PeptiGro®

BUILDING BLOCKS TO HIGHER YIELDS

TECHNICAL REPORT

CIBARI® BIOSCIENCES

FOLIAR PeptiGro®

Yield Increase:
Corn 3+ Bu./Ac.; Soybeans 1+ Bu./Ac.; Winter Wheat 1+ Bu./Ac.

Use Rate:
32 Fl. Oz./Ac. for corn, soybeans, and wheat.

Application:
Tank mix with herbicides†, other foliar fertilizers or fungicides, or apply as a standalone foliar fertilizer.

IN-FURROW PeptiGro®

Yield Increase:
Corn 3+ Bu./Ac.; Soybeans 1+ Bu./Ac.; Winter Wheat 1+ Bu./Ac.

Use Rate:
32 Fl. Oz./Ac. for corn, soybeans, and wheat.

Application:
In-furrow at planting with or without additional starter fertilizer.

EXECUTIVE SUMMARY

Building Blocks to Higher Yields.

PeptiGro is a powerful liquid solution that contains a blend of essential amino acids and short-chain polypeptides. These protein building blocks play a crucial role in promoting plant growth under both favorable and unfavorable growing environments. Proteins are also a rich source of nutrients for soil microbes. PeptiGro is a proactive, cutting edge tool that can be integrated into your foliar and in-furrow fertilizer program to help your crops reach their full potential.

Maximize Corn, Soybean, and Wheat Yield Potential.

PeptiGro has been extensively tested in >200 field trials located across 10 states. Based on results from >14,000 yield plots, PeptiGro has consistently shown a clear 1-3+ Bu./Ac. yield advantage when used as a foliar or in-furrow standalone product or mixed with a starter or foliar fertilizer. PeptiGro is cost effective and can be safely mixed with herbicides, fungicides, and other fertilizers. Our technical report provides comprehensive information on all the PeptiGro rates, application types, and timings that were tested in the field. It also contains detailed statistical output information that is essential for farmers, M.S./Ph.D. consultants, ag retailer agronomists, and others in the scientific community to have the same level of confidence in the yield enhancement benefits of our product as we do. We are confident that reviewing this report will help you gain a deeper understanding of PeptiGro and its potential to maximize your crop yields. We encourage you to try PeptiGro.

FOOTNOTES

*Return on Investment (ROI) based on Cibari Biosciences field testing results in corn (foliar, in-furrow), soybeans (foliar, in-furrow), and wheat (in-furrow), PeptiGro MSRP, and corn, soybean, and wheat prices of $4.50/bu., $9.00/bu., and $6.00/bu., respectively. ROI may change based on several factors and for this reason there is no guarantee of ROI results.

†Four university studies showed PeptiGro was physically compatible and had no impact on the functional ability of commonly used herbicides to control weeds. Herbicides tested: Roundup, Atrazine 4L, Callisto, Enlist One, Liberty, Steadfast Q, Laudis, Armezon PRO, Resource, DiFlex, SelectMax, Classic, Pursuit, Cobra, Flexstar, and FirstRate. In 2022, a university study further confirmed that PeptiGro had no negative impact on the physical or functional properties of >50 fungicides, further highlighting its potential as a safe and effective solution for enhancing crop yields and disease resistance.

See technical reports on cibaribiosciences.com.

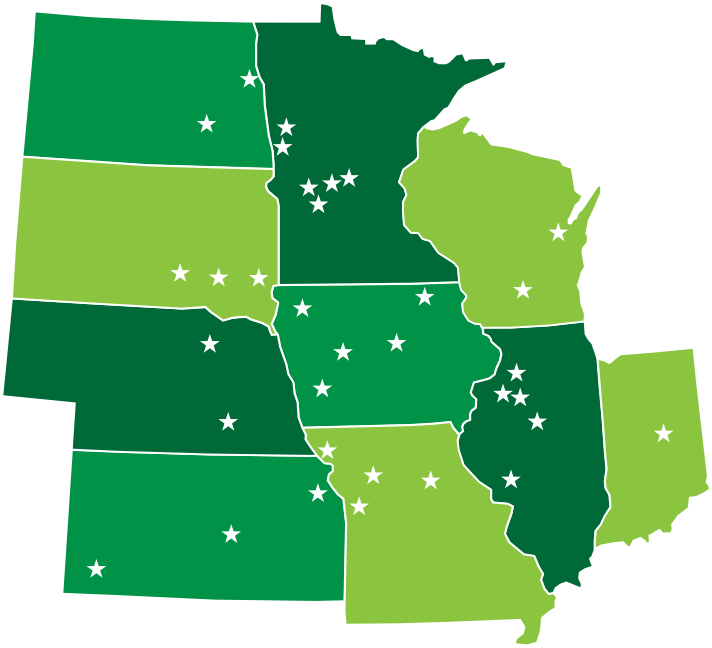
FIELD PROVEN: 3:1 ROI*

ROBUST YIELD TESTING

PeptiGro® Performance: Proven Effective in >10,000 Yield Plots, 214 Trials

(2020, 2021, 2022)

PeptiGro underwent extensive testing in various configurations in over 214 trials across 10 states (2020, 2021, 2022), including as an in-furrow standalone fertilizer, in combination with 5 gallons per acre of 6-24-6 starter fertilizer as well as a foliar standalone fertilizer, and in combination with 2 gallons per acre of foliar 6-24-6 fertilizer. Foliar studies in 2020 explored PeptiGro rates of 0, 8, and 64 Fl. Oz./Ac. and different application timing (data not used in this data analysis and report summary but results led to further testing of single application rates of 0, 8, 16, and 32 Fl. Oz./Ac. in 2021 and 2022).



See accompanying table below for details on trial types, trial and Rep quantities, and locations per crop.

CROP	EXP. TYPE	# YEARS	# TRIALS	# REPS	# STATES	STATES
CORN	Foliar	2	50	300	10	IA, IL, IN, KS, MN, MO, ND, NE, SD, WI
	In-Furrow	3	43	286		
SOYBEANS	Foliar	2	48	306		
	In-Furrow	3	41	373		
WINTER WHEAT	Foliar	2	16	288	4	IA, KS, MO, NE
	In-Furrow	2	16	288		

10,472 TOTAL YIELD PLOTS INCLUDED IN TECHNICAL REPORT. FIRST YEAR OF CORN AND SOYBEAN FOLIAR TRIALS HAD 3 EXPLORATORY RATES (0, 8, 64 FL. OZ./AC.) AND 1X (V5/R1 STAGE) VS. 2X (V5/R1, V10/R2 STAGES) APPLICATION TIMING TREATMENTS — THESE TRIALS INVOLVED 3,760 YIELD PLOTS (NOT INCLUDED IN TECHNICAL REPORT). GRAND TOTAL OF ALL YIELD PLOTS OVER 3-YR TESTING PERIOD FOR ALL CROPS WAS 14,232.

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EXPERIMENTAL DESIGN AND DESCRIPTION OF RESULTS FOR FOLLOWING TRIALS:

Trials were set up as Randomized Complete Block Design (RCBD) with variables Year, Trial ID, and Rep as random, and BLK, COL, STANDCNT@V2_OR as fixed covariates (in Model if covariate Pvalue ≤0.2).

Panel A

Displays LSMeans Differences t-test (α = 0.1, 8 LSMeans directly comparable and LSMeans not sharing a letter in common are significantly different).

Panel B

Displays LSMeans graph.

Panel C

Shows Power Analysis (probability to detect +Bu./Ac. changes at set alpha levels; Power(≥80%) preferred).

Panel D

Presents Summary of Fit: R^2, RMSE, Mean of Response, and Observations.

Panel E

Shows Fixed Effect Tests for Treatment and Covariates. Covariates used to remove a portion of the unexplained MODEL variation and thus, increase probability of measuring significant TREATMENT effects in the Fixed Effect Tests.

See footnote on second to last page for more details on the contents and importance of Panels A-E.

CORN FOLIAR: +2.9 BU./AC.

Testing Design Totals: 2-YR Results, 10 states, 50 trials, 8 Treatments, 300 Reps, 2,400 yield plots.

A

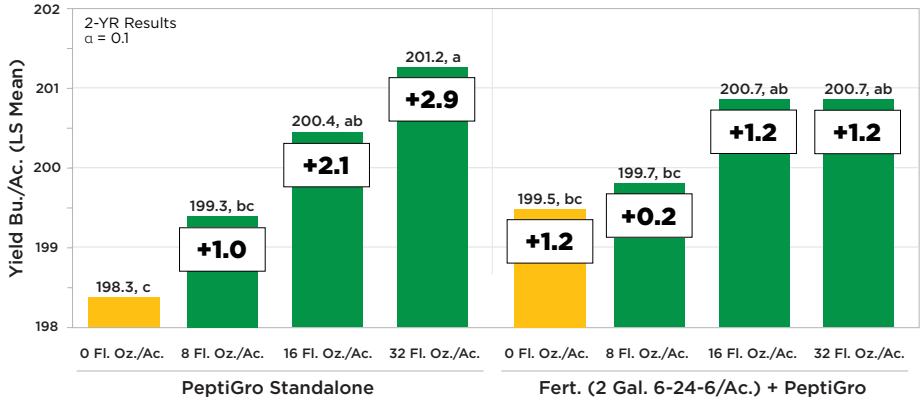
LSMEANS DIFFERENCES STUDENT'S t

α = 0.100

LEVEL	LEAST SQ. MEANS	LETTERS
0 Fl. Oz./Ac.	198.3	c
8 Fl. Oz./Ac.	199.3	bc
16 Fl. Oz./Ac.	200.4	ab
32 Fl. Oz./Ac.	201.2	a
FERT + 0 Fl. Oz./Ac.	199.5	bc
FERT + 8 Fl. Oz./Ac.	199.7	bc
FERT + 16 Fl. Oz./Ac.	200.7	ab
FERT + 32 Fl. Oz./Ac.	200.7	ab

Levels not connected by same letter are significantly different.

B



C

POWER ANALYSIS OF TRIAL DESIGN (μ = 200)

# REPS	RMSE	+BU./AC.	ALPHA	POWER
300	10.20	1.0	0.1	0.47
		1.0	0.2	0.64
		2.0	0.1	0.87
		2.0	0.2	0.94

D

SUMMARY OF FIT

RSQUARE	0.9563645
RSQUARE ADJ.	0.848648
ROOT MEAN SQUARE ERROR	10.19506
MEAN OF RESPONSE	200.3222
OBSERVATIONS (OR SUM WGTS.)	2377

E

FIXED EFFECT TESTS

SOURCE	NPARM	DF	DFDEN	F RATIO	PROB > F
COL [Year, Trial ID]	350	350	1718	4.5291	<0.0001*
TREATMENT	7	7	1721	2.3119	0.02390*

Conclusions for Foliar PeptiGro® in Corn:

- Foliar use of PeptiGro resulted in significant yield increases when used alone and as an additive with 6-24-6 foliar fertilizer.
- Application of 2 Gal./Ac. of 6-24-6 foliar fertilizer increased yield by +1.2 Bu./Ac. (α = 0.2).
- Standalone use of PeptiGro (8, 16, & 32 Fl. Oz./Ac.) showed a clear dose response with significant yield increases of +2.1 & +2.9 Bu./Ac. with foliar application of 16 and 32 Fl. Oz./Ac., respectively (α = 0.1).
- Mixing PeptiGro (16 & 32 Fl. Oz./Ac.) with 2 Gal./Ac. fertilizer resulted in significant +1.2 Bu./Ac. increase over 6-24-6 control (α = 0.2).
- Design had Power(87%, α = 0.1) to detect 2 Bu./Ac. and Power(64%, α = 0.2) to detect 1 Bu./Ac. change.

CORN IN-FURROW: +3.2 BU./AC.

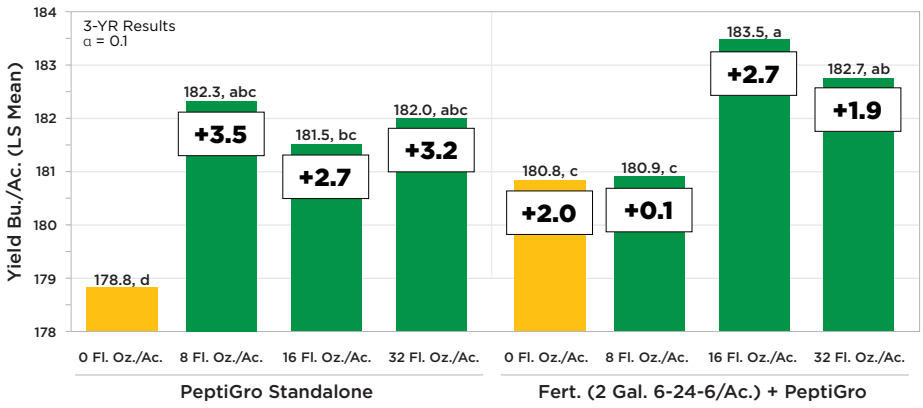
Testing Design Totals: 3-YR Results, 10 states, 41 trials, 8 Treatments, 286 Reps, 2,184 yield plots.

A

LSMEANS DIFFERENCES STUDENT'S t		
α = 0.100		
LEVEL	LEAST SQ. MEANS	LETTERS
0 Fl. Oz./Ac.	178.8	d
8 Fl. Oz./Ac.	182.3	abc
16 Fl. Oz./Ac.	181.5	bc
32 Fl. Oz./Ac.	182.0	abc
FERT + 0 Fl. Oz./Ac.	180.8	c
FERT + 8 Fl. Oz./Ac.	180.9	c
FERT + 16 Fl. Oz./Ac.	183.5	a
FERT + 32 Fl. Oz./Ac.	182.7	ab

Levels not connected by same letter are significantly different.

B



C

POWER ANALYSIS OF TRIAL DESIGN (μ = 189)				
# REPS	RMSE	+BU./AC.	ALPHA	POWER
286	11.63	1.0	0.1	0.40
		1.0	0.2	0.57
		2.0	0.1	0.78
		2.0	0.2	0.89

D

SUMMARY OF FIT	
RSQUARE	0.958869
RSQUARE ADJ.	0.950054
ROOT MEAN SQUARE ERROR	11.62788
MEAN OF RESPONSE	189.2999
OBSERVATIONS (OR SUM WGTS.)	2256

E

FIXED EFFECT TESTS					
SOURCE	NPARM	DF	DFDEN	F RATIO	PROB > F
COL [Year, Trial ID]	348	348	1572	2.8979	<0.0001*
STANDCNT@ V2_OR [Year, Trial ID]	43	43	146.3	1.6647	0.0137*
TREATMENT	7	7	1602	3.7309	0.0005*

Conclusions for In-Furrow PeptiGro® in Corn:

- PeptiGro provides yield benefit when used alone in-furrow or as an additive with 6-24-6 in-furrow.
- In-furrow application of 5 Gal./Ac. of 6-24-6 starter fertilizer significantly increased yield by +2.0 Bu./Ac. (α = 0.1).
- Standalone use of PeptiGro (3 different rates) showed significant yield increases of +2.7 to +3.5 Bu./Ac. (α = 0.1).
- Tank mixing PeptiGro (16 & 32 Fl. Oz./Ac.) with 5 Gal./Ac. 6-24-6 in-furrow starter fertilizer resulted in +2.7 & +1.9 Bu./Ac. additional yield increases, respectively, over 6-24-6 starter fertilizer alone (α = 0.1).
- Design had Power(78%, α = 0.1) to detect 2 Bu./Ac. and Power(57%, α = 0.2) to detect 1 Bu./Ac. change.

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SOYBEAN FOLIAR: +1.2 BU./AC.

Testing Design Totals: 2-YR Results, 10 states, 48 trials, 8 Treatments, 306 Reps, 2,448 yield plots.

A

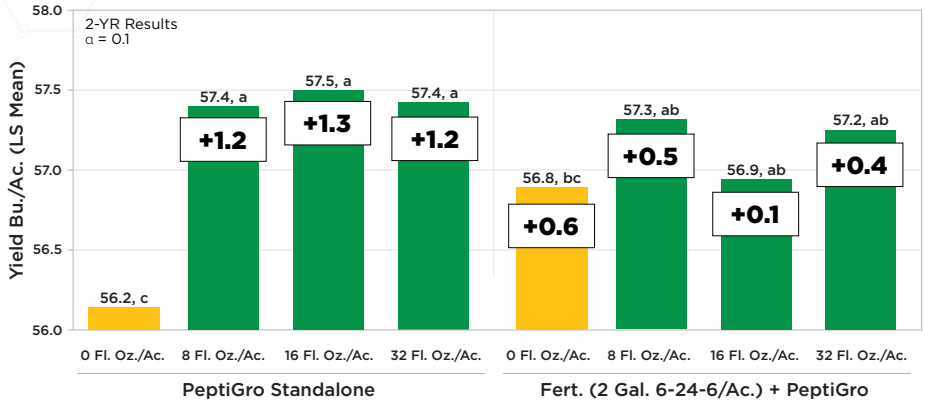
LSMEANS DIFFERENCES STUDENT'S t

α = 0.100

LEVEL	LEAST SQ. MEANS	LETTERS
0 Fl. Oz./Ac.	56.2	c
8 Fl. Oz./Ac.	57.4	a
16 Fl. Oz./Ac.	57.5	a
32 Fl. Oz./Ac.	57.4	a
FERT + 0 Fl. Oz./Ac.	56.8	bc
FERT + 8 Fl. Oz./Ac.	57.3	ab
FERT + 16 Fl. Oz./Ac.	56.9	ab
FERT + 32 Fl. Oz./Ac.	57.2	ab

Levels not connected by same letter are significantly different.

B



C

POWER ANALYSIS OF TRIAL DESIGN (μ = 57)

# REPS	RMSE	+BU./AC.	ALPHA	POWER
306	4.12	0.5	0.2	0.76
		0.5	0.1	0.60
		1.0	0.1	0.96

D

SUMMARY OF FIT

RSQUARE	0.956544
RSQUARE ADJ.	0.948682
ROOT MEAN SQUARE ERROR	4.120096
MEAN OF RESPONSE	57.1104
OBSERVATIONS (OR SUM WGTS.)	2292

E

FIXED EFFECT TESTS

SOURCE	NPARM	DF	DFDEN	F RATIO	PROB > F
COL [Year, Trial ID]	344	344	1644	3.8686	<0.0001*
TREATMENT	7	7	1654	2.8582	0.0058*

Conclusions for Foliar PeptiGro® in Soybean:

- PeptiGro foliar standalone applications resulted in significant yield increases and tank-mixed applications with 2 Gal. 6-24-6/Ac. showed a trend for increased yield.
- Standalone PeptiGro treatments (8, 16, and 32 Fl. Oz./Ac.) resulted in significant yield increases of +1.2 Bu./Ac., +1.3 Bu./Ac., +1.2 Bu./Ac. respectively, compared to 0 Fl. Oz./Ac. PeptiGro (control — water only).
- Foliar application of 2 Gal./Ac. of 6-24-6 fertilizer alone provided a numeric increase of +0.6 Bu./Ac. (non-signif. at α = 0.1 but signif. at α = 0.2).
- PeptiGro provided a numeric yield increase +0.1 to +0.5 Bu./Ac. when mixed with 6-24-6 foliar fertilizer (non-signif. at α = 0.1).
- Design had Power (96%, α = 0.1) to detect 1.0 Bu./Ac. and Power(60%, α = 0.1) to detect 0.5 Bu./Ac. change.

SOYBEAN IN-FURROW: +1.5 BU./AC.

Testing Design Totals: 3-YR Results, 10 states, 50 trials, 8 Treatments, 306 Reps, 2,488 yield plots.

A

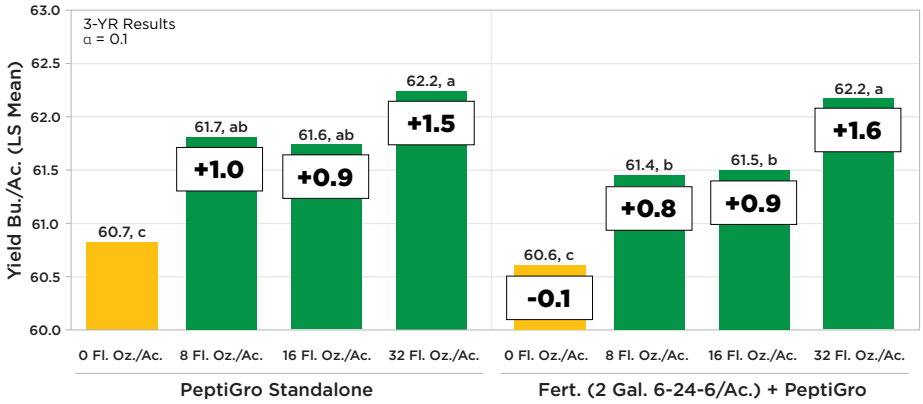
LSMEANS DIFFERENCES STUDENT'S t

α = 0.100

LEVEL	LEAST SQ. MEANS	LETTERS
0 Fl. Oz./Ac.	60.7	c
8 Fl. Oz./Ac.	61.7	ab
16 Fl. Oz./Ac.	61.6	ab
32 Fl. Oz./Ac.	62.2	a
FERT + 0 Fl. Oz./Ac.	60.6	c
FERT + 8 Fl. Oz./Ac.	61.4	b
FERT + 16 Fl. Oz./Ac.	61.5	b
FERT + 32 Fl. Oz./Ac.	62.2	a

Levels not connected by same letter are significantly different.

B



C

POWER ANALYSIS OF TRIAL DESIGN (μ = 59)

# REPS	RMSE	+BU./AC.	ALPHA	POWER
273	4.02	0.5	0.1	0.57
		0.5	0.2	0.73
		1.0	0.1	0.95
		1.0	0.2	0.98

D

SUMMARY OF FIT

RSQUARE	0.9527
RSQUARE ADJ.	0.942649
ROOT MEAN SQUARE ERROR	4.016594
MEAN OF RESPONSE	58.83516
OBSERVATIONS (OR SUM WGTS.)	2152

E

FIXED EFFECT TESTS

SOURCE	NPARM	DF	DFDEN	F RATIO	PROB > F
COL [Year, Trial ID]	329	329	1494	3.9093	<0.0001*
STANDCNT@ V2_OR [Year, Trial ID]	41	41	469.6	1.4888	0.0295*
TREATMENT	7	7	1526	4.8060	0.0001*

Conclusions for In-Furrow PeptiGro® in Soybean:

- PeptiGro applied alone (8, 16, and 32 Fl. Oz./Ac.) increased yield by +1.0, +0.9, and +1.5 Bu./Ac. respectively (α = 0.1).
- PeptiGro tank mixed with 5 Gal 6-24-6 fertilizer (3 rates) added +0.8, +0.9, and +1.6 Bu./Ac. increases over 6-24-6 alone (α = 0.1).
- In-furrow application of 5 Gal./Ac. 6-24-6 fertilizer alone did not improve yields in soybean (-0.1 Bu./Ac.).
- Design had Power(95%, α = 0.1) to detect 1.0 Bu./Ac. and Power(73%, α = 0.2) to detect 0.5 Bu./Ac. change.
- PeptiGro is an excellent source of nutrients for plants and microbes and provides a significant yield increase when applied as a standalone product or tank mixed with 5 Gal. 6-24-6 while 6-24-6 control showed no yield benefit, 5th vs. 1st bar).
- PeptiGro may be enhancing microbial growth which in turn enhances plant growth.

FOOTNOTES

[1] Data were analyzed using SAS JMP v.16 Statistical Software with the REML method to determine Fit Model variance components. The results of the LSMeans Differences Student's t test are displayed in Panel A and the LSMeans (grain yields) are presented in graphs in Panel B, showing the effects of PeptiGro alone and when mixed with fertilizer (left and right sides of graph, respectively). Significantly different treatments are indicated by letters not in common among LSMeans comparisons. Panel C shows the results of the Power Analysis, which was performed to assess the probability of detecting a specified yield difference at alpha levels of 0.1 and 0.2. Panel D summarizes the REML Model Fit where R2 indicates the % of total variation explained by the MODEL; RMSE stands for Root Mean Square Error and is a measure of the amount of unexplained variation by the MODEL. RMSE was used a sigma error value in Power Analysis; RMSE divided by Mean of Response value x 100 = estimate of Coefficient of Variability (%CV) where smaller CV values are preferred; Mean of Response indicates the mean yield across all treatments and reps for given crop tested; Observations indicates the total number of yield plots used in the MODEL, and number of Observations in Model divided by 8 (# treatments) estimates total #Reps in Trial; Panel E shows the Fixed Effect Tests, including the significance of the Treatment Effect and the covariates used in the REML Model if their Pvalue was 0.2 or less. [2]Always read and follow product label directions.

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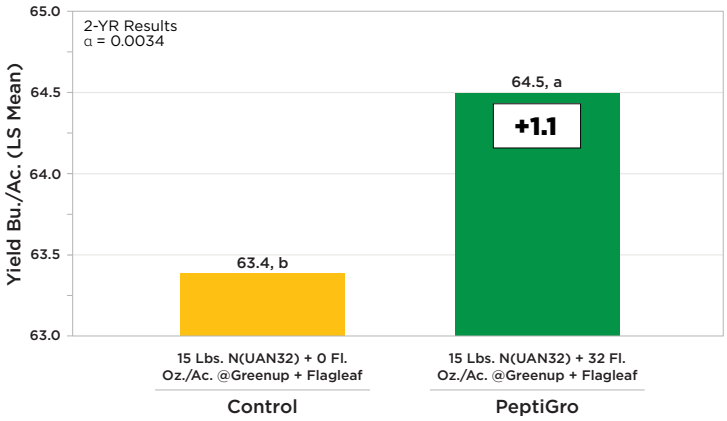
WINTER WHEAT FOLIAR: +1.1 BU./AC.

Foliar Testing Design Totals: 2-YR, 4 states, 16 trials, 248 Reps, 576 yield plots, 2 Treatments (15 lbs. N (UAN32)/Ac. applied @GREENUP +/- 0 Fl. Oz./Ac. (Control) vs. 32 Fl. Oz. PeptiGro®/Ac. applied @GREENUP + @FLAGLEAF).

B



C

POWER ANALYSIS OF TRIAL DESIGN (μ = 63)				
# REPS	RMSE	+BU./AC.	ALPHA	POWER
286	4.57	0.5	0.1	0.51
		0.5	0.2	0.68
		1.0	0.1	0.91
		1.0	0.2	0.96

D

SUMMARY OF FIT	
RSQUARE	0.924386
RSQUARE ADJ.	0.924252
ROOT MEAN SQUARE ERROR	4.566144
MEAN OF RESPONSE	63.40975
OBSERVATIONS (OR SUM WGTS.)	564

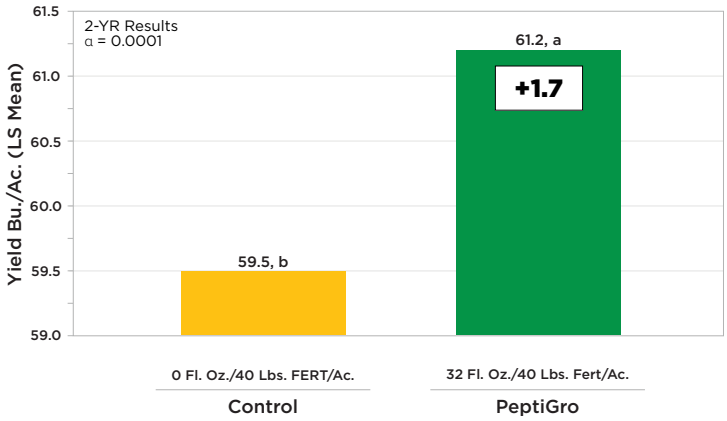
E

FIXED EFFECT TESTS					
SOURCE	NPARM	DF	DFDEN	F RATIO	PROB > F
TREATMENT	1	1	279.9	8.7134	0.0034*

WINTER WHEAT IN-FURROW: +1.7 BU./AC.

In-Furrow Testing Design Totals: 2-YR, 4 states, 16 trials, 248 Reps, 576 yield plots, 2 Treatments (0 vs. 32 Fl. Oz./Ac. PeptiGro coated onto 40 Lbs./Ac. dry 7-34-20 starter fertilizer and mixed with seed during planting).

B



C

POWER ANALYSIS OF TRIAL DESIGN (μ = 62)				
# REPS	RMSE	+BU./AC.	ALPHA	POWER
286	4.28	0.5	0.1	0.55
		0.5	0.2	0.71
		1.0	0.1	0.94
		1.0	0.2	0.97

D

SUMMARY OF FIT	
RSQUARE	0.977527
RSQUARE ADJ.	0.954409
ROOT MEAN SQUARE ERROR	4.276164
MEAN OF RESPONSE	62.15467
OBSERVATIONS (OR SUM WGTS.)	567

E

FIXED EFFECT TESTS					
SOURCE	NPARM	DF	DFDEN	F RATIO	PROB > F
COL [Year, Trial ID]	230	230	147.1	1.4663	0.0061*
BIK [Year, Trial ID]	56	56	118.7	1.9833	0.0010*
TREATMENT	1	1	145.8	15.3535	0.0001*

Conclusions for Foliar PeptiGro® in Winter Wheat:

- PeptiGro® increased grain yields in wheat when foliar applied and when coated onto dry starter fertilizer and applied in-furrow.
- Foliar application of PeptiGro resulted in a significant increase of +1.1 Bu./Ac. (α = 0.0034).
- In-furrow application of PeptiGro coated onto 40 Lbs. 7-34-20/Ac. resulted in significant yield increases of +1.7 Bu./Ac. (α = 0.0001).
- Foliar trial had Power(91%, α = 0.1) to detect 1.0 Bu./Ac. and Power(68%, α = 0.2) to detect 0.5 Bu./Ac. change.
- In-furrow trial had Power(94%, α = 0.1) to detect 1.0 Bu./Ac. and Power(71%, α = 0.2) to detect 0.5 Bu./Ac. change.

REGION
All

USE RATE
32 Fl. Oz./Ac. for corn, soybeans, and wheat.

APPLICATION GUIDE[2]
Corn Foliar V3 to V12
Soybean Foliar V3 to R4
Wheat Foliar GREENUP to FLAGLEAF
Corn/Soybeans/Wheat: Apply in-furrow with seed or 2" below x 2" to side of seed, or coat onto dry starter fertilizer.

ACTIVE INGREDIENTS[2]
2.0%: Nitrogen from amino acids
1.5%: Sulfur

PACKAGING
2 x 2.5-gallon jugs
1 x 250-gallon tote

For more information:
Call HQ at +1 712.277.2011 and ask for Jeff Mullen, VP R&D or send email to info@cibaribiosciences.com and Jeff will respond.

CIBARI® BIOSCIENCES

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