

Comparing Fertility Programs



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Abstract

Amalgamated Sugar provides fertility recommendations to growers with the goal of maximizing beet yield and sugar %, while minimizing beet juice impurities. These recommendations are carefully calculated after considering many factors and are provided as a free service to growers. Despite this, many growers elect instead to employ commercial agronomists and crop advisors to determine their fertility requirements. These companies determine their fertility recommendations based upon their own unique proprietary rationale. Their fertilizer recommendations are often very different from Amalgamated's and promote later season applications, more foliar micronutrient fertilizers, and higher levels of many crop nutrients. Despite these differences, these companies are often successful, well respected and trusted by sugarbeet growers. To better understand how our respective fertility programs differ we established a field trial in 2024 to compare different fertility programs to Amalgamated Sugar. Commercial advisors tended to recommend higher rates of nutrients, and nutrients that did not appear to be limiting based on the soil test, however results showed similar productivity and sugar returns across all companies. The lower input costs of the Amalgamated recommendation resulted in the highest \$/acre returns.

Research Objectives

- To compare Amalgamated Sugar's fertility program to those of commercial crop advisory companies
- To identify possible areas of improvement or refinement to Amalgamated Sugar's program

Materials & Methods

Table 1: Experimental design and agronomic details.

Location	Hatch Research Farm, Declo ID
Experimental design	randomized complete block
Treatments	<ol style="list-style-type: none"> Untreated Control (UTC) Amalgamated Sugar 1 (AMAL-1) Amalgamated Sugar 2 (AMAL-2) Stukenholtz Laboratory (Stukenholtz) Biowest Ag Solutions (Biowest) Rocky Mountain Agronomics (RMA)
Replication	8
Plot Size	4 row x 33 ft.
Variety	Crystal A862NT
Plant Date	April 25
Row Spacing	22 inch
Plant Spacing	8 inch (thinned)
Irrigation	wheel line
Previous crop	winter wheat & triticale
Harvest Date	October 1

- 6 fertility programs were compared
- Treatments differed in the type of nutrients applied, rates of application, and timing of applications
- Untreated Control (UTC) had no fertilizer applied
- Amalgamated's standard crop consultant recommendation was the reference
- Amalgamated 2 treatment determines N by weighting the individual 1ft sections of a 3ft soil test (1 ft = 100%, 2ft = 76%, 3ft = 60%)
- Petiole and leaf tissue sampling occurred on June 28 and July 17
- NDVI and canopy area measured at 9 timepoints
- Soil moisture sensors were used, and irrigation was scheduled to optimize water



Figure 1: An Amalgamated fertility recommendation

Table 2. Summary of treatment applications.

Date Applied	Sugarbeet Growth Stage	Treatment	Nutrient Applied lb/A										Type	Method		
			N	P	K	S	Zn	Fe	Mn	Cu	B					
April 18	Pre-plant	Amalgamated # 1	60												granular	broadcast
April 19	Pre-plant	Amalgamated # 2	60												granular	broadcast
April 19	Pre-plant	Stukenholtz	141.9	131.0	120.1	5.28				3.36		0.89			granular	broadcast
April 19	Pre-plant	Biowest	78.3	39.8	0.04	43.3									liquid	broadcast
April 19	Pre-plant	Rocky Mtn Ag	58.5	18.9	1.48	33.3	0.27	0.13	0.12	0.12	0.28				granular	broadcast
May 20	2-leaf	Amalgamated # 1	30												granular	broadcast
May 20	2-leaf	Amalgamated # 2	60												granular	broadcast
May 24	2-4 leaf	Rocky Mtn Ag					0.038	0.019	0.319	0.006	0.026				liquid	foliar
May 24	2-4 leaf	Rocky Mtn Ag					cytokinin, gibberellic acid, indole-3-butyric acid, indole-3-acetic acid								liquid	foliar
June 11	10-leaf	Biowest	67			24									granular	broadcast
June 24	Canopy Closure	Rocky Mtn Ag	34.6	20	25	39.5	0.5	0.35	0.5	0.13	0.13				granular	broadcast

Table 3. Total applied nutrients for each treatment, and total treatment cost.

Treatment	N	Total N Supply ²	Total Nutrients Applied lb/A								Cost \$/A	
			P	K	S	Zn	Fe	Mn	Cu	B		
Amalgamated # 1	90	240.9				35						\$60.86
Amalgamated # 2	120	270.9				35						\$76.99
Stukenholtz	141.9	292.8	131.0		120.1 ³	5.28				3.36	0.89	\$217.00
Biowest	145.3	296.2	39.8	0.04	67.3							\$304.75
Rocky Mtn Ag	93.1	244.0	38.9	26.48	72.8	0.808	0.499	0.939	0.256	0.436		\$194.00
UTC	0	150.9	0	0	0	0	0	0	0	0	0	0.00

¹ Total N Supply = 3 ft soil N + fertilizer N

² elemental sulfur + sulfate sulfur



Photo: The 2024 Fertility Comparison Trial on July 7 recommendation

- Grower payment was highest with the Amalgamated treatments. Treatment cost matters!

Table 4. Harvest results. Sugarbeet productivity indicators together with station averages for the nearby Hatch Receiving Station and grower payment estimates. Statistical analysis of variance of treatment means is also shown.

Treatments	Yield T/A	Sugar %	ERS/A lb/A	Nitrates ppm	Conductivity mmhos/cm	Payment \$/A
Hatch Station Avg.	41.25	18.54	13,154	131.00	0.690	
UTC	36.17 ^b	19.13	12,025	57.79	0.619 ^b	2131.15
AMAL 1	39.43 ^{ab}	19.08	13,558	54.46	0.625 ^b	2329.11
AMAL 2	42.06 ^a	18.71	13,685	58.33	0.622 ^b	2381.12
RMA	39.97 ^{ab}	18.79	13,033	58.33	0.625 ^b	2143.95
Biowest	42.03 ^a	19.04	13,869	54.40	0.667 ^a	2166.13
Stukenholtz	43.05 ^a	18.77	14,014	63.23	0.645 ^{ab}	2299.24
P>F	0.011*	0.498 ^{n.s.}	0.154 ^{n.s.}	0.896 ^{n.s.}	0.032*	0.343 ^{n.s.}
CV%	6.2	1.0	5.5	5.6	3.0	4.6

*means followed by the same letter within a column are not different at the $\alpha = 0.05$ probability level

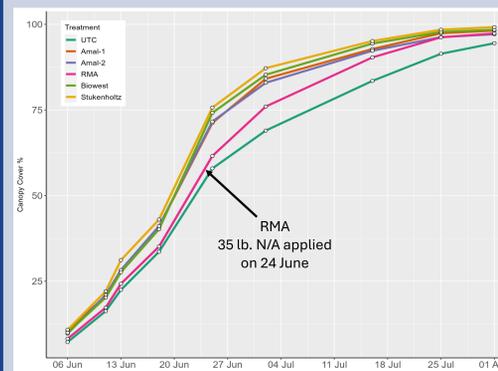
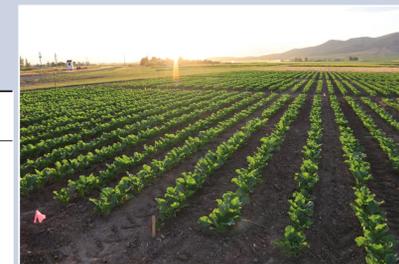


Figure 2. Canopy cover % over time. Canopy closure occurs at approximately 90% canopy cover.

Results

- A good growing year and excellent trial quality
- Decent yield of UTC despite only 150 lb. N/A. Suggests good natural site fertility
- All fertility programs produced good yields. Some slightly higher than commercial average, and some slightly lower. No significant difference between fertility programs.
- The optimum nitrogen rate at this site (the lowest N supply to achieve the statistically highest yield) was 240.9 lb. N/A (AMAL-1)
- Excellent sugar % with all treatments higher than the commercial average. No statistical difference between fertility programs
- Very good sugar yield (ERS/A), with most fertility programs similar to, or greater than the commercial average
- No statistical difference in ERS/A between fertility programs
- Juice purity was excellent for all fertility programs. Brei Nitrates and Conductivity were below commercial average and within optimal levels.



Photos. June 14 (above), Fertilizer treatments (below).



- Row closure around July 11 for all but UTC and RMA treatments
- Slow early growth for Rocky Mtn Agronomics due to lower nitrogen fertility. This was recovered following 35 lb. N/A applied on June 24
- Petiole and NDVI values correlate with nitrogen input levels
- Despite lower than optimal Petiole N, NDVI, and early season growth, RMA recovered to finish with similar productivity outcomes.

Table 5. Canopy cover %, Petiole NO₃, and NDVI (Normalized Difference Vegetative Index) at two sample dates. Statistical analysis of treatment means is also shown with pairwise differences.

Treatment	Canopy Cover %		Petiole NO ₃ , ppm		NDVI	
	June 25	July 17	June 28	July 17	June 28	July 17
Amal 1	71.2 ^a	92.8 ^{ab}	7,591 ^b	1807 ^d	0.721 ^{ab}	0.852 ^{ab}
Amal 2	71.6 ^a	92.3 ^{ab}	9,550 ^a	3403 ^c	0.723 ^{ab}	0.857 ^a
Biowest	74.2 ^a	94.4 ^{ab}	11,013 ^a	4440 ^b	0.722 ^{ab}	0.863 ^a
RMA	61.6 ^b	90.3 ^b	6,713 ^b	2856 ^c	0.705 ^{bc}	0.855 ^a
Stukenholtz	75.7 ^a	95.1 ^a	10,525 ^a	5532 ^a	0.732 ^a	0.867 ^a
UTC	57.9 ^b	83.5 ^c	3,360 ^c	695 ^e	0.697 ^c	0.834 ^b
P>F	<0.001	<0.001	<0.001	<0.001	0.045	0.021

Conclusions

- All fertility programs achieved similar yield and sugar outcomes. This trial suggests that sugarbeet fertility is not a 'one-size-fits-all' option, and that many different approaches can be successful
- Relatively high total nitrogen supply (296 lb. N Biowest, and 292 lb. N Stukenholtz) had no negative effects on sugarbeet productivity or sugar quality
- Late nitrogen applications (67 lb. N/A at 10-leaf stage (Biowest), and 35 lb. N/A prior to canopy closure (RMA)) had no negative effects on sugar quality or productivity
- Application of P, K, and micronutrients resulted in no significant productivity improvements suggesting that none of these nutrients were limiting
- Amalgamated's P, K, and micronutrient recommendations were the most agronomically accurate and economically optimal
- The slower canopy area % of RMA in the early season was recovered following additional nitrogen inputs in late June, and did not appear to have any negative effects on sugarbeet quality and productivity
- The difference between Amal-1 and Amal-2 suggests that the weighting of soil depth for nitrogen determination should be considered as a topic for future study
- The cost of the fertility program needs to be considered if the goal is to maximize \$/A beet payment. High ERS/A returns can be negated by high fertilizer input costs, resulting in a lower beet payment overall

