

On-Farm Evaluation of Nitrogen Rates in Dry Beans

Not applying nitrogen was the economical decision at four out of five on-farm trials. Dry bean nodulation was excellent in these on-farm trials even though inoculant was not applied.

AS APPLIED SMALL-PLOT research was investigating optimum nitrogen (N) rates, complementary on-farm trials were established to determine the effects of different N fertilizer rates on dry bean nodulation and yield at the field-scale.

From 2019 to 2021, MSPG's On-Farm Network conducted five trials testing a range of N fertilizer rates in non-inoculated dry bean fields. The selected fertilizer rates were specific to each farm, ranging from 0-140 lbs N/ac (Table 1). Residual soil nitrate-N levels ranged from 20-70 lbs N/ac.

At flowering, nodulation was scored on a rating scale where 0 = no nodules, 1 = ≤5 nodules/plant, 2 = 6-10 nodules/plant, 3 = 11-20 nodules/plant and 4 = >20 nodules/plant. Dry beans in these trials were not inoculated, yet they had good to excellent nodulation ratings (>3.5) at all locations where ratings were collected.

Even though inoculation is not common practice for dry beans in Manitoba, native soil rhizobia populations appear to be associating effectively with dry beans. This leads us to question how much biologically fixed N is contributing to dry bean N nutrition. Similar to results from the small-plot research, as the applied N rate increased, nodulation scores decreased by 0.5-2 points in on-farm trials.

Three of the five on-farm trials did not produce a yield response to increasing N rate (Figure 1). At one trial in 2020, yield was reduced at the greatest N rate (105 lbs N/ac applied) which has been attributed to prolonged vegetative growth and delayed maturity. In these four on-farm trials, the most economical decision was to not apply additional N.

In 2021, however, there was a significant yield increase of 151 lbs/ac

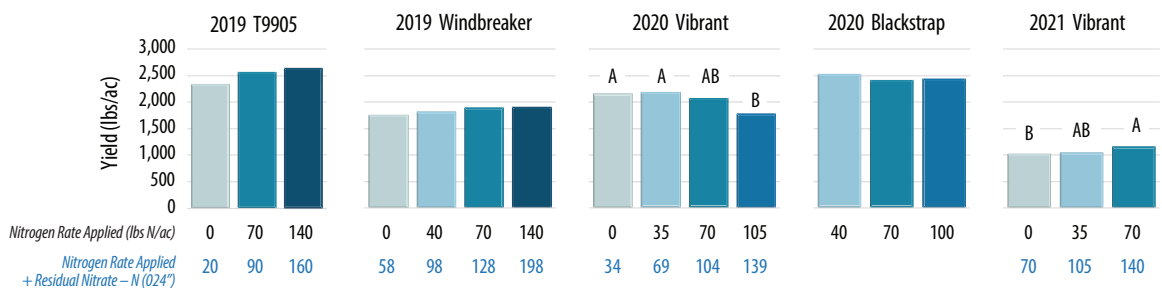
with 70 lbs N/ac applied compared to the 0 N control. This yield response is economical if the cost of N is less than \$1.00/lb and bean prices are more than 50 cents/lb. Nitrate in the top 12" was stable over the growing season at this trial, indicating that there may have been a limited contribution of mineralized-N to dry bean N nutrition. July rainfall was 7% of normal at this location and was expected to have reduced the contribution of mineralized-N, leading to a positive yield response to fertilizer-N.

Farmers are encouraged to dig up their dry bean roots at flowering to evaluate nodulation in their fields. Identifying if nodules are present and actively fixing N (indicated by a pink/red colour inside the nodule) is the first step in making future N management decisions. ▶

Table 1. Descriptions of the five On-Farm Network trials investigating nitrogen fertilizer rates in dry beans.

R.M.	2019		2020		2021
	Norfolk Treherne	Rhineland	Boisevain Morton	Norfolk Treherne	Norfolk Treherne
Variety	T9905	Windbreaker	CDC Blackstrap	Vibrant	Vibrant
Nitrogen rates tested (lbs N/ac)	0, 70, 140	0, 40, 70, 140	40, 70, 100	0, 35, 70, 105	0, 35, 70
Residual nitrate-N (0-24") (lbs N/ac)	20	58	n/a	34	70
Nodulation score in 0 N check strips (0-4 scale)	3.5	3.9	n/a	3.6	4.0
Yield response to fertilizer rate?	No	No	No	Yes, decrease	Yes, increase

Figure 1. Dry bean yield response to nitrogen fertilizer rates at five On-Farm Network trials.



Within each on-farm trial, bars with different letters are statistically different at p < 0.05.

PRINCIPAL INVESTIGATOR Manitoba Pulse & Soybean Growers On-Farm Network

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DURATION 3 years