Corn & Soybean News

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2021 Weed Control Options Come Into Clearer View

The recent announcements of the EU approval of RR2XtendFlex (RoundupReady 2 XtendFlex) soybean and EPA approval of three dicamba products has brought a clearer view of soybean weed control options available to Kentucky farmers in 2021. Prior to these two announcements the waters were murky with unknowns of if the flexibility of the RR2Xtendflex system would be available and if any dicamba formulations would be available to spray on any dicamba tolerant soybean acres. With the recent announcement came answers and clarification, but also prompted a few more questions and restrictions.

The most recent event to occur was the approval of Xtendimax (Bayer), Engenia (BASF), and Tavium (Syngenta) for applications to DT (dicamba tolerant) soybean. The three labels stayed largely unchanged from previous versions although crops outside of DT soybean and DT cotton have been removed from the labels. Restrictions of nozzles, tank mixes, sprayer speed, boom height, wind speed, and temperature inversions remain the same as previous labels. The restrictions that have changed are rate changes for Xtendimax burndowns, application cutoff date/growth stages, increases in buffer requirements, and the new requirements of a volatility reduction agent or buffer agent. Each change is described below:

- Xtendimax can only be applied at a rate of 22 fl oz/a per application, regard less of application timing. Previous la bels allowed up to 44 fl oz/a Xtendimax for preplant/burndown applications, but that rate is no longer labeled.
- All three labels have a federal cutoff date of June 30th and no application can be made after that date. The Xtendimax la bel also indicates a cutoff soybean growth stage of R1, whereas the Tavium label has a soybean growth stage cutoff of V4. In both cases whichever occurs first (date or growth stage) takes precedent. The Engenia label does not include a cut off growth stage, thus June 30th is the cutoff for this product.

- Down wind buffers have been extended from 110 ft in the previous labels to 240 ft in the new labels. Similar to previous labels these buffers can be included in directly adjacent roads, mowed grassy areas, corn fields, DT soybean fields, fields prepared for planting, and/or areas covered by a building. THIS BUFFER IS NOT INTENDED FOR PROTECITON OF DICAMBA SENSITIVE CROPS, THE LA BELS REMAIN THE SAME IN THAT AP PLICATIONS CANNOT BE MADE IF THE WIND IS BLOWING TOWARDS A SENSI TIVE CROP SUCH AS NON-DT SOYBEAN, TOBACCO, VINEYARDS, AND TOMATOES.
    - These buffers can be reduced with the use of hooded/shielded spray ers or other approved drift reduc tion technologies (DRT), as outlined on each label website.
    - Areas in which endangered species are present may need a 310ft down wind buffer plus a 57 ft omnidirec tional buffer. A list of these areas can be found on the Bulletins Live 2 website.
- The addition of a volatility reduction agent (VRA) or buffer agent is also re quired for all three labels in addition to drift reduction agents (DRA) that were required by previous labels. The list of approved VRA or buffers can be found on each respective products label website.

As in the past, dicamba specific training will still be required prior to application of Xtendimax, Engenia, and/or Tavium. This training will be offed by the registrants and will largely be available online.

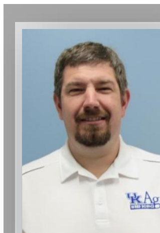
The additional restrictions bring some clarification to past issues of the previous dicamba labels, but the additional restrictions certainly do not make their application easier. The extension of the downwind buffer to 240 ft may cause havoc as many Kentucky fields are surrounded by trees and thus the buffers will have to be placed within the production field being sprayed. While the distance in necessary to protect our natural resources and endangered species, 240 ft can add up to numerous acres very quickly. In some cases, the area will be large enough for applicators/farmers to question the feasibility of applying the product to a given field.

The addition of the June 30th cutoff date places a hard deadline on applications, whereas past labels in which growth stages were used allowed many applications to continue to occur in the hot and humid months of July and August. Weather conditions in Kentucky in July and August simply are not ideal for dicamba applications in any crops, not to mention the numerous sensitive crops that are out during those time of year including tobacco. This cutoff date does however eliminate a lot of possible uses for double crop soybeans that likely will not be planted until late June and early July, so growers may need to seek an alternative herbicide programs for double crop soybean acres.

Despite the increase in restrictions of the new dicamba labels, the announcement of these labels comes on the heels of the approval of RoundupReady 2 XtendFlex soybean by the EU and thus full clearance for commercial production of those soybean varieties. The availability of RR2XtendFlex soybean varieties brings versatility to the Xtend platform that can be compared to its closest competitors. The XtendFlex soybean offers resistance to glyphosate and dicamba the same as RR2Xtend, but also offers glufosinate resistance. The addition of glufosinate offers postemergence flexibility for farmers who are dealing with glyphosate resistant broadleaves such as Palmer amaranth or waterhemp. The biggest fallacy, in my opinion, of the RR2Xtend soybean varieties was that farmers were largely married to dicamba for postemergence applications when dealing with waterhemp and Palmer amaranth, especially with the increasing incidence of PPO-resistance in these two weed species. In many cases a farmer/applicator was stuck in between a rock and a hard place when deciding when to apply dicamba under restrictive conditions and a rapidly growing weed. The addition of glufosinate offers a bit more flexibility and can allow a farmer to make an effective postemergence application of glufosinate if environmental conditions or surrounding crops do not allow for a timely application of dicamba. It must be said, though, that glufosinate is very capable of drifting the same as any other herbicide and thus if the wind is blowing at high speeds towards a sensitive crop no herbicide application, glufosinate, dicamba, or other should be applied.

As has been the message from University of Kentucky Weed Science in the past, the specific dicamba formulation one wants to apply and/or when to apply glufosinate matters less than the residual herbicide applied. Anybody choosing to raise RR2Xtendflex soybean who is dealing with Palmer amaranth or waterhemp must remain vigilant and apply robust preemergence herbicides. Research supported by the Kentucky Soybean Board has shown that even with the flexibility of the RR2XtendFlex soybean platform the use of a residual herbicide with 2 to 3 effective sites of action is more influential on end of season waterhemp and Palmer control than the choice or sequence of postemergence herbicides. This message applies to all herbicide tolerant soybean systems and will continue to be the message for these two troublesome weeds.

Up to the recent two approvals of RR2XtendFlex soybean and Xtendimax, Engenia, and Tavium there was a lot of unknowns in weed control going into 2021. These recent approvals have brought a lot clarification to what farmers will have available for weed control in 2021 and their options are now fairly large which is great for soybean farmers.



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Soybeans and Corn Quality Could Have Been Affected by Stink Bugs in 2020

Description of condition

This past growing season an outbreak of stink bugs occurred in Central and Western Kentucky. Stink bug egg-masses (Figures 1) were easily found while scouting for insects in soybean fields during mid-August. Later, first nymphal stages were observed (Figure 2), and during the first and second weeks of September all immature stages and adult stink bugs were tallied in 30 commercial soybean fields in twenty KY counties (Caldwell, Calloway, Christian, Crittenden, Daviess, Fulton, Graves, Hardin, Henderson, Hickman, Hopkins, Livingston, Lyon, Marshall, McLean, Logan, Muhlenberg, Ohio, Todd, and Trigg), and three research plots at the University of Kentucky's Research and Education Center (REC) at Princeton.

Soybeans and corn in Kentucky are affected by several stink bug species (Figure 2). These stink bugs include the green stink bug (*Chinavia hilaris*), brown stink bug (*Euschistus* spp.), southern green stink bug (*Nezara viridula*), brown marmorated stink bug (*Halymorpha halys*) and red shouldered stink bug (*Thyanta custator*).

Figure 1. Egg masses of green stink bugs; mature eggs change color before hatching (right). (Photo by Raul Villanueva)

Figure 2. Nymphal stages of the brown marmorated (left), green (center) and brown (right) stink bugs. (Photo by Raul Villanueva)

This article describes damages observed in soybeans and corn kernels due to a late stink bug occurrence.

Injures in soybean and corn

In soybeans, stink bug damages are highly visible due to the direct injury they cause to pods and beans during the reproductive stage of the plant. Adult and immature stink bug stages feed piercing tender terminals, and developing pods. This causes direct damages to beans and may cause poor seed development (aborted seeds, reduced seed size or seed deformation). Therefore, it lessens yield and quality of beans. (Figure 3).

Figure 3. Beans showing stains and aborted seeds caused by stink bug damage in 2020. (Photo by Raul Villanueva)

In corn seedling, stink bug feeding causes circular to oblong shaped holes in leaves as they emerge from the whorl, twisting of the whorl, and if heavy infestation and multiple feeding occurs, death of the growing point may happen. As stink bugs appeared during milk to hard dough stage, their damage showed dented, shrunken, or stained kernels (Figure 4).

Figure 4. Left: Undamaged corn ear (top) and two ears showing damage caused by stink bugs (bottom). Right: Corn ear zoomed to show shrugged and stained kernels. (Photo by Raul Villanueva)

Compared with previous years it seems that 2020 was a "great year for stink bugs." Tallies of stink bugs conducted in seven Kentucky counties (McLean, Henderson, Daviess, Ohio, Caldwell, Lyon and Crittenden) present an idea of this situation. In only three commercial soybean fields (Caldwell, Christian and Ohio counties) the numbers of stink bugs were below the economic thresholds of 9 stink bugs for the R1-R3 development stages or 36 stink bugs for R4-R6 per 100 sweeps (Figure 5). In addition, in nine out of thirteen locations the numbers tallied were considerable high (above 20 stink bugs/100 sweeps). Tallies were not conducted in commercial corn fields, but corn samples from farmers presented ears with similar damages as shown in Figure 4.

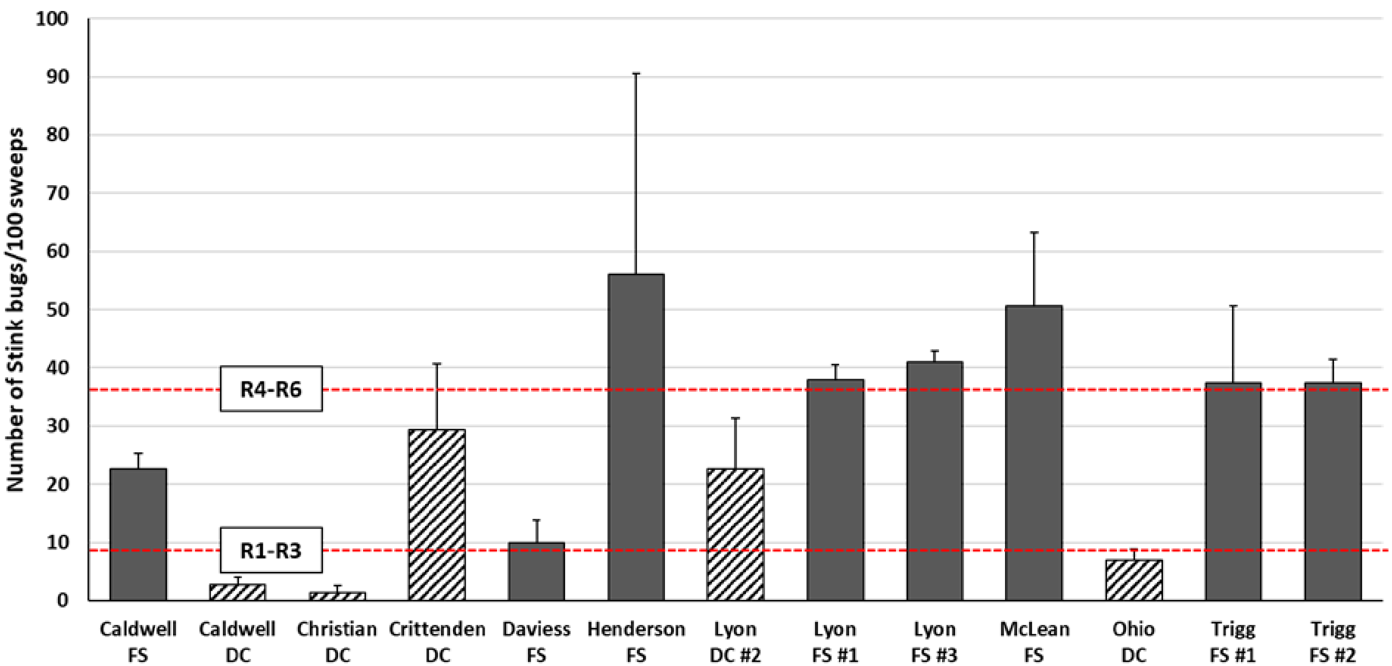

Figure 5. Mean (±SEM) numbers of stink bug tallies conducted during the first and second weeks of September 2020 in 13 commercial soybean fields in 9 KY counties. Economic threshold of 9 and 36 stink bugs per 100 sweeps for R1-R3 and R-4-R6 development stages, respectively, shown by red dashed line.

Management

Scouting for stink bugs is one the main tools of integrated pest management, and it should be conducted to control pests effectively. The recommended economic threshold is 36 stink bugs/100 sweeps during R1-R3 soybean stage in Kentucky. In North Carolina, the economic threshold for the R1-R2 corn stage is to treat if more than 28 stink bugs are found sampling 100 plants. Under the conditions described above for 2020 - increase of stink bugs during late reproductive stages of corn and soybeans developments- the use of insecticides may not be recommended. However, harvesting earlier may be an option if moisture conditions are reasonable.

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The Ins and Outs to Soil Carbon Sequestration

As we head towards winter, there's been more talk about soil carbon sequestration (storage) as soil organic carbon, brought on in part by a recent announcement proposing a value of \$15 per "metric ton carbon dioxide equivalent". This has stimulated some questions, and as a member of a science advisory committee to the now defunct Chicago Climate Exchange, I guess I deserve these. They are a combination of both chemistry and mathematics, fun topics for us all.

First question: What is a "metric ton carbon dioxide equivalent (mt CO_2eq) ", in terms of soil organic matter? To answer that, we need some other facts/conversions: A metric ton = 1000 kg = 2200 lb. A lb-mole of carbon dioxide (CO_2) = 44 lb and contains 12 lb of carbon (C). So, 1 mt CO_2eq = 2200 lb CO_2eq. Converting that to C, we get 2200 lb CO_2eq x 12/44 = 600 lb C, which is stored/sequestered in the soil as soil organic carbon (SOC). Soil organic matter (SOM) contains 58% SOC, so 2000 lb SOM x 0.58 = 1160 lb SOC. This means that 1 mt CO_2eq is the same as 600/1160 = 0.52 ton SOM.

Second question: The payment assumes the grower executes one or more management practices. How does the grower know that the level of carbon sequestration paid for was achieved? The short answer is – the grower can't make that guarantee. The payment also assumes, using published field research data and modeling/forecasting, that the practice or combination of practices will bring about the carbon sequestration that was paid for. Changes in SOM are hard to measure. For example, an average topsoil weight is assumed to be two million pounds per acre (2,000,000 lb/A). If the topsoil contains 2.5% SOM, then we have: 2,000,000 x 0.025 = 50,000 lb SOM/A = 25 ton SOM/A. An annual sequestration rate of 1 mt CO_2eq/year = 0.52 ton SOM/year, which is only 2.1% of the total SOM or 0.05% of the whole soil weight. To measure such a change – small each year – we need a lot of years. Long-term field research sites were used to get these data, and then modeling is used to "cover the gaps" and estimate values for other spaces and for future seasons.

Third question: I grow no-till corn and long-term trials involving corn are out there. What do those studies show? UK and Purdue research (studies that I know) has found that about 10% of above-ground stover (AGS) carbon and 20% of the below-ground root/root exudate residue (BGR) carbon are sequestered, yearly. I use these numbers knowing that the UK study site was warmer (encourages residue mineralization) and no-till (discourages mineralization) while the Purdue site was colder (discourages residue mineralization) and fall plowed (encourages mineralization). If you grow 200 bushel corn, estimated corn residue levels are: 200 bu x 56 lb grain/bu x 0.845 lb grain dry matter/lb grain = 9464 lb grain dry matter = 9464 lb AGS dry matter (I'm assuming corn's harvest index is 0.5). This gives a corn total above-ground biomass (grain plus stover) of 9464 x 2 = 18928 lb grain plus stover biomass.

I need this number because the BGR dry matter estimate is about 17% of total biomass, and 18928 x 0.17 = 3218 lb BGR dry matter. Corn residues (both AGS and BGR) contain 40% C, so we have 9464 lb AGS x 0.4 lb C/lb AGS x 0.1 lb SOC/lb C = 379 lb SOC sequestered from AGS and 3218 lb BGR x 0.4 lb C/lb BGR x 0.2 lb SOC/lb C = 257 lb SOC sequestered from BGR. Total SOC sequestration would be 636 lb SOC. The sequestered SOM would be 636 lb SOC x 100 lb SOM/58 lb SOC = 1097 lb SOM = 0.55 ton SOM.

While SOM is being added to the soil via the crops/cover crops being grown, there is mineralization of indigenous SOM going on (the soil microbes are at work) at a rate of about 1% per year. For our soil with 2.5% SOM (25 ton SOM/A), that means a loss: 25 ton SOM/A x 0.01 ton SOM/yr = 0.25 ton SOM/A/yr. So, with 200 bu corn per acre, the net sequestration is 0.55 - 0.25 = 0.3 ton SOM/A. Comparing 0.3 ton SOM/A to the 0.52 ton SOM/A value I calculated above, we wouldn't net 1 mt CO_2eq/A in sequestered C with 200 bu corn.

Fourth (and last) question: Are there other factors that we need to consider? The short answer is yes. For me, the most important of these other factors is that C sequestration is accompanied by nitrogen (N), phosphorus (P) and sulfur (S) sequestration. The SOM contains all these elements (and others) and these are subject to the same rules – sequestration means that these nutrient elements remain generally unavailable. As in the example given above, there will be some SOM turnover every year, but the 'net' impact is supposed to be sequestration – soil storage of C and associated organic N, P and S.

Let's look at the 1 mt CO_2eq = 0.52 ton SOM. Remember that SOM is 58% SOC and add that the average soil science textbook C:N:P:S weight ratio in SOM is around 120:10:1.3:1.3, we find that we have 0.52 ton SOM x 2000 lb SOM/ton SOM x 58 lb SOC/100 lb SOM x 10 lb N/120 lb SOC = 50 lb N. Similar calculations give 6.5 lb S and 6.5 lb P x 142 lb P_2O_5/62 lb P = 15 lb P_2O_5. Replacing these nutrients with dry fertilizer; ammonium sulfate (AS, 21-0-0-24S) at $270/ton for the S and part of the N, diammonium phosphate (DAP, 18-46-0) at $430/ton for the P_2O_5 and another portion of the N, and urea (U, 46-0-0) for all the remaining N, we will need to buy:

6.5 lb S x 100 lb AS/24 lb S x 1 ton AS/2000 lb AS x $270/ton AS = $3.66 (27.1 lb AS) and 27.1 lb AS contains 5.7 lb N = (27.1 lb AS x 21 lb N/100 lb AS); 15 lb P_2O_5 x 100 lb DAP/46 lb P_2O_5 x 1 ton DAP/2000 lb DAP x $430/ton DAP = $7.01 (32.6 lb DAP) and 32.6 lb DAP contains 5.9 lb N = (32.6 lb DAP x 18 lb N/100 lb DAP); (50 - 5.7 - 5.9) lb N = 38.4 lb N x 100 lb U/46 lb N x 1 ton U/2000 lb U x $360/ton U = $15.02 (83.5 lb U).

So, each 1 mt CO_2eq = 0.52 ton SOM also contains $(3.66+7.01+15.02) = $25.69 in S, P and N, respectively. At $15 per mt CO_2eq, we recover about 100 x ($15/$25.69) ≈ 60% of that value.

In summary, and as a soil scientist, I think recommendations that increase soil carbon sequestration are generally positive, improving soil health and productivity. Those practices that are beneficial to the producer and to SOM levels, like no-tillage, are win-win practices. For other recommendations, I think that all costs associated with these need to be transparent and well considered. Studies on soil formation tell us that SOM tends towards an equilibrium value for each soil/environment and that larger inputs are required to bring about those last small increments that give the highest SOM values. The law of diminishing returns eventually applies.

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Useful Resources

KyGRAINS.info

College of Agriculture, Food and Environment
WHEAT SCIENCE GROUP
http://wheatscience.ca.uky.edu/home

Crops Marketing and Management Update

Kentucky Pest News
Entomology · Plant Pathology · Weed Science
http://kentuckypestnews.wordpress.com/

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