

## BiOWiSH® Crop

### BiOWiSH® Crop Additive Increases Yield in Wheat Helena Research Tests BiOWiSH® Coated Urea Fertilizer

#### Executive Summary

Adding BiOWiSH® Crop Liquid to urea fertilizer results in significant return on investment (ROI) for wheat farmers. Helena Research conducted a study to test the effect of BiOWiSH® Coated Urea on wheat production. The trial used today's farming standard (urea fertilizer) as the control. It was then compared to 2 treatments: the control coated with BiOWiSH® Crop Liquid and reduced control coated with BiOWiSH® Crop Liquid. In both cases, the BiOWiSH® treatments resulted in increased yield, leading to higher profits. The nitrogen content, potassium, and phosphorous levels were maintained in the soil at the end of cropping season.

#### Background

##### About Helena Chemical Company

The Helena Chemical Company is a leading provider of crop production and crop protection products to the agriculture community in the United States and worldwide. Headquartered in Collierville, Tennessee, the company has been in the business for more than 50 years and has been working on product development and providing research services for more than a decade.

##### About BiOWiSH® Crop Liquid

BiOWiSH® Crop Liquid is an enhanced efficiency fertilizer that helps increase nutrient uptake in plants, improve plant vigor, stimulate microbial activity in the soil, and promote root development. BiOWiSH® Crop Liquid has been shown to enhance the effects of applied fertilizers by increasing yield and soil health. Growers, distributors, and institutions have reported that using BiOWiSH® Crop Liquid improves yields and adds directly to the farmer's bottom line.

#### Objectives

BiOWiSH® Technologies engaged Helena Research to test the efficacy of BiOWiSH® Crop Liquid. The focus was on BiOWiSH® Crop Liquid's impact on soil nutrients, root biomass, yield of spring wheat, and the ROI. This study was conducted at an Oregon State University research farm in central Oregon. The study introduced urea coated with BiOWiSH® Crop Liquid into the wheat growers' standard fertility program. The standard fertility program is the most commonly used fertilizing practice in the region using urea for wheat production.

#### Implementation

The study was a Randomized Complete Block Design with four replications. The control plots were treated with the standard grower program of 280 lb/a of urea. Alturas spring wheat cultivar was planted on Day 0. Urea treatments (see Table 1) were applied on a research site in Madras, Oregon on Day 1, and irrigation began on Day 3. The trial began on April 21<sup>st</sup> and the crop was harvested at maturity in August.

Treatment Name	Post-Plant Fertilization Program	Rate		Application Phase
		lb/a	kg/ha	
Control (no BiOWiSH®)	Urea (46-0-0)	280	314	Post-plant
Control + BiOWiSH®	BiOWiSH® Crop Liquid Coated Urea (46-0-0)	280	314	Post-plant
Reduced Control + BiOWiSH®	BiOWiSH® Crop Liquid Coated Urea (46-0-0)	240	269	Post-Plant

*Table 1: Treatment regimens*

## Results

- Both BiOWiSH® treatments resulted in significantly increased revenue
- Both BiOWiSH® treatments resulted in higher yield
- BiOWiSH® treated plants had larger root biomass
- BiOWiSH®, treated plants had higher foliar biomass
- All 3 treatments had statistically similar grain protein
- Soil nutrients were maintained across all treatments

## Economics

The revenue increased for the Control + BiOWiSH® Crop and Reduced Control + BiOWiSH® Crop Liquid by \$28.14 and \$15.27 per acre, respectively, over the control treatment.

Treatment	Revenue increase over control (USD/acre)	Revenue increase over control (USD/hectare)	Return On Investment
Control	-	-	-
Control + BiOWiSH®	\$28.14	\$69.53	4.6%
Reduced Control + BiOWiSH®	\$15.27	\$37.73	8.5%

*Table 2: Return On Investment Over Control*

The Reduced Control + BiOWiSH® allowed for the same input cost as the most common practice, yet increased yield resulting in more profit. While the Control + BiOWiSH® added some cost to the current practice program, the resulting higher yield increase provided even more profit. Additionally, because the soil nutrients were maintained, the increased yield did not result in future potential losses.

## Yield

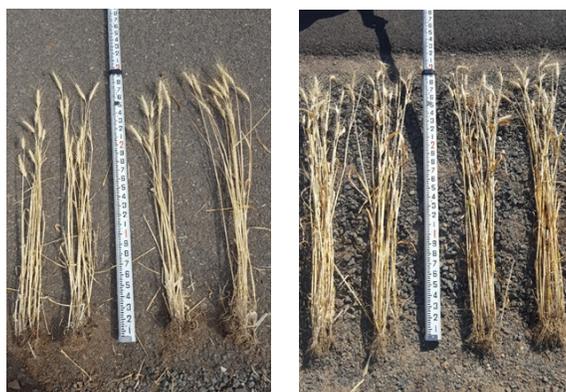
The Control + BiOWiSH® and Reduced Control + BiOWiSH® showed increased yield over the standard grower practice by 7% and 2%, respectively.

Table 3 shows Yield (bushels/acre and kilograms/hectare) for all 3 treatments:

Treatment	Yield (bu/a)	Yield (kg/ha)
Control	97.5	6557
Control + BiOWiSH®	104.7	7041
Reduced Control + BiOWiSH®	99.4	6685

*Table 3: Yield Totals*

Yield results are shown visually in Image 1 and graphically in Figure 1.



*Image 1: Control (left) and Control + BiOWiSH® (right)*

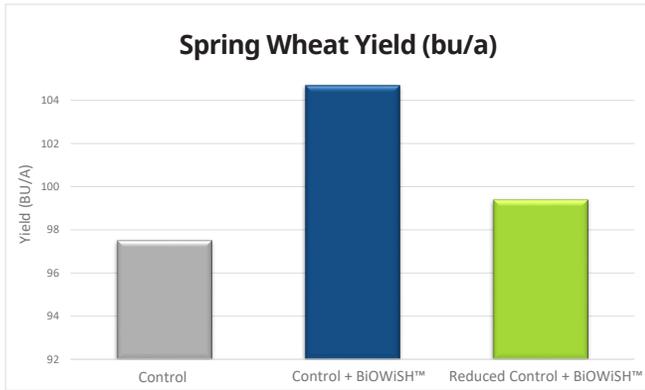


Figure 1a: Yield (bu/a) Results

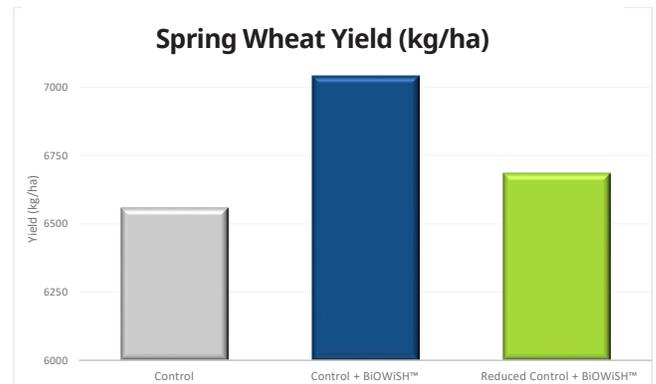
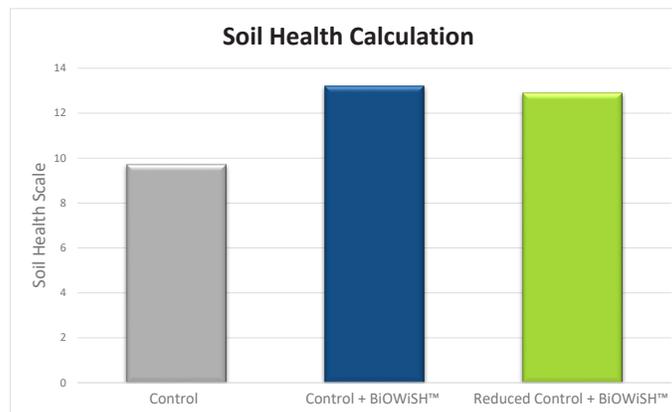


Figure 1b: Yield (kg/ha) Results

### Soil Health

Figure 2 shows the post-harvest Soil Health Calculation for the control and the two BiOWiSH®. The Soil Health Calculation looks at the balance of soil carbon, nitrogen, and their relationship to microbial activity. This number represents the overall health of the soil.



Soil Health values range from 0 to 25. A value below 7 indicates changes or adjustments are needed.

Figure 2: Soil Health Calculation

The Soil Health Calculation for the Control legs (Standard Grower Practice) was 9.7. The Control + BiOWiSH® Crop Liquid and Reduced Control + BiOWiSH® Crop Liquid legs had Soil Health ratings of 13.2, and 12.6, respectively.

In general, higher yield removes a greater amount of soil nutrients from the soil. When this happens, the growers need to bump up their fertilizer application in the following year. In this study (see Table 4), it was observed that **the yield increase in the BiOWiSH® Treatments did not deplete soil nitrogen or other nutrients.**

	Nitrate Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)
Control	7	16	349
Control + BiOWiSH®	10	18	394
Reduced Control + BiOWiSH®	11	21	405

Table 4: Post-harvest available soil macro-nutrients

## Plant Health

The Control + BiOWiSH® treatment resulted in 86% higher root biomass. The Reduced Control + BiOWiSH® showed a 24% increase in root biomass. In both cases the spring wheat BiOWiSH® Treatments developed larger roots, indicating overall mass flow of nutrients to the plant and benefits for low rainfall crops.

Table 5 shows average Root Mass (grams) for all three tested treatments:

Treatment	Root Biomass (g)	Increase (%)
Control	15.8	-
Control + BiOWiSH®	29.4	86%
Reduced Control + BiOWiSH®	19.6	24%

*Table 5: Root Biomass*

Table 6 shows average Foliar Biomass (grams) for all 3 treatments:

Treatment	Foliar Biomass (g)
Control	60.6
Control + BiOWiSH®	63.6
Reduced Control + BiOWiSH®	62.8

*Table 6: Foliar Biomass*

Table 7 shows Grain Protein percent for all 3 treatments:

Treatment	Grain Protein (%)
Control	10.0
Control + BiOWiSH®	10.0
Reduced Control + BiOWiSH®	10.0

*Table 7: Grain Protein %*

## Conclusion

Helena's research trial showed that, when added to urea fertilizer, BiOWiSH® Crop Liquid improves soil health, root biomass, and yield. At the same time, the BiOWiSH® treatment was able to maintain protein content in the wheat. The highest revenue increase came from adding BiOWiSH® to the standard practice of 280 lb/a urea, resulting in a \$28.14 increase in profit per acre (\$69.53 USD/hectare) compared to the standard practice without BiOWiSH®.

Reducing the grower standard nitrogen fertility allowed for a fertility program cost equal to the Control. With the equal cost, the Reduced Control + BiOWiSH® treatment resulted in equal grain protein content, enhanced root biomass, improved soil health, maintained soil macro-nutrients and increased yield. The spring wheat revenue was \$15.27 higher per acre (\$37.73 USD/hectare) than the standard practice, meaning that the \$15.27 increase was profit.

BiOWiSH® Crop Liquid can help wheat farmers achieve greater profits and sustain them by increasing the yield without depleting soil nutrients.



BiOWiSH™ is a registered trademark of BiOWiSH Technologies International, Inc.

### Contact us:

Tel: +1 312 572 6700

Email: [agronomy@biowishtech.com](mailto:agronomy@biowishtech.com)

Web: [biowishtech.com](http://biowishtech.com)