Corn & Soybean News

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Fall Residual Herbicides & Cover Crops Can Help with Ryegrass

Dr. Travis Legleiter, UK Extension Weed Specialist

Italian ryegrass (aka annual ryegrass) is becoming an increasingly problematic weed for Kentucky grain crop producers across the state. Growers are no longer just dealing with ryegrass in wheat, but rather are also dealing with ryegrass escapes and burndown failures prior to corn and soybean planting each spring.

Traditionally we have relied on spring burndown applications for control of winter annuals, including ryegrass, prior to corn and soybean planting. While this strategy is highly effective against the majority of winter annual weed species, Italian ryegrass is now challenging this strategy. We need to implore alternative strategies to reduce the pressure on spring burndown applications that are increasingly failing to control Italian ryegrass. This is where the use of fall residual herbicides is an option that can relieve the pressure on the spring burndown applications.

Several products that contain pyroxasulfone or S-metolachlor either have federal label language or 24 (c) special needs labels that allow for application in the fall for control of Italian ryegrass or fall germinating weeds. A list of products that have label language allowing for fall applications is contained in Table 1, along with application rates and replant restrictions.

Table 1. Herbicide products with federal or 24(c) labels allowing for fall applications for suppression of Italian ryegrass emergence prior to corn and/or soybean planting the following spring.

Trade Name Product	Active Ingredients (Site of Action Group #)	Labeled Application Timing	Fall application Rate (Medium Soils)[ab]	Replant Restrictions
Anthem Maxx	Pyroxasulfone (15) + fluthiacet-methyl (14)	Fall applications for controlling weeds germinating in the fall or winter annuals	Corn – 4 to 5 fl oz/a Soybean – 3.5 to 4.5 fl oz/a	Corn & Soybean – 0 Months
Boundary	S-metolachlor (15) + metribuzin (5)	Control of glyphosate-resistant Italian ryegrass in the fall prior to soybean or corn planting the following spring (24c Special Needs Label)	Corn & Soybean – 1.8 to 2 pt/a	Corn – 4 Months Soybean – 0 Months
Dual II Magnum[c]	S-metolachlor (15)	Fall application for residual control of glyphosate resistant Italian ryegrass in corn and soybean -	Corn & Soybean – .33 to 1.67 pt/a	Corn & Soybean – 0 Months
Helmet MTZ	Metolachlor (15) + metribuzin (5)	For control of glyphosate-resistant Italian Ryegrass in the fall prior to soybean planting the following spring (24c Special Needs Label)	Corn & Soybean – 2 pt/a	Corn – 4 Months Soybean – 0 Months
Zidua SC	Pyroxasulfone (15)	Fall/Winter application for controlling weeds germinating in the fall, or winter annual weeds	Corn & Soybean – 3.25 to 5 fl oz/a	Corn & Soybean – 0 Months

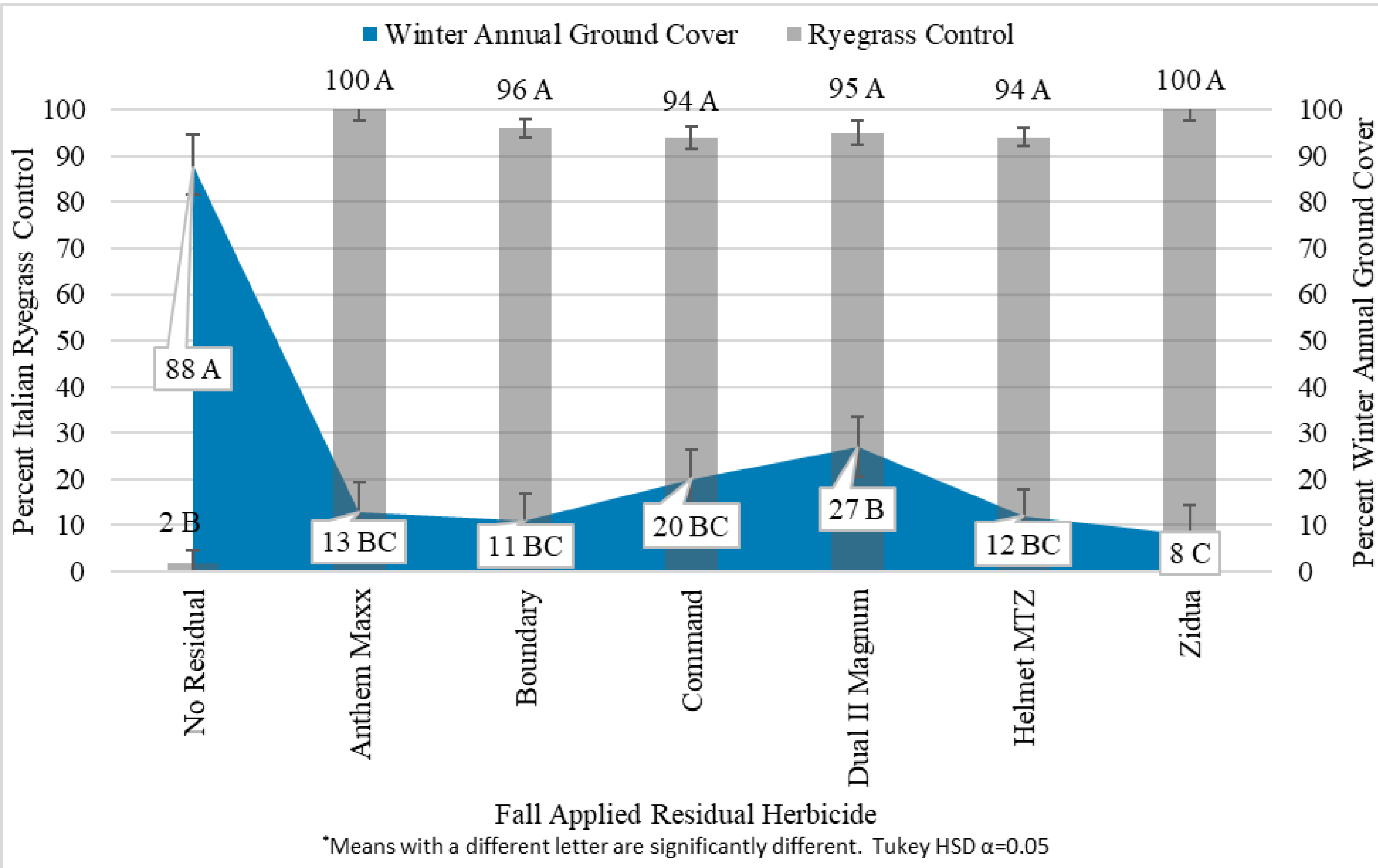
[a] Check the herbicide label for product rates to use on fine and coarse soils

[b] Refer to label for maximum seasonal/yearly rate allowance for each active ingredient.

[c] Numerous generic formulations of S-metolachlor and metolachlor exist on the market. Check product label to assure fall applications for control of ryegrass are labeled for each specific product prior to use.

Research trials evaluating fall applied residual herbicides were conducted at the University of Kentucky Research and Education Center in Princeton, KY in 2022 and 2023. Additionally, a trial evaluating residual herbicide and cover crop combinations was implemented in 2023. Results of the experiments can be found in following figures with summary results directly below the figure:

Figure 1. Italian ryegrass control and winter annual ground cover in the spring following a fall residual herbicide application.



- All residual herbicides provided greater than 94% ryegrass control the following spring and had greater control than a burndown herbicide alone which provided 2% control of ryegrass.
- Winter annual ground cover was significantly reduced by all residual herbicide as compared to a fall burndown without a residual herbicide indicating an increased risk of potential soil erosion with the use of fall residual herbicides.

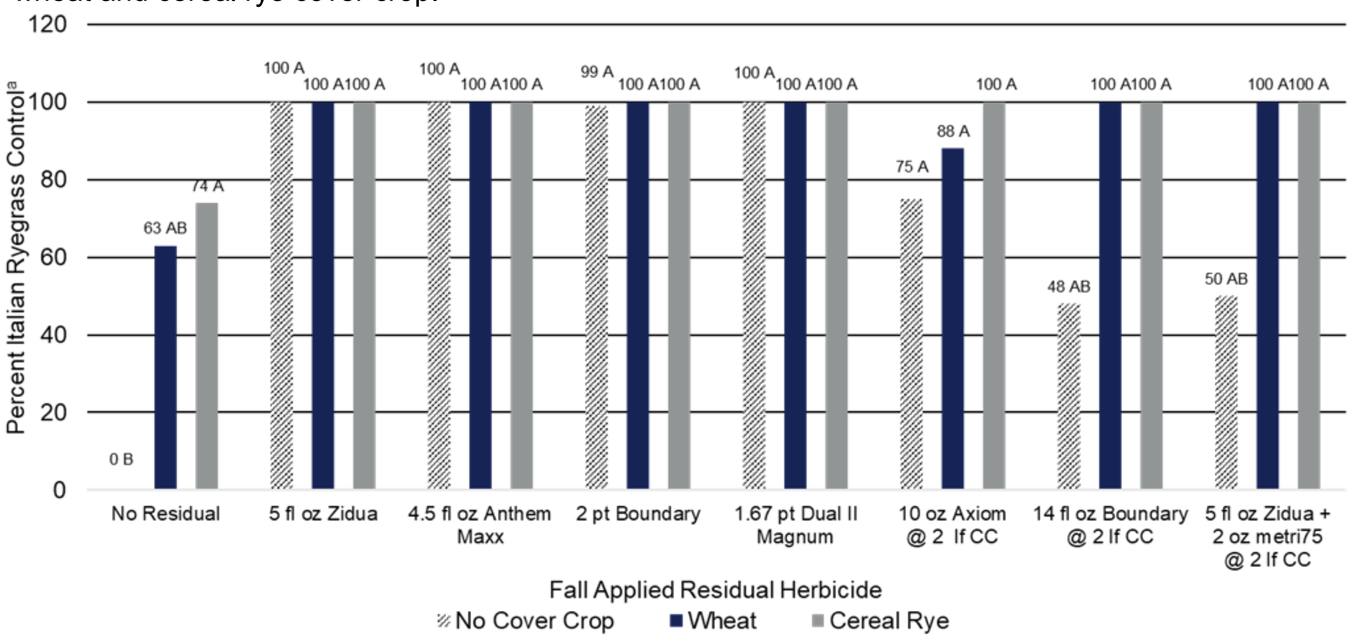
Table 2. Italian ryegrass density on April 3, 2023, following herbicide applications applied November 2, 2022.

Fall Applied Residual Herbicide	Ryegrass Plants per ft^2	
5 fl oz Zidua	0	A
4.5 fl oz Anthem Maxx	1	A
4.67 pt Dual II Magnum	2	A
2 pt Boundary	2	A
2 pt Helmet MTZ	1	A
No Residual Herbicide	14	B

[a] Means with a different letter are significantly different. Tukey HSD α=0.05

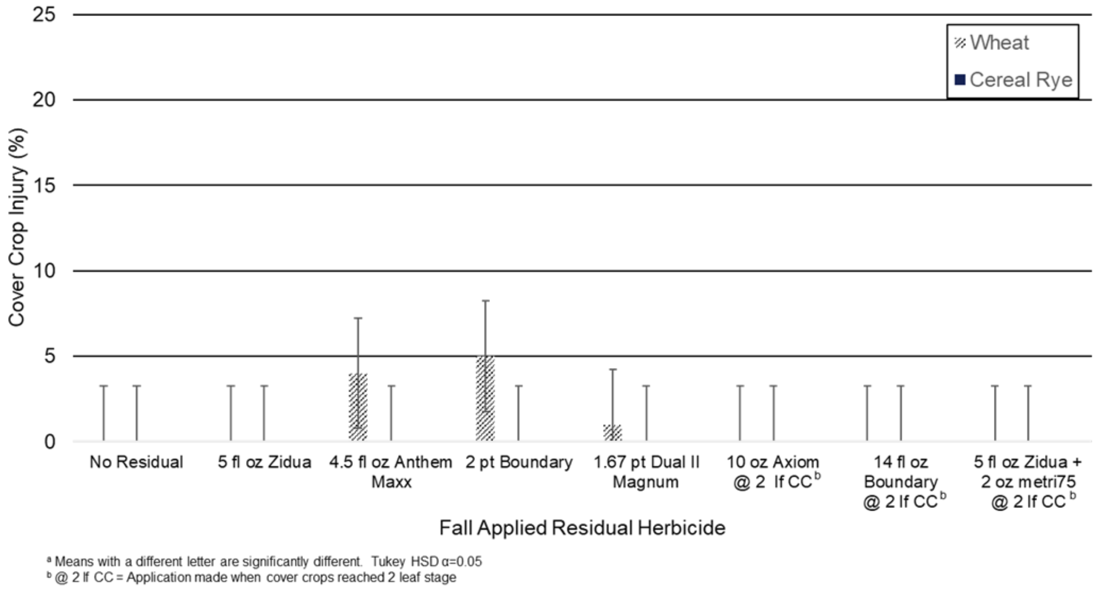
- Italian ryegrass density five months after fall residual applications was reduced to one to two plants per square foot as compared to a non-residual burndown application with 14 plants per square foot.

Figure 2. Italian ryegrass control on March 14, 2024, using fall residual herbicides with and without a wheat and cereal rye cover crop.



- The use of residual herbicides increased control of Italian ryegrass in the spring following applications both applied pre and post to cover crop emergence.
- The combination of residual herbicides and cover crops resulted in the greatest control of Italian ryegrass.

Figure 3. Cover crop wheat and cereal rye crop injury ratings following residual herbicide applications.



- Cover crop injury in 2023-24 was minimal on wheat, with less than 5% injury occurring. Cereal rye injury was insignificant in the 2023-24 trial.
- Cover crops were able to be established successfully in combination with both pre and post applications of residual herbicides allowing the use of a residual herbicide while minimizing overwinter soil erosion potential.

Recommendation for The Fall of 2024

These are my recommendations for those farmers dealing with Italian ryegrass based off these research results

- Farmers dealing with a highly suspected or confirmed glyphosate resistant Italian ryegrass population should apply a fall application of a tank mixture of paraquat (Gramoxone) plus either Boundary or Helmet MTZ. We know that paraquat and metribuzin have synergistic activity on Italian ryegrass thus the use of a residual premix with metribuzin will be beneficial.
- Farmers still able to control ryegrass with glyphosate should apply a residual herbicide with either glyphosate or paraquat. Those choosing to use paraquat see above for recommended residual tank mix partner. Those using glyphosate should include any of the residual herbicide listed in Table 1, all provided significant reductions in spring ryegrass densities.
- The incorporation of a cover crop of either wheat or cereal rye with a residual herbicide creates a scenario where Italian ryegrass suppression can be achieved while also maintaining a cover on the soil to reduce soil erosion potential.
- Plan to follow up with a spring burndown application to control any escapes. All residual herbicides provided significant reductions in ryegrass populations but did not provide 100% control of ryegrass in the spring.

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Mehlich III Extractable Sulfur and S Deficiency: Some Additional Considerations

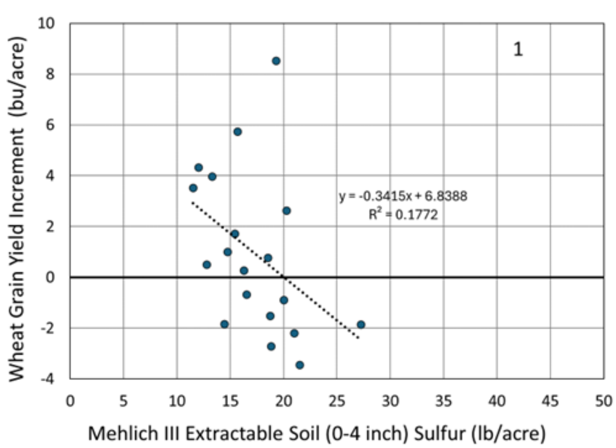
Dr. John Grove, UK Extension Soil Specialist

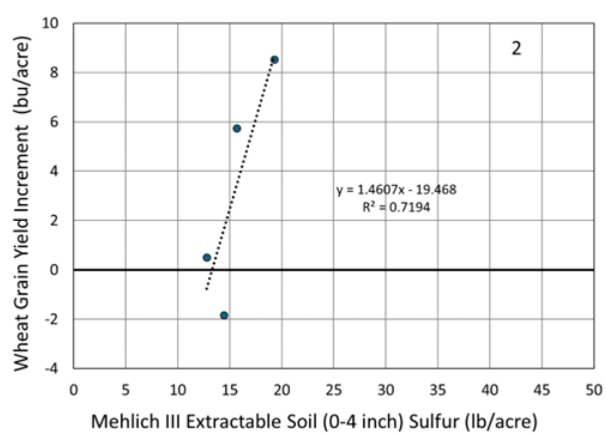
Introduction:

As an agronomist/soil scientist I often stress that soil testing is an important tool to use in nutrient deficiency detection. But we all know that soil testing is not always the best tool – here in Kentucky we know that soil test values for pH and plant available phosphorus (P) and potassium (K) are valuable. But soil tests for nitrogen (N) availability are weaker, less related to crop nutrition and yield.

In a "good" correlation between values from a particular soil test procedure and crop yield response, the correlation is 'negative' – the yield response to a fertilizer addition falls as the soil test value rises. These correlations often involve a wide variety of soils, and variety introduces variability that can cause complications. In this article I share with you a couple of complications that have arisen in our work to come up with a validated soil test for sulfur (S).

With support from the Kentucky Small Grain Growers Association, field research on wheat S nutrition was done across the state over two growing seasons, 2019-20 and 2020-21. The correlation between the wheat yield increment to S addition and the topsoil (0-4 inch depth) Mehlich III soil test S value is shown in Figure 1. The relationship is negative, as expected, but is not very well correlated – an R^2 of 0.18 is not very inspiring. Still, data binning suggests that soil test values below 15 lb S/acre are often (5 of 6 = 83%) associated with positive yield increments; values between 15 and 20 lb S/acre are somewhat less likely (6 of 10 = 60%) to cause a yield increase; values above 20 lb S/acre exhibited no (0 of 3 = 0%) possibility of yield increase.

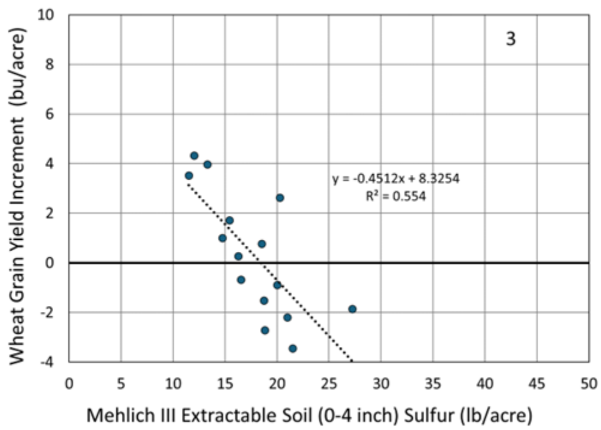


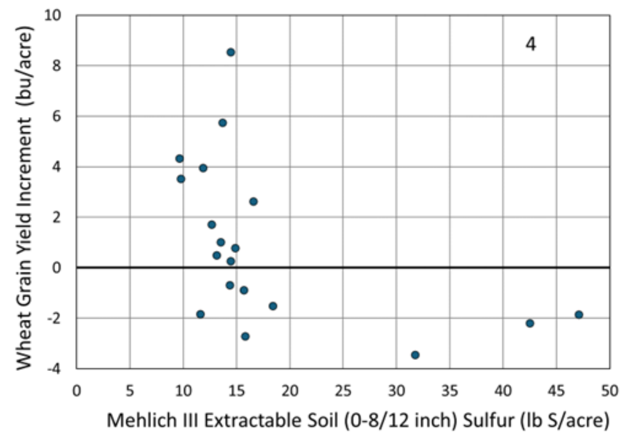


Wheat grain yield increment to fertilizer S addition as related to 0-4 inch Mehlich III extractable soil S: Figure 1. All locations; Figure 2. Inner Bluegrass locations.

There were 4 locations in the Inner Bluegrass (IBG), on high-phosphate soils. When separated from the other sites, their correlation looks entirely different (Figure 2). Within the narrow range in observed soil test S values (only 13 to 19 lb S/acre), the yield response to S addition rises as the soil test S value rises. This result suggests that these sites need to be removed from the relationship shown in

Figure 1, resulting in Figure 3. Among the sites shown in Figure 3, all on soils outside the IBG, the relationship is negative and better correlated – the R^2 is 0.55. Among these sites, sites with soil test values less than 15 lb S/acre had a strong possibility (4 of 4 = 100%) of a positive response; sites with values between 15 and 20 lb S/acre had a 50:50 chance (4 of 8 = 50%) of a positive response; and again, sites with values above 20 lb S/acre had little chance (0 of 3 = 0%) of yield gain. Clearly, removing the IBG sites strengthens the correlation relationship between yield gain and Mehlich III extractable S and refines the binning of the data.





Wheat grain yield increment to fertilizer S addition as related to Mehlich III extractable soil S:
Figure 3. 0-4 inch depth, Inner Bluegrass locations removed; Figure 4. 0-8/12 inch depth, all locations.

The exact mechanism is unknown, but I suspect that the high phosphate status of the IBG soils is impacting the Mehlich III S extraction. That said, it is still clear that when these IBG soils gave soil test values less than 20 lb S/acre, there was a good chance (Figure 2; 3 of 4 = 75%) of a yield benefit to S addition. There is not enough IBG data to better define an S recommendation for these soils.

Because sulfate-S is known to be only moderately mobile in many of our subsoils, we took deeper soil samples (to 8 inches in 2019-20 and to 12 inches in 2020-2021) in these studies – looking for additional S within the wheat root zone. The correlation between the wheat yield increment and Mehlich III soil test S for these deeper samples is shown in Figure 4. Because of the outlying points with high levels of soil test S, no attempt was made to determine a mathematical relationship. Compared to Figure 1, overall soil test S values shifted to the left (lower values) when deeper soil S levels at the site were lower and to the right (higher values) when deeper soil S levels at the site were higher. The binning analysis shifted as well – Mehlich III soil test S values less than 15 lb S/acre were much more likely (11 of 13 = 85%) to give a positive yield response while values greater than 15 lb S/acre were much less likely (1 of 6 = 17%). Sites with values above 30 lb S/acre often gave some of the largest yield losses with fertilizer S addition.

Research on soil testing for S availability is ongoing. For now, soil test S values will not be as valuable as other soil test parameters. More work is needed. Organic matter is a major S reservoir in many soils and some states adjust their fertilizer S recommendations accordingly. At this point, UK soil scientists have no basis for making such an adjustment.

The data we do have does indicate that producers should consider taking a deeper sample, to 12 inches, to learn whether there is a reservoir of Mehlich III extractable S below the topsoil. Mehlich III soil test S values for high phosphate soils of the Inner Bluegrass may eventually come to have a different, separate, interpretation/recommendation scheme. Given the ambiguities with soil S testing, growers should also consider using plant tissue analysis of the previous crop as an additional tool to understand the potential need for S in the next crop.

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Green-stem Syndrome in Soybean

Dr. E.B. Egli, UK Professor Emeritus

Green-stem Syndrome in a soybean field. Image by Dr. Shamim.

No producer wants to see soybean plants with green stems in a field that is ready to harvest. What's to be done, or, more importantly, can they be prevented? Understanding the green-stem syndrome will help us answer these questions.

Green stem has been attributed to virus diseases, insect feeding and the old catch-all – environmental stress. To learn more about the causes of green stem, Bill Bruening and I investigated the effect of pod removal on the appearance of green stems.

We applied two depodding treatments [25 and 50% pod removal at the beginning of seed filling (beginning of growth stage R6)] for two years to soybean varieties from Maturity Groups III, IV and V (three in each maturity group). We monitored the appearance of brown stems and pods as the plants matured and we measured seed moisture and carbohydrate and N levels in the stems at maturity.

Our depodding treatments produced the green-stem syndrome – fully mature brown pods on plants with green stems – 50% removal produced more green stems than 25% pod removal.

Stems on the depodded plants eventually turned brown (unless they were killed by freezing temperatures) with the delay, compared to the control, varying from as little as 4 days to more than a month. One variety still had green stems when a killing freeze occurred 46 days after the control reached 65% brown stems. We couldn't reach any conclusions about variety or maturity group effects because of extreme variability between years and the fact that depodded plants (especially in maturity group V) were often killed by frost before the green stems turned brown.

Pods on depodded plants turned brown only a few days after the control plants with no apparent differences among varieties or maturity groups. Seed moisture levels when pods on green-stem plants turned brown were the same as the seeds on control plants.

The green stems contained much higher levels of soluble sugars, starch and N than the control plants when 95% of the pods were brown. The 50% depodding treatment always had higher levels (often more than twice as much) than the 25% treatment.

Reducing the pod load produced classic green-stem symptoms – the remaining pods matured at roughly the same time as the control, but the stems stayed green. To understand this phenomena, we have to consider what goes on in a normal plant during seed filling.

Soybean plants start to senesce early in seed-filling. The enzymes in the leaves responsible for plant growth are destroyed and the ammo acids are shipped out to the growing seeds. Sugars and nitrogen stored in the stems are also translocated to the developing seeds. The plant basically destroys itself to support seed growth, leaving very little sugar and N in the abscised leaves and stems.

The lack of pods reduced redistribution of sugars and N to the seeds, so the stems stayed green. This same process can cause the leaves to stay green instead of turning yellow and falling off the plant. The cause of green stem seems to be an abnormal reduction in the pod load that prevents the normal senescence processes from occurring. So, the question – what causes green stem - is replaced with the question - what reduces the pod load?

Plants that are infected with certain viruses (e.g., bean pod mottle virus or tobacco ring spot virus) often exhibit reduced pod loads. Insects feeding on pods (stink bugs are a classic example) obviously reduce the pod load. A variety of environmental stresses (e.g., moisture stress) will increase flower, pod abortion, and reduce the pod load potentially causing green stem. Any stress that reduces the pod load can cause green stem.

The variety of causal agents makes managing green stem a real challenge, especially when the plants are set up for green stem well before green stems are visible.

What should a producer do when faced with a field full of green stems? Since the seed moisture in the pods on the green stem plants is similar to those on non-green stem plants, one option is to grit your teeth and grind those green stems through the combine.

Another option is to wait for the green stems to turn brown (or for a frost to kill them) before harvesting. Unfortunately, the delay may increase pod shattering, or disease may infect seeds before harvest, causing reductions in yield and/or quality. Obviously, neither option is very attractive.

There is no neat simple solution to the problem of green stem. Keeping your fields as disease and insect free as possible will help, but it won't protect you from the environmental aspects of this problem. When faced with green-stem syndrome it pays to remember that "The art of life is to know how to enjoy a little and endure much" William Hazlett (essayist, 1778 – 1830).

Adapted from Egli, D.B. and W. P. Bruening. 2006. Depodding causes green-stem syndrome in soy-bean. Crop Management. doi:10.1094/CM-2006-0104-01-R5.

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Assessing the Accuracy of Rainfall Reporting by Weather Services

Dr. Mohammad Shamim, Grain Crops Agronomic Extension Associate
Robbie Williams, Farm Business Owner
Dr. Chad Lee, Director- Grain & Forage Center of Excellence, UK Grain Crops Specialist

Accurate rainfall reporting is important in various sectors such as flood prediction and mitigation, water resource management, climate studies, and public safety. In agriculture though, its importance can never be over-emphasized. When reporting is accurate, farmers can anticipate the moisture levels in their fields and plan their activities without unnecessary trips, saving time and fuel. In precision agriculture, accurate rainfall data is essential for irrigation planning, managing water budgets, running crop simulation models, and applying fertilizers and chemicals efficiently. Knowing the correct amount of rainfall is vital for irrigation scheduling. But how reliable is the rainfall reporting?

To address this question, Robbie Williams, a farm business owner from Henderson, Kentucky, who advocates for ground-truthing technology, decided to verify the accuracy of three weather services (referred to as Apps) provided by agricultural giants: FarmServer from Beck's Hybrid, Climate FieldView from Bayer, and Operation Center from John Deere. Robbie and his collaborator, Shamim, from the University of Kentucky, created 18 identical one-acre polygons across a 10 by 20-mile stretch on his farms in Henderson, Kentucky. These polygons served as separate fields in the Apps for which daily rainfall (in inches) was reported by the Apps. Robbie installed rain gauges in the center of each polygon to collect observed data. John Deere and Beck's Hybrid provided the 5-inch capacity rain gauges.

Data from five rainfall events was collected from late June to mid-July and analyzed using the R language. The rain gauges were carefully read the morning after a rainfall event. The rainfall data was downloaded as weather reports. Notably, the rainfall data is not a forecast, which can be more or less biased, but a rainfall report generated at the end of each day (11:59:59 p.m.). A simple linear regression was used to see the correlation between gauge reading and estimated rainfall. Additionally, percent bias was calculated to measure the average tendency of the reported rainfall to be lower or greater than the gauge reading.

Results revealed considerable variations among the Apps and between the estimated and observed rainfall. Climate FieldView and JD OpsCenter consistently overestimated rainfall and had a positive bias of 37% and 60%, respectively. FarmServer, on the contrary, had a bias of 21%, with a tendency to overestimate when rainfall was lower than an inch and to underestimate as the rainfall increased beyond an inch (**Figure 1, top panels**). Climate FieldView tended to be less biased at lower rainfall but more so as the rainfall amount increased. FarmServer was positively biased at lower rainfall but tended to be negatively biased as the rainfall increased. Unlike Climate FieldView and FarmServer, JD OpsCenter had a higher positive bias, irrespective of the amount of rainfall (**Figure**

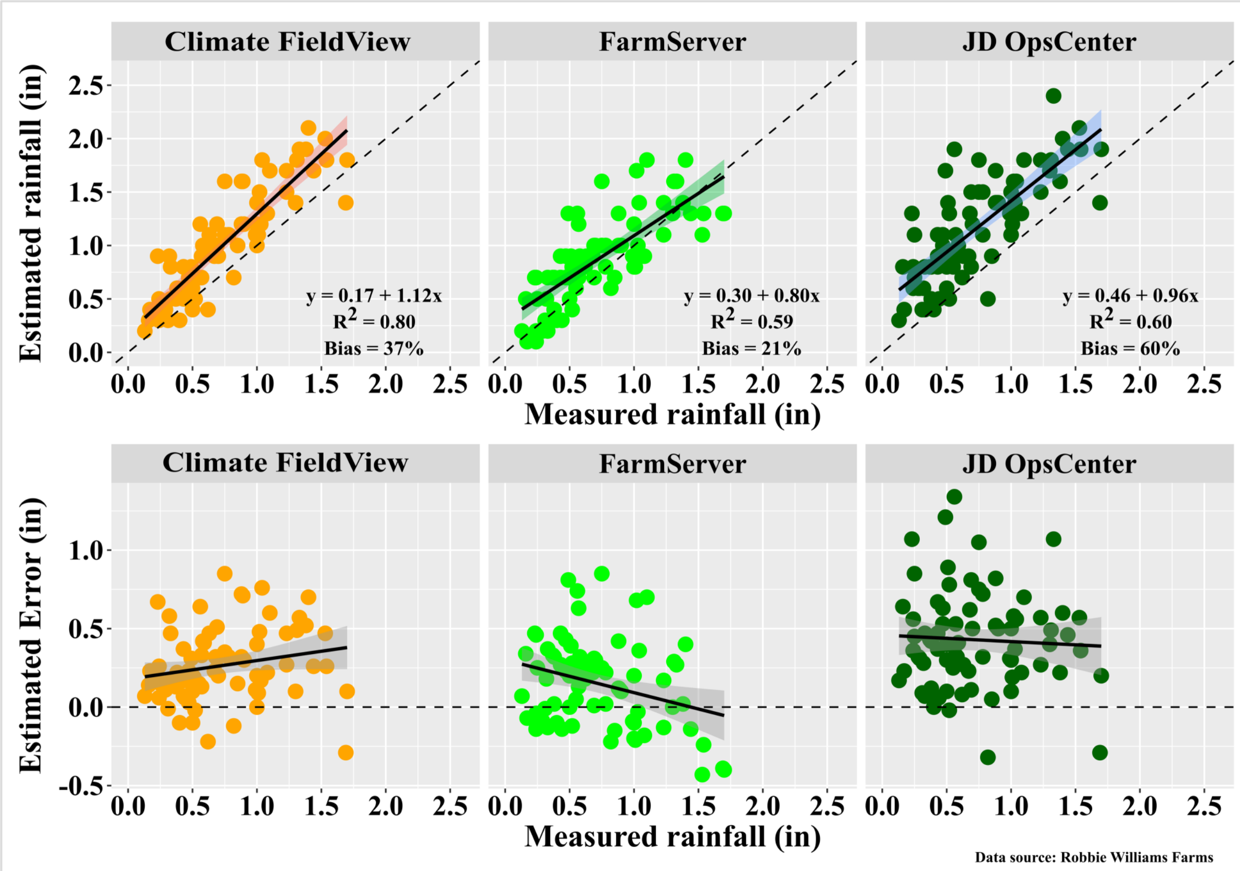

Figure 1: (Top panels) Scatter plots showing correlations between measured rainfall (Gauge reading) and estimated rainfall (Estimated by Apps). bottom panels) correlation between measured rainfall (Gauge reading) and estimated error (estimated rainfall – measured rainfall).

Figure 2 compares the performance of the three weather apps using key statistical parameters. Climate FieldView demonstrates the highest correlation with gauge readings and a lower centered normalized root mean square error (Centered nRMSE). However, it tends to overestimate rainfall in the current dataset. This means that Climate FieldView is more accurate in catching the trend of measured rainfall but less precise in terms of catching variability (relatively higher standard deviation, bias, and MAE). FarmServer App shows moderate correlation with gauge readings and has relatively higher Centered nRMSE; however, it has the lowest standard deviation and MAE, suggesting that FarmServer is more precise in catching variability (lower standard deviation, bias and MAE) but is less accurate in catching the trend of measured rainfall (lower correlation with gauge reading) compared to Climate FieldView. In contrast, JD OpsCenter shows similar correlation and Centered nRMSE to FarmServer but has a higher standard deviation and Centered RMSE. This suggests that JD OpsCenter significantly overestimates rainfall, making it both less accurate and less precise.

This finding has important implications for water budgeting in which precipitation is one of the major inputs. When used in irrigation where soil moisture is adjusted based on rainfall, inaccuracy of rainfall reporting in soybeans requiring 25 inches of moisture could, in reality, lead to up to a 10-inch water deficit depending on the weather App. In other words, your irrigated soybeans may still be exposed to water stress despite the fact that you irrigated them on time. Using ground-based, satellite-based, and reanalyzed products, Sun et al. (2018) also found considerable variations and inconsistencies in rainfall estimation, reporting that inconsistencies could soar up to 12 inches a year among these products. Our findings highlight the importance of carefully evaluating remotely accessed services (Doppler radars, satellites, etc.) for high-precision applications.

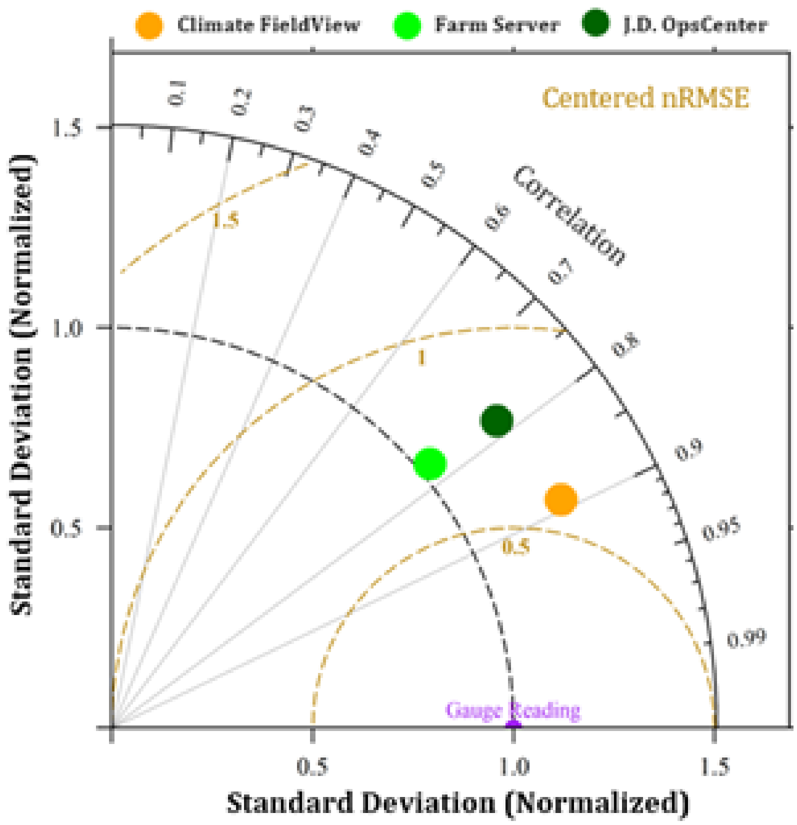

Figure 2: Taylor diagram showing comparison Among the Apps and between the measured rainfall (gauge reading) and reported rainfall (data from the App). The orange contours show centered normalized root mean square error (Centered nRMSE), which measures the discrepancy between the gauge reading and Apps based on their variations, rather than absolute value. A larger nRMSE means less accuracy. The angle from the x-axis shows a correlation between the Apps and gauge reading. A higher correlation means better estimation. Values on the x and y-axis show normalized standard deviation. It should match or be close to 1.0 for better prediction.

Sources:

Sun, Q., Miao, C., Duan, Q., Ashouri, H., Sorooshian, S., & Hsu, K. L. (2018). A Review of Global Precipitation Data Sets: Data Sources, Estimation, and Intercomparisons. Reviews of Geophysics, 56(1), 79–107. https://doi.org/10.1002/2017RG000574

Robbie Williams, a grower from Henderson County and a long-term partner of the University of Kentucky, played a pivotal role in conceptualizing, funding, and executing this experiment

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KENTUCKY YIELD CONTESTS

The Kentucky Extension Yield Contests are administered by the University of Kentucky Cooperative Extension Service. Additional information, contest rules and entry forms for these contests can be found on KyGrains.info or Scan the QR codes below:

2024 Kentucky Corn Production Contest

Send in harvest results within two weeks of the final supervised yield check per individual entry or no later than **December 2, 2024**, whichever is the earlier date.

Contest Classes

A. Division I: Tillage, Non-irrigated

B. Division II: No-Till, Non-irrigated

C. Division III: White Corn, Non-irrigated

D. Division IV: Irrigated Corn

The Kentucky Extension Corn Production Contest and the NCGA Corn Contest are two separate contests.

2024 Kentucky Soybean Production Contest

Forms A, B, & C Must Be ENTIRELY completed and submitted on or before **November 30, 2024** to be eligible for awards.

1. **Soybean Yield Contest**

   A. Full Season - Non-Irrigated

   B. Full Season - Irrigated

   C. Double Crop - Non-Irrigated

   D. Double Crop - Irrigated

2. **Soybean Quality Contest** (oil and protein)

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2024 Fall Crop Protection Webinar Series scheduled for October and November

Sign up now for a popular webinar series that addresses timely topics regarding integrated pest management for field crops. University of Kentucky Martin-Gatton College of Agriculture, Food and Environment extension specialists have once again organized the Fall Crop Protection Webinar Series, hosted through the Southern Integrated Pest Management Center. Each webinar will begin at 10 a.m. ET/9 a.m. CT, and will be one hour in length. Continuing education credits for Certified Crop Advisors and Kentucky pesticide applicators will be available.

2024 Fall Crop Protection Webinar Series

This year the webinars will be held Oct. 15, Oct. 29, Nov. 12, and Nov. 26. Pre-registration is required to attend each webinar. The webinars are open to agriculture and natural resource county extension agents, crop consultants, farmers, industry professionals, and others, whether they reside or work in Kentucky or outside the state. Pre-registration links and schedules follow:

Webinar #1: Oct. 15 — Dr. Raul Villanueva, Extension Entomologist
Title: Dealing with stink bugs and other insect pests in 2023-24
Webinar link: https://zoom.us/webinar/register/WN_MAppWNeZR5yCSoTGMGUj_Q

Webinar #2: Oct. 29 — Dr. Kiersten A. Wise, Extension Plant Pathologist
Title: Maximizing disease control AND return on investment for corn fungicides
Webinar link: https://zoom.us/webinar/register/WN_irdgz-OATPy3hCKsOVxyGQ

Webinar #3: Nov. 12 — Dr. Travis Legleiter, Extension Weeds Specialist
Title: Spray Application Parameters – The Offensive Line of Herbicide Applications
Webinar link: https://zoom.us/webinar/register/WN_rxH9T0W4T4a3HZRFAqGA1w

Webinar #4: Nov. 26 — Dr. Carl Bradley, Extension Plant Pathologist
Title: Management of important wheat diseases in Kentucky
Webinar link: https://zoom.us/webinar/register/WN_NUrPmPdgQICwWGHR-qOCEw

UPCOMING EVENTS

Fall Crop Protection Webinar Series

Oct 15, Dealing with stink bugs and other insect pests in 2023-24

Oct 29, Maximizing disease control AND return on investment for corn fungicides

Nov 12, Spray Application Parameters – The Offensive Line of Herbicide Applications

Nov 26 Management of important wheat diseases in Kentucky

2025

Kentucky Commodity all Crop Protection Webinar Series

January 16, 2025

Winter Wheat Meeting

February 4, 2025

2025 Kentucky Crop Health Conference

February 6, 2025

Wheat Field Day

May 13, 2025

Pest Management Field Day

June 26, 2025

Corn, Soybean & Tobacco Field Day

July 22 or July 29, 2025

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