Canadian Agri-Science Cluster for Horticulture 2

Progress Report December 2014

Activity 17, Potato 16

Nitrogen for Improved Yield, Quality and Profitability of Potato

Lead Researcher

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Collaborators

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Activity Objectives

- Determine optimal timing, placement and source of Nitrogen fertilizers for irrigated potato;
- Determine the impact of Nitrogen mineralization of soil on potato response to fertilizer additions;
- Evaluate the effectiveness of monitoring plant Nitrogen status to adjust fertigation additions.

Research Progress to Date

2013-2014:

- Determine soil characteristics of two field sites in Manitoba

  Completed. Analysis completed for basic soil properties including texture, organic matter, pH, EC, extractable inorganic N, Olsen-P
- Apply fertilizer treatments providing a range of early, med to late N availabilities at two sites in Manitoba.

  Two sites in Manitoba were chosen. Total N application rate for each site was based on the Manitoba Soil Fertility Guide recommendation using residual spring nitrate soil test levels and 375 cwt target yield for Russet Burbank. The recommended application rate was reduced by 20% to enhance treatment NUE differences. The site near Carman had a residual had an application rate of 142 lbs/ac and the one at Carberry had 107 lbs/ac.

  The treatments as fraction of applied N at planting, hilling and fertigation are provided below.

	Treatment	Fraction of applied N							
		Broadcast @ Plant	Banded @ Plant	Hilling Split (side dress)	Fertigation 1	2	3	4	Total
1	Untreated Check								0
2	Urea (46-0-0) @ Plant Broadcast	100							100
3	Urea Split (Broadcast at plant)	40		60					100
4	Urea Split (Band at plant)		40	60					100
5	Super-U split Broadcast	40		60					100
6	Super-U split Band		40	60					100
7	ESN (Coated Urea, 44-0-0)	100							100
8	50% ESN / 50% Urea @ Plant Broadcast	100							100
9	Fertigation A (28-0-0 diluted 1:10)	60			17	13	10		100
10	Fertigation B (28-0-0 diluted 1:10)	40			20	17	13	10	100
11	Fertigation C (28-0-0 diluted 1:10) (Broadcast @ plant 50 % ESN)	60			17	13	10		100

- Testing of soil and petioles for N contents during growing season
  Completed. Petiole samples were obtained and analyzed twice in Carman and once in Carberry. A clear increase in petiole N concentration with N application was apparent. Further, the fertigation treatments had low petiole N for the first sampling at Carman (before fertigation application). Soil samples for extractable inorganic N were taken mid-season and post harvest.
- Determination of tuber quality parameters.
  Completed. Analysis for sugar ends, defects, hollow heart, fry colour, density. No major differences found.
- Determine total and marketable yield, tubers size distribution and counts
  Completed.

Carman yield

	Treatment	Yield (cwt/ac)						Average Tuber Size (oz)
		< 3	3-6 oz	6-12 oz	> 12 oz	> 3 oz	Total	
1	Untreated Check	44.3 a	156.0 a	87.8 b	3.8 a	247.6 c	291.9 c	4.25 c
2	Urea at Plant	30.7 a	148.1 a	231.3 a	34.6 a	414.1 ab	444.8 ab	5.67 ab
3	Urea Split	27.8 a	135.8 a	254.3 a	33.9 a	423.9 ab	451.7 ab	5.85 ab
4	Urea Split	32.4 a	146.5 a	213.8 a	28.6 a	388.9 ab	421.3 ab	5.48 b
5	Super-U split	38.7 a	123.2 a	221.6 a	37.5 a	382.3 ab	421.0 ab	5.53 ab
6	Super-U split	35.3 a	151.1 a	210.0 a	39.6 a	400.7 ab	436.0 ab	5.36 b
7	ESN at Plant	28.8 a	135.4 a	244.4 a	54.3 a	434.1 a	463.0 a	5.99 ab
8	ESN/Urea	21.5 a	121.6 a	246.5 a	56.8 a	424.9 ab	446.5 ab	6.29 a
9	Fertigation A	34.0 a	141.8 a	219.0 a	70.5 a	431.4 ab	465.4 a	5.82 ab
10	Fertigation B	30.5 a	126.5 a	224.3 a	53.9 a	404.8 ab	435.3 ab	5.94 ab
11	Fertigation C	31.3 a	126.5 a	213.8 a	40.3 a	380.5 b	411.8 b	5.59 ab
LSD (P=.05)		ns	ns	58.3	ns	52.5	47.5	0.80
CV		32.39	18.38	18.75	73.34	9.24	7.72	9.93
Treatment Prob(F)		0.2811	0.5411	0.0003**	0.2468	0.0001**	0.0001**	0.0033**

Carberry yield

		Yield (cwt/ac)						Average Tuber
Treatment		< 3	3-6 oz	6-12 oz	> 12 oz	> 3 oz	Total	Size (oz)
1	Untreated Check	32.1 a	140.6 a	194.1 d	46.9 a	381.6 c	413.6 d	5.50 a
2	Urea at Plant	28.0 a	152.9 a	220.0 bcd	60.0 a	432.8 ab	460.8 abc	5.80 a
3	Urea Split	27.7 a	141.4 a	221.5 bcd	49.7 a	412.5 bc	440.2 cd	5.91 a
4	Urea Split	29.5 a	166.8 a	226.1 bcd	50.7 a	443.5 ab	473.0 abc	5.74 a
5	Super-U split	39.9 a	149.8 a	256.8 ab	39.9 a	446.5 ab	486.4 ab	5.44 a
6	Super-U split	26.7 a	133.2 a	256.1 ab	43.6 a	432.9 ab	459.7 abc	5.97 a
7	ESN at Plant	29.8 a	168.6 a	230.1 a-d	64.6 a	463.3 a	493.1 a	5.79 a
8	ESN/Urea	34.0 a	165.0 a	198.4 cd	46.4 a	409.8 bc	443.7 bcd	5.57 a
9	Fertigation A	33.3 a	169.3 a	237.3 abc	54.8 a	461.3 a	494.6 a	5.66 a
10	Fertigation B	23.0 a	138.4 a	252.6 ab	58.5 a	449.6 ab	472.6 abc	6.22 a
11	Fertigation C	27.4 a	151.0 a	269.3 a	41.9 a	462.2 a	489.6 a	5.89 a
LSD (P=.05)		ns	ns	41.1	ns	41.2	44.0	ns
CV		32.19	22.03	12.21	41.07	6.55	6.53	8.48
Treatment Prob(F)		0.569	0.7848	0.0113*	0.8125	0.0059**	0.0131*	0.5877

Additional

- Additional sampling was done to determine stand vigour (stem counts, plant counts, vine biomass) in case treatments reduced emergence or encourage seed rot. No major differences found.
- N content of tubers were determine to determine total removed N with potatoes Carman. No major differences found.

2014-2015:

- Determined soil characteristics of two field sites in Manitoba and one in Alberta
- Applied fertilizer treatments providing a range of early, med to late N availabilities at two sites in Manitoba and one site in Alberta
- Tested soil and petioles for N contents during growing season
- Determined of tuber quality parameters
- Determined total and marketable yield, tubers size distribution and counts

Additional

- Determined stand vigour. N content of tubers were determine to determine total removed N with potatoes

Early Outcomes (if any) or Challenges

In 2013 we could not find a suitable site under irrigation by a grower at Carman. This is because growers are using fertigation. Thus we had to manually irrigate using hoses and guns. This resulted in more labour and time to insure the crop was provided water.

It seems in 2013 that ESN at planting was the best treatment for increasing yield. The season started off wet so ESN may have afforded protection of nitrogen. Fertigation also seemed to work well. Thus the hypothesis of delayed N availability by nitrogen treatment ESN at plant and fertigation seemed to give best response in 2013.

Key Message(s)

For 2013 ESN at planting and less so fertigation provided best yields. The season was wet early on and may be the reason why these treatments were best. More study years are required to encompass weather variation.