



Fungicide + PeptiGro[®] Compatibility Study in Corn and Soybeans

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Author

Jeffrey A. Mullen¹, PhD.

¹VP Research and Product Development, Cibari Biosciences LLC / NF Protein LLC, 1919 Grand Ave, Sioux City, IA 51106
Corresponding author, Email: jeffrey.mullen@nfprotein.com, HQ Phone: +1 712-277-2011

Executive Summary

NF Protein LLC provided funding to faculty at Iowa State University to evaluate the physical and functional compatibility of PeptiGro[®] with fungicides commonly used in corn, soybean, and wheat production. A laboratory study was conducted to determine the physical compatibility of PeptiGro[®] with 54 commonly used fungicides, while a greenhouse study was carried out to assess the functional compatibility of PeptiGro[®] in combination with fungicides to control Common Rust in corn and to control Frogeye Leaf Spot in soybeans. The results of the studies showed that PeptiGro[®] was physically compatible with 52 out of 54 (96.3%) of the fungicides tested. The addition of PeptiGro[®] had no negative impact on the effectiveness of the respective fungicide in controlling Common Rust in corn for 52 of the 54 (96.3%) fungicides tested and had no negative impact on the effectiveness of all 54 (100%) fungicides in controlling Frogeye Leaf Spot in soybeans. These findings suggest that PeptiGro[®] can be used in conjunction with commonly used fungicides in crop production to effectively control plant diseases without compromising the performance of the fungicide.

Introduction

Amino acids are the building blocks of plant proteins. PeptiGro[®] is a liquid mixture of beneficial amino acids and short-chain polypeptides that helps plants maximize yield in a variety of favorable and unfavorable environments. PeptiGro[®] is an exciting, new, proactive tool to use in your foliar and in-furrow fertilizer program. Based on PeptiGro[®] yield performance measured with >10,000 data points in 214 trials across 10 States in 2020, 2021, and 2022, PeptiGro[®] provides a 3+ bu./ac. yield increase in corn and a 1+ bu./ac. yield increase in soybean and wheat. PeptiGro[®] can be applied as a standalone product in-furrow or foliar applied or can be tank mixed with herbicides, fungicides, and other foliar fertilizers.

Fungal diseases can significantly impact the yield and quality of crops, leading to economic losses for farmers. Fungicides are commonly used to control fungal pathogens in grasses and dicots, including corn and soybean, respectively, and can be applied either alone or in combination with other products such as fertilizers. PeptiGro[®] is a liquid mixture of beneficial amino acids and short-chain polypeptides that helps plants maximize yield in a variety of favorable and unfavorable environments. The main objectives of this research study were:

1. To evaluate the physical mixing compatibility of

PeptiGro[®] with 54 commonly used post-emergence foliar fungicides in grasses in a laboratory setting, as compared to the respective fungicide per se mixed in water.

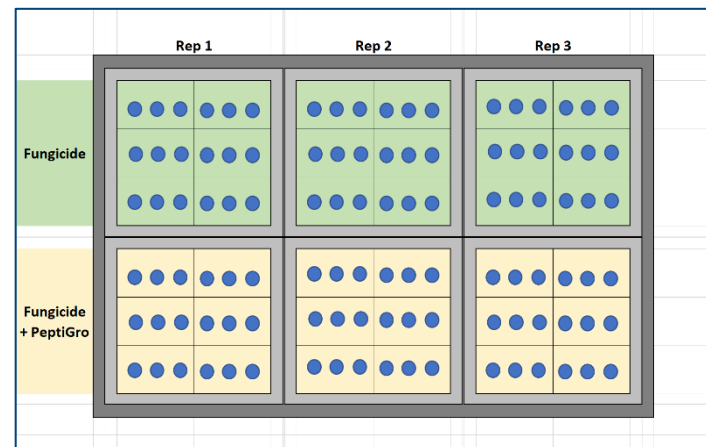
2. To assess the effectiveness of fungicides tank mixed with PeptiGro[®] in controlling Common Rust (caused by the fungus *Puccinia sorghi*) in corn, as compared to fungicide application per se. The study used the maximum recommended rate for pathogen control for each fungicide as stated on the respective label. The dose rate for PeptiGro[®] was 1 quart per acre.
3. To assess the effectiveness of fungicides tank mixed with PeptiGro[®] in controlling Frog Eye Leaf Spot (caused by the fungus *Cercospora sojina*) in soybeans, as compared to fungicide application per se. The study used the maximum recommended rate for pathogen control for each fungicide as stated on the respective label. The dose rate for PeptiGro[®] was 1 quart per acre.

Materials and Methods

A laboratory study was conducted to determine the physical compatibility of PeptiGro[®] with 54 commonly used fungicides. Each fungicide was mixed with water at the maximum recommended rate for pathogen control as stated on the respective label. PeptiGro[®] was added to each mixture at a rate of 1 quart per acre, and the mixtures were

observed for physical compatibility after 24 hrs. posted mixing, including the presence of sedimentation or precipitation. A greenhouse study was carried out to assess the functional compatibility of PeptiGro® in combination with fungicides to control Common Rust in corn and Frogeye Leaf Spot in soybeans. For this study, corn plants were sprayed with fungicide treatments and were sprayed again 1 day later with an inoculum of the fungus *Puccinia sorghi*, and soybeans were sprayed with fungicide treatments and were sprayed 1 day later with an inoculum of the fungus *Cercospora sojina*. Plants were assessed for % Common Rust and % Frogeye Leaf Spot (ranging from 0-100%) at 14 days post-application. Foliar fungicide and fungal inoculum applications were made using a Generation 4 spray booth by Devries Manufacturing (devriesmfg.com) using a Teejet ESV nozzle (TP8002EVS). Plants at time of sprays were at or near V1 stage (about 7-10 days after emergence) and had an average corn or soybean height of approximately 3 inches. The study consisted of 3 REPs of 18 individual plants in each replication. For each fungicide, there were three treatments: 1) control seedlings (no fungicide), 2) fungicide-only treated plants, and 3) fungicide + PeptiGro® treated plants.

The following diagram (shown for corn only) depicts the experimental layout for testing the effectiveness of fungicide-only vs. fungicide + PeptiGro®, while the subsequent picture provides an example of a tray of corn seedlings during the



time of assay.

To test 54 fungicides, assays were conducted over several months and for each assay run, control (fungal inoculation; no fungicide application), fungicide-only and fungicide + PeptiGro® treatments were implemented as described above.

List of Fungicides and Rates Tested in Greenhouse Studies on Corn and Soybean (Iowa State University)

Treatment	Evaluated as Single or Multiple Active Ingredients (AI)	Rate Range on Label (Fl. Oz./Ac.)	Max Rate (Fl. Oz. Tested)
Endura	Single AI	3.5 – 11.0	11
Alto 100 SL	Single AI	3.4 – 6.8	6.8
Omega 500	Single AI	12 – 16	16
ILEVO	Single AI	8.0 – 12.0	12
Evito 480 SC	Single AI	4.0 – 6.0	6
Xyway LFR 1.92 SC	Single AI	4.0 – 7.0	7
Escalia SC	Single AI	2	2
Provysol	Single AI	8.0 – 15.0	15
Relenya ST	Single AI	7.0 – 10.0	10
Aproach SC	Single AI	3.4 – 6.8	6.8
Aproach SC	Single AI	6.0 – 12.0	12
Tilt 3.6 EC	Single AI	2.0 – 4.0	4
Tilt 3.6 EC	Single AI	4.0 – 6.0	6
Proline 480 SC	Single AI	5.7	5.7
Miravis	Single AI	13.7	13.7
Headline 2.09 EC/SC	Single AI	4.0 – 8.0	8
Folicur 3.6 F	Single AI	4.0 – 6.0	6
Domark 230 ME	Single AI	4.0 – 6.0	6
Topsin M	Single AI	20.0 – 23.0	23
Absolute Max	Multiple AI	5	5
Acropolis	Multiple AI	20.0 – 23.0	23
Affiance 1.5 SC	Multiple AI	10.0 – 14.0	14
Aftershock 480 SC, Evito 480 SC	Multiple AI		
Aproach Prima 2.34 SC	Multiple AI	3.4 – 6.8	6.8
Aproach SC	Multiple AI	6.0 – 12.0	12
Delaro 325 SC	Multiple AI	8.0 – 12.0	12
Delaro Complete	Multiple AI	8.0 – 12.0	12
Preemptor SC	Multiple AI	4.0 – 6.0	6
Headline AMP 1.68 SC	Multiple AI	10.0 – 14.4	14.4
Headline SC	Multiple AI	6.0 – 9.0	9
Lucento	Multiple AI	3.0 – 5.5	5.5
Miravis Neo 2.5 SE	Multiple AI	13.7	13.7

Miravis Top 1.67 SC	Multiple AI	13.7	13.7
Nexicor EC	Multiple AI	7.0 – 13.0	13
Priaxor	Multiple AI	4.0 – 8.0	8
Priaxor 4.17 SC Xemium	Multiple AI	4.0 – 8.0	8
Propulse 3.34 SC	Multiple AI	6.0 – 10.2	10.2
Prosaro 421 SC (reduced to match AI rate)	Multiple AI	8	8
Quadris 2.08 SC	Multiple AI	4.0 – 12.0	12
Quadris 2.08 SC, multiple generics	Multiple AI	6.0 - 15.5	15.5
Quadris Top 2.72 SC	Multiple AI	8.0 – 14.0	14
Quadris Top SBX 3.76 SC	Multiple AI	7.0 – 7.5	7.5
Quilt Xcel 2.2 SE	Multiple AI	10.5 – 21.0	21
Quilt Xcel 2.2 SE, multiple generics	Multiple AI	10.5 – 14.0	14
Revytek	Multiple AI	8.0 – 15.0	15
Stratego YLD	Multiple AI	4	4
Stratego YLD 4.18 SC	Multiple AI	4.0 – 5.0	5
Stratego YLD 4.18 SC	Multiple AI	4.0 – 4.65	4.65
Topguard 1.04 SC	Multiple AI	7.0 – 14.0	14
Topguard EQ	Multiple AI	4.0 – 7.0	7
Trivapro	Multiple AI	13.7 – 20.7	20.7
Trivapro 2.21 SE	Multiple AI	13.7	13.7
Veltyma	Multiple AI	7.0 – 10.0	10
Xyway 3D 2.5 SC	Multiple AI	5.8-11.8	11.8
Xyway LFR 1.92 SC	Multiple AI	7.6 – 15.2	15.2
Zolera FX 3.34 SC	Multiple AI	4.4 – 6.8	6.8

except ILEVO, provided a significant reduction in % Common Rust compared to control non-fungicide treatment ($\alpha = 0.1$). The addition of PeptiGro® had no negative impact on the effectiveness of the respective fungicide in controlling Common Rust in corn for 52 of the 54 (96.3%) fungicides tested. The two fungicides that were functionally non-compatible were Relenya ST and Topsin M (see Table 1, bold entries). PeptiGro® had no negative impact on the effectiveness of all 54 (100%) fungicides in controlling Frog Eye Leaf Spot in soybeans.

These findings suggest that PeptiGro® can be used in conjunction with commonly used fungicides in crop production to effectively control plant diseases without compromising the performance of the fungicide. e technical reports on cibaribiosciences.com.

Discussion

The results of this study demonstrate that PeptiGro® is physically and functionally compatible with a wide range of commonly used fungicides in crop production. The physical compatibility of PeptiGro® with fungicides is important, as sedimentation or precipitation can lead to clogged sprayer nozzles and uneven distribution of the mixture on plants. The functional compatibility of PeptiGro® with fungicides is also crucial, as the combination of products should not compromise the effectiveness of the fungicide in controlling fungal pathogens. The results of this study indicate that PeptiGro® can be used in combination with commonly used fungicides in corn, soybeans, and wheat to effectively control fungal pathogens without compromising the performance of the fungicide.

Conclusion

The results of this study suggest that PeptiGro® can be used in conjunction with commonly used fungicides in corn, soybeans, and wheat to effectively control plant diseases without compromising the performance of the fungicide. The physical and functional compatibility of PeptiGro® with fungicides is important, and the results of this study demonstrate that PeptiGro® is compatible with a wide range of commonly used fungicides in row crop and small grain production. These findings provide valuable information for farmers and agronomists who are looking to optimize the control of fungal pathogens in their crops. Peptigro® has not been evaluated for tank mix compatibility with all herbicides, pesticides, and fertilizers, so a “JAR TEST” is recommended for unfamiliar tank mixes to ensure product compatibility.

See Table 1 on the following pages where physical compatibility is shown on the left portion of the table, and functional compatibility to control Common Rust in corn and Frog Eye Leaf Spot is shown in the middle and far right, respectively.

The data were analyzed using SAS JMP v.16 Statistical Software, with the Restricted Maximum Likelihood (REML) method used to estimate Fit Model variance components. To facilitate a more direct comparison between the treatments, the response data for the control group was included in each fungicide-specific Student's t LS Mean comparison, alongside the data for the fungicide-only and fungicide + PeptiGro® groups. This was done at α 0.1 level, with treatment LS Means not sharing a letter in common considered to be significantly different.

Results

The laboratory study showed that PeptiGro® was physically compatible with 52 out of 54 (96.3%) of the fungicides tested. The two fungicides that were physically non-compatible were ILEVO and Acropolis (see Table 1, bold entries). The greenhouse study showed that all fungicides,

25	52	Miravis Neo 2.5 SE + PeptiGro	Multiple AI	13.7	13.7	Compatible	Control	2.106	a		2.106	0.933	a		0.933
							Miravis Neo 2.5 SE	0.149	b		0.149	1.033	a		1.033
							Miravis Neo 2.5 SE + PeptiGro	0.115	b		0.115	0.800	a		0.800
26	53	Miravis Top 1.67 SC + PeptiGro	Multiple AI	13.7	13.7	Compatible	Control	2.109	a		2.109	0.933	a		0.933
							Miravis Top 1.67 SC	0.232	b		0.232	0.417	a		0.417
							Miravis Top 1.67 SC + PeptiGro	0.123	b		0.123	0.817	a		0.817
27	54	Nexicor EC + PeptiGro	Multiple AI	7.0 – 13.0	13	Compatible	Control	1.074	a		1.074	0.933	a		0.933
							Nexicor EC	0.096	b		0.096	0.400	b		0.400
							Nexicor EC + PeptiGro	0.13	b		0.13	0.433	ab		0.433
29	56	Priaxor + PeptiGro	Multiple AI	4.0 – 8.0	8	Compatible	Control	2.111	a		2.111	0.933	a		0.933
							Priaxor	0.617	b		0.617	0.283	b		0.283
							Priaxor + PeptiGro	0.757	b		0.757	0.267	b		0.267
30	57	Priaxor 4.17 SC Xemium + PeptiGro	Multiple AI	4.0 – 8.0	8	Compatible	Control	0.748	a		0.748	0.933	a		0.933
							Priaxor 4.17 SC Xemium	0.101	b		0.101	0.333	b		0.333
							Priaxor 4.17 SC Xemium + PeptiGro	0.045	b		0.045	0.306	b		0.306
33	60	Propulse 3.34 SC + PeptiGro	Multiple AI	6.0 – 10.2	10.2	Compatible	Control	0.742	a		0.742	0.933	a		0.933
							Propulse 3.34 SC	0.164	b		0.164	0.083	b		0.083
							Propulse 3.34 SC + PeptiGro	0.18	b		0.18	0.417	b		0.417
34	61	Prosaro 421 SC (reduced to match AI rate) + PeptiGro	Multiple AI	8	8	Compatible	Control	0.745	a		0.745	0.833	a		0.833
							Prosaro 421 SC (reduced to match AI rate)	0.066	b		0.066	0.000	b		0.000
							Prosaro 421 SC (reduced to match AI rate) + PeptiGro	0.085	b		0.085	0.000	b		0.000
35	62	Quadris 2.08 SC + PeptiGro	Multiple AI	4.0 – 12.0	12	Compatible	Control	2.109	a		2.109	0.933	a		0.933
							Quadris 2.08 SC	0.569	b		0.569	0.194	b		0.194
							Quadris 2.08 SC + PeptiGro	0.273	b		0.273	0.167	b		0.167
36	63	Quadris 2.08 SC, multiple generics + PeptiGro	Multiple AI	6.0 - 15.5	15.5	Compatible	Control	0.749	a		0.749	0.933	a		0.933
							Quadris 2.08 SC, multiple generics	0.063	b		0.063	0.125	b		0.125
							Quadris 2.08 SC, multiple generics + PeptiGro	0.121	b		0.121	0.233	b		0.233
37	64	Quadris Top 2.72 SC + PeptiGro	Multiple AI	8.0 – 14.0	14	Compatible	Control	0.751	a		0.751	0.933	a		0.933
							Quadris Top 2.72 SC	0.214	b		0.214	0.250	b		0.250
							Quadris Top 2.72 SC + PeptiGro	0.173	b		0.173	0.167	b		0.167
38	65	Quadris Top SBX 3.76 SC + PeptiGro	Multiple AI	7.0 – 7.5	7.5	Compatible	Control	0.747	a		0.747	0.933	a		0.933
							Quadris Top SBX 3.76 SC	0.198	b		0.198	0.333	b		0.333
							Quadris Top SBX 3.76 SC + PeptiGro	0.084	b		0.084	0.167	b		0.167
40	67	Quilt Xcel 2.2 SE + PeptiGro	Multiple AI	10.5 – 21.0	21	Compatible	Control	0.744	a		0.744	0.933	a		0.933
							Quilt Xcel 2.2 SE	0.215	b		0.215	0.389	ab		0.389
							Quilt Xcel 2.2 SE + PeptiGro	0.104	b		0.104	0.333	b		0.333
41	68	Quilt Xcel 2.2 SE, multiple generics + PeptiGro	Multiple AI	10.5 - 14.0	14	Compatible	Control	0.751	a		0.751	2.168	a		2.168
							Quilt Xcel 2.2 SE, multiple generics	0.233	b		0.233	0.051	b		0.051
							Quilt Xcel 2.2 SE, multiple generics + PeptiGro	0.191	b		0.191	0.596	b		0.596
42	69	Revytek + PeptiGro	Multiple AI	8.0-15.0	15	Compatible	Control	0.751	a		0.751	0.933	a		0.933
							Revytek	0.176	b		0.176	0.583	a		0.583
							Revytek + PeptiGro	0.081	b		0.081	0.417	a		0.417
43	70	Stratego YLD + PeptiGro	Multiple AI	4	4	Compatible	Control	0.747	a		0.747	2.200	a		2.200
							Stratego YLD	0.213	b		0.213	0.444	b		0.444
							Stratego YLD + PeptiGro	0.065	c		0.065	0.361	b		0.361
44	71	Stratego YLD 4.18 SC + PeptiGro	Multiple AI	4.0 - 5.0	5	Compatible	Control	0.748	a		0.748	2.200	a		2.200
							Stratego YLD 4.18 SC	0.305	b		0.305	0.556	b		0.556
							Stratego YLD 4.18 SC + PeptiGro	0.323	b		0.323	0.222	b		0.222
45	72	Stratego YLD 4.18 SC + PeptiGro	Multiple AI	4.0 – 4.65	4.65	Compatible	Control	0.755	a		0.755	2.200	a		2.200
							Stratego YLD 4.18 SC	0.195	b		0.195	0.778	b		0.778
							Stratego YLD 4.18 SC + PeptiGro	0.192	b		0.192	0.556	b		0.556
47	74	Topguard 1.04 SC + PeptiGro	Multiple AI	7.0 – 14.0	14	Compatible	Control	0.739	a		0.739	2.200	a		2.200
							Topguard 1.04 SC	0.09	b		0.09	1.222	ab		1.222
							Topguard 1.04 SC + PeptiGro	0.034	b		0.034	0.444	b		0.444
48	75	Topguard EQ + PeptiGro	Multiple AI	4.0 – 7.0	7	Compatible	Control	0.754	a		0.754	2.200	a		2.200
							Topguard EQ	0.208	b		0.208	0.778	b		0.778
							Topguard EQ + PeptiGro	0.078	b		0.078	0.111	b		0.111
2	77	Trivapro + PeptiGro	Multiple AI	13.7 – 20.7	20.7	Compatible	Control	0.725	a		0.725	1.067	a		1.067
							Trivapro	0.28	b		0.28	0.500	b		0.500
							Trivapro + PeptiGro	0.215	b		0.215	0.400	b		0.400
3	78	Trivapro 2.21 SE + PeptiGro	Multiple AI	13.7	13.7	Compatible	Control	0.754	a		0.754	1.067	a		1.067
							Trivapro 2.21 SE	0.096	b		0.096	0.850	ab		0.850
							Trivapro 2.21 SE + PeptiGro	0.192	b		0.192	0.400	b		0.400
5	80	Veltyma + PeptiGro	Multiple AI	7.0-10.0	10	Compatible	Control	0.742	a		0.742	2.200	a		2.200
							Veltyma	0.069	b		0.069	0.344	b		0.344
							Veltyma + PeptiGro	0.05	b		0.05	0.444	b		0.444
6	81	Xyway 3D 2.5 SC + PeptiGro	Multiple AI	5.8-11.8	11.8	Compatible	Control	0.747	a		0.747	2.200	a		2.200
							Xyway 3D 2.5 SC	0.048	b		0.048	0.500	b		0.500
							Xyway 3D 2.5 SC + PeptiGro	0.029	b		0.029	0.150	b		0.150
7	82	Xyway LFR 1.92 SC + PeptiGro	Multiple AI	7.6-15.2	15.2	Compatible	Control	0.748	a		0.748	2.200	a		2.200
							Xyway LFR 1.92 SC	0.212	b		0.212	1.333	ab		1.333
							Xyway LFR 1.92 SC + PeptiGro	0.156	b		0.156	0.944	b		0.944
8	83	Zolera FX 3.34 SC + PeptiGro	Multiple AI	4.4 – 6.8	6.8	Compatible	Control	0.741	a		0.741	2.200	a		2.200
							Zolera FX 3.34 SC	0.199	b		0.199	0.444	b		0.444
							Zolera FX 3.34 SC + PeptiGro	0.107	b		0.107	0.306	b		0.306