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SOYBEAN SEED TREATMENTS AND INOCULANTS

Fungicide Seed Treatments

Seed and seedling diseases will reduce germination and/or emergence of soybeans. Using an appropriate fungicide treatment on soybean planting seeds will increase the probability of achieving a satisfactory stand and will enhance early-season vigor of established seedlings. When seed of preferred varieties is in short supply or seed for replanting may not be available, using a seed treatment fungicide to enhance emergence and stand establishment of a first planting is imperative.

Environments in which fungicide seed treatments provide benefit are early planting in cool wet soils where germination and seedling emergence and growth will be slower, fields where minimum-till or no-till systems are used, fields with high amounts of surface residue, fields that are planted continuously to soybeans, and fields with a previous history of seedling diseases. There is evidence that the different oomycete or water mold species [e.g. *Pythium*] that attack soybean seedlings are adapted to different temperatures. Thus, some species prefer cooler temperatures while others prefer warm temperatures [CPN 2020].

There are two classes or types of seed treatment fungicides. Contact or protectant fungicides are active against species of pathogens such as *Phomopsis* that are present on planted seeds. Systemic fungicides are active against soil- and residue-borne fungi that attack planted seeds if soil conditions promote disease development.

Pythium, Phytophthora, Fusarium, Phomopsis, and *Rhizoctonia* are the most common pathogens that reduce soybean germination and emergence in the Midsouth, and represent both of the above classes. Fungicide combinations that control or suppress these pathogens are shown in **Table 1** and should be considered for broad-spectrum control of both classes of fungi.

The current commercial practice of applying a broad-spectrum fungicide seed treatment mix to soybean seed provides the most benefit for managing the different soybean fungal diseases that will affect germination and early-season growth of soybean. Also, yield increases from using fungicide seed treatments will likely be small or none. Click here for results from comprehensive research that supports this.

Many studies have shown that using an appropriate seed treatment results in a greater plant population than is achieved without a seed treatment. This can be used to decide what seed treatment expense is justified when no yield increase is expected. The following example illustrates this point.

Soybean stands are often increased by over 10% when the proper seed treatment is used. Therefore, a planned seeding rate of 150,000 seeds per acre can be reduced by at least 15,000 seeds per acre and still achieve the desired stand. For a variety that has 3,000 seeds per pound, this translates to saving 5 pounds of seed or $6.00 per acre when seed cost is $1.20 per pound. Thus, using an effective fungicide seed treatment that costs no more than $6.00 per acre [most cost less] can be justified in seed cost savings alone. Saving 15,000 seeds per acre also means that 10 acres instead of 9 can be planted with the same amount of seed. On a broader scale, 1,000 vs. 900 acres can be planted with the same amount of seed of a preferred variety if seeding rate is reduced from 150,000 to 135,000 per acre. This is an important consideration if seed of the preferred variety become unavailable for replanting. This assessment of a seeding rate reduction is supported by results from research conducted in Wisconsin and Iowa and reported here.

Use the information in **Table 1** to determine the most appropriate broad-spectrum fungicide seed treatment to use in a field environment with a history of known disease(s). Labels for each listed product can be accessed by clicking here. Information about rates and product effectiveness against damage by various pathogens can be accessed by clicking on the sites in the table footnote.

Be especially mindful of the following additional important points related to the decision of whether or not to use fungicide seed treatments, and the selection of an appropriate product.

The longer times between planting date and emergence because of lower soil temperatures in early plantings provides additional impetus to use effective fungicide seed treatments since seed and unemerged seedlings will be in the soil longer, and thus subject to infestations by soil-borne pathogens for a longer period. For example, results from research conducted as part of MSPB Project No. 75-2014 estimate that days to emergence for Mar. 30 plantings will be 4 days longer than days to emergence for plantings made on May 10. This additional time to emergence from the earlier planting can be critical if seed are not protected against soil-borne pathogens during this longer time between planting and stand establishment.

It is difficult to place a value on the additional benefit gained from using a broad-spectrum fungicide seed treatment in years and environments that have a history of unforeseen conditions after planting that will reduce stand below the level for optimum yield potential. Using a broad-spectrum seed treatment is cheap insurance to avoid replanting a failed stand, especially since such a replanting may result in a lower yield because of the later planting date.

ILeVO and Saltro, which are specific for control of the pathogen that causes sudden death syndrome [SDS] in soybean, should be applied to seed being planted in fields with a known history of SDS symptoms.

Vayantis [picarbutrazox (FRAC code U17)] is a systemic fungicide seed treatment that has activity against *Phytophthora* and all isolates of *Pythium*. Lumisena [oxathiapiprolin–FRAC code U15] and Intego Solo [ethaboxam–FRAC code 22] are newer fungicides that have been promoted to manage oomycete diseases. These fungicides can be used in lieu of or in combination with mefenoxam [FRAC Code 4] to improve efficacy against oomycetes through overlapping effective modes of action. This should also minimize the potential for resistance development in these fungi.

Using a fungicide seed treatment that is not broad-spectrum is a poor management decision. Thus, when having a fungicide seed treatment applied by the seed supplier, ensure that the product or products that are being used contain components that will control the different classes of soil- and seed-borne fungi shown in the below table.

Table 1. Seed-treatment fungicide combinations [contact + systemic] for broad-spectrum and target-specific control of soybean seed and seedling diseases, organisms controlled by each fungicide product, and efficacy ratings* for indicated pathogens. FRAC code in parentheses following product name indicates mode of action.

Trade name**	Ingredients [FRAC code]	Pathogens controlled/suppressed & efficacy rating*
ApronMaxx [RTA and RFC], Warden RTA	Mefenoxam [4] + Fludioxonil [12]	*Pythium [E], Phytophthora [E], Fusarium [G], Phomopsis [G], Rhizoctonia [G]*
Bean Guard/Allegiance	Metalaxyl [4] + Captan [M4] + Carboxin [7]	*Pythium [E], Phytophthora [E], Fusarium [G], Rhizoctonia [G]*
Trilex 2000	Trifloxystrobin [11] + Metalaxyl [4]	*Pythium [E], Phytophthora [E], Fusarium [G], Rhizoctonia [G]*
EverGol Energy	Prothioconazole [3] + penflufen [7] + metalaxyl [4]	*Pythium* [E], *Phytophthora* [E], *Fusarium* [G], *Phomopsis* [G], *Rhizoctonia* [G]
Acceleron D-961	Metalaxyl [4] + prothioconazole [3] + penflufen [7]	*Pythium* [E], *Phytophthora* [E], *Fusarium* [G], *Phomopsis* [G], *Rhizoctonia* [G]
ILeVO***	Fluopyram [7]	*Fusarium virguliforme*,SDS pathogen [VG]; early-season Septoria brown spot [*Septoria glycines*]; soil-borne nematodes
Saltro	Pydiflumetofen [7]	*Fusarium virguliforme*, SDS pathogen [VG]; early-season Septoria brown spot [*Septoria glycines*]; soil-borne nematodes
Intego	Ethaboxam [22] + ipconazole [3] + metalaxyl [4]	*Pythium [E], Phytophthora [E], Fusarium [G], Phomopsis [G], Rhizoctonia [G]*
Lumisena	Oxathiapiprolin [U15]	*Phytophthora sojae* [E]. Phytophthora rot pathogen
Vayantis	Picarbutrazox [U17]	*Pythium* [active on all isolates] and *Phytophthora*
Lumiante	Ethaboxam [22]	*Pythium* [E] and *Phytophthora* [E]

***EFFICACY RATINGS**: E = Excellent; VG = Very Good; G = Good; F = Fair; P = Poor. ILeVO and Saltro have efficacy against *Fusarium virguliforme*, the causal agent of SDS.
**Click here for link to CDMS website for labels of each listed product.
***Yield increase realized in fields with history of SDS symptoms [click here and here for research results].
CAUTIONS: Check product label for compatibility with B. *japonicum* inoculant, and do not feed or sell treated seeds that are not planted.
EFFICACY RATINGS from Crop Protection Network 2024.
CLICK here for guidelines for disposing of treated seed.

Insecticide Seed Treatments

An additional management option for Midsouth soybean farmers is treating planting seed with an insecticide in addition to the already proven effective treatment with fungicides. Available products contain systemic insecticides that provide effective control of early generations of bean leaf beetle, thrips, and three-cornered alfalfa, among others. They generally have a short period of efficacy [30 to 45 days], and are not a replacement for late-season insect control that may be necessary in some fields.

Reports from numerous studies indicate that using insecticidal seed treatments with a fungicide seed treatment will result in small but significant yield increases that apparently result from lessening the damage caused by insect pests early in the season. The majority of these studies use seed treatment products that contain both fungicides and an insecticide, so it is likely that the insecticide component does result in a relatively small yield increase when applied along with the fungicide seed treatment. Available products with both fungicide and insecticide components are shown in **Table 2**.

Table 2. Seed-treatment fungicide and insecticide combination products for broad-spectrum control of soybean seed and seedling diseases and soil-borne and early-season insects. FRAC code indicates mode of action for listed fungicides, and IRAC code indicates mode of action for listed insecticides.

Trade name*	Ingredients, FRAC codes for fungicides, and IRAC codes for insecticides**
CruiserMaxx	Apron Maxx [fungicides] plus Cruiser 5FS [thiamethoxam insecticide (4A)]
CruiserMaxx Vibrance	ApronMaxx fungicides + sedaxane fungicide [7] + Cruiser 5FS insecticide
CruiserMaxx APX	CruiserMaxx Vibrance + Vayantis fungicide
Inovate Pro***	Metalaxyl [4] and Ipconazole [3] fungicides plus Clothianidin insecticide [4A]
Intego Suite Soybeans***	Metalaxyl [4], Ethaboxam [22], and Ipconazole [3] fungicides plus Clothianidin insecticide [4A]
Equity VIP****	Mefenoxam [4], thiabendazole [1], fludioxonil [12], and sedaxane [7] fungicides plus thiamethoxam [4A] insecticide.
Seed Shield Select****	Mefenoxam [4], fludioxonil [12], sedaxane [7], azoxystrobin [11], and picarbutrazox [U17] fungicides plus thiamethoxam [4A] insecticide.
LumiGEN system	Base treatment–Lumisena + EverGol Energy fungicides + PPST 2030 G biofungicide [44]; Enhanced–Base treatment + Gaucho [4A] and Lumiderm [28] insecticides, and ILeVO option. [Gaucho being replaced by Phalanx (Thiamethoxam–4A) according to Corteva]

*Click here for link to CDMS website for labels.
**Note that all insecticide components except Lumiderm are in IRAC Code 4A.
***Metalaxyl and Ethaboxam are both rated excellent against *Pythium* and *Phytophthora*, but have different FRAC codes. Ipconazole fungicide rated fair to good against *Rhizoctonia*, good to excellent against *Fusarium*, and good against *Phomopsis*.
****Mefenoxam rated excellent against *Pythium* and *Phytophthora*, Thiabendazole rated good against *Phomopsis*, Fludioxonil rated good to very good against *Fusarium* and *Rhizoctonia* and good against *Phomopsis*, Sedaxane rated excellent against *Rhizoctonia* and good against *Phomopsis* [but a different FRAC code than Fludioxonil], Lumisena rated excellent against *Phytophthora*, Vayantis/Picarbutrazox rated for control of *Pythium* and *Phytophthora* [but a different FRAC code than mefenoxam], Thiamethoxam insecticide active against chewing and sucking insects.

The benefits from using a fungicide seed treatment are well known. Indications are that those benefits may be enhanced by using one of the above seed treatment products that combines fungicides and an insecticide.

Results from a meta-analysis of 170 trials conducted from 2005-2014 in Arkansas [24 tests conducted at three locations], Louisiana [24 tests conducted at one location], Mississippi [73 tests conducted at multiple locations], and Tennessee [49 tests conducted at two locations] and reported in an article published by North et al. in the J. of Economic Entomology [Vol. 109, No. 3., p. 1156-1160] in 2016 confirm this. A summary of the details of that analysis follow.

- All experiments included a base fungicide seed treatment [the same in all experiments] with and without a

neonicotinoid seed treatment [either imidacloprid or thiamethoxam–IRAC Group 4 MOA].

- In most of the experiments, insect populations consisted of a complex of multiple species occurring simultaneously or in sequence throughout soybean seedling growth.
- Across the 10 years of the experiments, the cost of the insecticide seed treatment ranged from $6.56/acre to $8/acre.
- Across all tests, the addition of the insecticide seed treatment to the fungicide seed treatment resulted in a significantly greater seed yield of 2.0 bu/acre when compared to yield from the fungicide-only seed treatment. Yield differences between the two treatments in each of the four states across the 10 years were significant, and were 1.67 bu/acre in Arkansas, 3.02 bu/acre in Louisiana, 2.45 bu/acre in Mississippi, and 1.04 bu/acre in Tennessee.
- Average net returns across all 170 experiments were increased by an average $13.36/acre when the insecticide seed treatment was used. However, the difference in net returns between treatments was significant only in Louisiana and Mississippi where yield difference was the greatest and exceeded 2.45 bu/acre.
- Across all experiments in each state, the neonicotinoid seed treatment significantly increased seed yield in 6 of 10 years and increased net returns in 4 of 10 years.
- These results demonstrate that 1) both increased yield and net returns from soybean production in the Midsouth may be realized from using neonicotinoid seed treatments in some situations, and 2) because the benefits that can be realized are likely the result of management of a complex of multiple insect species that usually occur at sub-threshold levels, and because those complexes are not easily predicted at soybean planting time, it is recommended that an insecticide seed treatment be added to a base fungicide seed treatment for best integrated pest management at soybean planting.

Resistance management is always paramount when using pesticides; therefore, these insecticidal products should be included as a seed treatment component only if the producer is confident that there is a history of or anticipates occurrence of crop damage from early-season insects since the neonicotinoid insecticide components all have the same mode of action [IRAC Group 4A]. Lumiderm insecticide seed treatment is a Group 28 insecticide.

Since three-cornered alfalfa hopper has reduced stands in many Mississippi fields over the years, and since there is evidence that increasing pressure from thrips in soybeans is worth taking note of, use of seed treatment insecticides should certainly be considered to control these early-season insect pests where it is anticipated they will occur at damaging levels.

Nematicide Seed Treatments

All soybean production regions in the U.S. experience problems with soybean cyst nematode [SCN], and SCN is especially problematic on the silt loam and coarser-textured soils of the Midsouth. With the increasing transfer of Midsouth cotton acreage to soybeans, reniform nematode infection of soybeans has become a concern as well. Root knot nematodes can also be problematic in the Midsouth since soybeans, cotton, and corn all serve as hosts.

Nematicides applied to seed or used in-furrow can reduce early-season root infection by nematodes, but do not provide season-long control and may not be economical. Nematicides can be effective in controlling SCN populations in infested fields, but their use should be based on expected yield and subsequent income, given that lessened yield loss resulting from their use in low-yield environments may not result in yields that are sufficient to be profitable.

Nematicides will not replace the use of resistant varieties and variety/crop rotation as primary nematode control practices.

Nematode control products that can be applied in combination with fungicide/insecticide seed treatments, or fungicides that have activity against soil-borne nematodes are listed below.

Votivo [Bacillus firmus] is a biological seed treatment that provides early-season protection against soybean cyst, reniform, and root-knot nematodes according to the label.

Poncho/Votivo is a combination insecticide [clothianidin] /nematicide that is applied to the seed prior to planting. The Poncho/Votivo product has no fungicide component.

Avicta Complete Beans 500 is a seed treatment product that combines a nematicide [Avicta 500FS—abamectin] with a fungicide [Apron Maxx] and insecticide [Cruiser 5FS], or CruiserMaxx premix. As with the above product, little is known about the effectiveness of this nematicide in situations with known populations of nematodes.

Clariva Elite Beans seed treatment product [Clariva pn/insecticide/fungicide] is an on-seed application of separately registered products that has the added nematicide component *Pasteuria nishizawae* for control of SCN. The nematicide component is in addition to the insecticide/fungicide components found in CruiserMaxx

Vibrance. The nematicide component only targets SCN and not other nematode species.

ILeVO and Saltro seed treatments are both Group 7 fungicides [fluopyram and pydiflumetofen, respectively] that, according to their labels, will provide early-season control of soybean cyst, root-knot, and reniform nematodes that will or can plague soybeans in infested fields.

Bissonnette and Tylka ISU Extension and Outreach] have published "Seed Treatments for Soybean Cyst Nematode" that provides a list of available nematode-protectant seed treatments that are available for use on soybean seed. However, their statement "Nematode-protectant seed treatments are intended to supplement current SCN management strategies, and therefore should be used in coordination with growing varieties with SCN resistance genes and rotation to nonhost crops" is in line with the above statements that nematicide seed treatments will not replace proven management practices that should be used to manage SCN at sites where they are present.

At this time, little is known about the effectiveness of the above nematicides in situations with known populations of nematodes. Thus, there is no supposition that any of these products will replace the accepted practices for nematode control and/or management. In fact, they should be used in combination with the accepted practices specified in the above-linked article.

Inoculants

The benefit from using *rhizobium*-containing inoculants is not as clearcut as are the benefits from using fungicide and insecticide seed treatments. It is well known that these bacteria must be present in the soil in sufficient numbers for proper nodulation on soybean roots to occur. The unknown in such a hard-and-fast fashion is just when to expect an economic or agronomic response when inoculants are applied.

The following points should be considered when making the decision of whether or not to use an inoculant.

- An appropriate inoculant is cheap–generally less than $3/acre. Thus, cost is not a factor in deciding whether or not to inoculate.
- Do not apply inoculants to gain a yield increase. Rather, apply them to ensure that nitrogen fixation will be sufficient for the crop to realize the yield potential from the planted site.
- Inoculants are generally not compatible with fungicide seed treatments, so inoculant application must be made at planting. This will slow the planting operation.
- There is overwhelming evidence that applying inoculants to soils that have recently been cropped to soybeans provides no yield benefit.
- The cheapness of inoculants warrants their application when soybeans have not been grown recently on a site and the risk of insufficient native soil inoculum is high. The importance of this fact is because there is no option after planting but to apply expensive nitrogen fertilizer to overcome the effects of poor nodulation.

Click here for a summary of results from Univ. of Kentucky research that was conducted in 2016, and a link to the article that reports the details of that research. Click here for results from a 2015-2017 study that was conducted in eastern Kansas. Results from these studies affirm that 1) application of an inoculant every year, even in a soybean-corn rotation, is an unnecessary expense, and 2) an inoculant should be applied to soybean that are planted in fields with no history of soybean production. The following points should also be considered then deciding whether or not to inoculate.

- With the change in cropping systems that is occurring in the Midsouth, it is a good idea to inoculate when soybeans are planted on a site that has had continuous cotton or corn or if the site has not been cropped to soybeans in the last 4-5 years.
- When inoculant use is warranted, there is a potential advantage from choosing inoculant products that contain more than one strain of bacteria.
- Results from a study that was planted behind the 2011 flood in Mississippi showed no advantage for applying inoculants even though the flood period was several weeks.
- Click here for an article that provides a concise summary that can be quickly perused to help in your decision about using inoculants.

SUMMARY

Deciding which soybean seed treatment or combination of seed treatments to use has become more complicated than when the first effective fungicide seed treatment(s) came into use in the 1990's. There are the usual broad-spectrum fungicide products; however, in recent years that market now has fungicide seed treatments that are active against only specific fungi, nematicides that are effective against SCN and other nematodes, and insecticides that are effective against soil-borne insects that may damage planted soybean seed. Many of these are highlighted in **Table 3**.

The following points should guide producers in deciding on which seed treatment products to use.

- There is an expense associated with all listed products. Therefore, producers should ensure that they use only

those products that are needed in individual production environments to avoid unnecessary expense and to avoid applying products that will promote resistance development in pathogens that are not at damaging levels.

- Not all planted seed or soybean production fields will be infested with all of the above listed pathogens or seed-damaging insects or nematodes. Therefore, producers should apply only those seed treatment products that will address pests they expect to be present based on soil type, field drainage pattern and capability following inundating rains, field history, and known resistance traits of planted varieties. This is an important component of avoiding or delaying pest resistance development to pesticides.
- The cost of a company's package of seed treatment products may be lower than if the individual components of that package are applied separately. However, adding an unneeded seed treatment component because of its low cost may contribute to resistance development in pathogens and insects that are present at below-damaging levels in the current production environment.
- Yield increase [often only 2-3 bu/acre] resulting from using individual insecticide and nematicide seed treatments in some environments may be too low to justify the expense of the seed treatment. Remember, many varieties have resistance to problematic soil pathogens and nematodes that may negate use of all-inclusive seed treatment products that may be more expensive.
- There have been concerns about mefenoxam and metalaxyl resistance development in both *Pythium* and *Phytophthora*. However, research results indicate that resistance is rare and not widespread. If a history of oomycete seedling diseases is suspected in a given field, applying seed treatments that contain more than one fungicide active ingredient is recommended to prolong the efficacy of available fungicide seed treatments.
- **Producers should use seed treatment products that contain only the components that address their known or expected pathogen or pest presence. They can do this by requesting that seed dealers customize the application of seed treatment ingredients to their seed based on the need for specific fungicide, insecticide, and nematicide components.**

A publication titled "What's on your seed?" from the Integrated Pest and Crop Management Program at the Univ. of Wisconsin provides a chart with the various seed treatment products that are available for corn, soybean, and small grains. Arguably the most valuable aspect of this chart is the designation of each product as a fungicide [F], insecticide [I], nematicide [N], and plant growth regulator [P].

Table 3. Selected seed treatment products and comments for use. FRAC and IRAC codes in parentheses indicate mode of action of pesticide component.	
Trade Name	**Comments**
Fungicides	
ApronMaxx, Warden; EverGol Energy + Allegiance	All rated good to excellent for control of *Pythium, Phytophthora, Fusarium, Phomopsis,* and *Rhizoctonia*. Use as base seed treatment on all planted soybean seed to ensure optimum stands and thus avoid having to replant.
ILeVO and Saltro [7]	For control of *Fusarium virguliforme*, SDS pathogen; Yield increase realized in fields with history of SDS symptoms.
Lumisena [U15]	Effective against all races of *Phytophthora sojae*.
Intego [22]	Rated excellent for control of *Pythium* and *Phytophthora*
Vayantis [U17]	Control of *Pythium* (all isolates) and *Phytophthora*
Seed treatment product combinations with indicated pesticide components*	
Pioneer Premium Seed Treatment	Lumisena + EverGol Energy fungicides +PPST 2030 G biofungicide [44], + Gaucho [4A] and Lumiderm [28] insecticides.
CruiserMaxx	Apron Maxx fungicides + Cruiser 5FS insecticide [thiamethoxam (4A)].
CruiserMaxx Vibrance	ApronMaxx fungicides + sedaxane fungicide [7] + Cruiser 5FS insecticide
Intego Suite Soybeans	Metalaxyl [4], ethaboxam [22], and ipconazole [3] fungicides + clothianidin [4A] insecticide; metalaxyl and ethaboxam are both rated excellent against *Pythium* and *Phytophthora*, but have different FRAC codes. Ipconazole fungicide rated fair to good against *Rhizoctonia*, good to excellent against *Fusarium*, and good against *Phomopsis*.
Equity VIP	Mefenoxam [4], thiabendazole [1], fludioxonil [12], and sedaxane [7] fungicides + thiamethoxam [4A] insecticide; note different mode of action for the four fungicides.
Avicta Complete Beans 500	CruiserMaxx [[ApronMaxx fungicides + Cruiser 5FS insecticide] + Avicta 500FS nematicide [abamectin]]; nematicide component for early-season protection against nematodes, including SCN, according to label.
Clariva Elite Beans	CruiserMaxx Vibrance [mefenoxam, fludioxonil, and sedaxane fungicides + thiamethoxam insecticide] + Clariva pn [nematicide]; nematicide component effective against SCN only.
Poncho/Votivo	Clothianidin [4A] insecticide + *Bacillus firmus* nematicide [provides early-season protection against soybean cyst, reniform, and root-knot nematodes according to label]; does not contain fungicide component.
Seed Shield Select	Mefenoxam [4], sedaxane [7], azoxystrobin [11], fludioxonil [12], and picarbutrazox [U17] fungicides + thiamethoxam [4A] insecticide; fungicide and insecticide package with multiple fungicide modes-of-action to control known early-season fungal pests.
*Note that all insecticide seed treatments except Lumiderm have the same mode of action. Check label of each product to determine which soil-borne insects are controlled by each product; however, all of the insecticides in the above products are labeled for early-season control of soybean aphid, bean leaf beetle, and seed corn maggot.	

MAY 2025 UPDATE

The US-EPA is proposing to register cyclobutrifluram, a new SDHI inhibitor [FRAC code 7] fungicide active ingredient [AI] developed by Syngenta Crop Protection that can be used as a soybean seed treatment for the control of select seed and seedling pests. The new AI will be marketed as Tymirium technology in the seed treatment Victrato for soybeans, and is touted by the developer to safeguard plant roots from attack by targeted pathogens. Producers are reminded that this pesticide has a new AI, but the FRAC code [SDHI inhibitor–FRAC code 7] is the same as that of other seed treatment products that are already on the market and shown in **Table 1**.

An article titled Cyclobutrifluram (TYRIMIUM tachnology): low risk of a soil applied nematicide and fungicide to non-target soil invertebrates and bees reports results from lab studies that indicate no adverse effects of this new AI on studied soil invertebrates or honeybees when applied at recommended rates.

June 2025 Update

Producers are encouraged to access an article titled "Biological Seed Treatments: The Big Picture" by Laura Temple. Pertinent points from that article which provides results from activities funded by checkoff dollars follow.

- This publication contains highlights from trials that were conducted with biological seed treatments across 21 states in 2022 and 2023 [101 site years].
- Producers need to remember that the AI's contained in biological seed treatments must be alive when applied.
- The treatment list for this research focused on AI's in available microbial products.
- Based on results from these trials, 1) no one product worked universally, 2) no AI consistently provided a statistically significant yield increase, and 3) any yield increases that resulted from the application of any of the AI's in the study were small. Thus, the return on investment from their application was negligible.
- Analysis of data beyond seed yield may help identify specific places where biological seed treatments offer an advantage. However, increased seed yield resulting from their use is not likely at this time.

Composed by Larry G. Heatherly, Updated June 2025,
larryh91746@gmail.com