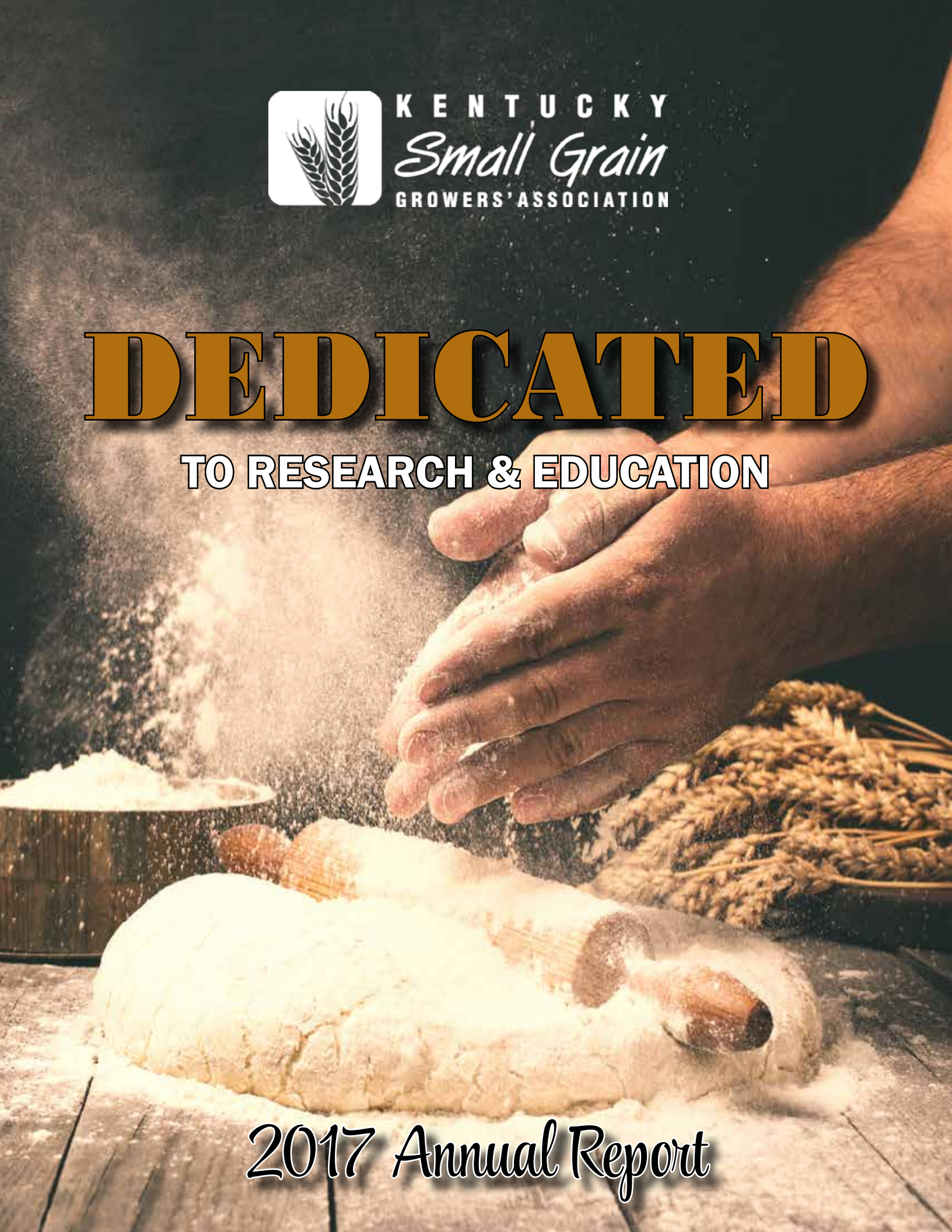
KENTUCKY
Small Grain
GROWERS' ASSOCIATION
DEDICATED
TO RESEARCH & EDUCATION
2017 Annual Report

KySGGA
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PLANTING A FUTURE:

Small Grain Growers Have Invested More than $3 Million in Production Research and Education

After 25 years of dedicating more than $3 million to production research, Kentucky wheat production has increased 87%. And while the past few years have not been record production years, the average wheat yields—80 Bu/A in 2016 and 77 Bu/A in 2017—are the highest recorded in Kentucky history. In fact, increases in average Kentucky wheat yields have exceeded that of corn for the same 25 year period. This tremendous growth is primarily due to the collaboration between farmers, the University of Kentucky's research and extension team, crop consultants, and end-users.

The Kentucky Small Grain Utilization Fund and our farmer-led Promotion Council was formed in 1991 to direct checkoff toward wheat and small grains research and grower education. UK's Wheat Science Group has worked to develop varieties that perform well under Kentucky conditions, and agronomic practices continue to be fine-tuned for the highest profitability. Much of our research centered on intensive management and no-till practices for many years, and now we are looking at technology and methods that may be considered beyond standard thinking: reducing the fragipan, soil irrigation, and disease control alternatives, to name a few.

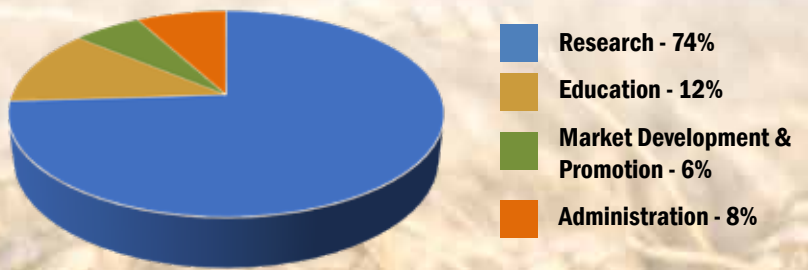
In this annual report, you will find reports on research, education, and marketing programs Kentucky Small Grain Growers supported over the past year. We also recently invested $250,000 in construction of the new University of Kentucky Grain and Forage Center of Excellence in Princeton, with additional research funding that will be matched by the Kentucky Agricultural Development Board in loans. Should you have questions about any of our programs, or would like to suggest funding opportunities or research projects, please contact our staff at 800-326-0906.

Annual Ky Small Grain Financial Report

From June 1, 2016 to May 31, 2017
Reviewed by Jones, Nale & Mattingly, PLC

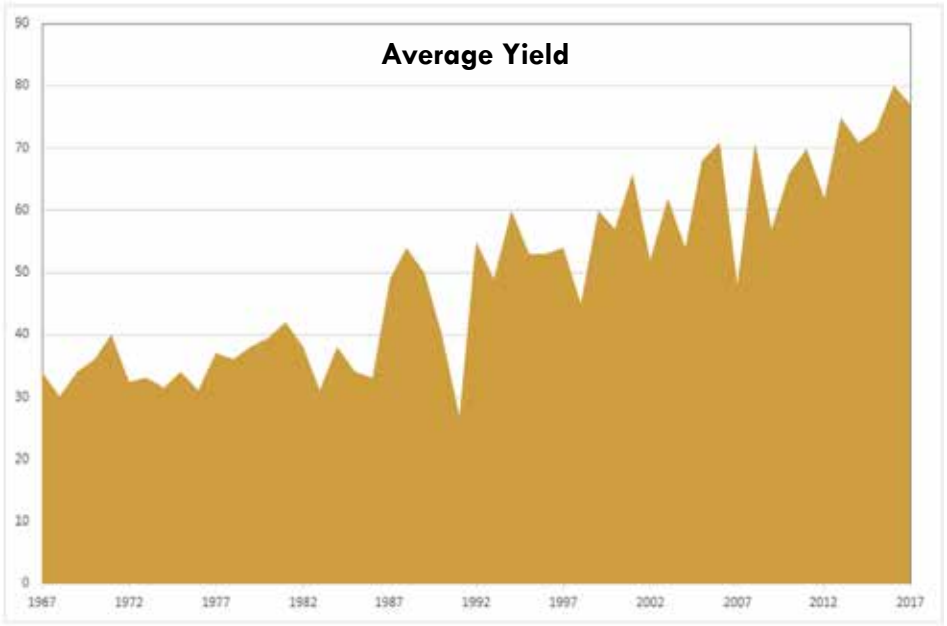
REVENUE		EXPENSES	
Checkoff Assessments	$353,520	Market Development	$22,772
Producer Refunds	-$20,952	Research	$267,186
Net Checkoff Income	$332,568	Education	$42,265
Interest Income	$2,367	Administration	$28,169
Total Revenue	**$334,935**	**Total Expenses**	**$360,392**

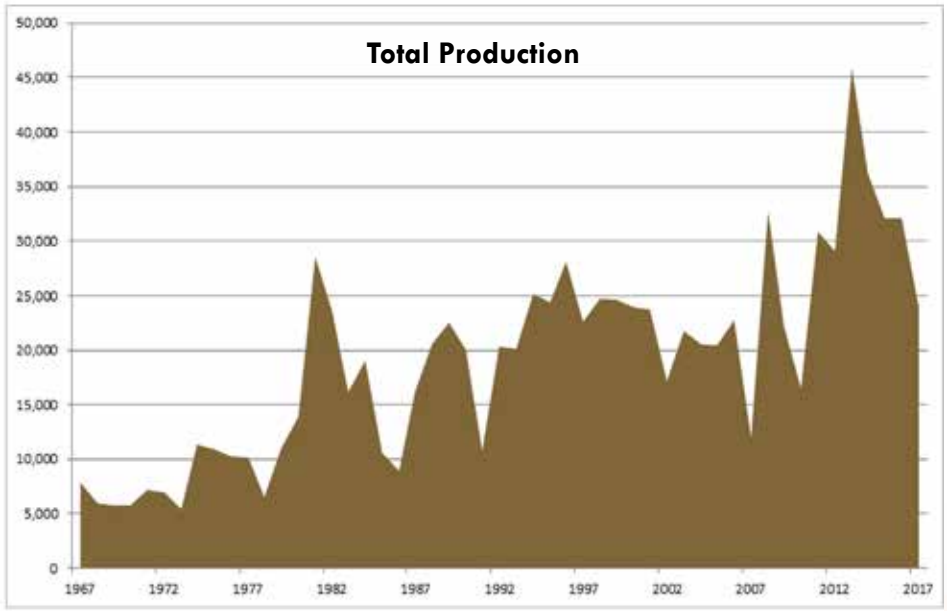
Distribution of Expenses

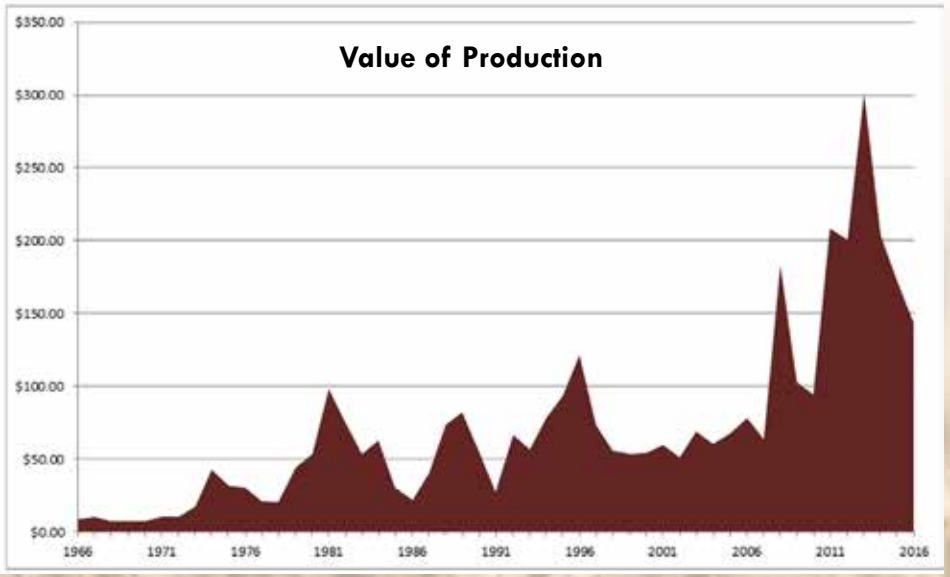


Kentucky Wheat Production (1967 - 2017)

Source: USDA-NASS







Kentucky winter wheat production lowest since 2010; yield 2nd highest

NASS released its Small Grains Summary Report the end of September from the Small Grains Production Survey.

"Kentucky wheat production dipped to the lowest level since 2010 based on a 25 percent decrease in harvested acres from 2016," said David Knopf, director of the NASS Eastern Mountain Regional Office in Kentucky.

"Producers planted 480,000 acres in the fall of 2016, and typically 75 to 80 percent of those acres are harvested for grain. However, freezing temperatures in mid-March damaged a number of acres resulting in those acres not being harvested for grain."

Kentucky farmers harvested 23.9 million bushels of winter wheat from 310,000 acres during the summer of 2017. This was down 25 percent from the previous year.

"Yields on harvested acres were very good, though," Knopf said. "The state average yield was 77 bushels per acre, down three bushels per acre from last year, but the second highest state yield on record."

Production of all wheat for the U.S. totaled 1.74 billion bushels, up slightly from the August 1, forecast and down 25 percent from 2016. Grain area totaled 37.6 million acres, down 14 percent from the previous year. The United States yield is estimated at 46.3 bushels per acre, up 0.7 bushels from the August 1, forecast and down 6.4 bushels from last year. The levels of production and changes from 2016 by type are winter wheat, 1.27 billion bushels, down 24 percent; other spring wheat, 416 million bushels, down 22 percent, and durum wheat, 54.9 million bushels, down 47 percent.

"Thank you to all the farmers for taking time to complete the NASS surveys," Knopf said. "We appreciate their efforts during what we know is a busy growing season."

Kentucky Small Grain Growers invest $785,000 in UK Grain and Forage Center for Excellence and related research

The Kentucky Small Grain Growers Association Board and Promotion Council voted this month to invest $250,000 in new graduate housing for the University of Kentucky Grain and Forage Center for Excellence and an additional $290,000 in UK grain-related research projects.

KySGGA's contribution to the Center since fundraising began in November 2015 totals $785,000. This amount will be added to the Center's goal of raising $15 million to be matched by the Kentucky Agricultural Development Fund.

"KySGGA is proud to be able to reinvest checkoff dollars that will benefit Kentucky farmers for generations to come," said Pat Clements, KySGGA president and Washington County farmer. "Our organization has been involved in this project from the very beginning, and the opportunity to leverage Kentucky Small Grain funds with matching dollars was a great step forward for this project."

More than $3 million in wheat and small grain check off contributions have been dedicated to Kentucky research over the past 25 years.

"There has been a unique partnership between the land grant university and farmers," said Don Halcomb, Kentucky Small Grain Promotion Council chairman and Logan County farmer. "One of the turning points in extension research was when UK field crops specialist Shirley Phillips worked with Harry Young to test the first plot of no-till corn more than 50 years ago. Research of this type has been very beneficial to the Kentucky farmer, and it is our responsibility to see that continue and move it forward, in the spirit of Young and Phillips."

In 2012, KySGGA also established a research endowment fund at the University of Kentucky to ensure the advancement of production research that is crucial to Kentucky's grain farmers.

Individual growers and businesses may donate to the fund, and KySGGA will match the sum of donations up to $50,000. In addition to cash, growers and businesses may make an above-the-line deductible donation of grain. KySGGA and growers have contributed more than $78,000 in gifts of cash, grain and matching funds to date.

"After 25 years of dedicating checkoff funds to production research, Kentucky wheat production has increased 87 percent," said Halcomb. "This tremendous growth is primarily due to the collaboration between farmers, UK's research and extension team, crop consultants and end-users."

Center director Chad Lee said he is honored to harvest the benefits of farmer investments.

"These partnerships keep Kentucky agriculture strong," Lee remarked.

Farmers interested in making a **"Gift of Grain"** donation to KySGGA's research endowment fund should visit www.kysmallgrains.org or contact Marci Hicks at UK at 859-257-7200.

Checks can be mailed to:

University of Kentucky College of Agriculture
Marci Hicks, Director of Development
E S Good Barn
1451 University Drive
Lexington, KY 40546-0097

Kentucky's Wheat Growers Take on Capitol Hill to Talk Farm Bill

From September 26-27, 2017, the National Association of Wheat Growers hosted around thirty growers from twelve top wheat producing states. They visited almost every House and Senate Agriculture Committee Member and their offices to discuss the importance of the Farm Bill. Among those attending were Kentucky Small Grain Grower leaders Pat Clements and Bernard Peterson.

"We are nearing the end of 2017 and with the Ag Committee working on drafting their versions of the Farm Bill, it was critical for NAWG's grower leaders to meet and discuss our priorities with key agriculture members and their staff," said David Schemm, NAWG President and farmer from Sharon Springs, KS.

In discussions, NAWG stressed that crop insurance is the most important risk management tool for growers and that it is vital to have a strong safety net program in the Farm Bill. Growers also urged members to maintain producer choice between revenue-based (Agriculture Risk Coverage) and price-based (Price Loss Coverage) programs and to make adjustments to enable them to function more effectively for wheat farmers. Other issues brought up during meetings included the need to double funding for MAP and FMD trade programs and to prioritize working lands conservation programs in the Conservation Title of the Farm Bill.

"It's important that our lawmakers hear from growers firsthand on how the Farm Bill is working for them," said Clements. "This is the best way to get the legislation passed quickly and working for all farmers."

KySGGA leaders Pat Clements and Bernard Peterson were among several wheat farmers who met with Senator Stabenow and other Senate leaders to discuss the Farm Bill.

UK and KySGGA Collaborate on Wheat Field School

By Edwin Ritchey, Extension Soil Specialist

A Wheat Field School training series was initiated at the University of Kentucky Research and Education Center (UKREC) to offer in-depth agronomic training to consultants, crop advisors, managers, agri-business, and producers of wheat. Trainings were developed as a hands-on, get dirty, collect samples rather than sit at a classroom or field day type setting to ensure participants were adequately trained and prepared to complete the topics presented. Each training session cost $60 to help offset program costs and were limited to 30 participants per session. Program income was also used to support an emergency wheat freeze meeting at UKREC to purchase supplies and lunch for the attendees.

Although this was a new program and format, we were pleased with the outcome of the first year of the field school. We targeted the major crop stages that influence when major management decisions had to be made. These included Greenup, Pre-Flower, and Pre-Plant. Topics appropriate to these growth stages were highlighted within each field school session. Specific examples of topics included: growth stage identification, nitrogen management, weed identification and management, herbicide symptomology, environmental influences on productivity, disease identification and management, tissue testing and interpretation, drill calibration and operations, seedbed preparation, seeding decisions, and seed treatment functions.

The Emergency Freeze Meeting covered topics of concern to those that experienced temperatures low enough that wheat could be injured and yield loss could occur. Fortunately, most wheat did not exhibit much damage or yield reductions. Topics covered were growth staging, how to dissect wheat plants to identify damaged wheat, alternate uses for wheat if grain yields were severely reduced, and management decisions that were necessary if wheat was not going to be harvested for grain.

We were pleased with participant involvement, diversity, and feedback. The three field schools and emergency freeze meeting had participant involvement from Kentucky, Tennessee, Indiana, Kansas, Missouri, and New Mexico and served consultants, agri-business, crop consultants, producers, insurance adjustors, and government organizations. The program is still developing, and processes will improve as we move forward. We feel this new program was successful, aligns well with the new Grain and Forage Center of Excellence, and ultimately will benefit Kentucky wheat producers.

View more photos at www.kysmallgrains.org.

Photos courtesy of Chad Lee, @KentuckyCrops

UK Hosts Distillers and Small Grain Farmer Leaders at Bourbon Field Day

Bourbon distillers, grain buyers and other members of the Kentucky Distillery Association visited the UK Spindletop Farm for a Bourbon Grains Field Day on August 8. Test plots with open-pollinated corn with century-old genetics were grown next to modern hybrids with the latest technology. Participants were encouraged to walk into plots and ask questions about the different types of corn. Farmers with the KySGGA were on hand to answer questions as well. Chad Lee also showed grain samples of barley and rye to participants to determine if grain was of adequate quality for milling.

Dr. Jeff Stringer discussed white oak management in Kentucky. All of the Kentucky bourbon barrels are made from white oak and these charred barrels add flavors and colors to the bourbon.

Lee said all seemed happy with the discussions and interactions.

KySGGA Vice President Michael McCain discussed corn pollination and grain fill with Jim Beam and Makers Mark staff.

Research Projects Approved for 2017/2018

Kentucky Small Grain Growers voted to fund the following research and grower education projects, for a total investment of $298,235, in the 2017-2018 growing season:

- Soft Red Winter Wheat Breeding & Variety Development - David Van Sanford, UK
- Improvement and Development of Barley for Use in Feed, Malt and Fuel - Wynse Brooks, VA Tech
- Enhanced Chia Production & Product Usage - David Hildebrand, UK
- Performance of Small Grain Varieties in Kentucky - Bill Bruening, UK
- Fragipan Remediation - Lloyd Murdock, UK
- Can Fusarium Head Blight Vomitoxin Levels Be Reduced with Agronomic Practices? - Carrie Knott, UK
- Updating Rye and Barley Management Guidelines for Kentucky - Chad Lee, UK
- Wheat Field Schools at University of Kentucky Research and Education Center (UKREC) - Edwin Ritchey, UK
- Soil Health Benefit from Winter Wheat in the Rotation - John Grove, UK
- Vertical Tillage or No-Tillage for Soft Red Winter Wheat - John Grove, UK
- Breeding New Cover Crop Rye Cultivars for the Midwest - Tim Phillips, UK
- Looking for Old and New Foes to Prevent BYDV Transmission on Wheat - Raul Villanueva & Carl Bradley, UK
- Improving Fungicide Application Recommendations for Managing Fusarium Head Blight of Wheat and Barley - Carl Bradley, UK
- Timed Insecticide Spray to Control Aphids and Reduce BYDV Infections - Raul Villanueva, UK
- Detection and Management of Herbicide-resistant Annual Ryegrass in Kentucky Wheat - Travis Legleiter, UK

Research REPORT

The Kentucky Small Grain Growers Association dedicates the largest portion of its budget to small grain research that may help increase grower success and profitability. The following report lists projects that are complete or continuing. Data and more in-depth results can be found at www.kysmallgrains.org.

Wheat Varietal Differences in Forage Yield Potential

By Bill Bruening, Research Specialist, University of Kentucky

Wheat is an important source of forage for many Kentucky growers. Approximately 20% of Kentucky's annual wheat acreage is not harvested for grain, and much of that acreage is utilized for forage production. One advantage of utilizing wheat for silage, green-chop, or hay production is that wheat forage production can be double-cropped with corn or full season soybeans. Additionally, wheat provides a reliable source of quality forage in the spring when other fall/summer sources are low in quantity and/or have deteriorated in quality. Wheat's potential for producing quality forage also allows growers some flexibility in crop utilization. Many acres are planted specifically for forage or grain production, but factors such as grain prices, forage supply/prices and crop condition (i.e. freeze damage) may affect end-use decisions based on potential profitability.

The time to harvest wheat forage is an important decision. Harvest timing is often dependent on if the crop is part of a double-crop system, weather conditions, labor/equipment issues, and the end use requirements of the crop (high quality forage [dairy] or greater yields of average quality haylage). A wheat silage crop for dairy forage should be cut at the late boot stage. At this stage the levels of energy, protein content and digestibility are high (similar to corn silage or alfalfa haylage). It is possible to double-crop with corn when harvested at this stage.

It is more common in Kentucky to harvest at later stages of development (up to the soft-dough stage). Biomass yields increase throughout the reproductive growth period, but the quality also declines throughout this period. Wheat cut at mid-dough stage produces what is considered average quality hay. Fiber content is higher and digestibility and protein are lower, but dry matter tonnage will be 30-60% greater than silage cut at the boot stage. Though not necessary, it is recommended for palatability purposes, that awnless (smooth) head type varieties be used if harvesting at this latter stage.

The University of Kentucky Small Grain Variety Testing Program evaluates wheat varieties for differences in forage yield potential. In 2016-17, 103 wheat varieties or experimental lines were planted in a small plot test with each variety replicated 4 times within the test. The test was harvested at the soft-dough stage with a small plot forage research combine and results were reported as tons dry matter per acre. Yields are reported for the current year's test, as well as the 2 and 3 year averages. In 2017, yields averaged 4.14 and ranged from 3.36 – 4.85 tons per acre. In 2016, yields ranged from 2.64 – 4.31 tons per acre, showing the dramatic differences in forage yield potential among wheat varieties. Due to natural variability of data from a single test, it is recommended that results from the 2 or 3 year average column be used for variety selection. The UK wheat forage variety test results table also lists the head type (smooth vs. bearded) for each variety tested.

Forage yields vary widely among wheat varieties. UK variety test data on forage yield potential are available at www.uky.edu/ag/WheatVarietyTest. For additional information, see AGR-160 Managing Small Grains for Livestock Forage, also available at the fore mentioned website.

Fragipan Remediation Update

By A.D. Karathanasis, Chris Matocha, John Grove, Dave McNear, Lloyd Murdock - University of Kentucky, Plant and Soil Sciences

The fragipan is a naturally occurring soil horizon that virtually stops water movement and root growth through the soil. Its depth averages about 20-24 inches in the soil types in which it occurs. The layer is due to the cementation of the soil particles with a silicate rich amorphous aluminosilicate binding agent. The fragipan is present in about 2.7 million acres of Kentucky soils and about 50 million acres in the U.S. Fragipan soils reduce yields of crops for 2 reasons: 1) limited water holding capacity due to limited soil depth 2) water saturated soil conditions during wet periods.

The fragipan itself is a silt loam soil that has been cemented. If the cementation is dissolved it would be very similar to the soil above it. The goal of this project is to try to dissolve the cementation and make a deeper soil that will hold more water for summer growing crops and reduce waterlogging in the winter which would make the soil better suited for winter crops and better support trafficking at this time of the year.

The approach to investigation of a remedy to the fragipan has three phases:

- Laboratory research and evaluation
- Greenhouse research and evaluation
- Field research and evaluation

The research on the fragipan by the research team is proceeding faster than originally expected. Of the many plants, compounds and combinations tested, there is one plant, potentially four compounds and possibly other materials that have been found to be effective in breaking apart the fragipan. **They are annual ryegrass, potassium chloride, potassium sulfate, sodium fluoride, sodium nitrate and possibly leonardite humate.** Previous research in Illinois offers additional support for the effectiveness of ryegrass.

Annual ryegrass has been chosen as the central focus of the greenhouse and field research due its notable advantages. Annual ryegrass roots apparently contain exudates that have a degrading effect on the fragipan. The deep root penetration also increases soil porosity and may facilitate the leaching of the four or five other effective compounds down to the fragipan. We are presently looking for varieties of annual ryegrass that are more effective in breaking down the fragipan and varieties that are more easily killed by glyphosate.

Through research findings in the laboratory, greenhouse and the field, we have gained enough confidence in the ryegrass treatment as a fragipan remedy and its yield increase potential, that we have begun cooperating with a few farmers across the state to establish on-farm trials. We have also found two fields in Kentucky that had a history of five years of annual ryegrass over a 10-year period which appears to have disintegrated the top five inches of the fragipan.

In addition to the four compounds that have shown promise in reducing the fragipan strength, we are continuing to experiment with other materials and additives that can accelerate the breakdown of the fragipan. The ones showing possible promise now are humates. They will be researched in combination with a ryegrass cover crop in the greenhouse and the field but at this time the results are mixed. We are continuing to look and have identified other plants that we hope will have this capability. They will be tested soon.

We are also finding lower bulk density and increased porosity as well as an enrichment in some organic compounds in the fragipan horizons undergoing degradation in the greenhouse where ryegrass is present when compared to the control. We are also finding compounds which we suspect are exudates released from the ryegrass roots which induce the fragipan degradation. If the exudates can be scientifically verified and identified, it will greatly aid in this effort and may lead us to a quicker and more effective method to remediate the fragipan.

The average yield increase of corn and soybeans over a three-year field research period for an annual ryegrass cover crop compared to no cover crop is an average of 9.8% per year on a fragipan soil at Princeton, Kentucky. The scientific evidence indicates that fragipan breakdown increases with time and the continued use of annual ryegrass as a cover crop. Therefore the yields should continue to increase with time.

The average yearly increase of corn grown after an annual ryegrass cover crop on a fragipan soil in southern Illinois is 3.7 bushels per acre per year over a 15-year period compared to the average corn yields for that area. This is not a scientific trial but indirect evidence on what might happen with time. The increase is accumulative resulting in an increase of 55 bushels per acre the 15th year. This results in an increased return of $1,228/ac over those 15 years for using annual ryegrass as a cover crop. This is calculated using $4/Bu for corn and an expense of $36.50/ac for planting and killing the cover crop. For 1,000 acres the increased return would be $1,228,000 over those 15 years.

With these limited results, it appears that it might be possible to increase yields of corn and soybeans by 25% on the fragipan soils by using an annual ryegrass cover crop. We also expect to improve the yields of wheat. A 25% increase would result in $500,000,000 in increased returns to Kentucky producers per year or $5,000,000,000 over a 10-year period on the 1.5 million acres of cropable fragipan soils in Kentucky. There are 2.7 million acres of total fragipan soils in Kentucky.

Wheat Breeding Project

By David Van Sanford

Crossing: We produced a total of 435 crosses in the greenhouse this season; this total includes single cross hybrids and three-way crosses where the hybrid is crossed to another parent. The single-cross hybrids will go back into the greenhouse this fall for an additional round of crossing, and the 3-parent F1 hybrids will be planted in headrows at Lexington this fall to produce F2 seed.

Line development: We grew F4 and F5 headrows at Lexington in 2017 and selected approximately 1,000 rows based on height, maturity, resistance to stripe rust and head scab and overall vigor. Seed has been packaged into envelopes will be put into a 1 rep Preliminary trial to be grown at Lexington and Princeton in 2017-18.

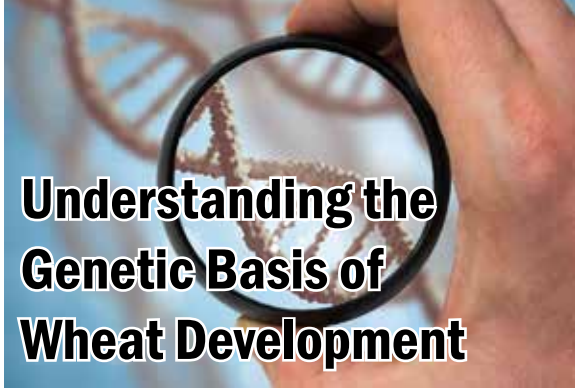
Yield testing: A very warm February followed by several nights of low temperatures led to concern about spring freeze damage to the wheat crop. However, after the threat of spring freeze, weather was ideal for grain filling and this was reflected in yields and test weights. Testing location averages were: Schochoh – 89 Bu/a; Princeton 87 Bu/a; Woodford 76 Bu/a; Lexington 93 Bu/a. Disease pressure was minimal, with little scab or stripe rust and less septoria leaf blotch than normal. We completed harvest at Spindletop farm on June 30, tied with 2016 for the earliest data of completion.

Scab screening: There was a high level of disease pressure in the irrigated, inoculated Lexington scab nursery, yet we were able to identify lines with resistance. For example, in one of our tests, scabby seed ranged from 5% to 72%. We are still waiting on DON data from the lab that processes our samples.

Purification and Increase: Headrows in Yuma, AZ were screened for uniformity and selected in mid May; seed was sent to us in early June. Seed from our top performing lines will go into large plot increases and will be treated as "breeder seed" that would be suitable for production of Foundation seed. We also grew small plot increases (~ 125 lb) at Spindletop farm for testing in the 2018 KY variety trial and USDA Uniform nurseries.

Genomic Selection: 2017 was our second year of using genomic selection where we take genomic information from lines that have been DNA-sequenced and field-tested to develop a prediction model and apply it to new lines that have been sequenced and have just been put into their first year of testing. Some of our top yielding lines were those that were predicted to do well based on the genomic selection model. Other top performers were not predicted to do as well by the model. We will plant a study this fall that includes lines in both categories. By growing these lines at several locations in replicated tests we will learn how best to use the prediction model to make the breeding program more efficient.

Doubled Haploids: Doubled haploid (DH) lines were screened in headrows in 2017 based on height, maturity, vigor and disease resistance. We selected 288 of these true breeding lines to test in our preliminary trials in 2018; this means that approximately 25% of our new lines came from doubled haploids, even though the crosses that produced these lines were made only 2 seasons ago. The time-savings in getting to the true breeding stage is tremendous.



Understanding the Genetic Basis of Wheat Development

By David Van Sanford and Carrie Knott

The objective of this project is to increase our understanding of the genes that affect the vernalization and photoperiod response in wheat. We hope to reduce growers' risk of freeze damage and yield losses by fine tuning our planting date recommendations based on the photoperiod and vernalization genes a variety has.

The development of the wheat plant through harvest maturity is controlled by genes with both large and small effects. The large effect genes are those that control response to vernalization—the cold period required for winter wheat to flower—and photoperiod or daylength. This is important because late spring freezes are common in Kentucky. Varieties like Truman will not flower until daylength is long enough for them to shift into reproductive growth. Truman's photoperiod sensitivity is associated with a maturity date that is too late for Kentucky growers. We want to combine this sensitivity with earlier maturity.

Based on the 2017 data, the long vernalizing genes were better (higher yields) in our environment, but this varied some with the photoperiod genes that were present in a line. In a line like Truman, for example, which is photoperiod sensitive (i.e., requires a long day in order to flower), the short vernalizing genes did not lower yield. This tells us that photoperiod sensitivity is more important that vernalization sensitivity in our environment, though this is not necessarily true in southern states like GA.

The picture is a complex one and we hope that a second year of data will produce the information we need to provide growers with planting date recommendations that are based on the photoperiod and vernalization profiles of different wheat varieties.

Irrigating the Soil to Maximize the Crop

By Ole Wendroth, Javier Reyes, and Chad Lee, University of Kentucky

Despite sufficient total annual rainfall in Kentucky, irrigation for efficient crop production and for securing high yields becomes increasingly relevant because draught periods often occur at times and crop growth stages when the water is needed.

Due to geomorphology of our Kentuckian landscapes, farmers' field soils exhibit substantial spatial variability of properties. Within the same field, the soil type can vary between silt loam and silty clay loam, or clay loam due to erosion processes that have caused former B-horizons that were rich in clay to now become the top horizon. These geomorphological processes have triggered a pattern of soil heterogeneity with different soil hydraulic properties. Due to this heterogeneity, we can find zones with locally differing water infiltration behavior.

We hypothesize that these zones and their different soil functions need to be considered for irrigation management. Zones with high clay contents cannot take up water at the same rate as zones with silt loam soil can. Irrigation rate needs to be adapted for the spatial variability of infiltration capacity in order to avoid unintended water losses.

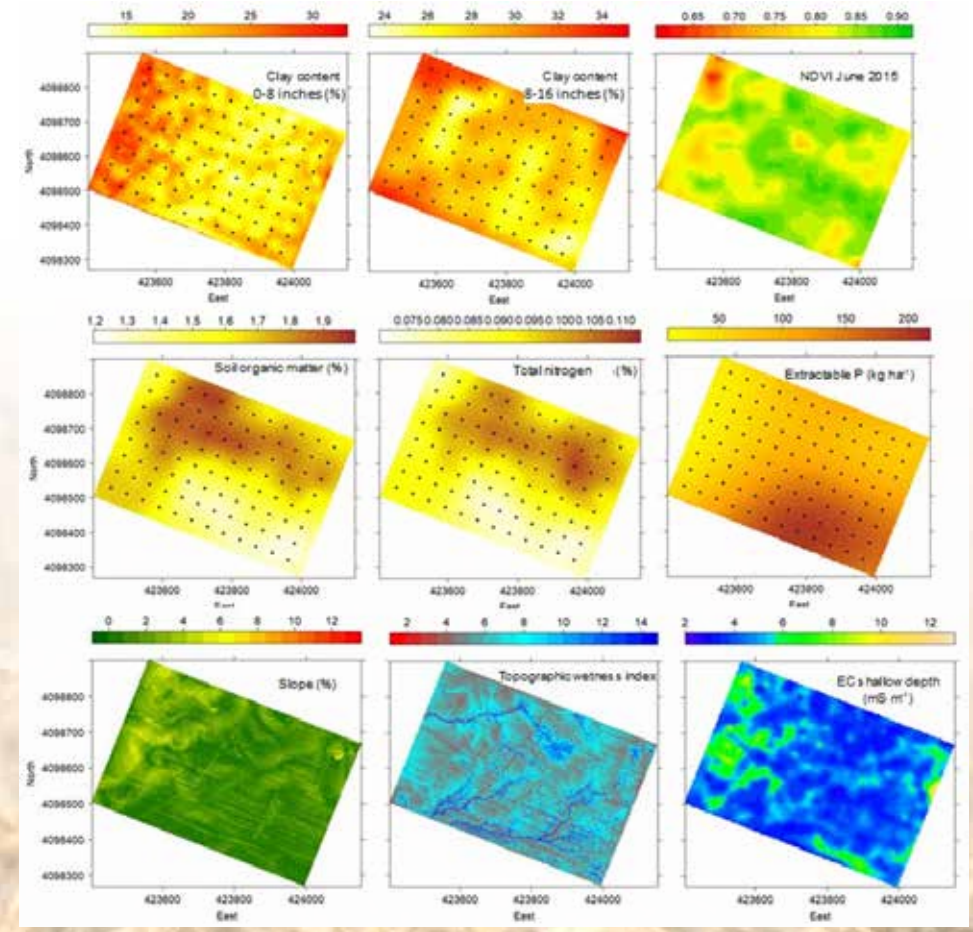
In the full report—found on the KySGGA web site, kysmallgrains.org, we show how the locations of different functional zones within a farmer's field can be derived from other information sources. According to the purpose of this project, with the results presented in the research report, we demonstrate "a strategy for deriving a map of functional soil water characteristics based on easily obtainable land surface observations."

Our research Project is conducted at Hillview Farms (Trevor Gilkey) in Princeton, Caldwell County. The Hargis field is equipped with a center pivot irrigation system which covers a total area of approximately 70 acres. Over the past three years, we have been taking numerous soil and crop data sets, many of which typically can be taken under farm conditions without extreme experimental efforts and laboratory analyses. In the following, we briefly describe the source of information for different maps and how helpful these different measurements or surveys are in delineating mapping zones for site-specific or variable-rate irrigation management.

This is an ongoing research project, and we encourage growers to contact the researchers to more fully utilize the information being gained from this project.

The purpose of this project is to develop a strategy for deriving a map of functional soil water characteristics based on easily obtainable land surface observations. The objectives are:

- To derive a field-scale characterization of soil hydraulic properties for better irrigation management,
- To implement this information and sporadic soil and crop measurements into a computer model for describing the annual water status in different zones across the field while taking into account crop growth, and
- To evaluate different sources of land surface remotely sensed information as a basis for upscaling detailed information and knowledge to improve irrigation management at a regional scale.



Updating Barley and Rye Management in Kentucky

By Chad Lee, Carrie Knott, James Dollarhide, Kathleen Russell and Katherine McLachlan Rod, University of Kentucky

The boom in distilleries and interest in locally-grown foods has combined to generate much interest in barley and rye for Kentucky. This has resulted in considerable interest from producers on current agronomic management practices for barley and rye. Unfortunately, management practices for these crops have not been extensively studied or updated in about 30 years, which was about the time that intensive wheat management was developed in Kentucky.

In 2016-2017, we investigated seeding rates and nitrogen (N) rates on barley, malting barley and hybrid rye. Seeding rates were 0.5, 0.75, 1.0, 1.25 and 1.5 million seeds per acre. For the seeding rate studies, N rate was set at 90 lb N/A with 30 lb applied at Feekes 3 and 60 applied at Feekes 5. In the nitrogen rate study, rates of 0, 30, 60, 90 and 120 lb N per acre were split-applied at Feekes 3 and 5. In addition, all plots received 30 lb N/A in the fall, consistent with our recommendations when following excellent corn yields. For the nitrogen rate studies, all small grains were seeded at 1.25 million per acre. In 2015-2016, the studies were conducted only at Spindletop Farm near Lexington, KY. For 2016-2017, studies were conducted at Spindletop and at the Research and Education Center at Princeton, KY.

Research conclusions are below. Full results can be found at kysmallgrains.org.

Six-Row Barley (Feed Barley)

Seed rates had little affect on yields (averaging more than 85 Bu/A for all five seeding rates at three locations), and this has occurred in other small grain studies before. We had excellent stands and tiller counts at all sites. The nitrogen rates are confusing. The 2016-17 season was an unusually warm winter with about five days of freezing temperatures. Damage to barley from the freeze was visually worse at Princeton. The warmer winter could have mineralized more nitrogen. Nitrogen was applied to all plots in the fall at 30 pounds per acre. That rate follows our recommendations when the preceding corn yields were excellent. However, that rate of 30 pounds N per acre plus an unusually warm winter could have resulted in more mineralized N available for plant uptake. For the Lexington 2017 site, the field was minimally tilled before planting the small grains. Prior to that, the field was in no-tillage for several years. Perhaps that tillage also increased N mineralization.

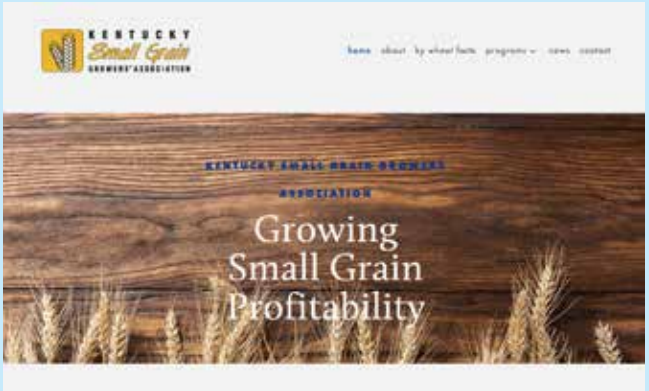
We would still recommend N fertilizer on barley. We will study barley again this season.

Two-Row Barley (Malting Barley)

Seeding rates between 0.75 and 1.25 million seeds per acre resulted in the highest yields across both locations of about 123 Bu per acre. These seeding rate ranges are similar to current recommendations for feed barley. However, because grain quality is much more restrictive for malting versus feed barley, agronomic management that maximizes grain yield may not produce desirable malting barley grain profiles. As such, additional research to characterize grain quality as well as yield are needed.

Hybrid Rye

A lack of yield response to seed rates is consistent with German guidelines for hybrid rye management. The yield response to nitrogen in 2016 is consistent with Germany as well, with the exception that nitrogen rates are at times higher than we tested. The lack of a nitrogen effect on yield in 2017 was similar to the barley trials at Lexington and equally confusing. Again, the warmer temperatures may have mineralized more nitrogen than normal. We would still recommend a nitrogen application on hybrid rye. We plan to modify the protocol for 2017-2018 to incorporate what we learned from Germany to see if hybrid rye in Kentucky will respond.



See full results from all projects on our updated website: kysmallgrains.org

Looking for Old and New Foes to Prevent BYDV Transmission on Wheat

By Raul Villanueva and Carl Bradley

Objectives:

1. Monitor abundance of aphid species and viruses in the fall 2016 and spring 2017 in research plots of Princeton
2. Survey for presence of new invasive Sipha maydis in several regions of Western KY, and collect samples for virus detection
3. Evaluate insecticide treatments for aphid management and BYDV's percentages in treatments

The abundance of aphids were low in western Kentucky in spite of the warm weather conditions of the winter season. However, there were two fields—one in each Todd and Christian counties—where aphid populations were extremely high. In these two fields there might be an apparent failure on the efficacy of a pyrethroid (a possible case of resistance or an inadequate use of the insecticide).

All 2016 fall wheat foliage samples from eight counties were negative for viruses. However, in the spring of 2017, seven out of 11 samples from 10 counties resulted positive for BYDV. Insecticide treated vs. untreated seeds were compared, but the small numbers of aphids in the experimental plot did not provide a conclusive evidence for its use. Similarly, the use of a spray program for aphid control was inconclusive for the same reason.

Reducing Fusarium Head Blight Vomitoxin Levels through Agronomic Practices

By Katherine McLachlan Rod, Carrie Knott, and Carl Bradley

Every year, vomitoxin levels caused by Fusarium graminearum, in soft red winter wheat are of major concern to wheat producers and millers. Current agronomic practices to reduce vomitoxin levels include planting moderately resistant wheat cultivars and fungicide applications at Feekes 10.5.1. The Kentucky Small Grains Growers' Association funded a research trial examining additional agronomic practices that have the potential to lower vomitoxin levels; harvesting wheat at higher grain moisture (20-22%) and in-furrow phosphorus applications at planting.

The objectives of this study are to 1) investigate the effect of harvesting wheat at different grain moisture contents on vomitoxin levels and grain yield, and 2) investigate the effect of phosphorus applications at planting on flowering date, vomitoxin levels, and grain yield.

Experimental fields were established in the fall of 2016 at the University of Kentucky's Research and Education Center in Princeton, KY. There was one field of ambient infection of F. graminearum and one field that was inoculated with F. graminearum infested scabby corn and irrigated to promote Fusarium Head Blight (FHB) development and infection in the spring. Each of these fields had a normal (mid-October) and late (mid-November) planting date and an early (20-22% grain moisture) and normal (13-15% grain moisture) harvest timing. Within each of the planting and harvest timings there was four treatments consisting of two cultivars (FHB susceptible Cumberland and FHB moderately resistant Pembroke 2016) and two in-furrow phosphorus applications (0 lbs/A of P_2O_5 and 42 lbs/A of P2O5). Trials were harvested in June 2017. The early harvest of the October planting occurred on June 8th, while the early harvest of the November planting occurred on June 12th. The normal harvest of both plantings was on June 21st. Wheat harvested at 20-22% grain moisture were placed into drying columns owned by UK's Biosystems and Agricultural Engineering, where the grain was dried to 12.5% moisture. Grain samples were sent to a commercial laboratory for vomitoxin analyses.

This was the first year of a three year study. Based on preliminary analysis of the data, our results are inconclusive. One field had significantly higher yields for the high grain moisture harvest timing compared to the normal harvest timing. We also found that the in-furrow phosphorus treatment had no effect on flowering date. It is unclear what, if any, effect the 2016 freeze event had on this study, therefore additional data is needed before conclusive findings can be made. This project has been funded for a second year. In 2018 we plan to determine the effect of in-furrow phosphorus on flowering uniformity, as well as having an additional treatment of an increased seeding rate of 56 seeds ft^2 to focus on uniformity of flowering and capturing all of the developing heads at Feekes 10.5.1, when fungicides are applied.

Research on managing Fusarium head blight (scab) of wheat and barley with foliar fungicides

By Carl Bradley, University of Kentucky Extension Entomology Specialist

Research trials funded by the Kentucky Small Grain Growers Association were conducted on soft red winter wheat and winter barley during the 2016-17 growing season at the University of Kentucky Research & Education Center in Princeton, KY. The overall objective of the research trials were to develop the best recommendations for managing Fusarium head blight (FHB; also known as scab) and the associated mycotoxin deoxynivalenol (DON; also known as vomitoxin) with foliar fungicides. The specific objective of each trial differed, and details and results of these trials are provided below.

PLEASE NOTE THAT SOME OF THE TREATMENTS EVALUATED ARE FOR RESEARCH PURPOSES ONLY AND MAY NOT BE REGISTERED FOR USE OR MAY HAVE BEEN AN APPLICATION THAT IS NOT IN ACCORDANCE WITH THE LABEL. ALWAYS READ AND FOLLOW LABEL DIRECTIONS AND REGULATIONS BEFORE MAKING A FUNGICIDE APPLICATION.

Soft red winter wheat fungicide trial

The objective of the soft red winter wheat trial was to determine if sequential applications of fungicides would provide better control of FHB and DON compared to a single application of a foliar fungicide. The treatments consisted of the fungicides Prosaro (applied at 6.5 fl oz/acre), Caramba (applied at 13.5 fl oz/acre), Folicur (applied at 4 fl oz/acre), or Miravis Ace (applied at 13.7 fl oz/acre) applied at Feekes growth stage 10.5.1 (beginning flowering) or sequential applications of Prosaro (Feekes 10.5.1) followed by Folicur (4 days later), Caramba (Feekes 10.5.1) followed by Folicur (4 days later), Folicur (Feekes 10.5.1) followed by Folicur (4 days later), or Miravis Ace (Feekes 10.5.1) followed by Folicur (4 days later). A nontreated check also was included as a treatment. Each treatment was replicated 4 times, and a mist-irrigation system was used to help provide an environment that would be favorable for FHB. The FHB-susceptible variety Agripro W1566 was used for this trial.

No statistically significant differences among treatments were observed for FHB index. Although not significantly different than the untreated check, FHB index values were lower when any of the single or sequential fungicide applications were made. No statistically significant differences among treatments were observed for DON concentrations in harvested grain. Although not statistically different from other treatments, the lowest DON concentration was observed in grain harvested from plots treated with a sequential application of Miravis Ace followed by Folicur.

Conclusions. Fusarium head blight and DON levels were too low in this trial to show statistically significant differences among the treatments. An additional year of the research is being planned.

Winter barley fungicide trial

The objective of the winter barley trial was to determine the best growth stage to apply a foliar fungicide to achieve the best control of FHB and DON. Prosaro (6.5 fl oz/acre), Caramba (13.5 fl oz/acre), Folicur (4 fl oz/acre), or Miravis Ace (13.7 fl oz/acre) was applied at either the boot stage, heading stage, or 5 days after heading. A nontreated check also was included as a treatment. Each treatment was replicated 4 times, and a mist-irrigation system was used to help provide an environment that would be favorable for FHB. The FHB-susceptible variety Thoroughbred was used for this trial.

The only treatment that had a statistically significant lower DON value than the untreated check was Miravis Ace applied 5 days after heading.

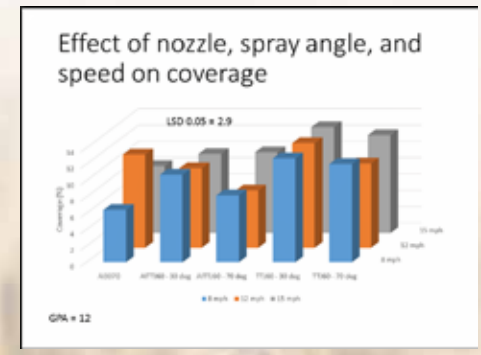
Conclusions. Although DON levels were relatively low in this trial, a statistically significant reduction in DON was observed with the Miravis Ace treatment applied 5 days after heading. However, to draw firm conclusions, it is important that this trial be repeated to ensure that the effects of the treatments evaluated are consistent. This research trial will be repeated again in 2018.

Fungicide coverage in soft red winter wheat

The objective of this trial was to evaluate the coverage of the wheat head with different fungicide application systems. Three different nozzle tips and orientations were evaluated at three different speeds. To evaluate coverage of the wheat head, water sensitive paper cards were wrapped around test tubes that were the approximate same size in diameter as wheat heads, placed on a metal rod at the approximate height of wheat heads, and water was applied through the different application systems. The research trial was conducted in a wheat field. Water sensitive cards were collected after water applications, digitally scanned, and special software was used to determine the % coverage of the cards with water droplets.

As observed in the figure below, statistically significant differences in coverage occurred among the different application systems evaluated. The greatest coverage occurred with the TurboTeejet 60 nozzles at a 30 degree angle at a speed of 15 mph.

Conclusions. The potential treatment variables that could be evaluated in a trial like this are endless (i.e. nozzle tip, nozzle orientation, height, speed, pressure, etc.). The treatments evaluated in this study were agreed upon for an initial investigation into these potential variables. Additional research will be conducted next year. One interesting observation is that the greatest % coverage was just above 12%. It is likely that fungicide efficacy on Fusarium head blight control will increase as head coverage increases, and much work is needed to develop fungicide application systems that will deliver a high amount (greater than 50%) of coverage.



See all tables and figures from this research at www.kysmallgrains.org.

Improvement and Development of Barley for Use in Feed, Malt, and Fuel

By Wynse S. Brooks, Mark E. Vaughn, Nicholas Meier, Joshua Fitzgerald, and Carl A. Griffey, Virginia Polytechnic Institute and State University

The Virginia Tech barley-breeding program is the largest and until recently was the only remaining public program in the eastern United States. The barley program is significantly diverse with breeding efforts focused on the development of superior, widely adapted, high yielding winter barley cultivars and a major focus on the incorporation of value-added traits geared towards the development of new markets.

As interest continues to grow in locally produced ingredients from the craft brewing industry in the mid-Atlantic and eastern U.S., finding malted barley is not easy for those located east of the Mississippi river. This has triggered significant demand for malting barley. We are trying to bridge this gap by evaluating malting barley cultivars developed by collaborators in the U.S. and Europe while rapidly developing and testing our own malting barley experimental lines. Locally produced malting barley is good for the economy and farmers can earn a $3 to $4 premium for growing quality malting barley. Virginia currently grows around 45,000 acres of feed barley annually, which could be converted to production of malting barley as well as fostering an expansion in total barley acreage. Winter grown barley is more sustainable since it is grown from October to June, providing farmers the added double crop opportunities with soybeans in the summer. According to the Brewers Association, Virginia's 124 craft breweries currently produce over 274,000 barrels of craft beer annually and economic impact over a million dollars.

Our main effort is breeding winter malting barley cultivars that have superior malt quality and are well adapted to the mid-Atlantic and southeastern United States. We have recently started developing Double Haploid (DH) malting barley lines in collaboration with Oregon State University. Results from these tests are encouraging since Double Haploids allow us to develop cultivars much faster than traditional methods. The DH lines are genetically pure, eliminating approximately 2-3 years of the total time required to develop a variety. Besides developing and testing our own experimental lines, we also collaborate with other breeding programs, which allows us to evaluate cultivars developed by our collaborators across the country as well as cultivars from around the world, especially Europe. Meanwhile, in 2017-2018 season, we plan to start a regional mid-Atlantic Malt Barley Trial with neighboring states to facilitate collaborations and enhance cultivar development. We have a graduate student, Nick Meier, developing molecular markers for malting quality traits to help us select superior quality malting lines with more precision and eliminate costly testing expenses. Nick is also working on flavor analysis of commonly grown cultivars to determine how malt flavor is affected by genetics and environment. We anticipate that interest in production of malting barley will continue to grow in this region and we plan to release cultivars to meet diverse market demands. Our future allotment of resources will continue to provide more resources to our winter malting barley as it continues to grow.

In 2017 harvest year, the overall grain yield of Thoroughbred was 96 bushels per acre with average test weight of 41.0 pounds per bushel compared to the mean yield of 91 bushel per acre and test weight of 42.1 pounds per bushel for the mean of all cultivars tested. Average grain yield of Secretariat (99 bushels per acre) was 3 bushels per acre higher than Thoroughbred, 5 bushels per acre higher than Atlantic (92 bushels per acre), 15 bushels per acre higher than Price, 17 bushels per acre higher than Callao and 24 bushels per acre higher than Nomini. However, the hulled barley experimental line VA14B-79 had the highest average overall grain yield (105 bushel per acre) that was 6 bushel per acre higher than Secretariat, 9 bushel per acre more than Thoroughbred and 14 bushel per acre higher than the overall test mean. In addition, two other hulled barley experimental lines (VA14B-63 and VA14B-74) ranked 2nd and 3rd respectively in average grain yield (103 and 100 bushels per acre) that were 3 to 4 bushels per acre lower than that of Secretariat and 1 to 2 bushels per acre higher than Thoroughbred.

In the Winter Malt Barley Trials (WMBT) conducted at locations in Blacksburg and Warsaw, VA in 2017; The winter malt barley variety Hirondella was the highest yielding (101 Bu/ac) cultivar among 30 entries and yielded 8 bushel per acre higher than the winter barley check cultivar McGregor, 12 bushel per acre more than the winter malting barley check cultivars Wintmalt, 19 bushel per acre higher than Thoroughbred, 27 bushel per acre higher than Endeavor, 53 bushel per higher than Charles. Two other malt barley varieties Flavia and Calypso ranked 2nd and 3rd respectively in grain yield. The malt barley cultivar Violetta ranked 10th in average grain yield. In addition, these new malt barley (Flavia, Calypso and Violetta) cultivars also have better disease resistance (0 = no disease, and 9 = severe infection) to leaf rust (1, 2) than Thoroughbred and Charles (8 and 9 respectively). Additionally, in an inoculated and mist-irrigated FHB field test at Mount Holly, VA; Violetta and Calypso expressed better resistance to FHB than the winter malt check cultivars Thoroughbred, Wintmalt, and Charles. Violetta and Calypso had mean FHB values for incidence of (50.0 and 56.3%), severity (9.9 and 10.4%) and index (5.1 and 6.0%) respectively.

Enhanced Chia Production & Product Usage

By David Hildebrand & Tim Phillips, University of Kentucky

Work conducted at University of Kentucky and also by Chris Kummer has indicated that chia, *Salvia hispanica*, has the potential to be an economically viable new crop for Kentucky farmers, but agronomic improvements and/or additional product markets are needed. The objectives of this research were to: 1) continue to develop new chia lines with improved yield and other agronomic performance characteristics by traditional breeding and further mutagenesis, particularly seed retention, lower lodging and larger seeds; 2) analysis of the genotype and environmental effects on seed composition of materials produced in 2016; 3) economical conversion of chia oil into high value lubricants; and 4) further market development of nutrigel fiber, ω3 applications and improved protein product streams from chia including fish and shrimp feed.

The most promising chia germplasm from around the world was assembled, and our most promising line was subjected to a further round of mutagenesis. Lines with larger seed, higher oil, reduced lodging and lower shattering were evaluated in the field in 2016 and most promising lines further analyzed in 2017. Breeding for higher yielding chia lines that can set seed in Kentucky was continued by crossing with the best additional chia genetic materials.

For commercialization of these lines as a high ω3 oil in addition to whole seeds, we further screened and selected lines for higher oil and ω3 levels. We established a very efficient screen for higher oil chia lines and have found considerable variability for oil content. Oil, protein and moisture calibrations that have been developed were applied to selecting higher oil and protein chia lines. Further work was conducted on processing and marketing chia for new commercialization opportunities for Kentucky growers for food, health, aquaculture and renewable chemical markets.

Accumulating evidence indicates that chia may be the best source of soluble fiber in addition to ω3 fatty acids. We further studied the formation, isolation, health properties, processing and marketing opportunity of chia water adsorbing fiber in addition to the oil and high protein meal. Removal of as much of the fiber as readily feasible to another product stream will likely make the remaining high protein/high ω3 meal more valuable as fish feed. The oxidative stability of chia oil and whole chia seed products compared to commodity and high ω3 oil sources was further studied for special high value health, nutraceutical and food applications. The chemical processes for converting chia oil into a high value renewable lubricant/motor oil and fuel cell energy source was refined and compared to competitive oil sources.

Can Wheat Yield and Grain Fill Duration be Increased by Decreasing Wheat Canopy Temperature?

By Carrie Knott, Grain Crops Agronomy, University of Kentucky

In 2015, the Kentucky Small Grain Growers' Promotion Council, KyCorn and the Kentucky Soybean Promotion Board worked together to provide funds for the University of Kentucky to purchase a 460-ft lateral irrigation system at the Research and Education Center in Princeton. The T&L system, equipped with a variable rate irrigation system, was installed in September 2015.

In 2016, the irrigation system was calibrated and wheat was established that fall to examine the effect of wheat canopy temperature on final grain yield in 2017 growing season. In the spring of 2017, the equipment necessary to monitor canopy temperature was purchased and assembled. Unfortunately, there was a problem with the electronic system controlling the variable rate application system. This problem was fixed, however not until the wheat had begun to senesce. Therefore, we were unable to start this study in 2017. We will plant wheat again this fall and evaluate the impact of irrigation on wheat canopy temperature in 2018.

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KENTUCKY Small Grain GROWERS' ASSOCIATION

2017 Annual Report

Kentucky Wheat Yield Contest Winners Announced

The University of Kentucky has announced the winners of the 2017 Kentucky Wheat Yield Contest.

The **No-Till State Champion is J. Stephen Emmick and Sons Farms** of Hancock Co. They achieved a yield of 126.46 Bu/A using Pioneer 25R50. Emmick and Sons will receive the DuPont Pioneer Travelling Trophy and the Kentucky Small Grain Growers Travelling Trophy in January 2018 at the Kentucky Commodity Conference in Bowling Green.

The **Conventional Tillage Champion is Jenkins Farms** of Henderson Co. They achieved a yield of 117.83 Bu/A using Southern States SS 8340 Seed.

Area winners:

Area 1 - Paul Yoder, Todd Co. - No-Till - Becks 120 - 102.37 Bu/A
Area 2 - Jeff Coke, Daviess Co. - No-Till - Pioneer 2520 - 118.64 Bu/A
Area 3 - Gary Summers, Simpson Co. - Conv. - SS 8340 - 107.05 Bu/A
Area 4 - Peterson Farms, Boyle Co. - No-Till - AgriMaxx 454 - 118.17 Bu/A

Kentucky COMMODITY CONFERENCE

Thursday, January 18, 2018
Holiday Inn University Plaza, Bowling Green, KY

7:00 am	Early Riser Agronomy Workshop
8:30	Registration & Trade Show
9:00	Economics Session
11:00	Luncheon and Entertainment
1:15 pm	Research Review
2:30	Ky Soybean Association Annual Meeting
3:30	Ky Corn Growers' Association Annual Meeting
4:30	Ky Small Grain Growers' Association Annual Meeting
5:30	Reception
6:30	Awards Banquet

Additional details and registration information are available at www.kycommodityconference.org.

UK Winter Wheat Meeting

January 4, 2018
Bruce Convention Center
Hopkinsville, KY

UK Wheat Field Day

May 8, 2018
UK Research and Education Center
Princeton, KY

Check kysmallgrains.org for details.