

## Vital Earth Resources

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

# 2004 Crop Results

## Vitazyme on Pearl Millet

[An article published on August 3, 2004, in the *Journal of Crop Management*]

**Researchers:** **S.A. Deepak**, Department of Studies in Applied Botany and Biotechnology, University of Mysore, Manasagangotri, Mysore 570 006, India; **P.W. Syltie**, Vital Earth Resources Research Center, 706 East Broadway, Gladewater, Texas 75647; **Chandrashekhara Shetty**, and **H.S. Shetty**, Department of Studies in Applied Botany and Biotechnology, University of Mysore, Manasagangotri, Mysore 570 006, India

Corresponding author: H.S. Shetty. hhs uom@hotmail.com

Deepak, S.A., Syltie, P.W., Shetty, C., and Shetty, H.S. 2004. Vitazyme promotes growth in pearl millet. Online. *Crop Management* doi:10.1094/CM-2004-0803-01-RS.

**Abstract:** This study investigated the incorporation of the plant growth promoter Vitazyme as an additional seed-dressing component to pearl millet, along with a regularly recommended systemic fungicide. Preliminary in vitro examination indicated a significant enhancement in seedling vigor for all of the concentrations tested. Vitazyme seed treatments, alone or in combination with Apron 35SD, resulted in improved field emergence. Yield analyses indicated Vitazyme seed treatment alone or in combination with foliar spray showed yield measurements comparable to Apron 35SD. Furthermore, the combination of seed treatments/foliar applications with Apron 35SD provided the best yield improvement.

Treatment	Concentration	Seed germination*	Seedling vigor*
	%	± SD	±SD
<b>Vitazyme</b>	0.0001	92 ± 1.4 bc	1189 ± 12.8 c
	0.001	92 ± 1.6 bc	1193 ± 11.0 bc
	0.01	91 ± 1.7 bc	1189 ± 12.3 c
	0.05	93 ± 1.8 abc	1192 ± 12.2 bc
	0.1	95 ± 1.1 a	1189 ± 12.6 bc
	0.5	92 ± 1.4 bc	1196 ± 12.7 bc
	1.0	92 ± 1.4 bc	1195 ± 10.0 bc
	2.0	95 ± 1.5 a	1203 ± 8.3 b
	3.0	90 ± 1.8 c	1196 ± 5.0 bc
	6.0	92 ± 1.0 bc	1201 ± 7.2 bc
12.0	92 ± 1.6 bc	1198 ± 7.5 bc	
18.0	92 ± 1.3 bc	1200 ± 7.3 bc	
24.0	93 ± 1.4 ab	1199 ± 7.7 bc	
<b>Apron</b>	6 g/kg of seeds	91 ± 0.9 bc	1146 ± 10.0 d
<b>Apron (6 g/kg) + Vitazyme (2%)</b>		92 ± 1.1 bc	1247 ± 8.5 a
<b>Control</b>	Distilled water	92 ± 1.2 bc	982 ± 6.0 e
Degrees of freedom		15	176
Significant at P =		0.001	0.001

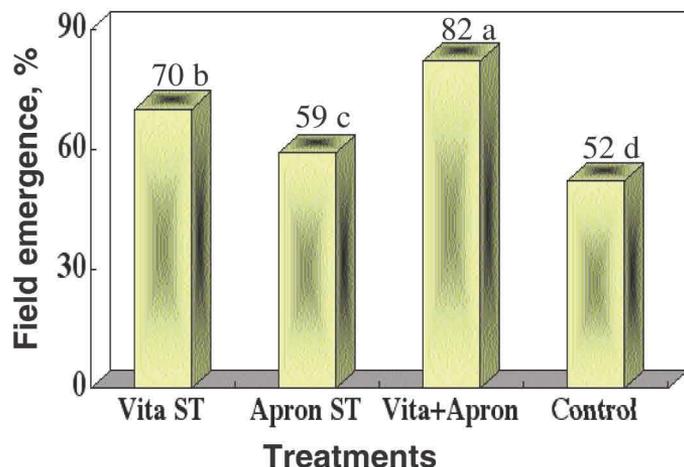
### Seed Vigor Results

#### Effects of Vitazyme seed treatments to pearl millet on seed quality parameters

\* Values are means of three independent trials. Means followed by the same letter(s) within the column are not significantly different according to Tukey's HSD. SD = significant difference.

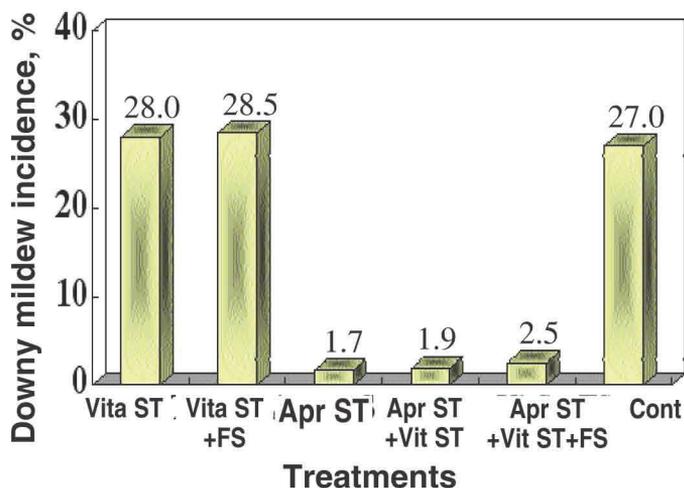
## Field Trial Results

**Efficacy of Vitazyme and Apron 35SD seed treatments to pearl millet on seedling emergence under field conditions**



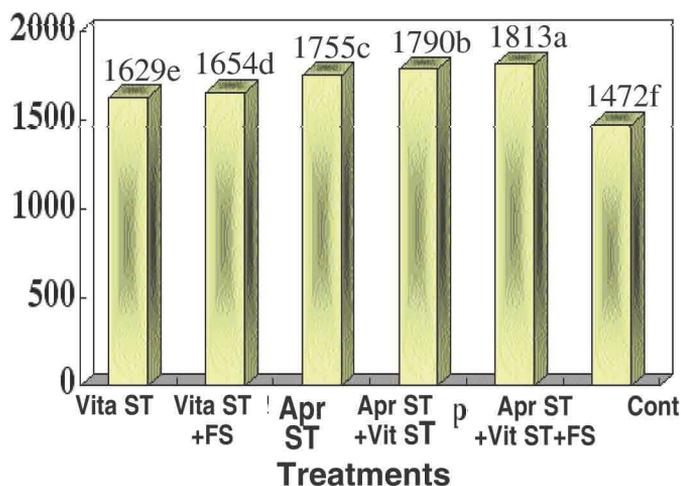
Values are means of three independent trials. Degrees of freedom, 3;  $P = 0.001$ . Means followed by the same letter(s) within the column are not significantly different according to Tukey's HSD. ST = seed treatment. FS = foliar spray.

**Downy mildew incidence (60DAS) under adverse plot conditions in Vitazyme and Apron 35SD treatments**



Values are means of three independent trials. Degrees of freedom, 5;  $P = 0.001$ . Means followed by the same letter(s) within the column are not significantly different according to Tukey's HSD. ST = seed treatment. FS = foliar spray.

**Effect of Vitazyme and Apron 35SD treatments to pearl millet on grain yield of pearl millet**



Values are means of three independent trials. Degrees of freedom, 66;  $P = 0.001$ . Means followed by the same letter(s) within the column are not significantly different according to Tukey's HSD. ST = seed treatment. FS = foliar spray.

**Conclusions:** Compared with other methods of applying Vitazyme, seed treatment is a more practical and cost effective treatment, especially for pearl millet. The application of effective growth promoters, such as Vitazyme, as a seed dressing for pearl millet, alone or in combination with systemic fungicides, for qualitative and quantitative trait improvement (germination, seedling vigor, and yield), is an appropriate agronomic practice.

For an on-line copy of the complete article, go to <http://www.plantmanagementnetwork.org/pub/cm/research/2004/millet>.

## Vital Earth Resources

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

# 2002 Crop Results

## Vitazyme on Pearl Millet

University of Mysore, Manasagangotri, Mysore, India

*A Germination, Vigor, Yield, and Disease Resistance Study: DANIDA Project*

Researcher: S.A. Deepak, Ph.D.

Location: Manasagangotri, Mysore, India

Variety: pearl millet

Institution: Department of Studies in Applied Botany, Seed Pathology, and Biotechnology, University of Mysore

Experimental design: This study was performed to evaluate the effectiveness of Vitazyme to stimulate germination, early growth and vigor, disease resistance, and yield of pearl millet in the laboratory, greenhouse, and field. Discussions will be divided into these three areas. Not many details are available on the methodology used for this study.

### Laboratory Studies

Pearl millet seeds were soaked in the Vitazyme solutions given below in conical flasks, with distilled water, for 6 hours. Root and shoot lengths were measured after a given growth period and compared to the control.

Treatment	Germination	Root and shoot length <sup>1</sup>	Vigor index <sup>2</sup>
% of Vitazyme	%	cm	
0.0001	92	12.2	1122 (+16%)
0.001	93	12.5	1162 (+21%)
0.01	91	13.2	1201 (+23%)
0.05	93	12.8	1190 (+23%)
0.1	95	13.1	1244 (+29%)
0.5	92	13.2	1214 (+26%)
1.0	93	12.7	1181 (+23%)

Treatment	Germination	Root and shoot length <sup>1</sup>	Vigor index <sup>2</sup>
% of Vitazyme	%	cm	
2.0	95	13.3	1263 (+31%)
3.0	90	13.0	1170 (+21%)
6.0	93	13.2	1227 (+27%)
12.0	92	12.9	1186 (+23%)
18.0	92	13.0	1193 (+24%)
24.0	94	12.7	1193 (+24%)
Control	91	10.6	964 —

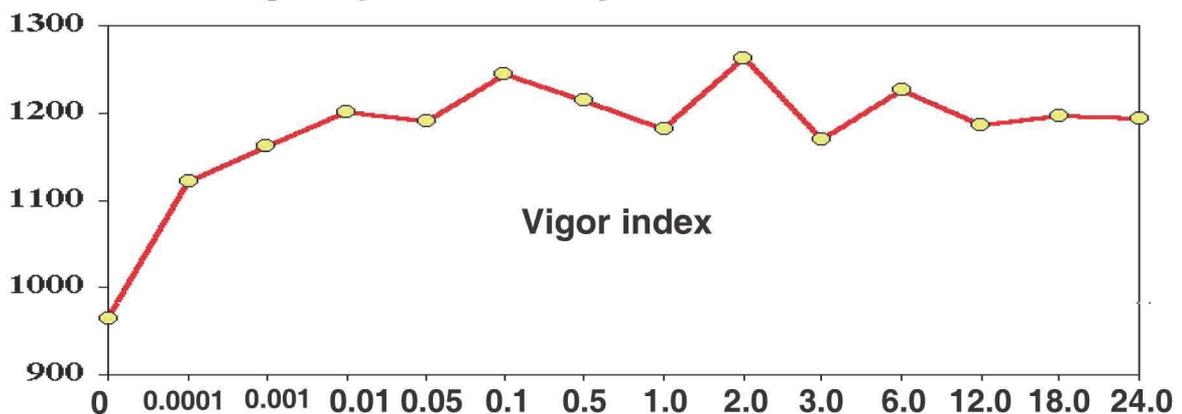
<sup>1</sup>Total length of roots and shoots.

<sup>2</sup>Product of germination percentage and total root and shoot length.

<sup>1</sup>Total length of roots and shoots.

<sup>2</sup>Product of germination percentage and total root and shoot length.

### Pearl Millet Seedling Response to Vitazyme At Different Concentrations



Pearl millet seedlings responded well (from 16 to 31% increases in growth) at all concentrations tested in the laboratory, as low as 0.0001% and as high as 24%, showing the great range of concentrations of Vitazyme that are effective in a laboratory setting.

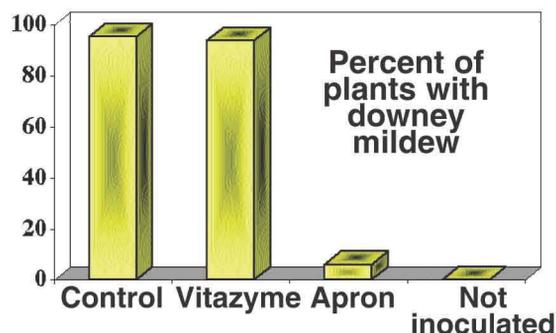
# Greenhouse Studies

## Downy Mildew (*Sclerospora Graminicola*) Disease Incidence

Pearl millet seeds were soaked in a 2% Vitazyme solution for 6 hours, and sown in clay pots with a mix of 1:2:1 sand:soil:manure. The plants were then challenged with downy mildew disease organisms to evaluate the relative resistance of the plants.

Treatment	Number of plants <sup>1</sup>	Number of diseased plants <sup>1</sup>	Plants with downey mildew %
Control	25.5 a	24.3 c	95.3
Vitazyme	26.5 a	24.8 c	93.6
Apron 35 SD	24.5 a	1.5 b	6.1
Uninoculated	24.8 a	0 a	0

<sup>1</sup>Means are not significantly different at P = 0.05 (4 reps).



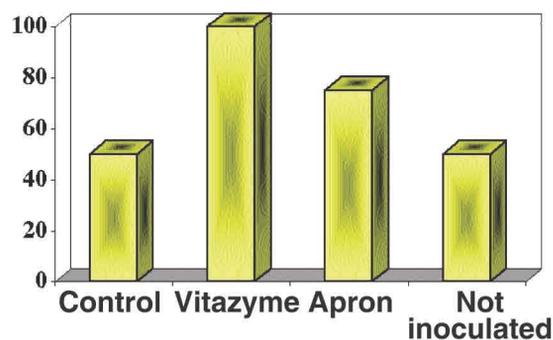
Pearl millet plants inoculated with downy mildew fungi, but treated with Apron 35 SD fungicide, were mostly protected from infection while the control and Vitazyme treatments had a high rate of infection. The uninoculated control showed no infection at all. Thus Vitazyme is shown to have little effect on the incidence of downy mildew in this study.

## Emergence of Plants in the Greenhouse

An estimate of the emergence of three days after planting was made for all treatments (4 reps).

Treatment	Emergence in three days
Control	50%
Vitazyme	100%
Apron 35 SD	75%
Uninoculated	50%

Plant emergence in three days, %



This study reveals that Vitazyme can greatly stimulate the early germination of seeds, in this case more so than a fungicide treatment and untreated controls.

## Demonstration of Systematic Acquired Resistance (SAR)

Vitazyme (2%) was applied to pearl millet, and downey mildew organisms were applied at from one to five days later for different treatments. In this way systematic acquired resistance (SAR) could be evaluated. The treated pots were compared to untreated pots (4 reps).

Treatment Protection <sup>2</sup>	Number of plants <sup>1</sup>	Number of diseased plants <sup>1</sup>	Disease incidence %	%
Vitazyme – first day	27.3 a	25.3 a	94.5	2.8
Control	27.3 a	26.5 a	97.1	—
Vitazyme – second day	22.5 b	20.3 b	90.2	2.9
Control	28.0 a	26.0 a	92.9	—
Vitazyme – third day	24.5 a	20.3 a	82.9	6.7
Control	25.3 a	22.5 a	88.9	—
Vitazyme – fourth day	25.3 a	20.3 b	80.2	7.8
Control	28.5 a	24.8 a	87.0	—
Vitazyme – fifth day	24.3 a	18.8 a	77.4	5.7
Control	23.5 a	19.3 a	82.1	—

<sup>1</sup>Means followed by the same letter are not significantly different at P = 0.05 (4 reps).

<sup>2</sup>Percent protection = % diseased (Vitazyme) – % diseased (control) / % diseased (control) x 100.

Vitazyme provided a mild but constant degree of protection to pearl millet plants in a greenhouse setting in this SAR study. **This small degree of protection was the greatest at the second and fourth days of inoculation, when there were significantly fewer plants affected by mildew with Vitazyme than without it.**

## Field Studies

Pearl millet was planted in the field with 4 replicates, and downy mildew disease incidence was evaluated beside Apron fungicide. Yields were also determined.

### Emergence and Yield

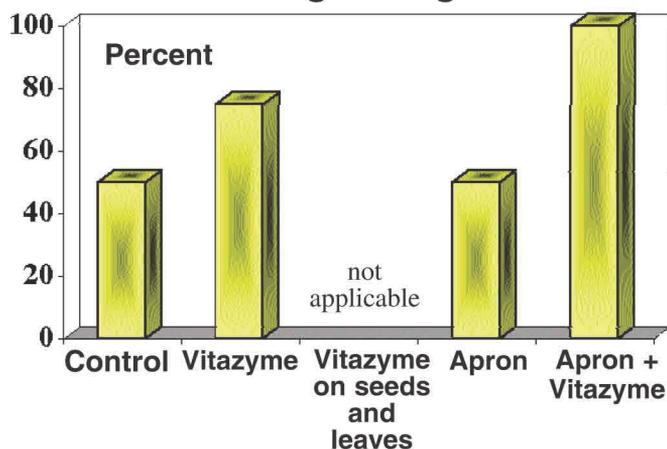
Treatment	Emergence <sup>1</sup>	Yield, seeds <sup>2</sup>	Change
	%	kg/ha	kg/ha
Vitazyme on seeds	75	1,648	+185 (+13%)
Vitazyme on seeds and leaves/soil <sup>3</sup>	—	1,683	+220 (+15%)
Apron 35 SD on seeds	50	1,776	+313 (+21%)
Apron 35 SD + Vitazyme on seeds	100	1,808	+345 (+24%)
Control	50	1,463	—

<sup>1</sup>Seedlings emerged after three days.

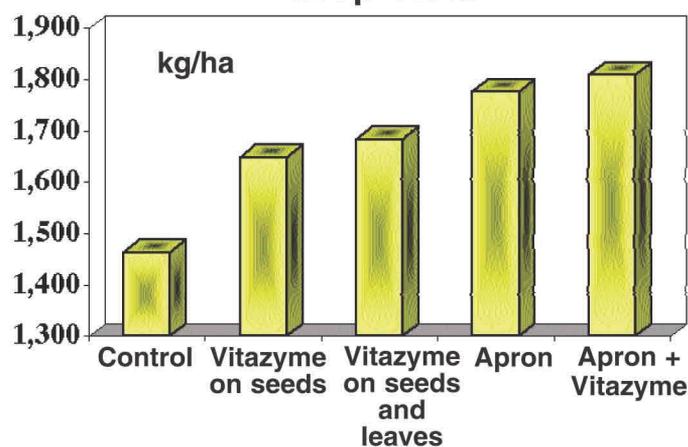
<sup>2</sup>Harvested 75 days after sowing.

<sup>3</sup>Not evaluated because treatment 1 evaluated the same variable.

### Seedling Emergence



### Crop Yield



In this evaluation of Vitazyme performance no “infector rows” — rows of plants containing the diseases within the plots — were included. Emergence and yield were determined. Vitazyme was applied as a seed treatment as well as a foliar/soil treatment in different cases.

Vitazyme had a strong effect of improving early emergence, emergence being 25% greater at three days after planting than the control or Apron alone. However, **Apron fungicide + Vitazyme showed an excellent synergism by increasing emergence to 100% at three days.** Millet yield was increased by 13% with Vitazyme on the seeds alone, and by 15% with both a seed and foliar/soil treatment. **When combined with Apron fungicide, Vitazyme boosted yield to 24% above the control versus a 21% increase for Apron alone.**

### Disease Protection Study

Treatment	Number of plants	Number of diseased plants <sup>1</sup>	Disease incidence <sup>1</sup>	Protection <sup>2</sup>
			%	%
Vitazyme on seeds	79.3	73.4	92.6 b	2.1 b
Apron 35 SD on seeds	77.5	5.8 c	7.5 c	92.1 a
Apron 35 SD + Vitazyme on seeds	74.5	5.5 c	7.4 c	92.2 a
Control	69.8	66.0 b	94.6 a	—

<sup>1</sup>Means followed by the same letter are not significantly different at P = 0.05 (4 reps)

<sup>2</sup>Percent protection = % diseased (Vitazyme) - % diseased (control) / % diseased (control) x 100

An evaluation was made of the incidence of Downy mildew on pearl millet plants in the field study. These evaluations were translated into percent protection figures.

Vitazyme slightly reduced the incidence of downy mildew on pearl millet in this field study, but not nearly as much as did Apron 35 SD fungicide. These facts are shown by the protection index, which is much higher for Apron 35 SD than for Vitazyme.

### **Vitazyme Effects on Pearl Millet in India**

<b>Vigor Index (lab):</b>	<b>+ 16 to 31% above the control</b>
<b>Emergence (greenhouse):</b>	<b>+ 100% above the control</b>
<b>(field):</b>	<b>+ 50% above the control</b>
<b>SAR protection (greenhouse):</b>	<b>+ 2.8 to 7.8 % above the control</b>
<b>Grain yield (field):</b>	
<b>Seed treatment:</b>	<b>+ 13% above the control</b>
<b>Seed treatment + Soil/Foliar:</b>	<b>+ 15% above the control</b>
<b>Seed treatment + Apron:</b>	<b>+ 24% above the control</b>

*Significant findings for this study:* Vitazyme did not offer much disease protection (downy mildew) of pearl millet plants in both greenhouse and field settings for this Indian study, though it did provide a certain amount of system acquired resistance. However, **Vitazyme greatly stimulated the growth and yield of pearl millet in all three settings: the laboratory, greenhouse, and field.** These improvements are summarized as follows:

*Comments by Dr. S.A. Deepak:*

- 1. Vigor of pearl millet can be improved significantly by Vitazyme treatment.**
- 2. Vitazyme treatment improves the emergence of pearl millet in pot and field conditions.**
- 3. By seed treatment/foliar spray best performance in grain yield can be obtained.**
- 4. Most importantly, Vitazyme is compatible with the systemic fungicide Apron 35 SD as evidenced by increasing yield over individual treatment in the field.**

## Vital Earth Resources

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

# 2000 Crop Results

## Vitazyme on Millet

A millet grower at Meridian, California, performed a Vitazyme study using the following program. One field (the control) did not receive Vitazyme, while a nearby one did.

1. Preplant: Liquid compost (2 gal/acre) + UAN 32
2. Foliar at six leaves: 13 oz/acre Vitazyme + 1 qt/acre Vigorator + 1 pt/acre PHOS
3. Foliar at early boot: 13 oz/acre Vitazyme + 1 qt/acre Vigorator + sulfur
4. Foliar at kernel coloring: ViFinisher + Calcium

### Yield results:

	Field 1 (control)	Field 2 (Vitazyme)	Change
	boxes/acre		
<b>Millet yield</b>	145	176	(+) 31 (+21%)

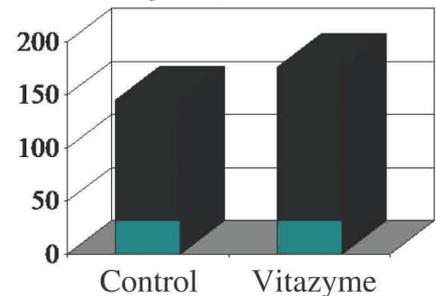
**Yield increase: 21%**

Income results: Millet sells for about \$25.00/box.

**Income increase: \$775.00/acre**

Conclusions: Returns from Vitazyme on this millet crop were excellent, about 24:1 for crop increase vs. product cost.

Millet yield, boxes/acre



## Vital Earth Resources

706 East Broadway, Gladewater, Texas 75647

(903) 845-2163 FAX: (903) 845-2262

# 1999 Crop Results

## Vitazyme on Millet (for Bird Seed)

### A Testimonial

Farmer: William “Chip” Struckmeyer      Location: Colusa, California

We have followed Kumen Meservy’s recommendation on this crop for five years, and it always makes us money. The program is as follows:

1. Preplant: two gallons of liquid chicken manure compost with aqua ammonia (the liquid to prevent ammonia escape)
2. Plant 3 to 6 inches: a foliar spray of 1 qt/acre Vigorator + 1 pt/acre PHOS
3. Head in the boot stage: a foliar spray of balanced nutrients, including S and Ca

Vitazyme is applied in the second and third foliar sprays at 13 oz/acre.

Results of a bird seed millet crop at the Tarke Ranch:

Untreated  
80 boxes/acre

Foliar nutrients  
110 boxes/acre

Foliar + Vitazyme  
134 boxes/acre (+22%)

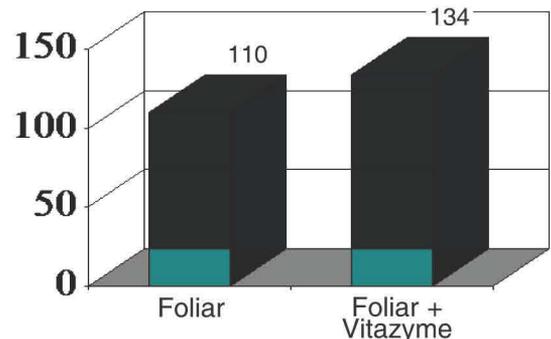
There were an extra 14 boxes/acre of millet heads “over budget” of 120 boxes projected. This increased production is as follows:

14 box x \$26.00/box = **\$364/acre increase**

Costs: Aerial application (\$8/acre) x 2 = \$16/acre  
Material cost (\$8/acre) x 2 = \$16/acre  
Total = \$ 32/acre

**Return on investment: \$364 : \$32 = 11.4 : 1**

**Boxes of millet per acre**



Will he use Vitazyme again? “Yeah, I’ll do it again... in a heartbeat!”