BiOWiSH® TECHNOLOGIES

Research Study

BiOWiSH® Crop Liquid

Evaluation of BiOWiSH® Crop Liquid on Cotton Lint Yields in Western Tennessee

Cotton

Executive Summary

BiOWiSH Technologies engaged the University of Tennessee to conduct a study to determine the effects of BiOWiSH® Crop Liquid coated onto urea to create an Enhanced Efficiency Fertilizer (EEF), as part of a cotton fertility program in western Tennessee.

The trial compared three treatments:

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

In this trial, a 7.4% increase in lint yield was observed for the Control + BiOWiSH® Fertility Program and a 7.2% increase was observed for the N Optimized + BiOWiSH® Fertility Program, which led to 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

About the West Tennessee AgResearch and Education Center (University of Tennessee)
Known for its research on agronomic crops as well as ornamentals, turf grasses, and horticultural crops, the West Tennessee AgResearch and Education Center, established in 1907, is the oldest AgResearch Center in the University of Tennessee Institute of Agriculture System. Scientists from several departments, USDA-ARS researchers, and capable support staff conduct more than one hundred investigations annually to evaluate new cultivars and develop technologies for more efficient crop production in a safer and aesthetically pleasing environment.

Objectives

The primary objective of this trial was to evaluate the performance of BiOWiSH® Crop Liquid coated onto urea as an Enhanced Efficiency Fertilizer (EEF) compared to the Control fertility practice on cotton lint yields in western Tennessee. The evaluation focused on nutrient data, yield, and economic benefits for the farmer.

Implementation Program

In this trial, the standard regional fertility program for cotton consisted of an application of 0-90-120-2Zn-13S across all treatments at planting, followed by a urea topdress at the trial location near Jackson, TN. Granular urea was applied after emergence at a rate of 174 lbs/acre (195 kg/ha). The Control program was compared to a program that included the addition of BiOWiSH® Crop Liquid coated onto urea as an EEF at the manufacturer's recommended rate. A third treatment (N Optimized Fertility Program + BiOWiSH®) constituted a 10% reduction in applied nitrogen for a total of 157 lbs/acre (176 kg/ha) of urea applied. The trial consisted of three treatments with six replicates in a randomized complete block design (RCBD). At the trial site, the cotton cultivar 'DP 2020 B3XF' was planted in accordance with local practices. There was no significant disease or pest pressure at the trial location.

Cotton lint yield was collected at harvest for each plot and analyzed comparing both BiOWiSH® treatments to the Control treatment. Cotton leaf samples were collected at the time of flowering initiation for nutrient analysis. Soil sample cores were taken at the same time. For each treatment, replicates were individually sampled, mixed together, and chemically analyzed.

Table 1. Fertilizer, Treatments, and Application Timing

Treatment	Application Rate lbs/acre [kg/ha]	Application Phase
Control, Standard Urea Fertility Program	174 [195]	Topdress
Control + BiOWiSH® Crop Liquid	174 [195]	Topdress
N Optimized Fertility Program + BiOWiSH® Crop Liquid	157 [176]	Topdress

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

Results

Plant Tissue

Compared to the Control, the plant tissue analysis for the BiOWiSH® treatments demonstrated similar or greater nutrient levels.

Table 2. Plant Tissue Analysis Table

Treatment	Total Nitrogen %	Phosphorous %	Potassium %
Control, Standard Urea Fertility Program	3.9	0.4	2.1
Control + BiOWiSH® Crop Liquid	4.1	0.4	2.1
N Optimized Fertility Program + BiOWiSH® Crop Liquid	4.2	0.4	2.3

Soil Analysis

Compared to the Control, the in-season soil analysis for the BiOWiSH® treatments demonstrated similar or greater nutrient levels.

Table 3. In-Season Soil Analysis Table

Treatment	Total Nitrogen ppm	Phosphorous ppm	Potassium ppm	OM %	pH
Control, Standard Urea Fertility Program	18	67	177	1.3	5.2
Control + BiOWiSH® Crop Liquid	21	71	186	1.4	5.2
N Optimized Fertility Program + BiOWiSH® Crop Liquid	17	64	176	1.3	5.3

Yield and Economics

Economic data on cotton lint yield from the study is presented in the table below. The Control + BiOWiSH® treatment had a profit change of $93 USD/acre ($231 USD/ha) greater than the Control. The N Optimized Fertility Program + BiOWiSH® treatment had a profit change of $95 USD/acre ($234 USD/ha) greater than the Control.

Table 4. Yield and Net Income Table

Treatment	Yield lbs/acre [MT/ha]	Yield Increase lbs/acre [MT/ha]	Yield Increase %	Net Income USD/acre [USD/ha]	Profit Change USD/acre [USD/ha]
Control, Standard Urea Fertility Program	1446 [1.62]	-	-	1305 [3134]	-
Control + BiOWiSH® Crop Liquid	1553 [1.74]	107 [0.12]	7.4	1402 [3365]	93 [231]
N Optimized Fertility Program + BiOWiSH® Crop Liquid	1550 [1.74]	104 [0.12]	7.2	1399 [3368]	95 [234]

**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 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. BiOWiSH® Crop Liquid, when added to a regional standard fertility program as an EEF, optimized yield potential by improved nutrient uptake in cotton. The 7.4% overall lint yield increase of 107 lbs/acre (0.12 MT/ha) over the Control increased profit to the grower by $93 USD/acre ($231 USD/ha) for the Control + BiOWiSH® treatment. For the N Optimized Fertility Program + BiOWiSH® treatment, the 7.2 % overall lint yield increase of 104 lbs/acre (0.12 MT/ha) over the Control increased profit to the grower by $95 USD/acre ($234 USD/ha).

In addition, the in-season soil, tissue, and yield data for both BiOWiSH® treatments, especially the N Optimized Fertility Program + BiOWiSH®, points to how the BiOWiSH® EEF increases nutrient use efficiency and supports nutrient uptake.

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