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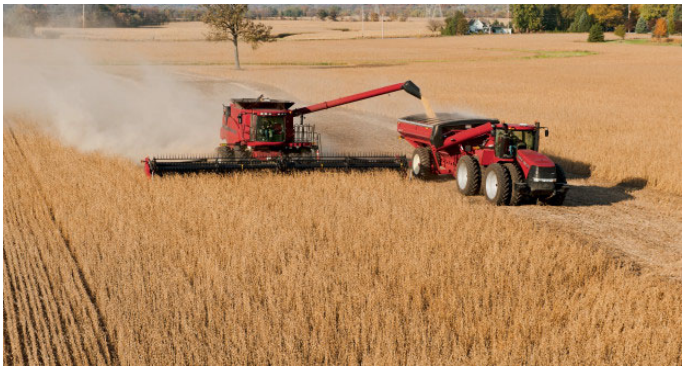
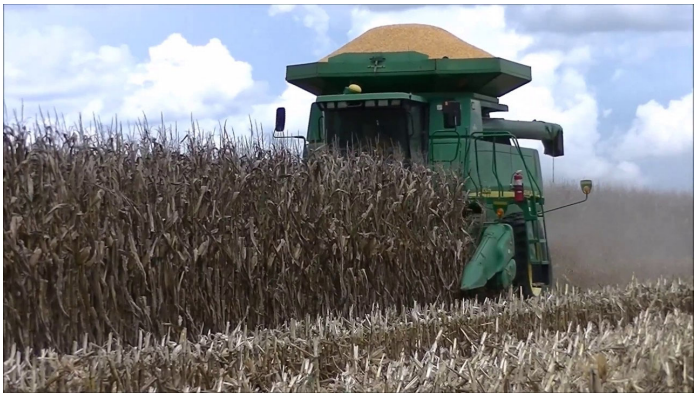
Auglaize County OSU Extension Weekly Agriculture Newsletter – October 16, 2019

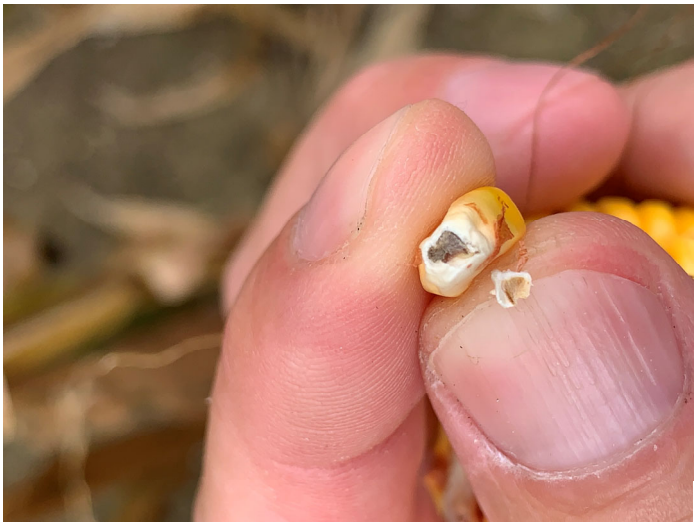
Scouting and Latest Information



Harvesting soybean



Harvesting corn



Corn at black layer = maturity

Hello!! Good afternoon! I pray you are well. We received little rain this past week!. Be sure to read the article about Tar Spot in corn. If you find any let me know. I have not seen any to date in the county.

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If you are a buyer and need some hay or have hay to sell, let me know. Call the OSU Extension office at 419-739-6580.

I will be in China for the next two weeks. I will try to get some type of a newsletter done each week, but it will not have much for current local conditions. Sorry about this.

Joke: **What farm animal keeps the best time??**

Rain fell only 1 day this past week. Rainfall on Friday, October 11th ranged from a trace at 2 miles southeast of Fryburg to 0.7" just north of Wapakoneta on Buckland – Holden Road. Rainfall for the week is the same as for Friday. Average rainfall for the week was 0.39". Temperatures were average to cooler than normal for the week.

Tasks for the week included: Tillage in preparation for winter wheat and cover crops, harvesting hay and corn silage, seeding wheat, hauling manure, harvesting corn and soybean, and tiling fields.

I was unable to drive the county on Sunday.

Wheat – Wheat is still being planted.

Alfalfa – Alfalfa looks pretty good but it is moisture stressed in parts of the field.

Corn – Corn stage is from R5 (dent) to R6 (black layer) with most of it at the R6 stage of development. I would think that at least 50% of fields are at black layer. Only about 2% of corn has been harvested in the county. I have not heard any yields yet. Last year at this time 43% of the corn was harvested. I left the corn condition the same again this week since we are so close to harvest. The condition last week was 2% excellent, 14% good, 74% fair, 10% poor and 0% very poor.

Soybean – Soybean growth stage is from R6 (full sized soybean) with yellow leaves to R9 (all pods brown). Most fields are at the R9. About 40% of soybeans have been harvested in the county. Yields are ranging from 45 to 65 bushels per acre with most in the 50 to 55 bushel per acre range. Moistures are from 10 to 18% with most in the 11 to 13% moisture range. Last year 43% of soybeans were harvested at this time. I left the crop condition the same this week since there is little impact at this stage. The condition last week was 2% excellent, 20% good, 64% fair, 12% poor, and 2% very poor.

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Weeds – Scout wheat fields for weeds. Scout fields for winter annual and biennial weeds.

Insects - I'm now down to just monitoring brown marmorated stink bug. I have no numbers for this week, so here is last week's again:
2 to 8/trap with average of 4.7/trap; Last week was 0 to 4/trap with average of 1.3/trap

There were NO changes to the XtendiMAX, Engenia, FeXapan, or Tavium labels. The Engenia label still has the most approved products compared to XtendiMAX and FeXapan. No new herbicides were added to the XtendiMAX label this past week, which totals 152 herbicides. No new adjuvant was added the XtendiMAX label, now totaling 344. No new nozzles were added to the XtendiMAX label, which totals 26. No new Drift Reducing Adjuvant (DRA's) was added to the XtendiMAX label this week, making a total of 58 DRA's. No new nutritional products were removed from the XtendiMAX label which totals 203. No new products were added to the Insecticides, Fungicides, Plant Growth Regulator and Other group on the XtendiMAX label which totals 61. No new adjuvants were added to the Engenia label, which now totals 482. No new herbicides were added to the Engenia label, which brings the total herbicide count to 144. No new products were added to the Other category (growth regulators, and fungicides) on the Engenia label, which totals 29. No new insecticide were added to the label which currently has 28 products. No new Drift Reducing Adjuvants (DRA's) were added to the Engenia label, which totals 105. No new nozzles were added to the Engenia label, which totals 29. No new nutritional products were added to the Engenia label which totals 177 products. No new product was added to the pH Modifier group of the Engenia label which totals 16 products. The FeXapan label has many of same the products and nozzles as the XtendiMAX label, but NOT all are the same, so check the FeXapan label carefully. There are 120 herbicides, 49 DRA's, 312 adjuvants, 151 nutritionals, 44 insecticides, fungicides, and others, and 26 nozzles that have been approved for the FeXapan label. There are 13 herbicides, 66 DRA's, 181 adjuvants, and 41 nozzles approved for use with Tavium.

Answer to joke: A watch dog!

Report from Brazil Trip

No further information at this time.

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Fall Herbicide Applications

Purple deadnettle, henbit, common chickweed, marestail (horseweed), field pennycress, shepherd's-purse, whitlowgrass and cressleaf groundsel are already present in fields. These are winter annual species. I have seen purple deadnettle and common chickweed up to 4 inches tall and marestail and field pennycress rosettes up to four inches in diameter! Due to the late planting this spring more winter annuals went to seed than normal, so there are more winter annuals in most fields than last year at this time.

The only way to try to eliminate seed production of these winter annual weed species before planting next spring is to apply herbicides this fall. If marestail is not controlled this fall, it becomes very difficult to control next spring and requires at least four active ingredients to obtain good control. One other weed that is important to control in the fall is cressleaf groundsel, the yellow flowering weed in the spring. If planting is delayed this plant will produce seed and blow around for long distances similar to marestail. This past spring lots of cressleaf groundsel went to seed because of the late planting. There is so much of this weed around that it is becoming prevalent in hay, pastures, and wheat fields. This weed is poisonous to livestock when it is fresh and when it is dried, making it a serious problem for livestock producers.

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Winter annual weeds begin emerging the beginning of August and continue to emerge until the soil freezes. New emergence is likely after each rain event in the fall. This wide window of emergence can make control more difficult.

When should I apply fall herbicides? The window of application is quite wide, but must be done before soils freeze or becomes saturated with water making it difficult to spray. Apply fall herbicides towards the end of October, especially if just glyphosate and 2,4-D are applied. Application of a residual herbicide can control those plants emerging after the application. It is always best to spray in as warm and sunny conditions as possible, although it is better to spray in cool conditions than not spray at all. The cold weather will take herbicides longer to control plants and control may not be perfect, but some control is better than nothing. The injured plants will be more easily controlled next spring.

What should I spray? A mixture of at least two herbicides is necessary. The most cost effective herbicide combination should be the one applied. One program is to apply glyphosate at 0.75 to 1.125 pounds acid equivalent per acre (22 to 32 fluid ounces of Roundup) plus 2,4-D ester at 1.5 pints per acre (of a 4 pounds per gallon formulation). The earlier this treatment is applied the more likely new emergence after the application will occur. Another popular combination is a premixture of 2,4-D and dicamba, such as Brash or Weedmaster applied at 1 quart per acre plus metribuzin at 6 ounces per acre. This program is fairly effective, but can be reduced under cold weather conditions because 2,4-D amine in these products is less effective under cold weather. The rate of the 2,4-D plus dicamba premixture should be increased to 1.25 quarts per acre if dandelion is present. The metribuzin is important to control common chickweed and provides some residual control for the fall (not the spring) allowing this treatment to be applied earlier. These two programs allow any crop to be planted next spring while most other combinations available lock you into a specific crop next season. Express could be used in the place of metribuzin to control common chickweed, but it will not control marestail like metribuzin. Another program would be to apply Canopy at 3 ounces per acre plus glyphosate at 0.75 pounds acid equivalent per acre plus 2,4-D ester at 1.5 pints per acre (of a 4 pound per gallon formulation), but you are locked into planting soybeans next spring. If residual products are applied in the fall, residual herbicides will still be required next spring to control summer annual weeds, especially the marestail that can also emerge in the spring.

C.O.R.N. Newsletter

https://agcrops.osu.edu/newsletter/corn-newsletter

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Sampling for Soybean Cyst Nematode – Fall is the time!

Harvest is well underway and once the soybeans are off the fields this provides some time to sample soil for the SCN populations. The SCN Coalition theme for the next few years is **What's your number?** Do you know which fields have SCN and what the current population is sitting at? If its high, then there is a second number – what is the SCN type? Which addresses the bigger question can it reproduce on the SCN resistance source PI 88788 or Peking. All of these numbers can impact management of this root pathogen and future losses.
The situation in Ohio: We know that the state is now "polluted" with SCN, fortunately most of those fields are at very low levels – which is where they should be kept.

From samples received to date of a statewide survey for Ohio of 50 counties as part of the SCN Coalition sampling, here are the numbers from 378 fields.

SCN Population Level	Total Fields	% Processed
None detected	151	39.9
Trace (40-200)	91	24.0
Low (200-2000)	79	20.9
Moderate (2000-5000)	34	8.9
High (5000+)	24	6.3
Total	378	

Yield losses have been measured as high as 25% with no above ground symptoms in populations of 2,000 and higher.

Summary to date:

- 60% of the Fields sampled in 2018 and 2019 in Ohio have detectable levels of SCN
- 15% of these have populations at economically damaging levels – do you know your number?

If your SCN report in the past has come back as:

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1. **Not detected**: this is not surprising. Remember that SCN sits in pockets and can we quite variable. Continue to monitor your fields.
2. **Trace**: May begin to measure some yield loss on susceptible varieties, especially on lighter soils.
3. **Low**: Plant SCN resistant varieties or rotate to a non-host crop (corn or wheat).
4. **Moderate**: Rotate to a non-host crop and follow with SCN resistant varieties the following year. We have planted susceptible varieties in fields with this level of SCN and have recorded 20 to 50% yield loss.
5. **High**: rotate to a non-host crop for two to three years, then sample SCN to determine if populations have declined to a level where soybeans can be planted again.

SCN is picky about what it feeds and reproduces on but it does like a few weed hosts and cover crops as well as soybean. If you have SCN in your fields , it is important to also control winter annuals such as purple deadnettle, but also avoid cover crops such as several of the clover's, cowpea and common & hairy vetch.

So it is time to sample! We recommend sampling in the fall – because in most cases this is what the population will be in the spring. With the warmer weather this year and hopefully no frozen ground should give ample time to collect and process the samples in plenty of time for spring planting. Processing of samples does cost time and money, so here are a few thoughts on how to sample or how to target your sampling to get the best information for your money.

For several counties there is still free sampling available please contact your county educator to target some of those problem (low yielding) fields.

Updated information on where to send the samples for processing for a fee:

OSU C. Wayne Ellett Plant and Pest Diagnostic Clinic
8995 E. Main St. Bldg 23
Reynoldsburg, OH 43068
Phone: 614-292-5006
www.ppdc.osu.edu - follow this link to download forms to go along with the samples
Brookside Laboratory Inc.
200 White Mountain Dr.
New Bremen, OH 45869
417-977-2766, info@blinc.com
www.blinc.com
Spectrum Analytic Inc.
1087 Jamison Rd. NW
Washington Court House, OH 43160
740-335-1562
www.spectrumanalytic.com

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For some additional information on Management of SCN – always check Ohio's SCN fact sheet and several other resources as well: https://u.osu.edu/ohscn/

https://soybeanresearchinfo.com/soybean-disease/soybean-cyst-nematode-scn/- link to the 5th edition of the SCN guide developed through the North Central Soybean Research Program.

Link to recent findings and sampling protocol for SCN: https://www.youtube.com/watch?v=FQgg-UPQdcs&feature=youtu.be

Author(s):
Anne Dorrance

Managing Phosphorus for Yield and Reduced Edge of Field Losses

A new factsheet highlights eight steps to reducing edge of field P losses while maintain soils for increase crop production. The Phosphorus Nutrient Management for Yield and Reduced P Loss at Edge of Field-AGF-509 (https://ohioline.osu.edu/factsheet/agf-509) highlight practices that can be used to reduce edge of field losses of P. There are eight field specific steps to considered.

1. Control erosion
2. Identify surface inlets to tile and use appropriate practices to reduce surface losses

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3. Consider ground and weather conditions prior to application of fertilizer and manure
4. Take a representative soil test
5. Use soil test as screening tool to meet crop production and water quality goals
6. **STP value of 40 PPM Mehlich III or less:**

CROP YIELD—Reduce risk of crop yield losses with nutrient application.

- A STP of 20 PPM defines the critical level. At 20 PPM or less, the risk of yield loss increases. Annual in season P nutrient application recommended. Recommendations to build STP to critical level are available.
- The maintenance STP range is 20–40 PPM. Recommended rate of P is equal to P removed in harvested crop. Annual application is not required. Risk of yield loss is low with flexibility to delay application one (or more) growing seasons, if needed.

WATER QUALITY—The greatest risk for event P losses occur when nutrient application is followed by runoff-producing rainfall. Use the following steps to reduce P loss risk at application:

- Use an agronomic rate of no more than two years' worth crop removal as recommended in the Tri-State Fertilizer Recommendations.
- Time fertilizer applications so predicted rainfall 12 hours after application is less than a 50 percent chance of more than 1 inch of rainfall.
- Time organic nutrient applications so predicted rainfall 24 hours after application is less than a 50 percent chance of more than 0.5 inches of rainfall.
- Subsurface placement reduces losses over surface application.

7. **STP value above 40 PPM Mehlich III:**

CROP YIELD—Response to fertilizer with STP greater than 40 PPM is highly unlikely.

- Do not apply additional fertilizer due to lack of economic return.
- Organic applications should be determined using P content from testing the organic source and not exceed P crop removal rate for the next two (and no more than three) crops in the rotation.
- Consider in-crop application to a nitrogen-using crop to reduce purchased N, maximizing economic return to organic application.
- Where in-crop application is not used, incorporate organic nutrients.

WATER QUALITY—The risk of P loss increases with STP values over 40 PPM, with greater risk after 150 PPM.

- Do not apply additional fertilizer: due to lack of economic return.
- Do not make organic applications when STP is greater than 150 PPM.
- Follow NRCS 590 site and rate criteria between 40 to 150 PPM. • Time organic applications so predicted rainfall 24 hours after application is less than a 50 percent chance of more than 0.5 inches of rainfall.

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- Use the Ohio P risk index, field scale hydrology/water quality models, or monitoring to evaluate site risk for P losses and need for further site BMPs. See step 8.

  8. BMPs for high risk P loss sites: Monitor fields for P loss using the Ohio P risk index and field scale hydrologic and water quality models. For sites with predicted high P losses, consider one or more of the following water management practices based on fitness and cost effectiveness for field site:

- Production practices that increase soil organic matter to retain water on site
- Drainage Water Management (NRCS 554)
- Nutrient removal wetlands (NRCS 656)
- P Precipitating Filter
- Saturated Buffer (NRCS 604)
- In-field water storage or detention basins

Author(s):
Greg LaBarge, CPAg/CCA

2019 Ohio Soybean Performance Trial- South Region Results Available

The South Region results of the 2019 Ohio Soybean Performance Trials are available online here: https://stepupsoy.osu.edu/news/2019-ohio-soybean-performance-test-south-region-results Results from the north and central regions will be added as harvest continues.
Early soybean varieties (2.7 to 3.6 RM) yielded an average of 60.4 and 49.0 bu/acre in Preble and Clinton County, respectively. The late soybean varieties (3.7-4.4 RM) yielded an average of 66.4 and 58.7 bu/acre in Preble and Clinton County, respectively.

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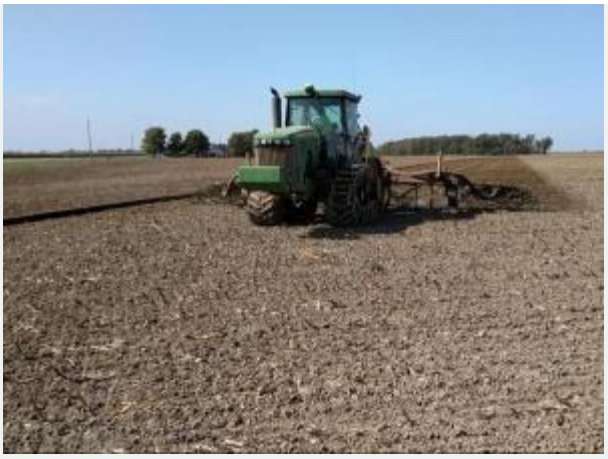
Surface Application of Manure to Newly Planted Wheat Fields



Several livestock producers have inquired about applying liquid dairy or swine manure to newly planted wheat fields using a drag hose. The thought process is that the fields are firm (dry), there is very little rain in the nearby forecast, and the moisture in the manure could help with wheat germination and emergence.

The manure nutrients could easily replace the commercial fertilizer normally applied in advance of planting wheat. The application of fall-applied livestock manure to newly planted or growing crop can reduce nutrient losses compared to fall-applied manure without a growing crop.

Both swine and dairy manure can be used to add moisture to newly planted wheat. It's important that the wheat seeds were properly covered with soil when planted to keep a barrier between the salt and nitrogen in the manure and the germinating wheat seed. It's also important that livestock producers know their soil phosphorus levels, and the phosphorus in the manure being applied, so we don't grow soil phosphorus levels beyond what is acceptable.

If the wheat is planted at its typical one-inch depth and swine or dairy manure is surface applied there should be no problem applying 5,000 gallons per acre of swine manure or 8,000 gallons per acre of dairy manure. If the wheat is emerging when manure is being applied, there is the possibility of some burn to the wheat from swine manure, but this has not happened in fields I have looked at in past years. If the wheat is fully emerged, there is little concern for burning.

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If incorporating manure ahead of planting wheat, try to place the manure deep enough (at least three inches) so the manure does not impact the germination and emergence of the wheat crop. Another option is to incorporate the manure and wait a few days before planting the wheat. If incorporated, the opportunity to carry some of the manure nitrogen through the winter could allow for a reduction in the amount of topdress nitrogen needed for the wheat crop next spring.

The application of 5,000 gallons of swine finishing manure could contain 200# of nitrogen, 100 pounds of P2O5 and 150 pounds of K2O. The application of 8,000 gallons of dairy manure could contain 175 pounds of nitrogen, 60 pounds of P2O5 and 150 pounds of K2O. Manure nutrient content can vary tremendously from one manure storage facilitate to another but stay reasonably consistence from the same facility year after year.

As always, print out the weather forecast when surface applying manure. Remember the “not greater than 50% chance of 0.5 inches of rainfall in the next 24 hours” rule in the western Lake Erie watershed. Also be certain to observe the proper setbacks from ditches and streams.

Author(s):
Glen Arnold, CCA

Tar Spot of Corn in Ohio Again this 2019

Tar Spot, a new disease of corn caused by the fungus *Phyllachora maydis*, was reported for the first time in Ohio at the end of the 2018 growing season. At that time, it was found mostly in counties close to the Indiana border, as the disease continued to spread from the middle of country where it was first confirmed in 2015. Over the last few weeks, there have been several new, confirmed report of Tar Spot in Ohio, this time not only in the northwestern corner of the state, but also from a few fields in central and south-central Ohio. As was the case last year, disease onset was late again this year, with the first reports coming in well after R4. However, some of the regions affected last year had more fields affected this year, with much higher levels of disease severity. It could be that Tar Spot is becoming established in some areas of the state due to the fungus overwintering in crop residue from one growing season to another. This is very consistent with the pattern observed in parts of Indiana and Illinois where the disease was first reported. We will continue to keep our eyes out for Tar Spot, as we learn more about it and develop management strategies. You can help by looking for Tar Spot as you walk fields this fall, and please send us

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samples.

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What does it look like? Even though corn is drying down, if Tar Spot is present, you can still detect it on dry, senescent leaves almost as easily as you can on healthy leaves. So, please check your fields to see if this disease is present. "**Symptoms of tar spot first appear as oval to irregular bleached to brown lesions on leaves in which raised, black spore-producing structures call stroma are formed... giving the symptomatic areas of the leaf a rough or bumpy feel to the touch… resembling pustules on leaves with rust. Lesions … may coalesce to cause large areas of blighted leaf tissue. Symptoms may also be present on leaf sheaths and husks.**" As the name of the disease suggests, symptoms look like the splatter of "tar" on the leaves. In some cases, each black tar-like spot may be surrounded by a necrotic halo, forming what is referred to as "fish-eye" lesions.

What causes Tar Spot and how damaging is it? In the past, the greatest impact of this disease in terms of yield loss were observed when *P. maydis*-infected plants were co-infected with a second fungus called *Monographella maydis. In other words, the damage tended to be much more severe when the two fungi worked together to affect the plant. So far,* only the first fungus, *P. maydis*, has been reported in the US, but based on work done in Illinois, this pathology alone is capable of causing substantial yield reduction on highly susceptible hybrids when conditions are favorable and infections occur early.

Where did it come from and will it survive and become established? At this point it is still unclear as to how Tar Spot got to the US in the first place and how it continues to spread. The fungus is not known to be seed-borne or infect other plant species, so corn seeds and weeds are unlikely to be the sources of inoculum. However, the fungus can survive and be moved around on fresh and dry plant materials such as leaves and husks. In addition, since spores of the fungus can be carried be wind, it could be blowing in from neighboring states/counties/fields. Although not yet confirmed through survival studies, it appears that the fungus could be overwintering in infected crop stubble between growing seasons.

What should I do if I find Tar Spot? If you see anything that fits the description of, or resembles (Picture) Tar Spot, please inform your state specialist, field specialist, or county extension educator, but most importantly, please send samples to my lab (1680 Madison Ave, Wooster, OH) for confirmation. We will also be using your samples to study the fungus in order to develop effective management strategies.

Read more about Tar Spot of Corn at:

https://cropprotectionnetwork.org/resources/articles/diseases/tar-spot-of-corn
https://www.extension.purdue.edu/extmedia/BP/BP-90-W.pdf

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New and Upcoming Episodes of the Agronomy and Farm Management Podcast Focus on Harvest and Compaction

The Agronomy and Farm Management Podcast has new episodes available to check out. Episode 36 features an interview with Jason Hartschuh and Will Hamman where we discuss tips

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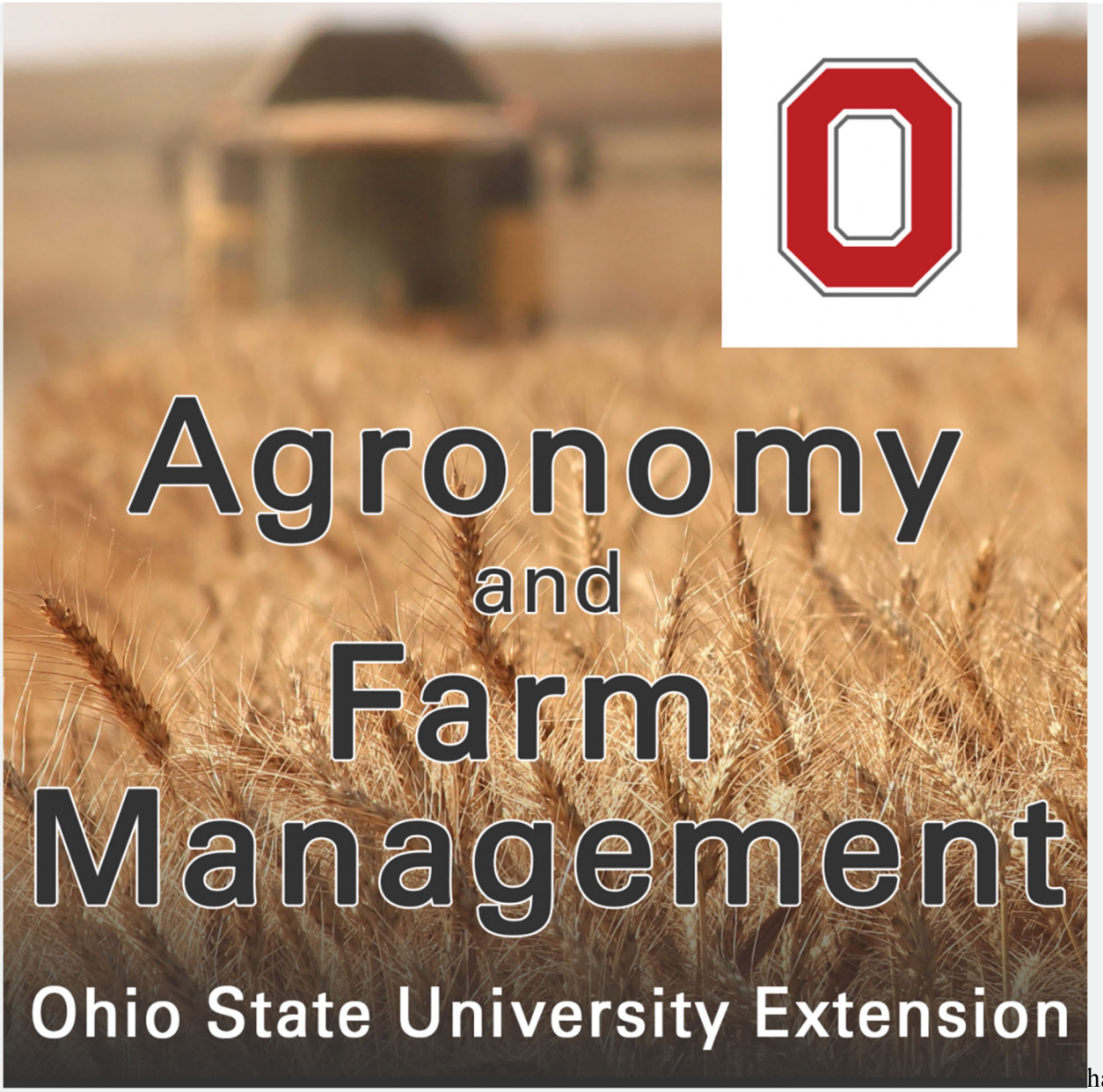

for harvesting late planted or drought stressed crops this fall. This episode is a must listen to help maximize the amount of your crop that will make it to the elevator or bin even with the variability we are seeing in crop yields and quality.

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Episode 37 will be released Wednesday, October 16 and focuses on compaction. The extremely wet fall in 2018 and spring in 2019 led to field operations needing to be conducted even when soil conditions were not ideal increasing the risk of soil compaction occurring. Dr. Scott Shearer sits down with us to talk about soil compaction, what it is, the causes, how to avoid it, and how to mitigate it. To listen or learn about the podcast, visit go.osu.edu/AFM.

Author(s):
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Other Articles

Genetics to feed the world

UNIVERSITY OF CÓRDOBA

SOURCE: https://www.eurekalert.org/pub_releases/2019-10/uoc-gtf101419.php

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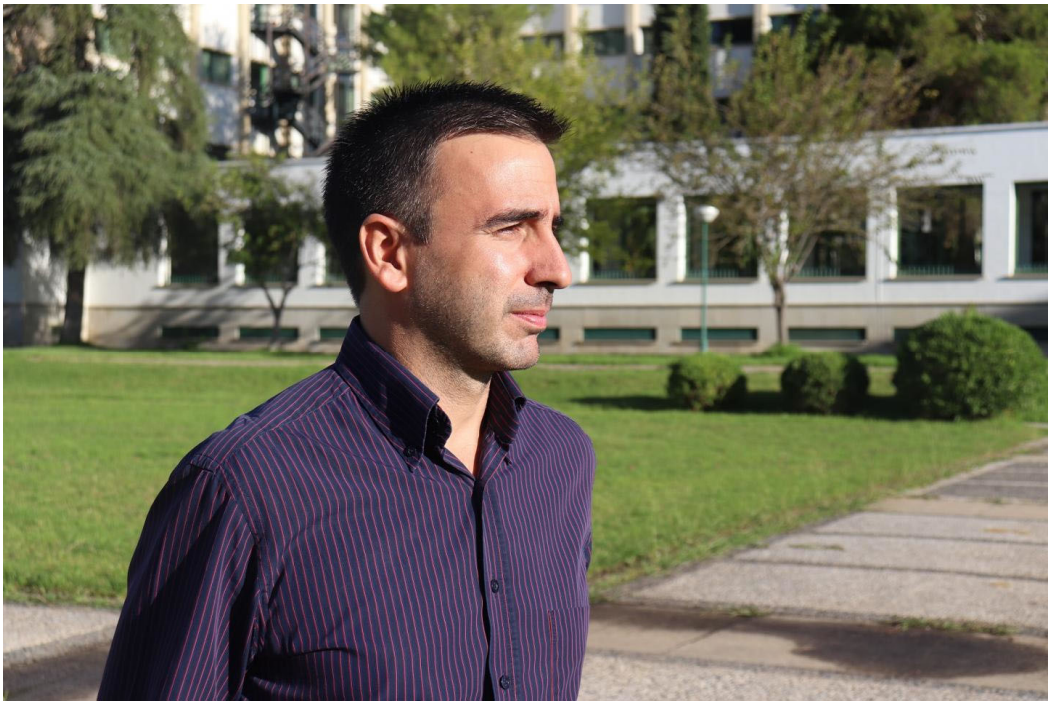

IMAGE: CARLOS GUZMAN, INVESTIGATOR OF THE UNIVERSIDAD DE CORDOBA

Wheat provides 20% of the total calories and protein content for the world's population and is a staple for more than 2.5 billion people around the world. However, the production system for this grain is currently facing several challenges that demand immediate solutions. How can wheat productivity increase in order to feed a population that will reach 9 billion in 2050 and at the same time deal with limited farmland and the harsh effects of climate change? Not to mention the threat of pests, for which it is necessary to find sustainable means instead of using harmful products.

The importance of this grain in the world's diet makes the search for the solutions to these challenges a matter of great urgency. In recently published research in the journal *Nature Genetics*, an international scientific team, including University of Cordoba researcher Carlos Guzmán, looked into the validity of genomic selection to improve wheat on a genetic level in order to cope with these problems.

"We are talking about testing whether it is possible to use information available in the genome to predict how productive a variety of wheat will be, if it will be drought- or heat-resistant and what quality its grain will have," explains Guzmán, who participated in the study via his work as head of the Chemistry and Wheat Quality

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Laboratory at the International Maize and Wheat Improvement Center (abbreviated to CIMMYT in Spanish) in Mexico.

According to the researcher, "thanks to this study, it will be possible to speed up improvement programs in order to develop new varieties of wheat, with less field work and less lab work."

The main aim of the study was to verify how precise the predictions done with genomic selection were for each characteristic of wheat. The results were quite varied. "For instance, the level of prediction was very good to determine resistance to certain diseases and grain quality but results were lower when attempting to predict yield," explains Carlos Guzmán.

Another aim was to find out which chromosomal regions of the DNA are associated with a specific characteristic in order to identify which gene or gene group needs to be worked with to improve each characteristic. Moreover, the identified chromosome regions turned out to be consistent over several geographical areas, meaning these results could be applied to other wheat improvement programs.

Though research has already been done in this area, this research project has the widest scope that has been done to date, due to the extent of the wheat populations and the diverse environments used to measure certain characteristics, such as field performance. In this specific case, experimental trials in over ten countries were used. The wide range of these countries include Canada, Mexico, India, Morocco and Sudan, leading to more precise results.

"The next step will be to see how we can integrate the genomic selection tool into a real wheat improvement program such as the International Maize and Wheat Improvement Center," reveals Carlos Guzmán. This program is one of the most important ones in the world. It is estimated that over 50% of the varieties of wheat grown around the world originally came from, or partly from, the International Maize and Wheat Improvement Center.

This program seeks to obtain varieties of wheat that are more productive, more disease-resistant, more tolerant to climate change and that produce grains that make flour suitable for making a range of different products. This can be done by genetic crossing and improvement. In addition to increasing wheat production, research is also being done to improve its nutritional content, given that most people who have wheat as a staple in their diet get insufficient iron and zinc.

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The next research projects will focus on improving genomic selection technology and finding new ways to predict yield. According to the researcher, "this tool will not do away with field testing but it will help reduce it, which will lower costs and save time."

Soil on moon and Mars likely to support crops

Mars soil simulant comparable to soil on Earth

DE GRUYTER

SOURCE: https://www.eurekalert.org/pub_releases/2019-10/dg-som101419.php

Researchers at Wageningen University & Research in the Netherlands have produced crops in Mars and Moon soil simulant developed by NASA. The research supports the idea that it would not only be possible to grow food on Mars and the Moon to feed future settlers, but also to obtain viable seed from crops grown there.

Wieger Wamelink and his colleagues at Wageningen University & Research, cultivated ten different crops: garden cress, rocket, tomato, radish, rye, quinoa, spinach, chives, peas and leek. The researchers simulated the properties of Lunar and Martian regolith and "normal" soil (potting soil from Earth) as a control.

Nine of the ten crops sown grew well and edible parts were harvested from them. Spinach was the exception. Total biomass production per tray was the highest for the Earth control and Mars soil simulant that differed significantly from Moon soil simulant. The seeds produced by three species (radish, rye and garden cress) were tested successfully for germination.

The article, "Crop growth and viability of seeds on Mars and Moon soil simulants", by Wieger Wamelink and colleagues has been published in De Gruyter's open access journal, *Open Agriculture*.

"We were thrilled when we saw the first tomatoes ever grown on Mars soil simulant turning red. It meant that the next step towards a sustainable closed agricultural ecosystem had been taken," said Wieger Wamelink.

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