Evaluation of Nitrogen Source and Rate on Irrigated Potato Production in New and Old Potato Fields

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INTRODUCTION

Potato growers often seek fields with no recent history of potato production to reduce disease pressure. Growers also aim to maximize crop yield, in part by optimizing the nitrogen (N) application rate and the form of N applied. Crop response to N rate and form may differ between new fields and fields with a history of potato production (old fields).

OBJECTIVES

Evaluate the responses of Russet Burbank potatoes to nitrogen (N) source and rate in new and old potato fields near Park Rapids, MN, in 2013 and 2014.

METHODS

This study was conducted on a Verndale soil series (Table 1).

Site: Park Rapids, MN
Years: 2013 and 2014
Baseline N rate: 115 kg ha^{-1} applied at planting

ESN (Environmentally Smart Nitrogen, a polymer-coated urea) application rates at emergence:
- 0 kg N ha^{-1}
- 90 kg N ha^{-1}
- 135 kg N ha^{-1}
- 180 kg N ha^{-1}
- 225 kg N ha^{-1}
- 270 kg N ha^{-1}

Sources of N applied at 135 kg N ha^{-1}:
- ESN
- Uncoated urea
- Amonium Sulfate
- ESN + Duration (a slower-release PCU)

Different pairs of fields were used each year (Figure 1).

Figure 1. New and Old field in Park Rapids, MN. Mid-season. Aerial Photo. 2013

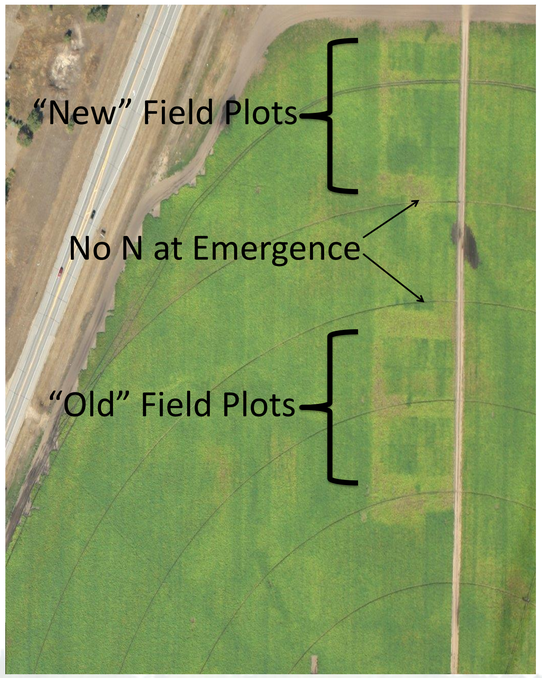


Table1. Initial soil characteristics

	Field	OM (%)	pH	CEC	P (ppm)	K (ppm)	Soil Type
2013	New	1.7	6.1	9	120	162	Loamy sand
	Old	0.7	5.9	5.2	115	125	Sand
2014	New	1.5	6.0	8.3	24	86	Sand
	Old	1.2	6.2	6.4	65	153	Sand

RESULTS

Figure 2. Marketable yield affected by N rates- 2013 and 2014.

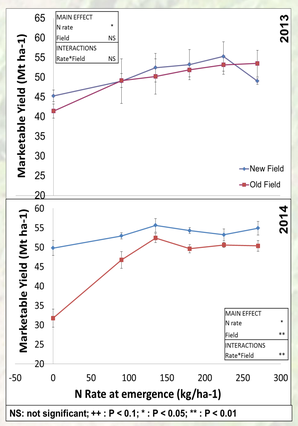
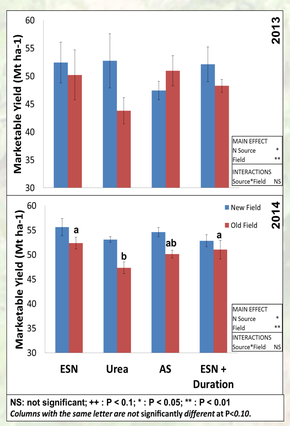


Figure 3. Marketable yield affected by N sources- 2013 and 2014.



RESULTS

Figure 4. N rate by field interaction-2013 and 2014.

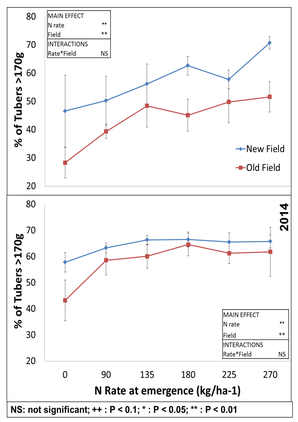


Figure 5. N source by field interaction-2013 and 2014.

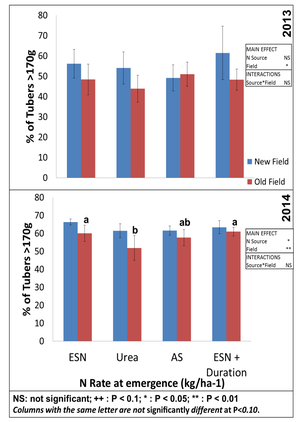


Figure 6. Petiole NO3-N concentration affected by Rates- 2013 and 2014.

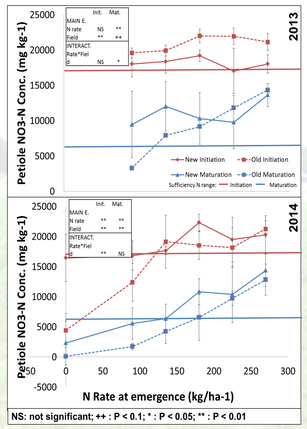


Figure 7. Petiole NO3-N concentration affected by N source- 2013 and 2014.

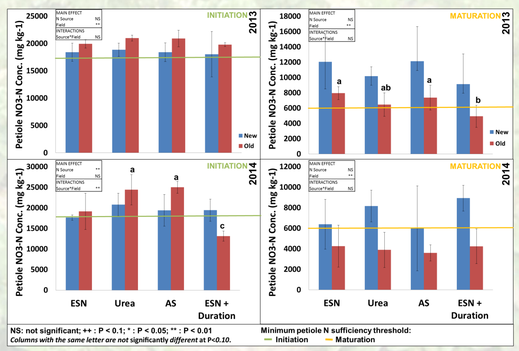


Table 2. *Verticilium dahliae* propagules/gram (VPPG) in New and Old fields.

	New VPPG	Old VPPG
2013	0.1	6.2
2014	0	22

SUMMARY AND CONCLUSIONS

Yield did not respond to N application rates above 90 kg ha^{-1} at emergence in 2013, or above 135 kg ha^{-1} in 2014, in either field (Figure 2).

In 2014, marketable yields in the old field responded more to N application rate than those in the new field at rates below 135 kg N ha^{-1} as ESN (Figure 2).

ESN significantly increased tuber yield in the 2014 old field compared with uncoated urea. (Figure 3).

The proportion of yield represented by tubers over 170 g increased with emergence N application rate to at least 270 kg ha^{-1} in 2013, but peaked or plateaued at lower rates (90 to 180 kg ha^{-1}) in 2014 (Figure 4).

The proportion of yield represented by tubers over 170 g was lower in plots fertilized with urea than other N sources in old fields in 2014 (Figure 5).

Petiole NO_3-N increased with N application rate and decreased over time (Figure 6).

At tuber maturation in 2013 and tuber initiation in 2014, the old field exhibited a stronger petiole NO_3-N response to N application rate than the new field (Figure 6).

Treatments receiving urea or ammonium sulfate had relatively high petiole NO_3-N at tuber initiation in 2013, but this was no longer the case at tuber maturation (Figure 7).

Soil *Verticillium* propagules were detected in the old fields in both years, with the 2014 concentration well above the treatment threshold. In the new fields, propagules were present in very low concentrations in 2013 and not detected in 2014 (Table 2).

These results suggest that utilizing a new field reduces disease pressure. New fields may also have higher baseline soil N.

Acknowledgements

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