MONITORING THE PERFORMANCE OF SUSTÅNE NATURAL FERTILIZERS IN ALBERTA AND SASKATCHEWAN

1990 – 1991 FIELD TRIALS For NUTRI CROP PRODUCTS INC.
Saskatoon, Saskatchewan

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SUSTÅNE® Naturally

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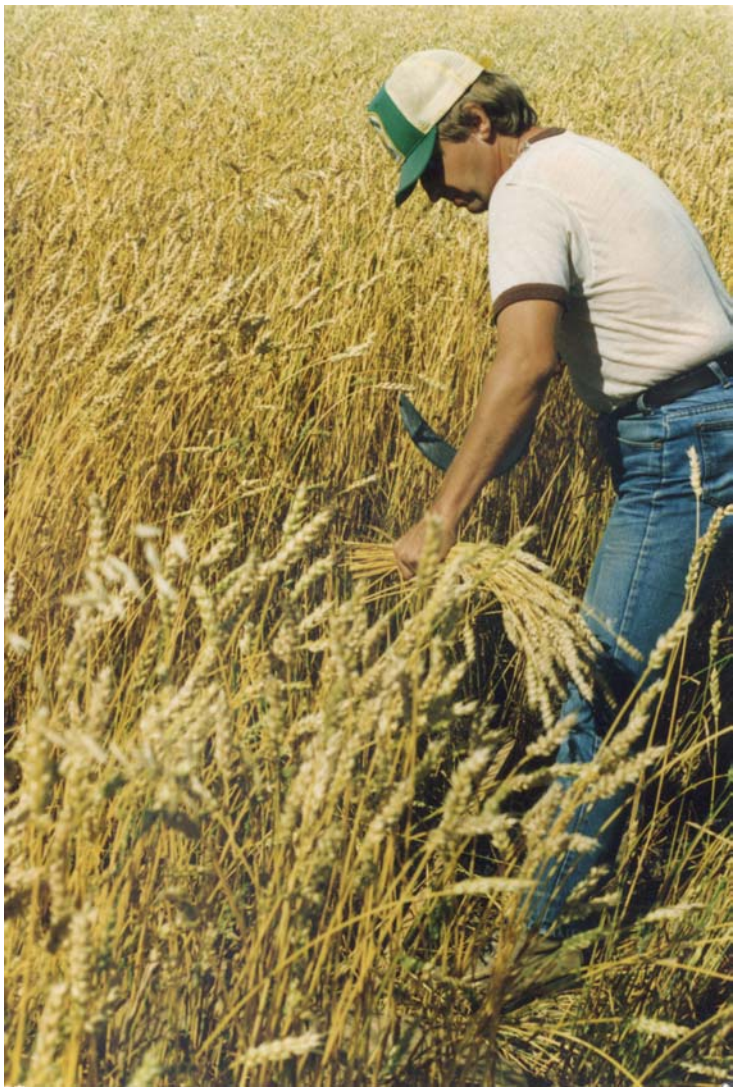

INTRODUCTION

This study and its publication is a result of the continuation of organic fertilizer trials established on small grain crops in the prairie provinces of Canada in 1990. Organic fertilizers, while generally lower in nutrient concentration of N-P-K than conventional synthetic fertilizers, are known to provide other plant growth promoting characteristics that are not present in standard synthetic compounds. These field studies were conducted on working farms in Alberta and Saskatchewan. The plots were established to evaluate and determine whether the application of a high quality organic fertilizer applied at cost conservative rates direct with the seed at planting (i.e. 35 – 70 lb. per acre or 39.2 – 78.4 kg. per hectare) could provide an economical return on investment for dryland grain farmers who produce crops for the certified organic markets. To the sponsor's knowledge, these are the first tests ever established to evaluate low doses of granulated organic fertilizer compared against MAP 11-51-0 and other synthetic compounds; and harvested and analyzed using independent research and statistical analysis.

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EXECUTIVE SUMMARY

1. Applying Suståne as a starter fertilizer at 10 sites in Alberta and Saskatchewan in 1991 resulted in five sites showing statistically significant yield increases in favor of Suståne, with one showing a mildly significant increase.
2. At three sites where Suståne was compared to commercial 11-51-0 applied at similar gross rates per acre, the Suståne yielded just as well even though it has a lower nutrient content than 11-51-0 (175% less nitrogen and 750% less P_20_5). At one site where Suståne was compared to a commercial mix 28-26-0 at similar rates, the Suståne treatment yielded significantly more than the commercial starter fertilizer.
3. The yield responses when using Suståne at such low rates, 30-75 lb. per acre, are likely because of a holistic interaction of 17 occurring elements, microorganisms, enzymes, and growth regulating compounds such as humic acid. The entirety of Suståne performs more consistently than if the components were separated out and applied as isolated components.
4. Using Suståne as a starter fertilizer does not replace the need for additional nitrogen fertilizer but appears to successfully replace MAP 11-51-0; and even at very low rates provides significant yield increases over untreated control plots.

Harvesting Paired-T research plots on dryland wheat. Suståne fertilizer trials 1991. Manitoba.

BACKGROUND

The agriculture industry in Western Canada is undergoing a restructuring due to the cost - price squeeze and recurrent droughts during the past decade. Until the early 1980's, farmers were not as concerned with the efficiency of using inputs such as fertilizers since grain prices were high relative to these costs. Maximum production was the goal as world markets for grain were very buoyant. Currently a new set of assumptions face the prairie farmer; grain prices are down substantially while the costs of inputs has continued to increase. As a result, farmers are looking for alternatives to provide higher returns and lower input costs.

Organic and sustainable agriculture have come to the attention of farmers as an alternative to their current practices. The sales of Canadian organic products are estimated to be $95 million with an annual growth rate of 25% (SRC, 1990). In Saskatchewan the annual sales of organic grains are approximately $5 million with demand exceeding supply (SRC, 1990). Currently, there are about 250 farms in Saskatchewan supplying the market at prices from 30-300% above the conventional prices. Many of Saskatchewan's 65,000 farmers are looking for fertilizing alternatives that are ecologically sound due to the increased awareness of the environment among consumers and farmers.

Suståne is a natural organic fertilizer (analyses 4-6-4) that is produced as a result of the composting of turkey manure and softwood shavings. Suståne is manufactured by Suståne Natural Fertilizer – Cannon Falls, Minnesota and is the result of over 10 years of development.

The target for Suståne in the prairies is a starter fertilizer for organic and ecological farmers. Organic farmers cannot use commercial synthetic fertilizers so Suståne offers a natural alternative. Suståne is in a granular form and can be applied as a starter fertilizer.

1.1 ACTIVE INGREDIENTS IN SUSTÅNE

Suståne contains 17 of the 17 essential elements required for plant growth: namely carbon, hydrogen, oxygen, nitrogen, phosphorous, potassium, calcium, magnesium, sulfur, iron, manganese, boron, molybdenum, copper, zinc, cobalt, and chlorine.

Approximately 50% of Suståne consists of organic matter in the form of humus. Humus is important for soils in improving water holding capacity and decreasing erosion. One of the active ingredients of humus is humic acid, which is a recognized chelating agent for increasing plant uptake of trace elements. Suståne also contains 1.5 million live beneficial bacteria per gram, which offers many potential benefits to soils.

1.0 1991 RESEARCH PROGRAM

2.1 OBJECTIVES

1. To further monitor the performance of Suståne as a starter fertilizer under prairie agricultural conditions. First year trials began in Canada in 1990.

2. To collect yield data on the effect of Suståne on crop yields.

3. To compare the performance of using Suståne as a starter fertilizer, with 11-51-0.

4. To collect research data to verify the efficacy and economics of Suståne in commercial agriculture.

2.2 MATERIALS AND METHODS

Ten sites were monitored for yields and plant physiology in 1991. Kim Simpso of Nutricrop provided names of his customers that purchased product; the participating farmers are listed in Table 1. On the fields where Suståne was applied; an area was left as a check (see Figure 2) where either no Suståne was applied or the regular fertilizer program utilized 11-51-0. There were true controls (no Suståne) at all sites except Ben Miller, Mark Onsrud, and Lakeview Colony.

The cooperating farmers applied the Suståne direct in row with their seeded crops. Farm management data was documented during the growing season to provide additional information for the study. Table 1 outlines the general site characteristics of the 10 sites.

TABLE 1. TEST SITES, SOIL TYPES, AND TREATMENTS

Farm Cooperator - Location	**Crop**	**Sustane Appl. Rate** lb. per acre	**Soil Types**
Art Scott - Nanton, AB	Barley	50	Dark Brown Chernozem
Kim Simpso - Weldon, SK	Barley	50	Eluviated Black Chernozem
Ben Miller -Westlock, AB	Canola	40[1]	Black Chernozem
Dennis Leblanc - Zenon Park, SK	Oilseed Radish	50	Dark Gray Luviso
Art Scott - Nanton, AB	Wheat	50	Dark Brown Chernozem
Kevin Bertram - Bieseker, AB	Wheat-1	35	Thin Black Chernozem
Kevin Bertram - Bieseker, AB	Wheat-2	45[2]	Thin Black Chernozem
Lakeview Colony - Unity, SK	Wheat	40[1]	Thin Black Chernozem
Rod Sjoberg -Speers, SK	Wheat	50	Eluviated Black Chernozem
Mark Onsrud - Birch Hills, SK	Wheat	40[1]	Eluviated Black Chernozem

1. Control is 11-51-0 at 50 lb. per acre
2. Control is 28-26-0 at 50 lb. per acre

Yield sampling was undertaken before each farmer swathed his crop. This was accomplished by sampling 10 square meters of grain at various locations in the field in both the Control and Suståne plots. (Figure 2). The sampling pattern was such that the comparison samples were adjacent to one another on similar soil and topographic position. The sampling design was a strip plot, which allowed the use of paired T statistics.

Plant physiological characteristics were observed in the treatments during field visits in July and August. General trends in plant height, color, rooting density and stem thickness were noted; where practical photographs were taken to document the observations.

2.3 Results

2.3.1. Plant Physiology Observations

At least one visit to each site was made during the growing season to observe any plant physiological differences. Table 2 outlines the general results.

In 6 out of the 10 study sites (Ben Miller, Kevin Bertram-Wheat 1, Kim Simpso, Dennis Leblanc, Mark Onsrud and Art Scott-Wheat) there were observable plant physiological development that showed in favor of the Sustane treatment. At the Jim Watts wheat site, which was not harvested, there was a huge visible difference in favour of the Sustane treatments. 2 of the 6 sites that showed visible differences, Ben Miller-Canola and Mark Onsrud – Wheat, had the competing treatment as 11-51-0. Three of these 6 sites, Miller – Canola, Bertram – Wheat Site 1, and Onsrud – Wheat, did not show any statistically significant yield increases, while the other three did.

Of the four sites where there were no observable differences in plant development, three of these sites (Bertram – Wheat Site 2; Sjoberg – Wheat; and Scott – Barley) showed statistically significant yield increases. One of the four sites, Lakeview – Wheat, also had the 11-51-0 treatment.

There was observable plant physiological development that showed in favor of the Sustane treatment at several trial sites. Photo above shows huge visible difference in favour of the Sustane treatments on the Jim Watts wheat farm. [Suståne 4-6-4 at 50 lb. per acre sample on

TABLE 2. FIELD OBSERVATIONS

Site	Crop	Site Visit	Crop Observations
Ben Miller	Canola	July 3	Generally Sustane plants were taller, greater stem thickness and more root growth than with 11-51-0.
Kevin Bertram	Wheat	July 19	Better root growth in Sustane versus control at site 1. No differences in the stubble in site 2.
Lakeview Colony	Wheat	August 6	No observable difference between Suståne and control.
Rod Sjoberg	Wheat	August 7	No observable difference between Suståne and control.
Kim Simpso	Barley	August 7	Sustane treatment had slightly better root development, thicker stems, bigger heads and was maturing earlier.
Jim Watt	Wheat	August 7	Where Sustane applied there was a large difference in height and darker green colour.
Mark Onsrud	Wheat	August 7	Sustane treated wheat was darker green in colour and heads were on average larger with better root growth.
Art Scott	Wheat	July 22	Sustane treated had better root growth, thicker stems and was taller.
Art Scott	Barley	July 22	No visible differences between treatments. where sweet clover was underseeded there was less disease. Barley seemed to be lacking in nitrogen.
Dennis LeBlanc	Oilseed Radish	August 8	Sustane treated was much taller, had more and larger pods, thicker stems and larger top roots.

2.3.2 YIELD RESULTS 1991

Table 3 outlines the yields for the 1991 field trials. The yield differences between Sustane and either Control or 11-51-0 ranged from -3.8% to +31.9%. Six out of ten sites had statistically significant yield increases in favor of Sustane. Three out of the four sites that did not show any yield differences were Sustane comparisons with 11-51-0; the other site that did not show a yield response (Bertram Wheat 1) was seeded on summer fallow.

Table 3 Crop Yields 1991 Sustane Field Trials

Farm Cooperator	Crop	Control Bu / Ac	Sustane Bu / Ac	Change %	Statistical Significance
Art Scott	Wheat	29.4	37.5	+27.3	p<0.005
Kevin Bertram	Wheat-1	40.9	39.7	-2.9	N.S.D.
Kevin Bertram	Wheat-2	27.9[1]	36.9	+31.9	p<0.005
Lakeview Colony	Wheat	39.0[2]	37.5	-3.8	N.S.D.
Rod Sjoberg	Wheat	29.7	33.4	+12.5	p<0.15
Mark Onsrud	Wheat	51.5[2]	53.5	+4.0	N.S.D.
Ben Miller	Canola	18.5[2]	20.2	+9.5	N.S.D.
Dennis LeBlanc	Oilseed Radish	571lb/ac	695lb/ac	+21.9	p<0.005
Art Scott	Barley	30.5	38.6	+26.8	p<0.005
Kim Simpso	Barley	65.5	82.6	+26.2	p<0.01

[1] Control is 28-26-0 at 50lb/ac.
[2] Control treatment is 11-51-0 at 50 lb/ac.
N.S.D. – No statistical differences between treatments.

In five out of the 10 sites, Suståne yielded significantly more than either Control or commercial fertilizer 28-26-0 ($p<0.05$)

At the Sjoberg wheat site, Suståne yielded more than the Control by a statistically ($p<0.15$) significant amount.

In the three sites where Suståne was compared to commercial 11-51-0 at similar rates, Suståne yielded the same.

At the Bertram Wheat site 2 there was a significant 31.9% ($p<0.005$) increase in the Suståne treatment compared to the 28-26-0 starter fertilizer.

The yield increases ranged from -3.8% (N.S.D) to +31.9% ($p<0.005$).

2.3.3 PRECIPITATION DATA

At most of the study sites on the prairies, the distribution of precipitation was higher than normal in May and June with normal or below normal precipitation for July and August. The drying trend in July and August probably helped the Suståne treatments to show more of an effect because of the extra plant stress late in the summer.

Location	Month	1991	1951-80 Mean Precip. (mm)	% Normal
1. McDowell, SK (Birch Hills, Weldon)				
	May	57.2	39.4	145
	June	146.0	69.1	211
	July	56.9	65.3	87
	August	20.0	52.1	38
	TOTAL	280.1	225.9	124
2. Ayisham, SK (Zenon Park site)				
	May	48.8	46.1	106
	June	85.5	84.6	101
	July	55.6	83.0	67
	August	25.6	71.4	36
	TOTAL	215.6	285.1	75
3. Hafford, SK (Speers site)				
	May	59.0	40.6	145
	June	143.2	63.6	225
	July	62.4	69.1	90
	August	27.4	49.9	55
	TOTAL	293.6	223.2	131
4. Scott CDA, SK (Unity site)				
	May	33.0	32.8	100
	June	101.7	66.4	153
	July	18.9	60.1	31
	August	41.3	46.5	89
	TOTAL	213.8	205.8	104
5. Calgary, AB (Bieseker site)				
	May	96.1	48.7	197
	June	113.2	89.4	127
	July	29.6	65.4	45
	August	64.2	55.4	116
	TOTAL	303.1	258.9	117
6. High River, AB (Nanton sites)				
	May	111.4	58.4	190
	'June	147.4	92.8	159
	July	12.2	54.0	23
	August	N.A.	63.0	
	TOTAL	N.A.	N.A.	
7. Redwater, AB (Westlock site)				
	May	97.0	38.7	251
	June	135.8	75.0	181
	July	17.6	70.8	25
	August	N.A	67.5	
	TOTAL	N.A.	N.A.	

3.0 DISCUSSION OF RESULTS

The 10 sites studied in 1991 are a continuation of the work initiated in 1990. In 1990, a small monitoring program found that at 3 out of 4 sites there was a yield response in favor of the Suståne treatments. The 1991 research was much larger, 10 sites, and covered a greater geographical area since Alberta farmers were included.

1990-1991 Average Results Yields (bushels per acre)

Crop	No. of sites	Control	Suståne	Bu Per Acre Increase	% Change % Increase
Barley	3	42.6	53.6	11.0	25.8
Canola3	1	18.5*	20.2	1.7	9.5
Oats	1	43.3	68.4	25.1	58.0
Oilseed Radish	1	11.4	13.9	2.5	21.9
Wheat 1	8	37.8	41.0	3.2	8.5
Wheat 2	5	31.8	35.5	3.7	11.7
Wheat 3	4	42.8	46.8	4.0	9.4

1- all sites
2- sites with a true control
3- conventional fertilizer as a control

Overall, one would have to conclude that using Suståne as a starter fertilizer placed with the seed has performed well. In the instance where Suståne was compared to a conventional fertilizer, Suståne has performed at least as well in 2 out of 5 trials and better in 3 out of 5.

DISCUSSION OF RESULTS continued

One persistent question that comes up from reviewing the results in 1990-91 is how can such a small amount of NPK cause such yield increases? For example the comparison of Suståne and commercial 28-26-0 at Kevin Bertram's in 1991 showed that the total analyses of a fertilizer is not the only important property.

Site	Yield bu/ac 28-26-0 at 50 lb/ac	4-6-4 Suståne at 45 lb/ac	Yield Increase bu. per acre
Bertram Wheat Site 2	27.9	36.9	9
Lb. of Nitrogen applied per acre	14	1.8	
Lb. of Phosphorous as (P^2O^5) applied per acre	13	2.7	

In this example, the commercial 28-26-0 supplied 12.2 lb/ac more nitrogen and 10.3 lb/ac more phosphorous (P_2O_5) but the yield in the Suståne treatment was 31.9% higher. Using the conventional logic of fertilizer use efficiency the following calculation can be made:

$$\frac{\text{9 bu/ac wheat yield increase x 13\% protein}}{6.25} = \text{11.2 lb N in grain}$$

Assuming nitrogen fertilizer is used at an efficiency of 50%, it would require 22.4 lb. of Nitrogen fertilizer to account for this yield difference.

Comparing the phosphorous concentration of 28-26-0 versus Suståne (10.3 lb/ac difference) it is obvious in this instance that Suståne is supplying this mineral at a more efficient rate to plants than 28-26-0. The Saskatchewan Soil Testing Laboratory says that fertilizer phosphorous is only used at an efficiency of 15-30%; in this case then the 28-26-0 would only be supplying 2.0 lb/ac of P_2O_5 at the 15% efficiency rating.

Assuming an average P content of wheat at 0.38 the following calculation can be made:

9 bu/ac increase x 0.38 4.5 lb/acre P205

Assuming an efficiency rating of 15%, 28-26-0 would require an additional 30 lb. per acre of P_2O_5 or 120 lb. per acre of 28-26-0 to produce this kind of a yield increase from standard phosphorous efficiencies.

Where do the other 22 lb. per acre of nitrogen and 30 lb. per acre of P_2O_5 come from? It is obvious that the holistic nature of Suståne increases the biological activity of the soil such that more of the natural soil fertility is utilized as well as probably a more efficient use of the applied fertilizer nitrogen. This could be explained partially by the better root growth. Is it also possible that the bacteria in Suståne that are inoculated into the soil are also fixing atmospheric nitrogen?

DISCUSSION OF RESULTS continued

In the context of using Suståne as a starter fertilizer with the seed, it is likely that the yield responses are the result of the holistic interaction of natural trace minerals, enzymes, microorganisms and organic compounds that stimulate soil processes and seed growth. Of the many favourable growth compounds in Suståne, the most likely active ingredient to increase yields this significantly would be the 10.8% by weight humic acid content.

Humic acid is part of the humic fraction of organic matter. Humic substances are amorphous, brown or black, hydrophilic, acidic polydisperse substances of high molecular weights (Schnitzer and Khan, 1972). The alkali soluble compounds are called humic acids and the fulvic acids are soluble in both acids and bases.

Humic substances have been found to behave like plant growth regulators when used at low concentrations. For example, soluble humic complexes were found to exert hormone like activity at concentrations 10.0 times lower than Indole-aceticacid (Cacco and Del Agnola, 1984).

Humic substances have been shown to have the following effect on plants:

1. Increase plant growth (Malik and Azam, 1985).
2. Increase nutrient uptake (Albuzio et al, 1986).
3. Function as growth regulators.
4. Enhance seed germination.
5. Enhance microbial activity (Visser, 1985).
6. Enhance root growth (Schnitzer and Poapst, 1967).

The scientific literature corroborates then that small amounts of certain organic compounds can have dramatic effects on soil and crop responses. Organic compost fertilizers are generally looked at for their macro-nutrient benefit, but the results from our research clearly show that they perform as well as 50 lbs./acre 11 -51 -0.

Why did some sites show visual responses during the summer but fail to yield any higher (Bertram Wheat -1) or not show any visual differences and still yield more (Scott Barley)? That seems to be part of the mystery and magic of growing crops. While the crop may have shown better root systems the extra nutrient uptake may have resulted in a better quality prop but not went into making yield.

The magic of compost products like Suståne seems to be their well rounded nature, with so many growth promoting and beneficial substances available that something good is bound to be happening to the land when we use them. The mystery of this complex process was best summarized by the late Dr. William Albrecht when he stated:

"All of man's knowledge concerning agricultural practices must be considered infinitesimal when compared to the absolute intelligence manifested by Mother Nature throughout her natural domain."

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Lodging effect of water soluble, quick release nitrogen on winter wheat. Treatment on right received double rate of N from 28% N. Sustâne organic N source treatment on left resulted in 14.5 bu per acre yield advantage at harvest (53.9 v. 39.4). All plots received a plant growth regulator (Cerone™) applied at Feeks 7.5 boot stage to prevent lodging from high nitrogen rates. Melhouse Farm, Wabasha County, Minnesota; C. Holden 1986. 4 replicates per treatment.

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IN ALBERTA AND SASKATCHEWAN 1990 – 1991

Dr. Jon Warnke, Agri-Growth Research, Inc. Evaluating early Suståne organic fertilizer research plots on Midwestern cash crops. Hollandale, Minnesota 1986.

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