan Forage Seed Development Commission.