MILAN NO-TILL 2014

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SAVE THE SOIL

28th Milan No-Till
Crop Production Field Day
TOUR REPORT
with
Crop Variety Demonstrations

Hosted by UT AgResearch
Thursday, July 24, 2014
7 a.m. - 2 p.m.

North Tract of the
AgResearch and Education Center
Milan, Tennessee

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THE UNIVERSITY of TENNESSEE
INSTITUTE of AGRICULTURE

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Tour A: No-Till Corn Production

Insect Control Traits and Late Season Insect Management

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Bt corn traits that are potentially available in Tennessee are quite numerous, and non-Bt corn refuge requirements vary depending whether you are in a corn only area or in a cotton growing area. Cotton growing areas in Tennessee include the counties of Carroll, Chester, Crockett, Dyer, Fayette, Franklin, Gibson, Hardeman, Hardin, Haywood, Lake, Lauderdale, Lincoln, Madison, Obion, Rutherford, Shelby, and Tipton. A larger refuge of non-Bt corn is required in cotton growing areas. Always check with company licensing agreements to make sure that you are in compliance.

Refuge-in-a-bag (RIB) options are for corn growing areas only. This is where the non-Bt refuge seed is mixed in the bag with Bt corn, either at a 5 percent or 10 percent level, depending upon the trait package selected.

In addition to Bt traits active against stem-boring caterpillar pests, there are recently introduced, stacked Bt traits that provide additional protection from ear-feeding larvae. Ear-feeding larvae such as corn earworm can be important insect pests of field corn in the midsouthern U.S. Following either simulated or naturally-occurring corn earworm injury to ear tips, corn ears were evaluated to determine how yield parameters including total kernel number, total kernel weight and individual kernel size were affected by different levels of kernel injury. Simulated corn earworm injury reduced total kernel weight when kernels were injured at the blister and milk stage in 2010 and when 60 or 120 kernels per ear were injured at the milk stage in 2011. In 2010, there was little or no indication that other kernels within the ear compensated for this injury. In 2011, simulated injury inflicted at both the blister and milk stage resulted in an increase in the size of kernels within the same ear. In 2013, whole ear measurements showed no differences for total kernel weight or weight of an individual kernel when ears were injured at either stage regardless of the number of kernels damaged.

There were no differences for kernels at the bottom end of the ears for total kernels, total kernel weight or weight of an individual kernel on ears damaged at the blister or milk stage. In 2013, simulated injury at both the blister and milk stages reduced the number of kernels and total kernel weight at the ear tip.

The Agricultural Act of 2014: Title 1 Program Options for Corn Producers

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After two years of debating a new farm bill, the Agricultural Act of 2014 was signed into law in February 2014. The five-year farm bill contained many changes designed to reduce federal spending over the life of the bill. Spending for Title I, or commodity programs, was reduced and more money was allocated to crop insurance. In addition, Title I programs shifted significantly from direct and counter-cyclical payments to a risk management safety net requiring farmers to make individualized decisions for their farms. The new farm bill contains many complexities with respect to which program best fits an individual farm. Farmers will choose from revenue and price protection plans for corn, soybeans, wheat, and other crops except cotton. Cotton will no longer be a covered commodity crop. Farmers will choose whether to enroll in the revenue or price programs on a covered commodity by covered commodity or whole farm basis. The decision will remain in place for the life of the farm bill.

Average Revenue Coverage (ARC) will protect against revenue losses on farms. Farmers will be able to choose from a county or individual-level program. Under the county-level plan (County-ARC), farmers will be paid on 85 percent of base acres if county-level revenue falls below benchmark revenues for a crop enrolled in the program.

Individual-ARC is the other revenue protection plan. It differs from County-ARC in that farmers will be paid on only 65 percent of base acres and they must enroll all covered commodity crops on that farm in Individual-ARC. Payments will be made if crop revenue falls below benchmark revenues on that farm rather than on county-level benchmark revenues.

Price Loss Coverage (PLC) will protect farmers if marketing year average prices fall below specified reference prices for each crop. Farmers will be paid on 85 percent of their base acreage for each crop. This option can be chosen on a covered commodity-by-covered commodity basis so it is possible to enroll in PLC for some crops and County-ARC (not Individual-ARC) for others. Farmers can also purchase a Supplemental Coverage Option (SCO) to add to their existing crop insurance coverage. Farmers choosing to enroll in ARC are ineligible to purchase SCO.

For cotton, farmers will be able to choose whether to purchase a Stacked Income Protection Plan (STAX) or Supplemental Coverage Option (SCO) to supplement crop insurance. The STAX program will not be available until 2015, thus cotton producers will receive transition payments for the 2014 crop year. Farmers cannot choose both types of coverage on their cotton acreage.

Farmers will have the opportunity to reallocate existing base acres across covered commodities while cotton base acres (now called generic base) will be allocated across program commodities. This decision will allow them to match potential payments to more recent actual plantings. In addition, farmers may wish to update payment yields if recent average yields are higher than their previous Farm Service Agency yields.

This presentation will discuss options within the new farm bill as they relate to Title I programs to aid producers in making an informed decision before signing up for these programs.

Irrigation and Genetic Traits for Adequate Water in Corn

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Variable rainfall in past years has led to an increase in irrigation equipment in fields planted to corn in many parts of the Mid-South. Timely use of irrigation can increase yields when water is applied in the right amounts at the right growth stage. There are a number of options that can be used to schedule water, ranging from the low tech “checkbook” method to using soil moisture sensors and variable rate nozzles for precision watering. One of the most important requirements for making irrigation work effectively is being able to accurately determine the growth stage of the corn crop. Peak water demand in corn is at silking and early grain development but adequate water is also needed at specific stages prior to tasseling in order to maximize ear size. We can apply a high amount of water season long, but that is costly and some soils cannot absorb high amounts of water without runoff. Corn growth stages will be discussed, including optimal amounts to apply for each stage. Also, a simple way to identify corn growth stage and physiological maturity or “black layer” will be demonstrated.

Seed companies have improved the drought tolerance of hybrids by increasing the number of stress traits in ‘Artesian' and ‘Aquamax' hybrids. Drought tolerant hybrids contain an increased number of stress traits which range from improved root development to physiological processes that use water more efficiently in the plant. Monsanto introduced the first genetically modified drought tolerant hybrids labeled ‘DroughtGard' which were commercially available in Tennessee in 2014. Most research identifying the benefits of drought tolerant traits has been conducted in arid parts of the U.S, including Colorado, Kansas and Texas. Because the

majority of corn acres are not irrigated in Tennessee, there is much interest in incorporating these hybrids into production and hopefully improving corn yields in years where producers undergo short term drought conditions. Research in Tennessee is ongoing to determine the value of drought tolerant technology in the humid midsouth using hybrids with drought traits compared to standard high yielding hybrids, and preliminary results will be discussed.

What's New in Planting Equipment?

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Finger pickup seed metering was introduced in 1969. For 23 years this was the best the industry had to offer. As a matter of fact this technology is still being used today, 45 years later.

Enter vacuum metering, 1992 was the year. Great improvement was seen in placement accuracy and population. Continued advancements have continued to make this type of seed metering the preferred choice on today's machines.

The biggest advancements in planting in recent years have been in three areas: down force, section control and monitoring. Let's look at down force… Being able to adjust down force on the go and even having the planter make these adjustments for us has brought seed depth to a never before seen consistency. Section control has given us the ability to eliminate over and under planting in the headlands. This has been a double bonus in both saving on seed cost and also increasing yield. Add to this the ability to monitor all aspects of planter function such as ride quality, population, percent skips, percent doubles, down force, and CV or coefficient of variation in spacing. This has given us tremendous insight to our planting operation.

Where do we go from here? Let's look at the issues in today's planters for the answer. From the introduction of the mechanical planter until today there is an uncontrollable 18 inch gap between the meter and the bottom of the seed trench. We do monitor that gap with a sensor but don't have complete control of it. Therefore some inconsistency will still occur on its path. Keep in mind everything we monitor is affected by this gap.

The future is here. With new unit technology we have complete control of the seed all the way to the seed trench. Seed delivery to the ground with a level of accuracy never before seen.

What will this technology provide to the farmer? How about the highest level of accuracy ever experienced in combination with an increase in planting speeds? How about covering the same number of acres with a smaller and easier to transport planter? How about more money on the bottom line? The equipment industry has taken one variable out of the production cycle with this new technology.

Stop by Tour A: No-Till Corn Production, What's New in Planting Equipment to see this latest planting equipment first hand.

Tour B: Soybean Breeders Tour

Development of High Oleic Soybeans

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The Soybean Breeding and Genetics Program at the University of Tennessee is embarking on a bold opportunity to develop new varieties of soybeans that are capable of producing USA grown vegetable oil remarkably similar to heart-healthy, pricy imported olive oil. We will accomplish this with key collaborative team efforts supported by the United Soybean Board and the Tennessee Soybean Promotion Board.

Hydrogenated soybean oil has dominated the vegetable oil industry for years, helping keep a steady demand for our farmers. But the use of hydrogenated oil fell out of favor following public concerns about trans fats and the passage of the Food and Drug Administration's trans fat labeling regulations in 2006. Approximately five *billion* pounds of soybean oil has been lost to other oilseed crops able to produce vegetable oils containing "no trans fat". Ironically, in order to satisfy FDA food product trans fat labeling regulations, major food processing companies have steeply ramped up purchases of imported palm oil, produced and shipped from Indonesia and southeast Asia, via vegetable oil tanker ships whose massive engines consume considerable volumes of diesel fuel along the way. But the predominant fatty acid in the lipid profile of palm oil is palmitic acid, which is a *saturated fat* named after palm oil.

In contrast, the *monounsaturated*, fatty acid *oleic acid*, is the predominant fatty acid in olive oil for which oleic acid is named. High oleic acid concentration is what significantly improves the oil's oxidative stability, processing functionality, and shelf life. Moreover, numerous nutritional studies on olive oil and Mediterranean diets have shown heart-healthy beneficial reductions in cholesterol and other metrics of consumers of olive oil. High oleic oils are now highly sought after by food processors and industrial processors. The discovery of the high oleic acid trait in soybean allows the domestic USA vegetable oil crop to soon compete head-to-head with the best oils in existence in the world.

The timing of accelerated support of the high oleic soybean trait has been fortunate in light of this past November's Federal Register, Docket No. FDA–2013–N–1317 "Based on new scientific evidence and the findings of expert scientific panels, the Food and Drug Administration (FDA) has tentatively determined that partially hydrogenated oils (PHOs) … which are the primary dietary source of … trans fat, are not generally recognized as safe (GRAS) for any use in food … and therefore … this would mean that food manufacturers would no longer be permitted to sell PHOs, either directly or as ingredients in another food product …"

The United Soybean Board has a stated goal to capture broad segments of the high oleic oil market by supporting the development of new high oleic soybeans across all U.S. maturity groups, with a goal for 25 million acres by 2023. Towards that end, USB has invested high levels of funding to DuPont-Pioneer and to Monsanto for developing, testing, and variety deployment of new transgenic events conferring the high oleic trait.

The United Soybean Board has also funded a key team of public University and USDA researchers working with natural but rare, gene variants that can produce non-GMO high oleic acid at levels that match or exceed that of DuPont's or Monsanto's genetically engineered transgenic events. Our UT Soybean Breeding and Genetics Program is working hard to ensure that our southern soybean production region is not left out of the loop in development of high oleic soybeans for producers. Genetically two fatty acid desaturase (FAD) genes (FAD2-1A and FAD2-1B) when combined in the homozygous recessive form from rare variants in the USDA soybean germplasm collection can produce >75 percent oleic acid, and can readily produce >80 percent oleic acid here in the southern region. We are actively engaged in combining that valuable trait with top yielding soybean lines to help sustain the

demand for USA soybeans and protect economic livelihoods of southern soybean producers.

Charcoal Rot of Soybean and Its Impact on Yield

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Charcoal rot of soybean is a root and stem disease that can reduce soybean yield and seed quality leading to plant death. It is common during hot, dry weather and has long been associated with high temperatures and drought. In the Southern United States, between 2011 and 2012, this disease ranked second and first, respectively in importance among all soybean diseases reported for the Southern U.S. More recently, charcoal rot has been found affecting soybean with increased frequency in fields of the upper Midwest with reported disease outbreaks in Illinois, Indiana, Iowa, Minnesota, North Dakota, and Wisconsin. The causal agent of charcoal rot is a soil-borne fungus known as *Macrophomina phaseolina* and has a host range of over 500 plant species.

Recently, a few moderately resistant cultivars have been identified. In the past however, drought avoidance was the only effective control measure and yield loss measurement was impossible. It was impossible because the effect of the disease is confounded with drought. In a two year study where plots were either irrigated or non-irrigated, yield loss was measured using two moderately resistant and two susceptible soybean cultivars. The result showed that charcoal rot caused yield loss even in irrigated plots. An estimated 15 percent loss for charcoal rot and 22 percent combined loss due to charcoal rot and drought were determined. Additionally, the yield advantage of moderately resistant over susceptible soybeans was estimated as ranging between 11 and 49 percent in infested plots. This study suggested that charcoal rot can be an economically important disease in causing a significant yield loss even with irrigation and a conducive environment for soybean growth. There is a definite need for identifying a high level of resistant soybeans with a high yield potential to reduce such losses.

USDA Soybean Breeding to Improve Resistance to Nematodes, Frogeye Leaf Spot, and Charcoal Rot in Tennessee

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USDA-ARS breeding program is actively developing soybeans for improved resistance to cyst nematode populations and fungal disease for Tennessee and Mid-South Region. The Mid-South has more acreage planted with soybeans than any other crop. Soybeans rank first in cash value among row crops produced in West Tennessee. The soybean cyst nematode has been found in much of the Tennessee and Mid-South region where soybeans are produced. The annual yield losses caused by SCN in Tennessee are nearly $8 million and losses in the South account for over $65 million. The use of resistant cultivars helps to minimize these losses and keep them relatively stable. But, SCN over time can adapt to resistant varieties with more aggressive nematode populations. Therefore breeding for SCN resistance will remain a constant challenge.

Recently, we released conventional soybeans adapted to Tennessee and Mid-South region, and these included; JTN-5303, JTN-5503, JTN-5203 and JTN-4307. These maturity group V soybeans that we developed, combine high yields with excellent resistance to nematodes and fungal diseases. In Tennessee, Frogeye leaf spot disease has been identified that is highly resistant to several commonly used Strobilurin fungicides and, JTN-4307 is highly resistant to Frogeye leaf spot. In 2013, soybean JTN-5110 that we developed, is the top yielder in Soybean Variety Performance Tests in Tennessee with excellent resistance to nematodes and fungal diseases. Our breeding methods combine both traditional and molecular marker technologies

for increased efficiency. The collaboration between the University of Tennessee and the USDA-ARS has been outstanding for soybean breeding research and development.

Tour C: No-Till Soybean Production

Glyphosate-Resistant Weed Management with Dicamba

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What is new in soybean weed control for 2014? Unfortunately, there is no new Roundup that will control a foot tall Palmer on the way for 2015. However, there are new or relatively new developments that may come into play when you are making your weed control plans for next spring. Currently, products with pyroxasulfone provide good residual activity on pigweed. Second, with more Liberty Link soybeans planted in Tennessee weed control with Liberty is an option. Lastly, we will be stressing the use of at least two herbicides with activity on Palmer pre plant/pre emergence. A little further down the road (2015+) Monsanto will introduce soybeans tolerant to both dicamba and glyphosate. About the same timeline Dow will introduce 2, 4-D- and glyphosate-tolerant soybean and Syngenta/Bayer CropScience will introduce a mesotrione, glufosinate, and isoxaflutole (MGI) tolerant. The MGI soybean will also be combined with other herbicide tolerant traits to offer the most options for weed management for soybean production.

Pyroxasulfone is a newer herbicide developed by Kumiai. Pyroxasulfone herbicide is like Dual but with better residual activity on pigweeds but probably not as much activity on weeds like nutsedge. Kumiai elected to market pyroxasulfone in a unique way as they have licensed it to three different companies for sale here in the United States. Valent will be selling it in a premix with Valor and the proposed trade name is Fierce. FMC will be selling it in a premix with Cadet and the proposed trade name will be Anthem. Finally BASF will be selling pyroxasulfone alone with the trade name Zidua. In our research Fierce, Anthem tankmixed with an Authority product and Zidua tank mixed with a number of PPO herbicides provided about 5 weeks of residual control. In other words, those premixes or combinations would provide residual control similar to Prefix. What are the possible drawbacks of these products? There still is a 12 month plant back to any crop other than corn and soybeans.

Many producers have struggled to consistently control Palmer with a PPO herbicide like Flexstar or Cobra. The problem is the inability to get the Palmer sprayed before it reaches a height of 4 inches. Many have found out that if they are unable to control Palmer that is 3 to 5 inches tall with the first PPO herbicide application, it will not be controlled by a follow-up PPO application. One advantage of Liberty over a PPO herbicide is that it will more consistently control Palmer that is over 4 inches tall. However, a sequential application of Liberty applied 7 to 10 days after the first Liberty application will typically control regrowth of Palmer that is in that 4 to 8 inch height range. That to me is the biggest advantage of Liberty over a PPO herbicide. The only recourse if Palmer is growing back from a PPO herbicide is to disk the field and replant or hire a chopping crew.

Using two herbicides with activity on Palmer amaranth applied prior to soybean emergence is a must going forward in managing pigweed. We cannot afford to lose another herbicide with activity on Palmer amaranth. The idea is that with two herbicides applied with good soil activity for Palmer we can at least delay Palmer developing PPO and/or glufosinate resistance.

Finally, new herbicide tolerant traits by Monsanto, Dow, and Syngenta/Bayer CropScience will be introduced most likely in 2015+. In our research these herbicide tolerant traits look like they will be good tools to aid in a complete weed management system to help us manage glyphosate-resistant horseweed and Palmer amaranth. These technologies are highlighted at the No-till weed control stop.

Kudzu Bug and More

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Insect pests in soybean are an annual problem in the south. This presentation will discuss general soybean IPM considerations but emphasize the kudzu bug, a new player on the block. Kudzu bugs (*Megacopta cribraria*) are an invasive pest originating from Asia. They were first discovered in Georgia in 2009, and its distribution has rapidly grown to include most of the Southeast and parts of the Mid-South. As the name implies, kudzu is an important host of this insect. Soybean and wisteria are also preferred hosts. Other members of the legume family are also hosts, but kudzu and soybean are the primary reproductive hosts for this pest. This insect is expected to spread across much of the southern one-half of the United States, particularly in areas where kudzu or soybean are common.

Kudzu bugs primarily feed on the stems of plants, removing plant juices (phloem). Thus, they can reduce the vigor of both kudzu and soybean, particularly when plants are already under stress. Infestations in soybean, at least initially, are often concentrated on field edges. It takes many kudzu bugs to cause economic damage to soybean. However, populations can reach several dozens or hundreds of insects per plant. Even though they are indirect pests, not feeding on the seeds of soybean, reported yield losses from unmanaged infestations have reached 70 percent.

Kudzu bugs are also a nuisance pest, invading homes during the fall for overwintering. They are particularly attracted to white or light-colored structures. Compounding this problem, the invading adults give off an offensive odor and may stain surfaces when disturbed. Other overwintering sites may include any protected cracks or crevices where the adults can aggregate such as behind tree bark.

It is unclear how quickly and to what extent kudzu bugs will become an economic pest of soybean in the primary production areas of Tennessee. It is likely that at least some fields will require treatment annually once this pest becomes widely established. Fortunately, kudzu bugs are not difficult to control with insecticides, and research in the Southeast indicates that one well-timed application is typically sufficient to prevent yield loss. The currently recommended threshold for kudzu bug is one immature per sweep. A common mistake is treating kudzu bugs too early, while adults are beginning to migrate into fields. Treating for adults is generally not suggested because immigrating bugs often re-infest fields, resulting in retreatment. Unfortunately, infestations may occur before other pests are present in treatable numbers. Thus, additional insecticide applications may be needed and could disrupt populations of beneficial insects. This may create secondary pest problems with pests such as corn earworm or soybean looper.

High-Yield Soybeans

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Winners of high-yield soybean contests have demonstrated repeatedly the yield potential of soybeans to exceed 100 bu/ac. Commercial soybean yields average substantially less. Contest winners use a range of techniques to reduce water and nutrient stress, alter plant growth habit, and improve or alter sunlight interception. In a preliminary study, some of these techniques were evaluated for yield potential, scientific merit, and suitability for commercial-scale production. Specifically, different row configurations (15-inch row spacing and 15-inch skip/twin-row), different seeding rates and different techniques (herbicide burn and mechanical clipping) to encourage branching and branch-pod set were evaluated. Although limited to one year and one environment, the skip row configuration resulted in greater yield at lower population densities whereas the other treatments did not improve yields. The potential of greater yields with reduced seed costs is attractive to producers but requires further investigation. This research has been expanded to include additional treatments such as post-nodulation nitrogen fertilizer applications as well as multi-location on-farm strip trials.

Cultivar Response to Fungicides

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Frogeye leaf spot (FLS) caused by a fungus *Cercospora sojina* can be a devastating foliar disease in many part of the Southern and Midwestern United States. Reductions in yields of 20-40 percent are not uncommon under environmental conditions that promote growth and sporulation of the fungus. Fungicide spray regimes and cultivar selection have been used to combat the impact of the disease by many producers. Over 600 different commercially available cultivars were evaluated in Milan, Tennessee, from 2003 through 2013. Maturity groups tested included maturity groups III, IV, and V. All plots were sprayed at the R3 growth stage with a commercially available fungicide, and were visually rated for FLS lesions at the R5-R6 growth stage. Yield was collected for each of the sprayed and unsprayed portions of the plots. Fungicide application significantly reduced FLS severity and increased yield across all cultivars and years. Fungicide application reduced FLS severity proportionately to the susceptible of the cultivars (i.e. the greater the susceptibility the greater the reduction in disease with a fungicide application). Average yield saved with a fungicide application also increased as FLS susceptibility increased. Results based on this research support cultivar selection and appropriate fungicide applications are critical in minimizing the loss of yield due to FLS.

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Fungicide-Resistant Frogeye Leaf Spot

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Frogeye leaf spot (FLS) disease of soybean is caused by a fungal pathogen known as *Cercospora sojina*. FLS can account for 12-15 percent of the annual soybean yield loss in the United States .FLS disease symptoms typically appear after flowering on soybean leaves as small dark specks which widen in diameter and lighten to a pale gray color as the disease progresses. These necrotic lesions are surrounded by a reddish-brown margin and can cause premature defoliation and yield losses as high as 60 percent. Disease is favored by hot and humid weather conditions, and may occur anywhere that soybeans are grown. While common in the southern United States since the 1920s, the reports of FLS in the northern United States have been steadily increasing. This rise in disease incidence is attributed to warmer winters, no-till practices, and the use of susceptible cultivars; however, it is worth noting that a recent study conducted in Milan showed that conventional tillage (~9 in deep) had no significant effect on FLS disease severity when compared to no-till plots in the absence of fungicide.

Image (above): Soybean leaflet displaying FLS lesions.

FLS disease is controlled by planting resistant cultivars, rotating out of soybean for at least two years, and fungicide applications. Strobilurin fungicides, also referred to as quinone outside inhibitors (QoI) fungicides based on their mode of action, are a commonly used class of fungicide that manage a broad variety of plant diseases. Some

examples of QoI/Strobilurin fungicides include Headline, Quadris, Abound, Reason, and Disarm. Strobilurins were introduced to the fungicide market in 1996 and since then resistance has been observed in multiple plant pathogenic fungi. In 2010, Tennessee was the first to report the emergence of strobilurin fungicide resistant FLS in a soybean field being treated with pyraclostrobin. To date strobilurin fungicide resistant FLS has been reported in 10 states and 106 counties in the U.S.

Fungicide resistance is when a fungus becomes less sensitive or completely insensitive to a fungicide. When a fungicide is applied, the pathogen population susceptible to that treatment will be killed, but there may be isolates in the population that are naturally resistant to the fungicide. These naturally resistant mutants can survive, cause new infections, and eventually dominate the field as the sensitive isolates are removed from the population. When a fungus becomes resistant to a certain fungicide, it is usually resistant to all fungicides from a fungicide group or with the same mode of action, this is called cross resistance. To help sort out different fungicide groups and help develop fungicide resistance guidelines the Fungicide Resistance Action Committee (FRAC) was developed. FRAC developed the FRAC code which uses numbers and letters to distinguish different fungicide groups. The FRAC code is found on most fungicide labels. The QoI/Strobilurin fungicide group is FRAC code 11. Other chemical groups and their FRAC codes include: demethylation inhibitors (DMI), also referred to as triazoles, are FRAC code 3; succinate dehydrogenase inhibitors (SDHI) are FRAC code 7; methyl benzimidazole carbamates (MBC) are FRAC code 1; and chloronitrile or phthalonitriles are FRAC code M5.

Disease control is essential to preventing yield loss; however, the population pressure within a field must be considered prior to fungicide application to receive the maximum benefits. Moderate to high disease pressure locations have greater response to treatment, in terms of disease control and yield, than low pressure locations. In a continuing study the UT field crops disease management program is investigating the effect of fungicides with different modes of action on FLS population diversity and fungicide resistance. Results from this study and others will be presented to illustrate the best management practices for FLS disease in soybean and fungicide resistance management, which include:

- Utilizing non-chemical control methods (disease resistant varieties, crop rotation, etc.)
- Following label recommendations and IPM practices and only applying a fungicide when warranted based on scouting and disease risk
- Using combination products (using 2 or more modes of action or FRAC codes) or rotating fungicide groups if applying more than one application in a season

Tour D: No-Till Cotton Production in Tennessee

Cotton Weed Control

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No-till weed control in cotton has become more challenging in recent years with the spread of glyphosate-resistant weeds. Glyphosate-resistant (GR) Palmer amaranth, in particular, has become a major control issue in cotton. Starting clean with a good PRE is especially important in cotton because there are few postemergence options until the cotton is big enough for a hood. Caparol, Cotoran, and Reflex are good choices for weeks of residual control of GR Palmer pigweed. A new herbicide Brake F2 received a section 18 label for limited release in 2014. The residual control it provided in 2014 was mostly good. However, there was some inconsistent performance due to either soil type differences or lack of activation. For residual control in crop after the PRE has worn off, Dual Magnum and Warrant can extend residual control of GR Palmer pigweed. However, once weeds have emerged, few postemergence options exist in cotton.

Due to GR Palmer pigweed, many growers have moved from a glyphosate-based system to a Liberty (glufosinate) based system. Liberty is a non-selective herbicide, like glyphosate, but there are several differences. First of all, Liberty will not control large pigweed like glyphosate once did. The label states pigweed should be 4 inches or less for consistent control, but may control 6-8 inch pigweed when the conditions are right. Another major difference is that glyphosate is a systemic herbicide while glufosinate is a contact herbicide. This means you need COVERAGE with glufosinate. At least 15 GPA is required, but 20 GPA or higher may be required with higher pigweed pressure. Today, we have several different nozzle types available on the market and when drift is a concern, air induction or turbo teejet nozzles are good options for reducing the risk of drift. For Liberty to be effective though, these nozzles are not good options because it reduces coverage. Flatfan or XR nozzles are recommended with herbicide applications that include Liberty. In addition, time of day of application may be a factor for pigweed control with Liberty. For glufosinate to work in the plant, it must be actively photosynthesizing. Therefore, growers should avoid applying glufosinate early in the morning. Our research indicates that growers should wait at least 2 hours after sunrise before applying Liberty.
In the Mid-South, a glufosinate-based system can include either true Liberty Link varieties, Liberty Link varieties with GlyTol (glyphosate tolerance) or WideStrike cotton. WideStrike cotton varieties are grown on a significant portion of our acres and these varieties do have glyphosate tolerance, but only have moderate tolerance to glufosinate. Injury from Liberty can range significantly, especially when tank mixed with certain herbicides or insecticides. Research conducted across the Mid-South indicates that three glufosinate applications to WideStrike cotton can reduce yield, but this may vary depending on the conditions. The important thing to note is that neither the manufacturer of Liberty, nor the manufacturer of WideStrike cotton, recommend applying glufosinate to WideStrike cotton. It is a legal application, but if significant injury and yield loss occur, the grower is stuck with the loss. GlyTol/Liberty Link varieties are becoming more prevalent in Tennessee. These varieties have true tolerance to glufosinate, so no injury or yield loss will occur. The newer GlyTol/LL varieties are a popular choice because you have the flexibility of applying glyphosate and glufosinate, without the risk of crop injury. One thing is clear as we move forward; glufosinate is and will continue to be an important tool for managing glyphosate-resistant weeds.

Variety Selection, Plant Growth Regulators, and Nutrient Management

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Variety selection, plant growth regulation, and nutrient management are more inter-related now than ever before. Maximum return on these inputs relies on an understanding that decisions in each of these categories often impact management in one (or both) of the other categories. Variety selection is still largely influenced by yield stability and fiber quality but value-added traits are fast becoming the criteria which drive selection. Additionally, early maturing varieties typically out-perform later maturing varieties at this latitude due to heat-unit constraints. These trends can be observed through UT conducted Official Variety Trail Data and County Standard Test Data.

Nutrient management is another factor which cannot be ignored if maximum yields are to be achieved. When addressing fertility, the first step is always pH. The target range for cotton is between 6 and 6.5. Maintaining a pH within this range will typically result in the greatest yields and highest fertilizer efficiencies. The University of Tennessee recommends nitrogen (N) rates from 45-80 lb N per acre with lower rates associated with bottom ground where rank growth has been noted in prior years. Over-application of N often results in rank growth and subsequently complicates management and harvesting operations. Potassium (K) is the second-most important nutrient in cotton production and is of particular interest in regions which typically plant earlier-maturing varieties, since some research has suggested these varieties require more K in order to prevent “bronzing,” a classic symptom of potash deficiency. New, timelier methods of deficiency detection for the purpose of amelioration are currently being explored at the University of Tennessee in collaboration with the University of Arkansas.

Proper plant growth regulation is largely a function of environmental conditions, variety selection and, fertility. Adequate to excessive soil moisture levels, warm temperatures, excessive nitrogen, or low fruit retention can support rapid internode expansion and increase the need for plant growth regulator applications. Later-maturing varieties typically require more aggressive management, but there are inherent differences in variety sensitivity to plant growth regulator applications. Recent work at Mississippi State University has examined the influence of both fruit retention and variety on plant height and the ability of plant growth regulators to control the crop after severe fruit shed.

Thrips Control and Insecticide Resistance

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Thrips are a constant, early season pest throughout Tennessee that must be properly managed to insure sufficient plant growth and proper timing of harvest. Thrips damage seedling cotton by feeding on the plant's epidermal cells with their rasping-sucking mouthparts and extracting plant nutrients with their maxillary stylets. Thrips feeding may cause many types of damage including: distortion and silvering of leaves, loss of apical dominance, plant stunting, maturity delay and in severe cases, plant death. Thrips damage is intensified by slow plant growth caused by unfavorable weather conditions and, herbicide injury.

Preventative management of thrips has moved away from granular and liquid, in-furrow insecticide treatments to the reliance of neonicotinoid insecticide seed treatments such as thiamethoxam (e.g., Cruiser) and imidacloprid (e.g., Gaucho). Over the past few years, control costs and yield loss due to thrips has been on the rise in Tennessee. University researchers and field consultants throughout the state, as well as the entire Mid-South, have observed an increase in thrips injury and plant injury in research plots and production fields. This increase in thrips populations and plant injury has coincided

with an increased use of pre-emergence and post-emergence herbicides to combat glyphosate resistant weeds.

Studies were done in 2013 and 2014 to investigate if some herbicides may be affecting the performance of insecticide and fungicide seed treatments. In 2013 and 2014, thiamethoxam failed to provide adequate control of thrips infestations. In 2014, not using an adequate fungicide seed treatment resulted in stand failure. Preliminary results indicate that, although some herbicides negatively affect plant growth, the performance of insecticide and fungicide seed treatments was the most important factor affecting plant health and stand establishment. University and industry data indicate a reduction in susceptibility to thiamethoxam (i.e., resistance) has developed in populations of tobacco thrips populations in the Mid-South. Although not the primary factor affecting plant health, the use of some pre- and post-emergence herbicides caused additional, negative effects on plant vigor.

The presence of glyphosate-resistant weed necessitates the use of herbicides that may injure seedling plants and delay development, potentially increasing the window of susceptibility to thrips. It is recommended that farmers use early maturing cotton varieties and plant during the recommended planting window to help mitigate the negative effects of herbicide use, seedling disease and thrips injury on the health of cotton plants. At-planting thrips and fungicide treatments, either in-furrow or as seed treatments, are still strongly recommended. However, thiamethoxam-based treatments should be avoided due to insecticide resistance in populations of tobacco thrips. Imidacloprid (e.g., Gaucho) is a preferred treatment, but cotton must still be monitored, and a supplemental foliar insecticide application for thrips may be needed before the third true leaf has emerged when thrips populations are high or when there are poor conditions for seedling growth. Alternative thrips treatments are currently being investigated.

Target Spot on Cotton

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Target spot incited by the fungus *Corynespora cassiicola* is an emerging disease in cotton and an established disease in soybean, sesame, tomato, cucumber, and container-grown ornamental crops. Next to nothing is known of the source, spread, and survival of C. *cassiicola* in cotton or soybean, disease epidemiology, or virulence of pathogen isolates across the range of potential crop hosts, particularly cotton and soybean. Target spot, which was initially restricted to irrigated, rank, intensively managed cotton in southwest Georgia, has spread to Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Virginia over the past 2 yrs. Disease intensity varies by location with heaviest damage found in the southern half of Alabama, Georgia and Florida Panhandle. Further north into the Tennessee Valley, some leaf spotting and defoliation occurs but disease impact on yield appears low. In South Georgia, disease-related yield loss estimates have ranged from 200 to 600 lb lint/A (~$180 to $540/A at the current cash price). Disease impact on the yield of cotton seed, which is widely used as a livestock feed supplement and vegetable oil, is likely to be similar to lint losses as turnout values are not impacted by target spot. In 2012 and 2013 in Alabama under ideal conditions for target spot development, yield losses range from 5 percent for Deltapine 1050 up to 20 percent for Phytogen 499. Yield loss may be related to either reduced boll set or premature boll shed. Generally, target spot has not impacted lint quality. In 2013, estimated farm gate revenue losses attributed to target spot in Alabama, Florida, and Georgia are $50 to $80 million. Presently, target spot control options are restricted due to limited information concerning fungicide efficacy as impacted by application timing, number, and placement along with tillage practices, crop rotation, planting date, plant populations, and variety sensitivity. In South AL field studies under high target spot pressure, yield protection with Headline 2.09SC, Twinline, and Quadris 2.08SC range from 100 to 300 lb lint/A, which translates into an income recovery of $90 to $270/A. Use of drop compared

with over-the-top fungicide placement reduced season long disease levels but not final disease ratings or improve yield. Also, better disease control and superior yield response was obtained with on-demand than calendar treatment programs on Phytogen 499 but not Deltapine 1252. Since these fungicides are widely used for frogeye leaf spot (caused by *Cercospora sojina*) and target spot control in soybean, often in the same field behind cotton, resistance-related control failures are likely and alternative fungicides identified. Base-line sensitivity of C. *cassiicola* isolates from cotton and soybean to the strobilurin and newly released carboxamide fungicides (Luna and Velum (fluopyram), Sercadis and Priaxor (fluxapyroxad), Fontelis (penthiopyrad), sedaxane), which are likely strobilurin replacements, has not been established nor has their efficacy against target spot. Preliminary field trial results suggest that regardless of the cropping partner, crop rotation may be of little value in managing target spot in cotton. Anecdotal observations suggest that later planting may suppress target spot, however, the yield penalty probably negates its value as a management tool. While the impact of plant populations on target spot is yet to be determined, high seed prices have reduced seeding rates to 2 seed/ft of row. All commercial cotton varieties are sensitive to target spot but the level of leaf spotting and premature defoliation greatly varies by variety and geographic location. Early maturing varieties tend to be less sensitive to target spot. Impact of target spot on the yield of most commercial cotton varieties is unknown but is likely to fall between the 5 percent and 20 percent losses reported for Deltapine 1050 and Phytogen 499, respectively.

Tour E: Beef: Capturing Greater Value in Cow-Calf Production

Economically Important Cow-Calf Management Practices

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UT Department of Animal Science

Cattle handling facilities and a short calving season are essential for a profitable cow-calf operation (Kirkpatrick, F.D. 1983). A handling facility can contribute to both the saving and making of money. Labor can be reduced by carrying out practices that are economically important, such as checking for pregnancy, applying health practices, controlling both internal and external parasites, implanting calf crop with growth stimulants, castrating and dehorning. Without handling facilities these practices and others are not done. All of these contribute to the returns of a cow-calf operation by improving performance as well as reducing labor costs.

Another important item to consider is that a good cattle handling facility can reduce the probability of injury to the animals and producer as well as stress. Cattle that are stressed will experience reduced performance and immunity to disease and efficacy of vaccines.

A number of cow-calf producers conclude that they cannot invest in cattle handling facilities; probably the greatest item in that conclusion is that they are not aware of the economic value of the practices that can be applied through the use of these facilities. The bottom line is that beef cattle handling facilities can improve the profitability of an operation. "If you can't catch them, you can't manage them."

As with any practice, constructing and using cattle handling facilities should be evaluated for effect on weaning or market weight, calf crop percentage weaned, cost of production and market price.

The purpose of this is not to illustrate all the charges that could occur, but the changes that come with adequate handling facilities. If a cow calf producer is not carrying out the economically important management practices that require handling facilities, improvement and profitability will be hindered. Response would vary between operations and current levels of management.

Financial assistance is available to Tennessee cattle producers to either construct or update current facilities through the Tennessee Agricultural Enhancement Program (TAEP). For additional information contact the Tennessee Department of Agriculture. Handling facilities can only "pay off" if used by the producer to improve the cow herd's production and reduce outgoing costs.

Essentials of a Cattle Handling Facility

Clyde Lane
Professor Emeritus
UT Department of Animal Science

Considerations When Selecting a Commercial Handling Facility

Producers considering the purchase of a commercial handling facility have a number of factors to consider before making the final decision. A handling facility is a sizable investment for most producers. Since the handling facility plays such an important part in the management of the beef herd, it is critical that producers select the best available handling facility that will meet their needs. This is too great an investment for a critical mistake to be made in the selection process.

General Considerations

Several things need to be considered when selecting a commercial handling facility. What type cattle operation will the unit be purchased for? If it is for a cow-calf operation, extra consideration should be given to the available adjustments that will allow working of both cows and calves. How much labor will be available when working animals? Will the unit be placed in a permanent location or will a wheel kit be needed to move the chute? Will the location where the facility is to be used have adequate space for all components of the unit to work properly?

Headgates

When evaluating the squeeze chute, a decision must be made about the type headgate that will be attached. Most chutes available in Tennessee come equipped with either a self- catching or a scissors type headgate. If a producer is working cattle alone,

the self-catching may be the headgate of choice. It must be remembered that this type headgate must be adjusted properly so the shoulders of the animal will cause the headgate to close. If improperly adjusted, the animal may be caught at the hips instead of the shoulders, resulting in a potentially dangerous situation. The self-catching headgate should be easy to adjust. If adjustments are difficult to make, then a different brand may need to be evaluated. The mechanism used to hold the headgate closed should be protected so an animal cannot cause the headgate to open. Look at the bottom of the headgate to see if there is the potential for an animal to catch its feet when pushing back. The headgate should be constructed in a manner that will prevent an animal from putting its feet through an opening where the feet will have to be removed prior to opening.

Scissors type headgates vary in the size of the opening when the headgate is opened to release the animal. If a producer has large animals, then a headgate that opens fully would be advisable. As with the self-catching headgate, there should not be any openings where the animal's feet can be caught and must be removed before opening.

With both the self-catching and scissors type headgates, the controls should be located where they can be operated with minimal effort. Also consider where the headgate and chute are going to be located on the farm. Will there be any obstructions that will make it difficult to operate the headgate? This could be from a low roof or placement too near a wall or fence. Look at the bars on the headgate where the animal's neck will be held. Are the bars straight where the head can move up and down or curved to limit movement? Is it easy to make adjustments to the bars if needed? Is there a place to position a neck restraint device on the headgate?

Chute

After evaluating the requirements for the chute, costs need to be considered. There is a considerable range in price from a simple manual chute to a complete hydraulic chute. After the decision is made as to the amount of money that can be spent, it is time to start looking at features of available squeeze chutes. All chutes have the same basic features, however, the ease of use and functionality can vary. Take time to operate all features to determine if they are easy to use. If the purchase involves the purchase of a wheel kit, detach and reattach the wheel kit before the check is written. A wheel kit that is uncomfortable for you to use should not be purchased.

The framework holding the sides of the chute should be attached to the headgate in a manner that will allow easy access to the neck area. If the chute does not allow easy access to give injections in the neck, it is advisable to look at different models. The bottom of the chute sides should be adjustable in width to accommodate different size animals. The adjustment mechanisms should be easy to operate and recessed so an individual will not trip over them while working cattle.

Sides of the chute should have bars that can be dropped to allow access to the animals. Different chutes have different type bar systems and different lengths. Determine if the bars are too high or too low to allow access to the animals that you will be working. Are the bars easy to raise up and let down? A drop-down panel should be on the bottom to allow access to the underside of animals. This panel should be strong enough to prevent bending but light enough to be easily opened and closed.

The controls for the squeeze mechanism of the chute should be readily accessible. The controls should allow the squeezing process to take place without excessive effort. Also the controls should allow for pressure to be easily removed. Is the side panel on the chute easy to open and close? Are the controls located so the risk of bumping into them is minimal?

Back Gate

The back gate on chutes come in a variety of forms. Some drop down behind animals, while some close like a headgate or simply slide closed. A producer should select the type that he/she feels the most comfortable using. Also consider where the chute will be located. Will there be adequate room for the back gate to operate? This could be either overhead clearance or on the side. Are the controls for the back gate readily accessible? Are the controls easy to use without unnecessary effort being required?

Palpation Cage

Squeeze chutes can be purchased with or without a palpation cage. It is strongly recommended that a palpation cage be purchased. The palpation cage provides easy access to the rear of animals for such practices as castration, pregnancy checking and artificial insemination. The palpation cage should be

large enough to provide easy access to the animal and have a door that will swing away from the chute and latch across the alley. This will provide protection from the next animal in line while working with the animal in the chute. Consider whether the palpation cage should have doors on both sides to provide easier access.

Scales
Scales are an important management tool in the beef operation. Some squeeze chutes can be purchased with scales integrated into the system. A decision must be made about the purchase of a combined unit. Having scales attached allows weighing each time an animal is caught. A negative aspect is that a combined unit has the extra wear and tear on the scales when animals pass over it every time they are worked. Evaluate where the scales are to be incorporated into the system prior to purchase of the squeeze chute.

Construction of Handling Facilities
Producers can construct the various components of a cattle handling facility; however, it recommended that a commercial headgate be purchase to use with constructed facilities. Dimensions recommended for the various components can be found on the UT Department of Animal Science Webpage at utextension.tennessee.edu/publications/Documents/SP690.pdf.

Summary
Any individual that owns a beef animal should have a way to restrain the animal. The cost and complexity of the facility will be determined by the number of animals on the farm and the available labor. Excellent facilities make performing recommended management practices much easier and safer for both the animal and producer. Each producer should follow basic facility guidelines when constructing or purchasing a handling facility. Assistance with design and selection of facilities is available at the local Extension office.

Tennessee Agricultural Enhancement Program and Cost Sharing in Constructing Facilities

Mark Powell
Director of TAEP
Tennessee Department of Agriculture

The Tennessee Agricultural Enhancement Program is a cost share program coordinated by the Tennessee Department of Agriculture. The program began in 2005 with the purpose of assisting farmers in making long-term farm investments through cost-share assistance. The program requires participants with beef cattle projects to be certified in the Beef Quality Assurance program. Participants can obtain a greater amount of cost share if they are certified in the Master Beef Program conducted by the University of Tennessee.

Beef Producers can participate in a variety of sectors depending on their current needs and type of farming operation. Sectors include: Genetics, Livestock Equipment, Hay Storage, Livestock Feed Storage, Grain Storage, Producer Diversification, and the new Livestock Working Facility Covering. Cost share assistance ranges from $1,200-$15,000.

Since its early beginning in 2005, 31,802 projects have been funded for close to $90 million in cost share assistance. Thirty percent of the dollars have been used for livestock equipment and another 30 percent has been used for hay storage structures. The remaining dollars are divided among the other four sectors. A recent University of Tennessee study revealed that for every enhancement dollar invested, $3.89 was generated in the rural economies in the form of retail farm store business, construction business, veterinary services, machinery and equipment manufacturing and a multitude of jobs.

The livestock equipment program improves long-term livestock husbandry and management capabilities while enhancing farm safety. To date 13,917 livestock equipment projects have been funded at $28,147,203. Items eligible for this sector include the livestock handling system components such as squeeze chutes, alleyways, palpation cages, scales and EID readers, panels, rolling block doors and crowding tubs. A variety of feeders qualify on the program including mineral feeders, bunk feeders, creep feeders and panels, and automatic feeders.

Cost share assistance is also provided to assist in feeding hay in the form of hay rings and hay feeding wagons. Feed bins and unload augers are found in the livestock equipment sector as are pasture sprayers.

The newest of the enhancement programs is the Livestock Working Facility Cover Program which was introduced in the 2014. The purpose of this program is 1) to enhance the longevity and life of the cattle working equipment and 2) to give producers a dry and safe area to work cattle. Keeping the elements away from the working facility equipment will give it a longer usable life and enhance its functionality. A covering also gives the producer more flexibility in working cattle and a more suitable working environment during harsh and unfavorable weather.

Tour F: Herbicide Technology

Roundup Xtend and Cover Crop Weed Management

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What is new in soybean weed control for 2014? That has been a common question this spring by consultants and producers. Unfortunately, there is no new Roundup that will control a foot tall Palmer on the way for 2014. Monsanto will be introducing soybeans tolerant to both dicamba and glyphosate (trade name Roundup Xtend). About the same timeline Dow will introduce 2,4-D, glufosinate and glyphosate-tolerant soybean (trade name Enlist). Just a year or so later Syngenta/Bayer will introduce soybean tolerant to glufosinate, isoxaflutole and mesotrione. DuPont will be introducing grain sorghum tolerant to ALS herbicide Accent. Finally, Syngenta will be introducing a new herbicide for corn named Acuron.

The new soybean and grain sorghum technologies will allow us to integrate modes of action into our weed control programs that are currently not available. Currently in Tennessee, PPO herbicides are being heavily relied on for both preemergence and in-season control of Palmer amaranth in soybeans. Not only will these technologies be beneficial in providing effective control options, they will also help to preserve the herbicides that we currently have for control. Each of the new technologies for soybeans show great promise for future weed control programs; however, it is essential that these products be integrated into sound weed control programs and not solely relied on for control of troublesome weed species such as Palmer amaranth.

Controlling grass weed species is one of the most challenging aspects of producing a grain sorghum crop in Tennessee. The number of herbicides that can be used in grain sorghum are currently very limited. The addition of this new grain sorghum trait will open the door for producers to control these grass species that are so troublesome. Additionally, the new corn herbicide from Syngenta, Acuron, is a premix of four different herbicides with three different modes of action. The premix will contain atrazine, mesotrione, s-metolachlor, and bicyclopyrone, which is a new HPPD-inhibiting herbicide. This herbicide is expected to receive a label for the 2015 growing season and will provide control of a wide range of grass and broadleaf weed species.

Finally, new herbicide tolerant traits by Monsanto and Dow will be introduced most likely in 2015. In our research these two herbicide tolerant traits look like they will be good tools to add in a complete weed management system to help us manage glyphosate-resistant horseweed and Palmer amaranth. These technologies are highlighted at the herbicide technology weed control stop.

New Soybean, Corn, and Grain Sorghum Weed Control Technologies

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In the simplicity of today's production agriculture, there are only a couple things you have to consider when making a spray application. One being product selection for the targeted pest. Another being timing of application. But you still have to think about the spray volume you wish to apply at, or how strong of a wind you have at application. Also, you need to be considerate of ground speed and when the next rain is coming, what the humidity is like that day, or how much sunlight you have. So maybe spray applications aren't simple and there are many things you have to consider when spraying. Although we can't always predict when the next rain event will occur, or when the next flush of Palmer amaranth will emerge, we can be mindful of a couple things, such as nozzle selection and application pressure.

Before we ever leave the shop to make an application, there are a couple components we must assess. The first is nozzle selection. The take home message, before we mention nozzle types, is that there is not a silver bullet, one size fits all, nozzle tip. All products will require different droplet sizes to work at their full potential. Most commercial sprayers today come equipped with at least three-way nozzle body turrets that should be utilized with an array of different nozzle types. While one of the most widely used and successful tips has been that of the traditional flat fan, in most of the future herbicide tolerant crops coming down the pipeline, flat fan nozzles will not be labeled for use. Flat fans typically produce a fine to medium droplet size, many of which have high potential to move off target. Although these nozzles typically produce very good coverage at the initial intended pressure and speed, at higher pressures that are required to compensate for faster ground speeds, the droplets become very small and are affected by environmental factors causing them to move off target. Nozzles that should be considered for use currently and in our future crops are venturi-type (air-induction) nozzles or nozzles with flow rate adjusting pre-orifices. Nozzles such as TeeJet's AIXR (Air Induction Extended Range) are venturi-type nozzles that produce droplets from a coarse to very coarse range at 30-60 psi. With these nozzles, you can bump the pressure up to the higher 60 psi range to compensate for faster ground speeds and still produce medium to course size droplets that do not have as high of a potential to move off target. Nozzles such as Greenleaf's TDXL (TurboDrop) and TeeJet's TTI (Turbo TeeJet Induction) use flow rate adjusting pre-orifices, deflectors, and air induction to create larger droplets. Dual fan nozzles also need to be considered for use to benefit both coverage and drift management. Nozzles such as TeeJet's AITTJ (Air Induction Turbo TwinJet) and Greenleaf's TADF (TurboDrop Asymmetrical Dual Fan) combine multiple spray angles and pattern fans with technology used in single fan nozzles to combat drift while improving coverage.

In order to be adequate stewards of the new crop technology coming on board to assist in managing resistant weed species, we need to be mindful of current and new application technology. Some of this technology will be displayed at the Weed Resistance Management stop.

Tour G: Row Crop Sustainability

Evaluation of Field Fertilizer Requirements

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Precision soil sampling is a crucial step in implementing a site-specific nutrient management plan. Agricultural fields exhibit minimal to very high degrees of spatial nutrient variability. Blanket applications of nutrients can be environmentally harmful and economically wasteful. Most fields will have areas under-fertilized, limiting yield potential, as well as areas over-fertilized, potentially losing applied nutrients to the environment. Precision soil sampling looks to minimize improper fertilization by better characterizing spatial variability than a single composite field value. Grid sampling and management zone sampling are used in precision sampling, differing in time and labor required, and prior knowledge necessary. We evaluated precision soil sampling methods, zone delineation techniques, and numbers of subsamples required to achieve consistent analysis results in West Tennessee agricultural fields.

Two fields were sampled in Milan, Tennessee, one being highly variable in soils, landscape, and yield potential and the other displaying little variation. Fields were divided into 1-acre grids and sampled at each grid center and randomly throughout each grid. Grid center samples were grouped by zones based on soil and yield maps. Smart point samples were collected similarly to grid center samples, but were shifted to reside in the dominant soil type of grid, if necessary. A 2-acre section of each field was divided into nine grid squares and sampled intensively, then sampled in triplicate at five levels of subsample intensity as a whole. Variability was compared between grid center and grid cell sampling methods. Zoning methods were compared to whole-field variation to determine whether or not they were valuable tools for grouping variation. Smart points were compared against grid point samples for each cell they were taken from to see if they could consistently achieve a better representation of the whole cell average value. Subsample numbers were compared for several nutrients and pH by comparing standard deviations about the 2-acre mean. We hypothesized that grid center samples will show higher coefficients of variation (CV) than grid-cell samples and zoning techniques will significantly reduce CV compared to whole field. We expect zoning techniques to have a greater effect and number of subsamples required to be higher in the more variable field.

Costs and Returns from Field Fertility Evaluations

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Fertilizer costs are a major expense for row crop producers, but a vital input to maximize profits. There is a growing interest among row crop producers, as well as government entities and conservation groups, in using variable rate fertilizer application to efficiently manage fertilizer inputs to reduce costs and minimize off-site movement of nutrients. Considering within field variability when applying fertilizer can help producers increase profits by reducing fertilizer costs and potentially increase yields. A uniform rate of fertilizer can lead to over and under application of fertilizer across a field. Over application has negative environmental impacts and reduces profits by increasing fertilizer costs, while under application reduces profits by reducing yields.

The objective of this presentation is to compare the cost of fertilizer for uniform and variable rate applications of lime, potash, and diammonium

phosphate (DAP). In 2013, researchers in the Department of Biosystems Engineering and Soil Science at the University of Tennessee collected data on variable rate lime, potash, and DAP applications on actual producer fields in West Tennessee. These data are used in this presentation to discuss the potential cost savings from using variable rate instead of uniform rate application.

Average variable rates were determined for each field by using ArcGIS software. Fertilizer costs were calculated by multiplying the average cost of fertilizer in 2013 by the quantity of fertilizer applied minus the cost of application. The average prices of fertilizer assumed in this analysis was $24/ton for lime, $0.30/lb for potash, and $0.32/lb for DAP. Based on the UT Custom Rate Survey (economics.ag.utk.edu/extension/pubs/CustomRates2013-rev.pdf), the average cost of custom application of variable rate fertilizer was $8.38/acre and $6.37/acre for uniform rate application. The additional $2.01/acre is assumed to include the cost of grid or zone soil sampling and the cost of machinery for the variable rate applicator.

First, the fertilizer cost for a uniform rate application of lime, potash, and DAP were compared to the fertilizer cost for variable rate applications to determine the application method that has the lowest fertilizer cost. Results are presented for four fields. For each field, variable rate cost savings were different across lime, potash, and DAP. This is due to the specific within field variability of nutrients. Depending on your recommended uniform rate of application, cost savings were found for variable rate fertilizer application of lime, potash, and DAP.

Additionally, we compare the cost of variable rate fertilizer application of DAP and potash based on soil sampling at a 2.5- and 5-acre grid resolution versus a uniform application rate. The purpose of this analysis was to show how the information from additional precision impacts fertilizer costs. Data from a single field is presented for DAP and potash. The analysis shows that fertilizer costs for potash and DAP are the lowest when sampled on the 2.5-acre grid.

Cost savings presented in this research are due to field-specific variability, which will likely be unique among fields. However, producers could use this information along with their own field variability when considering using variable rate fertilizer application.

Variable Rate Nitrogen Applications on Cotton

Frank Yin
Assistant Professor
UT Department of Plant Sciences

Sean Schaeffer
Assistant Professor
UT Department of Biosystems Engineering and Soil Science

Under most current N management systems, producers apply a uniform N fertilizer rate across the entire field, which often results in over- and under-applications of N because crop responses to N fertilization are often variable within an individual field. Therefore, it is essential to develop precision N management systems that can generate variable-rate fertilizer N recommendations based on spatial variances within the individual field. The objectives of this study were to 1) evaluate the impacts of variable-rate precision N management systems based on optical sensing of crop canopy relative to the current uniform-rate N application system; and 2) determine the benefits of incorporating yield maps or soil information into the sensor-based variable-rate precision N management system.

Nineteen field trials on cotton were conducted in Tennessee, Missouri, Mississippi, and Louisiana in 2012 and 2013. The following three N management systems were evaluated in large strip plots in a randomized complete block design with three replicates:

1) The current N management system with uniform-rate application of granular or liquid N fertilizer within the field. In this system, the N rate was determined based on farmer experience and input, and was the same across the entire strip plot and all three replicates.

2) A variable-rate precision N management system utilizing canopy optical sensing (NDVI or other

vegetation indices) and a fertilizer rate algorithm derived from multiple years of previous research data in each state.

3) A variable-rate precision N management system based on optical sensing but adjusted for soil productivity zones derived from bare soil imagery or historical yield monitor data.

The following sampling and measurements were taken on a sub-plot basis from each site-year: 1) a composite soil sample was taken before planting and after harvest for nitrate and ammonium; 2) NDVI or similar vegetation index readings were collected at early square, early bloom, and mid bloom; 3) leaf samples were collected coincidently to sensor readings for N concentrations; 4) seasonal fertilizer N consumption was recorded; 5) lint yield was determined; 6) fertilizer N use efficiency and post-harvest residual N levels in soil profile were calculated; and 7) an economic analysis including grower profitability and risks with the use of these new precision N management systems was conducted.

Twelve out of the nineteen trials in the four states showed that seasonal fertilizer N consumption was significantly lower with or without lint yield benefit under the variable-rate N management system based on either NDVI alone or NDVI and previous yield data/soil information relative to the current uniform-rate N management system used by the producer. Another three trials showed both lower seasonal N consumption and lower lint yield or higher seasonal N consumption and higher lint yield with higher N use efficiency and/or economic return under the variable-rate N management system based on either NDVI or NDVI and previous yield data/soil information compared with the uniform-rate N management system. The other four trials did not show any significant benefit with the two variable-rate N management systems. In conclusion, the performance of the variable-rate precision N management system based on either NDVI alone or NDVI and previous yield data/soil information relative to the current uniform-rate N management system used by the producer was frequently positive although it varied with location and year.

Tour H: Unmanned Aerial Systems (UAS)

Getting Started Using Unmanned Aerial Systems

Robert Freeland
Professor
UT Department of Biosystems Engineering and Soil Science

Utilizing small Unmanned Aerial Vehicles (UAVs) for agricultural purposes such as scouting and mapping crops, checking livestock and assessing inventory of nursery stocks has caught the attention of many producers. This presentation will discuss the various models of UAVs, and the pros and cons of each type. Essential hardware components and currently available software for processing the data collected from UAVs will be covered, as well as current local, state, and federal regulations with regard to their use in Tennessee.

Potential Uses of Unmanned Aerial Systems in Precision Agriculture

Michael Buschermohle
Professor
UT Department of Biosystems Engineering and Soil Science

Tim Woodward
Consulting Agronomist
Tellus Agronomics LLC

Precision agriculture data provides Tennessee producers various management opportunities to increase production, reduce input costs, and manage farmland more efficiently. Unmanned Aerial Systems (UASs) may be the next tool to improve precision agriculture data collection. Mapping with Unmanned Aerial Vehicles (UAVs) has the potential to provide imagery at an unprecedented spatial resolution. The highest spatial resolution data available from conventional platforms such as satellites and manned aircraft is typically in the range of 20-100 cm/pixel. UAVs are capable of flying at altitudes below 400 feet and hence can collect imagery at a much higher resolution, even as detailed as 1 cm/pixel. UAVs can be launched in narrow windows of good weather, fly large fields in preplanned flight patterns, and deliver the data rapidly to the producer at a lower cost than conventional platforms. Cameras mounted beneath UAVs gather images with normal light, infrared or thermal imaging, still photos or video formats. These images are digitized, geo-referenced and mapped. Producers and crop consultants can use this information to scout crops for weeds, insects and disease; detect nutrient deficiencies; variable rate apply crop inputs; assess flood or drought damage; and monitor wildlife damage.

This presentation will discuss some of the many potential applications for UASs in row crop production systems. One major application that will have immediate benefits will be directed crop scouting. With a UAS, producers or crop consultants can stand on the edge of the field with a ground station and see what a camera mounted on a UAV sees as it flies over the field. UASs won't replace scouting a field on foot, but they can direct scouts to specific areas in the field where problems exist. UASs will enable you to more effectively scout the entire field in a fraction of the time it takes to do it on foot.

Another application that has great potential is using UASs as a remote sensing tool to acquire high-resolution spatial data. Cameras attached to a UAV will enable producers to monitor the condition of their fields throughout the growing season. UASs are capable of collecting hyper resolution visible, multispectral, and thermal imagery for application in precision agriculture management. Visible imagery can be digitally processed into maps that give an indication of stand count, weed infestation or damage from floods and wildlife. Thermal imagery can be used to map soil moisture and plant canopy temperature, enabling assessment of irrigation

management and efficiency. Multispectral imagery enables the calculation of vegetation indices that relate to vegetation vigor and plant health which can be used for yield prediction mapping and management zone development, as well as precision fertilizer, herbicide, pesticide, and seeding applications – all of which can boost crop health, reduce input costs and increase yields by improving management decisions.

Although collecting good data is the most challenging part, the most time consuming and costly part can be processing the data to a point where it can be integrated into precision agriculture systems. The raw data will usually be images (up to several hundred – think gigabytes) and the challenge for data processing is to stitch these images together to generate one homogenous data set. This presentation will also discuss some of the image processing software packages that are currently on the market to process the data collected from a UAS.

Field Demonstration of Unmanned Aerial Systems

Michael Buschermohle
Professor
UT Department of Biosystems Engineering and Soil Science

Tim Woodward
Consulting Agronomist
Tellus Agronomics LLC

As the list of new technologies used in the agriculture industry continues to grow, the use of Unmanned Aerial Systems (UASs) has the potential to be among the most wide-ranging and beneficial technologies for producers and crop consultants. Unmanned Aerial Vehicles (UAVs) have the ability to collect high-resolution spatial data that can be utilized for real-time crop maintenance and precision application of crop inputs. This presentation will give field day participants an up-close look at the technology in live action. UASs flight demonstrations will include control and programming of units, digital displays of their output capabilities and maintenance of system components.

Tour I: Soil Management

No-Tillage, Cover Management, and Soil Health

Donald Tyler
Professor
UT Department of Biosystems Engineering and Soil Science

Ryan Blair
Research Associate
UT Department of Biosystems Engineering and Soil Science

In the Southeast, cover crops are usually winter annuals planted in the fall, allowed to grow thru the winter and spring, and then terminated close to the time of planting of the following row crop. These can be grass or legume species. The grass species commonly used are wheat or cereal rye. The two legumes recommended in Tennessee are crimson clover and hairy vetch. Both types of cover crops have advantages and disadvantages in row crop production. Ideally, cover crops are planted using no-tillage in previous crop residue.

Cover crops can offer a number of advantages when properly managed in row crop systems. They can supply additional soil cover, which is especially useful in systems such as non-rotated cotton which leaves limited residue on the soil surface even in continuous no-tillage. While the cover crop is growing in the fall, winter and spring it also captures additional carbon which would not be the case in most fallow situations. This can result in more rapid increases in soil carbon storage in no-tillage systems. The grass cover crops tend to make more fall growth than the legumes when planted after crop harvest. This is especially true when following cotton which in most cases is harvested later than corn or soybeans. This means that the grass covers will provide more winter erosion protection on highly erodible land than is usually the case with the winter annual legumes.

The legumes offer other distinct advantages including fixation of atmospheric nitrogen while growing. After growth termination, a part of this nitrogen is recycled to the following row crop as the legume cover crop residue decomposes. We recommend that if either crimson clover or hairy vetch is allowed to grow to mid-bloom before termination and subsequent row crop establishment that we can reduce fertilizer nitrogen application by 60 to 80 lbs N/acre for a number of crops including corn and cotton. The value chosen in this range depends on above ground biomass accumulation which can be related to initial stand establishment, growing conditions, etc.

Biomass accumulation can be enhanced in some situations by mixing grass and legume species. We have successfully used mixtures but they are more costly and in some cases are more difficult to manage in the following row crop.

Cover crop costs include seed, establishment, and in some cases additional burndown costs. Presently there are cost share programs offered by the Natural Resource Conservation Service to pay some of the cover crop expenses.

A number of new legume mixtures and species such as daikon radish are available for use as cover crops. Daikon radish along with oats have not been sufficiently winter hardy based on the experience with the cold winter we just had.

Cover crops can offer residue management enhancement in a number of row crop production systems especially in no-tillage cropping. However, they do cost money, time, and management.

If they can be properly managed in the crop system they can provide a number of soil quality and environmental benefits and in some cases result in higher yields and greater profitability.

Winter Cover Crop Management Strategies

Forbes Walker
Associate Professor
UT Department of Biosystems Engineering and Soil Science

Neal Eash
Professor
UT Department of Biosystems Engineering and Soil Science

For many years, UT AgResearch and Extension faculty, specialists, and extension agents have been conducting research and promoting the use of winter cover crops for Tennessee no-till cropping systems. However, typically less than 10 percent of the row crop acreage is put into winter cover crops. There are many potential reasons for the low levels of adoption by producers including the cost of cover crop establishment, methods to plant the cover crops and the need to harvest of some crops before a cover crop can be established. In 2013, cover crop and demonstration sites were established at the AgResearch and Education Center at Milan, in West Tennessee, following a soybean crop and a corn crop. In the soybean cropping system we investigated the effect of planting date on the establishment and effectiveness of three of the cover crop mixes and an unseeded control. In the corn cropping system we investigated two different seeding methods (broadcast and drill) on the establishment and effectiveness of six of the cover crop mixes and an unseeded control.

In the soybean/planting date study we compared an unseeded control, with a cereal rye cover crop, a wheat cover crop and hairy vetch combined with cereal rye. Cover crops were planted by broadcasting the seed (at 50 percent leaf yellowing stage) on October 3, 2014, and by drilling immediately after harvest on October 24 and approximately three weeks after harvest on November 11. Differences in cover crop establishment and weed control were observed in December 2013. By mid-March 2014, prior to termination of the cover crops, there was no significant difference in the ground cover between the treatments. Weed coverage of 61 percent was observed in the unseeded control plots compared to 25 to 30 percent in the cover crop plots.

In the corn/cover crop seeding method study we found little difference between the two seeding methods in cover crop establishment or average biomass. In the unseeded control plots we saw weed coverage of 31 percent compared to 0 to 2.5 percent in the cover crop plots. The seed mixes tested performed very well in terms of weed suppression and in providing a good ground cover. Above ground biomass was over 5.9 to 11.8 tons per acre for the cover crop mixes compared to about 2.2 tons per acre for the unseeded control plots. The six species soil health mix was the most expensive of the cover crop mixes tested.

Ongoing research into the effect of the cover crops on the main crop yield performance will be measured later on this year.

Cover Crop Economics and Risk Analysis

Jim Larson
Professor
UT Department of Agricultural and Resource Economics

Evan Markel
Graduate Research Assistant
UT Department of Agricultural and Resource Economics

This presentation discusses the potential profitability of growing cotton following legume and non-legume winter cover crops. Cotton lint yield data from a long-term (1981 to 2012) nitrogen fertilizer and cover crop experiment at the West Tennessee AgResearch and Education Center are used for the economic analysis. The four winter cover crops in the experiment are no cover crop, hairy vetch, crimson clover, and winter wheat. Profit maximizing nitrogen fertilization rates and yields along with the costs of establishing a cover crop and the net returns for cotton grown following the different winter cover crops are compared in the analysis. Several cotton lint and nitrogen fertilizer price scenarios and their impacts on the profit-maximizing nitrogen rate, nitrogen costs, and crop net returns with legume and wheat covers are discussed in the presentation. Results indicate that profit maximizing lint yields for legume winter covers are similar to the profit maximizing yields with no winter cover. Profit maximizing nitrogen fertilization rates (lb/acre) with the legume winter covers have the potential to be as much as 90 percent lower, depending on cotton lint and fertilizer nitrogen prices, than the nitrogen fertilization rates applied with no winter cover. The profitability of legume covers primarily depends on the tradeoffs between the fertilizer nitrogen cost savings and the costs of establishing the legume cover. Overall, as the cost of nitrogen fertilizer increases, the potential profitability of using legume cover crops increases. The potential effects of USDA NRCS Environmental Quality Incentive Program (EQIP) payments and other conservation program incentives on improving the profitability of using

cover crops in cotton production are also highlighted in the presentation.

NRCS Soil Health Initiative

Greg Brann
Soil Health and Grazing Land Specialist
NRCS, Nashville, Tennessee

Matthew Denton
District Conservationist
NRCS, Gibson County, Tennessee

Soil Health definition: The continued capacity of soil to function as a vital living ecosystem that sustains and improves soil, plant, animal and human resources.

I believe everyone would agree that most of our soils are degraded from past management. This initiatives goal is to not only sustain but improve soils functioning and productive capacity. There is more to soil health than cover crops although they are a major step on the path to better soils. NRCS is focusing on four major processes that lead to improved soil health:

- **Less Disturbance:** First thing we typically think of is reducing tillage, and that is a big factor, but disturbance can also be excessive nutrients, pesticides, uncontrolled traffic, grazing without a recovery period or anything else that impacts the soil.

- **Increase Cover:** Cover is carbon; the start of improving all functions in the soil. Cover can be increased by good agronomic practices and less disturbance, crop diversity helps and living roots throughout the year are beneficial.

- **Increase Diversity:** Plant diversity improves soil health by providing different root exudates (sugars) to feed soil life (bugs). Plant diversity can be improved by adding crops to the crop rotation and by planting diverse cover crop mixes. Different root forms and different rooting depths all improve soil health and soil life. Diversity in soil life improves resilience of the soil as well as aggregate stability. Aggregate stability is important because the soil maintains a good air and moisture relationship. Diversity is like an insurance policy – it is not likely to have a failure in all crops or species at one time.

- **Living Roots throughout the year:** Having a void in the cropping system is a missed opportunity to capture energy and bank it for future production. When roots die they create air space and an avenue for water infiltration. Roots are a major food source for soil biology. Other factors to consider are capturing more energy/sunlight, cycling water, cycling nutrients and improving soil life. Having the soil covered with living plants throughout the year improves all of the functions. If land is not disturbed by no-tilling, more crop residue will remain on the surface improving energy flow, nutrient cycling and soil life.

Potential Cost Share Assistance: NRCS in Tennessee and across the nation has put major emphasis on soil health. One of the biggest changes in recent years has been on promoting multi-species cover crops. This involves planting a cover crop mix of five species or more between primary crops. To be eligible for this cost share, the cover crop and primary crop must be no-till planted or aerial (broadcast) planted. The highest level of cost share and highest ranked applicants are those that are committed to planting a cover crop for three years on the same land. Cover crops will:

1. Serve as cover for a minimum of 90 days,

2. At termination, have 90 percent or better ground cover, and

3. Have a minimum height of 8 inches at termination; taller is better.

Grazing Cover Crop: Only producers with a commitment to manage grazing heights are allowed to graze cover crops. Management technique will be take half, leave half allowing cover to reach 8-inch height then graze to 4-inch minimum height, maintaining 70 percent ground cover. Producer must have an area to remove livestock from the cover crop when cover crop is vulnerable to

overgrazing or excessive trampling. Cover crop can be grazed to a 4-inch minimum height prior to termination. No mechanical harvest (e.g., silage, balage, hay etc.) allowed. The sacrifice area will be based on the feeding site assessment tool. The sacrifice area will not receive payment.

Leave an untreated area: For all cover crops, leave a portion of the field or similar field to compare results. Area should be wide and large enough to get a reliable yield monitor reading. Building soil can be a long term process however; increasing organic matter improves moisture and nutrient holding capacity. Payment is based on acres planted in cover crop.

Planting Options: When planting with a drill, use the lower recommended seeding rate. For broadcast (aerial) seedings, seed a minimum of 1.3 times the low rate. Significant soil health benefits can be achieved with early seeded cover crop. In developing mixes, seed a minimum of 20 percent of each species in the Soil Health cover, 70 percent legume in Nitrogen fixing cover and 70 percent brassicas in Nitrogen scavenging mixes. Total seeding rate will equal 100 percent or higher. Grasses improve bulk density of the soil and tap roots improve deeper soil. Use species in the mix that have similar planting dates. Up to 20 percent of the mix can be a species that will be terminated by frost or heat (e.g., buckwheat with cool season mix planted in August). The following are different purposes producers could sign up for cost share in for 2014:

- **Soil Protection**: Cereal rye or cereal rye and legume, Cotton is only eligible crop (one species).

- **Nitrogen Scavenging (up to 3 yr):** Two species minimum (e.g., Cereal rye and turnips) (70 percent of full mix rate will be brassicas)

- **Nitrogen Fixing Cover (up to 3 yr):** Two species minimum Cool season: Alfalfa, Austrian winter peas, crimson clover, red clover, vetch; Warm Season: Cow peas, Sun hemp. Adding 20 percent of full mix rate will be grass like rye or wheat on slopes over 3 percent in West Tennessee and over 5 percent in Middle and East Tennessee. (70 percent of full mix rate will be legumes).

- **Soil Health Cover (1 or 2 yr planting at same payment level as Nitrogen Fixing Cover, highest payment rate for 3 yr):** (small grain, legume and brassica mix 5 species minimum): see planting options above and in tables. Equal proportions of seed would be 20 percent of full rate of each species. All crops will be planted no-till.

- **Organic Weed Control Cover (up to 3 yr):** Cereal rye or cereal rye mix with legumes and brassicas. Cover crop will be rolled at termination.

- **Orchard/Vineyard Cover (up to 3 yr):** Crimson clover and annual ryegrass.

Tour J: Variable Rate Irrigation

Variable Speed Pumps and Pumping Costs for Center Pivot Irrigation

Shawn Hawkins
Associate Professor
UT Department of Biosystems Engineering and Soil Science

Wesley Wright
Research Associate
UT Department of Biosystems Engineering and Soil Science

Investment in farm irrigation systems in West Tennessee has increased in recent years, driven by historically high corn prices. The payback period for irrigation systems is principally affected by crop prices, the initial investment costs of the well, pump, power unit, and irrigation rig, as well as the increased yield provided during dry years. Generally, the breakeven corn price decreases as the field size increases (≈30-40 percent going from 60 to 200 acres). At large field sizes, variable speed pump controllers increase the initial investment costs but provide the ability to control irrigation rates to parts of the field with different soil types and thus infiltration rates. Variable pump speed technology can also be used to operate the well pump at the best efficiency point.
One factor that affects the payback period of an irrigation system is the operating cost of the pump and rig power unit. Very little precise observational data exist to quantify the cost for electrically powered systems, particularly systems with variable speed pump controllers. The Milan AgResearch and Education Center operates two center pivots that receive groundwater from a single well/electrical pump powered with a three phase motor. One of these pivots operates at a constant pump speed and uniformly covers approximately 58 acres in a half circle arc. The second pivot covers 63 acres in a near half circle arc and was recently upgraded to include variable rate irrigation (VRI). As a part of these upgrades, the pump control panel was equipped with a variable frequency drive, which allows the VRI control system to control the pump speed and thus irrigation rates to different parts of the field. The pump control panel was instrumented in May 2014 to measure the total irrigation system and pump electrical power consumption; a flow meter was also installed to measure the irrigation flow rate. Data will be accumulated during the 2014 cropping season to more precisely evaluate the payback period of irrigation systems with variable speed pumps. Specifically, the data will allow a more accurate comparison of the operating costs of diesel versus electrically powered irrigation systems.

Tentative data from this system is ready as of July 3, 2014; four irrigation events have been monitored. Three of those events were for the pivot without VRI technology (i.e. operated at a constant pump speed); one event was for the pivot with the VRI technology that included variable pump speed control. Power consumption by the pump accounted for 7.8 percent of total power consumption for the non-VRI pivot and 3.0 percent for the VRI pivot; however, the total electrical power cost (at the Tennessee average power rate of $0.1046 per kilowatt hour) for the non-VRI sytem ($2.92 per inch-acre irrigated) was slightly lower than for the VRI system ($3.15 per inch-acre irrigated). The electrical power cost per acre for a relatively dry year with 15 inches of irrigated water applied is $44.70/acre. The standby power consumption of the system is less than $1/day.

Variable Rate Options for Center Pivots

Justin Miller
Tennessee Tractor, LLC

Variable Rate Irrigation (VRI) offers you the ultimate in precision irrigation. With a combination of hardware and software, VRI allows you to customize water application based on topography information, soil data maps, yield data, and other user-defined information. Based on your VRI prescription, you're applying water only where it needs to be. So, you are not applying water to unnecessary areas in your field, such as: ditches, canals, buildings, and boggy areas.

We will explain the difference between VRI speed control and VRI zone control and how to create and wirelessly upload your VRI prescription to your center pivot. We can also demonstrate these devices on the stations pivot where the hardware was installed this past spring.

Tour K: Crop Variety Demo

The No-Till Crop Variety Demonstrations will have varieties of corn, cotton and soybean technology on display. Participants may interact with representatives from the various companies represented. This tour will be located immediately behind the bus loading area.

DuPont Pioneer
Monsanto
NK Brand Seeds
Phytogen
UniSouth Genetics Inc.

Tour L: Compatibility of Honeybees and Agriculture

Beekeeping 101

Wilbur Brewer
Beekeeper

Bobby Hathcock
Beekeeper and Professor (Retired)
UT Martin Plant Sciences

We will use two posters showing the life of the honey bee and the year of the beekeeper.

We will have a live display of honeybees, a bee hive [no live bees in hive], beekeeper equipment and a display of honey.

Topics we will cover:

1. History of the honey bee and how they got to America. Facts of beekeeping going back to the Egyptians.

2. We will show the present day beehive and parts. Why this hive is required for inspections of the bees by the Tennessee Department of Agriculture.

3. The purposes of keeping honeybees on the farm. The pollination process and the plants that need help with bee pollination.

4. The life of the honeybee, we will show the poster, discuss the jobs that are performed by the queens, workers and drones.

5. Products of the hive, showing the honey display, beeswax, etc. [candles, lip balm, shoe polish, bee venom].

6. Life of the beekeeper. We will show the poster and beekeeping equipment and what is needed to become a beekeeper. We will discuss the process of acquiring bees and the benefits of belonging to a bee club. If questions should arise about the diseases of the hive and the CCD [colony collapse disorder] we will refer to John Skinner.

Agriculture, Pesticides, and Managing Bee Health

John Skinner
Professor
UT Department of Entomology and Plant Pathology

Gus Lorenz
Professor and Extension Entomologist
University of Arkansas

The health of honeybees and other pollinators is a hot topic. Many factors have been implicated in affecting the health of honeybees including bee parasites such as varroa mite, loss of habitat, diseases, and pesticide use. Neonicotinoid insecticides, which are commonly used in agriculture and landscapes, have gained national attention for their potential role in affecting pollinator health. Examples of neonicotinoid insecticides include seed treatments such as Cruiser (thiamethoxam), Gaucho (imidacloprid), and Poncho (clothianidin). Foliar applications of Centric (thiamethoxam) and imidacloprid are also commonly made to cotton. Like many insecticides, neonicotinoid insecticides are acutely toxic to honey bees. However, they are used at relatively low rates compared with many other insecticides. Concerns about bee health are affecting the regulation and use of all pesticides in agriculture, with significant restrictions being placed on the use of many insecticides.

Research at UT and in cooperation with the USDA and other universities in the Mid-South is addressing how pesticide use in agricultural and non-agricultural areas is impacting honeybees. Research was initiated in 2012 to determine if and at what concentration neonicotinoid insecticides occurred in the pollen and nectar of crops being visited by bees. Other research addresses potential contamination of wild flowers near agricultural fields that might be used by honey bees as a food source. Current efforts are examining the health of bee hives established in both agricultural and non-agricultural areas.

Our data suggests that neonicotinoid insecticides may persist at some level in the soil for a year or more. However, data from the Mid-South also indicate that the use of neonicotinoids as an insecticide seed treatment resulted in little or no

contamination in the pollen or nectar of cotton or in soybean flowers. Neonicotinoids were detected in the pollen of corn at levels similar to those previously reported in other studies. In the Mid-South, studies on bee foraging behavior indicate that bees only occasionally target corn pollen as a primary food source. However, this can vary considerably depending on what other food sources are available to bees. Ongoing studies are investigating how foliar applications of neonicotinoid insecticides, used commonly in cotton and less so in soybean, might also potentially affect bee health.

These presentations will address the causes of declining honey bee health. It will also address the compatibility of agricultural production and apiculture, addressing ways to mitigate any negative effects of agriculture on honey bee health. This includes increasing the awareness and communication of both beekeepers and farmers and using insecticides judiciously.

Tour M: Your Farmland Legacy

Your Farmland Legacy

Dan Strasser
Tennessee Farmland Legacy founding member

What is the future of your farm? Is there anything you can do to ensure its success and longevity? Every farmer and landowner can create a legacy.

Farming in Tennessee is a $3.1 billion industry at the farm gate. Agriculture, including forestry, generates more than $60 billion in total economic activity and provides employment for nearly 500,000 Tennesseans. Agriculture is the main economic driver in rural communities and every farm dollar turns over multiple times in the local economy.

All that is great but success of our state's agricultural industry and economy begins with the success of your farm. Tennessee Farmland Legacy Partnership knows the first step for a farm to be successful and for that farm to transition generations, it must be profitable. Listen in on this session to learn of resources available to every farmer and landowner. Some of these resources can be found at www.farmlandlegacy.org.

Tennessee's agriculture is beneficial to all Tennesseans in some way. Therefore, the Farmland Legacy Partnership goes beyond farms to work with a variety of organizations, agencies and individuals. Finding balance among competing land uses in our communities is vital to the future of our state's economy, health and quality of life. Each year, Tennessee loses an average of 1,300 family farms and 100,000 acres of farmland. Much of this land is converted to other uses and is taken out of agricultural production, sometimes unalterably forever. Farmers often find it difficult to pass their farmland to the next generation due to a lack of interest in farming by other family members, a lack of information on succession planning, or due to economic and development pressures. The future of Tennessee agriculture depends on the ability of exiting farmers to transition, without losing valuable farmland, to new generations of farmers who need access to affordable and productive farmland.

The Tennessee Farmland Legacy Partnership seeks to raise awareness among farmers and other landowners, government officials including community planning and zoning officials, developers, business and civic leaders, media and citizens as to the values, needs and opportunities for farmland preservation in the state. The Partnership will also direct farmers and community officials to the technical and financial programs offered by organizations and agencies related to farmland protection.

What can be done to ensure success and longevity of your farm?

Joseph T. Howell
Attorney at Law

What can every farmer do to cultivate a legacy? Regardless of size, everyone has an estate and no one can take it with them when they die. You can create your own estate plan or the state of Tennessee can do it for you. To ensure your wishes are carried out, you need to provide instructions stating whom you want to receive something of yours, what you want them to receive and when they are to receive it. You want this transition to occur with the least amount of tax consequences, legal fees and court costs.
Questions to ask yourself:

- Have you prepared a will or a trust? Have you designated a personal representative and beneficiaries?
- When was your estate plan last reviewed?
- Are all of your heirs over the age of 21 and financially responsible?
- Are you certain that your assets will not be subject to probate?
- Do you have assets titled jointly with a child or someone else?
- Does your current plan provide your heirs with asset protection, divorce protection and lawsuit protection?
- Is this your first marriage? Have you reviewed beneficiary designations?

- Have you designated an agent to make health care and financial decisions in the event you become incapacitated?
- Have you designated a guardian for minor children?
- Do you have a family member or loved one who has special needs and receives governmental benefits?
- Do you have insurance - do you have life insurance for your family at your death, disability insurance to replace your income if you cannot work due to illness or injury, and long term health care insurance to pay for your care in the case of extended illness or injury?

Be prepared and set a deadline!

Tools Empowering a Farm Legacy

Andy Davis
UT Extension Area Specialist

Leasing land is very common with Tennessee farmers. This session will highlight what every lease should consider. Other tools available to increase farm profitability also will be discussed. Landowners, farmers, and partners are encouraged to attend.

More than a quarter of Tennessee's farmers lease land and leased land accounts for more than one-third of Tennessee's farmland. Thus, continued access to leased land is crucial to the successful operation of many of Tennessee's farms. In addition, leasing provides young farmers with access to land and facilitates the transfer of land from transitioning and retiring farmers. In many instances, farmland leases are of the handshake variety. As a result, many leases fail to provide for a wide range of contingencies that could and should be addressed. This failure can lead to unnecessary conflict between landlords and tenants either because they fail to consider and agree on how to address these contingencies or because one or the other misunderstands or misremembers how the contingencies are to be addressed (from Introduction to Farmland Leasing, PB1816-A). This session will highlight what every landowner or tenant should consider when crafting a lease. A variety of farmland leasing tools will also be highlighted.

Part of leaving a legacy is ensuring the success and financial health of farming operations. The MANAGE program was designed specifically to help Tennessee farm families carefully evaluate their individual situation and assist them in improving their quality of life. The MANAGE program is conducted by UT Extension. Over 15,000 Tennessee farm families have participated in the intensive farm and financial planning phase of MANAGE. The MANAGE program helps families analyze their total farming business so they can make informed decisions regarding their future. Staff trained in farm and financial management help families:

- review their current financial situation
- capitalize on strengths and reduce weaknesses in the farm business
- develop individualized farm and financial plans
- explore alternatives both on and off the farm
- evaluate capital investment opportunities including land and/or machinery purchases
- analyze likely consequences of changing the scope of enterprises
- determine appropriate production practices

Assistance with risk management, financial and production recordkeeping, cash flow planning, and partial budgeting analysis is also offered by the MANAGE program. This session will highlight the MANAGE program and the services it offers.

Farmland Forever Through a Land Trust

Gary Moore
Middle Tennessee Project Manager
The Land Trust for Tennessee

Land conservation and protection options for your family and farm for immediate income tax benefits and possible future estate tax planning benefits coupled with the satisfaction of knowing that your farm will be a farm forever.

Talking Points

- The Land Trust for Tennessee was founded in 1999 as a non-profit and non-governmental organization by then Mayor Bredesen, CEO-Jeanie Nelson, and 12 like-minded individuals to form the Board. Today, we still have the same CEO, 18 fulltime and part time employees, and 35 board members. We are funded by grants and grant foundations, donors/donations, philanthropic minded individuals/entities, and estate bequeaths.
- The Mission: To preserve the unique character of Tennessee's natural and historic landscapes and sites for future generations.
- According to the UT Extension, our state has lost 600,000 acres belonging to 3,000 farms during the period of 2007-2012 to development for commercial, industrial, residential, and transportation purposes. Many times these losses represent many acres of prime and/or good farmland.
- We are committed to conserve and protect the following land uses for willing landowners or units of government: Critical Watersheds and River Corridors; Community and Historical/Cultural Resources; Natural Landscapes and Recreation Corridors/Open Spaces; and Working Lands – Farms and Forests.
- The conservation easement is the primary tool we use for protecting land that lasts forever by being attached to the deed. It is a legal agreement with restrictions that is flexible and tailored to specific property and landowner's needs and desires that can be phased in over a period of time and totally voluntary.
- One primary benefit of a conservation easement is three forms of tax relief. If your farm is already in a greenbelt status, the easement may or may not further reduce your property taxes. Estate tax relief for landowners may allow heirs to keep the land in the family rather than be forced to sell it. The most popular tax relief is through the federal income tax deduction where landowners are able to take sizeable deductions in relieving them of some of their annual tax burden.

To date and since 1999, we now have protected over 92,000 acres on 280 properties in 54 counties. Of this amount, working land total 81 farms for over 25,000 acres.

Tour N: Grain Bin Management

Grain Drying, Aeration, and Energy Conservation

Samuel G. McNeill, PhD, PE
Associate Extension Professor
Extension Specialist
University of Kentucky, Princeton

The first step towards delivering good quality grain to the elevator is to thoroughly clean all equipment that grain will pass through from the field to the storage bin. This list includes combines, grain carts, trucks or gravity wagons, dump pits, transport augers or bucket elevators, hopper tanks, dryers, conveyors and storage bins. Use a small, wet-dry vacuum cleaner for hard-to-reach ledges and other areas in this equipment. Pay close attention to the back of the combine where insects can hide in small pockets of debris or dust.

Balance the costs of machine losses and heated air drying to know when to start harvest. A 3-year study in Mississippi showed average corn harvest losses to be about 12 percent (which compares to 5 to 6 percent for the Midwest). A recent study with US machines in Brazil showed a range of 0.3 to 3.6 percent (1.2 to 5.5 percent for soybeans), with the highest losses due to severe weather. Recent weather events in the US (hurricanes Katrina and Rita in 2005, Ike in 2008, and heavy rainfall in 2009 and 2013) have stimulated interest in grain dryers. Variations in grain prices and the cost of drying fuel have complicated the decision of when to start harvest to make the most profit. A spreadsheet has been developed to help with this decision. Results for a range of yields, average loss, and corn and fuel prices are shown in Table 1 for removing 8 points of moisture and anticipating a yield loss of 5 percent. For the average yield (150 bu/a), the returns for energy cost and drying equipment is $10 and $3 per acre, respectively. Information on harvest losses for individual farms is needed to make a site-specific decision.

Table 1. Comparison of the costs of field losses with corn drying ($5.00 per bushel, $1.50 per gallon of LP, drying from 23 to15 percent).

Harvest loss:		5.0%					
Standing Yield (bu/ac)	Harvest Loss (bu/ac)	Harvested Yield (bu/ac)	Value of losses ($/ac)	Drying cost ($/ac)		Return to drying ($/ac)	
				Energy Cost	Total Cost	Energy	Total
100	5.00	95.0	$ 25	$ 18	$ 23	$ 7	$ 2
150	7.50	142.5	$ 37	$ 27	$ 34	$ 10	$ 3
200	10.00	190.0	$ 50	$ 36	$ 45	$ 14	$ 5

In addition to reducing harvest losses (and the potential weed problem for crops that follow), other advantages to early harvest are the opportunity to capture early market premiums, better control of the harvest and grain quality (aflatoxin reduction), and early fall tillage. Ballpark estimates for drying costs can be made by knowing four things: 1) the efficiency of the dryer [which ranges from 1,500─2,000 Btu per pound of water removed for most bin and some new high temperature dryers to 2,500─3,000 Btu/lb for older high speed dryers]; 2) the amount of water that is removed when drying corn [3.50 or 7.47 pounds per bushel for 5 or 10 points of moisture, respectively]; 3) the amount of heat available from a gallon of LP gas [about 90,000 Btu with typical burner efficiencies]; and 4) the price of LP gas [between $1.40 to $1.80 per gallon]. Thus, a gallon of LP can dry between 8.6 to 17.1 bushels when drying 5 points (or 4 to 8 bushels at 10 points), depending on the system. So, when LP costs $1.50 per gallon, drying costs will range between 8.8 and 37.5 cents per bushel across systems. A spreadsheet tool is available to help operators calculate their specific drying costs based on the drying efficiency of their equipment, amount of moisture removed, and fuel price.

Proper drying can help prevent many problems during storage, so the associated costs can result in fewer quality related discounts at the elevator. Match the final moisture level to the length of storage for your area. Avoid over-drying grain that will be sold before spring warm up. At this season's grain prices, moisture shrink is worth 6, 15 and 7 cents per bushel for each point below market level for corn, soybeans and wheat, respectively.

Grain that will be held after the spring warm up should be cleaned before binning to remove broken grain and foreign material. Run the first cooling cycle ASAP after drying (can be as early as late August or early September, as weather allows). All bins should be cored after filling to remove the center peak of grain for improved aeration and to allow room for workers to check the surface every 2 to 4 weeks. Monitor grain below the surface with temperature cables and use this information to manage aeration fans. Cool grain once a month during the fall to lower the temperature about 10 degrees until you reach the winter average.

Frequently inspect stored grain for insect activity and changes in temperature or moisture. Always caution those who enter the bin to be aware of the potential entrapment and suffocation hazards involved, especially when the normal flow of grain from the bin is blocked. If sanitation, proper drying and aeration fail to control insect activity and populations reach an economic threshold, contact an approved applicator to fumigate infested bin(s). Following preventative management practices represents a lot of sweat equity, but the reward will be fewer insect problems during storage and lower discounts when grain is sold.

The University of Kentucky Biosystems and Agricultural Engineering Department has the spreadsheet tools mentioned here along with new and archived publications that provide more details on different grain drying, aeration and storage systems, safe grain inspections (www.bae.uky.edu/ext/Grain_Storage).

Grain Bin and Auger Safety

Tim Prather
Extension Specialist
UT Department of Biosystems Engineering and Soil Science

On-farm grain storage can provide flexibility during harvest and allow grain to be held for use or market timing. In order to take advantage of on-farm grain storage, you must minimize economic losses that can occur due to spoilage, insect infestations, excessive energy use and mishaps that cause injures or property damage. The Grain Bin Management tour stop features three presentations that highlight good practices to protect your investments.

Grain drying during harvest and aeration during storage can consume large amounts of energy. Maximizing energy efficiency can pay big dividends by getting the most value from every dollar in energy costs. Learn how changes in moisture content at harvest, grain dryer management and aeration practices can impact grain quality and energy costs.

The safety presentation identifies common mishaps and health hazards around grain bins and grain handling equipment, and precautions to minimize the risks.

The fumigation and pest management presentation identifies common problems and Integrated Pest Management practices, including grain bin fumigation and the safety issues that accompany fumigation.

Tour O: Natural Resources

A Lesson in the Process of Timber Inventory

David Mercker
Extension Specialist II
UT Department of Forestry, Wildlife and Fisheries

Timber inventories are the main tool used to determine the volume and value of standing trees on a forested tract. A timber inventory, like any inventory, involves taking stock of how much material is available. While timber inventories have traditionally been performed to place a value on a stand before a logging operation, they are also useful for providing information for the development of management strategies, investment, estate planning, tax basis, or litigation.

The methods and descriptions in this presentation are not intended as a substitute for the work and advice of a professional forester. Professional foresters can tailor an inventory to your specific needs. They can help you understand how an inventory may be inaccurate and provide margins of error for estimated values. However, this publication should educate you enough to discuss timber inventories with a professional, and may allow you to perform intermediate inventories to monitor the status of forest land or gather data to support decisions. The author is confident that if the guidelines described herein are closely adhered to, and with the experience of someone with experience and knowledge, a general timber inventory can be conducted.

If this is your introduction to measuring forests, you will find that there is considerable terminology and an array of specialized tools. The speaker helps define some terminology and introduces you to the tools necessary for the project.

Timber inventory can be a very complex and subjective process. Even trained professional foresters and experienced loggers arrive at differing volumes and values when inventorying a stand. Because most private forest landowners are not comfortable with inventorying their own timber, professional assistance is highly recommended. This is particularly the case when decisions related to timber value have lasting consequences.

"Something is Fishy Here" – Managing Private Ponds

Ron Blair
Director
UT Extension Henderson County

This program will be an open discussion dealing with anything and everything for private pond owners. Topics included will include weed identification and control, fish stocking and harvest, management of the fish population using creel catch and relative weights. Water quality, nutrient management and wildlife issues will all be discussed. Pond owners should bring questions, photos and weeds to share and discuss.

Walnut Twig Beetle: A Threat to Tennessee Timber?

Jackson Audley
Forest Products Graduate Student
UT Department of Forestry, Wildlife and Fisheries

Abstract: The Thousand Canker Disease carried by the Walnut Twig Beetle is one of many recent exotic pests introduced to Tennessee. We will provide an overview of trees pests and trends and what it might mean for our forests. Ongoing research at UT will be discussed as well as how you can become involved in a related project as a *citizen scientist*.

Identification and Control of Nonnative Invasive Plants in Forest Management

Larry Tankersley
Extension Specialist II
UT Department of Forestry, Wildlife and Fisheries

Discussion of several common nonnative plants that are commonly invading areas where they are not wanted.

Species include: tree of heaven, paulownia, mimosa, privet, bush honeysuckle, Japanese honeysuckle, kudzu , serecia and other lespedeza, Japanese stiltgrass

Intro to lingo:

Native vegetation is historically found in local areas and are well suited to their environment.

Exotic plants are found locally but originated in another country or continent. These are also nonnative but a plant from a different region of this country or continent, are likewise nonnative.

Invasive plants can be either native or nonnative but cause economic and ecological damage by crowding out more desirable plants.

Invasive plants spread at a rampant rate; often assisted by humans. The seeding and sprouting character of these plants contributes to their spread in addition of people moving them around.

Controlling non-native invasive plants is often difficult. Cutting and mowing remove the plant from sight but the root system is only temporarily affected and the plant is often back soon. Most professionals recommend herbicide applications as the most effective way to control invasive plants. When used properly, herbicides have a number of benefits. Primarily, herbicides can kill the entire plant; roots included, thus preventing/reducing sprouting. Established patches of invasive weeds typically require repeated treatments for eradication. Determination is often required to maintain control of many of these plants.

The recommendations provided are intended as treatment for one or a few individual plants not for broadcast treatments of sizable area. Every situation should be carefully evaluated before any herbicide is used. Regardless of the herbicide used, carefully read the label and follow the directions.

(Table from Jackson, Sam and Wayne Clatterbuck)

Control Recommendations			
Species	**Large Trees**	**Saplings**	**Seedlings**
Tree-of-Heaven	Stem injections with Garlon 3A, Pathway*, Pathfinder II or Arsenal AC*. Midsummer application is best. Apply herbicide to stumps of felled trees to prevent resprouting.	Apply Garlon 4 as a solution in a basal oil to the bark of saplings. Basal oil will help keep the herbicide on the tree. A penetrant would help the herbicide get through the bark.	Wet leaves in late summer with a water-herbicide mixture with surfactant (helps herbicide adhere to the leaf and be more effective). Herbicides include Arsenal AC*, Krenite S or Garlon 4.
Royal Paulownia	Stem injections with Arsenal AC* or a glyphosate herbicide. Apply any time besides March and April. Apply herbicide to stumps of felled trees to prevent sprouting.	Apply Garlon 4 in a basal oil to the bark of saplings. Use a bark penetrant.	In late summer and early fall, apply Arsenal AC*, a glypho-sate herbicide, Garlon 3A or Garlon 4 with surfactant to leaves.
Mimosa	Stem injections with Garlon 3A or Arsenal AC*, both applied by the label at any time but late spring. Apply herbicide to stumps of felled trees.	Apply Garlon 4 in a basal oil to the bark of saplings. Use a bark penetrant.	In late summer and early fall, apply Garlon 3A, Garlon 4 or glyphosate herbicide with surfactant to leaves.
Privet	Apply Garlon 4 in a basal oil to the bark of larger plants. Use a bark penetrant. Can also cut stems and treat stumps with Arsenal AC*, Velpar L*, a glypho-sate herbicide or Garlon 3A.	Apply a glyphosate herbicide or Arsenal AC* with surfactant in August though December. Wet all leaves.	
Amur Honeysuckle	Cut stems and treat stumps with Arsenal AC* or a glyphosate herbicide.	Apply a glyphosate herbicide with surfactant to leaves in August – October. Garlon 4 in basal oil can be used on stems.	
Japanese Honeysuckle	Cut large vines and treat stumps with a glyphosate herbicide or Garlon 3A in late summer and early fall. Prescribed fire in spring also can control vines.	Spray leves with Escort* and a surfactant in late summer. Treat foliage with a surfactant and glyphosate herbicide or Garlon 3A or 4 in July through October.	
Kudzu	Apply a glyphosate herbicide or Garlon 4 with surfactant to leaves and stumps. Can apply Garlon 4 with penetrant and basal oil to bark of large vines in January – April.	Wet all leaves with the following herbicides in a surfactant-water mix: Tordon 101*♦ or Tordon K*♦ in July – October, Escort* in July – September, or Transline+.	
Sericea or Chinese Lespedeza	Wet all leaves with the following herbicides in water with a surfactant in July through September: Garlon 4, Escort*, Transline+, glyphosate herbicide or Velpar L*. Mowing the vegetation at least a month before treatment makes the herbicide more effective.		
Japanese Grass	Apply a glyphosate herbicide in a water-and-surfactant mix in late summer. Vantage can be used according to its label for more protection of surrounding plants. Repeat treatments will be necessary over several years.		

* Use may kill or injure non-target surrounding vegetation by root uptake of this herbicide.

\+ Transline controls the leguminous group of plant species.

♦For Tordon herbicides to be effective, rainfall must occur within six days following application for soil activation. Tordon herbicides are Restricted Use Pesticides.

Precautionary Statement:

To protect people and the environment, herbicides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of an herbicide. ***According to laws regulating herbicides, they must be used only as directed by the label.***

Disclaimer:

Herbicides recommended in this publication were registered for the prescribed uses when printed. Herbicide registrations are continuously being reviewed. Should registration of a recommended herbicide be cancelled, it would no longer be recommended by the University of Tennessee. Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others, which may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product.

Wild Hog Trapping Techniques

Chuck Yoest
Big Game Coordinator
Tennessee Wildlife Resources Agency

Daniel Stanfield
Big Game Coordinator
Tennessee Wildlife Resources Agency

Wild hog populations exist in approximately 80 Tennessee counties and are of growing concern to Tennessee's agriculturists. Wild hogs cause soil erosion, destroy crops, threaten animal and human health, etc. Due to the widespread distribution of wild hogs and threats posed, it is crucial for landowners to be proactive in responding to the presence of wild hogs. Hunting, an obvious response, has proven unsuccessful in controlling wild hogs because it targets only single animals and entices certain individuals to stock wild hogs for hunting purposes. The best approach to wild hog control is a cooperative trapping program complemented by USDA Wildlife Service's aerial gunning program. However, trapping will be the focus of our demonstration since landowners can conduct it themselves.

Wild hog control is not an easy or quick process. Rather, effective control is a year-round process requiring an investment in trapping equipment and an in-depth understanding of wild hog behavior. Additionally, effective control requires cooperation by landowners since wild hog home ranges typically include lands owned by more than one person.

The Wild Hog Eradication Action Team (WHEAT) is a partnership of 24 organizations dedicated to eradicating wild hogs from Tennessee. Members of WHEAT will be on hand educating landowners on how to properly respond to an occurrence of wild hogs. WHEAT members will share techniques used to verify the presence of wild hogs and demonstrate effective wild hog control. Other subject matter will include: trap construction and placement, trapping methodology, etc.

Tour P: Farmers vs. Hunger

Sponsored by:

Hunters Sharing the Harvest Inc.
Cargill
Tennessee Soybean Promotion Council
Farm Credit Mid-America
Outreach Inc.

Other sponsors will be listed at the Field Day.

On-site Coordinator:
Chuck Danehower
UT Extension Area Specialist – Farm Management

This tour will run continuously from 9:00 a.m. to 2:00 p.m.

Stop by the West Tennessee Agricultural Museum, cool off from the hot sun, and participate in the Farmers vs. Hunger tour stop. This stop is a unique blend of what can be accomplished when farmers and others in the agricultural community come together to address the needs of those who are in need. This stop features a hands-on activity where participants will participate in an assembly line and assemble a soy meal protein and vitamin-enhanced macaroni and cheese product that is a substantial meal for children and adults. The soybean ingredient is a vital component of this nutritious and affordable meal. Soybeans are grown on 1.6 million acres in Tennessee and are the largest row crop in the state.

In Tennessee, 17.1 percent of the state's population, including 24.7 percent of the children, are food insecure and can't afford enough food to consistently meet their basic needs. The meals packaged at this tour will be distributed to food banks and food pantries throughout the local area. Stop in and help stamp out hunger while attending the Milan No-Till Field Day. Activities will begin at 9:00 a.m. and will continue throughout the day.

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