Rescue nitrogen applications on poorly nodulated soybeans in Manitoba

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Background

In spite of improved soybean inoculation systems, nodulation failure still occurs each year in Manitoba. Possible reasons for nodulation failures are: acidic soil, cold, saturated soils, excessively dry soil, Iron deficiency chlorosis (IDC), high soil nitrate levels.

Past studies in Manitoba[1] suggest an application of 50-100 lb N/ac at pod filling to salvage yields in such impaired situations.

In order to fine tune this guideline, fields with less than adequate nodulation were sought out in 2014 and these treatments applied.

Method

Fields near Lettelier, Holland and Roseisle were identified in late July due to reduced growth and yellow colour (Figures 1-3)

Figure 1. Letellier plot area with narrow strip of better nodulated soybeans in background on higher ground.

Figure 2. Holland site with flooded soybean plot area in foreground and unflooded soybeans upslope. (inset of plant comparison)

Figure 3. Roseisle site.

Investigation of the nodulation failures and severity.

The cause of poor nodulation at Holland was due to temporary flooding by the Assiniboine River.

Cause of nodulation failure at other 2 sites were not apparent based on field practices and soil tests (Table 1) for acidity, soil nitrate-N or the IDC risk factors of salts and CCE. Spring soil tests at the Roseisle site were moderately high at 62 lb nitrate-N/ac. June rainfall was 50 -130% above normal at these sites and higher areas of the fields were better nodulated. Both were virgin fields, wholly dependent upon on seed inoculation for nodule development.

Table 1. Field history and late July soil analysis.

	Letellier	Holland	Roseisle
Variety	Richer	900Y61	P008T22R2
Inoculation	2 x liquid	Liquid + granular	2 x liquid
Years soybean	1st yr	2nd yr	1st Yr
Soil	Dencross clay	Mowbray loam	Almasippi loamy sand
Soil nitrate-N lb/ac 0-24”	35	24	19
OM%	5.7%	5.9%	4.7%
Soil pH	8.2	7.9	8.7
CCE%	5.2% (M)	0.4%	4.0%
Salts mmho/cm	0.6 (M)	0.36 (L)	0.35 (L)

Severity of nitrogen deficiency was measured several ways (Table 2) including a Smartphone app for chlorophyll content (Figure 4) and pocket GreenSeeker for biomass or NDVI (Figure 5).

Figure 4. Using the FIELDSCOUT Greenindex to determine leaf colour.

Figure 5. Using the pocket GreenSeeker for NDVI.

Table 2. Observations of poor versus well nodulated areas of the field (values from good areas in brackets).

	Letellier	Holland	Roseisle
Leaf colour (SPAD chlorophyll)	30.7 (43.9)	28.9 (40.2)	36.7 (38.6)
Leaf N content (%)	3.7% L (5.4%S)	2.5% D (4.8%S)	3.7% L (4.5%S)
Plant height ”	18.2” (20”)	20.9” (30.1”)	14.6” 20.3”
Nodules / plant	4.6 (25)	13.4 (46.4)	1.5 (43.3)
GreenSeeker NDVI on Sept.2	0.67 (0.82)		

.The grower at Letellier applied dribbled UAN @ 50 lb N/ac prior to our visit which caused obvious leaf burn, especially in overlapped areas (Figure 5).

Figure 5. Leaf burn in UAN overlaps.

Rescue treatment

Nitrogen at 50 and 100 lb N/ac was applied as Agrotain treated urea at Letellier at the R3 stage on July 28 and the R5 stage on August 7. A single application was made on July 30 at R3-4 at Holland and Roseisle.

Treatments were replicated 3-4 times in a RCBD.

Figure 6. Colour and growth differences in Letellier plots in early September..

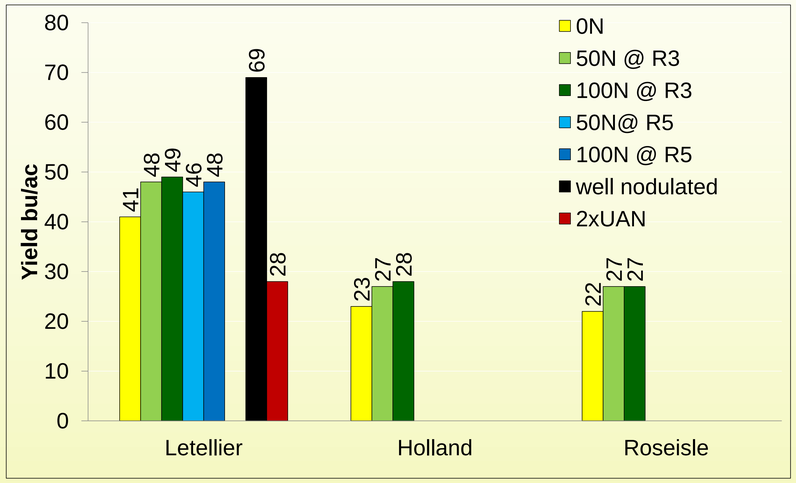

Figure 7. Soybean yield response to rescue N applications.

Yield response to applied N was consistent but slight and was significantly greater than the check at the Roseisle and Letellier sites (Figure 7). There was no advantage to using the higher N rate.

Reasons for slight response are:

•Little rain was received in the 19 days after N applications (general rains of 15-30 mm between August 18-19). Early lack of rain may have led to N losses, stranding of N at the soil surface and minimized crop response to N.

•Yield potential at Holland was reduced by a September frost.

•The slightly higher ground at Letellier had much greater growth and nodulation and yielded very high in comparison (Table 2 and Figure 7). The leaf injury from overlapped UAN reduced yields (Figure 5 and 7).

Summary

In spite of reduced nodulation, response to rescue N applications was slight, probably because timely rainfall did not occur to incorporate fertilizer and allow the crop to make use of the N.

If growers make rescue N applications they should minimize leaf coverage. with UAN solution or apply granular N sources.

The 2 x rate of the on-seed liquid inoculant appeared inadequate for successful nodulation under adverse conditions. A combination of granular and on-seed inoculant is suggested for first year fields.

References

[1] Heard et al. 2012. Rescue applications of N for non-nodulated soybeans http://www.umanitoba.ca/faculties/afs/agronomists_conf/media/Heard_Rescue_N_applications_poster.pdf