

## BiOWiSH® Crop Liquid

### Evaluation of BiOWiSH® Crop Liquid on Grain Yield in Rice

#### Executive Summary

BiOWiSH Technologies, Inc. engaged Helena R&D as a third-party Contract Research Organization (CRO) to conduct a study to determine the effects of BiOWiSH® Crop Liquid on rice yields in a continuous flood system. The trial compared four treatments:

- A regional fertilizer program as the control (Control)
- The same fertilizer program with BiOWiSH® Crop Liquid added (Control + BiOWiSH® Crop Liquid)
- Stabilized nitrogen technology
- Controlled release polymer coated

The study determined that the Control + BiOWiSH® Crop Liquid program had a significant effect on plant growth and yield in rice which led to higher profit.

#### Background

##### About BiOWiSH® Crop Liquid

BiOWiSH® Crop Liquid is a microbial biostimulant that can be coated onto dry fertilizer or mixed with liquid fertilizers to create an enhanced efficiency fertilizer with industry leading shelf-life and consistent results across a broad range of operating conditions and environments, all at a low cost to farmers. BiOWiSH® Crop Liquid stimulates native microbial activity and promotes root development, increasing nutrient uptake and improving plant vigor. BiOWiSH® Crop Liquid is proven to enhance the effects of applied fertilizers by increasing yield and soil health.

##### About Helena Agri-Enterprises

Helena Agri-Enterprises is a leading provider of crop production and crop protection products in the United States and worldwide. Headquartered in the USA, the company has been in the agronomic products supply business for more than 50 years and has expanded their contract research services over the last decade. As an independent CRO, Helena R&D is a team of highly trained and experienced study directors, field researchers, and support staff. They are one of several independent CROs that BiOWiSH Technologies, Inc. works with to independently evaluate our agronomy products.

#### Objective

The objective of this research study was to determine the efficacy of BiOWiSH® Crop Liquid, manufactured in the USA by BiOWiSH Technologies, Inc., on rice production when added to a fertility program common to the production area in California. The focus was on BiOWiSH® Crop Liquid's impact on grain yield, plant vigor, and the grower economics.

In addition, the Control and Control + BiOWiSH® programs were compared to a stabilized nitrogen technology and a controlled release polymer technology.

#### Implementation Program

The study was conducted on a grower field near Marysville, California, USA. The treatments were organized as a Randomized Complete Block Design with 4 replications. The field was prepared normally, beginning with soil tillage, leveling and, rolling. Then plots were delineated and a 6-foot-wide levee plot was established to create a contiguous soil border between plots so as to maintain the integrity of the treatments.

Two fertilizer application schemes were used in the study: a single pre-flood soil surface application with the fertilizer incorporated, and a sequential program with base fertilizer as previously described followed by a sequential fertilizer application into the flood water at panicle initiation.

### BiOWiSH® Crop Liquid



- Improves crop yields
- Increases nutrient availability
- Enhances root development
- Improves plant vigor
- Stimulates native microbial activity in the soil
- Improves soil health

#### Available Sizes

- 50 gal/190 L
- 264 gal/1000 L

Treatment Name	Fertilization Program	Rate* [Kg/Ha] lb/acre	Application Timing Stage
<b>Control</b>	Urea (46-0-0)	[339] 302.4	At planting
	MAP (11-52-0)	[108] 96.4	At planting
	MOP (0-0-60)	[112] 99.9	At planting
	Urea (46-0-0)	[73] 65.1	Panicle initiation
<b>Reduced Control + BiOWiSH®</b>	BiOWiSH® Coated Urea (46-0-0)	[321] 286.4	At planting
	MAP (11-52-0)	[108] 96.4	At planting
	MOP (0-0-60)	[112] 99.9	At planting
	BiOWiSH® Coated Urea (46-0-0)	[69] 61.6	Panicle initiation
<b>Stabilized Nitrogen Technology</b>	Stabilized Nitrogen Coated Urea	[366] 328.5	At planting
	MAP (11-52-0)	[108] 96.4	At planting
	MOP (0-0-60)	[112] 99.9	At planting
<b>Controlled Release Polymer Coated</b>	Polymer Coated Urea	[147] 131.2	At planting
	Urea	[140] 124.9	At planting
	MAP (11-52-0)	[108] 96.4	At planting
	MOP (0-0-60)	[112] 99.9	At planting

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

\*BiOWiSH® Coated Urea (46-0-0) is urea coated with BiOWiSH® Crop Liquid according to the label recommendations.

The control treatment is the most common best management practice used by growers in the region as defined by the independent third-party testing company. Observations of the following characteristics were made to represent the effect of the various nitrogen technologies on rice performance including:

- Plant Growth: Height
- Plant Health: Color and vigor
- Yield: Plant stand and grain yield

Plant tissue samples were collected for plant nutrient composition analysis. An economic evaluation of the different fertilizer programs was performed based on current cost data for farmers in California.

## Results

### Crop Performance

There was a significant effect on yield in this study in treated plots versus the most common practice base fertilizer treatment, with the BiOWiSH® treatment having the highest yield.

Treatment Name	Plant Stand* [pl/m <sup>2</sup> ] pl/f <sup>2</sup>	Plant Height* [cm] inches	Vigor (0-5)
<b>Control</b>	[153.9] 14.3	[82.6] 32.5	3.5
<b>95% Control + BiOWiSH®</b>	[183.0] 17.0	[87.1] 34.3	3.8
<b>Stabilized Nitrogen Technology</b>	[186.2] 17.3	[87.4] 34.4	3.5
<b>Controlled Release Polymer Coated</b>	[172.2] 16.0	[83.6] 32.9	3.5

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

At day 28 of this study (after seeding), a trend for an increase in plant stand was observed in plots treated with nitrogen-enhancement technologies as compared to the control. Furthermore, plants treated with BiOWiSH® showed the highest plant height, vigor, and color values at this time.

### Plant Analysis

The plant analysis revealed that BiOWiSH® technology can increase yield while maintaining plant nutrient levels. In fact, the treatments showed sufficient Nitrogen, Phosphorous, and Potassium levels for a high-quality plant.

Treatment Name	Nitrogen (%)	Phosphorus (%)	Potassium (%)
<b>Control</b>	4.64	0.49	2.62
<b>Reduced Control + BiOWiSH®</b>	4.05	0.47	3.06
<b>Stabilized Nitrogen Technology</b>	4.32	0.39	2.85
<b>Controlled Release Polymer Coated</b>	3.77	0.43	2.93

### Economics

BiOWiSH® treatments resulted in a significant increase in the economic return as compared to the recommended best management practice fertilizer program (Control). The reduced urea plus BiOWiSH® Crop Liquid treatment gave the best economic result: an additional \$1836 per hectare (\$743/acre) over the recommended most common fertilizer program.

Treatment Name	Grain Yield [mT/ha] Ton/acre	Yield Increase (%)	Net Income* [US\$/Ha] US\$/acre	Profit Change** [US\$/Ha] US\$/acre
Control	[10.40] 4.64	-	[\$5048] \$2042	--
95% Control + BiOWiSH®	[14.19] 6.33	36.4	[\$6885] \$2786	[\$1836] \$743
Stabilized Nitrogen Technology	[13.61] 6.07	30.8	[\$6591] \$2667	[\$1593] \$645
Controlled Release Polymer Coated	[13.11] 5.85	26.1	[\$6363] \$2575	[\$1364] \$552

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 and does not account for non-fertility expenses.

\*\*Profit change is the difference between the respective program and the control.

## Conclusion

BiOWiSH® Crop Liquid coated fertilizer had a significant effect on plant growth and yield of rice produced in California. The BiOWiSH® Crop Liquid treatment with reduced nitrogen resulted in the best overall plant characteristics and highest increase in grain yield. BiOWiSH® was easy to apply and there were no deleterious effects on the handling ease, application of the treated fertilizer, or the crop itself. The ability to reduce fertilizer application combined with improving production offers a significant return on investment opportunity to the grower.



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