

On-Farm Evaluation of Single versus No Inoculation of Soybeans

There was no yield response to single inoculation on fields with a history of at least three, well-nodulated soybean crops with the most recent soybean crop grown in the past four years.

SOYBEANS ACQUIRE BETWEEN 46–74% of their nitrogen (N) through biological N fixation in root nodules. This process takes place due to a symbiotic relationship between the soybean plant and *Bradyrhizobium japonicum*, the bacteria included in soybean inoculant products.

In previous on-farm studies, MPSG has found limited soybean yield response to double inoculation (two formulations or placements of inoculant), compared with single inoculation on fields with at least two years of soybean history. This prompted the question: would inoculation still be necessary when there is a more extensive history of well-nodulated soybean crops?

The objective of this on-farm trial was to quantify the agronomic and economic impacts of seed-applied inoculant versus no inoculant in soybean fields with a history of at least three previous, well-nodulated soybean crops.

Twenty-seven trials were established on soybean production fields in the central, eastern and Interlake regions of Manitoba from 2016 to 2018. Fields had a history of at least three well-nodulated soybean crops and the most recent soybean crop was established in the past four years. Crop rotation, soil characteristics, soil fertility and field equipment varied between trial sites covering a broad range of field characteristics.

There was no significant yield response to a seed-applied, single inoculation treatment compared to an untreated, uninoculated check. Soybean plants were evaluated at R1 (beginning bloom) for nodulation. All plants examined were found to have adequate nodulation, having at least 10 nodules per plant. No visual differences between treatments nor signs of N deficiency were observed.

These research results suggest that soybean inoculation is not needed when

there is a history of at least three well-nodulated soybean crops on a field where soybeans had been grown in the last four years. However, some may choose to continue to utilize a single inoculation strategy on their farm as the cost of a single application of liquid inoculant on seed is relatively inexpensive compared to the risk of a non-nodulated soybean crop.

Factors that may reduce survival of inoculum in the soil should be considered before eliminating inoculation. Risk factors include non-optimal soil pH (less than five or above eight), soils with a high percentage of sand and prolonged water stress (flooding or drought). There are currently no tools available to farmers that estimate residual soil inoculum levels.

A related MPSG-funded research project led by Dr. Ivan Oresnik, at the University of Manitoba, evaluated soil samples taken from these treatments to quantify the population of *B. japonicum* in the soil. The results from this study will contribute to the development of a rapid soil test to determine the levels of *B. japonicum* within a field. With the ability to test bacterial levels, a recommendation could be given on whether the population in the soil is sufficient for good nodulation and whether inoculation would be profitable. ■

Figure 1. Soybean yield difference between single and no inoculation at 27 sites from 2016 to 2018. No significant differences were present between sites.

