

Assessment of Soil Rejuvenation, Seed Germination and Foliar Fertilizer Products for Barley Forage and Grain Yield Improvement

By Akim Omokanye, PCBFA

For optimal growth, plants need a diversity of nutrients. Enhanced microbial activity in the soil will lead to healthier and more fertile soil. Plants that grow out of the healthier soil tend to have more branching and tillering (with more plant mass), better root systems, better lodging resistance because of superior stems, earlier and/or longer flowering, more heads, higher brix in plants and better quality of grain. Crop nutrients can be provided through different nutrient application methods, including nutrient seed priming and foliar fertilizer application of nutrients. Foliar fertilizer applications produce quick results and are easy to incorporate with traditional spray programs. The Best Farming Systems' Soil Rejuvenation, Seed Germination and Foliar Fertilizer products are custom blend formulations that are respectively applied to soil, seed and plants

Objectives

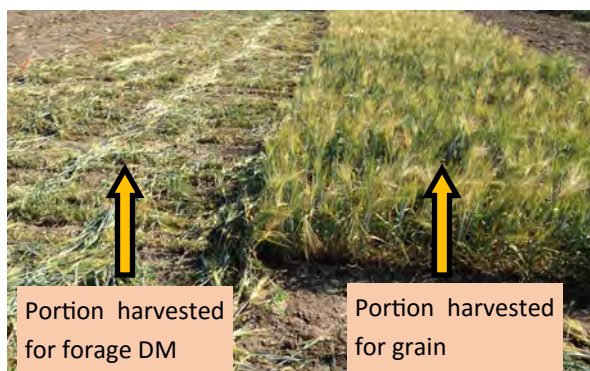
- ◆ To test different Best Farming Systems products on barley grain & forage yield, and their quality
- ◆ To monitor soil nutrient, quality and microbiological changes
- ◆ To examine the cost-benefit ratios of different treatments tested

Methods

A small plot field trial was carried out at Fairview Research Farm (NW5-82-3W6) on RR #35, MD of Fairview in 2015 by Peace Country Beef & Forage Association (PCBFA) in collaboration with Best Farming Systems.

A randomized complete block design (RCBD) with four (4) replications was used in small plots. Eight (8) treatments consisting of the following were studied for their effects on barley grain and forage production and quality:

1. Soil Rejuvenation (SR)
2. Foliar Fertilizer (FF)
3. Seed Germination (SG)
4. SR+FF
5. SR+SG
6. FF+SG
7. All Best Products (1, 2 & 3)
8. Check



Depending on the products, the blends may contain some of the following nutrients: N, P, K, S, Mg, Fe, Cu, Zn, Mo, Mn and B (See Table 1). For more information on Best Farming Systems products, please visit <http://www.bestfarmingsystems.com/>

	N	P	K	S	Mg	Ca
Product		(P ₂ O ₅)	(K ₂ O)			
Soil Rejuvenation (SR)	2.0	1.0	-	2.0	0.01	-
Foliar Fertilizer (FF, 5-12-4)	5.0	12.0	4.0	2.0	1.0	-
Seed Germination (SG)	3.0	9.0	1.0	0.11	-	0.01

Sundre barley variety (6-rowed, smooth-awned, hulled feed type) was seeded on May 25 at 25.9 plants/ft² (or 114 lb/acre) using a 6-row Fabro plot drill at 9" row spacing. A uniform amount of fertilizer blend (lbs/acre: 200 N + 96 P + 62 K + 75 S) was applied to all plots at seeding (regardless of treatments imposed) following soil test (0-6" depth) recommendation for barley by Exova laboratory.

Application rates, methods and timing:

- ◆ SR was sprayed twice: 100 ml/acre sprayed in the burn off and 100 ml/acre sprayed with the in crop spraying of 0.44 L/ha Prestige A + 1.98 L/ha Prestige B.
- ◆ SG (pre-seeding seed treatment) was used to treat seed at 150 ml/acre before seeding
- ◆ FF was sprayed twice @1.5 L/acre, first at the 3 - 4 leaf stage and again at the soft dough stage.

Measurements - Plant stand was visually inspected in all plots to assess adequacy of crop emergence 4 weeks after seeding. Each plot was examined for plant lodging. Harvesting was done at the soft-dough stage on August 6. About 0.5 kg sub-sample was dried to constant weight for forage dry matter (DM) yield estimation and nutritive analyses. Forage samples were analyzed by Central Testing Laboratory Limited, Winnipeg, using standard methods for wet chemistry. The forage nutritive values (reported on a dry matter basis) were determined using two dry samples per treatment, composites from replications 1 & 3, and replications 2 & 4.

A total of 4.32 inches (109.73 mm) of rain was received from seeding (May 25) to forage harvest (August 6).

Results

Forage Moisture, Yield and Quality

The results showed that forage moisture content at harvest (soft-dough stage) for silage/greenfeed was significantly different for the treatments. The forage moisture content was highest (57.0%) for treatment consisting of a combination of all Best products (SR+FF+SG) and check, while treatment with SG appeared to have the lowest moisture (54.5%, see Table 2). The generally low moisture content for all treatments at the soft-dough stage could be attributed to moisture situation in Fairview in 2015, as the year was very dry.

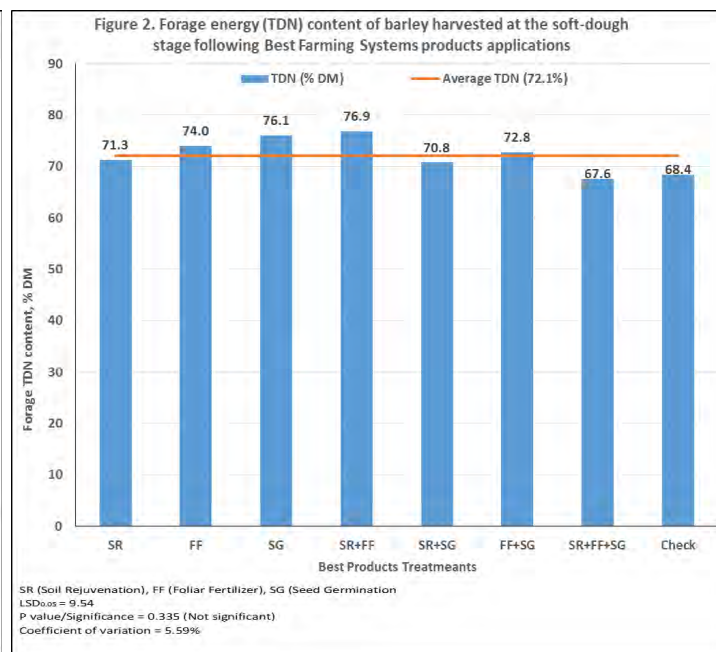
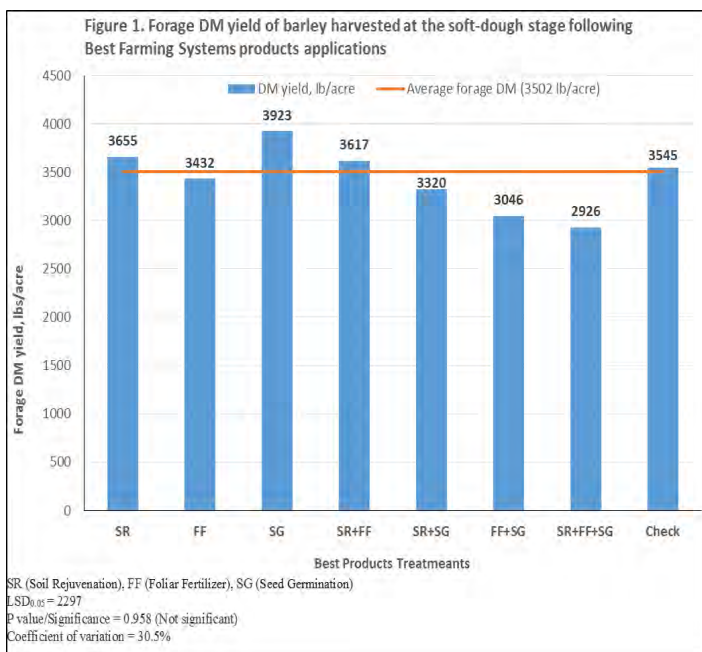
The forage DM yields from all treatments were statistically similar, varying from 2926 lb/acre for SR+FF+SG treatment to 3923 lb/acre for SG treatment (see Figure 1). Only treatments SR, SG and SR+FF appeared to have slight forage DM yield advantage of 72-378 lb DM/acre over check.

Forage Protein and Macro-mineral Content

The forage protein (CP) content as well as all measured macro-minerals (Ca, P, Mg, K and Na) were statistically similar for all treatments. However, forage CP and P content appeared to be favoured by treatments with Best products (11.8-12.8% CP, 0.18-0.22% P) than treatment without Best product (check, 10.1% CP, 0.14% P) (see Table 2).

Table 2. Forage Moisture, protein and mineral content with and without Best Farming Systems Products (* indicates significant at $P < 0.05$; ns indicates not significant at $P < 0.05$)

Best Product Treatment	Moisture (%)	CP (%)	Ca (%)	P (%)	Mg (%)	K (%)	Na (%)
Soil Rejuvenation (SR)	56.6	12.8	0.41	0.18	0.25	1.16	0.25
Foliar Fertilizer (FF)	55.6	12.8	0.39	0.19	0.25	1.29	0.13
Seed Germination (SG)	54.5	12.7	0.30	0.19	0.20	1.45	0.10
SR+FF	55.7	12.6	0.39	0.22	0.25	1.11	0.11
SR+SG	56.9	11.8	0.43	0.19	0.27	1.15	0.18
FF+SG	55.0	12.3	0.43	0.20	0.23	1.53	0.06
SR+FF+SG	57.0	12.2	0.53	0.18	0.27	1.33	0.20
Check (Control)	57.0	10.1	0.40	0.14	0.26	1.30	0.22
<i>Mean</i>	55.7	12.2	0.41	0.18	0.25	1.29	0.16
<i>LSD_{0.05}</i>	1.75	3.47	0.19	0.07	0.07	0.86	0.14
<i>P value/Significance</i>	0.017*	0.649 ^{ns}	0.416 ^{ns}	0.331 ^{ns}	0.451 ^{ns}	0.920 ^{ns}	0.132 ^{ns}
<i>Coefficient of variation, %</i>	1.83	12.1	19.8	15.7	12.1	28.3	38.2



Forage Detergent Fiber and Energy

The forage acid detergent fiber (ADF) content was statistically similar for all treatments, varying from 20.4% ADF for SR+FF to 29.1% ADF for SR+FF+SG (Table 3). The forage energy (TDN) content was statistically similar for all treatments. However, the application of Best Products (except for SR+FF+SG treatment) appeared to increase forage TDN (2.4-8.5%) than check (see Figure 2). The results also showed that all treatments were similar with respect to other forms of energy measured (Table 3).

Table 3. Forage acid detergent fiber (ADF) and other forms of energy with and without Best Products

(ME- metabolizable energy, NE_G- net energy for gain, NE_L- net energy for lactation, NE_M-net energy for milk, DE- digestible energy, ns indicates not significant at P<0.05)

Best Product Treatment	ADF (%)	ME (Mcal/kg)	NE _G (Mcal/kg)	NE _L (Mcal/kg)	NE _M (Mcal/kg)	DE (Mcal/kg)
Soil Rejuvenation (SR)	25.7	2.61	1.08	1.63	1.70	3.14
Foliar Fertilizer (FF)	23.1	2.71	1.16	1.70	1.79	3.26
Seed Germination (SG)	21.2	2.79	1.22	1.75	1.86	3.36
SR+FF	20.4	2.82	1.24	1.77	1.88	3.39
SR+SG	26.1	2.59	1.07	1.62	1.69	3.12
FF+SG	24.2	2.67	1.13	1.67	1.75	3.21
SR+FF+SG	29.1	2.48	0.98	1.54	1.59	2.98
Check (Control)	28.4	2.51	1.01	1.56	1.61	3.02
<i>Mean</i>	<i>24.7</i>	<i>2.64</i>	<i>1.11</i>	<i>1.65</i>	<i>1.73</i>	<i>3.18</i>
<i>LSD_{0.05}</i>	<i>8.93</i>	<i>0.35</i>	<i>0.27</i>	<i>0.24</i>	<i>0.31</i>	<i>0.42</i>
<i>P value/Significance</i>	<i>0.335^{ns}</i>	<i>0.344^{ns}</i>	<i>0.339^{ns}</i>	<i>0.345^{ns}</i>	<i>0.345^{ns}</i>	<i>0.331^{ns}</i>
<i>Coefficient of variation, %</i>	<i>15.3</i>	<i>5.61</i>	<i>10.2</i>	<i>6.03</i>	<i>7.46</i>	<i>5.56</i>

Grain yield and A component of grain yield (Table 4)

Seed weight - The combination of SR +FF+SG (treatment 7) significantly improved seed weight (58.1 g/1000-kernels) over other treatments as well as the check. The check had similar seed weight to treatments 2, 3, 4 & 6.

Grain Yield - Grain yield was significantly highest for the combination of SR+ FF (treatment 4, 58.0 bushels/acre), followed by a combination of SR+FF+SG (53.1 bushels/acre). Other treatments had <50 bushels/acre.

Table 4. Grain yield and 1000-kernel weight of barley with or without Best products		
	1000-kernel weight	Grain yield
	(g)	(bushel/acre)
Soil Rejuvenation (SR)	52.0	47.9
Foliar Fertilizer (FF)	50.7	48.2
Seed Germination (SG)	51.5	40.1
SR+FF	50.6	58.0
SR+SG	53.0	34.7
FF+SG	51.5	32.7
SR+FF+SG	58.1	53.1
Check (Control)	50.0	45.5
<i>Mean</i>	52.2	45.0
<i>LSD_{0.05}</i>	1.5	1.3

Some Implications of Results Obtained

Fairview was dry in 2015, with a total rainfall of 4.32 inches (only 3.08 inches from May 25 to August 2) received by the seeded barley crop before harvest for forage. The generally low DM yield obtained and the lack of significant differences in DM yields between treatments tested was a reflection of the dry year. Of the treatments imposed on barley for improved forage yield and quality, Seed Germination in particular appeared to have favoured higher forage DM by just 378 lbs/acre over the check.

In terms of forage quality, though no statistical differences were found for forage nutritive values, but the forage CP, P, ADP & TDN content all appeared to be slightly improved by individual Best products as well as their combinations. The forage CP content from all treatments was adequate for a mature beef cow (except for check which fell short of the 11% CP needed by a mature lactating/nursing cow). The slight increases or benefits obtained for forage CP (%N x 6.25) and the P content for treatments consisting of one or more best products over check, could be attributed to the additional N (2-5%) and P (1-12%) contained in the Best products used (see Table 1).

The forage ADF is a strong predictor of forage quality. The ADF values are important because they relate to the ability of an animal to digest the forage. As ADF increases, digestibility of forage usually decreases. Lower ADF values are better and preferred. Considering that as ADF increases, digestibility of forage usually decreases, it will be sufficed to say that when the forage from all treatments are presented side by side to cows in a preference study SR + FF treatment forage would probably be the most consumed by cows because of its low ADF value (20.4%).

Conclusion - In the present study, a combination of SR + FF appeared to have improved forage quality (particularly CP, P, ADF, TDN and all other forms of energy) and grain yield compared to other treatments including the check. The combination of SR+FF+SG also seemed to have improved seed weight as well as grain yield over most treatments.