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Grain Farming Primer for Landowners

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Introduction

This publication is an introduction to the topic of grain crops production and the dynamics associated with land rental agreements. Basic terminology and definitions for grain crops production in addition to a basic discussion of land rental agreements are included. Because this publication serves only as an introduction, questions in specific areas may arise. A list of references with more detail about specific subjects is provided for the reader.

The modern Kentucky grain producer typically raises corn, soybean, and wheat. Some Kentucky farmers raise grain sorghum (milo) or barley but on very few acres compared with corn, soybean, and wheat.

Technological improvements in machinery, crop genetics, fertilizers, and agrochemicals have allowed each farmer to manage more land. For example, the most current machines used to harvest grain can be equipped with more computer technology than was used by Apollo 11 when it landed on the moon.

As grain farmers manage more acres per person, they quite often manage rented farm land. Landowners willing to rent land to grain producers are an essential component of the American agricultural system because they help U.S. farmers continue to produce the most abundant, safest, and least expensive food supply in the world.

Management Decisions

All grain farmers face challenges and management decisions related to fertilization, lime application, tillage method, crop rotation, seed selection, and weed and pest control. But the farmer raising grain crops on rented land faces special considerations in each of these areas. Some of these considerations are discussed below.

Fertilization

Grain crops require various nutrients to grow and produce grain. These plants acquire many of these nutrients from the soil. Most soils do not have enough of these nutrients, in plant-available form, for adequate plant growth. Farmers need to take samples to determine the level of available nutrients in the soil. Reports from these soil tests will provide fertilizer recommendations indicating the amount of nutrients that need to be added to the soil to optimize crop growth. The three major nutrients added to soils are nitrogen, phosphorous, and potassium (abbreviated as N, P, and K). When added to the soil at high enough rates, fertilizer phosphorous and potassium will remain there for several years. Farmers can build up plant-available phosphorous and potassium in the soil and may not need to apply these fertilizers every year.

On the other hand, fertilizer nitrogen must be applied each year for certain crops such as corn, grain sorghum, wheat, and barley. Soybean is able to obtain its own nitrogen from the environment and typically does not need the application of extra nitrogen.

One other nutrient for corn production that is applied to some soils is zinc. Application of zinc depends on phosphorous and pH levels in the soil. A soil test will indicate if zinc is needed.

Lime

The soil pH measures the acidity or alkalinity of the soil. The pH scale ranges from 1 (acidic) to 14 (basic). Soil pH affects nutrient uptake. A farmer can add fertilizer nutrients to the soil, but if soil pH is not at a proper level, the plants may not be able to use those nutrients. A soil pH range of 6.0 to 6.8 is optimal for nutrient uptake by grain crops. Most soils in Kentucky and the United States tend to be slightly acidic (pH range of 5. 2 to 6.0). In these cases, the soil must be amended to adjust the pH to 6.0 to 6.8.

In most cases, lime is used to adjust soil pH. Lime is crushed limestone rock, typically made of a calcium source. It is added to fields at rates in the tons per acre. Most lime applications are made in the fall to allow time for lime to react with acidic soil. Lime applications made in the spring will have little effect on the corn or soybean grown that season but will have a positive impact on crops planted in following springs.

The full return on investment in a single application of lime is not realized for several years after the application. Single-year leases discourage lime application because of the time required to realize a return on this investment. Landowners need to consider the implications of short-term leases because farmers are less likely to negotiate them unless arrangements have been made to cover the cost of any lime application.

No-Tillage vs. Tillage

The three types of tillage systems used in Kentucky are no-tillage, minimum tillage, and conventional tillage.

No-Tillage Systems

No-tillage soil management means that a field is not tilled before planting. The no-till field will be sprayed with a herbicide to "burn down" the weeds. The farmer will plant into dead or dying weeds. The action of the planter units actually tills a very small strip of soil where the seed is placed, but the remaining field area is not tilled. No-till fields will have a lot of dead plant residue on the soil surface at the time of planting, causing the no-tillage field to look "uglier" in the spring than a tilled field. However, those residues help control erosion better in fields with rolling topography. The plant residue also builds soil organic matter. Organic matter can improve soil nutrient retention and water infiltration, thereby improving overall crop production. Many Kentucky fields are sloping and are ideal for no-tillage soil management.

Minimum Tillage Systems

Minimum tillage refers to a situation in which a field may be tilled once with an implement in an attempt to disturb the soil while leaving as much plant residue on the soil surface as possible. Minimum tillage systems are "in between" no-tillage and conventional tillage systems. Minimum tillage is used to alleviate compaction or remove perennial weeds such as vines. Many Kentucky fields that were once under a conventional tillage system are now under a minimum tillage system.

Conventional Tillage Systems

Conventional tillage means that the farmer will till the field in the fall and/or in the spring before planting, leaving little to no plant residue on the soil surface. Fields that are fairly level and/or that tend to be wet in the spring are often conventional-tilled. Conventional tillage helps these fields dry out earlier and warm up more quickly in the spring.

Conventional-tilled fields will lose soil organic matter over time. Some farmers using conventional tillage also use cover crops. Cover crops are planted in the fall and "cover" the soil during the winter. These crops are tilled into the soil in the spring. The cover crop helps reduce erosion during the winter and helps maintain soil organic matter.

Crop Rotation

The two major grain crops in Kentucky are corn and soybean. Wheat and grain sorghum are also grown on some acres. Many farmers rotate between corn and soybean, meaning that the farmer will plant corn one year and soybean the following year. Rotation helps the farmer manage nutrients and pests.

Corn requires more inputs, such as fertilizer, than soybean. However, corn typically returns more gross revenue per acre. Soybean requires fewer nutrients and usually requires less management than corn. Soybean is often more productive under stress conditions than corn and is better suited to some soils.

Soybean can be planted later in the season than corn. If a field is intended for corn but stays wet in the spring, delaying planting, then farmers often switch such a field to soybean.

Because of management decisions, field conditions, and economic considerations, some fields are not rotated between corn and soybean. Farmers realize that in these continuous crop (monoculture) situations, more attention to pest management will be needed. Long-term lease agreements aid in the planning of crop rotations and cash flow for both the landowner and tenant-farmer.

Seed

Seed costs of corn and soybean are increasing but so is the option of technologies offered to farmers. Corn hybrids can have herbicide resistance, insect resistance, or both traits. The herbicide-resistant traits can result in less injury to the crop from herbicide applications. The insect-resistant traits can reduce applications of insecticides.

Corn hybrids with herbicide resistance include the Liberty Link®, Clearfield™, and Roundup Ready® systems. Each of these trade names refers to a specific class of herbicides. Both the Liberty Link and Roundup Ready systems were developed by genetic engineering, while Clearfield corn was not developed with genetic engineering.

Corn hybrids with resistance to insects have been genetically engineered to produce a Bt compound that is toxic to specific insects but not toxic to animals. These "Bt hybrids" will allow the corn crop to resist certain insects but will still be susceptible to other insects. A farmer will select a Bt hybrid based on previous insect history. Corn that is planted late is at greater risk for corn borers, a type of insect. Studies in Kentucky have shown that Bt hybrids perform better in late plantings than non-Bt corn. Farmers raising Bt hybrids must include non-Bt hybrids in a portion of the same field as part of proper pest management practices.

Some soybean varieties have resistance to glyphosate herbicide. These soybean varieties are known as Roundup Ready soybean. Roundup Ready soybean varieties are planted on about 85% of the total soybean acres in the United States because the glyphosate herbicide is very effective at controlling many weeds and does not injure Roundup Ready soybean.

Farmers who use soybean varieties or corn hybrids with these traits do so because of the benefits they provide to the production system. However, farmers are always searching for a market advantage. Some markets do not accept corn or soybean that has been genetically engineered for insect resistance and often pay a premium for the grain harvested from these conventional varieties. When considering one of these markets, the farmer must weigh the advantages of using or not using varieties with genetically engineered traits. Even though markets may offer premiums for grain from conventional varieties, there are cases when the farmer is able to gain a greater net profit by growing the genetically engineered corn or soybean. The perceived advantage from growing varieties that have been genetically engineered is evidenced by the fact that such varieties are widely used in Kentucky and across the country.

Pesticides

To produce a crop, farmers in Kentucky and across the country have to battle with weeds, insects, and diseases. Farmers use herbicides to control weeds, insecticides to control insects, and fungicides to control fungi that cause diseases.

Pesticides are defined as any compound designed to kill an organism. Most people use pesticides every day and do not realize it. For example, antibacterial soaps are technically pesticides since they are designed to kill bacteria. Household cleaners that claim to kill germs are pesticides. Household products designed to kill insects are insecticides, which is a type of pesticide.

The type of tillage system used in a field will affect pest populations and pesticide use. Farmers in no-till cropping systems typically need to use more herbicides to remove weeds than farmers in conventional tillage systems. In addition, insect populations are often higher in a no-till system, often requiring the use of insecticides to protect a crop. However, a conventional tillage system requires more fossil fuel use and potentially leads to more soil erosion than a no-till system.

All pesticides legally used in the United States must be approved by the Environmental Protection Agency as well as state government agencies. Each pesticide that goes through the Environmental Protection Agency review process must have years of data on how that pesticide works on the intended pest, its effect on animals, and its fate in the environment. In addition, anyone applying agricultural pesticides or "agrichemicals" is required to be licensed by the Commonwealth of Kentucky. To obtain the license in Kentucky, pesticide applicators must pass a test on how to use pesticides safely and properly. Pesticide applicators are required to attend training events each year to maintain their licenses. Some farmers do not apply pesticides but hire out that job to a company or a neighboring farmer with the proper licensing and machinery.

Organic Farming

Farmers opposed to using synthetic compounds are trying to grow grain organically. Organic farming has come to mean that a farmer does not use synthetic compounds to raise a crop, but "natural" pesticides and fertilizers are used.

Instead of using a synthetic insecticide or a genetically engineered insect-resistant crop, the organic farmer will use a "natural insecticide" such as a Bt powder to control the insects. In this case, the Bt powder will kill the insects the same way that genetically engineered Bt corn kills insects. However, the Bt powder is sprayed or dusted over the top of the crop several times a year to kill insects. Soaps are also used to help fight off some insects and some diseases. Like the Bt powder, the soaps often have to be applied several times a year to help defend against insects or diseases. Other insecticides approved for organic farming include oils, which are used to suffocate insects, and plant extracts, such as the highly lethal pyrethrins. Instead of using an herbicide to control weeds, the farmer will cultivate between the crop rows, use a flame thrower to burn the weeds, or pull the weeds by hand. In addition, the organic farmer must rely heavily on crop rotation to help reduce the impact of weeds, insects, and diseases.

Organic farmers will not use synthetic fertilizers but will use things like animal manure and rock phosphate to provide some of the required nutrients. In some cases, organic farmers will grow one crop strictly to fertilize the following crop. Whether synthetic fertilizers or fertilizers approved for organic farming are used, both types of fertilizer will be broken down into the same compounds before plant roots can use the nutrients.

Many individuals who do not raise crops often think that organic farming leaves less of an impact on the environment than conventional farming. There are debates on that subject when factors such as soil erosion or increased fossil fuel consumption from increased tillage are considered.

One thing that is not debated is that organic farming requires intensive management and will not allow a farmer to manage as many acres as conventional farming. Premiums are often offered for organically grown products, but those premiums may not offset the increased cost of management. Because of the high management requirements, organic farming is typically conducted on small land parcels and on crops that are sold at farmers' markets or at specific stores. These crops include vegetables such as lettuce and tomatoes.

Organic grain farming is extremely challenging in Kentucky due to weeds, insects, and some diseases. Anyone considering organic farming should evaluate available markets, premiums, expected yields, crop management, labor requirements, and land size.

Marketing and Economics

Successfully planting, managing, and harvesting grain crops are only part of the farm management equation. Another—and equally important—step is the ability to sell harvested crops at a level that profits are realized. Much of the grain grown in Kentucky is sold to local elevators and grain distributors at market prices as determined by the Chicago Board of Trade.

The simple explanation for determining commodity prices is that the Chicago Board of Trade considers supply and demand to determine price throughout the year. However, determining the supply and demand of a commodity is extremely complex. Commodity prices fluctuate throughout the year depending on current and expected weather conditions and their expected impact on crop conditions. Expectations about current and future stocks of grain and current and future demand also impact grain price action. Since grain commodities are marketed in a global environment, all of these conditions must be considered on a global basis. This means that current and expected geopolitical events impact commodity prices.

Commodities such as corn, soybean, and wheat can be "marketed" to try to offset some of the risk from price fluctuations in commodity prices. Various marketing alternatives are available with the goal of being able to lock in a minimum price, thereby avoiding low prices, and yet retain the ability to benefit from higher prices later. For example, a farmer or anyone wanting to sell commodity grain could look at projected prices for corn in December and decide to lock in the December price for a certain amount of grain.

Locking in a specific price does not eliminate risk. By locking in the price, the farmer is agreeing to deliver a certain amount of grain at a certain date. Crop failures can cause a farmer to be short on the agreed amount of grain to deliver and cause that farmer to either buy additional grain to meet the contract or to renegotiate the terms of the contract with the buyer. In addition, locking in a specific price for a commodity brings about the risk that prices for that commodity could rise above the locked price and thereby limit potential revenue.

Good marketing methods require management and understanding of the commodity market. Some marketing strategies require storage facilities, which require additional management of the grain. Landowners keeping a portion of the harvested crop as payment for leased land must also consider these marketing strategies.

Some varieties or types of grain are grown for a specific contract. These contracts require the farmer to deliver a certain amount and type of grain to a designated market. Food-grade corn is an excellent example of a crop grown on contracts. In these cases, food processors want to ensure a set amount of food-grade corn for their processing facilities and offer contracts. Farmers agree to grow the specific type of corn on a set number of acres for a set price. These contracts typically offer a price premium over the Chicago Board of Trade. However, these crops often do not yield as much as commodity crops. In addition, the farmer often must be ready to deliver the crop on demand. To meet timely deliveries, the farmer may have to clean, condition, and store grain for a while. If the crop is stored, it will have to be kept separate from other varieties. Production management, yield, storage management, and shipping are all factors that must be considered when a farmer determines to grow a crop for contract.

Land Lease Agreements

A major portion of Kentucky cropland is farmed on a lease arrangement between a tenant-farmer and a landowner. The critical factor in managing leased land for grain crops production is the land lease agreement. This agreement is determined by both the landowner and the tenant-farmer and will define the level of risk, investments, and returns shared by each party.

Land lease agreements are typically set up either as a cash lease system or a crop-share lease system. Cash lease systems involve the landowner and tenant-farmer agreeing to a set price per acre. The crop-share lease system means that the landowner and tenant-farmer will agree to a ratio of the final crop yield from the farm. Both the cash lease and crop-share lease systems are used widely. Deciding which leasing option is better depends on both the landowner and the tenant-farmer.

Cash Lease System

The cash lease involves less risk than the crop-share lease to the landowner. However, the cash lease systems caps the potential income to the landowner and increases the risk to the tenant-farmer. The tenant-farmer assumes all of the risk of production and pricing.

The tenant-farmer often pays a portion of the cash lease prior to the growing season. This cost to the tenant-farmer can limit cash flow during the growing season. Landowners typically have very little involvement with farm management in a cash lease system.

Crop-Share System

The crop-share lease has higher risk to the landowner but does not put a cap on potential profits. The crop-share system has less impact on the tenant-farmer's cash flow during the growing season. The landowner usually assumes part of the management decisions with a crop-share lease. Those decisions will be negotiated by the landowner and tenant-farmer during the lease agreement.

Multiple-Year Contracts

In addition to deciding on a cash lease or crop-share lease, the landowner needs to decide if the land will be rented to the same tenant-farmer for multiple years. Multiple-year contracts allow the tenant-farmer and the landlord to make a long-term plan for soil and crop management. Some inputs, such as lime and tiling, are much more feasible on multiple-year contracts. In addition, multiple-year contracts allow the tenant-farmer to better manage problems such as weeds and factors such as crop rotation.

Evaluating Your Situation

Two tables are provided to help producers work through their potential crop leasing arrangements. Table 1 provides an example of an arrangement for one acre of corn. Table 2 is a worksheet based on the example in Table 1. An electronic spreadsheet complete with calculations is available in the HTML version of this publication at <www.uky.edu/Ag/AgEcon/extension.html>.

Ethical Guidelines for Tenants and Landowners

A fixed supply of farmland ensures that economic competition will determine lease arrangements between landowners and tenant-farmers. As they negotiate the terms of lease agreements, it is important that both parties treat each other with openness and respect to assure a fair and equitable lease.

A fair lease arrangement is one where information is shared completely, and both parties are satisfied. The terms of the lease should compensate each party fairly for all the resources they contribute to the enterprise. These resources include not only the physical resources of land, machinery, labor, and other inputs but also the management abilities and risk preferences of each party.

Tenant-farmers and landowners should regard each other as partners, not as adversaries trying to gain advantage. Ethical behavior on each side will protect personal and community relationships. Fair leases reward both parties and provide for long-term stewardship of the land.

Table 1. Example of cost share for crop leasing arrangements for one acre of corn.

Costs per Acre	Amount	Unit	Price	Total $/Ac	Land-Owner Share	Tenant-Farmer Share	Land-Owner Cost	Tenant-Farmer Cost
Seed	0.35	bag or lb	$105.00	$36.75	0%	100%	$0.00	$36.75
Nitrogen	150	lb	$0.30	$45.00	0%	100%	$0.00	$45.00
Phosphorus	40	lb	$0.27	$10.80	0%	100%	$0.00	$10.80
Potassium	40	lb	$0.12	$4.80	0%	100%	$0.00	$4.80
Lime	1	ton	$12.12	$12.12	100%	0%	$12.12	$0.00
Herbicides	1	acre	$15.00	$15.00	0%	100%	$0.00	$15.00
Insecticides	1	acre	$0.00	$0.00	0%	100%	$0.00	$0.00
Fungicides	1	acre	$0.00	$0.00	0%	100%	$0.00	$0.00
Tillage	2	trips	$8.50	$17.00	0%	100%	$0.00	$17.00
Planting	1	acre	$12.00	$12.00	0%	100%	$0.00	$12.00
Spraying	2	trips	$4.50	$9.00	0%	100%	$0.00	$9.00
Harvest	1	acre	$25.00	$25.00	0%	100%	$0.00	$25.00
Trucking	150	bushel	$0.10	$15.00	0%	100%	$0.00	$15.00
Drying	150	bushel	$0.15	$22.50	0%	100%	$0.00	$22.50
Crop insurance	1	acre	$0.00	$0.00	0%	100%	$0.00	$0.00
Other	1	acre	$0.00	$0.00	0%	100%	$0.00	$0.00
Hired labor	0	hours	$8.00	$0.00	0%	100%	$0.00	$0.00
Operating interest (1/2 year)	$224.97	dollars	3.0%	$6.75	5%	95%	$0.36	$6.39
Land value	$2,000	dollars	5.0%	$100.00	100%	0%	$100.00	$0.00
Buildings/facilities value	$200	dollars	5.0%	$10.00	0%	100%	$0.00	$10.00
Property taxes	1	acre	$9.50	$9.50	100%	0%	$9.50	$0.00
Operator labor/ management	2.75	hours	$10.00	$27.50	0%	100%	$0.00	$27.50
Total Cost and Cost Share				$378.72	32%	68%	$121.98	$256.74

Instructions and assumptions for completing Table 1:
The cost share indicates the percentage of expenses borne by each party. Share leases should reflect this distribution of crop revenues. Non-monetary factors like risk and management may affect the negotiated share arrangement.

The default values in this example are for corn. Any crop can be evaluated by changing the amounts and prices of inputs.

Values not included in this example are the costs associated with soil sampling and property improvements, such as tiling the field or improving access points. These values could be placed in the "Other" line as determined by the leasing arrangement. Shaded values have been adjusted to fit this situation.

Table 2. Sample worksheet of cost share for crop leasing arrangements.

Costs per Acre	Amount	Unit	Price	Total $/ac	Land-Owner Share	Tenant-Farmer Share	Land-Owner Cost	Tenant-Farmer Cost
Seed		bag or lb						
Nitrogen		lb						
Phosphorus		lb						
Potassium		lb						
Lime		ton						
Herbicides		acre						
Insecticides		acre						
Fungicides		acre						
Tillage		trips						
Planting		acre						
Spraying		trips						
Harvest		acre						
Trucking		bushel						
Drying		bushel						
Crop insurance		acre						
Other		acre						
Hired labor		hours						
Operating interest (1/2 year)		dollars						
Land value		dollars						
Buildings/facilities value		dollars						
Property taxes		acre						
Operator labor/ management		hours						
Total Cost and Cost Share								

Instructions for Table 2:
Insert your own values for your cropping situation. Use Table 1 as an example only. Table 1 provides an example for corn, but any crop can be evaluated by changing the amounts and prices of inputs.

Indicate with a percentage in the "Landowner Share" column the proportion of expenses paid by the landowner. Indicate with a percentage in the "Tenant-Farmer Share" column the proportion of expenses paid by the tenant-farmer. The cost share indicates the percentage of expenses borne by each party. Share leases should reflect this distribution of crop revenues.

Nonmonetary factors like risk and management may affect the negotiated share arrangement.

An electronic version of this table with calculations in place is available in the online version of this publication at <www.uky.edu/Ag/AgEcon/extension.html>.

Ensuring Ethical Behavior in Land Leases

This checklist is offered as a guideline for ethical behavior among all parties. Not all costs or benefits can be expressed in dollars. Fair and just leases will protect both farms and feelings.

Tenant-Farmers

- Should respect the landowner and the rights of other potential tenants.
- Should be positive in dealings with potential landlords and not overstate your strengths. Never make false or misleading statements about competitors.
- While economics are often a driving factor for cash rents, economics alone should not dictate leases. Care of the land and facilities and/or heritage of the farm are other factors that may be considered. Every farm situation is different, and price alone should not dictate leases.
- Do not ask prospective landowners to divulge details of their current rental arrangement or offer to "beat" current or future offers.
- Should keep the landowner informed of any change in business arrangements or change in legal status.
- Should follow pesticide labels, record-keeping requirements, and seed patent laws.

Landowners

- Should disclose any intended changes in rental arrangements in writing at least six months prior to the expiration date of the lease.
- For protection of all parties, should not disclose existing lease arrangements when recommending a tenant-farmer to another landowner or when seeking a new tenant-farmer.
- Should use reasonable care to ensure that documents pertaining to the lease agreement are maintained along with any written extensions and amendments.
- Should advertise public solicitations for lease bids in local papers or other public places.

Landowners and Tenant-Farmers

- Should consider current and future value, farm program payments, lease term, and local customary practices when negotiating a fair lease.
- Should preserve confidentiality of information during and following termination of legal agreements.
- Communication must be open between both parties. Written agreements help lay out the expectations and responsibilities.
- Government payments go to the person who is at risk. Typically, a landowner who cash leases property is not eligible for the payments. Consult the Farm Services Agency regarding any changes or guidelines in payments.
- The Water Quality Plan and Soil Conservation Plan are the responsibility of the landowner. Determining who maintains waterways, Conservation Reserve Program acres, and other conservation practices should be outlined in the lease agreement.
- Leases should include survivorship provisions to address the status of the lease if the landowner or tenant-farmer dies prior to the end of the lease.
- Be as specific as possible on due dates for leases, access points to fields, and other unique terms of the lease.
- Ownership of input records, crop records, soil characteristics, GPS data (including field maps, soil maps, yield maps, etc.) should be defined in the terms of the lease.

Resources

A list of publications with more information regarding specific areas of grain crop production is included below. Printed copies of these publications and guidance are available from your local county Extension office.

Many publications can be found online at the University of Kentucky Grain Crops Extension Web site: http://www.uky.edu/Ag/GrainCrops/. Decision aids based on economics are available online at the University of Kentucky Department of Agricultural Economics publications Web site: http://www.uky.edu/Agriculture/AgriculturalEconomics/pubs.html

The following publications are available in print and online. Unless otherwise noted, they can all be found online at:

http://www.ca.uky.edu/agc/pubs/agpubs.htm

Lime and Fertilizer

- **AGR-1:** Lime and Fertilizer Recommendations

Corn Production

- **ID-139:** A Comprehensive Guide to Corn Management in Kentucky

Soybean Production

- **AGR-128:** Soybean Production in Kentucky Part I: Status, Uses and Planning
- **AGR-129:** Soybean Production in Kentucky Part II: Seed Selection, Variety Selection and Fertilization
- **AGR-130:** Soybean Production in Kentucky Part III: Planting Practices and Double Cropping
- **AGR-131:** Soybean Production in Kentucky Part IV: Weed, Disease, and Insect Control
- **AGR-132:** Soybean Production in Kentucky Part V: Harvesting, Drying, Storage, and Marketing
- **AGR-182:** Specialty Soybean Production and Management in Kentucky
- **AGR-184**: Predicting Soybean First Flowering Date

Small Grains Production

- **ID-125:** A Comprehensive Guide to Wheat Management in Kentucky
- **ID-125A:** Kentucky Winter Wheat Calendar
- **ID- 136:** No-Till Small Grain Production in Kentucky

Pest Management

- **AGR-6:** Weed Control Guide Recommendations for Field Crops http://www.uky.edu/Ag/Agronomy/Weeds/agr-6.htm
- **PPA-10a:** Kentucky Plant Disease Management Guide for Corn and Sorghum
- Insect Management Recommendations for Field Crops and Livestock (online only) http://www.uky.edu/Agriculture/PAT/recs/rechome.htm

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