



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

For optimal growth, plants need a diversity of nutrients. Enhanced microbial activity in the soil will lead to healthier and more fertile soil, which, ultimately, can allow farmers to reduce some of the input costs they are using and grow higher yielding, healthier crops. Plants that grow out of 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 levels and better quality of grain. Crop nutrients can be provided through different nutrients 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 applied to the soil and plants or to the seed at seeding. For more information on Best Farming Systems products, please visit <http://www.bestfarmingsystems.com/>

Objectives

- ◆ To test different Best Farming Systems products on barley grain & forage yield, and 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 total of 4.32 inches (109.73 mm) of rain was received from seeding (May 25) to forage harvest (August 6).

A randomized complete block design (RCBD) with four (4) replications was used. 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

Table 1. Guaranteed Minimum Analysis (%) of Best Products used						
	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

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).

Sundre barley variety (6-rowed, smooth-awned, hulled feed type) was seeded on May 25, 2015, 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 2 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 after 3-4 weeks of seeding. Each plot was examined for plant lodging. Harvesting for forage was done at the soft-dough stage on August 6, 2015. About 0.5 kg sub-sample was dried to constant weight for forage dry matter (DM) yield estimation and nutritive analyses. Feed samples were analyzed by Central testing Laboratory Limited, Winnipeg, using standard methods for wet chemistry. The forage nutritive values (reported on dry matter basis) were determined using two dry samples per treatment, composites from replications 1 & 2, and replications 3 & 4.

Data Analysis - The data for all the measurements were subjected to analysis of variance (ANOVA) using a pre-defined model in Costat statistical software program (Version 6.4).

Results

Forage Yield and Quality

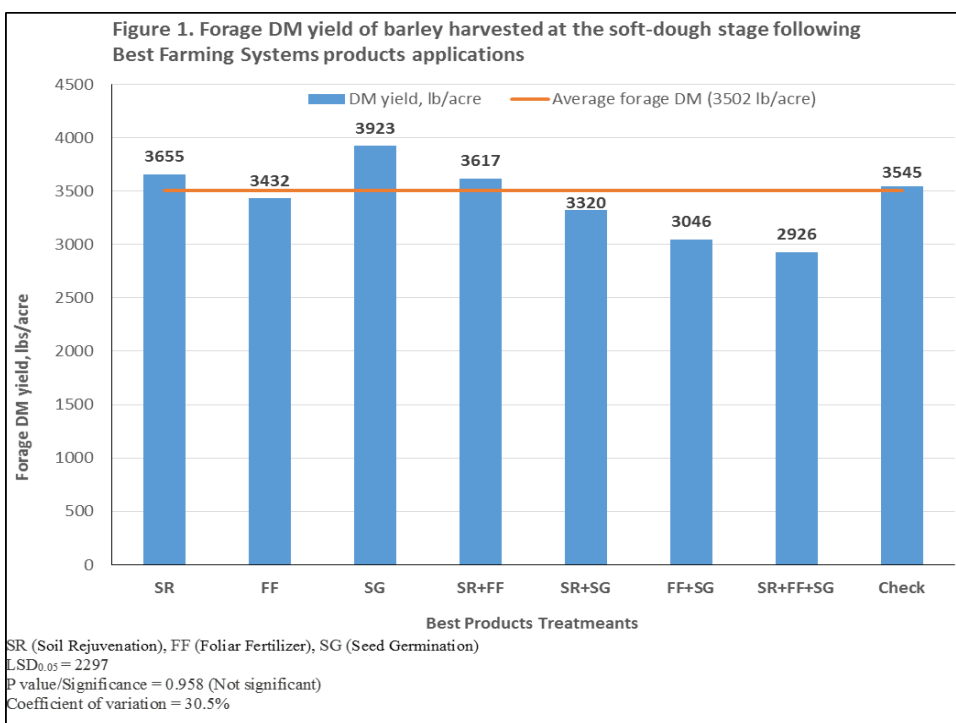
Moisture Content - The results showed that forage moisture content at harvest (soft-dough stage) for silage/greenfeed was significantly different for the treatments. The forage moisture content was highest (57.0%) for treatment consisting of a combination of all Best products (SR+FF+SG) and check, while treatment with SG appeared to have the lowest moisture (54.5%, see Table 2).

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	0.3	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
Mean	55.7	12.2	0.41	0.18	0.25	1.29	0.16
LSD _{0.05}	1.75	3.47	0.19	0.07	0.07	0.86	0.14
P value/Significance	0.017*	0.649 ^{ns}	0.416 ^{ns}	0.331 ^{ns}	0.451 ^{ns}	0.920 ^{ns}	0.132 ^{ns}
Coefficient of variation, %	1.83	12.1	19.8	15.7	12.1	28.3	38.2

Forage DM yield (see Figure 1)- The forage DM yields of all treatments were statistically similar, varying from from 2926 lb/acre for SR+FF+SG treatment to 3923 lb/acre for SG treatment.

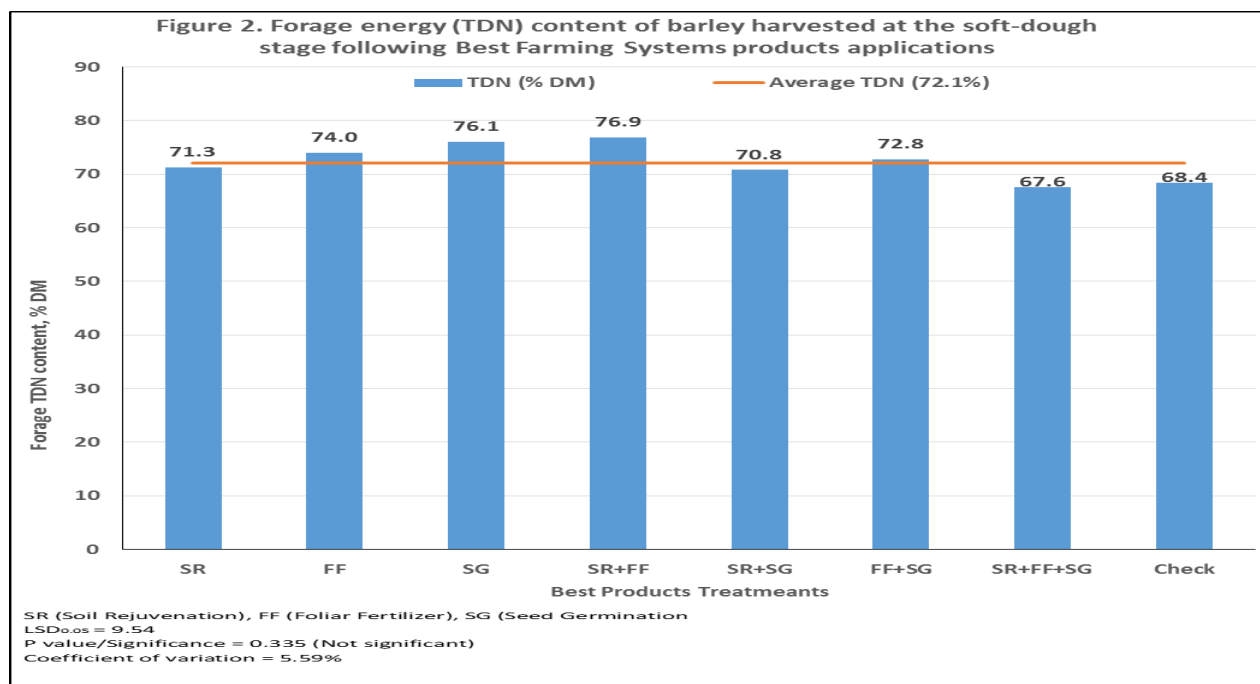
Protein and Macro-mineral Content- The forage protein (CP) content as well as all measured macro-minerals (Ca, P, Mg, K and Na) were statistically similar for all treatments. However, the forage CP and P content appeared to be favoured by treatments with Best products (11.8-12.8% CP, 0.18-0.22% P) than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



Forage Detergent fiber and Energy -The forage acid detergent fiber (ADF) content was statistically similar for all treatments, varying from 20.4% for SR+FF to 29.1% 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%) compared to the 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
Mean	24.7	2.64	1.11	1.65	1.73	3.18
LSD _{0.05}	8.93	0.35	0.27	0.24	0.31	0.42
P value/Significance	0.335 ^{ns}	0.344 ^{ns}	0.339 ^{ns}	0.345 ^{ns}	0.345 ^{ns}	0.331 ^{ns}
Coefficient of variation, %	15.3	5.61	10.2	6.03	7.46	5.56



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 likely 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, 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 increase, digestibility of forage usually decrease, 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%).

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) over other treatments.