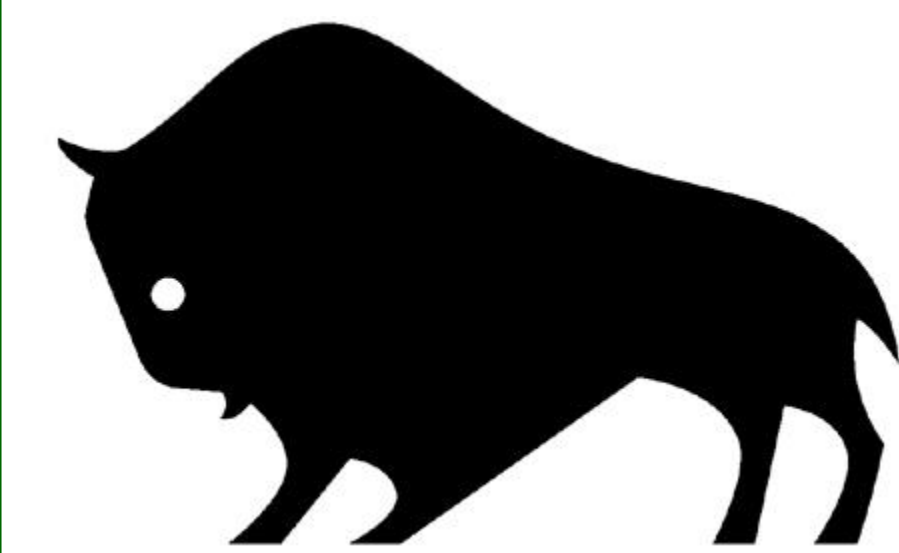


# Flawed vs. Sound On-Farm Tests: Simulated Testing of Crop Nutrition Products

John Heard<sup>1</sup>, Marla Riekman<sup>1</sup> and Megan Bourns<sup>2</sup>

<sup>1</sup>Manitoba Agriculture and Resource Development, <sup>2</sup>Manitoba Pulse and Soybean Growers



## Evaluating Products with Limited Performance Data

There is limited unbiased third party testing of new nutritional or growth promoting products being marketed to farmers. It may be up to crop advisers to coach farmers on doing effective evaluations on their own. Guidance on such testing is available in "Protocols for Field-Scale Assessments of Biofertilizers and Biostimulants Applied to Enhance Nutrient Use Efficiency of Grain Crops."<sup>1</sup>

At the 2019 Manitoba Crop Diagnostic School, a number of products were tested in "simulated on-farm-tests" using 100' long strips, incorporating several flaws to challenge the participants in evaluating well vs. poorly done tests.

## Biofertilizer Evaluation

A biofertilizer (BF) is a formulated product containing one or more microorganisms that may enhance the nutrient status (and growth and/or yield) of plants by either replacing soil nutrients and/or making nutrients more available to plants and/or increasing plant access to nutrients. For the demo, a BF was used that claims to replace a portion of recommended nitrogen (N) fertilizer. The standard treatments are the grower's normal practice (GNP following best management practices) vs. the BF at 70% the GNP N rate.

Replicate 1		Replicate 2		Replicate 3		Replicate 4	
101	102	201	202	301	302	401	402
GNP	70% GNP & BF	GNP	70% GNP & BF	GNP	70% GNP & BF	GNP	70% GNP & BF
100 lb N/ac	70 lb N/ac	100 lb N/ac	70 lb N/ac	100 lb N/ac	70 lb N/ac	100 lb N/ac	70 lb N/ac



Figures 1 and 2. Plot layout (left) and strip harvest with plot combine (above).

Field observations and results were analysed using the IHARF On-Farm-Research Data Analysis Tool (V1.1)<sup>2</sup> (right) and summarized in Table 1.

Notes: GNP was treatment 1, 70% N and BF was treatment 2.

Table 1. Summarized results for the Biofertilizer (ns = not statistically significant).

	NDVI	SPAD	Stand #/m	Yield bu/ac	Protein %
A = 100 lb N/ac	54	31	33	41.6	16.7
B = 70 lb N/ac & BF	47	29	29	43.6	16.4
Significance	ns	ns	ns	ns	ns

**Conclusion: The BF works – it produced similar yield at 30% less nitrogen. Or did it???**

- Was 70 lb N/ac & soil test N (57 lb N/ac in 0-24") already sufficient for medium yield potential? - see high protein values
- Did modest yields produced due to weak crop husbandry (seeding May 29 and delayed harvest) mask differences?
- Treatments were not randomized on a sloping field
- Large edge effect producing high yields (strips 101 and 402)

## Biostimulant Evaluation

A plant biostimulant (BS) is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrient content. For the demo, a BS was used that claims to increase nutrient efficiency and uptake from applied phosphorus (P) fertilizer, producing denser stands and faster emergence. The standard treatments are the GNP vs. the BS at 70% the GNP P rate vs. 70% the GNP P rate alone.

Replicate 1			Replicate 2			Replicate 3			Replicate 4		
101	102	103	201	202	203	301	302	303	401	402	403
A	B	C	B	C	A	C	A	B	B	A	C
GNP	BS		BS		GNP		GNP	BS	BS	GNP	
50 lb P <sub>2</sub> O <sub>5</sub> /ac	35 lb P <sub>2</sub> O <sub>5</sub> /ac	35 lb P <sub>2</sub> O <sub>5</sub> /ac	35 lb P <sub>2</sub> O <sub>5</sub> /ac	35 lb P <sub>2</sub> O <sub>5</sub> /ac	50 lb P <sub>2</sub> O <sub>5</sub> /ac	35 lb P <sub>2</sub> O <sub>5</sub> /ac	50 lb P <sub>2</sub> O <sub>5</sub> /ac	35 lb P <sub>2</sub> O <sub>5</sub> /ac	35 lb P <sub>2</sub> O <sub>5</sub> /ac	50 lb P <sub>2</sub> O <sub>5</sub> /ac	35 lb P <sub>2</sub> O <sub>5</sub> /ac



Figures 3 and 4. Plot layout (above) and sprayer wheel track lengthwise through one of strips (left).

Table 2. Summarized results for the Biostimulant.

	NDVI early	SPAD	NDVI late	Stand #/m	Yield bu/ac
A = 50 lb P <sub>2</sub> O <sub>5</sub> /ac GNP	51 ab	32	77	32	41.9
B = 35 lb P <sub>2</sub> O <sub>5</sub> /ac & BS	48 b	33	78	30	41.2
C = 35 lb P <sub>2</sub> O <sub>5</sub> /ac	54 a	31	79	32	39.9
Significance	Pr>F 0.009	ns	ns	ns	ns

**Conclusion: The Biostimulant (BS) with a lower rate of P produced similar yields as the high P rate (A). But so did the low rate of P alone.**

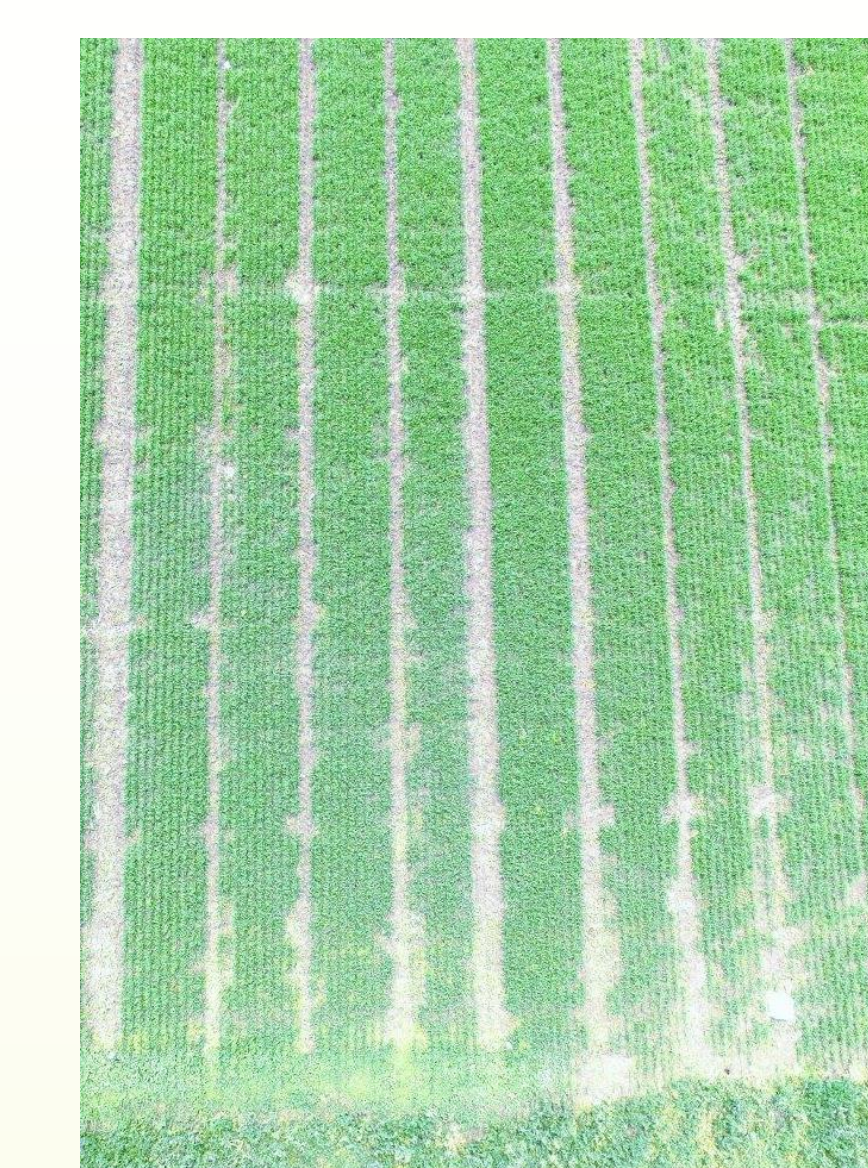
- On this soil (STP = 9 ppm), 35 lb P<sub>2</sub>O<sub>5</sub>/ac was probably sufficient for good yield response in the short term. A 0 P rate strip or cell would have added value.
- Stands were similar in population (#/m) but significantly LESS dense with the BS based on early season NDVI.
- Including lengthwise sprayer wheel tracks in the harvest strip increases variability in OFT, shown to reduce strip yields some 5-15% with a 35-36' header in MB wheat tests.<sup>3</sup>



Figure 5. Crop Diagnostic School participants are briefed on tests before finding the flaws.

## Novel Fertilizer Evaluation

A novel fertilizer (NF) formulation may include compound fertilizers (with each granule having the same analysis) or coated fertilizers (with inhibitors, slow release coatings or micronutrients). For the demo, a NF formulation was applied to meet copper micronutrient needs of the wheat crop. The standard treatments are the GNP vs. the GNP plus the NF.



Replicate 1		Replicate 2		Replicate 3		Replicate 4	
101	102	201	202	301	302	401	402
GNP	NF	NF	GNP	GNP	NF	NF	GNP

Figures 6 and 7. Aerial image (left) and plot layout (above).

Table 3. Soil test analysis contrasting slope positions of the test.

Slope	N lb/ac	P ppm	K ppm	S lb/ac	Cu ppm	Zn ppm	Mn ppm	B ppm	OM %	pH
Eroded upper	93	7	232	94	0.31	1.01	2.5	0.6	4.9	7.7
Lower	70	19	251	76	0.41	2.52	1.8	0.6	5.9	7.0

Table 4. Summarized results for the Novel Fertilizer.

	NDVI	SPAD	Tissue Cu ppm	Yield bu/ac Eroded upper	Yield bu/ac Lower
A = GNP	51	32	4.8	50.8	51.2
B = NF	46	30	4.0	46.4	48.2
Significance	ns	ns	ns	ns	ns

**Conclusion: The Novel formulation did not correct the micronutrient deficiency...OR Did a even deficiency exist?**

- Soil and tissue levels were low but not deficient. Visual deficiencies were not seen. A rate of a conventional micronutrient treatment should have been included.

## Summary:

To properly conduct product comparisons with OFT, one requires:

- a responsive site – use soil testing or past history or rotation
- appropriate treatments – low enough that high fertilizer rates do not mask true efficiencies.
- high yield production practices for full yield expression (timely seeding top varieties and pest management)
- appropriate in-season observations to help explain results – rainfall, images, tissue tests, ratings, etc.
- Other needs?

Note – the yield variability in this simulation was more than that commonly found in well conducted on-farm-tests.

## References:

- [https://nutrientstar.org/wp-content/uploads/2019/04/Protocols\\_field\\_scale\\_biological\\_evaluations.pdf](https://nutrientstar.org/wp-content/uploads/2019/04/Protocols_field_scale_biological_evaluations.pdf)
- <https://iharf.ca/on-farm-tool/>
- <https://mbwheatandbarley.ca/wp-content/uploads/2019/04/OFT-summary-2017-FINAL.pdf>