

# Assessing Soybean Inoculant Strategies

Inoculant increased yield, nodule number and seed protein compared to uninoculated soybeans on fields with no history of soybean. Inoculant products, formulations, rates and combinations performed similarly, regardless of field history.

**SELECTING AN APPROPRIATE** soybean inoculant is dependent on field history, equipment availability, inoculant cost and environmental conditions. Seed-applied liquid- and peat-based products are cheap and conveniently applied to the seed. In comparison, in-furrow granular inoculant is more expensive and requires an extra seed cart tank to apply, but it is more resilient to environmental extremes. For first- and second-time soybean fields, a “double inoculation” strategy – use of two inoculant formulations or placements (i.e., seed-applied liquid and in-furrow granular) is recommended to ensure adequate rhizobia populations are introduced to the soil. Increasing the rate of inoculant may also achieve the same result, but double inoculation has the potential added benefit of improved rhizobia survivability. Once several successfully nodulated soybean crops have been established over time, farmers may use the more economical single inoculation strategy. Some inoculant

products are formulated to improve early crop development, plant nutrition or the rate of nodulation. Examples of “enhanced” inoculants tested in this study were Jumpstart® and Tagteam® (with phosphate-solubilizing microorganism, *Penicillium bilaii*), Nodulator® N/T (with plant growth promoting rhizobacteria, *Bacillus subtilis*) and Optimize® (with lipochitooligosaccharide, a signal that initiates nodule development).

This field study was conducted at Melita, Carberry, Carman, Roblin and Beausejour from 2014 to 2016. Fourteen inoculant treatments were compared, including an uninoculated control and different inoculant products (Cell-Tech®, Nodulator®, “enhanced”), formulations (liquid, granular, liquid + granular) and rates (1X, 2X).

Inoculation had important economic implications at the five fields with no history of soybean. On average, inoculant increased the number of nodules per plant by 20, yield by 15 bu/ac and protein by

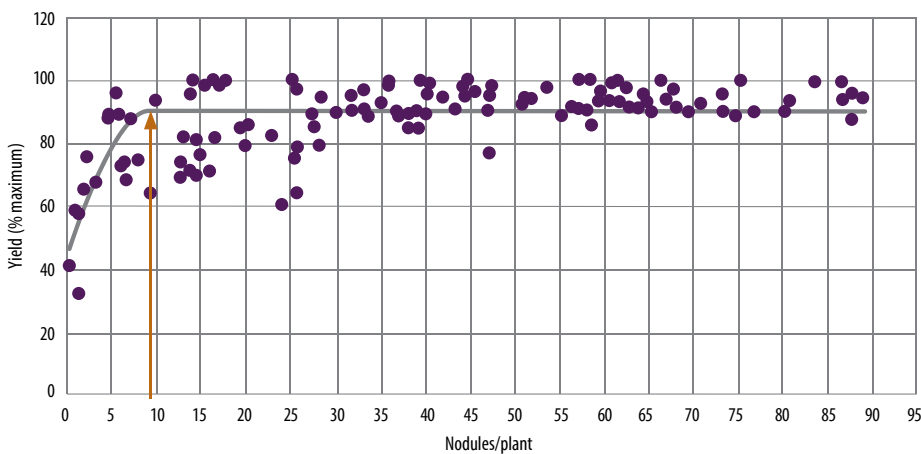
4.8% compared to the uninoculated control. There was no difference in soybean yield, nodulation or protein between individual inoculants, regardless of field history.

Despite the lack of response among inoculant strategies, MPSG still recommends double inoculating fields with a limited history of soybeans and moving to a single inoculation strategy after at least two successfully nodulated soybean crops have been established. There are several possible explanations for the lack of response to double inoculation in this trial, which cannot always be guaranteed under field conditions: 1) soybeans were seeded into ideal soil conditions that were favourable for crop emergence and inoculum survival during late May to early June, 2) inoculants were properly stored, handled and applied, according to label recommendations and 3) there were no inoculant compatibility issues with fungicide and/or insecticide seed treatment, as bare seed was used.

Yield and nodule number were, on average, higher in fields *with* a history of soybeans compared to *no* soybean history (46.4 vs. 39.8 bu/ac, 58 vs. 22 nodules per plant, respectively). However, inoculant had no impact on average seed yield, protein and nodulation in fields *with* a history of soybeans, across four sites.

Regardless of inoculant strategy or field history, nodulation should be assessed in every field, every year. This study found that the minimum number of nodules required to reach 90% of maximum yield was approximately 10 nodules per plant at the R4 stage (Figure 1). Assessing nodulation at R1 allows for rescue nitrogen fertilizer application at the ideal window (R2–R3), ahead of peak soybean N-uptake requirements (R4–R5). ■

Figure 1. Relationship between number of nodules at R4 per soybean plant and relative yield.



**PRINCIPAL INVESTIGATOR** Manitoba Pulse & Soybean Growers

**MPSG INVESTMENT** \$17,920 | **DURATION** 3 years

**ACKNOWLEDGEMENT** Yvonne Lawley (U of M), Scott Chalmers (WADO), Craig Linde (CMCDC), James Frey (PCDF) and Nirmal Hari (PESAI)