

Soil Nitrate Concerns for Pulse and Soybean Crops



Good nodulation is critical to produce good yields of pulse and soybean crops. Occasionally Manitoba soils will have high residual nitrogen (N) levels that will affect normal nodulations.

The question that many farmers and industry people are asking, is how do peas and soybeans handle the high nitrogen levels, and what will the effect be on nodulation in these crops?

There are 3 main reasons for higher nitrate levels:

- less crop uptake and removal
- some crops being terminated early and reseeded, but they did not germinate
- few losses to leaching and denitrification in dry conditions

Soybeans

High nitrate levels can be an asset for high N- use crops and a nuisance for N fixing crops. During the 2000s, when soybeans were introduced across Manitoba, high nitrate levels played havoc with good nodulation of first-time soybean fields. Based on field observations and a handful of studies, a loose rule of thumb was developed to avoid growing soybeans if nitrate levels exceeded 60-70 lbs N/ac.

As soybeans were grown more frequently, and background soil levels of rhizobium built up, this rule of thumb became less and less relevant. Research funded by the Manitoba Pulse and Soybean Growers indicated that growers should target a minimum of 10 nodules per plant. A few field studies indicated that high N levels reduced nodule numbers on virgin fields below the 10 per

plant target. On experienced fields, although high N levels reduced nodule numbers, the number of nodules usually exceeded the 10 per plant target (Heard et al. 2013). In the worst-case treatment of 100 lbs N/ac as urea, soil nitrate levels averaged 110 lbs N/ac or 70 lbs more than the check. In this instance, first-time soybeans and 4/8 experienced soybeans had less than 10 nodules.

Soybeans do use and need some soil nitrate to get established. We measured that some 50 lbs N/ac is taken up by the vegetative plant in the spring prior to N fixation, which then produces the last 150-200 lbs N/ac needed by the crop. The problem is when soil nitrate is high enough to inhibit nodulation, but insufficient to meet the whole yield potential of the crop.

Field Peas

Field peas have a much longer history in Manitoba than soybeans, and the rhizobia bacteria are naturally found in the soil across western Canada. From past work done on peas and nodulation, a rule of thumb is that 50 lbs of residual nitrogen is the most you want to see when growing peas. The in-furrow granular formation would be available much later in the growing season.

A study in Saskatchewan on lentils with high nitrogen levels (Bremer et al. 1988) found there was little impact on yield at the high nitrogen rate of 80 lbs/acre as long as inoculant was used. This could be used as a guideline for peas. Although not directly tested on peas, it would lead one to believe the results would be similar.

If nitrogen is higher than 100 lbs/ac, one would expect to see reduced nodulation, but the field peas would still grow and have respectable yields given good growing conditions. If N levels are well above 100 lbs/acre, the first choice would be to change to a crop that would benefit from high N levels, such as a cereal or canola. If a grower decides to plant peas on a field with high residual N we suggest assessing nodulation at the 6-9th node stage or at R1 (flower bud) to capture peak nodulation. There are no rescue treatments if nodulation fails, but it would allow a producer to get a good handle on the level of nodulation.

If your soil test indicates high nitrogen levels and you are thinking about growing peas or soybeans, consider the following when making the decision:

References

- Bremer, E., Rennie, R.J., and Rennie, D.A. 1988. Dinitrogen fixation of lentil, field pea and fababean under dryland conditions. *Can. J. Soil Sci.* 68: 553-562.
- Heard, J., Lee, J., and Tone, R. 2013. Nitrogen and soybeans: Friends, foes or just wasted fertility? Available: https://umanitoba.ca/faculties/afs/agronomists_conf/media/2013_Heard_N_on_soybeans_friend_foe_or_waste_Dec_3_final.pdf

- Consider a high N use crop like wheat, canola or corn. If drought led to high nitrogen levels in the soil, it probably also increased risk of herbicide residues, and these need to be respected.
- Consider soybeans or peas if there has been a recent history of well-nodulated crops. Fields with a history of peas and soybeans are less likely to have nodulation failures when the same crop type is grown than fields without a history of these crops.
- Inoculate with liquid on seed as well as a granular or liquid sideband since it is available later in the season.
- Grow iron deficiency chlorosis (IDC) tolerant soybean varieties. High nitrate levels are one of the risk factors, besides salinity and free lime or calcium carbonate that lead to IDC in soybeans.
- If there is a volunteer crop, regrowth or cover crops, let them keep growing. These can decrease soil nitrate levels (in studies up to 50 lbs/ac) and they do not tend to provide all the N back to the following crop.
- Retest soils in the spring. Nitrate levels can decline if we have surplus fall and spring moisture resulting in leaching in sandy soils or denitrification in saturated soils.

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