

# Inoculant FAQs: Soybean

## What is an inoculant?

Inoculants contain live rhizobia bacteria that are needed to form root nodules on legume plants. These root nodules fix atmospheric nitrogen and transfer nitrogen to the plant, in return the plant supplies energy to the bacteria. This symbiotic nitrogen fixation is an essential process for good legume production.

## What are the different kinds of inoculants?

Legume inoculants are generally available in liquid, powdered, and granular formulations. Selection of the best formulation depends on the type of legume crop and agronomic practices.

## Do I need different inoculants for different crops?

Yes, although all inoculants contain live rhizobia, different crops require different rhizobia. For instance, soybeans need *Bradyrhizobium japonicum* bacteria to form nodules, while peas need *Rhizobium leguminosarum* bacteria. While different legumes often need different species of rhizobia to form nodules, there are some exceptions, e.g., peas, lentils, and faba beans associate with the same species of rhizobia.

## How do I know if my inoculant is working?

Approximately 4-6 weeks after planting, carefully dig out a plant with the roots and surrounding soil. Gently wash or break away the soil to reveal the nodules adhered to the roots of the plant. Slice them open and they should be pink in colour, indicating that the process of nitrogen-fixation is being carried out by the rhizobia.

## Where do I look for nodules?

With seed treatment inoculant application, nodules are more prevalent at the crown and with in-furrow inoculant application, nodules are more prevalent on the lateral roots.

## Why are some nodules not pink inside?

Young nodules, not yet fixing nitrogen, are white or greyish inside. When they are pinkish to red, active nitrogen fixation is taking place and these should be the most abundant during the middle of the growing season. Nodules no longer fixing nitrogen turn green/grey and can be shed from the roots.<sup>1</sup>

## Can soil acidity kill rhizobia?

Yes, rhizobia can die rapidly in soil pH below 5.5.<sup>2</sup>

## Should I inoculate if my soil has high nitrogen levels, ?

It depends, if soil nitrogen levels are high, plants will use this source first, before fixing their own. Application of nitrogen above 55 lbs/ac generally inhibits nodule formation and nitrogen fixation.<sup>2</sup>

## My field has been flooded for more than 3 days, do I need to inoculate?

Yes, anaerobic conditions stress the rhizobia populations and reduce their numbers. Inoculation adds fresh and healthy rhizobia.

## I'm planting soybeans on virgin ground. How can I ensure good nodulation?

Higher rates of inoculant may be beneficial in fields with little or no history, or virgin soil, of any particular legume crop. Some agronomists suggest dual inoculation is very effective in virgin ground.



For further information, visit [www.xitebio.ca](http://www.xitebio.ca) or call us toll-free: 1-855-XITEBIO (1-855-948-3246)  
XiteBio® is a registered trademark of XiteBio Technologies Inc.

## When is dual inoculation a good idea?

In general, dual inoculation is the application of both a liquid inoculant on-seed and a liquid or granular inoculant in-furrow. Dual inoculation increases the rhizobia population in virgin and new legume acres. This seems to have a greater effect on soybean crops with the development of new varieties and increasing new acres in Western Canada.<sup>3</sup>

## My legumes don't have any nodules. Is there anything that can be done?

In the event of a light green, slow-growing crop with no nodules some options may be available. These include reseeding the crop, if it is still early enough in the season, with the correct rhizobia at higher concentrations.<sup>1</sup> Also, according to Michigan State University, the application of 60-70 lbs N/ac between the R1 and R2 stages can improve plant growth<sup>4</sup>, though this will inhibit further nodule development and nitrogen fixation. Thus, the economics of such a decision are difficult to evaluate.<sup>5</sup>

## I used an inoculant, but the plants have no nodules. What may be the cause?

Various studies show that there are a variety of reasons why nodules may fail to form following inoculation. These include:

- Low soil pH (<5.5)<sup>2</sup>
- High soil pH (≥8)<sup>4</sup>
- Presence of root diseases<sup>6</sup>
- Cool soil temperatures<sup>5,7</sup>
- Presence of high background levels of N<sup>4</sup>
- N applied beyond any starter N application<sup>2,4</sup>
- Saline soils<sup>6,8</sup>
- Nutrient deficiency or toxicity, including phosphorous, potassium, iron, molybdenum, manganese, calcium, and zinc<sup>6</sup>
- Failure to follow all label directions, including proper storage conditions, application directions, length of time between inoculation & treating and planting<sup>4,6</sup>, and awareness of seed treatment/pesticide combination compatibility<sup>8</sup>

**DISCLAIMER:** The above is provided for information only and based on the references cited below. Always check with your local agronomist to confirm appropriate measures for specific crops & each unique situation in the field, and specific recommendations for local growing conditions.

## References

- <sup>1</sup> Lindeman WC, Glover CR. 2015. Nitrogen Fixation by legumes. Guide A-129, Revised June 2015. New Mexico State University, USA. Available on-line at [http://aces.nmsu.edu/pubs/\\_a/A129](http://aces.nmsu.edu/pubs/_a/A129). Accessed 6 Aug 2015.
- <sup>2</sup> Bjederbeck VO, Bjorge HA, Brandt SA, Henry JL, Hultgreen GE, Kielly GA, Slindard AE. 2005. Soil improvements with legumes. Ed: BJ Green, VO Bjederbeck. Government of Saskatchewan. Available on-line at: <http://www.agriculture.gov.sk.ca/Default.aspx?DN=4b50acd7-fb26-49a9-a31c-829f38598d7e>. Accessed 18 Aug 2015.
- <sup>3</sup> Quarry Seed. 2014. Inoculant and seed treatment trial. 2014 Oakville, MB Summary Report. Quarry Seed, Stonewall MB.
- <sup>4</sup> Staton M. 2014. Identifying and responding to soybean inoculation failures. Michigan State University. Published 4 Feb 2014. Available online at: [http://msue.anr.msu.edu/news/identifying\\_and\\_responding\\_to\\_soybean\\_inoculation\\_failures](http://msue.anr.msu.edu/news/identifying_and_responding_to_soybean_inoculation_failures). Accessed 24 July 2015.
- <sup>5</sup> Conley S. 2015. Non-nodulating soybean questions. Agri-View Briefs. Published 23 July 2015. Available online at: [http://www.agrview.com/briefs/crop/non-nodulating-soybean-questions/article\\_9b2f79e6-dd9d-5277-b414-4e80a63fd84f.html](http://www.agrview.com/briefs/crop/non-nodulating-soybean-questions/article_9b2f79e6-dd9d-5277-b414-4e80a63fd84f.html). Accessed 24 July 2015.
- <sup>6</sup> Epp M. 2015. Why nodulation fails. Grainews. Published 26 March 2015. Available online at: <http://www.grainews.ca/2015/03/26/why-nodulation-fails/>. Accessed 24 July 2015.
- <sup>7</sup> Bohner H. 2014. Cold temperatures hamper soybean nodulation. Ontario Ministry of Agriculture, Food and Rural Affairs. Published 2 Sept 2014. Available online at: <http://www.omafra.gov.on.ca/english/crops/field/news/croptalk/2014/ct-0914a4.htm>. Accessed 24 July 2015.
- <sup>8</sup> Panwar JDS, Laxmi V. 2005. Biological Nitrogen Fixation in Pulses and Cereals. In: Developments in Physiology, Biochemistry and Molecular Biology of Plants Volume 1. Eds.: B Base, A Hemantaranjan. New India Publishing Agency, New Delhi, India. pp.125-158.



For further information, visit [www.xitebio.ca](http://www.xitebio.ca) or call us toll-free: 1-855-XITEBIO (1-855-948-3246)  
XiteBio® is a registered trademark of XiteBio Technologies Inc.