Vital Earth Resources
706 East Broadway, Gladewater, Texas 75647
(903) 845-2163 FAX: (903) 845-2262

2008 Crop Results

Vitazyme on Corn, for silage

Treatment of the cut corn versus molasses

Researcher: Richard Stonewigg
Location: Gicheha Farm, Brooke Side Dairies, Kenya
Variety: unknown
Soil type: unknown
Age at chopping: 130 days
Date of silage preparation: August 15, 2008

Experimental design: Corn was cut for silage and prepared in the two environments, one with Vitazyme and the other with molasses. Comparisons of the feeding value were made with typical silage evaluations.

1. Vitazyme **2. Molasses**

Vitazyme treatment: A silage heap was prepared by layering 10 tons of chopped maize, uniformly sprayed with 200 ml of Vitazyme (20 ml per ton of silage) in 200 liters of water, with another 10 ton layer that received the same Vitazyme treatment. The heap was then covered with a polyethylene tarp, and ensiling continued until August 10, 2009, when samples were collected.

Molasses treatment: In a manner similar to Vitazyme treatment, 20 kg of molasses (2 kg per ton of silage) in 200 liters were sprayed uniformly on two 10 ton layers of silage, and covered with a polyethylene tarp.

Quality analysis of the silage: On August 10 of 2009 the silage began to be fed to the cattle, at which time samples from each treatment were taken and submitted to an American Breeding Society laboratory for analysis. Results are shown below.

Dry Matter	Fat	Crude protein	Crude Fiber	Phosphorus	Ash	Metabolizable energy
%	%	%	%	%	%	kcal/kg dry matter
32	2.65	11.3	21.6	0.01	11.3	10.7

Comments by the general manager of Gichelon Farm: "On silage made by using Vitazyme compared with the known value using molasses,

- **Very good dry matter; the best we have ever achieved was 30.45 at 123 days past germination [versus 32.00% here].**
- **Very high crude protein; the average for maize is 8% crude protein [versus 11.3% here].**

"Recommendation: promote Vitazyme as a product for silage making."

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2001 Crop Results

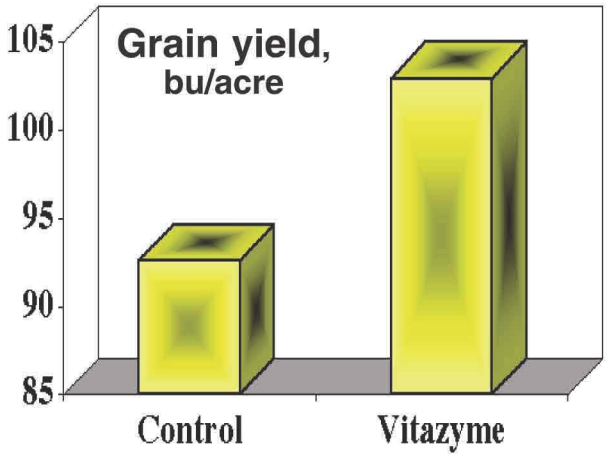
Vitazyme on Corn

Researcher: Kurt VanNice *Location*: Blue Grass, Iowa *Variety*: Baldridge 705 silage corn
Previous crop: corn *Soil type*: unknown *Planting date*: May 1, 2001
Population: 28,000 seeds/acre *Row spacing*: 30 inches *Soil fertility*: very high P and K
Tillage: ripped the fall of 2000, and field cultivated in the spring
Experimental design: A field was divided into two sections, each treated differently:

1. **Control: the usual fertilizer program**
2. **Vitazyme: the control program plus Vitazyme**

Fertilization: Both areas received 100 lb/acre N plus 5 lb/acre sulfur at planting. Both areas also received 50 lb/acre of additional N sidedressed, with 5 lb/acre of sulfur. They received 5 gal/acre of Liquid Grow 8-19-3 starter in the furrow at planting.
Vitazyme application : 12 oz/acre of Vitazyme with the herbicide
Pesticide applications: 2.3 qt/acre of Harness Extra herbicide; Force insecticide
Growth results: **The Vitazyme treated corn was about one foot taller than the other treatment during much of the growing season.**
Yield results: Because of the very dry summer and fall, yields were greatly reduced from normal levels.

	Control	Vitazyme	Increase
	----------	bu/acre	----------
Grain yield	92.6	102.9	10.3 **(+ 11%)**



Yield increase: 11%

Conclusions: In spite of a very dry period from late July to September, Vitazyme applied with the herbicide boosted the corn grain yield by 11% over the control in this Iowa study.

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2002 Crop Results

Vitazyme on Corn, for Silage

– Plus Milk 2000 Calculations –

Researcher: Ronald Stutzman
Location: Stutzman's Research Farm, Arkport, New York
Variety: Agway 3311
Soil type: silt loam
Row spacing: 30 inches
Population: 26,000 plants/acre
Soil pH: 6.6
Planting date: June 7, 2002

Experimental design: A randomized complete block design was set up to evaluate three treatments on silage corn. Five replicates were used, with each plot 10 x 50 ft (0.01148 acre).

1. **Control (no Vitazyme)**
2. **60% nitrogen, plus Vitazyme**
3. **100% nitrogen, plus Vitazyme**

Weed control: Python at 4 oz/acre; Atrazine at 1 lb/acre; Banvel at 2 oz/acre

Fertilization:

Treatment	Manure[1]	Organic Matter[2]	Urea	Total
	lb N/acre			
1	40	95	0	135
2	40	95	57	192
3	40	95	95	230

[1] Estimated at 1.0% N, and a 20%/yr. release = 40 lb/acre. Applied the fall of 2001.
[2] About 4% soil organic matter: at 0.19% N/acre = 3,800 lb/acre x 2.5% annual release = 95 lb N/acre.

All areas received 125 lb/acre of a 10-30-10 starter, and no P or K.

Vitazyme treatments: (1) 13 oz/acre dribbled over the dry fertilizer placed 2 in x 2 in below and beside the seeds, at planting for Treatments 2 and 3; (2) 13 oz/acre sprayed over the leaves and soil at the V6 stage of Treatments 2 and 3

Harvest date: September 20, 2002

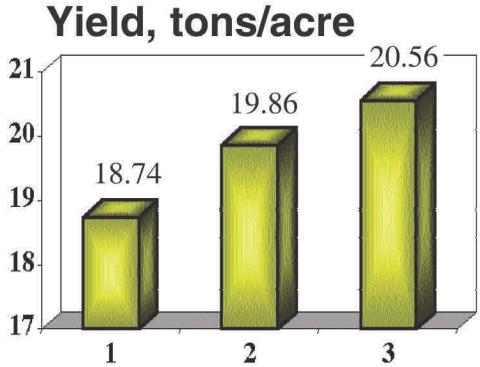
Weather during the growing season: Rain and temperatures were favorable for corn growth during June and early July, but hot and dry weather prevailed through much of July and August.

	Precipitation	Growing degree days
June	5.3	497
July	2.6	624
August	1.6	511
September	?	484

Yield results: Silage yields were determined in all plots on September 20.

Treatment	Yield[1]	Change vs. Control
	tons/acre	
3. 100% N + Vitazyme	20.56 a	(+) 1.82 (+10%)
2. 60% N + Vitazyme	19.86 a	(+) 1.12 (+6%)
1. Control (no Vitazyme)	18.74 a	— —

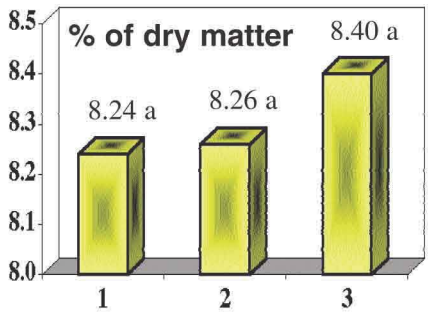
[1] Yield adjusted to 32% dry matter. Yields are not significantly different at P=0.10, but differences in silage quality translated to highly significant differences in projected milk output as will be shown later.



Yield increase with Vitazyme on dry fertilizer: 10%

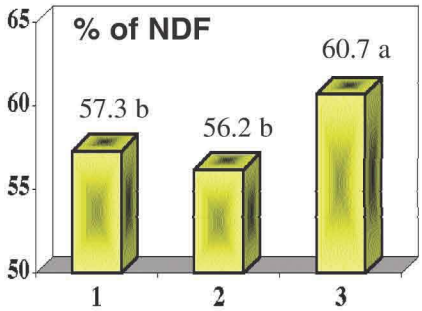
Quality and feeding value results: Several feeding value parameters were investigated from silage samples sent from each plot to Marshfield, Wisconsin. All samples were packed in ice and mailed to the laboratory of the University of Wisconsin Corn Silage Evaluation System – Milk 2000; they arrived in excellent condition. The Tukey-Kramer test was used to evaluate significant differences between treatment means in an analysis of variance.

Crude Protein



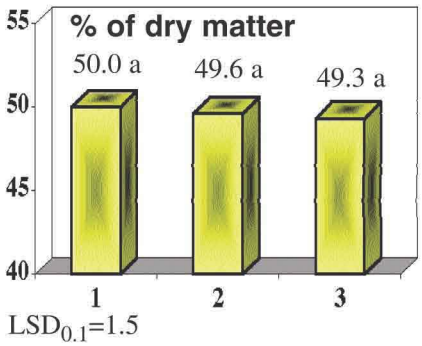
$LSD_{0.1}$=0.32

Neutral Detergent Fiber Digestibility



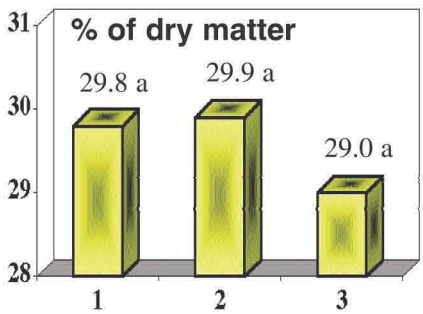
$LSD_{0.1}$=1.7; P=0.0035**
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)

Neutral Detergent Fiber



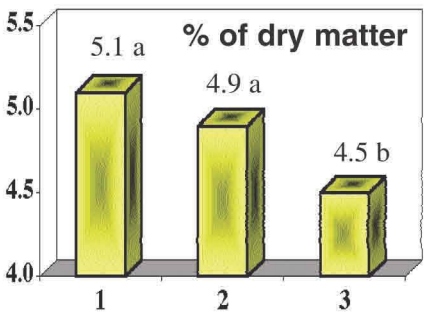
$LSD_{0.1}$=1.5

Starch



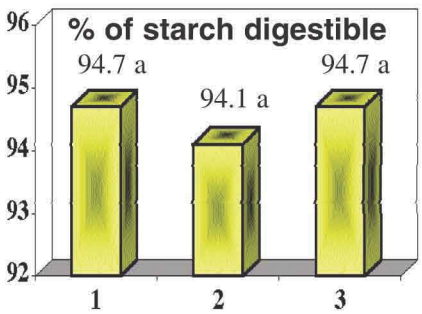
$LSD_{0.1}$=1.7

Ash



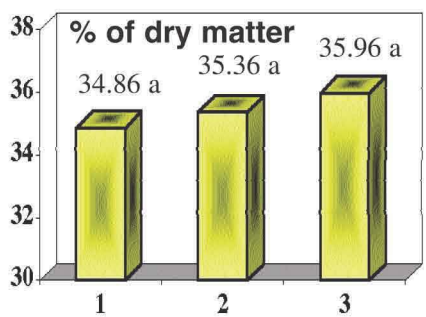
$LSD_{0.1}$=0.3; P=0.025*
Trt. 1 and 2 > Trt. 3 at P=0.10 (Tukey-Kramer)

Starch Digestibility



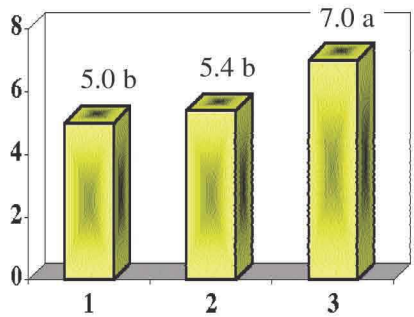
$LSD_{0.1}$=0.9

Non-Fiber Carbohydrate



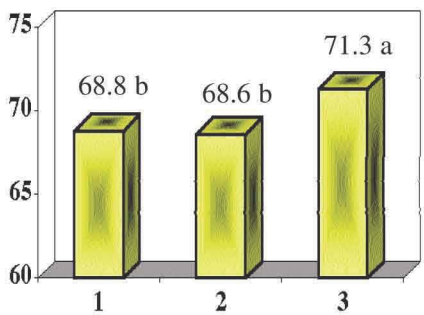
$LSD_{0.1}$=1.19

Sugars and Volatile Fatty Acids



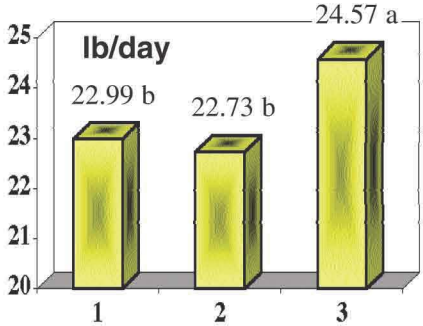
$LSD_{0.1}$=1.3; P=0.044*
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)

Total Digestible Nutrients



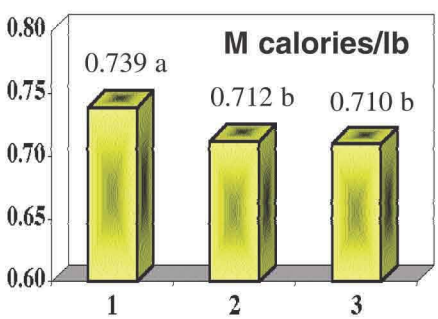
$LSD_{0.1}$=0.8; P=0.0004***
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-

Dry Matter Intake*



$LSD_{0.1}$=0.52; P=0.0003***
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)
* Based on how much a cow can eat, calculated from NDF

Net energy of Lactation



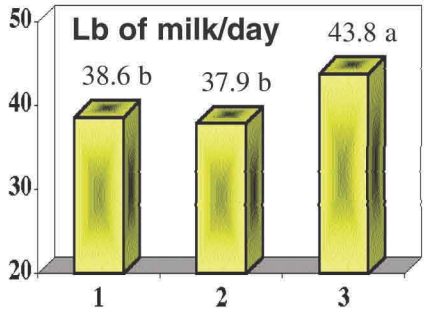
$LSD_{0.1}$=0.008; P=0.0003***
Trt. 1 > Trt. 2 and 3 at P=0.10 (Tukey-Kramer)

Calculated milk production: Based on Milk 2000 calculations of feeding value of the silage coupled with per acre yields, the following values of milk output have been calculated for each of the three treatments.

Results and conclusions: **A Summary of Digestibility and Components of Silage Treatments**

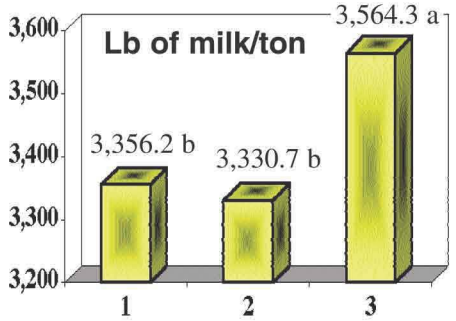
(Treatments are arranged from the highest on the left to the lowest on the right.)

Milk Output Per Day*



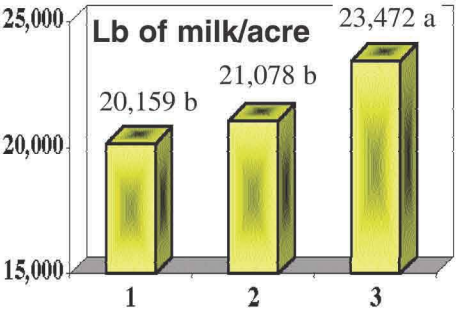
$LSD_{0.1}$=1.6; P=0.0002***
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)
* This figure approximates a balanced ration based on several assumptions, and incorporates both yield and quality parameters.

Milk Per Ton of Silage*



$LSD_{0.1}$=69.0; P=0.0004***
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)
* This value is an index of how much milk would be produced from a ton of silage based on the quality of the silage.

Milk Per Acre*



$LSD_{0.1}$=0.52; P=0.0003***
Trt. 3 > Trt. 1 and 2 at P=0.19 (Tukey-Kramer)
* This figure is an index of (milk/tons of silage) (tons of silage/acre) = milk/acre.

Yield and Quality of the Silage

Crude protein (CP)	**3**	**2**	**1**	**Ash**	**1**	**2**	**3**
Neutral detergent fiber (NDF)	**1**	**2**	**3**	**Starch digestibility**	**3**	**=1**	**2**
NDF digestibility	**3**	**1**	**2**	**Non-fiber carbohydrate (NFC)**	**3**	**2**	**1**
Starch	**2**	**1**	**3**	**Sugars and volatile fatty acids**	**3**	**2**	**1**
Total Digestible nutrients (TDN)	**3**	**1**	**2**	**Net energy of lactation (NEL)**	**1**	**2**	**3**
Dry matter intake (DMI)	**3**	**1**	**2**				

The yield was the highest for the 100% N + Vitazyme, being 10% greater than the untreated control treatment; the 60% N+Vitazyme treatment proved to give the second highest yield. **Thus, Vitazyme on top of the 100% N program produced an excellent yield, while a reduction of fertilizer N by 40% with Vitazyme actually resulted in a 6% gain in yield above the control with no Vitazyme**

Silage quality was significantly improved by Vitazyme for the 100% N level, with significant boosts in neutral detergent fiber, sugars and volatile fatty acids, total digestible nutrients, and dry matter intake. These improvements in crop quality, coupled with a higher yield, resulted in a significant increase in milk production as will be shown later.

Milk Production from the Silage

Treatment 3 (100% + Vitazyme) produced the highest milk output per cow, milk per ton of silage, and milk per acre of all three treatments, exceeding the other two by the amounts shown in the table below. There was little difference in production between the reduced N treatment with Vitazyme (Treatment 2) and the control (Treatment 1).

Income changes: The income for the three treatments is based on a price of $15.00/cwt of milk.

Treatment	Milk output per day	Change vs. 1	Milk per ton of silage	Change vs. 1	Milk per acre	Change vs. 1
	lb/day	lb/day	lb/ton	lb/ton	lb/acre	lb/acre
3. 100% N + Vitazyme	43.3	+4.7 (+12%)	3,564.3	+208.1 (+6%)	23,472	+3,313 (+16%)
2. 60% N + Vitazyme	37.9	– 0.7 (– 2%)	3,330.7	– 25.5 (– 1%)	21,078	+919 (+6%)
1. Control (no Vitazyme)	38.6	—	3,356.2	—	20,159	—

Improvements with Vitazyme applied with 100% dry N fertilizer:

Milk output per day per cow: +12%

Milk per ton of silage: +6%

Milk per acre: +16%

Treatment	Milk per acre	Gross income	Change
	lb/acre	$/acre	$/acre
1. Control (no Vitazyme)	20,159	3,023.85	—
2. 60% N + Vitazyme	21,078	3,161.70	+137.85
3. 100% N + Vitazyme	23,472	3,520.80	+496.95

Income increase with 100% N + Vitazyme: $496.95/acre

Income increase with 60% N + Vitazyme: $137.85/acre

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2002 Crop Results

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– Plus Milk 2000 Calculations –

Researcher: Ronald Stutzman
Location: Stutzman's Research Farm, Arkport, New York
Variety: Agway 3311
Soil type: silt loam
Row spacing: 30 inches
Population: 26,000 plants/acre
Soil pH: 6.6
Planting date: June 7, 2002

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Fertilization:

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[1] Estimated at 1.0% N, and a 20%/yr. release = 40 lb/acre. Applied the fall of 2001.
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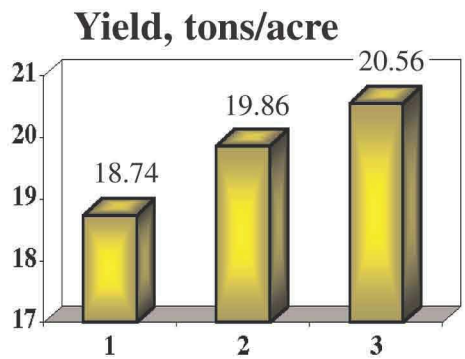

Yield increase with Vitazyme on dry fertilizer: 10%

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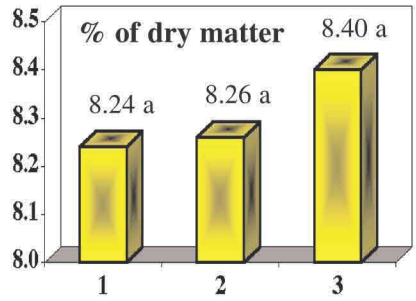
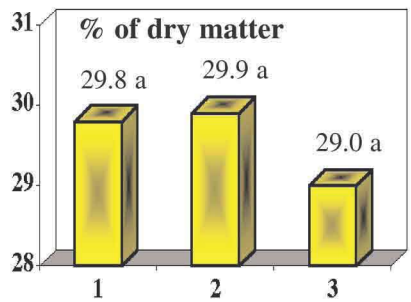
Crude Protein



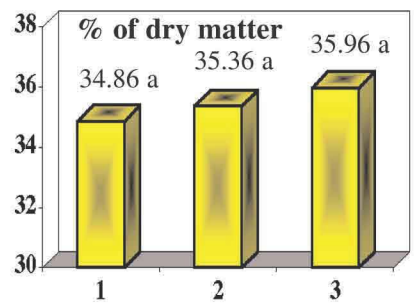
$LSD_{0.1}$=0.32

Starch



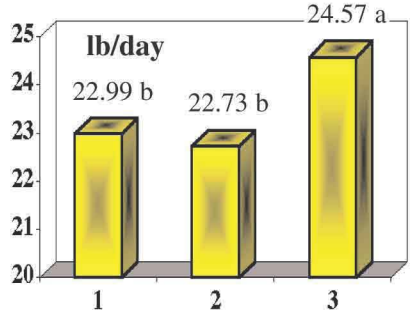
$LSD_{0.1}$=1.7

Non-Fiber Carbohydrate



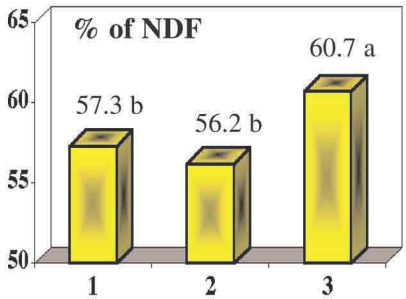
$LSD_{0.1}$=1.19

Dry Matter Intake*



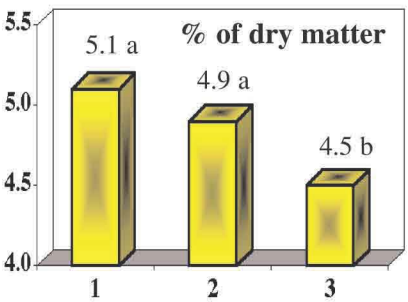
$LSD_{0.1}$=0.52; P=0.0003***
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)
* Based on how much a cow can eat, calculated from NDF

Neutral Detergent Fiber Digestibility



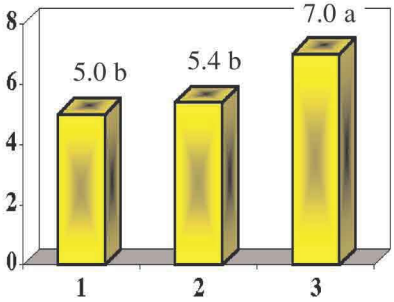
$LSD_{0.1}$=1.7; P=0.0035**
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)

Ash



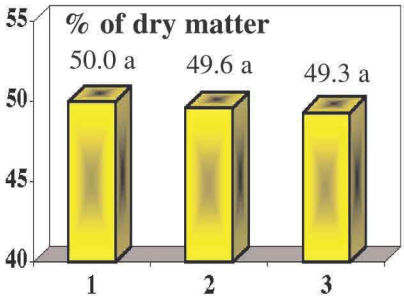
$LSD_{0.1}$=0.3; P=0.025*
Trt. 1 and 2 > Trt. 3 at P=0.10 (Tukey-Kramer)

Sugars and Volatile Fatty Acids



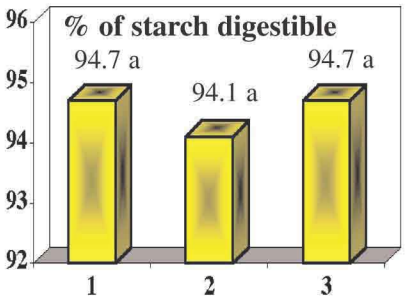
$LSD_{0.1}$=1.3; P=0.044*
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)

Neutral Detergent Fiber



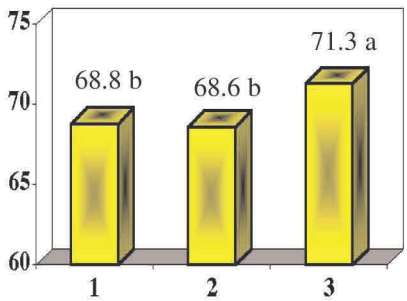
$LSD_{0.1}$=1.5

Starch Digestibility



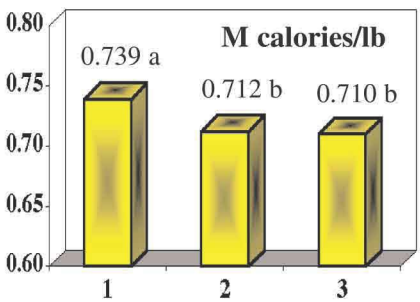
$LSD_{0.1}$=0.9

Total Digestible Nutrients



$LSD_{0.1}$=0.8; P=0.0004***
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)

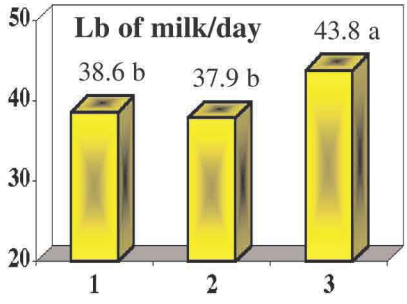
Net energy of Lactation



$LSD_{0.1}$=0.008; P=0.0003***
Trt. 1 > Trt. 2 and 3 at P=0.10 (Tukey-Kramer)

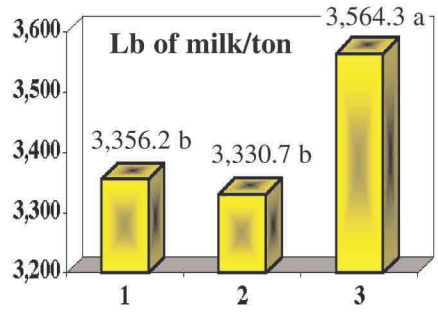
Calculated milk production: Based on Milk 2000 calculations of feeding value of the silage coupled with per acre yields, the following values of milk output have been calculated for each of the three treatments.

Milk Output Per Day*



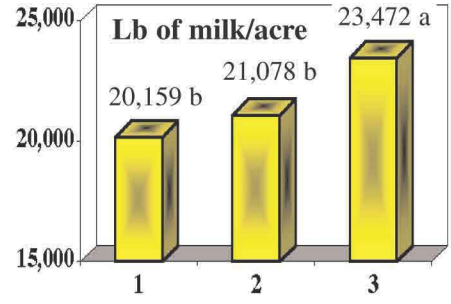
$LSD_{0.1}$=1.6; P=0.0002***
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)
* This figure approximates a balanced ration based on several assumptions, and incorporates both yield and quality parameters.

Milk Per Ton of Silage*



$LSD_{0.1}$=69.0; P=0.0004***
Trt. 3 > Trt. 1 and 2 at P=0.10 (Tukey-Kramer)
* This value is an index of how much milk would be produced from a ton of silage based on the quality of the silage.

Milk Per Acre*



$LSD_{0.1}$=0.52; P=0.0003***
Trt. 3 > Trt. 1 and 2 at P=0.19 (Tukey-Kramer)
* This figure is an index of (milk/tons of silage) (tons of silage/acre) = milk/acre.

Results and conclusions: **A Summary of Digestibility and Components of Silage Treatments**

(Treatments are arranged from the highest on the left to the lowest on the right.)

Crude protein (CP)	**3**	**2**	**1**	**Ash**	**1**	**2**	**3**
Neutral detergent fiber (NDF)	**1**	**2**	**3**	**Starch digestibility**	**3**	**= 1**	**2**
NDF digestibility	**3**	**1**	**2**	**Non-fiber carbohydrate (NFC)**	**3**	**2**	**1**
Starch	**2**	**1**	**3**	**Sugars and volatile fatty acids**	**3**	**2**	**1**
Total Digestible nutrients (TDN)	**3**	**1**	**2**	**Net energy of lactation (NEL)**	**1**	**2**	**3**
Dry matter intake (DMI)	**3**	**1**	**2**				

Yield and Quality of the Silage

The yield was the highest for the 100% N + Vitazyme, being 10% greater than the untreated control treatment; the 60% N+Vitazyme treatment proved to give the second highest yield. **Thus, Vitazyme on top of the 100% N program produced an excellent yield, while a reduction of fertilizer N by 40% with Vitazyme actually resulted in a 6% gain in yield above the control with no Vitazyme**

Silage quality was significantly improved by Vitazyme for the 100% N level, with significant boosts in neutral detergent fiber, sugars and volatile fatty acids, total digestible nutrients, and dry matter intake. These improvements in crop quality, coupled with a higher yield, resulted in a significant increase in milk production as will be shown later.

Milk Production from the Silage

Treatment 3 (100% + Vitazyme) produced the highest milk output per cow, milk per ton of silage, and milk per acre of all three treatments, exceeding the other two by the amounts shown in the table below. There was little difference in production between the reduced N treatment with Vitazyme (Treatment 2) and the control (Treatment 1).

Treatment	Milk output per day	Change vs. 1	Milk per ton of silage	Change vs. 1	Milk per acre	Change vs. 1
	lb/day	lb/day	lb/ton	lb/ton	lb/acre	lb/acre
3. 100% N + Vitazyme	43.3	+4.7 (+12%)	3,564.3	+208.1 (+6%)	23,472	+3,313 (+16%)
2. 60% N + Vitazyme	37.9	– 0.7 (– 2%)	3,330.7	– 25.5 (– 1%)	21,078	+919 (+6%)
1. Control (no Vitazyme)	38.6	—	3,356.2	—	20,159	—

Improvements with Vitazyme applied with 100% dry N fertilizer:

Milk output per day per cow: +12%

Milk per ton of silage: +6%

Milk per acre: +16%

Income changes: The income for the three treatments is based on a price of $15.00/cwt of milk.

Treatment	Milk per acre	Gross income	Change
	lb/acre	$/acre	$/acre
1. Control (no Vitazyme)	20,159	3,023.85	—
2. 60% N + Vitazyme	21,078	3,161.70	+137.85
3. 100% N + Vitazyme	23,472	3,520.80	+496.95

Income increase with 100% N + Vitazyme: $496.95/acre

Income increase with 60% N + Vitazyme: $137.85/acre

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2000 Crop Results

Vitazyme on Corn (Silage)

Researcher: Ron Stutzman, Brubaker Consulting Group
Arkport, New York
Variety: Golden Harvest 7651 Roundup Ready
Row spacing: 30 inches
Location: Stutzman Research Farm,
Planting Date: May 25, 2000
Seeding rate: 32,000 seeds/acre
Soil type: silt loam

Experimental design: A randomized complete block design was set up with a plot size of 10 x 50 ft. (0.0115 acre). Three treatments were used on the 12 plots with four replications.

1. Control 2. Furrow (seed) application 3. Foliar application

At harvest time the corn from each plot was harvested with a forage chopper, and a sample was placed in a cooler overnight to stop respiration. This sample was then sent to DHI Forage Testing Laboratory in Ithaca, New York.

Fertilization: 175 lb/acre N and 120 lb/acre K_2O preplant incorporated and sidedressed, plus 100 lb/acre 5-24-25-micronutrients starter at planting

Vitazyme treatment: Treatment 2: 13 oz in the seed row at planting; Treatment 3: 13 oz/acre sprayed on the leaves and soil at 15 inches corn height

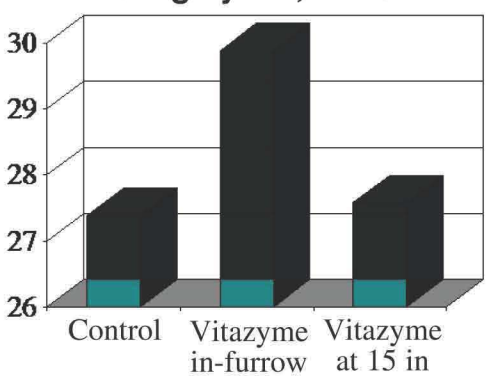
Harvest date: September 27, 2000

Yield results: Wet silage yields were adjusted to 32% moisture.

	Control*	Vitazyme in-furrow*	Vitazyme at 15 in*
		tons/acre, at 32% H_2O	
Silage yield	27.38 a	29.88 b (+9%)	27.58 a (+1%)

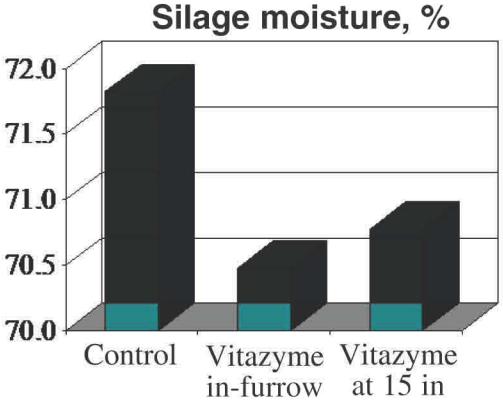
* Means followed by the same letter are not significantly different at P=0.06 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 1.77.

Silage yield, tons/acre



Silage yield increase (Vitazyme in-furrow): 9%

Silage moisture, %



Silage quality results:

Dry Matter/Moisture

	Control*	Vitazyme in-furrow*	Vitazyme at 15 in*
		% H_2O	
Moisture content	71.83 a	70.48 b	70.78 ab
Dry matter	28.13 a	29.52 b (+5%)	29.22 ab (+4%)

* Means followed by the same letter are not significantly different at P=0.06 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 0.90.

NDF, as fed*

	Control**	Vitazyme in-furrow**	Vitazyme at 15 in**
	%, as fed		
NDF	12.45 b	13.10 a (+5%)	12.93 ab (+4%)

* NDF, as fed = neutral detergent fiber, on an as-fed moist basis

** Means followed by the same letter are not significantly different at P=0.12 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 0.85.

NDF, DM*

	Control**	Vitazyme in-furrow**	Vitazyme at 15 in**
	%, DM		
NDF	44.15 b	44.45 a (+1%)	44.43 a (+1%)

* NDF, DM = neutral detergent fiber, expressed in terms of dry matter

** Means followed by the same letter are not significantly different at P=0.1 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 3.15.

IVTD, DM*

	Control**	Vitazyme in-furrow**	Vitazyme at 15 in**
	%, DM		
IVTD	81.10 b	83.15 a (+3%)	82.90 a (+2%)

* IVTD, DM = in vitro true digestibility, expressed in terms of dry matter. It is an anaerobic fermentation performed in the laboratory using rumen fluid from cows consuming a typical ration.

** Means followed by the same letter are not significantly different at P=0.04 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 1.28.

DNDF, DM*

	Control**	Vitazyme in-furrow**	Vitazyme at 15 in**
	%, DM		
DNDF	57.18 b	61.98 ab (+8%)	66.60 a (+16%)

* DNDF, DM = the digestible portion of the plant less the grain (vegetation portion only); expressed in terms of dry matter

** Means followed by the same letter are not significantly different at P=0.1 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 9.43.

Summary of Silage Quality Parameters, as Affected by Vitazyme*

Treatment	Dry matter	NDF, as fed	NDF, DM	IVTD, DM	DNDF, DM
	% increase above the control				
Vitazyme in-furrow	**+5%**	**+5%**	+1%	**+3%**	+8%
Vitazyme at 15 in	+4%	+4%	+1%	**+2%**	**+16%**

* Bold letters indicate statistically greater values than the control.

Conclusions: Vitazyme applied to the seeds and soil in the furrow at planting provided a significant increase in silage yield (9%), plus improved silage quality in terms of dry matter (5%), NDF, as fed (5%), and IVTD, DM (3%); DNDF, DM was increased by 8% as well. Vitazyme sprayed on the plants and soil at 15 inches in height increased yield (1%), and also significantly increased IVTD, DM (2%) and DNDF, DM (16%); dry matter and NDF, as fed, were also increased by 4% each. **All yield and quality parameters in every case were increased with Vitazyme applied either of the two ways.**

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2000 Crop Results

Vitazyme on Corn

Farmer: Ron Stutzman, Brubaker Consulting Group Arkport, New York
Variety: Golden Harvest h7615 Roundup Ready
Planting population: 30,000 seeds/acre
Location: Stutzman Research Farm,
Planting date: May 26, 2000
Row spacing: 30 inches
Soil type: silt loam

Experimental design: A randomized complete block design with plots 10 x 50 ft. (0.0115 acre) was set up with four replications and 12 total plots. Three treatments were used.

1. Control 2. Vitazyme on the seeds 3. Vitazyme on the leaves and soil

Fertilization: 175 lb/acre N and 120 lb/acre K_2O preplant incorporated and sidedressed, plus 100 lb/acre 5-24-25% N-P_2O_5-K_2 + micronutrients starter at planting
Vitazyme treatment: 6 oz/acre on the seeds at planting (Treatment 2); 6 oz/acre sprayed on the leaves and soil with the herbicide
Herbicide application: Roundup (glyphosate)
Harvest date: November 11, 2000
Grain moisture results:

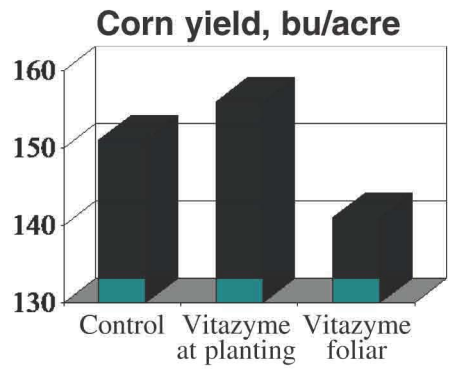
	Control*	Vitazyme at planting*	Vitazyme foliar*
	% of grain		
Grain moisture	27.63 a	28.13 a	28.40 a

* Means followed by the same letter are not significantly different at P=0.10 according to Tukey's Honestly Significance Difference Test. $LSD_{0.10}$=1.49.

Grain yield results:

	Control*	Vitazyme at planting*	Vitazyme foliar*
	bu/acre		
Corn yield	151 a	156 a (+3%)	141 (-7%)

* Means followed by the same letter are not significantly different at P=0.10 according to Tukey's Honestly Significance Difference Test. $LSD_{0.10}$=11.



Yield increase (planting application): 3%

Conclusions: Vitazyme was applied in this study at half the recommended rate of 13 oz/acre, and only once in the two Vitazyme treatments. Neverthless, yield increased by 5 bu/acre with a seed row application, though a foliar application at 6 oz/acre reduced yield by 10 bu/acre. Neither treatment produced a significant (P=0.10) yield change. Grain moisture and test weight were not significantly affected by these treatments. It is likely that a full 13 oz/acre rate, applied on the seed and also on the leaves and soil, would have produced a sizable and significant yield increase.

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2001 Crop Results

Vitazyme on Corn, for Silage

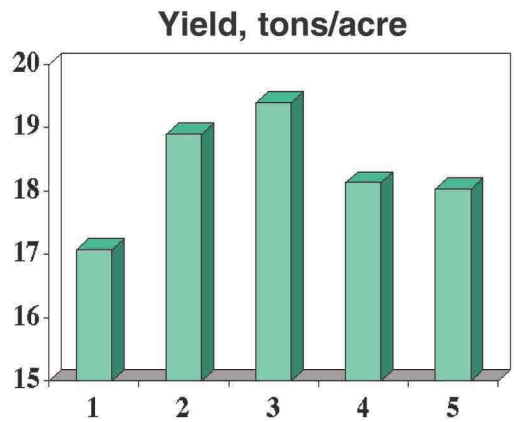
Researcher: Ron Stutzman
Location: Stutzman's Research Farm, Arkport, New York
Variety: Mycogen 108
Soil type: silt loam
Row spacing: 30 inches
Population: 30,000 plants/acre
Planting date: May 22, 2000
Soil test values: pH, 6.8; P, 165 lb/acre; K, 399 lb/acre; Mg, 501 lb/acre; Ca, 3,153 lb/acre; CEC, 12.6 mg/100 g of soil
Experimental design: A randomized complete block design was devised, with each plot 10 x 50 ft (0.0115 acre). Three replicates were utilized, with five treatments, or 15 total plots. The treatments were as follows:

1. **Control**
2. **Vitazyme at 13 oz/acre in the seed furrow with pop-up fertilizer at planting plus 100% N**
3. **Vitazyme at 13 oz/acre in the dry fertilizer, 2 x 2 inch placement from the seeds**
4. **Vitazyme at 13 oz/acre in the seed furrow with pop-up fertilizer at planting, plus 100% N, and Vitazyme a second time at 13 oz/acre at 20-inch height**
5. **Same as Treatment 4, but 70% N**

Fertilization : 80 lb/acre N + 145 lb/acre K_2O plowed down in the fall; 80 lb/acre N topdressed July 15
Vitazyme treatments: Treatments 2, 4, and 5 received 13 oz/acre of Vitazyme directly on the seed at plant-ing, while Treatments 4 and 5 were given an additional 13 oz/acre sprayed over the plants and soil at 20-inches in plant height. Treatment 3 received 13 oz/acre of Vitazyme in the dry fertilizer, placed 2 inches below and two inches beside the seed row.
Harvest date: September 11, 2001
Weather during the growing season: The entire growing season had minimal rain, with severe drought conditions by mid-summer. Temperatures in mid-summer were usually high. Rainfall amounts: May, 2.7 in; June, 2.5 in; July, 1.9 in; August, 2.8 in; September, 1.7 in; total, 10.5 in.
Yield results: Because of the severe drought, growing conditions were highly unfavorable for respectable yields. On August 15 it was obvious that tasseling was being restrained by the lack of moisture, but rains on August 16, 19, 26, and 28 – totaling 3.8 inches – recovered the crop to some degree.

Treatment	Yield[1]	Change vs. Control
	---------- tons/acre----------	
3 Vitazyme in fertilizer	19.40	(+)2.33 (+14%)
2 Vitazyme on seed + 100% N	18.90	(+)1.83 (+11%)
4 Vitazyme on seed + leaves + 100% N	18.13	(+)1.06 (+6%)
5 Vitazyme on seed + leaves + 70% N	18.03	(+)0.96 (+6%)
1 Control	17.07	—

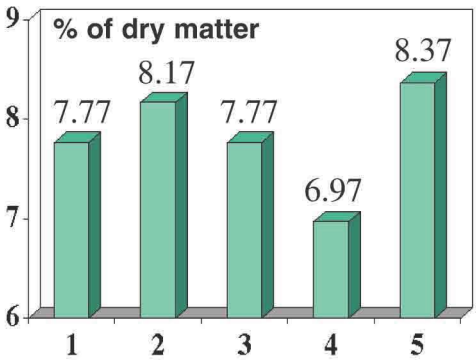
[1] Adjusted yield to 32% dry matter. Yields are not significantly different at P=0.10, but Treatment 3 is greater than the control at P=0.12 according to the Tukey-Kramer Test. $LSD_{0.1}$=2.63 tons/acre



Yield increase with Vitazyme on dry fertilizer: 14%

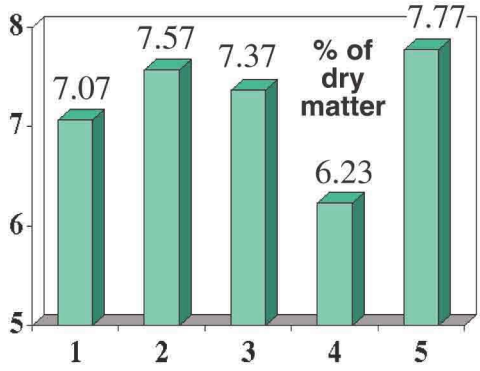
Quality and feeding value results: A number of quality and feeding value parameters were determined at the DHI Forage Teating Laboratory in Ithaca, New York. These evaluations are shown below. All are calculated on a dry matter basis.

Crude Protein



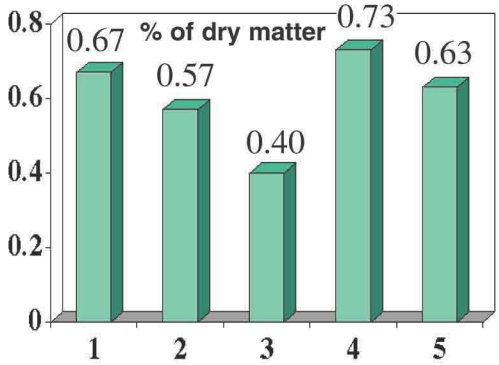
$LSD_{0.1}$=0.93%
Trt. 5>Trt. 4 at P=0.10
(Tukey-Kramer)

Available Protein



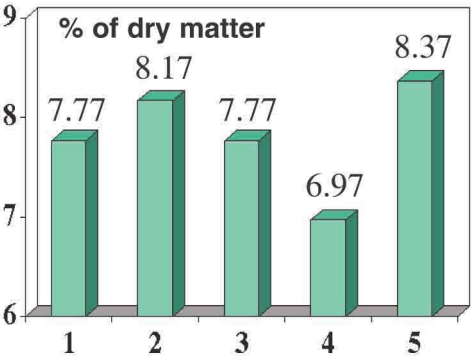
$LSD_{0.1}$=0.85%
Trt. 5>Trt. 4 at P=0.10
(Tukey-Kramer)

Acid Detergent Insoluble Crude Protein*



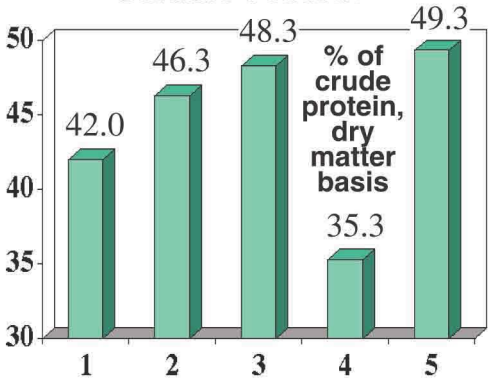
* Bound or unavailable protein
$LSD_{0.1}$=0.29%
Trt. 4>Trt. 3 at P=0.10
(Tukey-Kramer)

Adjusted Crude Protein



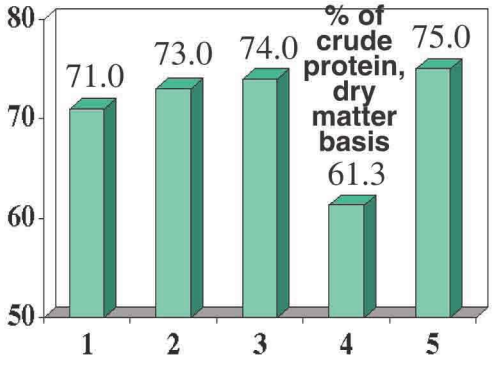
$LSD_{0.1}$=0.93%
Trt. 5>Trt. 4 at P=0.10
(Tukey-Kramer)

Soluble Protein



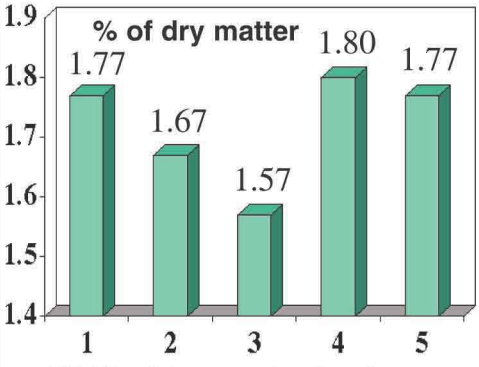
$LSD_{0.1}$=6.9%
Trt. 5>Trt. 1 and 4; Trt. 3>Trt. 4 at P=0.10
(Tukey-Kramer)

Degradable Protein



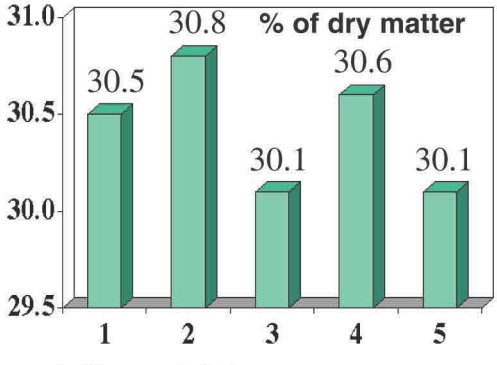
$LSD_{0.1}$=10.0%
Trt. 2,3, and 5>4 at P=0.10
(Tukey-Kramer)

Neutral Detergent Insoluble Crude Protein*



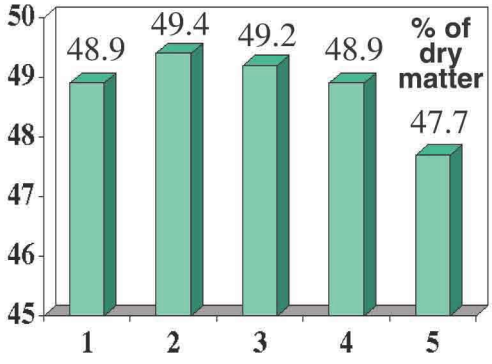
*Utilizable protein that is not termed available
$LSD_{0.1}$=0.26%

Acid Detergent fiber



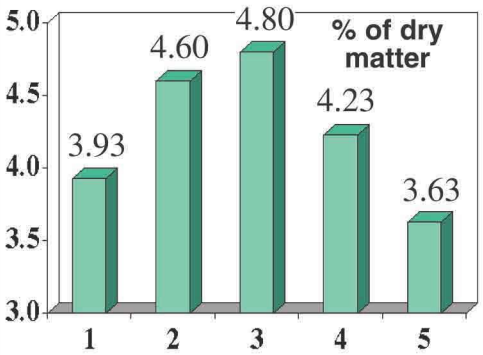
$LSD_{0.1}$=1.3%

Neutral Detergent Fiber



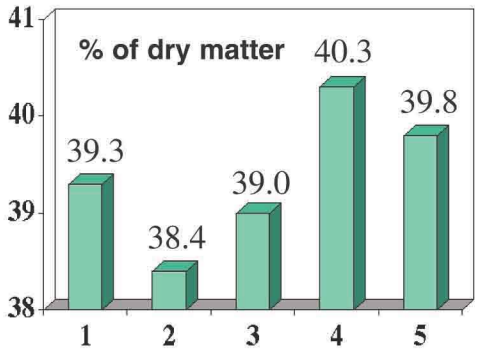
$LSD_{0.1}$=1.6%
Trt. 2>Trt. 5 at P=0.10
(Tukey-Kramer)

Lignin



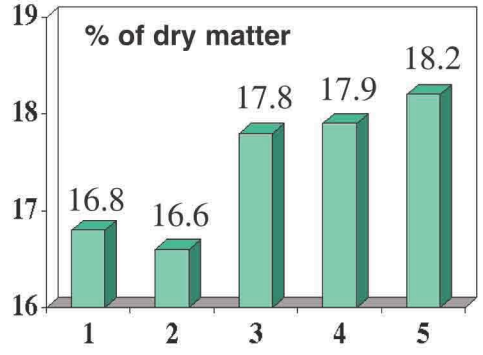
$LSD_{0.1}$=1.22%

Non-Fiber Carbohydrate



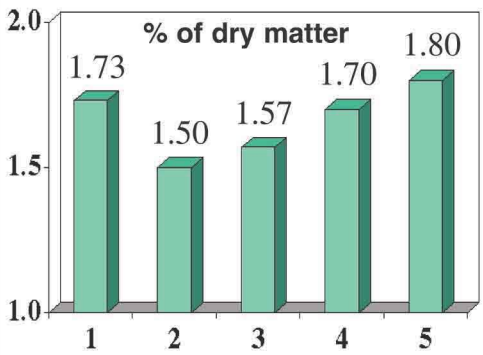
$LSD_{0.1}$=2.5%

Starch



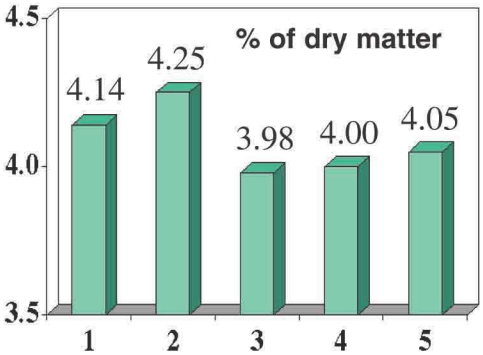
$LSD_{0.1}$=2.0%

Crude Fat



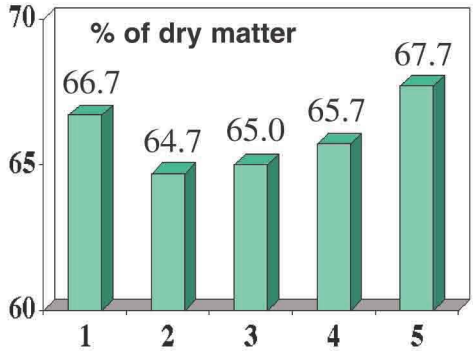
$LSD_{0.1}$=0.34%

Ash



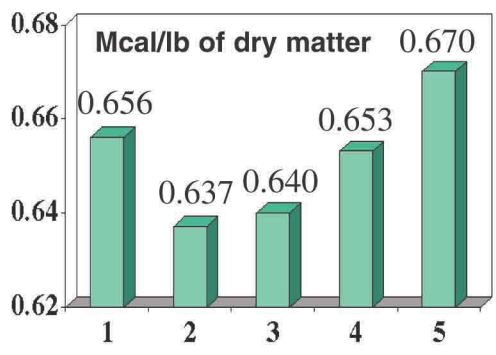
$LSD_{0.1}$=0.34%

Total Digestible Nutrients



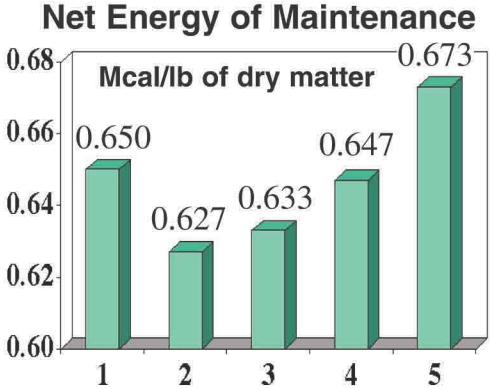
$LSD_{0.1}$=2.0%
Trt. 5>Trt. 2, 3, and 4; Trt. 1>2 at P=0.10 (Tukey-Kramer)

Net Energy of Lactation



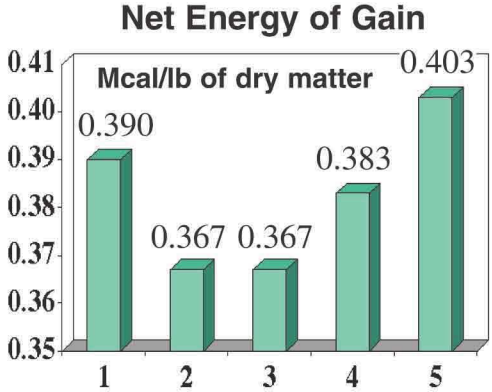
$LSD_{0.1}$=0.016 Mcal/lb
Trt. 5>Trt. 2. 3. and 4; Trt. 1>Trt. 2 and 3; Trt. 4>Trt. 2 at P=0.10 (Tukey-Kramer)

Net Energy of Maintenance



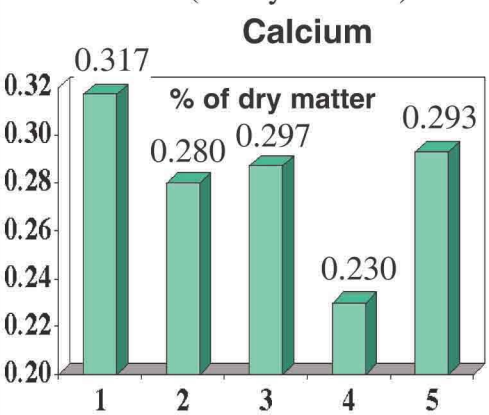
$LSD_{0.1}$=0.029 Mcal/lb
Trt. 5>Trt. 2, 3, and 4 at P=0.10 (Tukey-Kramer)

Net Energy of Gain



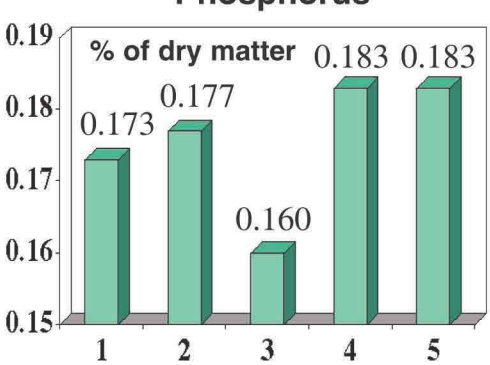
$LSD_{0.1}$=0.026 Mcal/lb
Trt. 5>Trt. 2 and 3 at P=0.10 (Tukey-Kramer)

Calcium



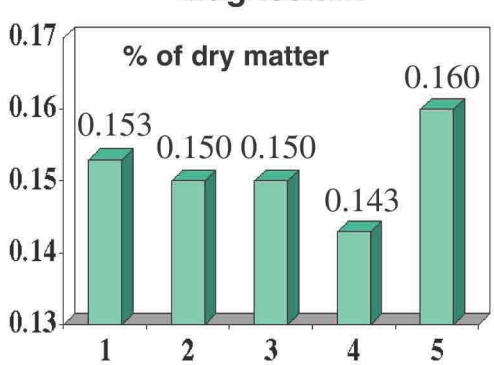
$LSD_{0.1}$=0.071%
Trt. 1>Trt. 4 at P=0.10 (Tukey-Kramer)

Phosphorus



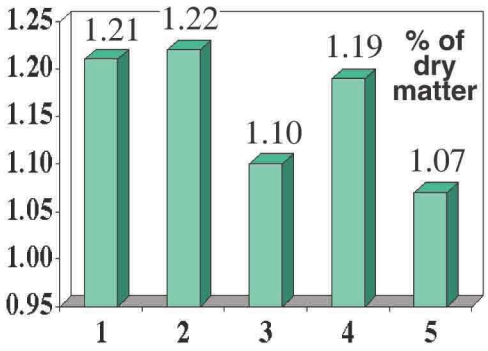
$LSD_{0.1}$=0.028%

Magnesium



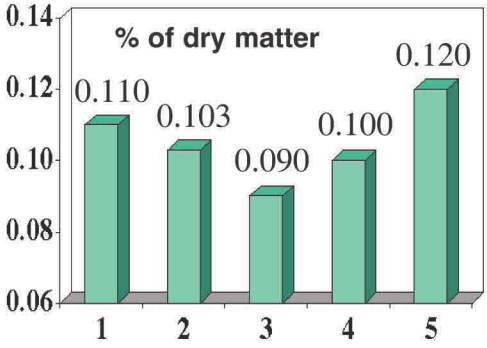
$LSD_{0.1}$=0.027%

Potassium



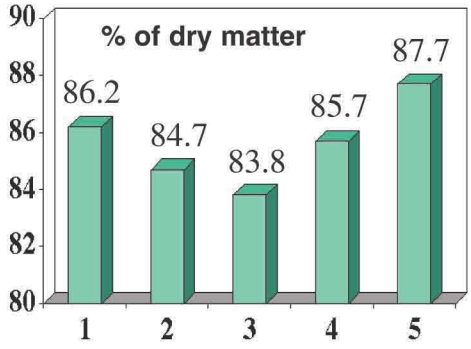
$LSD_{0.1}$=0.23%

Sulfur



$LSD_{0.1}$=0.021%
Trt. 5>Trt. 3 at P=0.10 (Tukey-Kramer)

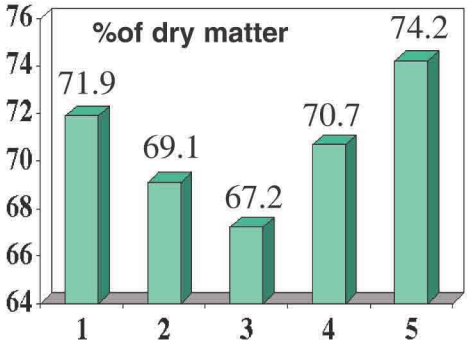
In Vitro True Digestibility



$LSD_{0.1}$=2.1%
Trt. 5>Trt. 2 and 3; Trt. 1>Trt. 3 at P=0.10 (Tukey-Kramer)

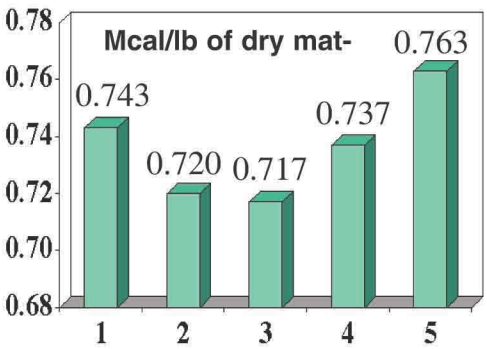
Conclusions for quality and yield analyses: Despite severe drought effects on the corn crop, some trends are detectable. Treatment 3 (Vitazyme on the dry fertilizer) produced the highest yield in this test – 14% above the control – followed closely by Treatment 2 (Vitazyme on the pop-up fertilizer in the seed row and 100% nitrogen), which gave an 11% yield increase. Quality analyses proved that Treatment 5 (Vitazyme on the pop-up fertilizer in the seed rows and 70% nitrogen plus Vitazyme at 20 inches height) was superior. Notice the following summary table.

Digestible Neutral Detergent Fiber



$LSD_{0.1}$=4.1%
Trt. 5>Trt. 2 and 3; Trt. 1>Trt. 3 at P=0.10 (Tukey-Kramer)

In Vitro Net Energy of Lactation



$LSD_{0.1}$=0.021%
Trt. 5>Trt. 2, 3, and 4; Trt. 1>Trt. 2 and 3 at P=0.01 (Tukey-Kramer)

A Summary of Digestibility and Components of Silage Treatments

(Treatments are arranged from the highest on the left to the lowest on the right.)

Crude Protein	5 2 3 1 4	Lignin	3 2 4 1 5	Calcium	1 3 5 2 4
Available protein	5 2 3 1 4	Non-fiber carbohydrate	4 5 1 3 2	Phosphorus	5 4 2 1 3
ADI crude protein	4 1 5 2 3	Starch	5 4 3 1 2	Magnesium	5 1 2 3 4
Adjusted crude protein	5 2 3 1 4	Crude fat	5 1 4 3 2	Potassium	2 1 4 3 5
Soluble protein	5 3 2 1 4	Ash	2 1 5 4 3	Sulfur	5 1 2 4 3
Degradable protein	5 3 2 1 4	Total digestible nutrients	5 1 4 3 2	In vitro digestibility	5 1 4 2 3
NDI crude protein	4 5 1 2 3	Net energy l	5 1 4 3 2	DNDF	5 1 4 2 3
Acid detergent fiber	2 4 1 3 5	Net energy m	5 1 4 3 2	IVNEL	5 1 4 2 3
Neutral detergent fiber	2 3 4 1 5	Net energy g	5 1 4 3 2		

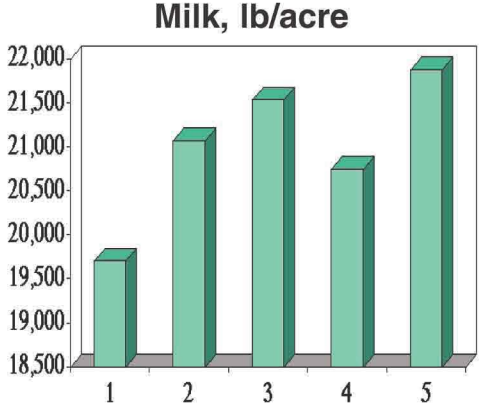
It will be noted from this table that treatment 5 usually has the highest value of all five for nutrients and digestibility factors, while all of the other treatments are varied in their positions. Note that the protein values are highest for treatment 5, while unavailable protein (ADI crude protein) is not high for this treatment. Fiber and lignin, on the other hand, are low for Treatment 5. Starch and fat levels are highest, and consequently energy levels are highest for Treatment 5, as are levels of several elements (P, Mg, and S). Thus, it is quite clear that **the silage produced by corn grown with Vitazyme applied in-furrow with pop-up fertilizer at planting, 70% of the normal nitrogen, and Vitazyme sprayed on the leaves and soil at 20 inches corn height, produced the best overall feed for animals.**

Estimates On Milk Per Acre

An estimate was made of milk production per acre using the Milk 2000 computer program developed by the university of Wisconsin. This program requires the percentage of dry matter of the silage, crude protein (% of dry matter), neutral detergent fiber (% of dry matter), digestibility of the neutral detergent fiber (% of neutral detergent fiber), starch (% of dry matter), neutral detergent fiber crude protein (percent of dry matter), ash (percent of dry matter), either extract (percent of dry matter), and yield (tons of dry matter per acre).

Treatment	Milk per acre	Change	Value of Increase*
	------- lb of milk/acre-------		$/acre
1 (Control)	19,607	——	——
2 (Vita on seed, 100% N)	**21,075**	**+1,378 (+7%)**	**213.59**
3 (Vita of dry fertilizer)	**21,075**	**+1,839 (+9%)**	**285.05**
4 (Vita twice, 100%)	**20,749**	**+1,052 (+5%)**	**163.06**
5 (Vita twice, 70% N)	**21,883**	**+2,186 (+11%)**	**338.83**

* Based on an average price of $15.50/cwt.



Increase in milk per acre with Vitazyme: 1,052 to 2,186 lb/acre

Increase in milk income per acre with Vitazyme: $163.06 to $338.83/acre

Conclusions: In spite of a very dry and hot summer, Vitazyme for all four applications increased milk production per acre, but especially the double application with 70% nitrogen. The nitrogen reduction was presumably instrumental in improving forage quality (see earlier in this report), which translated to a big increase in likely milk output. While Vitazyme on the dry fertilizer increased yield the most, the quality of the yield was not as high as for the double Vitazyme application with reduced nitrogen.

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2000 Crop Results

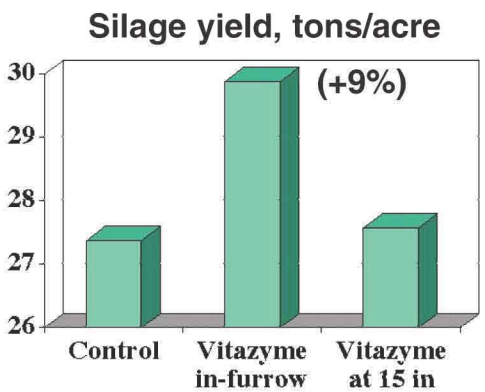
Vitazyme on Corn (Silage)

Milk Returns Calculated by "Milk 95"

Researcher: Ron Stutzman
Location: Stutzman Research Farm,Arkport, New York
Planting Date: May 25, 2000
Seeding rate: 32,000 seeds/acre
Variety: Golden Harvest 7651 Roundup Ready
Soil type: silt loam
Row spacing: 30 inches
Experimental design: A randomized complete block design was set up with a plot size of 10 x 50 ft. (0.0115 acre). Three treatments were used on the 12 plots with four replications.

1. Control **2. Furrow (seed) application** **3. Foliar application**

At harvest time the corn from each plot was harvested with a forage chopper, and a sample was placed in a cooler overnight to stop respiration. This sample was then sent to DHI Forage Testing Laboratory in Ithaca, New York.
Fertilization: 175 lb/acre N and 120 lb/acre K_2O preplant incorporated and sidedressed, plus 100 lb/acre 5-24-25-micronutrients starter at planting
Vitazyme treatment: Treatment 2: 13 oz in the seed row at planting; Treatment 3: 13 oz/acre sprayed on the leaves and soil at 15 inches corn height
Harvest date: September 27, 2000
Yield results: Wet silage yields were adjusted to 32% moisture.



	Control*	Vitazyme in-furrow*	Vitazyme at 15 in*
		tons/acre, at 32% H_2O	
Silage yield	27.38 a	29.88 b (+9%)	27.58 a (+1%)

* Means followed by the same letter are not significantly different at P=0.06 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 1.77.

Silage quality results:

Dry Matter/Moisture

	Control*	Vitazyme in-furrow*	Vitazyme at 15 in*
		% H_2O	
Moisture content	71.83 a	70.48 b	70.78 ab
Dry matter	28.13 a	29.52 b (+5%)	29.22 ab (+4%)

* Means followed by the same letter are not significantly different at P=0.06 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 0.90.

NDF, as fed*

	Control**	Vitazyme in-furrow**	Vitazyme at 15 in**
	%, as fed		
NDF	12.45 b	13.10 a (+5%)	12.93 ab (+4%)

* NDF, as fed = neutral detergent fiber, on an as-fed moist basis

** Means followed by the same letter are not significantly different at P=0.12 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 0.85.

NDF, DM*

	Control**	Vitazyme in-furrow**	Vitazyme at 15 in**
	%, DM		
NDF	44.15 b	44.45 a (+1%)	44.43 a (+1%)

* NDF, DM = neutral detergent fiber, expressed in terms of dry matter

** Means followed by the same letter are not significantly different at P=0.1 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 0.32.

IVTD, DM*

	Control**	Vitazyme in-furrow**	Vitazyme at 15 in**
	%, DM		
IVTD	81.10 b	83.15 a (+3%)	82.90 a (+2%)

* IVTD, DM = in vitro true digestibility, expressed in terms of dry matter. It is an anaerobic fermentation performed in the laboratory using rumen fluid from cows consuming a typical ration.

** Means followed by the same letter are not significantly different at P=0.04 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 1.28.

DNDF, DM*

	Control**	Vitazyme in-furrow**	Vitazyme at 15 in**
	%, DM		
DNDF	57.18 b	61.98 ab (+8%)	66.60 a (+16%)

* DNDF, DM = the digestible portion of the plant less the grain (vegetation portion only); expressed in terms of dry matter

** Means followed by the same letter are not significantly different at P=0.1 according to Tukey's Honestly Significant Difference Test. $LSD_{0.1}$ = 9.43.

Summary of Silage Quality Parameters, as Affected by Vitazyme*

Treatment	Dry matter	NDF, as fed	NDF, DM	IVTD, DM	DNDF, DM
	% increase above the control				
Vitazyme in-furrow	**+5%**	**+5%**	+1%	**+3%**	+8%
Vitazyme at 15 in	+4%	+4%	+1%	**+2%**	**+16%**

* Bold letters indicate statistically greater values than the control.

Milk 95 Calculations

Milk 95 is a computer program devised by the Department of Dairy service and Agronomy st the University of Wisconsin-Madison, to evaluate the probable milk output of dairy cows in response to being fed a ration containing a particular forage . . . in this case corn silage. Taken into account are total yield, dry matter, crude protein, fiber, digestibility, and other factors. Thus, it is a good estimate of forage quality as it relates to milk output and dollar returns.

Treatment	Return per ton of dry matter	Increase over control	Return per acre	Increase over control
Control	$258/ton	—	$7,062/acre	—
Vitazyme in-furrow	$267/acre	$9/ton	$7,970/acre	$ 908/acre
Vitazyme at 15 inches	$265/ton	$7/ton	$7,302/acre	$240/acre

Increase in income with Vitazyme (in-furrow): $908/acre, $9/ton

Conclusion: Due to increases in silage quality, Vitazyme applied in the furrow or to the leaves and soil increased the per acre and per ton return above the costs of production. A $908/acre return increase represented the greatest improvement, with the in-furrow treatment.

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1999 Crop Results

Vitazyme on Corn (Silage)

Researcher: Ron Stutzman
Location: Stutzman Research Farm, Arkport, New York
Planting Date: unknown
Variety: unknown
Row spacing: 30 inches
Seeding rate: 32,000 seeds/acre
Soil type: silt loam
Experimental design: A field was divided into several sections, each with a different treatment using different products and applications. Only one replicate of each treatment was made. Two of those treatments were as follows:

1. Control **2. Vitazyme on the leaves and soil**

Fertilization: unknown
Vitazyme treatment: 13 oz/acre on the leaves and soil at 15 inches plant height
Harvest date: unknown
Leaf chlorophyll: On August 11, 1999, 30 representative leaves from each treatment were analyzed with a Minolta SPAD meter, and averaged.

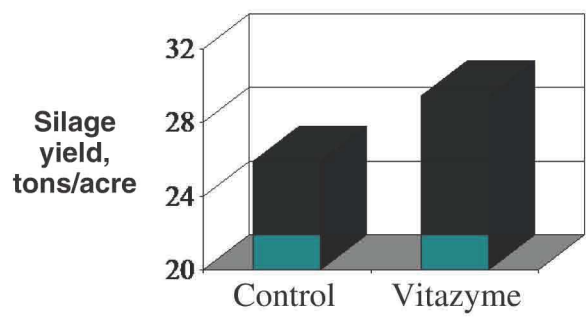
	Control	Vitazyme	Change
		SPAD units	
Leaf chlorophyll	59.0	56.3	(+) 2.7

Leaf chlorophyll increase: 2.7 SPAD units

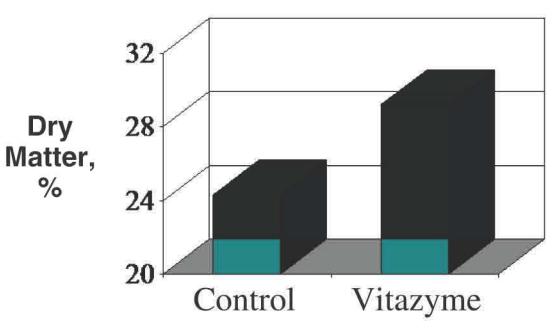
Yield results: Wet silage yields were adjusted to 32% moisture.

	Control	Vitazyme	Change
		tons/acre	
Silage yield	25.90	29.45	(+) 3.55 (+14%)

Silage yield increase: 14%



Silage quality results:



	Control	Vitazyme	Change
		%	
Dry matter	24.3	29.2	(+) 4.9 (+20%)

Dry matter increase: 20%

*NDF, as fed**

	Control	Vitazyme	Change
	%, as fed		
NDF	57.0	38.5	(–) 18.5 (–32%)

* NDF, as fed = neutral detergent fiber, on an as-fed moist basis.

*DMD, DM**

	Control	Vitazyme	Change
	%, DM		
DMD	48.23	69.52	(+) 21.29 (+44%)

* DMD, DM = dry matter digestibility, or the % of the silage digested by the cow.

*DNDF, DM**

	Control	Vitazyme	Change
	%, DM		
NDF	39.58	40.86	(+) 1.28 (+3%)

* DNDF, DM = the digestible portion of the plant less the grain (vegetative portion only), expressed in terms of dry matter.

Dry matter digestibility increase: 44%

Conclusions: Vitazyme applied to the leaves and soil of this corn crop substantially improved the leaf chlorophyll content during the growing season, which increased plant growth and final yield of the crop by 14%. Silage quality was also improved, reflected by a 44% improvement in dry matter digestibility compared to the control. The total digestibility of all plant cell material was also increased by 3% with Vitazyme.