Sunflowers *with Vitazyme Bio application*

Researcher: Y. A. Veklenko
Research organization: National Academy of Agrarian Sciences of Ukraine, and Institute of Feed and Agriculture of Podilla, Vinnytsia, Ukraine
Location: Agronomichne Village, Vinnytsia District, Vinnytsia Region, Ukraine
Variety: MAS 817.P (MAS Seeds, France), early maturing, linole type

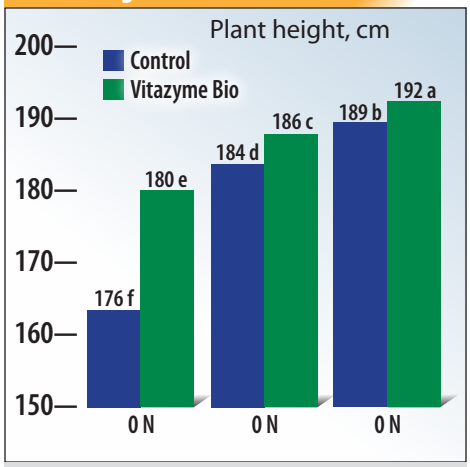
The experimental area of the sunflower trial is shown here in the full flowering stage.

Planting rate: 60,000 seeds/ha
Planting date: May 2, 2024 ***Emergence date:*** May 13, 2024 ***Previous crop:*** spring barley
Soil type: gray forest soil, medium loamy on loess
Soil analysis: organic matter = 2.2-2.4%, pH (salt extract) = 5.2-5.4, 9.0-11.2 mg of easily hydrolyzable N/100 g of soil, 8.1-11.6 mg of exchangeable K/100 g of soil, 12.1-14.2 mg of mobile P/100 g of soil
Tillage: fall plowing to 20-22 cm, spring disking to 10-12 cm, pre-sowing cultivation to 5-7 cm
Experimental design: A small-plot trial with sunflowers in Ukraine was established to evaluate the effect of Vitazyme Bio on the growth yield, and quality of sunflower seeds, at three rates of nitrogen. Four replications of 56 m^2 each were used, with plots arranged in a randomized complete block design.
Fertilization: Ammonium nitrate was applied at either 30 or 45 kg/ha to treatments 3 to 6 at the 3 to 4 leaf-pair stage of the sunflowers.
Vitazyme Bio application: 1 liter/ha sprayed on the leaves and soil at the 3 to 4 leaf-pair stage (BBSN 16-18), on June 3, 2024
Weed Control: Alpha-Promethrin at 3.0 liters/ha, Antizlak at 0.8 liter/ha, and Geliantex at 0.045 liter/ha
Harvest date: unknown (October)
Growing season weather: The season was rather warm, with adequate rainfall.

Treatment	Nitrogen	Vitazyme
	kg/ha	
1. 0 N	o	o
2. 0 N + Vita	o	x
3. 30 N	30	o
4. 30 N + Vita	30	x
5. 45 N	40	o
6. 45 N + Vita	40	x

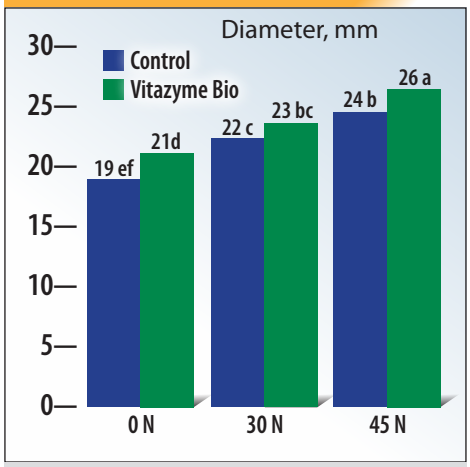
Plant morphological development results:

Plant Height[1]



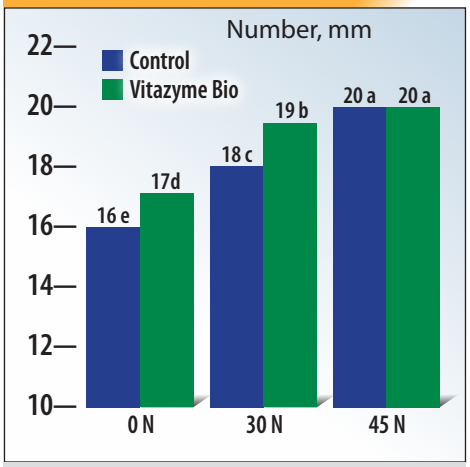
[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA)

Stem Diameter[1]



[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA)

Leaf Number[1]



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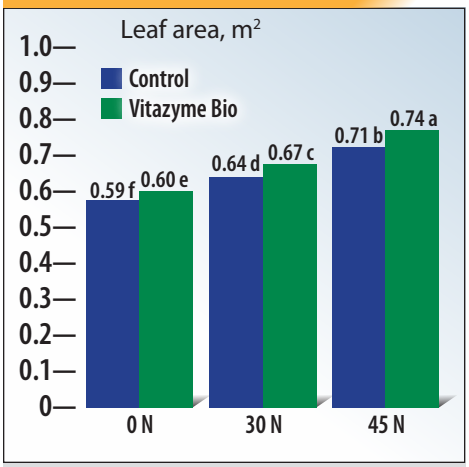
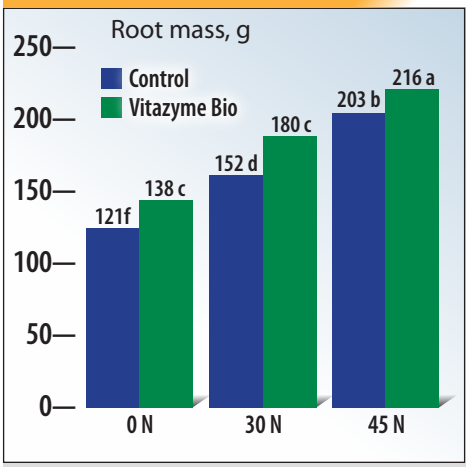
Leaf Area[1]



[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA)

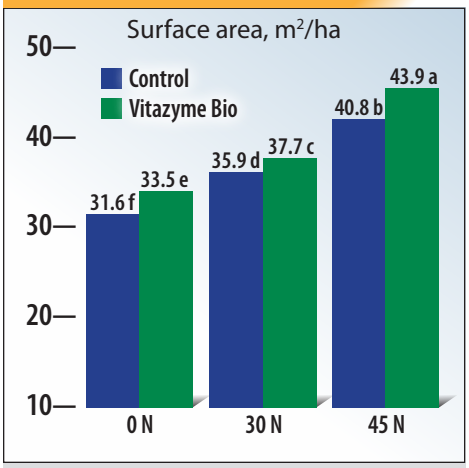
Root Mass[1]



[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA)

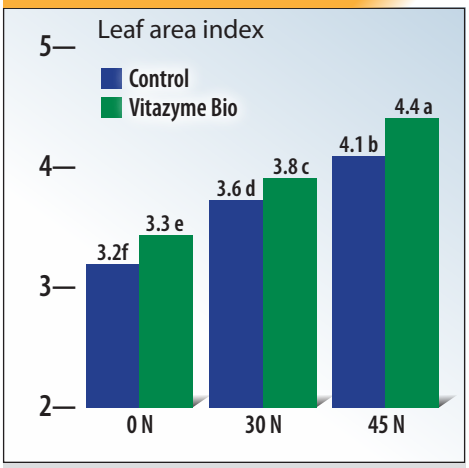
Nearly all morphological parameter measurements were significantly improved by Vitazyme Bio at each N level at P = 0.05.

Leaf Surface Area[1]



[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA)

Leaf Surface Index[1]



[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA)

Both the leaf surface area and the leaf area index were significantly increased with Vitazyme Bio at P = 0.05 at all three N levels.

Plant disease results:

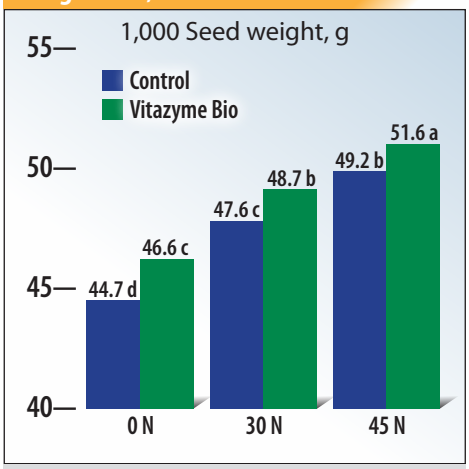
Treatment	Phomosis[1]		Phomopsis[1]		Sclerotinia[1]		Lodging[1]	
	Plants	Area	Plants	Area	Plants	Area	Plants	Area
	%	0-9	%	0-9	%	0-9	%	0-9
ON	18	2	22	2	58	6	12	1
ON + Vita	10	1	17	2	42	4	8	1
30 N	12	1	18	2	47	5	5	0
30 N + Vita	8	1	14	1	34	3	3	0
45 N	8	1	16	2	23	2	1	0
45 N + Vita	4	0	8	1	20	2	0	0

[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA).
NOTE: Plants = percentage of plants affected. Area = the estimited leaf, head, and stem area affected by the disease or lodging of plants; 0 is no infection, 9 is severely infected.

Vitazyme Bio in all cases reduced the infection rate of the three plant diseases evaluated: phomosis (*Phomamacdonaldii*), phomopsis (*Diaporthehelianthi*), and sclerotinia (*Sclerotiniasclerotiorum*). Lodging of plants was also reduced with Vitazyme Bio.

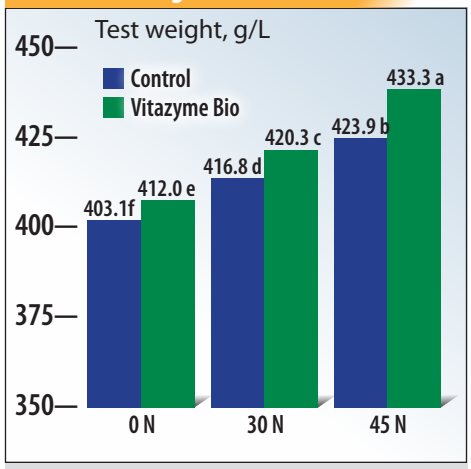
Seed and test weight results:

Weight of 1,000 Seeds[1]



[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA)

Seed Test Weight[1]

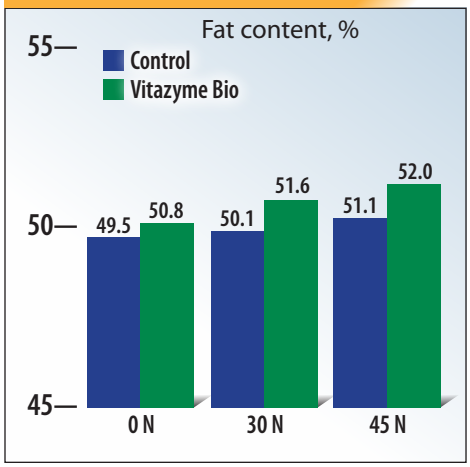


[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA)

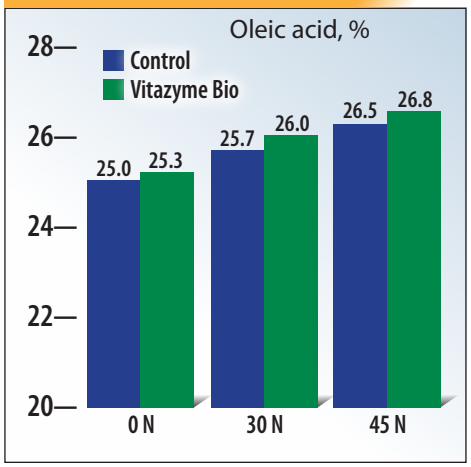
Vitazyme Bio enhanced 1,000 seed weight significantly in all cases at all N levels, by 4% with 0 N and by 5% at 45 N. Test weight was also in every case increased significantly by Vitazyme Bio by up to 2%.

Seed quality results: Analyses were made at the institute of Feed and Agriculture of Podillya of the National Academy of Agrarian Sciences of Ukraine.

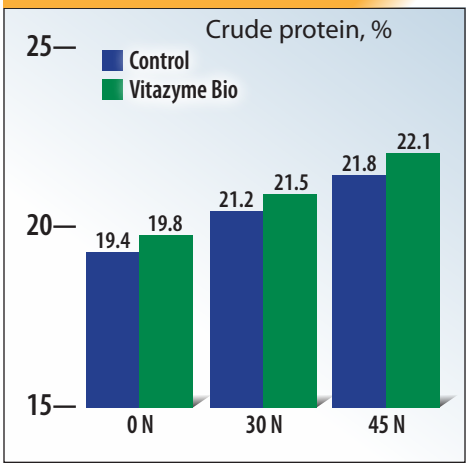
Seed Fat Content



Seed Oleic Acid Content



Seed Crude Protein Content



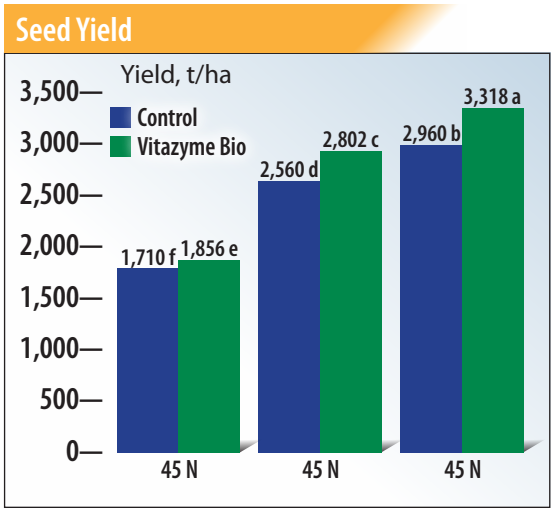
Seed fat, oleic acid, and crude protein all increased with Vitazyme Bio treatment at all three N levels. No statistics were run for these three parameters.

Here is shown some sunflower diseases for the Ukraine trial, which were evaluated for diseases during the "lemon ripeness" stage.

Sunflower seed yield results:

Treatment	Seed yield[1]	Yield change[2]
	t/ha	
1. 0N	1,710 f	—
2. 0N + Vitazyme Bio	1,856 e	146 (+9%)
3. 30 N	2,560 d	—
4. 30 N + Vitazyme Bio	2,802 c	242 (+9%)
5. 45 N	2,960 b	—
6. 45 N + Vitazyme Bio	3,318 a	350 (+12%)

[1]Means followed by the same letter are not significantly different at P = 0.05 (ANOVA). Yields are of the standardized adjusted weights at a uniform moisture content.
[2]Yield increases are calculated for the same N level.



Yield increase with Vitazyme Bio

0 N..... 9%
30 kg/ha N 9%
45 kg/ha N 12%

Vitazyme Bio significantly improved the seed yield at every N level, by up to 12% at the 45 kg/ha N rate.

Income results:

Treatment	Yield	Increase	Value	Vitazyme application	Income increase
	t/ha	t/ha	$/ha	$/ha	$/ha
1. 0N	1,710	—	—	—	—
2. 0N + Vitazyme Bio	1,856	146	87.6	24	63.6
3. 30 N	2,560	—	—	—	—
4. 30 N + Vitazyme Bio	2,802	242	145.2	24	121.2
5. 45 N	2,960	—	—	—	—
6. 45 + Vitazyme Bio	3,318	358	214.8	24	190.8

Increase in income with Vitazyme

0 N..... $63.60/ha
30 kg/ha N $121.20/ha
45 kg/ha N $190.80/ha

Conclusions: Based on the research work, the following scientific conclusions can be formulated regarding the effect of the biological product Vitazyme Bio on the yield and quality of sunflower of the MAS 817.P hybrid in the conditions of the Vinnytsia region in 2024:

1. ***Duration of the growing season:*** The use of Vitazyme Bio, especially in combination with nitrogen fertilizers, contributed to the extension of the growing season of sunflower, which had a positive effect on the rational use of the bioclimatic potential of the growing region.
2. ***Morphometric indicators:*** Vitazyme Bio at P = 0.05 had an impact on the morphometric indicators of sunflower plants, in particular on the increase in plant height (up to 3%); stem diameter (up to 10%); head diameter (up to 12%); leaf surface area (up to 25%); mass of the root system (up to 18%).
3. ***Photosynthetic potential of crops:*** The use of Vitazyme Bio, especially in combination with 45 kg/ha of N, significantly increased leaf surface area and LAI, which indicates an increase in plant photosynthetic activity.
4. ***Disease resistance:*** Vitazyme Bio had a positive effect on the resistance of sunflower to major fungal diseases (phomosis, phomopsis and sclerotinia), especially in combination with 45 kg/ha of N, significantly reducing the level of plant damage.
5. ***Quality indicators of seeds:*** Vitazyme Bio had a positive effect on the quality indicators of seeds, increasing the indicators of seed nature (up to 2%), weight of 1000 seeds (up to 5%), fat content in seeds (up to 1.5%), oleic acid content (up to 0.3%), and crude protein content (up to 0.7%).

6. ***Plant density and seed moisture:*** The use of Vitazyme Bio in combination with nitrogen fertilization contributed to better plant survival during the growing season, and an increase in the final stand density (up to 1.1-2.9%), and an increase in seed moisture before harvesting (up to 0.2-1.0%).
7. ***Seed yield:*** The use of Vitazyme Bio increased the biological yield of sunflower by 3-7%, depending on the fertilization option, reaching a maximum (3,567 t/ha) with 45 kg/ha of N. With direct combining, the increase was 9-12%, with a maximum seed harvest of 3,318 t/ha from the most fertilized variant.
8. ***Cost-effectiveness:*** The use of Vitazyme Bio is economically justified, providing a profit increase of from 63.6 USD/ha to 121.2-190.8 USD/ha.

It is clear that Vitazyme Bio improves the utilization of fertilizer nitrogen, and use of the biostimulant is highly recommended in Ukrainian sunflower production.

Here the researchers of the Ukraine sunflower trial are evaluating the "biological yield" of the various plots, which revealed superior yields with Vitazyme treatment.

Sunflowers *a Nitrogen Rate Study*

Researcher: Kernel personnel
Research organization: Kernel Company, Ukraine [Kernel is the largest producer of sunflower oil in Ukraine, and exports oils and grains worldwide, and provides storage for grains and seeds.
Location of trial: Uman District, Cherkasy Region, Chorna Kamianka Village, Ukraine
Variety: SiExperto ***Planting date:*** unknown
Planting rate: unknown ***Previous crop:*** unknown
Experimental design: A sunflower field in 2023 was divided into several treatments to evaluate the effect of Vitazyme on the application of four different nitrogen fertilizer rates with sunflowers. Sunflower yield was evaluated for each treatment.
Fertilization: nitrogen applied at the rates given in the table to right.
Vitazyme application: Vitazyme applied at 1 liter/ha sprayed on the leaves and soil at the 10-leaf stage (BBCH 30) on June 23, 2023.

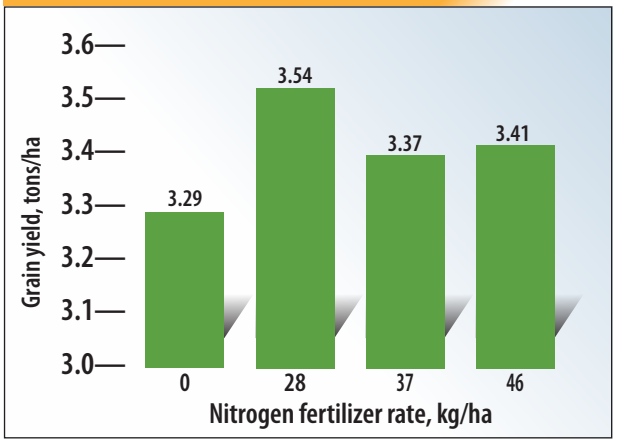
Treatment	Fertilizer rate	Vitazyme
	kg of N/ha	liter/ha
1	0	1
2	28	1
3	37	0
4	37	1
5	46	1

Yield results:

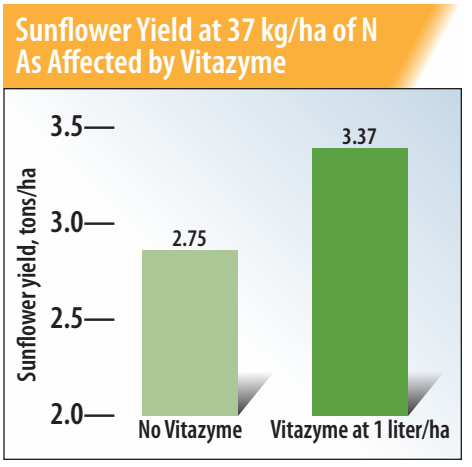
Treatment	Grain yield	Yield change*
	tons/ha	tons/ha
1. No N + Vitazyme	3.29	—
2. 28 kg/ha N + Vitazyme	3.54	+0.25 (+8%)
3. 37 kg/ha N	2.75	-0.54 (-16%)
4. 37 kg/ha N + Vitazyme	3.37	+0.08 (+2%)
5. 46 kg/ha N + Vitazyme	3.41	+0.12 (+4%)

*Yield of Treatments 2, 3, 4, and 5 compared to the no-nitrogen Treatment.

Sunflower Yield As Affected by N-Rate and Vitazyme



Sunflower Yield at 37 kg/ha of N As Affected by Vitazyme



Yield increase with Vitazyme at the same N level: 0.62 ton/ha (+23%)

Conclusions: This sunflower field trial in the Cherkazy Region of Ukraine, using four different nitrogen fertilizer rates, with Vitazyme applied at 1 liter/ha at the 10-leaf stage to all but one treatment, revealed that the product in every case increased sunflower seed yield considerably. Without Vitazyme, even with 37 kg/ha of N applied, the yield was only 2.75 tons/ha, whereas all of the Vitazyme treatments greatly exceeded this no-Vitazyme but fertilized treatment by up to 0.79 ton/ha (Treatment 2 versus Treatment 3). The yields of the higher N rates, of 37 and 46 kg/ha of N, did not exceed the yield of the lower N rate of 28 kg/ha for some unknown reason, but all of the Vitazyme treatment yields were similar — including the unfertilized Treatment 1 — varying by only 0.25 tons/ha. These results show the great effectiveness of Vitazyme treatment in enhancing sunflower yield in Ukraine, even in the absence of N fertilizer.

Sunflowers *with Vitazyme application*

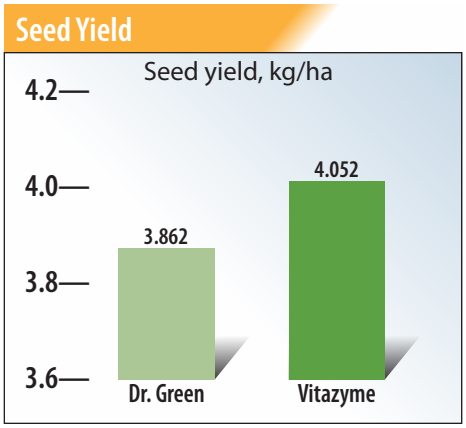
Researcher: Dumitru Manole, Ph.D. ***Research organization:*** S.C. Sport Agra, Ltd., Romania
Trial location: Amzacea Village, Constanta County, Romania ***Variety:*** Corteva P64LE25
Planting date: March 25, 2022 ***Planting rate:*** 6.5 seeds/m^2 (65,000 seeds/ha) ***Previous crop:*** corn
Field preparation: disking to 15-20 cm the fall of 2021; harrowing the spring of 2022
Experimental design: A sunflower field of 49.45 ha was used to apply two treatments: Vitazyme and Dr. Green Energy to plots totaling 1.44 ha. The purpose of the trial was to determine the effect of these two materials on the yield of sunflower seeds.

❶ *Vitazyme* ❷ *Dr. Green Energy + Dr. Green Rape*

Fertilization: At planting time (March 25), 250 kg/ha of 18-46-0% N-P_2O_5-K_2O; after emergence (April 25), 150 kg/ha of 34.5-0-0 N-P_2O_5-K_2O.
Weed control: herbicides
Vitazyme application: 1.3 liters/ha sprayed on the leaves and soil on May 5
Dr. Green Energy + Dr. Green Rape application: Dr. Green Energy (100 g N; 400 g K_2O) and Dr. Green Rape (245 g SO_3, 5g MgO, 100 g B, 2 g Cu, 25 g Fe, 50 g Mn, 0.5 g Mo, 20 g Zn) were applied to a plot on May 5 at 1 kg/ha and 2 kg/ha, respectively.
Fungicide application: On April 27, Pictor fungicide, comprised of 200 g/liter Boscalid and 200 g/liter Dimoxystrobin, was sprayed at 0.5 liter/ha over the sunflowers.
Date of emergence: April 8 to 10
Harvest date: August 15, 2022
Yield results:

Treatment	Seed yield	Yield change
	kg/ha	kg/ha
1. Vitazyme foliar	4.052	—
2. Dr. Green Energy + Dr. Green Rape	3.862	0.190 (+5%)

Increase in seed yield with Vitazyme: 5%



Conclusions: This sunflower trial in Romania, which compared Vitazyme biostimulant with a mineral fertilizer, was not a strict comparison of similar products; it was a comparison of a biostimulant with a mineral fertilizer. Even so, Vitazyme outperformed the Dr. Green Energy + Dr. Green Rape by 0.190 kg/ha, a 5% yield increase. This result shows that Vitazyme improves the uptake of available soil nutrients which the mineral application did not equal.

Sunflowers *with Organic Vitazyme application*

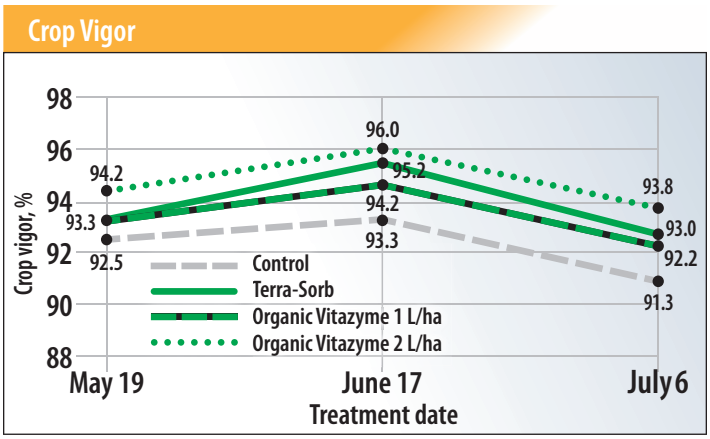
Researchers: Bence Kiraly, Natalia Simon, and Jeno Simon
Research organization: Syntech Research Group, 6636 Martely, hrsz.; 013818, Hungary; Vital Earth Resources, Inc., Gladewater, Texas, USA
Location: Hodmezovasarhely-Erzsebet, Csongrad-Csanad, Hungary
Variety: Duet CL *(Helianthus annuus)* ***Planting date:*** May 4, 2022 ***Row spacing:*** 75 cm
In-row spacing: 21.8 cm ***Plant depth:*** 5 cm ***Planting rate:*** 61,000 seeds/ha
Soil traits: clay loam chernozem; good fertility ***Tillage:*** conventional
Experimental design: A small-plot with sunflowers was established, with plots that were 3 x 10 meters (30 m^2), using six replications. Four treatments were applied in a randomized complete block design to determine the effect of Organic Vitazyme and Terra-Sorb Foliar on the yield and other parameters of sunflowers.

Treatment	Rate	Stage of growth	Date of treatment
1. Control	0	—	—
2. Terr-aSorb Foliar	1 liter/ 100 kg seed	Seed treatment	May 4
3. Organic Vitazyme	1 liter/ha	Seed treatment	May 4
4. Organic Vitazyme	2 liters/ha	Seed treatment	May 4

Fertilization: unknown
Organic Vitazyme application: See the treatments above. Organic Vitazyme was applied as concentrated product on the seeds to achieve the desired 1or 2 liter/ha rates.
Terra-Sorb Foliar application: Terra-Sorb Foliar is a formulation of mostly free amino acids that, when sprayed on leaves, will increase chlorophyll and photosynthesis, improve fruit set, and promote plant recovery during times of stress. It was applied at 1 liter/100 kg of seed.
Herbicide applications: Wing-P at 3.5 liters/ha on May 6; Pulsar 40 SL at 1.2 liters/ha on May 24; Mospilan 20 SG at 0.15 kg/ha on June 19.
Growing season weather: normal
Phytotoxicity results: Neither Organic Vitazyme nor Terra-Sorb were phytotoxic to the sunflower plants.
Crop vigor results:

Treatment	Rate	Assessment date*		
		May 19	June 17	July 6
	L/ha	%	%	%
1. Control	0	92.5 a	93.3 b	91.3 a
2. Terra-Sorb	1	93.3 a	95.2 ab	93.0 a
3. Organic Vita	1	93.3 a	94.2 ab	92.2 a
4. Organic Vita	2	94.2 a	96.0 a	93.8 a
LSD (P=0.10)		2.1	1.8	4.1
CV		2.26	1.88	4.37
Treatment F		0.6098	0.0945	0.7380

*Crop vigor assessment by the Student-Newman-Keuls method; means followed by the same letter are not significantly different at P=0.10.



While crop vigor on both May 19 and July 6 did not vary significantly among the three treatments, Organic Vitazyme at 2 liters/ha was significantly more vigorous than the other two treatments, and all treatments exceeded the control for all three dates.

Crop emergence results: There were no significant differences in crop emergence for all four treatments, although all three treatments slightly exceeded the control.

Crop height results:

Treatment	Rate	Assessment date*	
		May 19	July 6
	L/ha	cm	cm
1. Control	0	6.7 b	109.1 a
2. Terra-Sorb	1	6.9 ab	111.7 a
3. Organic Vita	1	6.8 ab	109.6 a
4. Organic Vita	2	7.0 a	112.1 a
LSD (P=0.10)		0.2	4.2
CV		3.19	3.77
Treatment F		0.1349	0.5281

*Crop height assessment by the Student-Newman-Keuls method; means followed by the same letter are not significantly different at P=0.10.

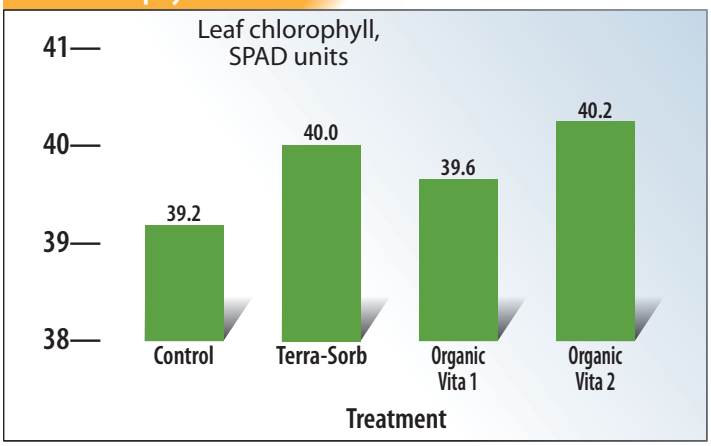
Organic Vitazyme at 2 liters/ha on the seeds significantly increased plant height shortly after emergence. However, the treatments did not differ significantly once the plants grew larger.

Chlorophyll results: The leaves were measured on 20 plants/plot on June 17.

Treatment	Rate	Leaf chlorophyll*
	L/ha	SPAD units
1. Control	0	39.2 c
2. Terra-Sorb	1	40.0 ab
3. Organic Vita	1	39.6 bc
4. Organic Vita	2	40.2 a
LSD (P=0.10)		0.5
CV		1.29
Treatment F		0.0166

*; Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test.

Leaf Chlorophyll



All treatments significantly exceeded the control, but Organic Vitazyme at 2 liters/ha gave the greatest leaf chlorophyll increase, at 1.0 SPAD unit greater than the control.

Heat diameter results: There was a slight increase in head diameter with all of the treatments, which was 0.9 cm for Organic Vitazyme at 2 liters/ha. This represented an 8% increase (12.0 cm vs. 11.1).

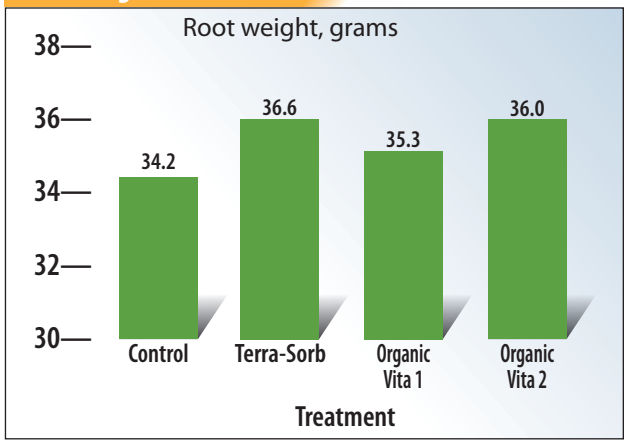
Seed yield results: The plants were harvested on September 13. All yield values were not significantly greater than the control.

Root weight results: There were no significant differences in root weight among the four treatments, although the three treatments gave heavier weights than the control. Sampling was made on 20 representative roots per plot, on September 13.

Oil content results: No significant differences were detected among the treatments.

1,000-grain weight results: There were no significant differences in 1,000-grain weight for the four treatments. However, the three treatments produced seeds that were slightly heavier than the control.

Root weight



Conclusion: This sunflower small-plot experiment in Hungry, comparing Organic Vitazyme at 1 and 2 liters/ha on the seeds and Terra-Sorb Foliar on the seeds, revealed that all three treatments produced small improvements in most-parameters measured, including crop vigor, crop emergence, crop height, leaf chlorophyll content, head diameter, seed yield, root weight, oil content, and 1,000-grain weight. In a few cases these increases were significant, especially for Organic Vitazyme at 2 liters/ha for crop vigor, crop height, and leaf chlorophyll. This treatment produced the best overall results in this study, followed by Terra-Sorb and Organic Vitazyme at 1 liter/ha.

Sunflowers *with Vitazyme Bio (Organic Vitazyme) application—Herbicide Stress Reduction*

Researchers: Vadim V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: LLC "Sunvit," Berezivsky District, Odessa Region, Viktorivka Village, Ukraine; southern Ukraine (270-350 mm of rain per year)
Variety: LG5542KL
Planting date: May 2, 2021
Planting rate: 50,000 seeds/ha
Previous crop: winter wheat
Tillage: disking to 6-8 cm, plowing to 22-24 cm, harrowing, cultivation in two tracks to 5-6 cm
Soil type: podzolized chernozem (3.5% organic matter)
Experimental design: A sunflower field with serious herbicide stress was treated on 31 hectares with Vitazyme Bio to attempt to relieve the stress. One hectare was left untreated to serve as a control. The effects of the product on plant recovery and yield was measured to evaluate the effect of Vitazyme Bio on yield as affected by herbicide stress reduction.

Note the serious necrosis of the leaves of a sunflower plant mistakedly sprayed with a toxic herbicide.

The superior top growth of the Vitazyme Bio treated plants is reflected by a much greater root mass, that complements this increased leaf mass. The yield with the product was 28% greater than with the untreated plants.

❶ Control ❷ Vitazyme Bio

Fertilization: 6-12-12-4 kg/ha of N-$P_2 0_5$-$K_2 0$-S in-furrow at planting
Vitazyme Bio application: 1 liter/ha sprayed on the leaves of 31 hectares on June 8, at BBCH 18 (8-leaf stage)
Herbicide application: The sprayer was contaminated with a herbicide containing Prosulfuron and MCPA, which had been used to spray weeds in flax. The sprayer was then filled with Eurolightning herbicide (a.i. Imazamox at 33 g/liter and Imazapyr at 15 g/liter), and the field was sprayed on May 30 at 1 liter/ha. The crop was at BBCH 14 (four leaves). Strong herbicide damage ensued, causing much leaf necrosis, but the growing point was still alive on June 6.

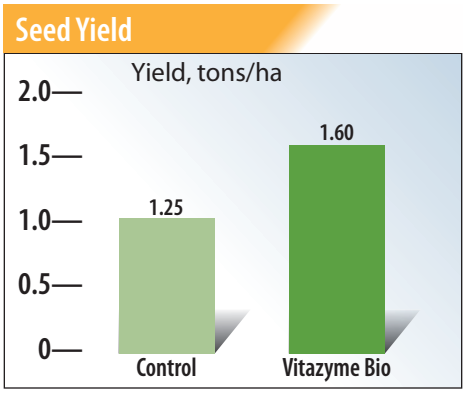
These sunflowers have recovered by some weeks after Vitazyme Bio application to the right side of this photo. Note the superior growth compared to the untreated side.

These sunflowers have recovered by some weeks after Vitazyme Bio application to the right side of this photo.Note the superior growth compared to the untreated side.

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	1.25	—
2. Vitazyme Bio	1.60	0.35 (+28%)

Yield increase with Vitazyme Bio: 28%



Growth results: Height measurements of the plants for both treatments were made late in the growth cycle, and gave the following results:

Vitazyme Bio plant height ..... 1.2 m
Untreated plant height ..... variable, from 0.4 to 0.8 m or less

Income results: As a result of Vitazyme Bio application to the severely herbicide stressed sunflowers, the yield increase of 0.35 ton/ha (+28%) from Vitazyme Bio gave an income increase of $104/ha.

Conclusions: A sunflower field of 32 hectares was sprayed in error with a herbicide that was contaminated with another herbicide that had been used on a flax field, and which was toxic to the sunflowers. Considerable leaf necrosis was noted within a week, and the farmer then sprayed 1 liter/ha of Vitazyme Bio over all but one hectare to attempt to relieve plant stress and recover the crop. The result was a fine recovery of the crop, and an increase in yield of 0.35 ton/ha (28%) from Vitazyme Bio, giving an income increase of $104/ha. These results indicate that the stress reduction properties of the brassinosteroids in Vitazyme Bio are highly effective in recovering herbicide damaged sunflower crops in Ukraine.

Sunflowers *with Vitazyme Bio application*

Researcher: V.V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: LLC "Obriy", Vinnytsia District, Vinnytsia Region, Strointsi Village, Ukraine: central Ukraine (440-590 mm of rain per year)
Variety: NK Kondi ***Planting date:*** May 5, 2021 ***Planting rate:*** 60,000 seeds/ha ***Previous crop:*** winter Wheat
Tillage: disking to 6-8 cm, deep harrowing to 22-24 cm, cultivation in two tracks to 5-6 cm
Soil type: gray podzol (1.7% organic matter)
Experimental design: A sunflower field was divided into a Vitazyme Bio treated portion, with an untreated portion left as a control, to evaluate the effect of this product on sunflower seed yield.

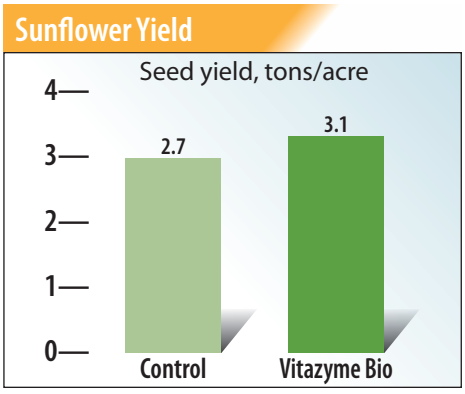
Sunflowers grown in the Vinnytsia region of central Ukraine show a markedly darker color of Vitazyme Bio treated plants in the lower portion of the photo. Treated plants were larger with bigger heads, and yielded 15% more.

1 ***Control*** **2** ***Vitazyme Bio***

Fertilization: 34 kg/ha of N during pre-plant tillage, and 2-24-24 kg/ha of N-P_2O_5-K_2O at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil on June 5, 2021, at the 6-leaf stage. Vitazyme Bio is the same as Organic Vitazyme marketed in different parts of the world.
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	2.7	—
Vitazyme Bio	3.1	0.4 (+15%)

Increase in seed yield with Vitazyme: 15%



Vitazyme Bio improved sunflower yield by 15% above the untreated control.

Income results: A yield increase of 0.4 ton/ha resulted in an income increase of $277/ha.
Conclusions: In this Ukrainian field-scale sunflower trial, where Vitazyme Bio was applied at 1 liter/ha on the leaves and soil at the 6-leaf stage, the yield was increased by 0.4 ton/ha (15%) above the control, netting the farmer an additional $277/ha of income. This product is shown to be highly effective for improving sunflower yield and income in Ukraine.

Sunflower plants dug from the two treatments illustrate the effect of Vitazyme Bio to improve total plant biomass, root mass, leaf area, and head size.

Sunflowers *with Vitazyme application—Effectiveness in Reducing Herbicide Stress*

Researcher: V. V. Plotnikov
Research organizations:
Plant Designs International, Rochester, New York;
Agro Expert International, Kaharlyk, Ukraine,
and the Cherksy Experimental Station of Bioresources
Location: Drabiv District, Cherkasy Region,
Drabovo-Bariatynske Village, Ukraine; central Ukraine
(440 to 590 mm of rain per-year)
Variety: NK Neoma
Planting date: April 21, 2020
Planting rate: 55,000 seeds/ha
Previous crop: winter wheat
Tillage: disking to 6-8 cm, harrowing to 22-24 cm,
cultivation to 5-6 cm
Soil type: typical Chernozem (3.9% organic matter)
Experimental design: A sunflower field was divided into an untreated and a Vitazyme treated area, to evaluate the effectiveness of this plant growth stimulator to improve the yield of sunflower seeds.

Sunflower responses to Vitazyme in Ukraine continue to be excellent, as for the 2020 trial in central Ukraine, where the yield was improved by 12.

1 ***Control*** **2** ***Vitazyme***

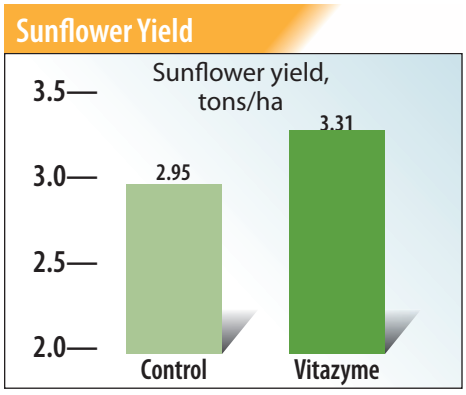
Fertilization: 46 kg/ha of N during pre-plant cultivation, and 4-15-20 kg/ha of N-$P_2 0_5$-$K_2 0$ per ha at planting
Vitazyme application: 1.0 liter/ha sprayed at the 6-leaf staage on May 24, 2020.
Herbicide application: In 2019, a herbicide with the active compound amidosul Furon 250 had been applied to winter wheat, and the carryover effect seriously affected the sunflower crop. To ameliorate this stress, Vitazyme was applied on May 24 at 1 liter/ha.

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	2.95	—
Vitazyme*	3.31	0.36 (+12%)

*Applied to relieve herbicide stress.

Increase in sunflower yield with Vitazyme: 12%



Income results: This increase in yield of 0.36 ton/ha produced an income increase of $181/ha.

Conclusion: A field-scale trial in Ukraine compared an untreated control with Vitazyme applied at 1.0 liter/ha over the canopy at the six-leaf stage. This application was designed to relieve herbicide stress. This single application produced a marked yield increase of 12% (0.36) tons/ha over the untreated control, showing the great-efficacy of this biostimulant to increase sunflower yields in Ukraine in spite of herbicide damage.

Sunflowers *with Vitazyme application*

Notice the enhanced head size and development with the Vitazyme program in this Ukraine trial. The yield has been sustantially improved and very profitably.

Supple heads that are well-filled are the hallmark of Vitazyme use with Suflowers, which is a major oilseed crop in Ukraine. In this trial yield was increased by 9%.

Researcher: V. V. Plotnikov
Research organizations: Plant Designs International, Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: Cherkasy Experiment Station of Bioresources, Drabiv District, Cherkasy Region, Drabovo-Bariatynske Village; Central Ukraine (440-590 mm of precipitation per year)
Variety: CI Diamantis
Planting date: April 19, 2019
Planting rate: 50,000 seeds/ha
Previous crop: winter wheat
Soil type: typical Chernozem (humus = 3.9%)
Field preparation: disking to 6-8 cm, plowing to 22-24 cm, cultivating in two tracks to 5-6 cm
Experimental design: A sunflower field was divided into conventionally treated and Vitazyme treated portions to evaluate the effects of Vitazyme on the yield of the crop.

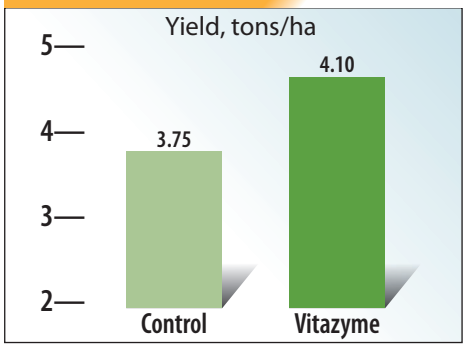
1 ***Control*** **2** ***Vitazyme***

Fertilization: 46 kg/ha of N cultivated in before planting; 4-10-20 kg/ha of $N\text{-}P_2O_5\text{-}K_2O$ applied during planting
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at the eight-leaf stage on May 30.

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	3.75	—
Vitazyme	4.10	0.35 (+9%)

Sunflower Yield



Increase in seed yield with Vitazyme: 9%

Income results: The extra 0.35 ton/ha gave an addition $95/ha income.
Conclusion: Sunflowers grown in a Vitazyme trial in central Ukraine, using 0.5 liter/ha sprayed at the eight-leaf stage, gave an additional 0.35 ton/ha yield (9%), that provided $95/ha more income. This program is thus shown to be highly effective in increasing the yield and income for sunflower growers, even when used at lower than normal rates.

Sunflowers *with Vitazyme application*

Researcher: V. V. Plotnikov
Research organizations:
Plant Designs International, Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: LLC "Herron Invest", Yarmolynci District, Khmel'nytskii Oblast, Tarasivka Village, Ukraine; Western Ukraine (550-750 mm at precipitation per year)
Variety: P62 LL 109 ***Planting date:*** April 4, 2019
Planting rate: 62,000 seeds/ha ***Previous crop:*** winter wheat
Soil type: Podzolic Chernozem (humus = 3.3%)
Field preparation: disking to 6-8 cm, plowing to 22-24 cm, cultivating in two tracks to 5-6 cm
Experimental design: A sunflower field was divided into normally treated and Vitazyme treated portions to evaluate the effects of Vitazyme on the yield of the sunflower seeds.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 80-0-30 kg/ha of N-P_2O_5-K_2O applied during plowing; 12-52-0 kg/ha of N-P_2O_5-K_2O applied during planting
Vitazyme application: 1.0 liter/ha sprayed on the leaves and soil at the eight-leaf stage on May 15.

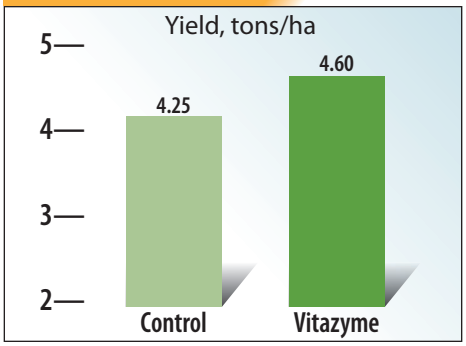
Enhanced overall plant metabolism producing larger stalks, larger leaves and heads, and greater photosynthetic capacity from Vitazyme application has produced the plants shown in this trial.

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	4.25	—
Vitazyme	4.60	0.35 (+8%)

Increase in seed yield with Vitazyme: 8%

Sunflower Seed Yield



Income results: An extra 0.35 tons/ha gave an additional $84/ha income.
Conclusion: This Ukrainian study on sunflowers, using 1 liter/ha of Vitazyme sprayed on the crop at the eight-leaf stage, resulted in an excellent 0.35 ton/ha seed increase (8%). This yield increase resulted in $84/ha extra income, showing the considerable value of this program for sunflowers in Ukraine.

Sunflowers *with Vitazyme application*

Researcher: V.V. Plotnikov
Research organization: State Enterprise "Scientific Innovation and Technology Center of the Institute of Feeding and Agriculture of Podilla of the National Academy of Agrarian Sciences of Ukraine"
Location: Vinnytsia District, Vinnytsia Region, Agronomichne Village, Ukraine
Variety: Sumiko
Planting date: April 30, 2018
Previous crop: spring wheat
Soil type: brown podzolic (humus = 2.2%)
Planting rate: 55,000 seeds/ha
Field preparation: disking to 6-8 cm, plowing to 22-24 cm, cultivation to 5-6 cm
Experimental design: A sunflower field was divided into a Vitazyme treated area, leaving the rest of the field untreated to determine the effect of this product on the yield of sunflower seeds.

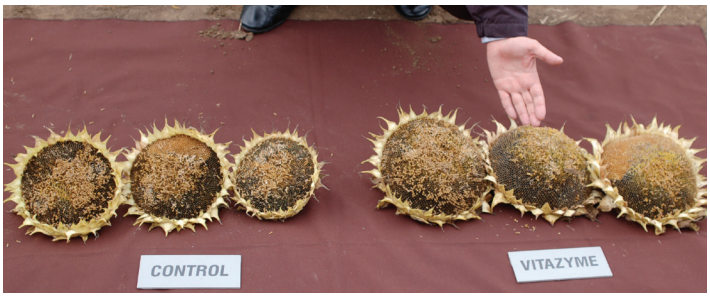
1 ***Control*** **2** ***Vitazyme***

Fertilization: unknown
Vitazyme application: (1) 0.5 liter/ha sprayed on the leaves and soil at the 8-leaf stage on June 8; (2) 0.5 liter/ha sprayed on the leaves at "basket formation"
Yield results:

Treatment	Yield	Yield change
	tonnes/ha	tonnes/ha
1. Control	2.33	—
2. Vitazyme	2.77	0.44 (+19%)

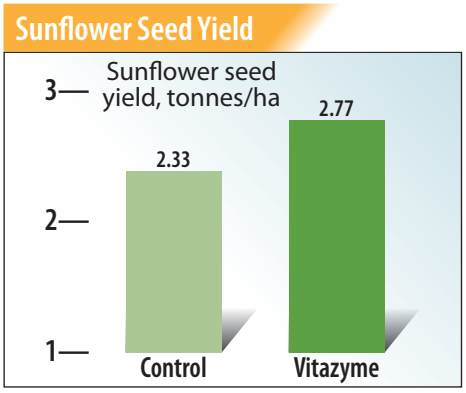
Increase in sunflower yield with Vitazyme: 19%

Income results: The extra yield of 0.44 tonne/ha resulted in $150/ha more income.



Notice the larger heads and higher yield for the Vitazyme treated plants. Birds have eaten many of the seeds in some heads.

These Ukrainian sunflowers produced significantly better when treated with Vitazyme twice during the growing season.



Conclusions: A sunflower field trial in Ukraine produced a 19% yield increase from two 0.5 liter/ha Vitazyme applications, at the 8-leaf and "basket formation" stages. With an income increase of $150/ha, this program is seen to be highly effective for sunflower growers in Ukraine.

Sunflowers *with Vitazyme application*

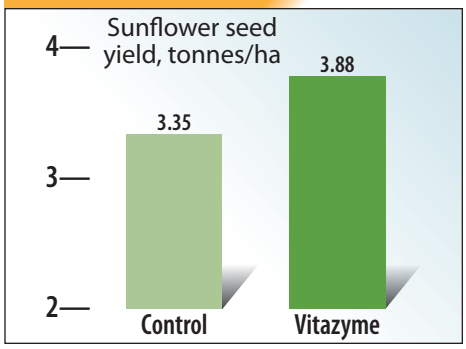
Researcher: V.V. Plotnikov
Research organization: Plant Designs, Inc., Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: Onufriivka District, Kirovograd Region, Vyshnivtsi Village, LTD Zlagoda, Ukraine
Variety: NK Kondi ***Planting date:*** May 1, 2018 ***Previous crop:*** winter wheat
Soil type: dark brown podzolic (humus = 2.6%) ***Planting rate:*** 50,000 seeds/ha
Field preparation: disking to 6-8 cm, plowing to 22-24 cm, cultivation to 4-5 cm
Experimental design: A sunflower field was divided into a Vitazyme treated area and an untreated control area to determine the effect of this product, in two applications, on yield and profitability.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 44-26-26 kg/ha N-P_2O_5-K_2O at plowing; 34 kg/ha N at pre-planting cultivation
Vitazyme application: (1) 0.5 liter/ha sprayed on the leaves and soil at the 8-leaf stage on June 10; (2) 0.5 liter/ha sprayed on the leaves at "basket formation" on June 21
Yield results: (See bar graph to the right)
Income results: The added yield of 16% (0.53 tonnes/ha) gained $185/ha more income.
Conclusions: Two 0.5 liter/ha applications of Vitazyme in this Ukrainian sunflower study provided for an excellent seed yield increase at 0.53 tonne/ha (+16%), while returning the farmer an additional $185/ha of income, showing the great value of this program for sunflower growers in Ukraine.

Treatment	Yield	Yield change
	tonnes/ha	tonnes/ha
1. Control	3.35	—
2. Vitazyme	3.88	0.53 (+16%)

Sunflower Seed Yield



Increase in seed yield with Vitazyme: 16%

Sunflowers *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: PJSC "Kurland", Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Zhmerynka District, Vinnytsia Region, Tarasivka Village, Ukraine
Variety: NK Roki
Seeding rate: 50,000 seeds/ha
Planting date: May11, 2017
Previous crop: wheat
Soil type: brown podzolic; humus=2.0%
Seedbed preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing to 5-6 cm
Experimental design: A sunflower field was divided into Vitazyme treated and untreated control areas to determine the efficacy of the product in promoting yield increases.

❶ ***Control*** ❷ ***Vitazyme***

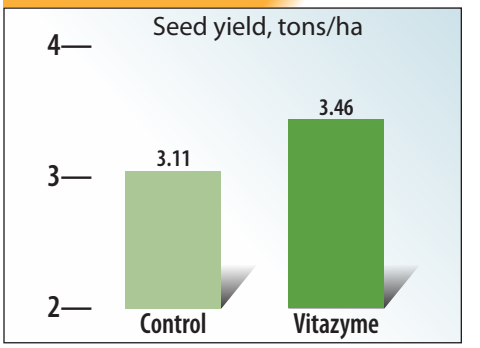
Fertilization: 20-20-12 kg/ha N-P_2O_5-K_2O broadcast before plowing, and 32/ kg/ha of N in-furrow at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 10-leaf stage on June 25, 2017
Growing season weather: dry
Yield results:

Treatment	Seed yield	Yield change
	tons/ha	ton/ha
1. Control	3.11	—
2. Vitazyme	3.46	0.35 (+11%)

Increase in sunflower seed yield with Vitazyme: 11%

Income increase: At a price of $362.86/ton of sunflower seeds, the added 0.35 ton/ha gave an additional $127/ha income.

Sunflower Seed Yield



Conclusions: A sunflower trial in a field in Ukraine in 2017, using a single 1 liter/ha application of Vitazyme at the 10-leaf stage, showed an 11% yield increase (0.35 ton/ha) despite very dry conditions during the growing season. This increase resulted in $127/ha greater returns to the farmer, revealing the excellent efficacy of this product for sunflower growers in Ukraine.

Sunflowers *with Vitazyme application*

The head size has been dramatically improved in this central Ukraine sunflower study. Yield increases over 20% are common.

Vitazyme treated sunflowers in Ukraine display a much improved and vigorous root system, which translates into higher yields.

Researcher: Vadim Plotnikov
Research organization: State Enterprise "Drabivske", Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Drabiv District, Cherkasy Region, Drabovo-Baryatinske Village, Ukraine
Variety: NK Neoma
Seeding rate: 50,000 seeds/ha
Planting date: April 26, 2017
Previous crop: wheat
Soil type: typical Chernozem; humus=3.9%
Soil preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing, to 5-6 cm
Experimental design: A sunflower field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

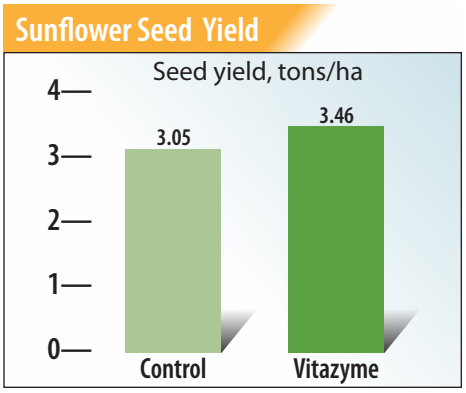
1 ***Control*** **2** ***Vitazyme***

Fertilization: 120 kg/ha of nitrogen broadcast before planting, and10-26-26 kg/ha of N-P_2O_5-K_20 in-furrow starter at planting
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at the 8 to10-leaf stage on June 10, 2017
Growing season weather: dry
Yield results:

Treatment	Seed yield	Yield change
	tons/ha	ton/ha
1. Control	3.05	—
2. Vitazyme	3.46	0.41 (+13%)

Increase in sunflower seed yield with Vitazyme: 13%

Income increase: At a price of $397.56/ton of sunflower seeds, the added 0.41 ton/ha gave an additional $163/ha income.



Conclusions: This Vitazyme full-scale field trial with sunflowers in the Ukraine, utilizing just one foliar/soil application of 0.5 liter/ha at the 8 to 10-leaf stage, provided an excellent 0.41 ton/acre (13%) seed yield increase, which gained the farmer $163/ha more income. These results show how useful this program is for sunflower growers in Ukraine.

Sunflowers *with Vitazyme application*

Researcher: V. V. Plotnikov
Research institution: Agro Expert International, Vinnytsya, Ukraine
Location: L. L. C. Zelen'ky, Zelen'ky Village, Myronivs'kyi District, Kyiv Region, Ukraine
Variety: NK Condi
Planting date: May 5, 2016
Seeding rate: 50,000 seeds/ha
Soil type: podzolized
Soil type: podzolized Chernozem (3.3% organic matter)
Cultivation: disking to 6-8 cm, plowing to 20-22 cm, harrowing, and two cultivations to 4-5 cm
Rainfall: 500-550 mm
Experimental design: A sunflower field was divided into a Vitazyme treated and untreated area, with the objective of determining the effect of this product on the yield of the seeds.

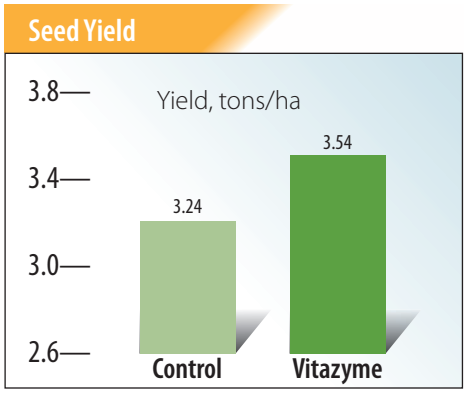
1 ***Control*** 2 ***Vitazyme***

Fertilization: at planting, 16-16-16 kg/ha of N-P_2O_5-K_2O in-row
Vitazyme application: 1.0 liter/ha on the leaves and soil at the 8–leaf stage, on June 17, 2016
Yield results:

Treatment	Seed yield	Yield change
	tons/ha	tons/ha
Control	3.24	—
Vitazyme	3.54	0.30 (+9%)

Increase in seed yield with Vitazyme: 9%

Sunflowers treated with Vitazyme in Ukraine have consistently produced superior yields of both tonnage and oil content.

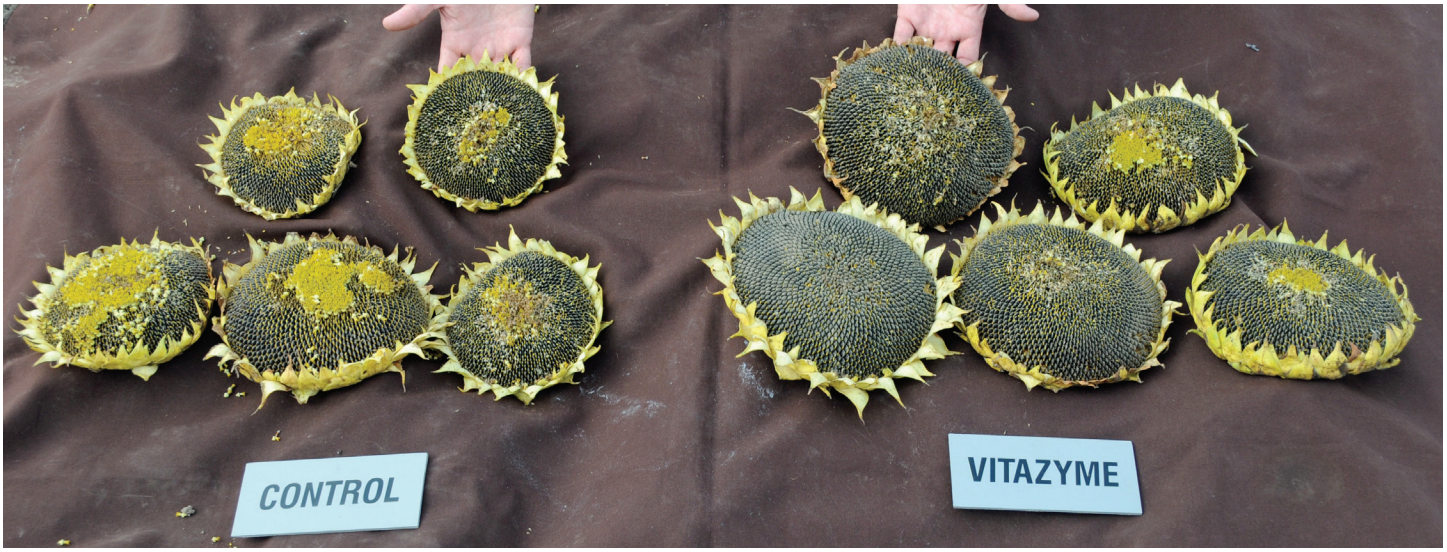


Income results: Vitazyme increased net profit by 104 USD/ha.
Conclusions: This Vitazyme soil and foliar trial in Ukraine showed that only 1 liter/ha produced a 9% yield increase. Profits were substantially increased by 104 USD/ha, revealing the value of this product for sunflower production in Ukraine.

VitalEarth 2015 Crop Results

Sunflowers

A Summary of Three Field Trials in Ukraine

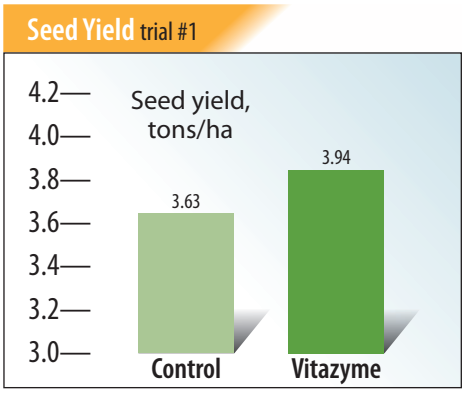


Sunflower response to Vitazyme has been uniformly excellent over the many years it has been trialed in several countries, including Ukraine where this trial took place.

All trials were organized by V.V. Plotnikov, Ph.D, to determine the yield and profit-improving potential of Vitazyme. Fields were divided into Vitazyme and control areas.

1. Conducted by Agricultural Cooperative "Agrobusiness" at Kaharlystkyi District, Kyiv Region, Horohove Village, Ukraine, on a podzolized chernozem (3.1% organic matter).

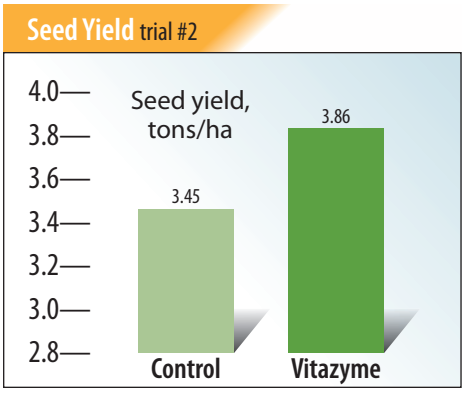
Variety: NK Brio hybrid
Seeding rate: 50,000 seeds/ha
Planting date: April 25, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 22 cm, cultivation to 6 cm
Fertilization: 45 kg/ha N, pre-plant incorporated; 15 kg/ha N, 15 kg/ha P_20_5, 15 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 8-leaf stage on May 31, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.31 tons/ha(+9%)
Profit increase with Vitazyme: 2,114 UAH/ha

2. Conducted by JLLC "Palmira Vidhodivlya" at Zolotonosha District, Cherkasy Region, Voznesens'ke Village, Ukraine, on a chernozem soil (3.5% organic matter).

Variety: NK Kondi hybrid
Seeding rate: 50,000 seeds/ha
Planting date: April 21, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 22 cm, cultivation to 6 cm
Fertilization: 45 kg/ha, pre-plant incorporated; 15 kg/ha N, 15 kg/ha P_20_5, 15 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 6-leaf stage on, May 22, 2015
Results: *(See bar chart to the right)*

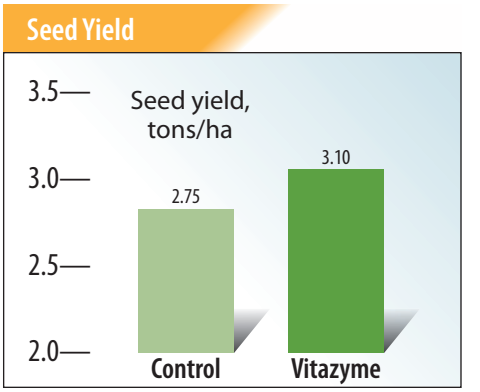


Yield increase with Vitazyme: 0.41 ton/ha(+12%)
Profit increase with Vitazyme: 2,954 UAH/ha

Sunflowers *A Summary of Three Field Trials in Ukraine cont.*

3. Conducted by CMTC "Nadiya Ukrayiny", at Kiliys'kyi District, Odesa Region, Kiliya Town, Ukraine, on a calcareous chernozem (2.5% organic matter).

Variety: LH55.43 KL hybrid
Seeding rate: 50,000 seeds/ha
Planting date: April 9, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 24 cm, cultivation to 6 cm
Fertilization: 35 kg/ha N, pre-plant incorporated; 16 kg/ha N, 16 kg/ha P_20_5, 16 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 6-leaf stage on May 5, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.35 ton/ha(+13%)
Profit increase with Vitazyme: 2,450 UAH/ha

Location	Yield increase	Profit increase
	%	UAH/ha
Central Ukraine (500-550 mm ppt)		
"Agrobusiness" — Horohove	9	2,114
"Palmira Vidhadivlya" — Voznesens'ke	12	2,954
Southern Ukraine (300-350 mm ppt.)		
"Nadiya Ukrayiny" — Kiliya	13	2,450
Mean	11.3	2,506

Conclusion: All three of these sunflower trials produced excellent yield increase from a single 1 liter/ha foliar Vitazyme application at the 6 to 8 leaf stage. The average increase was 11.3%, and the average profit increase was 2,506 UAH/ha for all three trials. This program is shown to be an excellent addition to sunflower production programs in Ukraine.

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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**

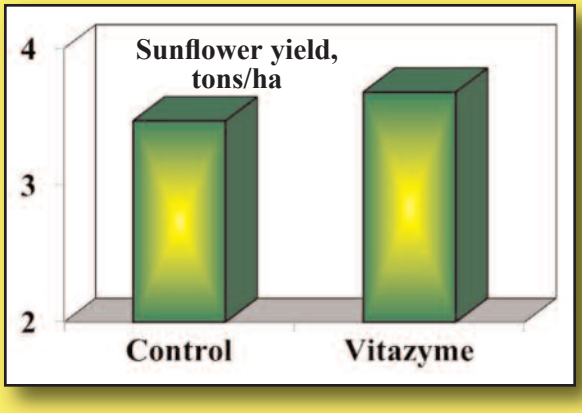
Fertilization: 50 kg/ha of nitrogen broadcast and incorporated before planting, and 10-26-26 kg/ha of N-P_2O_5-K_2O in-furrow at planting.

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

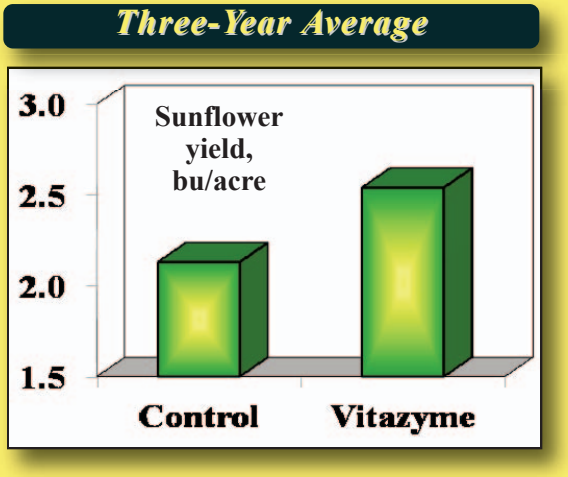
Researcher: V.V. Plotnikov *Location*: National Academy of Agrarian Sciences, Vinnytsia State Agricultural Research Station, Vinnytsia, Ukraine (Central Forest and Steppe Region)

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

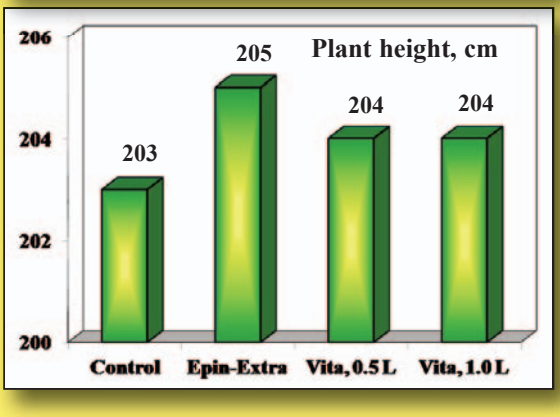
Vitazyme on Sunflowers

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.

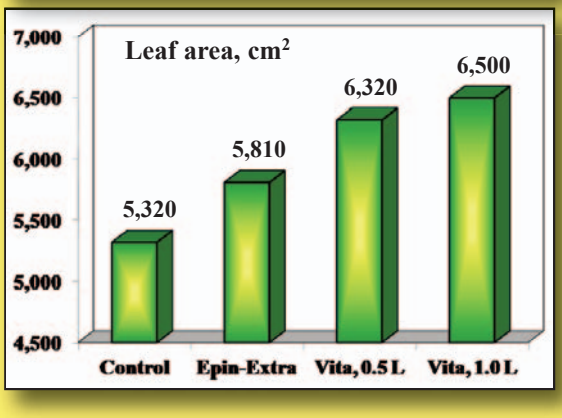
Plant Height



$HCP_{0.05}$=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

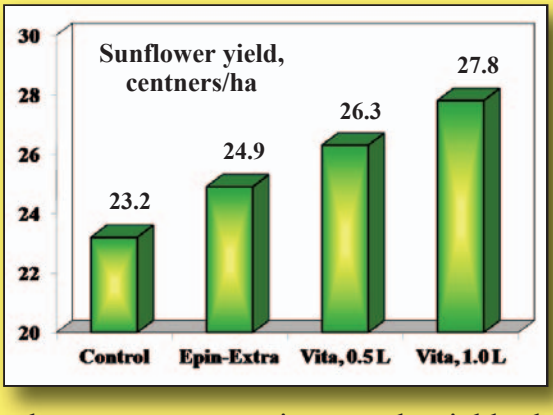
0.5 liter/ha ..... +19%
1.0 liter/ha ..... +22%

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	

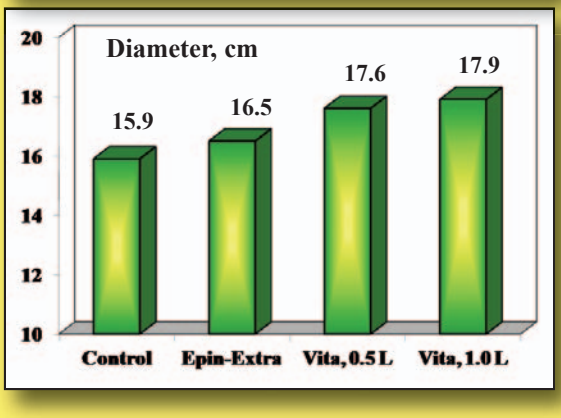
Increase in yield with Vitazyme

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.

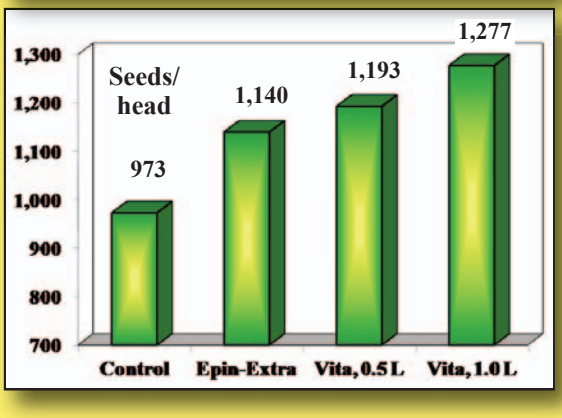
Head Diameter



$HCP_{0.05}$=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.

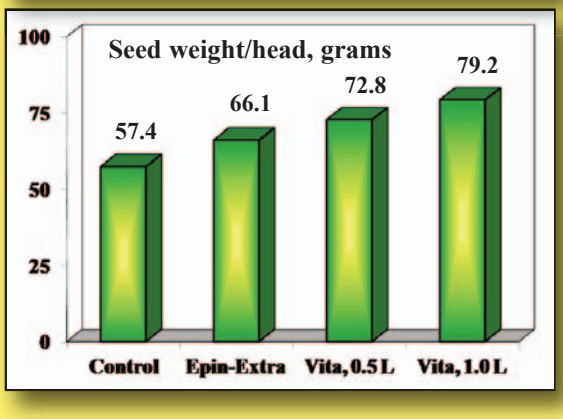
Increase in head diameter with Vitazyme

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%

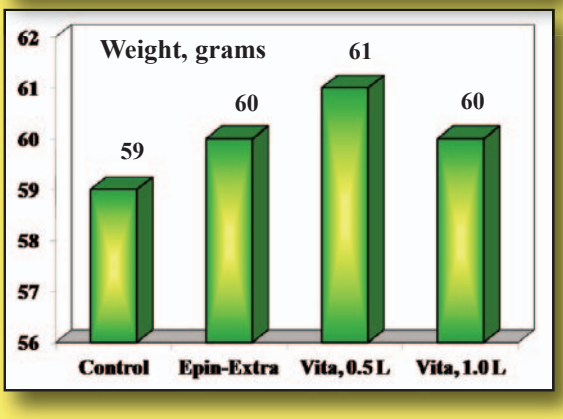
Seed Weight Per Head



$HCP_{0.05}$=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.

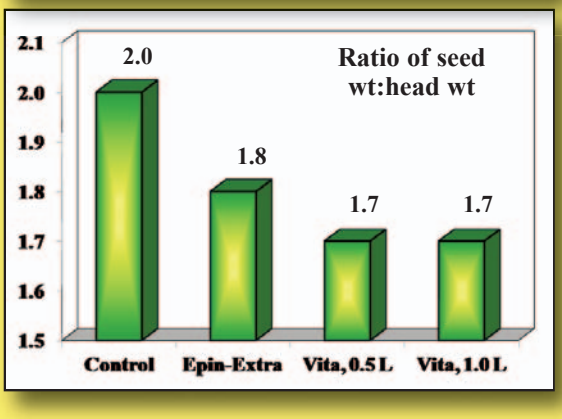
Increase in seed weight with Vitazyme

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

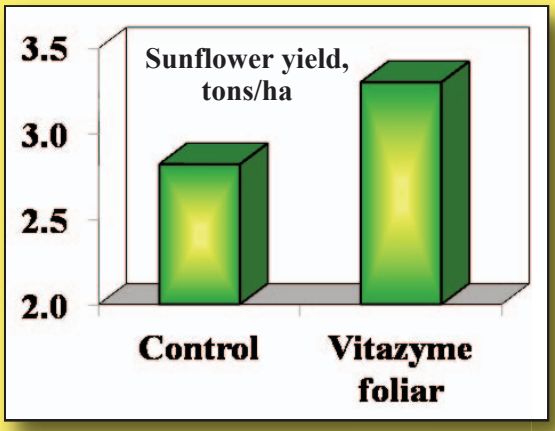
Vitazyme on Sunflowers

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

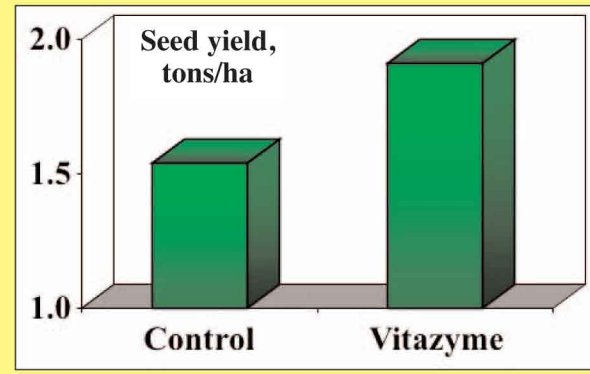
Researcher: O.V. Kornijchuk, V.V. Plotnikov, and agronomic scientists
Organization: Vinnytsia State Agricultural Experiment Station, Ukraine Academy of Agrarian Sciences, Vinnytsia, Ukraine *Location*: Ukraine central forest-steppe area near Vinnytsia
Seeding rate: 5 kg/ha *Planting date*: May 22, 2009 *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.