

INSTITUTE FOR RICE RESEARCH

EFFECTS OF THE BIO-REGULATOR VITAZYME ON IRRIGATED RICE CULTIVATION

The phito-hormones or bio-regulators of natural origins play an important role in stimulating growth, development and productivity of plants, because they contain compounds such as gibberellins and auxins, as well as other elements that induce such effects.

One example of such hormones is the product Vitazyme, which contains:

Concentrated water produced by plant fermentation and carbohydrates which contain phitoactive agents.	24.64 %
K ₂ O (K ₂ SO ₄)	0.80 %
Fe (Fe -EDTA)	0.20 %
Cu (Cu -EDTA)	0.07 %
Zn (Zn -EDTA)	0.06 %
Extracts, Calcium lignosulphanate, humic acid, ascorbic acid	1.23 %
Water	73.00 %

The product may be applied in various ways: treating the seed or the small seedlings before transplanting, applying to the soil and/or the plants or by an irrigation system.

The objective of this paper is to verify the effects of the stimulant vitazyme on the cultivation of irrigated rice.

MATERIALS AND METHODS

I. Effects of treating the seed with vitazyme on the rice seedlings.

Three experiments were developed under laboratory conditions at the Institute for Rice Research, using Petri dishes with a diameter of 9 cm and a height of 1.5 cm. In order to maintain the humidity conditions in the dishes filter paper was installed at the bottom of the dish. The length of the coleoptiles and the root was evaluated at 5 and 10 days after germination. The rice variety used was the *Reforma*. A completely random design was utilized with six treatments: control with distilled water and with vitazyme concentrations (2, 4, 6, 8 and 10%), each treatment was replicated four times with 100 seeds each. Humidity conditions were maintained throughout the duration of the experiment by periodically adding distilled water.

II. Effects of vitazyme on the yield and growth of rice cultivation.

The experiments were conducted at two locations: at the *Institute for Rice Research* in the province of Havana and the *Experimental Station* at the South of Jíbaro in the province of Sancti Spiritus, during the 2003 humid season.

The following treatments were performed in field plots:

- T1. Absolute Control (0 NPK)
- T2. Control parcel with 100 NPK according to the “Technical Instructive”..
- T3. 75% N
- T4. 100% N + VITAZYME applied during active tillering and beginning of budding.
- T5. 75% N + VITAZYME applied during active tillering and beginning of budding.
- T6. 75% N + VITAZYME applied during active growth.
- T7. 75% N + VITAZYME applied at primordium change phase.
- T8. 75% N + VITAZYME applied during beginning of flowering.

The triple super-phosphate and potassium chloride were applied identically in all treatments at a rate of 68 and 90 kg/ha (kilograms per hectare) phosphorous and potassium in Sancti Spiritus. The rate in Havana was 34 and 48 kg/ha of the same elements.

The following dosage of urea was applied: 170 and 127 kg N/ha in Sancti Spiritus and Havana respectively.

The variety known as “Perla de Cuba” {Cuban Pearl} (short cycle) and variety 4499 (medium cycle) in Havana and Sancti Spiritus respectively.

The solutions without surfactant, were applied with a manual sprayer at a pressure of 1.4 atmospheres, at a delivery rate of 100 ml/m².

A random block design was used for the 4 x 3m parcels in four repetitions in Sancti Spiritus and a totally random design of 2 x 10m parcels with two repetitions was used in Havana. Plant height, number of stems/m², foliage area/m², the thickness and the length of the first basal internode and agricultural growth were evaluated at 14% humidity.

The data was analyzed using the Anova software.

RESULTS ACHIEVED

I. Effects of treating the seed with vitazyme on the rice seedlings.

In the following table 1 the average results achieved with three experiments are shown in the evaluation of the coleoptiles growth and roots when the seed was treated by various concentrations of vitazyme. {TN: Roots are probably primary roots. They are so referred throughout.}

It can be seen that even though there are no significant differences in the growth of the roots and the coleoptiles in the seed treated with vitazyme, a stimulative effect from the product was observed because the coleoptiles and the root lengths were increased 15% and 11% in relationship with the controls, at 5 and 10 days from germination (it corresponds with 0.6 cm and 0.7 cm).

Table 1. Root and coleoptiles behavior with Reforma-variety seed treatment.

Dosage (%)	Roots		Coleoptiles	
	5 DDG	10 DDG	5 DDG	10 DDG
Control	4.12 a	5.49 a	1.75 a	4.88 a
2	4.37 a	5.46 a	1.62 a	5.00 a
4	4.57 a	6.17 a	1.81 a	5.07 a
6	4.71 a	5.87 a	1.83 a	5.19 a
8	4.75 a	5.74 a	1.92 a	5.26 a
10	4.75 a	5.75 a	1.73 a	4.91 a
cv	7.3	5.92	7.09	7.29

II. Effects of vitazyme on the yield and growth of rice cultivation.

In table 2 it can be observed that vitazyme had a stimulative effect on the indicators of growth, in such a way that increases in the plant height between 4 and 8 cm were achieved when compared to the 100% NPK control. In those treatments in which 100 and 75% of nitrogen was applied and in the sprayings of vitazyme during active tillering and beginning of flowering, however, applications during the primordium change phase and beginning of flowering did not show this phenomenon, which leads us to believe that the effect is achieved with early applications of the product.

In relation to the number of leaves/m² it was verified that the application of the product at the beginning of flowering favor this indicator because the treatments with 100% of nitrogen with vitazyme application at the active tillering and beginning of flowering and treatments with 75% of nitrogen with vitazyme application at the beginning of flowering showed in both cases superior values over the control.

The internode thickness was superior in the treatments when compared with the control according to the “Technical Instructive” except in those applications at 75% nitrogen with application at the primordium change or at the beginning of flowering, from this it can be derived that applications at the first stages favor the internode thickness. In the case of the internode length, contrary to the prior case, applications at the primordium change or at the beginning of flowering favor this indicator when compared with the control.

The area of the foliage increased in all treatments except in applications at the beginning of flowering.

In treatment number 4 with applications of 100% of nitrogen and vitazyme during the active tillering and beginning of flowering it was found that all growth indicators were stimulated and it is precisely in this treatment where the highest increases of the agricultural yield were achieved.

Table 2. Behavior of certain growth indicators in the “Perla de Cuba” rice variety during the 2003 humid season.

Treatment	Height (cm)	Number of leaves/m ² .	Number of stems/m ² .	Internode Thickness (mm)	Internode Length (cm)	Leaf surface (cm ²)
Absolute	92	1888	688	0.53	3.8	22.2
NPK Control	96	3024	864	0.43	4.9	23.3
75% N	102	3024	864	0.49	3.9	28.5
100% N + Vita in AT + BF	100	3440	560	0.5	5.9	26.7
75% N + Vita in AT + BF	100	3152	832	0.44	3.7	33.3
75% N + Vita in AT	104	2480	672	0.49	3.8	30.3
75% N + Vita in PC	92	2784	704	0.37	7.2	24.0
75% N + Vita in BF	74	3648	992	0.36	5.0	16.0

Identical letters do not significantly differ at 5%.

Legend:

- AT. Active Tillering
- PC. Primordium Change
- BF. Beginning of Flowering

At Sancti Spiritus, the indicator height evaluated at 53 and 76 days after germination increased compared with the control in the treatments where vitazyme was applied, the best values were reached in treatment 4 (with applications of vitazyme in the active tillering and the beginning of flowering) (table 3).

In table 4, as it can be seen, the yield did not show any significant differences among the treatments, it is important to highlight that it increased between 8 and 10% in treatments T4, T5 and T6, where 100 and 75% nitrogen was applied with applications at the active tillering and beginning of flowering and with 75% nitrogen plus vitazyme in active tillering. It is during treatments T4 and T5 that when the greatest yield values were observed the greatest number of full grains per panicle were achieved.

The yield components do not show significant differences among the treatments.

At the *Experimental Station*, Sancti Spiritus, the agricultural yield increased with vitazyme applications, reaching a percentage between 25 and 36% during the treatments with 75 and 100% of nitrogenated fertilization plus vitazyme during the active tillering and the beginning of panicle stage

and it is in these treatments where the greatest increases in the components of growth were achieved.

The number of unproductive grains decreased with the application of vitazyme and the panicle length increased in the treatment with 100% nitrogen and vitazyme during the active tillering and the beginning of flowering stages were favorably increased compared with all treatments (table 5).

The economic calculations performed with the best variants as a result of experiments conducted in Sancti Spiritus, refers to the best values (128.62 and 94.38 UDS/HA) in the treatments with 100% nitrogen plus vitazyme application during active tillering and beginning of flowering and with 75% plus the application at the appropriate times.

Table 3. Plant height in cm -- variety 4499 with vitazyme applications.
Humid season 2003. *Experimental Station, Sancti Spiritus.*

Treatment	26 DDG	37 DDG	53 DDG	76 DDG
Absolute control	19	32	38	39
NPK Control	30	51	44	78
75% N	28	43	47	71
100% N + Vitazyme in AT + BF	30	48	61	88
75% N + Vitazyme in AT + BF	28	47	52	76
75% N + Vitazyme in AT	29	40	51	81
75% N + Vitazyme in PC	27	44	53	80
75% N + Vitazyme in BF	28	45	37	81

Identical letters do not significantly differ at 5%.

Legend:

- AT. Active Tillering
- PC. Primordium Change
- BF. Beginning of Flowering

Table 4. Agricultural yield results and its components with vitazyme applications to the “Perla de Cuba” variety. Havana.

Treatment	Agricultural Yield (t/Ha)	Panicles/m ²	Full grains/panicle	Weight of 1000 grains	Panicle length
Absolute control	2.41	230 b	64 a	24.86 c	22 bc
NPK Control	2.88 ab	344 a	72 a	26.58 ab	22 c
75% N	2.96 ab	343 a	61 a	26.00 bc	23 bc
100% N + Vitazyme in AT + BF	3.19 a	301 a	75 a	26.14 abc	23 abc
75% N + Vitazyme in AT + BF	3.10 a	330 a	81 a	26.64 ab	23 abc
75% N + Vitazyme in AT	3.18 a	332 a	67 a	27.50 a	23 ab
75% N + Vitazyme in PC	3.08 a	315 a	61 a	27.25 a	22 bc
75% N + Vitazyme in BF	2.65 bc	347 a	72 a	26.67 ab	24 a
Cv	8.93	10.5	16.67	4.5	4.3

Identical letters do not significantly differ at 5%.

Legend:

AT. Active Tillering

PC. Primordium Change

BF. Beginning of Flowering

Table 5. Agricultural yield results and other indicators with vitazyme applications to the 4499 variety. Sancti Spiritus.

Treatment	Agricultural Yield (t/Ha)	Panicles/m ²	Full grains/panicle	Unproductive grains/panicle	Panicle length
Absolute control	3.17 e	182 f	62 c	25 a	18.4 c
NPK Control	4.65 c	267 d	79 b	17 ab	21.3 b
75% N	3.83 d	215 e	77 b	16 ab	20.7 b
100% N + Vitazyme in AT + BF	6.34 a	365 a	92 a	18 ab	23.3 a
75% N + Vitazyme in AT + BF	5.81 b	336 ab	81 b	13 b	21.3 b
75% N + Vitazyme in AT	5.17 c	327 b	82 b	18 ab	21.3 b
75% N + Vitazyme in PC	4.74 c	310 bc	78 b	17 ab	20.7 b
75% N + Vitazyme in BF	5.12 c	288 cd	83 b	20 ab	18.4 c
Cv	5.65	9.1	11.2	6.3	4.5

Identical letters do not significantly differ at 5%.

Legend:

AT. Active Tillering

PC. Primordium Change

BF. Beginning of Flowering

Table 6. Economic Indicators of the best variants at the Experimental Station at the South of Jíbaro. Humid season 2003.

Treatment	Yield Rice with shell (T.ha ⁻¹)	Yield White (T.ha ⁻¹)	Price of Rice (USD)	Production to Market (USD.ha ⁻¹)	Cost of increased yield (USD.ha ⁻¹)	Cost fertilizer + others (USD.ha ⁻¹)	Total Cost (USD.ha ⁻¹)	Profit (USD.ha ⁻¹)	Economic Effect (USD.ha ⁻¹)
Control	4.65	3.02	170	513.4	--	101.7	101.70	411.70	--
100% N + Vitazyme in AT + BF	6.34	4.12	170	700.4	27.5	132.58	160.08	540.32	128.62
75% N + Vitazyme in AT + BF	5.81	3.78	170	642.6	19.0	117.57	136.50	506.10	94.38
75% N + Vitazyme in AT	5.17	3.36	170	571.2	8.5	110.73	110.73	460.47	48.77

Identical letters do not significantly differ at 5%.

Legend:

- AT. Active Tillering
- PC. Primordium Change
- BF. Beginning of Flowering

CONCLUSIONS.

- The bio-stimulant Vitazyme increased the agricultural yield of rice cultivation.
- The 100 and 75% nitrogen variants plus the application of Vitazyme during the active tillering or beginning of the panicle stages were the most effective to increase the agricultural yield with economic effects of \$128.62 and \$94.38 per hectare respectively.