Perennial Ryegrass Growth, Development and Seed Yield Influenced by Phosphorus Source, Rate, Placement, and Timing.
Annual Report 4/1/15 – 5/27/16

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Perennial ryegrass is a relatively new grass seed crop in northwestern Minnesota harvested on over 30,000 acres in 2014. Currently, perennial ryegrass is raised on more acres than all the other grass seed crops combined including Kentucky bluegrass, timothy, native grasses and reed canary grass. The primary objective of this research is to validate the current phosphorus recommendations for perennial ryegrass grown in the high pH soils of northwestern MN. Data collected from this research will expand the knowledge base in perennial ryegrass seed production. In addition, information from these small and large on-farm trials will be used to refine the phosphorus recommendations for the perennial ryegrass seed production region of northwestern Minnesota. Crop sensor technologies have the potential to be used as a management tool in crop production, we will evaluate the use of a chlorophyll meter as a diagnostic tool to predict phosphorus deficiencies in perennial ryegrass.

Objective 1: Validate the current phosphorus fertilizer recommendations in perennial ryegrass seed production with a phosphorus rate and timing small plot trial conducted in the high pH soils of northwestern Minnesota.

Objective 2: Conduct small plot replicated research trials in perennial ryegrass seed production to evaluate phosphorus source (dry & liquid) in high pH soils.

Objective 3: Conduct large on-farm replicated research trial(s) comparing standard management practices to a higher P rate.

Objective 4: Chlorophyll meter readings will be compared to plant tissue analysis to determine if a chlorophyll meter can be used as a diagnostic tool for phosphorus management.

Perennial ryegrass is a relatively new grass seed crop raised in northwestern Minnesota with the majority of the perennial ryegrass acres are established by underseeding the perennial ryegrass with spring wheat the first year and harvesting the perennial ryegrass seed crop the following year. The practice of seeding perennial ryegrass under wheat allows for an economic return (wheat) during the establishment year while protecting the ryegrass plants during the winter by catching snow with the wheat stubble. Limited fertility research has been reported for perennial ryegrass seed production, the most recent University of Minnesota fertility guidelines for grass seed crops updated in 2011 does not include perennial ryegrass. Recent research at the University of Minnesota Magnusson Research Farm has suggested an improvement in wheat development, growth, and yield from phosphorus applied in-furrow at twice the standard rate and local agronomists have made similar field observations in several other crop species grown in the high pH soils of Lake of the Woods and Roseau Counties. An increase in uptake of early season phosphate by plant roots is theorized to improve plant growth and development which may lead to increased crop yields, improved winter survivability, crop quality, and ultimately profitability. Both the small plot trials and on-farm research were initiated during 2014. Severe winter injury on perennial ryegrass resulted in poor and variable stands. Perennial ryegrass seed yields were determined in August, 2015 on one small plot trial but were confounded by winter injury. With the poor results obtained from the perennial ryegrass small plot trial, the experiments described in Objective 1 and 2 were re-established in 2015 with treatments applied and setup for collection of seed yield data in

2016. The 2015 planting was assessed for winter injury in April, 2016 and sustained minimal damage. Data will be collected on these two fertility trials for seed yield and seed yield components to provide growers with better fertility recommendations.

In summary, severe winterkill and wet soil conditions impacted trials resulting in a loss of complete experiments and more variable data on trials that were harvested. Trials were re-established in 2015 for data collection in 2016 to meet the objectives of the grant. Data collected in 2015 from Objective 1 and 3 is presented below, reliable conclusions cannot be drawn from the data due to stand variability and winter injury.

2014-15 Ryegrass Phosphorous Trial

Magnusson Research Farm-Roseau, Mn.

	Fertility	Fertilizer	Seed Yield	Harvest-8/17/15		Stand %[2]	RCI[3]
Trt#	Treatment	timing*	(lbs/A)	Lodging[1]	Ht. (in.)	5/23/15	7/21/15
1	0-20-40	EF	886	6.5	25	59	451
2	0-40-40	EF	968	6.3	24	53	409
3	0-60-40	EF	832	7.3	26	70	348
4	0-80-40	EF	846	7.3	26	73	370
5	0-0-40	EF	748	4.8	24	60	438
6	0-20-40	SF	741	6.0	25	73	404
7	0-40-40	SF	832	5.5	25	58	397
8	0-60-40	SF	908	7.8	26	69	336
9	0-80-40	SF	972	7.5	27	54	388
10	0-0-40	SF	790	5.8	25	63	406
11	0-20-40	S	928	6.0	24	48	430
12	0-40-40	S	808	7.0	26	65	362
13	0-60-40	S	768	7.0	25	70	329
14	0-80-40	S	797	7.3	27	79	326
15	0-0-40	S	863	6.5	24	46	470
16	0-20-40	F/S	708	7.0	25	73	374
17	0-40-40	F/S	861	6.5	25	51	402
18	0-60-40	F/S	852	7.3	26	70	337
19	0-80-40	F/S	843	7.0	26	63	314
20	0-0-40	F/S	803	5.8	25	55	478
21	0-0-0		812	6.5	24	81	423
	LSD @5% level		219	1.7	2	30	81
		CV(%)	18	19	5	34	15

[1]Lodging: 1=upright; 9=flat

[2]%stand: visual rating of new growth

[3]RCI: Relative chlorophyll index, a higher number indicates more chlorophyll

Data from Objective 3: one on-farm trial with severe winter injury.

2014 Added Phosphorus to Perennial Ryegrass*
Rice Farms-Northwest of Roseau, Mn

	Fertilizer Rate[1]	**Seed[2] Yield(#/ac)**
1	6-30-30	**474**
2	12-60-30	**452**
	LSD @5% level	**NS**

Experimental Design; RCB with 3 reps

*Variety=Evolution

[1]Fertilizer applied 9/23/2014 to entire area received 6-30-30; Trt#2 had additional 6-30-0 application

[2]Clean seed yield corrected to 12%moisture

Added fertilizer treatment, data collection and yield subsampling done by U of M

Harvest and all other management operations done by grower using best management practices.

Plot size=70' x 600'

Soil test results- 9/10/2014

Olsen P (ppm)	NH_4OAc-K (ppm)	LOI OM (%)	Water pH	SO_4-S (ppm)
10	125	4.5	7.9	6.00