

BiOWiSH[®] Crop Liquid

Evaluation of BiOWiSH[®] Crop Liquid on Rice in Shuangcheng District, China



Executive Summary

Nestle Grain Competence Center (GCC) conducted a study to test the effect of BiOWiSH[®] Crop Liquid coated bulk blend fertilizer to create an Enhanced Efficiency Fertilizer (EEF) on rice in Shuangcheng District, Heilongjiang Province.

The study compared two treatments:

- Control, Standard Fertility Program
- N Optimized Fertility Program + BiOWiSH[®] Crop Liquid

The results indicate that the addition of BiOWiSH[®] Crop Liquid optimized yield potential by improved nutrient uptake for the grower's rice program in the N Optimized Fertility Program. In this study, a 10.5% (1.05 MT/ha, 0.47 tons/acre) yield increase was observed in the N Optimized Fertility Program + BiOWiSH[®], resulting in higher profit.

Background

About BiOWiSH Technologies

Headquartered in Cincinnati, Ohio, BiOWiSH Technologies, Inc. is a global provider of biotechnology solutions. As a leader in the agricultural market, we help farmers increase crop production sustainably, safely, and cost effectively. Our revolutionary BiOWiSH[®] Crop Liquid is a blend of proprietary microbial cultures that can be coated onto dry fertilizer or mixed with liquid fertilizers to create an enhanced efficiency fertilizer. BiOWiSH[®] endophytic *Bacillus* deliver soil nutrients to crops through the rhizophagy cycle creating a symbiotic relationship between the plant and soil microbes. This helps farmers achieve consistent results across a broad range of operating conditions, climates, and environments. By unifying nature and science, BiOWiSH reinvents the way food is grown. For more information, visit biowishtech.com.

BiOWiSH[®] Crop Liquid



- Optimizes yield potential by improved nutrient uptake
- Increases nutrient use efficiency and supports nutrient uptake
- Optimizes soil conditions for greater root mass
- Improves soil conditions for increased plant vigor
- Enhances beneficial microbes in the rhizosphere

Available Size

- 264 gal/1000 L

Background on Rice in Heilongjiang Province

Heilongjiang Province is a major agricultural province, located in one of the three recognized black soil zones in the world. Rice, the most important grain crop in Heilongjiang Province, was grown on an area of nearly four million hectares in 2022. Rice is also a major producer of greenhouse gases, partly caused by the rice physiological metabolic characteristics, but more importantly, it is caused by certain improper cultivation measures, such as excessive fertilization, over-irrigation, and low nitrogen utilization efficiency.

Objectives

The purpose of this trial was to evaluate the performance of BiOWiSH® Crop Liquid coated onto granular fertilizer in an optimized fertility program for rice, compared to the standard full fertility program. This study could serve as an example for low-carbon emission, climate-smart management practices in rice production for local farmers, all while maintaining yield potential.

Implementation Program

The study was conducted on rice (*Oryza sativa*) at the Nestle Grain Competence Center (GCC), comparing two fertilizer treatments in a side-by-side design with plot sizes of 969 ft² (90 m²). The Control program is a local standard fertility program, consisting of phased applications at regreening, tillering, rice booting, and heading using Ammonium Phosphate, Ammonium Sulfate and Potassium Chloride (see Table 2 for details and rates). For the N Optimized Fertility Program + BiOWiSH® the rates for each fertilizer application were reduced by 20% compared to the Control, and all solid fertilizers were coated with BiOWiSH® Crop Liquid at the manufacturer's recommended rate prior to application.

Given the lodging present among both treatments, six subsamples of 13 ft² (1.2 m²) were taken from each plot to estimate yield and other biological parameters.

The trial began in April and the rice was harvested in mid-October. Pest and disease management techniques were implemented when necessary. Fertilizer costs, regional crop values, and yields were used to determine net income and net income gain at the time of the study.

Table 1. Treatment Program

Treatment	Program Type	Application Phase
Control	Standard Fertility	Broadcast
N Optimized Fertility Program + BiOWiSH® Crop Liquid	80% Standard Fertility	Broadcast

Table 2. Fertilizer, Treatments, and Application Timing

Treatment	Fertilizer Application Timing	Ammonium Phosphate kg/ha [lbs/acres]	Ammonium Sulfate kg/ha [lbs/acres]	Potassium Chloride kg/ha [lbs/acres]
Control	Transplanting	56 [50]		56 [50]
	Regreening		75 [67]	
	Tillering		75 [67]	
	Rice booting		75 [67]	
	Heading		150 [134]	38 [33]
N Optimized Fertility Program + BiOWiSH® Crop Liquid*	Transplanting	45 [40]		45 [40]
	Regreening			
	Tillering		60 [54]	
	Rice booting		60 [54]	
	Heading		120 [107]	30 [27]

*BiOWiSH® Crop Liquid used at manufacturer's recommended rate.

**Calculations for conversions between imperial and metric units are based on the original source data; slight rounding differences may occur within reported publication values.

Results

Soil Analysis

Compared to the Control, soil nutrient data of the trial indicate that the BiOWiSH® treatment increased nutrient use efficiency and supported nutrient uptake over the course of the trial.

Table 3: Soil Analysis

Sample Timing	Treatment	Available P ppm	Alkali-hydrolyzed N ppm	Available K ppm	Organic Matter %	pH
Pre-Planting		13.7	231.5	229	3.0	6.3
	Control	6.9	156.5	196	3.6	6.7
Post Harvest		9.5	198.9	210	3.8	6.7
	N Optimized Fertility Program + BiOWiSH® Crop Liquid					

Biological Parameters of Rice

The results below indicate that the BiOWiSH® treatment improved soil conditions for increased plant vigor. This is evidenced by higher treatment means for the BiOWiSH® treatment across all biological parameters, with significant differences observed for the effective tiller number and proportion of effective tillers ($P < 0.05$).

Table 4: Plant Agronomic Trait Data for Late Rice

Treatment	Root Length cm	Plant Height cm	Effective Tiller Number	Proportion of Effective Tillers %	SPAD Rating
Control	22.3 ^a	102 ^a	18 ^b	88 ^b	22.5 ^a
N Optimized Fertility Program + BiOWiSH® Crop Liquid	24.7 ^a	104 ^a	21 ^a	91 ^a	22.6 ^a

Note: unique letter subscripts indicate significant differences between treatment means at an alpha of 0.05.

Yield Data

BiOWiSH® Crop Liquid, when coated onto fertilizer, optimized yield potential by improved nutrient uptake in rice. When added to this N Optimized fertility program, a yield increase of 10.5% (0.47 tons/acre, 1.05 MT/ha) was observed. By virtue of the higher yield and reduced input costs at the time of study for the N Optimized Fertility Program + BiOWiSH® Crop Liquid treatment, a higher profit was achieved over the Control.

Figure 1: Yield Data

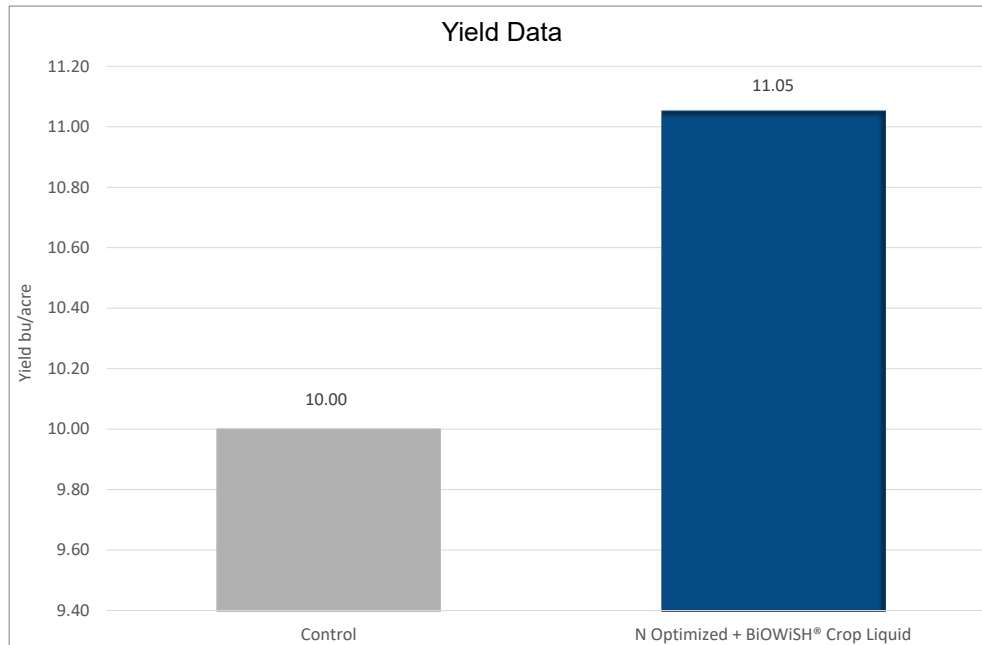


Table 5: Yield and Net Income Table

Treatment	Yield MT/ha [tons/acre]	Yield Increase MT/ha [tons/acre]	Yield Increase (%)	Net Income USD/ha [USD/acre]	Profit Change USD/ha [USD/acre]
Control	10.00 [4.46]	-	-	4697 [1901]	-
N Optimized Fertility Program + BiOWiSH® Crop Liquid	11.05 [4.93]	1.05 [0.47]	10.5	5234 [2118]	537 [217]

*Calculations for conversions between imperial and metric units are based on the original source data; slight rounding differences may occur within reported publication values.

**Net income is the crop value minus the fertility program cost. It does not account for the non-fertility expenses.

***Profit change is the difference between net income of the respective program and the Control.

Conclusion

BiOWiSH® endophytic *Bacillus* deliver soil nutrients to crops through the rhizophagy cycle creating a symbiotic relationship between the plant and soil microbes. Together, the cycle improved soil conditions for increased plant vigor in this study. This enabled optimized yield potential by improved nutrient uptake, which led to profit changes of \$537 USD/ha (\$217 USD/acre) for the N Optimized + BiOWiSH® Crop Liquid treatment in this study. This demonstrates that despite a reduction of fertilizer rates, fertilizer coated with BiOWiSH® Crop Liquid has the potential to achieve higher yield potential on lower input costs.



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