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

2014 Crop Results

Vitazyme on Sunflowers

Researcher: unknown *Research organization*: Kernel Company, LLC, Ukraine
Location: Man'kivs'ky District, Cherkasy Region, Viktorivka Village, Ukraine *Variety*: NK Dolbi
Planting rate: 50,000/ha *Planting date*: May 19, 2014
Previous crop: winter wheat *Soil type*: Chernozem, with 3.7% organic matter
Seedbed preparation: disk-plowing to 6-8 cm, plowing to 22 - 24 cm, harrowing, two cultivations to 5-6 cm
Experimental design: A sunflower field was divided into a Vitazyme treated area and an untreated control, to discover the effects of the product on seed yield and profitability. All plant protection and fertilization regimes were identical for both treatments.

1. Control **2. Vitazyme**

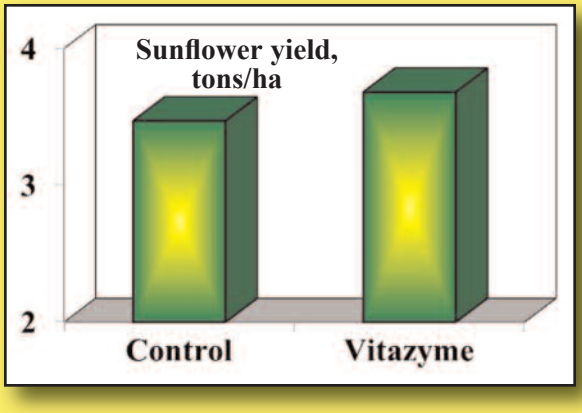
Fertilization: 50 kg/ha of nitrogen broadcast and incorporated before planting, and 10-26-26 kg/ha of N-P_2O_5-K_2O in-furrow at planting.

Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 6-leaf stage, on June 14

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	3.47	—
Vitazyme	3.68	0.21 (+6%)

Increase in sunflower yield with Vitazyme: 6%



Income results: Income and expense calculations showed that the 1 liter/ha application increased net income by 956 UAH/ha ($60.71/ha at 1UAH = 0.0635 USD).

Increase in income with Vitazyme: 956 UAH/ha

Conclusions: Sunflowers grown in Ukraine responded excellently to a single 1 liter/ha application of Vitazyme at the 6-leaf stage. The yield was improved by 6%, resulting in an increase in income of 956 UAH/ha ($60.71/ha), showing the excellent utility of utilizing this program on sunflowers in Ukraine.

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2011 Crop Results

Vitazyme on Sunflowers

Researcher: Unknown
Research coordinator: I.V. Braginets
Research organization: Alfa-Agro, Ukraine
Variety: unknown
Experimental design: A field was divided into a Vitazyme treated and an untreated portion to evaluate the effect of this product on crop yield.

1. Control **2. Vitazyme**

Fertilization: farm practice
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 10 to 12-leaf stage
Yield results: No yield results are available, but the increase in yield is given.

Increase in sunflower yield with Vitazyme:
0.45 ton/ha (16.7 bu/acre)

Conclusion: This yield increase was an excellent result of Vitazyme application in this Ukraine study.

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Average Values for 2009 to 2011 in Ukraine

Vitazyme on Sunflowers

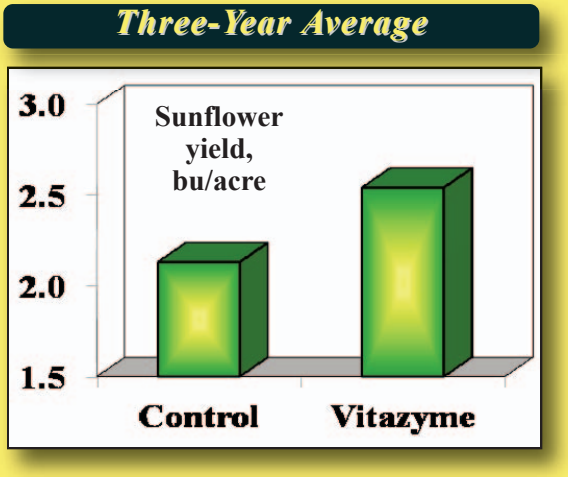
Researcher: V.V. Plotnikov *Location*: National Academy of Agrarian Sciences, Vinnytsia State Agricultural Research Station, Vinnytsia, Ukraine (Central Forest and Steppe Region)

Demonstration plot values averaged over three years, 2009 to 2011:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	2.13	—
2. Vitazyme at head formation[1]	2.54	0.41 (+19%)

[1]1 liter/ha at head formation.

Three-Year Average Increase With Vitazyme: +19%



Conclusion: Over three years of demonstrations, Vitazyme is shown to be an excellent adjunct to sunflower production in Ukraine.

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2011 Crop Results

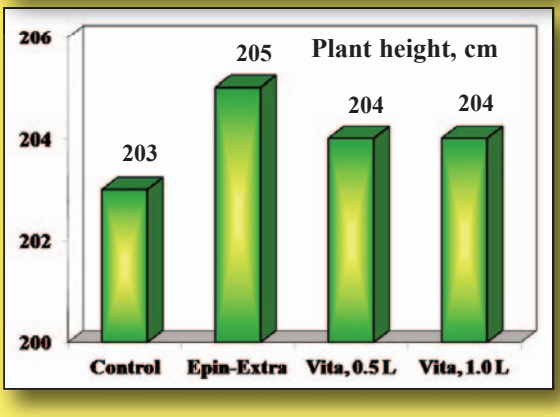
Vitazyme on Sunflowers

Researcher: V.D. Strelkov, Ph.D., and V.V. Morozovsky *Research organization*: State Research Institution, All-Russian Research Institute of Biological Plant Protection, Russian Agricultural Academy
Location: Russia *Variety*: Flagman *Soil type*: Chernozem (Mollisol)
Field preparation: disking and plowing in 2010, and disking in April of 2011
Previous crop: winter wheat *Planting date*: April 28, 2011
Planting rate: 10 kg/ha, adjusted to 40,000 plants/ha
Experimental design: A replicated trial with sunflowers was initiated on a field having plots of 25 m^2, using Vitazyme, a standard treatment (Epin-Extra), and an untreated control. The purpose of the trial was to determine the effect of the products on yield and quality of the crop.

1. Control
2. Epin-Extra
3. Vitazyme (0.5 L/ha) at head formation (budding)
4. Vitazyme (1.0 L/ha) at head formation (budding)

Fertilization: ammonium phosphate plus potassium (16-16-16% N-P_2O_5-K_2O) at 2 centners/ha in rows
Vitazyme application: either 0.5 or 1.0 liter/ha with a backpack sprayer at the beginning of head formation (budding), applied in 250 liters/ha of water on June 15, 2011
Epin-Extra application: applied at 0.004 liter/ton of seed in 10 liters of water, as well as 0.04 liter/ha on the plants at 2 to 3 true leaves, in 250 liters/ha of water with a backpack sprayer, on May 24, 2011
Plant growth results: At the beginning of ripening the height and leaf area of each plot were measured using AAC-100 methods.

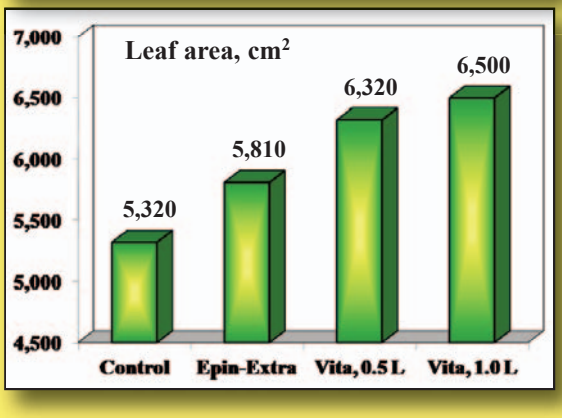
Plant Height



$HCP_{0.05}$=3.25 No Significant differences.

There was little effect of Vitazyme or Epin-Extra on plant height.

Leaf Area



$HCP_{0.05}$=70.3 Significant differences.

Both Vitazyme treatments substantially increased leaf area, leading to greater photosynthesis and yield potential. Epin-Extra increased leaf area nominally.

Increase in leaf area with Vitazyme

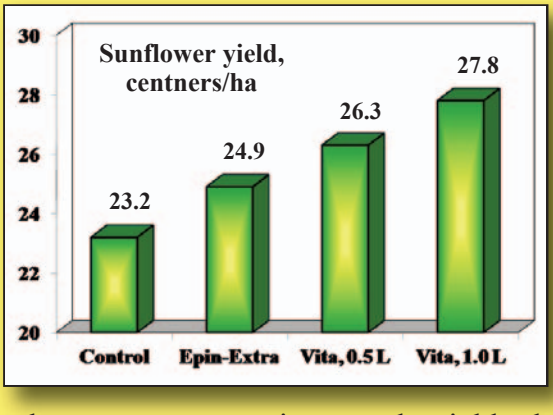
0.5 liter/ha ..... +19%
1.0 liter/ha ..... +22%

Yield results: Harvest was completed on September 23, 2011, using a Xere-125 combine. Yield as well as seed characteristics were evaluated.

Treatment	Yield	Yield change
	centners/ha	centners/ha
1. Control	23.2	—
2. Epin-Extra	24.9	1.7 (+7%)
3. Vitazyme, 0.5 L/ha	26.3	3.1 (+13%)
4. Vitazyme, 1.0 L/ha	27.8	4.6 (+20%)
$HCP_{0.05}$	1.14	

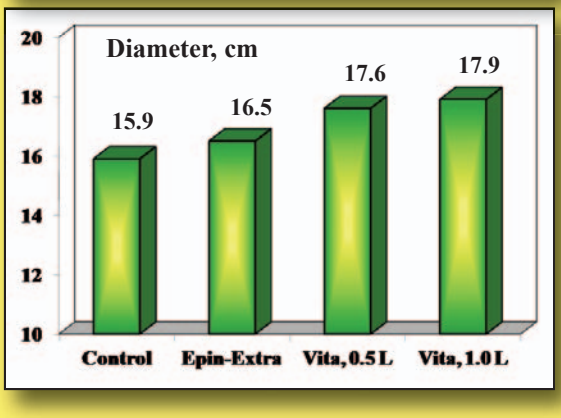
Increase in yield with Vitazyme

0.5 liter/ha ..... +13%
1.0 liter/ha ..... +20%



All three treatments increased yield, but Vitazyme at both rates produced a much bigger increase than did Epin-Exta.

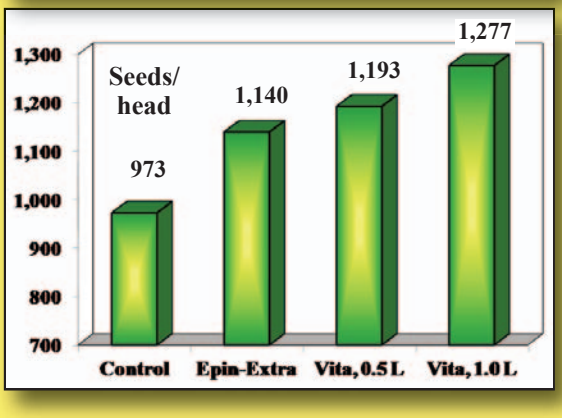
Head Diameter



$HCP_{0.05}$=0.45

All treatments increased head diameter, especially the Vitazyme treatments.

Seeds Per Head



$HCP_{0.05}$=28.5

Seeds per head were markedly increased by all three treatments, but most by Vitazyme.

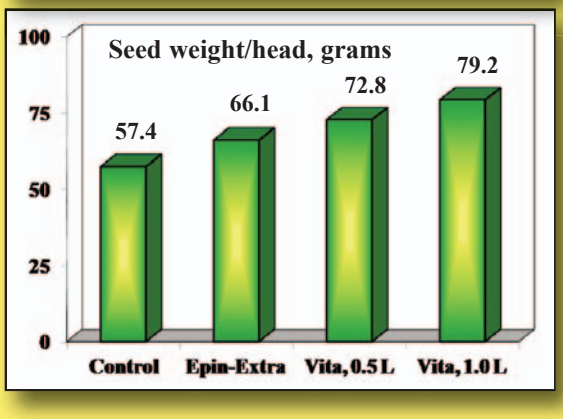
Increase in head diameter with Vitazyme

0.5 liter/ha ..... +11%
1.0 liter/ha ..... +13%

Increase in seeds/head with Vitazyme

0.5 liter/ha ..... +23%
1.0 liter/ha ..... +31%

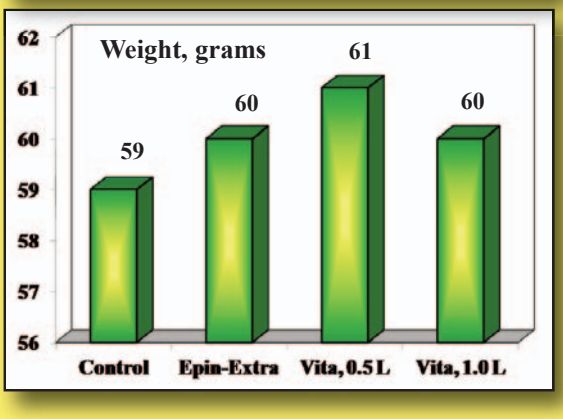
Seed Weight Per Head



$HCP_{0.05}$=3.75

All three treatments increased per head seed weight significantly.

Weight of 1,000 Seeds



$HCP_{0.05}$=0.94

The three treatments all increased the 1,000 seed weight significantly.

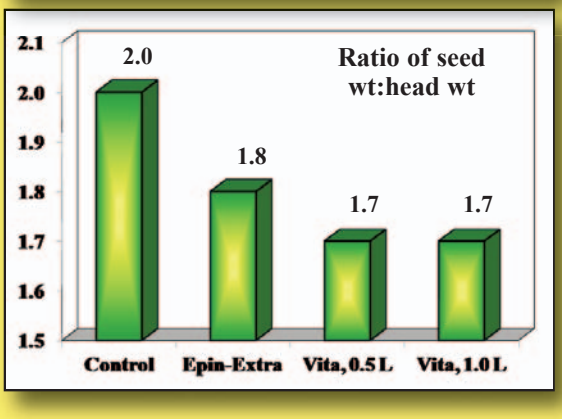
Increase in seed weight with Vitazyme

0.5 liter/ha ..... +27%
1.0 liter/ha ..... +38%

Increase in 1000 seed weight with Vitazyme

0.5 liter/ha ..... +2 grams
1.0 liter/ha ..... +1 gram

Seed Weight Per Head Weight



$HCP_{0.05}$=0.20

Clearly the three treatments produced more seeds per head, so the seed weight to head weight ratios were reduced, especially for the two Vitazyme treatments.

Conclusion: This replicated sunflower study in Russia showed that Vitazyme applied at head formation, using either 0.5 or 1.0 liter/ha, greatly improved leaf area (19 to 22%), as well as final yield (13 to 20%), and harvest characteristics such as head diameter, seeds per head, seed weight per head, 1,000 seed weight, and seed weight per head weight. The 1.0 liter/ha rate was superior to the 0.5 liter/ha rate in most cases. Epin-Extra, a commonly used seed treatment in Russia, produced modest improvements in growth and yield, but they were far inferior to Vitazyme responses. Vitazyme is shown to be an excellent management tool for increasing sunflower yields and growth in Russia.

Increase in seed:head weight ratio with Vitazyme

0.5 liter/ha ..... -27%
1.0 liter/ha ..... -38%

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2011 Crop Results

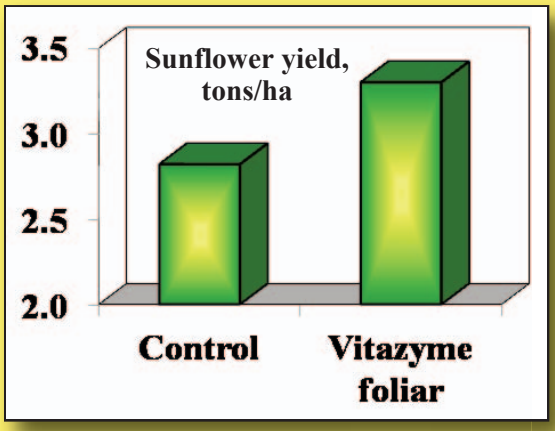
Vitazyme on Sunflowers

Researcher: Unknown *Research organization*: National Academy of Agrarian Sciences, Vinnytsia State Agricultural Research Station *Location*: Vinnytsia, Ukraine (Central Forest and Steppe Region)
Variety: MAS-91A *Planting date*: unknown
Soil type: gray podzolic (organic matter = 2.2%, hydrolyzed N = 8.4 mg/100 g soil, P = 15.8 mg/100g soil, exchangeable K = 12.4 mg/100 g soil, pH = 5.5)
Experimental design: Sunflower plots were prepared and treated with Vitazyme to evaluate the effect of the product on sunflower seed yield and profitability.

1. Control **2. Vitazyme on leaves**

Vitazyme applications: 1 liter/ha on the leaves at head formation on June 16, 2011
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	2.82	—
Vitazyme foliar	3.30	0.48 (+17%)



Yield increase with a Vitazyme foliar treatment: 17%

Income results: Income increase with a Vitazyme treatment: +1,376 hrn/ha
Conclusion: This replicated sunflower trial in Vinnytsia, Ukraine, in 2011 revealed that Vitazyme improved yield by 17%, while income increased by 1,376 hrn/ha. These results mirror the sunflower data from previous years, and show how effective this program is for Ukrainian agriculture.

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2009 Crop Results

Vitazyme on Sunflowers

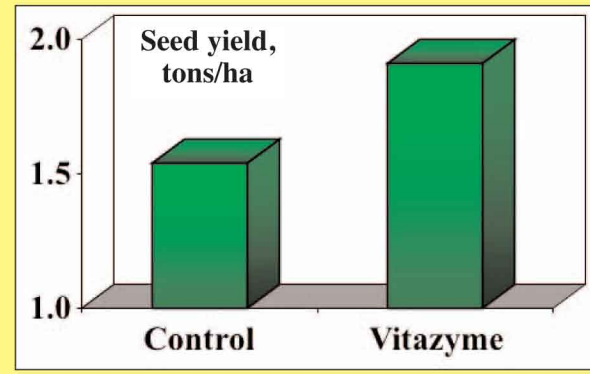
Researcher: O.V. Kornijchuk, V.V. Plotnikov, and agronomic scientists
Organization: Vinnytsia State Agricultural Experiment Station, Ukraine Academy of Agrarian Sciences, Vinnytsia, Ukraine *Location*: Ukraine central forest-steppe area near Vinnytsia
Seeding rate: 5 kg/ha *Planting date*: May 22, 2009 *Variety*: Gelio 06 AK0324
Tillage: plowing, harrowing, and cultivation *Previous crop*: winter wheat
Soil type: gray forest steppe soil; in the 0-30 cm layer, 2.2% organic matter, 8.4 mg/100 g of soil "hydrolyzed nitrogen", 15.8 mg/100g of soil phosphorous, 12.4 mg/100 g of soil exchangeable potassium, and pH=5.5.
Experimental design: A uniform field was divided into plots of 1.0 ha each with two treatments and four replications. The objective of the study was to evaluate the effect of Vitazyme as either a seed application, or a seed plus foliar application on the yield of sunflowers.

1. Control **2. Vitazyme, once foliar**

Fertilization: 45 kg/ha N
Vitazyme application: Treatment 2 received 1.0 liter applied to the leaves and soil on June 25, 2009, at "basket" formation.
Yield results:

Treatment	Seed yield	Yield change
	tons/ha	tons/ha
Control	1.54	—
Vitazyme	1.91	0.37 (+24%)

Increase in seed yield with Vitazyme: 24%



Income results:

Income increase with Vitazyme: 632 hrn/ha

Conclusions: Sunflowers raised with Vitazyme (foliar at 1 liter/ha) in Ukraine produced 24% more seeds, and 632 hrn/ha more income compared to the control treatment. This product has proven itself to greatly improve sunflower production and profits in Ukraine.