University of Kentucky
College of Agriculture, Food and Environment
Cooperative Extension Service

Wheat Science

August 27, 2019 Volume 23, Issue 4
Research & Education Center
Princeton, KY 42445

What's inside

University of Kentucky
College of Agriculture, Food and Environment
Grain and Forage Center of Excellence

Selecting Wheat Varieties

Carl Bradley—Extension Plant Pathologist
Bill Bruening—Research Specialist
Dave Van Sanford—Wheat Plant Breeder

Kentucky wheat producers have a critical decision to make at this time of year: choosing the wheat varieties that they will plant this fall. Year to year climate variability means that certain traits may be more important in some years than in others, but there are always several "must have" traits. Yield and test weight are at the top of everyone's list, but disease resistance, early maturity and straw strength are essential as well. It is important to select well adapted varieties that demonstrate stable performance over years of testing. While early maturity is important for doublecropping, growers should select varieties that differ in harvest maturity so that all of the wheat is not ready to combine at once. Risk can be reduced by selecting varieties that have demonstrated track records of good yield and test weight, in varied environments. Growers with an interest in straw or forage yield should pay particular attention to those data in the variety bulletin. The risk of spring freeze can be high in Kentucky but can be minimized by following this rule: late flowering varieties should be planted first in the fall, and varieties that head early should be planted last. We have observed that in years with severe spring freeze damage (e.g. 2012), early heading varieties planted too early in the fall have been most damaged by the freeze. Selecting varieties that differ in heading date will also help growers avoid planting two varieties that are actually the same genetic line licensed under different brand names. Other traits such as height, head type and straw or forage yield potential, will also help growers avoid these potential branding issues. Maturity is also important when considering head scab or Fusarium head blight. In some years with heavy scab pressure, early flowering varieties may be hit hard; in other years, later flowering varieties may face more intense scab pressure. Though scab was not a serious problem for most growers in Kentucky in 2019, our wheat crop is always at risk because the fungus that causes head scab (*Fusarium graminearum*) is abundant in Kentucky. There are no varieties that are completely immune to scab, but a number of agronomically productive varieties with moderate scab resistance can be found. To minimize the risk of serious losses to head scab, growers should plan to use varieties with demonstrated resistance and be ready to apply the right fungicide at the proper time if conditions favor scab during the window when infection can occur. While fungicides can be an effective tool to reduce losses from head scab, susceptible varieties can still be severely damaged in years with heavy scab pressure in spite of a timely application of a fungicide. Though multiple characteristics need to be considered, variety selection is widely recognized as the simplest and most cost-effective way to maximize production profitability. Although head scab generally was not a major problem for Kentucky farmers in 2019, ratings were made at one location, and data were collected for leaf and glume blotch through the UK Wheat Variety Testing trials. Results of the 2019 UK Wheat Variety Testing trials, as well as results from past years, are available at http://www.uky.edu/Ag/wheatvarietytest/.

Soil Nitrogen and Fall Wheat N Nutrition

Edwin Ritchey—Extension Soil Specialist
John Grove—Soil Fertility Research
Josh McGrath—Extension Soil Specialist

Most winter wheat grown in Kentucky follows corn – sometimes soybean. The residual nitrogen (N) fertilizer remaining and/or that N released from crop residue is typically sufficient to meet wheat's fall N requirement, prior to dormancy. But how does one know if sufficient N is present to meet the wheat N requirement?

A soil test is recommended every 1-2 years, depending on crop rotation and knowledge of field history. When discussing soil tests, we usually refer to phosphorus (P), potassium (K), and soil pH. Soil tests provide the field's current nutrient status and provide guidance on soil fertility needs of the next crop(s). Soil tests for N are typically not recommended due to the transient nature of soil N soil and the lack of soil test N correlation/calibration for wheat.

In the spring, for non-manured fields, the majority of the N applied the previous year is assumed to have been utilized by that crop or lost to the environment via denitrification of N gases, leaching, or in runoff. This is why spring residual N tests are not necessary or useful in our climate. However, wheat starts growth in the early fall, prior to fall/winter N losses and there is considerable potential for residual N recovery by the crop. That N recovery can lead to substantial fall growth and greater lodging susceptibility, especially if a high rate of N is also applied to the wheat in the spring. This happened to the 2013 winter wheat crop following the low yielding 2012 corn crop. A fall 2019 soil N test may help wheat growers, providing some guidance about a field's fall soil N status.

The 2019 growing season was wetter than average for most parts of the state, but there were some dry areas, too. Corn yields will likely be very good in many areas, with predictably little residual N remaining. This is a situation where some additional N might be added at or near wheat seeding. In other areas corn yields will be below average to average, whether due to dry weather or possibly soil compaction, and residual N levels are less predictable. These are the fields for which a residual soil N test might be informative.

Residual soil testing for inorganic N can provide some valuable insights. Soil inorganic N comes in two forms, ammonium and nitrate, both of which are plant-available. Nitrate is mobile in the soil but ammonium is not. Ammonium is at highest soil concentrations closest to the fertilizer application event, but will quickly convert to nitrate. At the end of the season, the majority of residual soil inorganic N should be nitrate. The presence of organic N sources, such as manure or a killed legume cover crop, will result in higher levels of residual soil ammonium in the soil.

The University of Kentucky Regulatory Services offers a residual soil nitrate N (not ammonium N) test at Princeton, but the Princeton lab is being impacted by the construction/renovation associated with the Grain and Forage Center of Excellence and is unable to offer the test this fall. Many private soil testing labs will conduct soil nitrate and ammonium tests upon request. Getting the right test will depend mostly on the form of N applied to the previous crop. If manure wasn't applied, or a legume cover crop wasn't terminated, then a nitrate test will probably be sufficient. However, testing for ammonium should provide additional information if manure or a legume cover crop were used.

Sample the soil to a depth of 12 inches in the middle between the corn rows (at 15 inches from the row in corn grown at a 30-inch row spacing. The deeper depth is used to capture any nitrate N that might have moved into the lower root zone during the season, but would still be available to a fall seeded wheat crop. The number of cores should be sufficient to adequately represent the field or field area being sampled. Remember that the results provided from the lab are only as good as the sample submitted for analyses.

The results will be reported from most labs in parts per million (ppm). Every 6 inches of soil weighs approximately 2 million lb, so 12 inches of soil will weigh approximately 4 million lb. To convert your sample result from ppm to lb/acre, multiply by 4. For example, if a 12 inch soil sample has 11 ppm nitrate N, this is equivalent to 44 lb nitrate N/acre (11 x 4 = 44). Samples that have 30-40 lb nitrate N/acre present in the fall at seeding have adequate N for growth and early tillering and no additional fall N is needed. Wheat fields or field areas with sample results exceeding 25 ppm nitrate N (100 lb N/acre) should be monitored carefully so that later N management does not contribute to excessive lodging potential next spring.

Knowing the ammonium concentration can provide additional information, especially when manure or a legume cover crop was used. Most of the N should have converted to nitrate by seeding time, but under certain situations there may still be some in the ammonium form. Make the same conversion as for nitrate from ppm to lb/A and add the two forms together. For example, if the 12 inch sample with 11 ppm nitrate N also has 5 ppm ammonium N, this is equivalent to 64 lb inorganic N/acre [(11 x 4) + (5 x 4) = 64].

What is the best way to provide additional N if little residual N remains? If the soil test recommends P, MAP (10-52-0) or DAP (18-46-0) provide 10 or 18 lb of N for every 100 lb of fertilizer added, respectively. Urea or other forms of N can also be used when the N need exceeds that provided by added P fertilizer.

Remember that sufficient, but not excessive, residual N is present for fall wheat growth most years. Years/areas with high corn yield and/or an exceptionally wet season are those that might favor application of some fall N for wheat. Also of concern are years/areas where the corn yield is lower than expected and where residual inorganic N may be high. Just because corn yield was lower or higher than normal, or the season was drier or wetter than normal doesn't automatically indicate whether we know enough to decide on the need for fall N for wheat. A residual soil N test should help with that decision.

USEFUL RESOURCES

KyGRAINS.info

Kentucky Pest News

Entomology · Plant Pathology · Weed Science

http://kentuckypestnews.wordpress.com/

College of Agriculture, Food and Environment

WHEAT SCIENCE GROUP

http://wheatscience.ca.uky.edu/home

Crops Marketing and Management Update

http://www.uky.edu/Ag/AgEcon/extcmmu.php

KATS

Kentucky Agriculture Training School

Ryegrass Control in Wheat Begins at Planting

Travis Legleiter—Extension Weed Control Specialist

Italian ryegrass (AKA: annual ryegrass) continues to be a major weed in Kentucky wheat acres, and has arguably become tougher to control over the last several years. This spring in particular we observed numerous wheat fields in western and central Kentucky that had ryegrass escapes late in the season and at harvest. Many producers have traditionally depended on postemergence herbicides for control of ryegrass including several ALS-inhibitors and more recently Group 1 herbicides such as Axial XL and the recently released Axial Bold. While these postemergence products have shown great efficacy against ryegrass, and still do in some cases, the development of resistance to these sites of action have eliminated their utility on many Kentucky wheat acres. These resistance events include the confirmation of pinoxaden (Axial XL) resistant ryegrass in the state of Kentucky. The increasing instances of resistance to postemergence herbicides requires wheat growers to rethink their strategy for controlling ryegrass in wheat, primarily rethinking the timing of ryegrass control.

While ryegrass escapes become most blatantly obvious late in the season the optimal time for controlling ryegrass in wheat, regardless of resistance within the population, is prior to or immediately after planting. A number of herbicides have been labeled for use as residual herbicide for control of annual ryegrass in wheat. Along the same lines as using PRE herbicides in our corn or soybean acres, the use of preemergence herbicides in wheat brings a great amount of utility in not only providing effective weed control, but also allowing for the use of alternative herbicide sites of action within the growing season.

The majority of preemergence herbicides labeled for ryegrass control in wheat contain the active ingredient pyroxasulfone. These products provide preemergence control of ryegrass only and do not control emerged ryegrass so timing is critical. Another consideration of application timing is the risk of potential crop injury. The labeled timing of each product varies but ranges from 14 day preplant to early wheat postemergence. Products currently available for use in wheat in Kentucky are Zidua, Fierce, and Anthem Flex. The labeled application timings, use rates, and maximum cumulative rate per year for each product are outlined in Table 1.

As mentioned above there is a risk of injury to wheat with pyroxasulfone products. The risk of injury depends on soil type, planting conditions, and environmental conditions. Fields with coarse soils and low organic matter are at greater risk of pyroxasulfone injury than those with medium and fine texture soils with higher organic matter. Wheat should be planted at least 1-inch-deep to avoid injury and poor planting conditions such as cloddy seed beds or unclosed furrows increase risk of injury due to direct exposure of seed to the herbicide. Heavy rainfall and saturated soils following pyroxasulfone application can concentrate the herbicide in the seed furrow and also cause significant injury. Avoidance of these environmental conditions can significantly reduce the risk of wheat injury.

The risk of pyroxasulfone injury to emerging wheat is greatest when applications are made preemergence and prior to wheat germination. Currently, Anthem Flex is the only herbicide that is allowed to be applied preemergence from planting until wheat spiking. This application timing is allowed through a local needs 24c label for Kentucky wheat acres. The 24c label comes with several restrictions including allowance on only on medium and fines soils with 2.5% or greater organic matter. A full list of restrictions for application of Anthem Flex applied preemergence in order to reduce crop injury risk are listed in Table 2. The University of Kentucky has evaluated this timing of Anthem Flex within these restrictions and has observed great utility in this application timing with limited crop injury risk. Fierce is the only product allowed to be applied preplant to wheat in Kentucky and requires at least 14 days between application and planting to reduce risk of injury.

The timing of Delayed Pre is allow with both Zidua and Anthem Flex. This timing is from when 80% of the wheat has an at least ½ inch long shoot until spiking. Allowing wheat to germinate and produce a ½ inch shoot reduced the risk of crop injury, although this timing may only span a couple of days and can be very difficult to time. The other fallacy with this timing is that often ryegrass is emerging with wheat and the pyroxasulfone application fails to control those already emerged or emerging ryegrass plants, so a postemergence herbicide must be included to control those emerged or emerging plants.

The Anthem Flex and Zidua labels also allow for early postemergence timings that pose the least amount of risk for wheat injury. Although again any ryegrass that has emerged prior to this application will not be controlled by the pyroxasulfone. Farmers may consider split applications in which they apply part of their ryegrass residual preemergence and follow that with the remainder of residual applied early postemergence prior to any ryegrass emergence. Refer to table 1 for maximum allowable cumulative rate of each product per year.

While there is risk of crop injury with the pyroxasulfone products, the benefit of suppressing ryegrass emergence outweighs these risk in many cases. This is especially true for those farmers who are dealing with ALS- and pinoxaden-resistant ryegrass populations. In numerous studies conducted at the University of Kentucky pyroxasulfone has shown superb suppression of ryegrass when applied appropriately and prior to ryegrass germination. Data combined across trials from the previous two growing seasons has shown that pyroxasulfone products applied 14DPP, PRE, or Delayed Pre provide 78% or greater control of ryegrass during spring evaluations. Early post applied products showed greater variability in control, but still provided 65% or greater control in the spring. As with all herbicide residual products, these herbicides are not intended to provide season long control, but rather are another tool in controlling difficult and resistant weeds. The use of preemergence herbicides also helps preserve our currently limited postemergence herbicide options by reducing the selection pressure on the postemergence applications.

Table 1. Pyroxasulfone based herbicides for use in wheat to suppress annual ryegrass emergence.

Trade Name	Active Ingredients	Labeled Application Timings[1]	Use Rates[2]	Maximum Cumulative Rate per year
Zidua SC	Pyroxasulfone	Delayed PRE & Early POST	1.25 to 4 fl oz/A	4 fl oz/A
Anthem Flex	Pyroxasulfone + carfentrazone	PRE[3], Delayed PRE, & Early POST	2.0 to 4.5 fl oz/A	4.5 fl oz/A
Fierce	Pyroxasulfone + flumioxazin	14 DPP[4]	3 oz/A	3 oz/A

[1] **14 DPP:** Fourteen days prior to wheat planting. **PRE:** From planting up to spiking. **Delayed PRE:** 80% germinated wheat with ½" shoots up to spiking. **Early POST:** Spiking to 4 tiller wheat

[2] Refer to herbicide labels for use rates by soil texture and application timing

[3] Labeling of Anthem Flex applied PRE in wheat is through 24c supplemental labeling valid in Kentucky till August 14, 2023.

[4] Labeling of Fierce in wheat is through 24c supplemental label valid in Kentucky till December 31, 2022.

Table 2. Anthem Flex preemergence application restrictions to reduce crop injury potential.

Do not apply preemergence to coarse soils (soils classified as sand, sandy loam, or loamy sands)
Do not apply preplant incorporated in wheat.
Do not apply to broadcast seeded wheat.
Do not apply preemergence if ¼ inch or more of rain is expected within 48 hours of application.
Plant wheat at a minimum of 1 inch deep.
Do not plant wheat over1.5 inches deep.
Do not irrigate fields after a preemergence application until after wheat reaches the spiking stage of growth.
Do not apply Anthem FLEX to saturated or flooded soils.
Do not apply more than a maximum cumulative amount 4.55 fl oz/a (0.142 lb ai/A containing 0.133 lb ai of pyroxasulfone and 0.0095 lb ai of carfentrazone) of Anthem FLEX per year.

Effects of Rainfall or Drought in the Abundance of Aphids in Winter Wheat

Raul T. Villanueva—Extension Entomologist

The bird cherry oat aphid (*Rhopalosiphum padi*) and the English aphid (*Sitobion avenae*) are the most abundant aphid species in small grains in Kentucky. They are key pest species because they are vectors of the Barley Yellow Dwarf Virus (BYDV). Virus transmission occurs during early stages of plant development when plants are more vulnerable to be affected by BYDV. These earlier infection of plants in the fall can produce stunted plants and reduce yields. Consequently, the abundances of aphids during the fall might be the critical period when aphid species that are carrying BYDV can potentially reduce incomes of growers.

Small grains are not planted during the summer in KY however, bird cherry oat and English aphids are present in alternative hosts. Bird cherry oat aphids in North America are hosted by the common choke-cherry (*Prunus virginiana*); whereas English aphids is hosted by several volunteer small-grains and weedy grass species such as rough barnyard grass, yellow foxtail, and green foxtail. Also, these two aphid species can be found in field corn (Figure 1) and millet planted in the summer.

Figure 1. Severe infestation of Bird cherry oat aphids in a research plot in corn at the UK's Research and Education Center in Princeton by the end of August in 2018 (Photo by Raul T. Villanueva)

Thus a question comes up here, would the rainfalls (or the absence of them) in summer months (July to August) influence the small grain aphid abundances during early stages of small grains development (from mid-October to December). Information on these type of events are based on anecdotal evidence. However, there have been several studies where models were developed using simulated droughts or rainfall events.

In simulated studies it has been shown that aphids reared on plants grown on drought events had heavy weights than aphids reared under normal conditions. Researchers explained that this happened because under drought, insects feed on plants that have higher concentrations of amino acids. However, in some cases the number of offspring produced was unaffected by the watering regime of the adult aphids' host plants. Furthermore, it was shown a high correlation between insect body size, insect performance, and fecundity.

In a study conducted in Chile, 76% of bird cherry oat aphids and 69% of English grain aphids fell from the wheat seedlings when rainfall was simulated (30 mm/h for 30 min), in comparison with 11 to18.4% from control, not subjected to simulated rainfall. Under natural rainfall (7.4 mm in 24 h), an average of 45 % of bird cherry oat aphids and English grain aphids were washed off the plants. These rainfalls also affected 58 % mummified aphids or empty mummies. However, it was found that several parasites species (*Aphidius*, *Ephedrus* and *Praon*) were able to emerge from the mummies washed to the ground, even after remaining under water for several weeks.

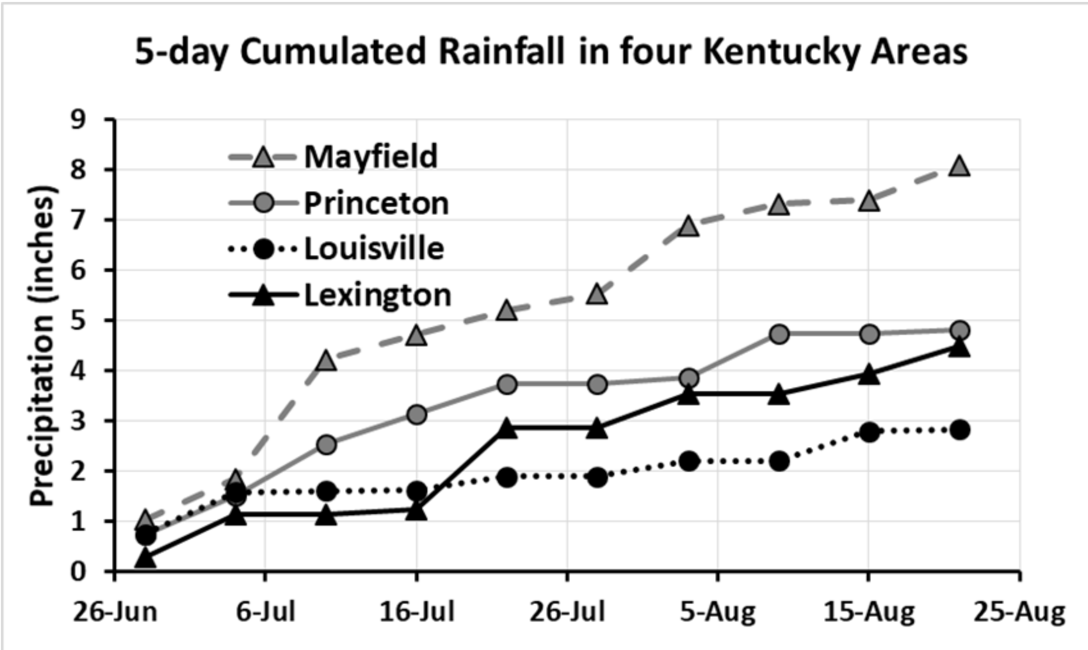


Figure 2. Cumulated rainfall from 26 June to 25 August 2019 in four Kentucky areas from west to east (Mayfield, Princeton, Louisville, and Lexington).

Rainfall events from the end of June to August in 2019 were not uniform in different regions of Kentucky (Figure 2). It appears that areas around Louisville have fewer rainfalls compared with Mayfield and Princeton. Thus, forecasting the aphid densities for Kentucky based on environmental conditions is a difficult task for the different regions. In general, the number of aphids colonizing the winter grains in autumn is largely dependent on the populations that have built up on grasses during the late summer. In Great Britain, warm, wet summers have been positively linked with large numbers of bird cherry oat aphid migrants in autumn.

Based on what is discussed above, rain events dislodge aphids from plants; whereas drought spells may produce aphids with heavier weights, but in general it is difficult to predict aphid populations for earlier stages of winter wheat development. In Kentucky, insecticide seed treatment is utilized by >80% of small grain farmers to protect plants from aphids. This is a preventive-prophylactic tool that protect fields for the 30 to 40 first days after seed emergence. Insecticide seed treatments is a recent practice in small grains, and as this practice is becoming generalized there is a potential risk that aphids may develop resistance in a near future. For this reason, growers and consultants need to continue scouting and monitoring for aphid populations to detect populations that may develop resistance to insecticide treated seeds. Scouting is an important IPM tool that will help with the identification of the pest and facilitate future control management practices if resistance start to develop within certain region.

Wheat Outlook for 2019-20 and Risk Management for the 2020 Crop

Todd Davis—Extension Grain Marketing Specialist

While the grain markets continue to struggle with understanding the size of the 2019 corn and soybean crops, the market pretty well understands the 2019 winter wheat crop's estimated production. As of August 19, USDA's weekly *Crop Progress* report pegged the winter wheat harvest in the U.S. as 93% completed. At this point, the market will focus on the demand side of the balance sheet, as the supply estimates will not change substantially in future reports.

USDA estimates the 2019 wheat crop, for all types of wheat, at 1.98 billion bushels. If realized, the 2019 crop will be 96 million bushels larger than last year's crop. With a smaller carry-in and the same projected amount of imports, the 2019 wheat supply will be slightly larger than last year at 3.18 billion bushels (Table 1).

Table 1. U.S. Wheat Supply and Use

	2016-17	2017-18	2018-19 Estimated	2019-20 Projected	Change from 18-19
Planted Acres (million)	50.1	46.1	47.8	45.6	-2.2
Harvested Acres (million)	43.9	37.6	39.6	38.4	-1.2
Yield (bushels/acre)	52.7	46.4	47.6	51.6	+4.0
	------------------ Million Bushels ------------------				
Beginning Stocks	976	1,181	1,099	1,072	-27
Production	2,309	1,741	1,884	1,980	+96
Imports	118	157	135	135	+0
Total Supply	3,402	3,079	3,118	3,187	+69
Food	949	964	955	960	+5
Seed	61	63	60	68	+8
Feed and Residual	156	51	96	170	+74
Exports	1,055	901	936	975	+39
Total Use	2,222	1,980	2,046	2,173	+127
Ending Stocks	1,181	1,099	1,072	1,014	-58
Stocks/Use	53.2%	55.5%	52.4%	46.7%	-5.7%
Days of Stocks	194	203	191	170	-21
U.S. Marketing-Year Average Price ($/bu)	$3.89	$4.72	$5.16	$5.00	-$0.160

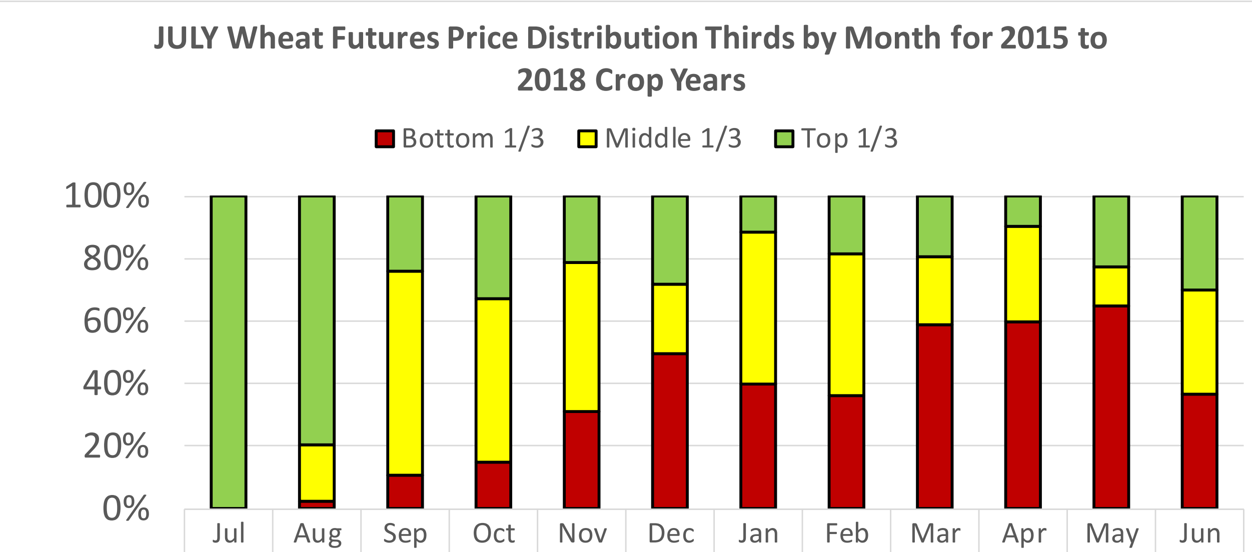
Source: August 2019 WASDE - USDA: WAOB.

The demand side of the balance is projected to be almost the same as last year with total use projected to increase by 127 million bushels. Food use increases with the population, and USDA's current estimate is 960 million bushels. USDA projects feed use to increase due to the potential smaller corn crop, especially in the Plains states. USDA currently projects exports to increase slightly from last year. Since the U.S. is the residual supplier, this export number could increase in response to a production problem elsewhere.

USDA currently projects ending stocks to decline slightly from last year to a little over 1 billion bushels. Prices typically respond higher whenever stocks decline; however, USDA projects the 2019-20 U.S. marketing-year average to be a little lower at $5.00 per bushel.

Protecting Price for the 2020 Wheat Crop

Sometimes the best time to price a crop is before the seed leaves the bag. This has been the case for wheat for the 2015 to 2018 crops as the July Wheat futures contract traded in the year's top-third trading range mostly in July and August. Figure 1 shows the frequency of the July futures contract closing in each year's trading range in the top, middle, or bottom price range. The seasonality in the futures market is clear as the futures price tends to trade lower once the crop breaks dormancy and approaches harvest. Better pricing opportunities have been in July, August, and into September as the market prices in a minor premium for wheat. Given the potential carryout of over 1 billion bushels, the market does not have to provide a substantial premium now. If weather conditions worsen into fall seeding, then the market may provide another pricing opportunity.



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Top 1/3	100%	80%	24%	33%	21%	28%	11%	18%	19%	10%	22%	30%
Middle 1/3	0%	18%	65%	52%	48%	22%	49%	45%	22%	30%	13%	33%
Bottom 1/3	0%	2%	11%	15%	31%	49%	40%	36%	59%	60%	65%	37%

SOUTHEASTERN GRAIN GATHERING

UK Horticulture Research Farm - 4321 Emmert Farm Lane - Lexington, KY 40514

Join us September 15-16, 2019 in Lexington, KY for a celebration and learning exchange for anyone with an interest in grains from our Southeast region. Farmers, millers, bakers, chefs, researchers, maltsters, brewers, distillers and consumers – from producers to end users – will build community and conversation around small grain value chains in our region.

This event will guide the next steps in building a local grain movement in the Southeast, and will feature:

- Hands-on baking demonstrations and classes
- Conversations about building local grain value chains—including “farm-to-loaf” and “farm-to-bottle connections”
- Networking opportunities for producers, processors, end users, and consumers.

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RETURN SERVICE REQUESTED

UPCOMING EVENTS

2019	***EVENT***	***LOCATION***
SEPT 15-16	SOUTHEASTERN Grain Gathering—UK Hort Research Farm	LEXINGTON KY
SEPT 19	RIBBON CUTTING CEREMONY— University of Kentucky Grains & Forage Center of Excellence at UKREC	PRINCETON KY
SEPT 26	KATS—Harvest and Storage Decisions/Cover Crops/Successful Wheat Establishment	PRINCETON KY
2020		
JAN 7	UK WINTER WHEAT MEETING	PRINCETON KY
MARCH 11	IPM MEETING	PRINCETON KY
MAY 12	UKWHEAT FIELD DAY—UK Research Farm	PRINCETON KY

Carrie Knott, Extension Grain Crops Specialist