27th Milan No-Till

Crop Production Field Day

TOUR REPORT

with

Crop Variety Demonstrations

Hosted by UT AgResearch
Thursday, July 26, 2012
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North Tract of the
AgResearch and Education Center
Milan, Tenn.

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INSTITUTE of AGRICULTURE

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TOUR A: NUTRIENT MANAGEMENT

Fertilizer Enhancement Products

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Fertilizer enhancement products are being promoted every year in Tennessee and throughout much of the Southeast. Three products of recent interest include Agrotain Ultra, Nutrisphere and Avail.

N-(n-butyl) thiophosphoric triamide (NBPT) is commercially known as Agrotain Ultra (Koch Agronomic Services). Agrotain Ultra blocks the activity of a naturally occurring enzyme called urease which acts to convert urea into ammonium forms. At rates currently used at Ag dealers, the material inhibits conversion of urea into ammonium for up to two weeks. The product is sprayed onto solid urea products (product becomes colored as it is coated by the Agrotain spray) or mixed with liquid products. University of Tennessee research and numerous studies in other states have demonstrated the efficacy of the product. Use of this product with surface applied urea materials is highly desirable to avoid excessive nitrogen loss as ammonia. The product is sprayed at the fertilizer dealer onto solid urea materials imparting a green color to the urea or it is mixed into liquid urea materials.

Nutrisphere Nitrogen (NSN) is an organic polymer that is sold to reduce urea volatilization and perhaps denitrification losses when coated on urea or mixed with UAN. It is commercially sold and exclusive with Southern States in the South. Southern States trial comparisons show positive responses. University of Kentucky and other university trials show mixed results. Its efficacy as a urease or denitrification inhibitor seems inconsistent. There are limited data available for Tennessee. Some university trials (especially recent research in Arkansas) do not classify it as an effective control measure for urea volatilization.

Avail is a polymer which is sold as an organic compound that, when coated on a phosphate fertilizer, is expected to increase the efficiency of the phosphorus use in plants. This product is also exclusive with Southern States in the South. Southern States trial comparisons show positive responses. University of Kentucky shows no positive responses to this point. Other university research is mixed and is described as inconsistent.

In summary:
Agrotain Ultra efficacy as a urease inhibitor has been conclusively demonstrated in Tennessee and in many other university research studies and is widely suggested as the most appropriate urease inhibitor for use with urea containing fertilizers when not incorporated into the soil by tillage, rainfall or irrigation.

NSN effectiveness as a urease inhibitor and denitrification inhibitor is questionable and appears to be inconsistent at best.

Avail may increase P fertilizer efficiency under certain (not readily clear) conditions but appears to be unpredictable and sporadic in performance at best.

Nitrogen Rate Calculator Overview

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The University of Tennessee Department of Plant Sciences and Department of Agricultural and Resource Economics in the Institute of Agriculture teamed up in 2009 to develop a decision aid called the Corn Nitrogen Rate Calculator. The decision aid can be downloaded at http://www.utcrops.com/corn/corn%20fertility.htm. The objective of the calculator is to help farmers make nitrogen (N) fertility rate decisions that

maximize profit. The calculator can be used to show how changes in the prices of corn and N change the profit-maximizing N rate per acre for irrigated and nonirrigated corn, and serves as a complement to the N rate recommendations provided by UT Extension. We discuss how to use the Corn N Rate Calculator and the potential benefits from considering economics in selecting an N rate to apply.

The calculator was developed using actual corn yield data from experiments conducted at the Milan AgResearch and Education Center from 2006 to 2008. The soil types were Loring for irrigated corn and Grenada for nonirrigated corn. Irrigated corn was grown following soybeans in a one-year rotation. Nonirrigated corn was grown after soybeans, cotton or corn. The fields used in the experiments have been under no-till production for over a decade. The N fertilizer rates were 0, 55, 110, 165 and 220 lbs. N/acre/year in 2006 and 2007. In 2008, an additional N fertilizer rate of 275 lbs./acre was added to the experiment. The N source was ammonium nitrate (34-0-0; N-P-K).

We used data from the experiments to estimate yield response functions that show how corn yield increases in response to increased N applications. A quadratic plateau yield response function was selected as the most appropriate for the calculator. This response function is commonly used by researchers across the United States to estimate corn yield response to N. It allows corn yield to increase with additional N until the yield maximum is reached, after which additional N does not increase yield.

The Corn N Rate Calculator provides estimates of the profit-maximizing N rate to apply. The key economic concept used in the calculator is a profit-maximizing farmer should apply additional N so long as it produces more revenue from the increased yield than the cost of the additional N. The profit-maximizing N rate is the rate where the increased revenue from applying more N equals the cost of the additional N. An N rate above the profit-maximizing rate might be able to increase yield, but the fertilizer cost to achieve the additional bushel will be greater than the revenue received. Overapplication of N can be costly, and the Corn N Rate Calculator is intended to reduce the excess cost from applying more than the most profitable amount of N.

The Corn N Rate Calculator can be used to perform many what-if scenarios. As an example for nonirrigated corn, if the farmer entered a corn price of $6/bushel into the calculator and an N price of $0.5/lb., the calculator would show a profit-maximizing N rate of 196 lbs./acre. Now if the farmer changed the N price to $1/lb., the profit-maximizing N rate would decrease to 162 lbs./acre. The profit-maximizing N rate decreases because additional revenue is obtained at a higher cost of N fertilization. Similarly, if the farmer entered a corn price of $3/bushel and an N price of $0.5/lb., the profit-maximizing N rate would be 162 lbs./acre. If the farmer then increased the N price to $1/lb., the calculator would show a decrease in the profit-maximizing N rate to 132 lbs./acre. These example show how the calculator can be used to build several scenarios to help corn growers make fertility decisions that are the most profitable.

The Corn N Rate Calculator is currently being updated with additional experimental data for 2009 through 2011. We plan on including corn-soybean and corn-cotton rotations, as well as continuous corn in the decision aid. These new features of the decision aid will be available next year.

Nutrient Management: Keeping Nutrients Out of the Water and Farmers Out of Trouble

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Tennessee Department of Agriculture

Plants from asparagus to zoysia and everything in between require nutrients in the soil in order to grow. When it comes to farming commercially, a big part of a farmer's job is managing the level of nutrients in the soil to maximize production at a tolerable cost of inputs. However, nutrients don't always stay where they are intended once they are applied on the landscape. Most of the time, when they are not managed properly, they move from the part of the environment where we want them (i.e., the soil profile) to parts of the environment where they cause pollution (i.e., surface waters, groundwater, or the atmosphere).

Many nutrients are essential for plant growth, but the two main ones of concern to the environment are nitrogen (N) and phosphorus (P). Too much N and P in surface waters in particular cause excessive algal growth, eutrophication, low dissolved oxygen, and fish kills. In addition to these effects, high levels of N and P also make it more expensive for water treatment plants to provide safe drinking water — costs they pass on to their customers.

In an effort to safeguard the environment, lower water treatment costs, and minimize risk to human health, state and federal agencies administer two types of programs to encourage farmers to employ intensive nutrient management: voluntary programs and regulatory programs. For the most part, voluntary programs are intended to provide benefits to farmers who implement good nutrient management. These benefits could be things such as technical advice and guidance and cost-share programs that provide financial incentives for nutrient management plans, etc. Regulatory programs are intended to force good nutrient management through the enforcement of laws that punish individuals proven to be polluting waters. The purpose of this presentation is to discuss reasons to implement good nutrient management on your farm, highlight voluntary programs available to encourage good nutrient management, and briefly mention the regulatory programs that punish poor nutrient management.

Micronutrients and Plant Tissue Analysis

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Optimal production and yield in crops depends on nutritional status of the plant. Additionally, a robust, strong crop can increase the ability to resist disease, insect and weed competition. Complete nutrition involves adequate levels of 17 chemical elements and a proper soil pH to allow uptake. Primary plant nutrients are nitrogen (N), phosphorus (P) and potassium (K), which are essential and needed in fairly large amounts compared to other nutrients. These nutrients are usually the first to become deficient. Why? Primary nutrients are used by the plant in relatively greater quantities; thus, crop harvest causes removal of nutrients in seed and leaf tissue. Secondary nutrients are calcium (Ca), magnesium (Mg) and sulfur (S). Micronutrients are boron (B), chloride (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), nickel (Ni) and zinc (Zn). Several more nutrients exist but only needed in some plants are cobalt (Co), silicon (Si), sodium (Na) and vanadium (V). Micronutrients are required in small amounts, are crop specific in some cases and deficient less often than primary or secondary elements. Primary and secondary nutrients (except S) are adequately measured by soil test however plant tissue analysis best evaluates micronutrient uptake.

Tools used to measure plant nutritional status are soil testing and plant tissue analysis. Various methods of soil extraction are used in Tennessee; however, methodology of tissue testing is fairly consistent. Leaves of the plant are gathered at recommended stages of growth, dried and pulverized; then elements are chemically extracted for quantification. Plant tissue analysis measures nutrient uptake whereas soil testing predicts nutrient availability. Soil testing is not the best at measuring micronutrients since interactions can prevent uptake and results can be misleading. Sulfur (S) is a secondary element. However, it is one that is best measured by tissue analysis. Several methods exist for extracting soil sulfur, but organic matter, atmospheric S and soil texture, among others, affect availability of nutrient to the plant.

Plant tissue laboratory results are reported in units of percent (%) and parts per million (ppm). Interpretation involves knowledge of sufficiency or typical values for your crop at stage of growth in which plant samples were taken. Tissue samples can be taken to troubleshoot growth problems or to monitor plant uptake for ongoing fertility management. For information on sufficiency ranges in particular crops, visit http://aesl.ces.uga.edu/publications/plant.

It is important to note plant tissue testing should always be used with an associated or current soil test result to ensure that soil pH or major element deficiency is not causing the problem. Before adding micronutrients to your fertilizer spreader, evaluate crop needs by utilizing soil testing and plant tissue analysis.

TOUR B: NO-TILL CORN PRODUCTION

Intra-Ear Compensation for Silk Clipping in Field Corn

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UT Department of Entomology and Plant Pathology

Jeff Lannom
Director, UT Extension Weakley County

Many parameters affect pollination in corn and a major component is silk health and viability. Data have shown that the factors of total pollen production and the ability of the exposed silks to intercept this pollen is crucial in establishing seed set, thereby determining grain. Silks are receptive to pollen for approximately seven days after emergence.

There are many insects that feed on silks. The key silk-feeding insects found in Tennessee are Japanese beetle (Popillia japonica) and corn earworm (Helicoverpa zea). Recently in West Tennessee, producers have become concerned with the increasing number of Japanese beetles that are invading corn and clipping silks during pollination.

The Japanese beetle is an invasive species that was accidentally introduced from Japan into the northeastern United States sometime before 1916. Since they have few natural enemies and many suitable hosts here, numbers have increased greatly and their range of habitat continues to expand. Japanese beetles feed on almost 300 species of plants. Corn silks are a preferred host, and Japanese beetles can aggregate on corn silks and devour them to the tip of the developing cob. Japanese beetles are well established in Tennessee and are most likely here to stay. The predominantly no-till crop production practices in Tennessee may favor overwintering grub survival. Little has been written about thresholds of Japanese beetles in pollinating corn.

Studies were done in 2010 and 2011 to evaluate how silk clipping in field corn (Zea mays) affects pollination and yield. The objectives of this research were to evaluate: (1) susceptible corn stages and amount of silk clipping that will significantly affect pollination, (2) whether compensation occurs by pollinated kernels within the same ear if other kernels are not pollinated, and (3) if partially clipped silks can pollinate. Tests were done by manually clipping silks with scissors and by caging Japanese beetles on ears.

Manually clipping silks once daily in the early morning hours during silking had no statistical impact on yield. However, daily clipping during the first five days of silking did reduce pollination, i.e. total number of kernels per ear in 2010, but the other kernels in the ear were heavier. Once daily silk clipping had no impact on kernel numbers in 2011. In another study in 2011, 100 percent of the silks were clipped multiple times daily during the first five days of silking. This level of silk clipping decreased pollination (kernel numbers) and yield. Silk clipping after five days had no impact on kernel numbers or yield. The take home point of these studies was that treatment effects were only evident when clipping was done earlier in the silking window.

Silk clipping by Japanese beetles was examined by caging beetles on ears during the first five days of silking. It was found that feeding could reduce the number of kernels per ear, increase the average weight of an individual kernel, and at one of two locations, reduce the total kernel weight per ear. Drought or heat stress appeared to intensify the effects of silk clipping.

New Technologies in Corn Weed Control

Angela McClure
Associate Professor
UT Department of Plant Sciences

Growers have traditionally relied on a variety of weed control options in corn as a way to help manage troublesome weeds when rotating into other crops. There are more herbicide products labeled for corn which contain different modes of action that can be effective on glyphosate-resistant palmer amaranth or marestail. Although the introduction of novel herbicides has slowed in recent years, there are some new and newer products that are either on the market or will soon be registered for use in the U.S. These new and newer products will be discussed as well as the timeline for launching genetically modified corn

that will have enhanced tolerance to existing modes of action. Additionally, problems and issues that are occurring this year in corn weed control due to the early planting window and drought will be discussed.

Combine Set-up Tips for Fall Harvest

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Grain loss during harvest can be both costly and difficult to prevent. Learn where those losses originate and ways to prevent them from occurring. We will cover settings and adjustments to optimize your combine performance.

TOUR C: NO-TILL SOYBEAN PRODUCTION

Glyphosate-Resistant Weed Management — Present and Future

Larry Steckel
Associate Professor
UT Department of Plant Sciences

What is new in soybean weed control for 2013? 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 2013. However, there are new or relatively new developments that may come into play when you are making your weed control plans for next spring. First, there is a new experimental herbicide, pyroxasulfone, that has good residual activity on pigweed. Second, there are more Liberty Link soybeans planted in Tennessee this spring and likely even more in 2013. Third, we will be stressing the use of at least two herbicides with activity on Palmer preplant/pre-emergence. A little further down the road (2014) Monsanto will introduce soybeans tolerant to both dicamba and glyphosate. About the same timel, Dow will introduce 2,4-D- and glyphosate-tolerant soybean.

Pryoxsulfone is a new herbicide developed by Kumiai. The best way I know to describe pyroxasulfone herbicide is that it is like Dual, only with better residual activity on pigweeds and probably not as much activity on weeds like nutsedge. Kumiai elected to market pyroxsulfone in a very 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 tank mixed with an Authority product and Zidua tank mixed with a number of PPO herbicides provided about five 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? Very likely in the first year out, there will be an 18-month plant back to any crop other than corn and soybeans. This plant back will likely be reduced as more data from residue studies is submitted.

Judging by discussions I have had with consultants and producers, there were many more Liberty Link soybeans planted in Tennessee this spring. Many producers have struggled to consistently control Palmer with a PPO herbicide like Flexstar or Cobra. The problem is not being able 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 taller than 4 inches. However, a sequential application of Liberty applied seven to 10 days after the first Ignite 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 Ignite resistance.

Finally, new herbicide tolerant traits by Monsanto and Dow will be introduced most likely in 2014. 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 No-Till weed control stop.

Application Technology

Thomas C. Mueller
Professor
UT Department of Plant Sciences

No-Till soybean weed control 20 years ago was complicated. A nonselective burn down herbicide was applied either before or with a pre-emergence mixture containing both grass and broadleaf activity. A sequential application of another mixture with two modes of action was applied after soybean emergence.

Soybean weed control was very simplistic in the Roundup Ready era. A farmer sprayed Roundup until there was nothing but soybeans left. These were very good days for no-till soybean weed control, but times have changed.

Glyphosate-resistant horseweed, or marestail, made no-till soybean weed control a little more complicated, but not too much worse. One simply sprayed 2,4-D/Clarity or Sharpen to kill glyphosate-resistant horseweed. Even if a few horseweed plants survived, yield losses were often small.

Palmer pigweed is a much more difficult weed control challenge now that it has developed glyphosate resistance (GR). New strategies and technologies will be needed to control this GR pest. Other weeds also are developing resistance to current weed control systems, so new tools are needed to control no-till soybean weeds.

In the near future soybeans with new genetic traits will allow for the over-the-top application of 2,4-D or dicamba herbicide. These applications will be made at a time when more sensitive non-target vegetation will be present. These molecules also have a history of volatility and movement away from the application site. This presentation focuses on three major factors related to application technology: 1) new formulations of these herbicides, 2) new nozzles to use, and 3) various choices the applicator can make at the time of spraying.

Both DowAgroSciences and BASF are developing new formulations of their respective molecules that have a reduced tendency to volatilize under field conditions. These new formulations still provide excellent weed control of susceptible plant species.

Several manufacturers of nozzles have developed new concepts that maintain an adequate spray pattern while minimizing the number of small droplets that tend to drift. The operation of these nozzles requires the user to select the appropriate pressure for their system.

The applicator striving to produce no-till soybeans has several decisions to make in the boom setup and sprayer operation. Some are made prior to application, such as choice of adjuvants or nozzles; others are made at the time of application, such as boom height, time of day to spray, and whether to stop spraying under windy conditions. There is always a potential trade-off between the theoretical factors responsible for reducing drift, and the "on the ground" reality of producing soybeans under typical agronomic commercial conditions.

Late Season Soybean Insects

Gus Lorenz
Professor and Extension Entomologist
University of Arkansas

There are many late-season insects that can be problematic in soybean. Stink bugs and corn earworm are the most damaging because they feed on the pods and can directly impact yield. We will discuss thresholds, sampling technique, estimating defoliation and control of late-season insect pests. Also, we will discuss the threat of emerging insect problems such as Kudzu bug and brown marmorated stink bug.

Managing Fungicide-Resistant Frogeye Leaf Spot in Soybean

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Frogeye leaf spot can be a serious disease of soybean in areas that have a favorable environment for this disease. Management of frogeye leaf spot with strobilurin fungicides has been a common way to manage this disease. Fungicide products that include a strobilurin fungicide active ingredient include Headline, Stratego YLD, Quadris, Quilt Xcel and Evito. In 2010, isolates of the frogeye leaf spot fungus, Cercospora sojina, that were resistant to strobilurin

fungicides were found in areas of western Tennessee, western Kentucky, and southern Illinois. In 2011, newly identified areas with strobilurin fungicide-resistant C. sojina isolates were five new counties in Kentucky, one county in Missouri, two new counties in Tennessee, and two parishes in Louisiana. These isolates were similar to those identified in 2010, in that they were highly resistant to strobilurin fungicides in laboratory tests.

A field study was conducted at the University of Illinois Dixon Springs Agricultural Center in southeastern Illinois to evaluate the efficacy of different fungicides for control of frogeye leaf spot caused by a strobilurin fungicide-resistant isolate. In this trial, 14 different fungicide treatments were applied and compared to a nontreated control. Treatments included fungicides from the triazole class, benzimidazole class and the strobilurin class. Products that contained only a strobilurin fungicide did not reduce frogeye leaf spot severity compared to the nontreated control. Fungicides that contained an active ingredient from the triazole or benzimidazole class had significantly less frogeye leaf spot than the nontreated control.

Additional field studies were conducted at the University of Illinois Dixon Springs Agricultural Center and at the University of Tennessee AgResearch and Education Center at Milan, Tenn., where both strobilurin-resistant and strobilurin-sensitive C. sojina isolates were inoculated onto a frogeye leaf spot susceptible variety. Both Headline and TopGuard fungicides were evaluated in this trial. At both locations, TopGuard was the most effective in reducing frogeye leaf spot in these trials.

The field research trials that were conducted indicate that fungicides from other classes (i.e. triazoles and benzimidazoles) can be used to manage frogeye leaf spot caused by strobilurin fungicide-resistant C. sojina. In addition, research conducted at Milan for the last several years has indicated that planting varieties with a high level of resistance to frogeye leaf spot is a very effective way to manage this disease.

In light of the appearance of strobilurin fungicide-resistance in the frogeye leaf spot pathogen and the research conducted so far, the following practices are recommended to manage fungicide resistance:

1. Plant soybean varieties resistant to frogeye leaf spot. This tactic is the best way to manage the disease.
2. If you plant a frogeye leaf spot-susceptible variety and are considering application of a fungicide, apply a product that contains either a triazole or benzimidazole active ingredient or a mixture of a strobilurin with either a triazole or benzimidazole active ingredient. Fungicides in the triazole or benzimidazole chemistry classes have different sites and modes of action on fungi than strobilurin fungicides, and strobilurin-resistant isolates should not be cross-resistant to these fungicides.
3. Only apply a foliar fungicide to control plant diseases. Every time a fungicide application is made, a "selection pressure" is applied that selects out individuals in the pathogen population that may have reduced sensitivity to fungicides. Applying a fungicide only when it is needed — based on disease risk and scouting observations — will reduce the selection pressure placed on the pathogen population and slow the development and spread of fungicide-resistant isolates.

TOUR D: IMPROVING SOYBEAN PRODUCTION THROUGH PLANT BREEDING

Two New USDA Frogeye-Resistant Lines

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The recent discovery in Tennessee of Frogeye Leaf Spot (FLS) that is highly resistant to several common Strobilurin fungicides reinforces varietal resistance as a preferred way to control this disease. Soybean cyst nematode (SCN) is also best controlled by planting resistant varieties. In the United States, combined yield losses in soybean caused by SCN and FLS are estimated to be nearly $1 billion. In Tennessee, these two diseases are estimated to have caused yield losses valued over $25 million to growers in 2011. We have recently developed two new soybean lines, JTN-5203 and JTN-4307, which have combined resistance to many nematodes and fungal diseases, including FLS.

Soybean JTN-5203 was derived from the cross Caviness X Anand and released for use in January 2012. In the 2009 Tennessee Soybean Variety Performance Tests, JTN-5203 produced very high seed yields up to 67 bushels/acre. It is resistant to nematode populations (races) 2, 3 and 14. It is also resistant to FLS, SDS and Stem Canker. Currently, Maturity Group V varieties that are both high yielding and highly resistant to Race 2 SCN are unavailable for growers in Tennessee. JTN-5203 pairs SCN resistance with high yield and FLS resistance, and can be an excellent conventional soybean for producers in the Midsouth.

JTN-4307 was derived from cross S97-1688 X V94-0198 and also has combined resistance to nematode populations and fungal pathogens. Soybean cyst nematode populations include Races 2, 3 and 14. JTN-4307 is as highly resistant to FLS as cultivar Davis, and also has moderate resistance to charcoal rot, another economically important fungal pathogen in Tennessee. Additionally, it is resistant to southern root-knot nematode, reniform nematode and Stem Canker. This early Maturity Group V conventional soybean yields competitively with seed yields ranging from 43-50 Bu/A. JTN-4307 offers a superb disease package addressing the needs of Tennessee producers.

One unique feature of these two soybean lines is that both were developed using traditional breeding methods combined with DNA markers tagged to resistance genes for nematodes and FLS. Markers confirm resistance more efficiently and quickly. These two soybeans were developed in collaboration with Vince Pantalone, professor, University of Tennessee; Grover Shannon, professor, University of Missouri; and Alemu Mengistu, USDA-ARS, Jackson, Tenn.

Measurable Yield Loss Due to Charcoal Rot of Soybeans

Dr. Alemu Mengistu
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Charcoal rot of soybean is caused by a fungus Macrophomina phaseolina. It is a disease of economic significance causing yield losses in the north central and southern United States as well as in the tropical and subtropical regions of the world. Diseased plants may wilt and prematurely die, with dead leaves remaining attached to petioles and petioles remaining attached to stems.

Even though charcoal rot of soybean is known to cause yield reduction, it has not been experimentally determined. Since charcoal rot is severe during periods of drought it is generally assumed that the yield loss is due to stress caused by lack of moisture availability and left out the contribution of charcoal rot to this loss.

In order to objectively determine the effect of charcoal rot on yield reduction of soybean, irrigation treatment has to be utilized to remove the effect of drought. In addition, the availability of moderately resistant

and susceptible genotypes can be used to compare its impact on yield under various sets of environments. When soybean genotypes with similar maturity and yield but differing in resistance are used it could provide a better estimate of yield performance. Four genotypes DK 3964 (susceptible) and AG 3905 (moderately resistant) in MG III and DT97-4290 (moderately resistant) and Egyptian (susceptible) in MG IV were used for this test. The field was also fumigated to remove the fungus and then reintroduced into the needed plot areas.

The result showed that under irrigation (when drought effect was removed), the yield of DK 3964 was significantly lower (33 percent) than its resistant counterpart, AG 3905, with a yield difference of 20 Bu/a; while the yield of Egyptian was significantly lower (18 percent) than its resistant counterpart, DT97-4290, by 11 Bu/a difference. This indicates that charcoal rot can reduce yield significantly even under an environment that is conducive for high soybean yield production.

Across genotypes and years, estimated yield loss due to the effect of charcoal rot under irrigation was 15 percent. While under nonirrigated, the yield loss was 22 percent, indicating that the loss from the combined effects of drought and charcoal rot is more (additive). Drought contributed an additional 7 percent yield loss. This comparison suggested that the combined effects of charcoal rot and drought may exceed the loss to either drought or charcoal rot alone. Soybeans that are nonirrigated are often prone to drought and drought can reduce soybean yield independently where charcoal rot is not present, but it is also a predisposing factor that may promote M. phaseolina infection and higher yield loss.

This study shows that yield loss measurement for charcoal rot in nonirrigated environments may provide false estimates. By comparing the performance of genotypes in irrigated environment, we were able to differentiate the infection levels and yield differences between moderately resistant and susceptible genotypes in all the comparisons. Moderate levels of resistance to M. phaseolina conferred a yield advantage in soil with high population of M. phaseolina.

Research and Improvement of Soybean for Tennessee and the Midsouth Region

Vince Pantalone
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Our University of Tennessee Soybean Breeding and Genetics Program uses modern methods of traditional plant breeding coupled with DNA technologies to develop high yielding conventional and herbicide resistant soybean varieties for producers in Tennessee and the Midsouth Region. UT AgResearch soybean varieties provided nearly $50 million in estimated farmer revenue based on acreages of our varieties that were grown by producers during the past four years, coupled with excellent commodity prices. Their high yields added about $6 million dollars in additional farmer revenue from the extra bushels produced compared to average varieties.

Our newest glyphosate herbicide resistant variety 'USG 75T40' was the top yielding Group V entry in the 2011 Tennessee State Variety Test, as well as in that test's 2- and 3-year average. Its notable traits include extraordinary resistance to soybean cyst nematode (SCN) Race 2, and strong field tolerance to sudden death syndrome (SDS). Our new conventional line TN05-5018 was developed from the cross (USG 5601T × USG 5002T) between two of our previous varieties. It was the top yielder in the 2011 Tennessee State Variety Test as well as in the 2011 USDA Southern Regional Test grown at more than 20 environments throughout the South.

Our graduate students engage in hands-on research projects applying genomic information for the genetic improvement of soybean yield, seed quality and

disease resistance. For example, Ben Fallen and Chris Smallwood are currently working with an exceptional genetic mapping population of approximately 1,000 recombinant inbred lines mapped with over 50,000 single nucleotide polymorphisms (SNPs) through collaboration with the U.S. Department of Agriculture. That population produced millions of DNA data points from over 17,000 polymorphic SNPs and will serve as a foundation for the new USDA linkage map of the soybean genome. Ben Fallen has detected numerous genomic regions that are associated with seed yield; he has also identified regions for amino acids which are important components of the nutritional value of high protein soybean meal. Chris Smallwood has detected and confirmed regions associated with isoflavones, which are compounds that may have beneficial effects including cancer prevention, reduction of symptoms of menopause, and reduced bone loss density with age.

Jeff Boehm is tackling a project to reduce phytate concentration in the seed. The low-phytate trait will enhance nutrition for poultry and swine, and will protect the environment by reducing phosphorus loads from manure applied to agricultural lands. Phosphorus leaches into aquifers, streams and rivers resulting in algal blooms and oxygen depletion to fish and shellfish. Currently, no commercial low-phytate soybean variety exists. We plan to help fill that gap and solve a current need. New biotechnology instrumentation in our laboratory and excellent field testing facilities at our AgResearch and Education Centers across the state enable our students to apply their discoveries to improve the environment and the health and livelihood of the people of Tennessee and the Midsouth region.

TOUR E: NO-TILL COTTON PRODUCTION

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 (GR) weeds. 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. 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. Most of our Palmer pigweed is not only glyphosate-resistant, but also ALS-resistant, meaning that herbicides such as Staple or Envoke will have little to moderate efficacy at best on pigweed. This leaves Liberty (previously called Ignite) as really the only viable option.

As a result, many growers are moving from a glyphosate-based system to a Liberty (glufosinate) based system. Liberty is a nonselective herbicide, like glyphosate, but there are several differences. First, 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- to 8-inch pigweed when the conditions are right. Another major difference is that glyphosate is a systemic herbicide while glufosinate is a contact herbicide, which 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 that produce smaller, fine droplets 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 two hours after sunrise before applying Liberty.

In the Midsouth, 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 Midsouth 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, recommends 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. True Liberty Link or GlyTol/Liberty Link varieties are becoming more prevalent in Tennessee because 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.

New Bt Technologies for Cotton

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Agronomist
Bayer CropScience

Foliar applied insecticides were used to control lepidopteron pests, primarily Heliothines, in cotton prior to the introduction of Bt cotton. Resistance to pyrethroid insecticides in tobacco budworm (Heliothis virescens) helped implement the adaptation of Bt cotton throughout the Midsouth and Southeast Cotton Belt. The shift of worm control from foliar

chemicals to genetically modified plants is evident in the discovery and introduction of Bt (Bacillus thuringiensis) cotton. Bacillus thuringiensis (Bt) is a soil bacterium expressed within the tissues of genetically modified cotton to produce crystalline endotoxins within an alkaline midgut of lepidopteran pests.

Various Bt cry-proteins have been introduced into the marketplace with varying degrees of control in common lepidopteran pests. "Single gene" cotton that included Cry1Ac only was phased out by the Environmental Protection Agency (EPA) in 2010. Current Bt toxins available in cotton include Cry1Ac + Cry2Ab (Bollgard II) and Cry1Ac + Cry1F (WideStrike). Both of these technologies contain the Cry1Ac protein that was found in the original Bollgard I.

New Bt technologies under development include Cry1Ab + Cry2Ae (TwinLink) and combinations of genes that include vegetative insecticidal proteins (VIP). VIP proteins are developed from Bacillus thuringiensis, but within a different life cycle of the organism. These technologies have been evaluated by industry and university experts and continue to provide excellent tobacco budworm (Heliothis verescens) control, and good to excellent control of cotton bollworm (Helicoverpa zea). Implementing new proteins within the Bt cotton system should enhance the longevity of these technologies by reducing the amount of selection pressure on any one Bt protein.

Nutrient Requirements for High-Yielding Cotton

Frank Yin
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UT Department of Plant Sciences

Current nutrient recommendations for cotton may need to be modified because of the significant yield increases resulting from new cotton cultivars and improved management practices. The objectives of this study were to: 1) determine the optimal nitrogen (N) application rates for high-yielding cotton cropping systems and 2) evaluate cotton yield and fiber quality responses to sulfur (S) applications in Tennessee.

A strip-plot trial was conducted on six private farms in Crockett, Fayette, Gibson, Haywood, Lake, and Lauderdale counties in 2009 and five private farms in Fayette, Gibson, Haywood, Lake, and Lauderdale counties in 2010 in West Tennessee. Five N treatments of 0, 40, 80, 120 and 160 lbs. N/acre were evaluated as side dress N in large strip plots (38 feet wide running the length of the field) with three replicates. Results of the trial in 2009 and 2010 showed applying 40 to 80 lbs./acre N via side dressing was adequate to meet plant N requirement during the midseason regardless of location and year. Our results suggest that application of approximately 70 to 100 lbs./acre N (including preplant and side dress N) per season is adequate for optimal cotton yields with current cotton cultivars and management practices in Tennessee.

Sulfur deficiencies have increasingly occurred in crops due to declined use of S- bearing fertilizers and reduced atmospheric S deposition. A field trial was conducted on an S-deficient soil at Jackson, Tenn., during 2007-2010. Sulfur treatments of 0, 10, 20 and 30 lbs./acre S were broadcast before planting. Soil S levels were increased by applying 30 lbs./acre S in 3 out of 4 years. Leaf S concentrations were increased by S applications. Application of 20 or 30 lbs./acre S increased lint yields by 8 to 9 percent and micronaire by 4 to 5 percent averaged over the three normal growing seasons (2008-2010). A container-grown cotton trial was also conducted to study effects of S deficiency on yield components. Plants were fed nutrient solutions with adequate or low S concentrations. The low S treatment reduced leaf S concentration but tended to increase leaf concentrations of other nutrients. Seedcotton per plant was reduced by S deficiency in 3 of 4 years, with fewer bolls per plant and fewer locules per boll. Results indicate that application of 20 to 30 lbs./acre S may be beneficial for no-till cotton on soils testing low for S in Tennessee and similar environments.

TOUR F: COTTON IRRIGATION — WATER USE, SENSORS AND CROP RESPONSE

Crop Water Use at Different Stages

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Only a fraction of initiated fruit on a cotton plant is ever harvested. Much of the yield loss can be attributed to water stress or associated heat stress during critical periods of development. Water stress can also cause short staple, high micronaire or immature fiber thereby reducing fiber quality. Supplemental irrigation can increase lint yield by increasing the number of fruiting branches, fruiting positions and individual boll retention. However, the total percent of bolls retained may decrease due to greater fruit initiation at secondary and tertiary positions. These positions are much more susceptible to fruit shed caused by numerous factors including carbohydrate imbalance, nitrogen imbalance, and both biotic and abiotic stresses. Irrigation can increase leaf area which allows it to supply a greater amount of photosynthate for node and fruit development. Yet, even a cloudy day may increase the number of bolls shed due to a relatively brief reduction in photosynthesis.

Water stress has different effects on lint yield and fiber quality depending on the stage of development in which it occurs. Young squares in the secondary and tertiary positions and young bolls (<14 days old) are highly susceptible to water stress, large squares and bolls over 30 days old are only somewhat susceptible to water stress, and flowers and open bolls are somewhat resistant to water stress. Therefore, one needs to ensure that there is adequate soil moisture from square initiation through when a majority of 1st and 2nd position bolls (which account for 90 percent of yield) are at least 14 days old. On silt-loam soils of West Tennessee, the recommendation is to irrigate from square initiation through first open boll at approximately 1 inch of rainfall plus irrigation per week.

Irrigating prior to square initiation may have a detrimental effect on yield. During this time, roots grow faster than leaf area and if the soil moisture was adequate at planting, the roots are usually able to supply adequate water to keep up with demand. Excessive irrigation can reduce oxygen levels deeper in the soil profile preventing deep root growth. This reduces nutrient uptake and causes the crop to be more susceptible to midseason water stress.

Research is ongoing to improve irrigation recommendations by evaluating the combined effects of different irrigation and nitrogen rates on early and late maturing cultivars.

A Real Time View of Irrigation Scheduling Tools in Cotton

Brian Leib
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UT Department of Biosystems Engineering and Soil Science

Real time sensor data for irrigation scheduling can be available on your computer and smartphone via radio, satellite, cellphone and Internet communication. Using available sensors systems, we will examine crop water use, soil water content, soil tension and canopy temperature for cotton being grown in soils that vary from 0.5 to 2.0 in./ft. of water-holding capacity. As the cotton uses water from the soil profile, the soil water content drops, creating a situation where the cotton must pull against increasing soil tension to remove water from the soil. The soil tension can increase to the point where cotton can no long pull all the water it needs from the soil to cool itself, leading to increased canopy temperature. As of the end of June, cotton grown in the sandy soils had already required substantial irrigation while the deep silt loams were just starting to require irrigation.

Cotton Growth and Development Response to Irrigation

Chris Main
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Sixteen cotton varieties were evaluated in Arkansas, Mississippi and Tennessee during 2011 for plant yield and fiber response to irrigation. Each trial was implemented as a split block design with blocks representing irrigation level (no irrigation, or well irrigated). Trials in Arkansas and Mississippi were furrow irrigated when the crop reached a 2-inch water deficit. In Tennessee the well-irrigated plots received 1 inch of water either from rainfall or irrigation weekly. There were significant effects from location. Arkansas received 15.47 inches of rainfall, Mississippi received 19.86 inches of rainfall and Tennessee received 17.5 inches of rain during the growing season. Timing of rainfall played a significant role in cotton development. While total water received by the crop was similar for Arkansas and Mississippi, a 4-inch rainfall in Mississippi during late August caused dramatic differences.

Plant growth parameters of total number of nodes and plant height were improved with irrigation. Irrigated plots developed two more nodes and were 8 inches taller than the nonirrigated check. In Arkansas the addition of irrigation increase the average yield of 16 varieties by 660 pounds of lint per acre. In Mississippi the added irrigation reduced yields 280 pounds per acre due to excessive growth and fruit loss caused by the 4-inch rain in late August. Tennessee cotton yields were improved 50 pounds per acres with irrigation. The Tennessee location had more timely rainfall and a better soil moisture profile going into bloom than the other locations, thus irrigation response was not as great.

The fiber quality parameter most affected by irrigation was micronaire. In Arkansas, irrigation reduced the trial average micronaire from 5.2 to 4.4 in the most rainfall limited environment. In Mississippi and Tennessee, micronaire was unaffected by irrigation. At all locations fiber length was improved by the addition of irrigation. Similar to micronaire, in Arkansas fiber uniformity was improved into loan premium range with irrigation. The same trend continued for fiber strength in Arkansas, the addition of irrigation improved fiber strength from base loan grade into premium range.

In summary, trial location and irrigation impacted cotton variety response. Interaction of cotton variety and irrigation was not evident in these trials. However, the dramatically different environments caused variety responses to differ by location and masked any potential interactions of varieties with irrigation.

TOUR G: BEEF CATTLE PRODUCTION IN TENNESSEE

The Beef Checkoff and Its Impact on the Tennessee Cow-Calf Producer

Larry Cunningham
Cow-Calf Producer
Spring City, Tenn.

"Impact:" How do we quantify that? The definition of impact is a collision, an effect or force. In this instance force seems to be the best definition. The force exerted by a new idea, concept, technology or ideology that causes change.

Over the last 26 years, the impact, or force, of the Beef Checkoff Program has been impressive. There have been and continue to be opportunities to improve the quality, versatility and safety of our product, which in turn helps us maintain and improve consumer confidence in beef. The Beef Checkoff Program has been that force that has kept our industry proactive and prepared.

The Tennessee Beef Industry Council (TBIC) has been serving Tennessee beef producers and consumers since 1986 when a nationwide producer vote initiated the Beef Checkoff Program. The TBIC was formed and continues to be managed by a rotating board of directors representing the Tennessee Cattlemen's Association, Tennessee Farm Bureau, Tennessee Livestock Markets Association, Tennessee Beef Cattle Improvement Association and the American Dairy Association of Tennessee. In 2010 the TBIC directors decided, rather than spend approximately the same money on another lease, they would invest in a unique opportunity for our state by purchasing a building. It houses our state business offices as well a beef demonstration kitchen that allows the council to host and promote beef to many different consumer, retail, food service, and nutrition audiences. In addition, Tennessee beef producers recently approved an additional 50-cent-per-head increase that will provide additional funding for educational outreach, promotional activities and advertising opportunities within the state. The TBIC staff includes Valerie Bass, executive director; Nancy Waugh, accountant and compliance manager; and Janna Sullivan, Director of Retail and Food Service. Please feel free to contact the TBIC 615-896-5811 or visit www.beefup.org.

When we talk the impact the Beef Checkoff Program has had on Tennessee beef producers, we tend to want to quantify it in financial terms since there is a financial investment. To that end, the Ward study indicates that producers who invest $1 per head receive a $5.55 return on their investment. But the impact of the Beef Checkoff Program is far greater than a monetary return on investment. It protects something priceless: consumer confidence. Each and every research, advertising and educational program is targeted toward preserving and improving consumer confidence in beef. Numerous negative forces are impacting the beef industry daily, from well funded anti-meat activists to food safety issues.

The Beef Checkoff program has forced change in beef's versatility and new product development over the last 26 years. The Muscle Profiling Study has made one of the biggest impacts on the industry in Checkoff history and has been instrumental in driving innovation and change. Most of us are aware of the flat iron steak, which is second most tender muscle in the carcass, but in addition, the study generated 11 new cuts from the chuck and 10 new cuts from the round that are currently being widely used by food service and retail. The impact to the industry from the Checkoff-funded Muscle Profiling Study has created a $1.25 billion category for new beef cuts didn't exist just a few short years ago. This figure translates into an increase of at least $50 per head (this is a 2009 figure and would be significantly higher today) in carcass value.

Beef Safety — Without a doubt, safety is "job one" for the beef industry. Consumer confidence in the safety of our products is essential to demand for our product. Since 1993 the beef industry has spent more than $28 million on beef safety research, outreach and education through the Beef Checkoff Program. Including private industry investments, the beef industry spends more than $350 million a year on improving beef safety. Much of that work has focused on E. coli O517:H7, as healthy cattle can harbor the organism in their GI tracts and shed it in their waste. Tremendous strides have been made by the beef industry to reduce foodborne illnesses caused by E. coli O517:H7. According to the Foodborne Disease Active Surveillance Network, infections have

declined significantly and E. coli O157:H7 was the only pathogen, of the 9 tracked, to have less than one case per 100,000 people by 2010. "Consumers are safer because of what you do," said Dr. Elisabeth Hagen, U.S. Department of Agriculture undersecretary for food safety, during her keynote address at the 2011 Beef Industry Safety Summit hosted by the Beef Checkoff. Work continues, and some of the new preventative technologies include seaweed extract, orange peel and pulp, antibiotic feed additives, Hide washing, Bacteriophages (viruses that kill bacteria), and E. coli and Salmonella vaccines. If reductions can be made in pathogen loads of cattle entering harvest facilities, a corresponding reduction of foodborne pathogens on carcasses and in beef products will occur. This reduction will benefit the beef industry as a whole and will help us deliver on our promise to consumers to provide the safest beef possible.

The force (exerted by a new idea, concept, technology or ideology that causes change) of the Beef Checkoff is evident. From the preparedness our industry experienced in the wake of the positive BSE case to the bold nutrition study that is helping to set the record straight about beef's role in a heart healthy diet and all points in between, your Beef Checkoff continues to make an impact!

Culling Beef Cows Before They Become a Problem

Justin Rhinehart
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UT Department of Animal Science

Cows generate 70-75 percent of "non-fed" beef in the U.S. and are used for more than just ground beef (roasts, steaks, fajita strips, etc.). Because these animals are worth more than ever before, it is important to market them while they are healthy and mobile. "Downer cows" are no longer accepted by market facilities, and buyers are wary of cattle that are more likely to be condemned at the packing facility.

Beef consumers and the general public are more interested now about where their food comes from and how it is produced than at any other point in the history of modern beef production. Marketing cows before their health declines not only makes the herd more profitable, it also helps the entire industry maintain the good reputation for animal care that it deserves.

Think about culling as if you are giving each cow in the herd an annual performance review for its job and consider the following checklist for culling criteria:

1. Pregnancy check all cows. Any mature cow or replacement female that is not pregnant should be culled to maintain the profitability of the operation. For bulls, have a breeding soundness exam done before each breeding season and cull bulls that do not pass.
2. Major defects would include very bad temperament, chronic lameness, eye problems (early signs of cancer eye), or severe udder problems.
3. Inspect teeth of cows so that you know the number of effective years each cow has left. Cows with broken teeth or badly worn teeth should be high on the culling list. Teeth that are somewhat worn indicate they are getting old, but they have a few years left in the herd.
4. Consider culling cows that produce calves with very low weaning weights. Calves with extremely light weaning weights should be culled soon. Make a note of cows producing calves with less than average weaning weights (but not extremely low). Cows that repeatedly wean calves less than the herd average should be considered for culling when the need/opportunity arises to cull extra cows.
5. For farms with a calving season, consider selling any cows that will calve late or out of your window. These cows have a higher likelihood of coming up open in the next breeding season or producing a lightweight calf. Pregnant cows in this category would be marketed differently than open, defective or old cows. These cows may be out of line with your calving season, but they might work for someone else.
6. Cull cows that do not maintain their body condition score when fed properly. Even if they do not end up with a high culling priority due to one of the criteria discussed above, they should be considered for culling during a drought year because there is a higher chance that they will not breed back, or that they have underlying health issues that would come out during times of stress.

7. A deep culling might be a good time to consider selling any cows that are extreme in frame size or muscling in your herd. These cows may be very small or very large ones that produce calves that are not uniform with the rest of your calf crop, perhaps dairy-cross or off color cows. Anything you can do to increase the uniformity of your herd will help you with future marketing plans.

These criteria might not fit each farm/ranch perfectly. But starting with these general concepts and tailoring them to your specific objectives should help identify cows that need to be marketed. Selling culls at the right time will improve profits for that year and build profitability for future calf crops.

Marketing Cull Cows

Andrew Griffith
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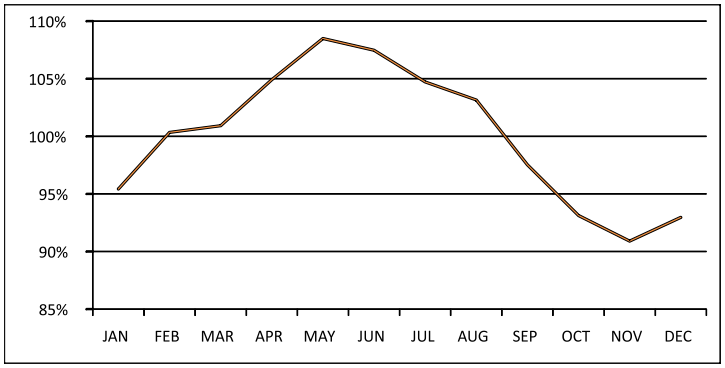
UT Department of Agricultural and Resource Economics

Once the decision to cull a cow is made many producers sell the culled cows as soon as possible. Selling immediately is an option and may be the only option due to resource constraints, but it is not always the most profitable option. In many operations the sale of cull cattle accounts for 15 to 30 percent of total revenue from the cattle enterprise. Therefore, producers should ask the question: Is it more profitable to sell cows when the culling decision is made or should they be fed for a period of time and "marketed" at a later date? Three key factors should be considered when making this decision.

1) Seasonality of cull cow prices.
Cull cow prices, like most agricultural commodity prices, fluctuate throughout the year. Most producers prefer to market their commodities when the price for the commodity is highest in order to maximize revenue. Tennessee cull cow prices tend to be highest from April through July, while they are traditionally lowest from October to January. It is important to recognize the seasonality of cull cow prices, but this does not necessarily mean that all producers will be best off by marketing culls from April to July because there are other factors to be considered.

Seasonal Index for Utility Cows at Tennessee Auctions, 1996-2010.



2) Price differences between cull slaughter grades
The second factor that should be considered is the slaughter grade the animal will be when marketed. A few factors determine the value of the cow:

- Potential of the cow being condemned due to lameness, visible and carcass defects, and withdrawal periods which can result in the animal having little to no value.
- Finish — Trimmings and muscle cuts.
- Carcass/live weight — The amount of weight the cow is carrying.
- Dressing percent — The ratio of meat to live weight.

Cows are graded into four categories: canner, cutter, utility (breaking and boning utility), or commercial.

Cutter/canner animals are thin and have lost muscle mass due to poor nutrition and health.

- Boning utility is the "optimal" weight for a producer and has a higher value than cutter/canner graded animals because its higher condition level allows higher valued cuts of beef such as the loin, top rounds, and strips to be pulled from the carcass.
- Breaking utility animals have a sufficient quantity of marbling (intramuscular fat) and produce cuts such as the rib and the loin which increases the value of the carcass.

Carcass Grade	Lean Percentage of Trimmings	Body Condition Score (BCS)	Discount (2011)
Cutter/Canner	85%	1-3	$11.88
Boning Utility	80-85%	4-6	$1.83
Breaking Utility	Less than 80%	7-9	Base

3) Cost of feeding cull cows

Feeding cull cows has the potential to increase gross revenue due to price seasonality, increased sale weight, and slaughter grade changes. Increasing gross revenue does not always translate into increased profits. The value of gain must exceed the cost of gain. In other words, the additional revenue gained by feeding animals for a period of time instead of selling immediately after the culling decision must exceed the cost incurred between the culling decision and the time of sale. Some elements that need to be considered when making the decision whether to feed or not include:

- Time of year.
  Fall to spring usually works well.
  Need 50-90 days to be profitable.
- Health of cows.
  Need to be healthy enough to gain.
  Need some teeth.
- Cost of feed.

Cows tend to be inefficient at converting feed. (10:1-15:1 feed:gain vs. feedlot steers at 7:1)
Need relatively cheap feed source. (Winter annuals, byproduct feeds, etc.)

The take-home message is **market cows like you would market calves.**

- Market healthy animals (do not want visible signs of unhealthy animals).
- Market animals before October or after January.
- Market animals that are not too fat or too thin (BCS 5-6).
- Consider the economics of feeding cows.
- Consider adding value by marketing in truckload lots and source-verified cows.
- Consider taking bids and marketing direct.

Contributions from Dr. Emmit Rawls (University of Tennessee) and Dr. Curt Lacy (University of Georgia) are much appreciated.

Transporting Cattle with Stock Trailers

Clyde Lane Jr.
Professor Emeritus
UT Department of Animal Science

Hauling cattle is an integral part of most beef operations. Whether cattle are hauled to the local livestock market or to a different pasture, ensuring that proper management practices are used can prevent injury to the cattle. Reducing cattle stress and injury can lead to more profitable operations.

Maintenance

- Trailers should be kept in good condition with all repairs made as needed.
- Tires should be checked for proper air pressure and tread wear and should be free of dry rot.
- Wheels should be maintained and greased according to manufacturer recommendations.
- A jack capable of lifting the loaded trailer, block and spare tire should be kept with the trailer.
- Inspect trailer wiring and lights to ensure that they are properly functioning prior to hauling cattle.
- Ensure that brakes are in good working order.
- Inspect the trailer floor and repair/replace as needed. The useful life of a wooden trailer floor is probably fewer than 10 years; if the trailer is not cleaned out on a regular basis the life expectancy is probably shorter.
- Any trailer used to haul cattle should have a nonslip floor.
- Options include wire cattle panel or a rubber mat.
- If wire cattle panels are used, make sure the panels are securely held down by using ample staples to hold them in place.
- Clean the trailer after each use.
- Cleaning the trailer will help prevent injuries from slipping.
- Cleaning will assist in biosecurity and help prevent the spread of disease.

Loading/ Unloading

- When loading cattle onto the trailer care should be taken to move the cattle slowly and quietly.
- Use low stress handling techniques when moving, loading and unloading cattle.
- Avoid using electric prods and aggressive use of canes, whips and sorting sticks. Avoiding these techniques will minimize stress, help prevent the animals from getting excited, and lessen the degree of shrink.

- Sort cattle into groups based on size, sex and horns. Load different groups into separate compartments.
- Load heavier cattle toward the front of the trailer
- Bulls that have not been together should be loaded into separate compartments.
- Separate cattle that are purchased from separate sources or different groups. The separation will prevent them from trying to establish a new social order on the trailer.
- Minimize the height that cattle must step onto the trailer by backing the trailer into a slope.
- Load cattle at the edge of the operation to help support the biosecurity plan and minimize introduction of health problems.
- Allow the cattle to establish a flow onto the trailer to reduce stress.

Equipment selection

- Do not overload the truck and trailer. Check the truck's gross vehicle weight rating, or GVWR, to ensure it can handle the load to be pulled safely.
- Use the loading density charts (Tables 1 and 2) to ensure that there is adequate floor space per head to minimize stress, bruising, injury and possible death losses.
- Use proper facilities for loading cattle.
- Take care when opening and closing gates. If the cattle are overloaded there can be a great deal of tension on the gates causing them to spring forward when unlatched. Similarly cattle can hit the gates causing them to spring forward.

Driving Considerations

- Careful driving can prevent bruises, injuries and even death while hauling cattle.
- Defensive driving is highly encouraged.
- Prior to hauling cattle, plan routes carefully avoiding heavy traffic and sharp turns while minimizing stops.
- Gentle acceleration and braking will minimize stress and help prevent injuries.

Weather Considerations

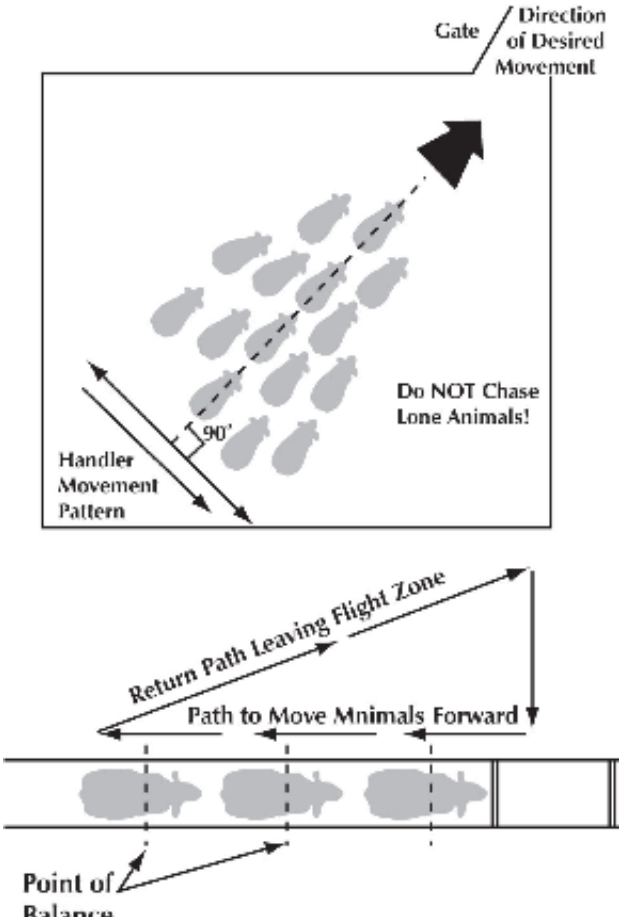
- Avoid hauling cattle during extreme weather conditions.
- Summertime temperatures and high humidity can be stressful on cattle. If possible, haul cattle in the early morning hours after the road has cooled off overnight.
- When hauling cattle in the winter try to avoid the coldest part of the day. Remember to account for wind chill when driving.
- The worst time to haul cattle is during a cold rain during the winter. This weather decreases the temperature on wet cattle causing stress and sickness.
- Avoid hauling cattle during icy conditions.

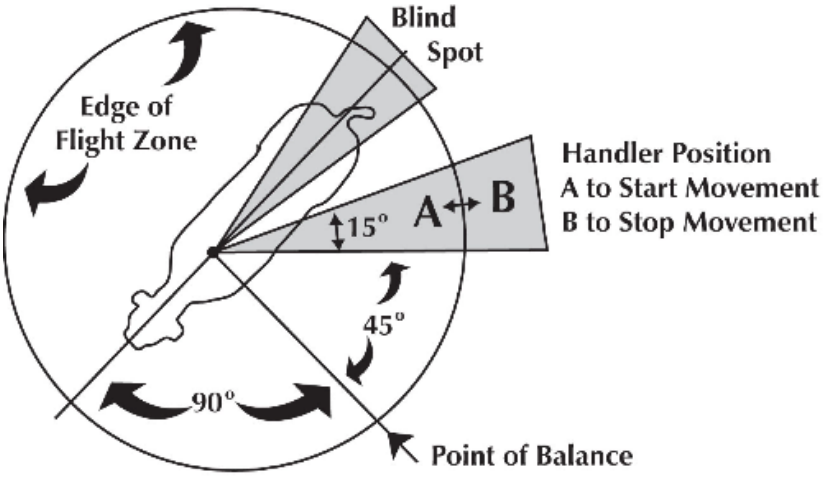
Fit to Load? Checklist for hauling cattle to be sold

- Are cattle physically able to be loaded and unloaded several times?
- Can cattle walk normally bearing weight on all four legs?
- Are any cattle suffering from advanced stages of health disorders such as cancer eye, open wounds, mastitis, emaciation, malnutrition, exhaustion or deformity?
- Can each animal keep up with the rest of the group?
- If cattle have been treated has the withdrawal time passed?
- Are cattle completely blind?
- Do not haul female cattle that are in the late stages of pregnancy.

Summary

Beef Quality Assurance programs require that animals be handled in a manner that will result in a high-quality product for consumers. Transporting animals from farm to farm or to the market must not jeopardize the quality of product already produced. Also there is an economic incentive to proper transport of animals. Cattle that are injured will sell for less, so taking steps to prevent injury in transit can result in higher selling prices. Similarly cattle that are injured or bruised will have a greater degree of trim loss. This is particularly true for market cows and bulls that usually do not have enough fat thickness to help provide some degree of protection from bruising. Animals suffering from weather-related stress will be more susceptible to disease. Taking care to follow these recommended transportation practices can result in higher quality beef, less trim out loss, fewer injuries and a more profitable operation.


Gate
Direction of Desired Movement
Do NOT Chase Lone Animals!
90°
Handler Movement Pattern
Return Path Leaving Flight Zone
Path to Move Mnimals Forward
Point of


Blind Spot
Edge of Flight Zone
Handler Position
A to Start Movement
B to Stop Movement
A
B
15°
45°
90°
Point of Balance

Heat Index

High Temperature °F

RH	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
90	91	95	98	102	105	109	113	117	122	126	131	136	141	147	152	158	164	170	176
85	90	93	96	99	102	106	110	113	117	122	126	130	135	140	145	150	155	161	167
80	89	91	94	97	100	103	106	110	113	117	121	125	129	134	138	143	148	153	158
75	88	90	92	95	97	100	103	106	109	113	116	120	124	128	132	136	141	145	150
70	86	88	90	93	95	98	100	103	106	109	112	116	119	123	126	130	134	138	143
65	85	87	89	91	93	95	98	100	103	105	108	111	114	118	121	125	128	132	136
60	84	86	88	89	91	93	95	97	100	102	105	107	110	113	116	119	123	126	129
55	84	85	86	88	89	91	93	95	97	99	101	104	106	109	112	114	117	120	124
50	83	84	85	86	88	89	91	93	95	97	99	101	103	105	108	110	113	115	118
45	82	83	84	85	87	88	89	91	92	94	96	98	100	102	104	106	109	111	114
40	81	82	83	84	85	87	88	89	91	92	94	95	97	99	101	103	105	107	109
35	81	82	83	84	85	86	87	88	89	90	92	93	95	96	98	100	102	104	106
30	80	81	82	83	84	85	86	87	88	89	90	92	93	94	96	97	99	101	102
25	80	81	82	82	83	84	85	86	87	88	89	90	91	93	94	95	97	98	100

RH = Relative Humidity

HI > 100 (Gray, Red # Area) is the Emergency Zone

Wind Chill Index (WCI)

Wind Speed \ LowTemperature °F	-10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
25	-59	-56	-53	-50	-47	-44	-41	-38	-35	-32	-29	-26	-23	-20	-17	-14	-12	-9	-6
23	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-28	-25	-22	-19	-16	-13	-10	-7	-4
21	-54	-51	-49	-46	-43	-40	-37	-34	-31	-28	-26	-23	-20	-17	-14	-11	-8	-5	-3
19	-52	-49	-46	-43	-40	-37	-35	-32	-29	-26	-23	-21	-18	-15	-12	-9	-6	-4	-1
17	-48	-46	-43	-40	-37	-35	-32	-29	-26	-24	-21	-18	-15	-13	-10	-7	-4	-2	1
15	-45	-42	-39	-37	-34	-31	-29	-26	-23	-21	-18	-15	-13	-10	-7	-5	-2	1	4
13	-41	-38	-36	-33	-30	-28	-25	-23	-20	-17	-15	-12	-9	-7	-4	-2	1	4	6
11	-36	-33	-31	-28	-26	-23	-21	-18	-16	-13	-11	-8	-6	-3	-1	2	4	7	9
9	-30	-28	-26	-23	-21	-18	-16	-14	-11	-9	-6	-4	-2	1	3	6	8	10	13
7	-24	-21	-19	-17	-15	-12	-10	-8	-5	-3	-1	1	4	6	8	10	13	15	17
5	-15	-13	-11	-9	-7	-5	-3	0	2	4	6	8	10	12	14	16	18	21	23
3	-4	-2	0	2	4	6	7	9	11	13	15	17	19	21	22	24	26	28	30

Table 1. Maximum * recommended number of head for trailers of different lengths for polled and dehorned cattle.

		Cattle under, lbs.													
Length	Width	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600	MAX**
14	6	16	13	11	9	8	7	6	6	5	5	5	4	4	<6500
16	6	18	15	12	11	9	8	7	7	6	6	5	5	5	<7400
18	6	21	17	14	12	10	9	8	8	7	6	6	6	5	<8400
20	6	23	18	15	13	12	10	9	8	8	7	7	6	6	<9300
22	6	25	20	17	15	13	11	10	9	8	8	7	7	6	<10200
24	6	28	22	18	16	14	12	11	10	9	9	8	7	7	<11100
26	6	30	24	20	17	15	13	12	11	10	9	9	8	8	<12000
28	6	32	26	22	18	16	14	13	12	11	10	9	9	8	<13000
30	6	35	28	23	20	17	15	14	13	12	11	10	9	9	<13900
32	6	37	30	25	21	18	16	15	13	12	11	11	10	9	<14800
34	6	39	31	26	22	20	17	16	14	13	12	11	10	10	<15700
20	7	27	22	18	15	13	12	11	10	9	8	8	7	7	<10800
22	7	30	24	20	17	15	13	12	11	10	9	8	8	7	<11900
24	7	32	26	22	18	16	14	13	12	11	10	9	9	8	<13000
26	7	35	28	23	20	18	16	14	13	12	11	10	9	9	<14000
28	7	38	30	25	22	19	17	15	14	13	12	11	10	9	<15100
30	7	40	32	27	23	20	18	16	15	13	12	12	11	10	<16200
32	7	43	34	29	25	22	19	17	16	14	13	12	11	11	<17300
34	7	46	37	31	26	23	20	18	17	15	14	13	12	11	<18400

*The number of head loaded during hot conditions should be reduced.
**The maximum weight of cattle for each trailer size with these calculations. Do not exceed the Gross Vehicle Weight Rating for your truck and stock trailer.

Table 2. Maximum * recommended number of head for trailers of different lengths for horned and tipped cattle.

		Cattle weight, lbs.													
Length	Width	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600	MAX**
14	6	15	12	10	9	8	7	6	5	5	5	4	4	4	<6000
16	6	17	14	11	10	9	8	7	6	6	5	5	5	4	<6900
18	6	19	15	13	11	10	9	8	7	6	6	6	5	5	<7800
20	6	21	17	14	12	11	10	9	8	7	7	6	6	5	<8600
22	6	24	19	16	13	12	10	9	9	8	7	7	6	6	<9500
24	6	26	21	17	15	13	11	10	9	9	8	7	7	6	<10300
26	6	28	22	19	16	14	12	11	10	9	9	8	7	7	<11200
28	6	30	24	20	17	15	13	12	11	10	9	9	8	8	<12000
30	6	32	26	21	18	16	14	13	12	11	10	9	9	8	<12900
32	6	34	27	23	20	17	15	14	12	11	11	10	9	9	<13800
34	6	36	29	24	21	18	16	15	13	12	11	10	10	9	<14600
20	7	25	20	17	14	13	11	10	9	8	8	7	7	6	<10000
22	7	28	22	18	16	14	12	11	10	9	8	8	7	7	<11000
24	7	30	24	20	17	15	13	12	11	10	9	9	8	8	<12000
26	7	33	26	22	19	16	14	13	12	11	10	9	9	8	<13000
28	7	35	28	23	20	18	16	14	13	12	11	10	9	9	<14000
30	7	38	30	25	21	19	17	15	14	13	12	11	10	9	<15000
32	7	40	32	27	23	20	18	16	15	13	12	11	11	10	<16000
34	7	43	34	28	24	21	19	17	15	14	13	12	11	11	<17000

*The number of head loaded during hot conditions should be reduced.
**The maximum weight of cattle for each trailer size with these calculations. Do not exceed the Gross Vehicle Rating for your truck and stock trailer.

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Dr. Jim Turner formerly with North Carolina State University
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Dr. Temple Grandin, Colorado State University

Understanding Cattle Behavior to Improve Safety When Working Cattle

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UT Department of Animal Science

There are many reasons cattle react the way they do when trying to get them up at cattle working time. Many of their reactions are a result of their innate characteristics. Understanding these characteristics and how animals respond to different situations can make cattle handling a safe and less stressful event. Decreasing stress and excitability to both the cattle and cattle handler will contribute to the improvement of safety to both parties at this event. Many accidents are a result of people not understanding animal behavior and wanting to get the job done in a hurry.

Vision:
Cattle have panoramic vision in excess of 300 degrees, which means they can see in all directions, except for directly behind themselves. In contrast a human's vision is roughly 180 degrees. Approaching cattle from directly behind can startle them, and then they become dangerous to the handler.
Cattle have poor depth perception. Their ability to perceive ground depth while moving is very limited. Because of this, they have to stop and lower their head to focus. That is the reason unfamiliar objects and shadows on the ground are the cause of animals balking when entering or moving through the chute. Due to the limitation in vertical vision and lack of ability to focus, a shadow on the ground can appear to be a large ditch.
Cattle are sensitive to light differently than humans and move more freely from a dimly illuminated area to a more lighted area providing the light is not glaring in their eyes. This is why it is difficult to get them to move into a dark chute from a sunny outdoor crowding pen. If working cattle at night, frosted lamps need to be used in order to eliminate glare in the cattle's eyes.

Hearing:
Cattle hear differently than humans. They can hear both lower volume and higher frequency sounds better than humans but cannot pinpoint the source as well as humans. Loud sounds scare them very easily. Because of their poor depth perception, excessive screaming and hollering can agitate them and cause them to move away from the source and crash into fences or other objects, including people. Be extremely careful of cattle with sight problems (such as cancer eye), as they rely on hearing to a greater extent and may overreact to sounds.

Flight Zone or Distance:
Just like people, cattle have a comfort zone. Their flight zone is measured by how near you can approach them before they move. When you enter an animal's flight zone, the animal will start to move. If approaching cattle from the front they will turn around and move away from you. If approaching them from the rear, they will turn to look at you and move forward. Depending upon their temperament, the speed at which they move will vary. Wild cattle or those that have had bad experiences with cattle handling will have larger flight zones than docile cattle, and they will not allow a person to get near them before moving. Calmer cattle will allow a person to get closer to them before they start movement. Familiarity of the cattle with the cattle handler will also affect the size of the flight zone. The cattle will be more apprehensive with persons which they are not familiar.

Herd Instinct:
Cattle are prey animals and feel comfortable and safe in a group. This instinct causes them to want to be in a group and follow other animals' movement in that group. Being alone may cause them heightened anxiety, fearfulness and willingness to fight back in a situation that a human might not perceive as dangerous. When an individual is separated from the herd it can become very stressed, agitated and aggressive. When trying to separate an individual from a herd, it is often much easier to allow one or two additional animals to go with that animal.

Maternal Instinct:
Cows have a defensive instinct to protect their young from danger. A cow or heifer's behavior can become very unpredictable at or after calving. A docile animal can become aggressive and charge when being separated from its young. A cow is often aggressive just after calving and is not to be trusted. As a rule, the younger the calf the more dangerous is the mother. Always keep the calf and some barrier between yourself and its mother when ear tagging or any other practice for newborn calves.

Territorial:
Animals are attached to their own territory and are comfortable in that area. Changing environments or location alters their comfort level and can lead to changes in temperament. They may become very tentative when exposed to strange surroundings. Also, in a new environment they sometimes try to re-establish a new pecking order. A single animal moved to a foreign environment may become overly agitated and aggressive. It is best to provide that single animal with a companion animal to overcome stress and excitement.

Bulls:
Bulls react differently to people than cows. Cows are protective of their calves and themselves and when threatened they are usually in the defensive mode. When you retreat the cow will usually do the same and not bother you. Bulls are territorial and are possessive of their space and cows. Never trust a bull and never turn your back to him! Without warning, a submissive and docile bull may turn aggressive and cause serious injury or death. Never attempt to separate a bull from the herd by yourself. Bulls need to be respected and not necessarily feared. Dairy bulls are more dangerous than beef bulls.

The management system under which bulls are raised has a profound effect on their temperament. Individually reared bulls as calves can become more aggressive toward a person than group reared bull calves because they perceive their handler as rivals and not a dominant power. An innate fear of humans is lost during individual rearing. It is made worse when the calf is teased, played with or constantly rubbed on the head and he views a person as a competitor. When he matures he may want to challenge a person again.

Basic cattle instincts contribute to behavior patterns that are based on actions to make them feel most comfortable in their environment. These behavior patterns or instincts allow cattle to respond to changes in their surroundings or environment. Some of their responses to different situations can be dangerous to both them and the cattle handler. Understanding how and why cattle respond to different situations can greatly reduce the risk of accidents when working with cattle.

TOUR H: NO-TILL WEED CONTROL

New and Old Technologies for Weed Control in Soybeans

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Brit Gaban
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As glyphosate resistance continues to be a problem, area producers are looking to ag industry leaders to help combat glyphosate-resistant species, particularly Palmer pigweed. Unfortunately, no new chemistry is available to control large Palmer (> 6 inches), but what we do see is ag industry incorporating older herbicides that have activity on Palmer amaranth into seed technology traits to provide producers some new tools. Roundup Ready and Liberty Link systems are both in production systems now in the Midsouth area, but on the horizon are dicamba + glyphosate-tolerant soybeans and 2,4-D + glyphosate-tolerant soybeans from Monsanto and Dow AgroSciences, respectively. These new technologies that will be coming online in the near future show great promise, especially when added to a weed control program utilizing PREs, multiple modes of action, and timely application of POSTs.

Roundup Ready soybeans have had a prominent share of the soybean market since they were first released and continue to be utilized now. However, increased glyphosate-resistant weed pressure has sharply decreased the amount of Roundup Ready soybeans being planted in the Midsouth. Roundup Ready technology still can provide control on some weeds, especially when implemented into a production system using PREs with activity on Palmer. However, if the Palmer escapes pre-applied residual herbicides, there is little a producer can do short of destroying the crop or hiring a chopping crew, as only timely POST applications (< 3-4 inches) of PPO herbicides provide adequate control on Palmer pigweed.

Liberty Link technology has proven to be an effective option to manage Palmer amaranth. Timely applications of Liberty POST can control most Palmer pigweed in the 6 inches or less category. That being said, it is important to note that Liberty can prove to be a finicky herbicide as results often vary from field to field based on environment and time of day the herbicide is applied. Keys to successful control of Palmer pigweed are to apply in a timely manner (3-5 inches), and if not applied in time, a sequential application 5-10 days later will be needed for adequate control. Also, the use of a PREs with activity on Palmer, as well as POST applications of PPO herbicides, can aid in the fight against pigweed and reduce the likelihood of Palmer becoming PPO and/or Liberty resistant. This weed management tool is one that producers cannot afford to lose.

Coming online in the near future is Dow Agro Sciences 2,4-D + glyphosate-tolerant trait, which can prove to be a great tool to help control glyphosate-resistant weeds. This technology looks to be quite beneficial when being added to a weed control program using PREs, multiple modes of action, and timely application of POSTs.

Also on the horizon is Monsanto's dicamba + glyphosate-tolerant trait, which also will prove to be a good asset in situations where glyphosate-resistant populations of weeds are present. This technology also looks to show best results when being utilized in weed control programs using PREs, multiple modes of action, and timely applications of POSTs.

Weed Control Considerations for Transitioning Fields (Pastures or CRP) into Row Crops

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Increasing feed grain prices in recent years have caused a number of producers to consider converting land currently either in pasture or the Conservation Reserve Program (CRP) to row crops. A number of issues, not the least of which is weed control, should be considered prior to conversion. First and foremost, producers are encouraged to remember that there are likely some very good reasons why certain fields are in grass rather than crop production. Low available water holding capacity, erosion, steep terrain, etc. can seriously limit productivity. Even on productive soils, conversion to row crops needs to be considered as a transition process; not all problems, particularly woody brush infestations, low pH/low fertility, etc. can be corrected in one year. Also, if the field is in the CRP program, producers are strongly encouraged to work closely with their district conservationist to be sure any proposed modification to their conservation plan is approved so that participation in the CRP and other farm programs is not jeopardized.

Where possible, it is recommended to begin the transition process at least one year prior to planting. Fields should be assessed for predominant grass cover (tall fescue, broomsedge, common bermudagrass, etc.) and broadleaf weeds (herbaceous and woody brush). Fields heavy in common bermudagrass should be avoided. The majority of pastures and CRP fields in Tennessee are in tall fescue. Research conducted in Tennessee has consistently shown that tall fescue is much easier to kill in the fall than in the spring. We recommend cutting, baling and removing heavy growth in late summer. Allow for 6 to 8 inches of regrowth, and then spray with glyphosate in October. This will do an excellent job on tall fescue, but it is too late for control of broomsedge which is common in unmanaged pastures and CRP ground. The University of Tennessee recommends the use of no-till practices wherever possible, but fields heavy in broomsedge may require tillage in preparation for converting to row crops. Cut, bale and remove broomsedge, then follow with a heavy disk, chisel plow and then two more trips with the disk. Cultimulch, and then plant a fall cover crop of wheat.

The year prior to converting to crops is a good time to address broadleaf weed and brush problems. Select herbicides with care; products containing aminopyralid (Milestone, ForeFront, GrazonNext, Chaparral) or picloram (Grazon P+D, Surmount, Tordon) are persistent and should not be used the year prior to a soybean-corn rotation. Nonpersistent options for several herbaceous broadleaf weeds include 2,4-D, dicamba, and premixes of 2,4-D + dicamba (WeedMaster, Range Star, Brash). Nonpersistent options for woody brush include Remedy Ultra (triclopyr) and PastureGard (triclopyr + fluroxypyr premix). PastureGard would be our preferred recommendation where serecia lespedeza and brambles (blackberries, dewberries) are present. Spot sprays of either PastureGard or Remedy Ultra would be recommended for woody brush such as poplar, locust, sumac, oak, sassafras and wild cherry. Fields heavy in sweet gum should be avoided if possible.

In most cases, corn would be preferred over soybeans for the first year of conversion. In all likelihood, most fields will still have some broomsedge and woody saplings emerge the first year. Corn will provide much better shading than soybeans. In many cases a corn header, unlike a soybean header, can be raised above woody escapes. A vigorously growing Roundup Ready hybrid should be selected, and because soil insects are usually troublesome following sod, consideration should be given to ordering seed with the higher, labeled rates of recommended insecticide seed treatments. For preplant and in-crop weed control, producers should follow the recommended corn weed control programs in UT Extension Publication 1580 "Weed Control Manual for Tennessee" which can be obtained at your local county Extension office.

Following corn harvest, fields should be scouted for any brush or perennial broadleaf escapes. Spot sprays of Remedy Ultra, PastureGard, or glyphosate prior to frost may be useful for reducing problems going into the second year of row crop production.

TOUR I: SEED TREATMENTS FOR NO-TILL

What Are Insecticide Seed Treatments Worth to You?

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UT Department of Entomology and Plant Pathology

In the last decade, insecticide seed treatments have almost completely replaced the use of in-furrow sprays or granular treatments. In Tennessee, nearly 100 percent of cotton and corn seed is treated with insecticide, and approximately one-half of soybean seed are also treated with similar insecticides. Indeed, seed corn is almost universally treated by seed companies prior to sale. Currently, most insecticide seed treatments belong to the neonicotinoid class of chemistry including imidacloprid (Gaucho) on cotton and soybean; thiamethoxam (Cruiser) on cotton, soybean and corn; and clothianidin (Poncho or NipsIt) in corn or soybean. New insecticide seed treatments from different classes of chemistry are also under development. Insecticide seed treatments provide early season protection from seed and seedling pests including thrips, white grubs, wireworms, grape colaspis, bean leaf beetle, threecornered alfalfa hopper, southern corn rootworm, seed corn maggot and other pests. However, the value of these treatments in protecting yield varies considerably among crops depending on its sensitivity to early season insects. Also, they do not control all pests that may occur.

Research has been done during the last decade to document the level of pest protection and value of insecticide seed treatments in Tennessee on cotton, soybean and corn. This presentation will summarize the finding of this research in these crops. It will also discuss the efficacy of some new seed treatments. Data in Tennessee indicate that insecticide seed treatments in cotton provide a consistent return on investment, averaging approximately 100 pounds more lint than seed not treated with insecticide. The primary target of insecticide seed treatments in cotton is a complex of thrips species. The yield response from an insecticide seed treatment in corn typically averages about 4 bushels per acre and is less consistent than that observed in cotton. In Tennessee, soybean responds less consistently to insecticide seed treatments than either cotton or corn, averaging about 2 bushels more per acre than untreated seed. In all cases, and especially in soybean and corn, yield responses are variable and will not occur every year or in all fields. There are risk factors in these crops that increase the need for using an insecticide seed treatment including no-till production, early plantings, and poor emergence and growing conditions during the first 2-3 weeks after planting. Also, seed treatments are more likely to increase profits when crop commodity prices are relatively high. No commercially available seed treatments should be expected to provide control of early season insects for more than three weeks. However, plant protection is often most critical during the first few weeks after emergence after which plants can tolerate more injury from soil and seedling pests.

Insecticide seed treatments are generally recommended in cotton and corn unless in-furrow sprays or granular insecticides are used. Some use of insecticide seed treatments in soybean is recommended, particularly in high-risk fields such as early planted and reduced-tillage fields. The use of insecticide seed treatments does not replace the need to scout for potential insect pest problems. A foliar insecticide application for thrips control is commonly recommended in cotton even when a seed treatment was used. Insecticide seed treatments often provide little protection or only suppression of injury from cutworms, false chinch bug in cotton or soybean, and sugarcane beetles in corn.

Should I Use a Fungicide Seed Treatment on Soybeans?

Melvin Newman
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UT Department of Entomology and Plant Pathology

Diseases affecting seed quality and yield differ in severity among cultivars, years and locations, but the pathogens responsible are well established in most production areas. Soybean seed produced in warm, wet seasons or where rain has delayed the harvest is often of poor or reduced quality. Using a fungicide seed treatment provides insurance against seed-borne and soilborne seed rots and seedling blights. Fungicide seed treatments also provide some seed coat protection and some systemic control of late season and foliar

diseases. When high quality seed is planted under conditions favorable for good seed germination there may not always be a significant yield increase even though stand may be increased.

Proper seed treatment with a fungicide will increase germination of poor quality seed if the low quality is the result of fungal infection. Fungicide seed treatments also protect the seed and seedlings against seed-borne and soilborne pathogens. Producers will benefit most from a fungicide seed treatment when planting seed infected with disease-causing fungi or when planting where there is a likelihood of delayed emergence. Poor germinating seed caused by mechanical damage, physiological aging or other non-pathological factors may not be improved with the addition of a fungicide seed treatment.

Fungicide seed treatment products are available in many formulations such as wettable powders, flowables, hopper box dusts or liquid slurries. These products can be custom applied by seed conditioners, purchased already treated, or applied directly in the planter or drill box. Since seed rots and seedling diseases are caused by a variety of fungal pathogens, seed treatment products are generally composed of several classes of fungicides which may include strobilurins, triazoles and premixed with other systemic or contact fungicides. Fungicide seed treatment products also may contain insecticides, nematicides, rhizobium inoculants or other enhancement technologies.

Fungicide seed treatments are generally most beneficial when seed germination is below 80 percent; or when seedling disease problems have been observed in the past; or when planting early especially in cool, wet soil; or when crop residue or wheat stubble remain on the seed bed. For the cost, fungicide seed treatments offer one of the best returns on investment in soybean production.

Should You Use a Seed Treatment Nematicide?

Pat Donald
Research Plant Pathologist
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UT Department of Entomology and Plant Pathology

Scott Martin
Seed Care Technology Asset Lead
Syngenta

Most traditional nematicides from the 1950s through 1980s are no longer available due to environmental concerns as well as dangers to humans either in production or during application. Plant-parasitic nematodes however, are still a threat to crop yield. Plant-parasitic nematodes are characterized by being generally microscopic, translucent, soil inhabitants that feed on plant roots causing yield loss and sometimes plant death. The damage to the plant roots is done as the plant-parasitic nematode's stylet extracts plant cell contents from roots cells and uses it for growth. Plant-parasitic nematodes feed in three primary ways: 1) nematode body outside of the roots, 2) nematode body inside the roots, or 3) a combination of feeding while outside and moving inside the roots. Once nematodes are inside the plant root, they are protected from chemicals designed to kill nematodes through contact or exposure to the product. Some nematicide mode of action is to interfere with the nematode's chemotaxis in finding plant roots, which also would prevent injury from the nematode. Levels of the nematodes could decrease in the soil if the nematodes were not able to find the plant roots and obtain food prior to depleting their body reserves. Damage from plant-parasitic nematodes is generally done before the problem is recognized and too late to take corrective action during the current growing season.

Recently seed treatment [application of a pesticide(s) to the seed coat] has been targeted as an environmentally safe and effective way to place one or multiple pesticides on the seed to prevent damage from target organisms including plant-parasitic nematodes. Seed treatment for fungi and insects were developed prior to development of nematicide seed treatments. Current field crop nematicide seed treatments are aimed at plant-parasitic nematodes which parasitize corn, soybean and cotton. The seed treatments include conventional pesticides and in some cases biologicals.

The biological in the treatments, depending on the seed treatment, either live in the plant rhizosphere or otherwise protect the plant's roots by unknown modes of action. These products are broad spectrum or nonspecific in that they target all nematodes in the plant rhizosphere. Other biologicals are hyperparasites of the target nematodes and will parasitize only specific nematodes.

Data from tests in West Tennessee will be presented.

TOUR J: USING PRECISION AGRICULTURE TO IMPROVE FARM SUSTAINABILITY

Reducing Crop Input Costs With Variable Rate Technology

Mike Buschermohle
Professor
UT Department of Biosystems Engineering and Soil Science

Lori Gibson
Extension Specialist
UT Department of Biosystems Engineering and Soil Science

Row crop producers are being challenged to maintain profitability and meet the food and fiber needs of a growing population, while responding to increased scrutiny of land and water resources. Properly managing within field variability has the potential to minimize nutrient losses and optimize crop inputs, thus enabling producers the opportunity to maximize farm income while protecting surface and groundwater resources. Site-specific management (SSM) and variable rate application (VRA) are precision agriculture technologies that have the potential to better evaluate production input factors, accurately predict yield potential, and precisely vary the rate of crop inputs across the field.

Traditionally, producers have applied single-rate applications of P and K fertilizers based on average soil fertility levels for the entire field. Oftentimes, this single-rate application leads to overapplication of crop fertilizers in some areas of the field and under-application in others. Under-fertilization has the potential to reduce yields, while over-application can be harmful to the environment. Directed soil sampling, whether it is 2.5 or 5 acre grid, or directed sampling based on yield or soils maps, aerial images, or other spatial data, is a site-specific management strategy that provides much more information than a whole field average sample. The additional information from directed soil sampling can improve management and has the potential to reduce input costs by applying the right rate of fertilizer at the right place in the field.

Zone management is a strategy that matches crop input requirements according to site-specific yield potential rather than averaging input requirements for the whole field. This management strategy divides fields into management zones based on realistic yield potential, thus making use of natural within field variability to apply varying rates of crop inputs in order to maximize farm profits while helping to reduce potential impacts on land and water resources. Measuring the yield variability in a field is an essential step in defining areas in the field that are potentially high- or low-producing areas. In ideal situations, the main yield limiting factor or factors would be consistent from year to year and crop to crop. If that were truly the case, interpreting multiple-year yield maps would be the same as a single year map. Unfortunately, what may be a yield-limiting factor to one crop or in a given year does not necessarily have the same effect on a different crop or in the next year. One approach is to compare yields from either the same crop or different crops by using normalized yields. Normalized yield is obtained by dividing each yield sample point by the field average.

This tour stop will discuss how you can utilize site-specific management strategies coupled with variable rate application of crop inputs to better understand and manage within field variability to reduce your input costs, while at the same time, helping to protect our land and water resources.

Increasing Production Efficiency with Auto-Guidance

Rob Freeland
Professor
UT Department of Biosystems Engineering and Soil Science

Auto guidance and section control are today in the forefront for savings and increased productivity during ag machinery operations. State-of-the-art guidance systems supply less overlap than manual steering, thereby reducing fuel, seed, fertilizer and pesticide wasted. Operator hours are extended to 24/7 for those

time critical operations, and in turn, driver stress and fatigue are greatly reduced.

This presentation will cover the most common auto-guidance issues for producers in our region. We will discuss current equipment requirements, options, correction signal coverage and common problems. Auto-guidance systems integral to the tractor will be compared to portable, retrofitted steering systems. In addition, recent new trends and regulations pertaining to older RTK GPS base stations transmitting corrections via radios to their tractors in the 150-512 MHz range will also be discussed.

Increasing Profits Using Planter Automatic Section Control

Margarita Velandia
Assistant Professor
UT Department of Agricultural and Resource Economics

This talk will introduce the Automatic Section Control for Planters Cost Calculator (ASCCC), an interactive computerized decision aid that is designed to evaluate potential benefits of Automatic Section Control (ASC) for planters and estimate the number of years it would take an investment in ASC for planters to return its original cost through the annual net cash revenue it generates. Many farmers have purchased or are considering automatic section control units for their planters. Potential benefits of this technology are lower seed costs due to reduction in double-planted acres and improved yield potential in these double-planted areas at harvest time. This decision aid was developed to help farmers make an ASC for planters' investment decision based on their farm situation. A marginal approach that utilizes partial budgeting techniques is used ascertain the marginal change in costs and revenues associated with double planting. This method as well as assumptions and data used to develop ASCCC will be discussed. The use of the decision aid tool will be explained using real examples of investment analysis using ASCCC.

TOUR K: NATURAL RESOURCES CONSERVATION SERVICE (NRCS) UPDATE

NRCS Conservation Programs for Producers

John Rissler
Assistant State Conservationist for Programs
Natural Resources Conservation Service

NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Public benefits of these programs include enhanced natural resources that help sustain agricultural productivity and environmental quality while supporting continued economic development, recreation and scenic beauty.

Financial Assistance Programs
NRCS offers voluntary programs to eligible landowners and agricultural producers to provide financial and technical assistance to help manage natural resources in a sustainable manner. Through these programs the agency approves contracts to provide financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and nonindustrial private forest land.

Tennessee NRCS receives around $40 million in conservation funding that goes to landowners and operators on an annual basis. This open forum will be discussing the programs below as time and interest permits. Come ready to learn and bring your questions. You can learn more before or after the session by visiting www.tn.nrcs.usda.gov/programs or www.nrcs.usda.gov and browsing by program.

Mississippi River Basin Healthy Watersheds Initiative
• Mississippi River Basin Healthy Watersheds Initiative
Conservation Technical Assistance Program and Activities
• Conservation of Private Grazing Land
• Conservation Reserve Program (USDA Farm Service Agency)
• Conservation Technical Assistance
• Grazing Lands Conservation Initiative
• State Technical Committees
Environmental Improvement Programs
• Cooperative Conservation Partnership Initiative
• Environmental Quality Incentives Program
  - Conservation Activity Plans
  - EQIP Initiatives Overview
    • EQIP Air Quality Initiative
    • EQIP On-Farm Energy Initiative
    • EQIP Organic Program Initiative
    • EQIP Seasonal High Tunnel Initiative
  - National Water Quality Initiative (NWQI)
• Conservation Innovation Grants
• Wildlife Habitat Incentive Program
  • Working Lands for Wildlife
Stewardship Programs
• Conservation Security Program
• Conservation Stewardship Program
Easement Programs
• Emergency Watershed Protection Program (Floodplain Easements)
• Farm and Ranch Lands Protection Program
• Grassland Reserve Program
• Wetlands Reserve Program

Rainfall Simulator Demonstrating the Benefits of Cover Management

Greg Brann
State Grazing Lands Specialist
U.S. Department of Agriculture Natural Resources Conservation Service

Pat Turman
State Agronomist
U.S. Department of Agriculture Natural Resources Conservation Service

Soil quality, also referred to as soil health, is defined as how well soil does what we want it to do. Reducing or eliminating tillage has a major influence on soil health. Other management factors that improve soil health are crop rotation, cover crops, residue management, quick canopy, balanced fertility, higher yields and live roots throughout the year. A cooler, moister soil has more

biological activity throughout the year, and residue and canopy are key in maintaining these conditions.

Benchmark conditions:
Assess the current soil conditions: surface residue, green plant cover, root depth, plant vigor, low oxygen indicator plants, compaction, low fertility, soil erosion, moisture holding capacity, soil life (earthworms, macropores, rhizobia nodules on legumes, dung beetles in pasture, length of time it takes for manure to decompose).

Soil Structure and Rooting Depth:
Assess compaction with a probe or even a wire stuck in the ground to feel resistance in the field, and then check in the fence row where no traffic has occurred. A penetrometer or compaction meter is the ideal tool to use. There will normally be some increase in penetration resistance between a surface layer and a subsurface or subsoil layer. Dig a hole generally to 6 or 8 inches deep and assess the soil structure and root form in the surface layer. Granular structure generally is ideal in the surface layer. It is normal, even in healthy soils to have blocky structure in the subsurface and subsoil layers, however the structural units should ideally be well defined with roots moving around and through the blocky soil aggregates, and show evidence that humus or clay has been redeposited on the surfaces of the blocky aggregates and in pores by moving water. Relatively young soils on flood plains may have not yet formed structure in the layers below the surface layer. Assess the soil structure: is it platy (compacted), blocky, or granular (generally preferred). Tap roots that are J shaped or fibrous roots that are weak or that stop at a certain depth are generally an indication of a root restricting layer that may be compacted or dense. Tap roots can improve issues with compaction in the subsoil, and fibrous roots help to improve aeration and lower bulk density.

Earthworms:
How many earthworms are present in a cubic foot? In general 10 earthworms per cubic foot are good for crop land, and typically they do not exceed 20 per cubic foot in crop soils. Earthworms in grass land soils can range up to 50 per cubic foot, the more the better.

Organic Matter:
Soil test for percent Organic Matter. The state average is less than 2 percent, but the potential is up to 4 percent for many soils, and it may be above 8 percent in cooler or wetter areas. Also test for pH, P2O5 and K2O. Testing OM allows producers to assess the impact of their management over time. Relative differences in soil organic matter can be visually estimated by comparing the darkness of the topsoil color at different sites, and observing the patterns of the darker surface colors as they grade into the subsurface and subsoil layers and along root channels. In crop rotations, do not expect much change in organic matter content in less than five or 10 years.

General management recommendation to improve soil quality:
- Live plants and roots present at all times.
- Residue cover on the surface at all times. Crop residue improves available water holding capacity, nutrient content, aggregate stability, soil macro and microfauna, macropores and micropores, infiltration, etc.
- Crop canopy covering the field as long as possible throughout the year breaks the impact of raindrops and cools the soil.
- Crop diversity either through crop rotation, cover crop mix or pasture mix improves soil, water, plant and animal resources.

Cropland Soil Quality is first improved by reducing or eliminating tillage operations. Crop rotations of plants from different functional groups improve soil quality. Different functional groups include warm-season and cool-season crops, and different families of crops including grasses, legumes and nonlegume broadleaf crops (e.g. corn, wheat, soybeans, canola, cotton, sunflowers, pumpkins, etc.).

Pasture Soil Quality can be improved the most by managing grazing heights and soil cover with plant residue. For faster improvement of soil quality, practice high density grazing (40,000 pounds or more of animals per acre). Stocking rate for the farm would only require supplemental feed for 60 days or less. Best if pastures are grazed leaving at least half of the forage behind. This residual forage is best laid flat by the livestock. Residue will serve as a soil cover and return nutrients to the soil. Regrowth of pasture will be two

times faster due to more forage (better solar panel) capturing sunlight and improved moisture holding capacity.

Summary:
To improve soil quality, plan for continuous soil cover, plant diversity and retention of plant material. Plant cover crops when primary crops are not growing. As little as 90 days are needed to grow a cover crop. Aerial seeding can aid in quicker establishment of cover when primary crops are still in field. On pasture and hay land, maintain vegetative and residue cover on the soil year around. Plants growing and plant residue ensures that fertility, available water holding capacity, crop production, weed control and animal health will be more consistent, even in times of drought. Flooding damage is also reduced since water infiltration is improved and less runoff occurs. Managing for better soil quality improves soil functions, the quantity and quality of water, and plant and animal resources while reducing energy demand; therefore the entire environment is improved.

Buffers: Buffers for Wildlife and Conservation

Mike Hansbrough
Area Resource Biologist (Area 1)
U. S. Department of Agriculture Natural Resources Conservation Service

This presentation will summarize some of the opportunities that landowners have to enroll different types of buffers via U.S. Department of Agriculture programs and potential conservation and wildlife benefits. Buffers are areas planted in permanent vegetation and are generally located between sensitive sites like streams, ponds, field edges and the more active agricultural fields that include cropland, pasture, and hay. Conservation practices such as filter strips, riparian forest buffers and field borders are some examples of the most popular buffers that are commonly planted in the Midsouth. These buffers have been effective in reducing erosion and protecting water sources by trapping chemicals, fertilizers and sediments.

Buffers can help increase farm income by taking low-yielding areas out of production and provide an option for economic return on field edges with some programs. They also can serve as important habitat for a wide variety of wildlife on farm landscapes if wildlife friendly vegetation is utilized in the buffer planting. Landowner selection of cover type to be used in buffer establishment is an important planning consideration if wildlife habitat is desired. Native trees, shrubs, warm-season grasses and forbs are wildlife-friendly materials that could be considered the first choice in buffers where a wide range of benefits are desirable.

Northern bobwhite and songbird populations have declined severely over the past several decades. Recent research has documented that buffers planted into native grasses around crop fields have a positive effect on breeding season bobwhites abundance and other songbirds. Fall bobwhite density also increased on many field border studies in the Southeast. Some of the results of songbird monitoring on field borders in Tennessee and other states will be discussed. For more information on USDA programs and opportunities, please visit http://www.tn.nrcs.usda.gov.

TOUR L: SOIL MANAGEMENT

Cover Crops and Nitrogen

Donald Tyler
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UT Department of Biosystems Engineering and Soil Science

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

In the Southeast, cover crops are usually winter annuals planted in the fall, allowed to grow through the winter and spring, and then terminated close to the time of planting of the following row crop. These cover crops 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 disadvantage 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 nonrotated 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. Cover crops can also result in enhanced biodiversity of soil organisms such as bacteria, fungi, etc.

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. 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 aboveground 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 crops 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. Some advantages and disadvantage of these will be discussed.

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.

Rotation versus Continuous Cropping of Corn, Soybeans and Cotton

Fred L. Allen
Professor
UT Department of Plant Sciences

Richard Johnson
Research Associate II
UT Department of Plant Sciences

Crop rotation and cover crops can be an important part of no-till production, affecting yield as well as reducing erosion and promoting soil and water quality. The objectives of this study are to determine the long-term effects of continuous cropping vs. crop rotations of corn, soybean and cotton in combination with different cover crops on: (1) changes in soil organic carbon and (2) yields of the three crops in a no-till system. The cover crops used are winter wheat, hairy vetch, poultry litter and fallow. The experiment was initiated in 2001 and has been conducted annually since then. The cover crops have been planted on the same strips each year, and the crop rotations (including the continuous cropping treatments) have been conducted in four-year cycles starting in 2002. The third cycle (12 years) will be completed in 2013. In addition to the three continuous cropping treatments, there are 10 crop rotation sequences. This tour stop will present data on the crop yields (Objective 2) of corn, soybean and cotton from continuous vs. rotations in combination with the different cover crops.

Economics of Cover Crops

Jim Larson
Professor
UT Department of Agricultural and Resource Economics

Burt English
Professor
UT Department of Agricultural and Resource Economics

Planting a winter cover crop following cotton or corn harvest can provide benefits in crop management including:

1. Reductions in Soil Erosion — Losses of soil from water and wind erosion can be reduced greatly by establishing a cover crop such as winter wheat after cotton or corn harvest to protect the soil in the late fall, winter and early spring.

2. Improvements in Soil Quality — Cover crops improve organic matter levels in the soil. Beneficial soil organisms such as earthworms increase in the soil with the improved availability of plant biomass for the organisms to decompose. Soil tilth and water infiltration are improved and soil compaction is reduced because of cover crop root growth into the soil.

3. Improvements in Soil Fertility — A vigorous cover crop of a legume such as vetch can replace a substantial amount of nitrogen fertilizer through fixation of legume nitrogen in soils. Nonlegume cover crops, such as winter wheat, can reduce the leaching of nutrients from soils over the winter period. Nonlegume cover crops have the ability to take up excess nitrogen from the previous crop and recycle the nitrogen and available phosphorus and potassium to the following crop.

4. Improvements in Pest Control — Beneficial insects such as lady bugs may increase with the use of winter cover crops. A dense stand of a cover crop such as winter wheat can suppress the growth of weeds through the production of allelochemicals and by shading soils from sunlight.

This presentation discusses the potential costs and profitability of growing cotton and corn following legume and nonlegume winter cover crops. It also compares profit-maximizing nitrogen rates, costs of production, yields and net returns for corn and cotton grown following no cover crop, a vetch cover crop, or a winter cover crop. Cotton and corn yield data from long-term nitrogen fertilizer and cover crop experiments at Milan and Jackson will be used for the economic analysis. The profitability of alternative cover crops can be calculated by changes in yields and the savings of purchased fertilizer and other inputs versus the additional cost of establishing the cover crop. Overall, as the cost of nitrogen fertilizer continues to increase, the potential profitability of using legume cover crops increases. Thus, three

nitrogen fertilizer price scenarios and their impact on the profit-maximizing nitrogen rate, nitrogen costs, and crop net revenues will be discussed. The three nitrogen price scenarios are a low nitrogen price, the current nitrogen price and a high nitrogen price. In addition, there are also other factors that are not easily accounted for in the profitability of cover crops such as enhanced soil quality (e.g., increased soil organic matter, water infiltration, soil tilth, reduced soil erosion) and improved pest control. The effects of U.S. Department of Agriculture Natural Resource Conservation Service Environmental Quality Incentive Program (EQIP) payments on improving the profitability of using cover crops in cotton and corn production to realize the aforementioned benefits of cover crops will also be highlighted in the presentation.

Fertilizing No-Till Corn With Biosolids

Forbes Walker
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UT Department of Biosystems Engineering and Soil Science

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

University of Tennessee Extension soil test recommendations are based on the "sufficiency" approach to managing soil fertility. Under the "sufficiency" approach, fertilizer nutrient recommendations are made only when crop yield increases as a result of adding more fertilizers. These recommendations are based on field research conducted over many years throughout Tennessee. Phosphorus and potassium (potash) recommendations are indexed to soil test results. Nitrogen recommendations are based solely on anticipated crop yield.

Biosolids are an organic residual produced during waste water treatment that can be used as an alternative fertilizer. Biosolids must meet strict quality control criteria established by Environmental Protection Agency regulations before they can be land applied. Biosolids that can be land-applied are categorized either as Class A or Class B for the degree of pathogen reduction. Pathogens are undetectable in Class A biosolids, so these biosolids can be land-applied without any restrictions relating to grazing or crop harvest. Exceptional quality (EQ) biosolids are the highest quality Class A biosolids available and can be applied to any type of land (even on home gardens). In Tennessee, Nashville Metro produces EQ biosolids with a nutrient analysis similar to a 4:3:0 NPK fertilizer.

Before biosolids are used as a nutrient source on crops it is important to conduct research to document the crop yield response. Between 2009 and 2011, UT Extension evaluated the Nashville Metro EQ biosolids (marketed as Top Choice Organic) as a fertilizer for tall fescue dominated pastures at two University of Tennessee AgResearch and Education Centers (Plateau and Greeneville). The nitrogen availability for spring-applied biosolids was 32 ± 7 percent. Forage yield and quality were equivalent to what was obtained with chemical fertilizers at a moderate application rate of 1.5 tons per acre. In 2011, similar work was initiated at Milan to evaluate the performance of EQ biosolids as an alternative fertilizer for no-till corn. Biosolids and chemical fertilizers were surface-applied at planting or three weeks after planting. Nitrogen rates were 150, 170, 190 and 210 pounds per acre. We will report on last season's corn yields and the results obtained for fescue hay between 2009 and 2011.

Ditch-Line Protection and Buffers for Improved Water and Field Quality

Andrea Ludwig
Assistant Professor
UT Department of Biosystems Engineering and Soil Science

Stream bank erosion and channel incision are threats to personal property and may significantly contribute to water quality degradation. Many ways exist to protect stream banks and ditch lines to minimize bank failure, erosion, and excessive scour. The most effective approach to preventing the loss of land due to erosion is to maintain riparian buffers around streams and wet weather conveyances (or ditches). Riparian buffers are areas of land between an agricultural production field and top of bank of a stream or ditch that is planted with grasses, forbs, shrubs and trees. If maintained appropriately, riparian buffers reduce the amount of sediment and other non-point source pollutants carried from fields and into streams by stormwater runoff. Three keys to buffer maintenance are to: 1) sustain a dense stand of vegetation year round through reseeding when necessary and mowing two to three times a year at 6-12 inches tall, 2) stabilize areas of erosion or channeling to prevent flow shortcutting and ensure sheet flow through buffer, and 3) aerate the soil as needed to facilitate infiltration and additional pollutant filtration. Riparian buffers that consist of multiple zones of vegetation are most effective at holding stream banks in place and protecting aquatic habitat. Native grasses and forbs at the edge of field filter runoff, and shrubs and trees along the top of stream banks provide shade that creates a thermal buffer from the sun for sensitive aquatic organisms.

Riparian buffers protect streams from edge of field stormwater runoff, but stream bank erosion may still occur. While stream channel migration is a natural process in most landscapes, stream bank failure and channel incision are often the result of changes in flow contributions upstream. Stream banks and ditch lines need to be inspected regularly to ensure that banks and channels are stable. In the case of localized bank failure (or cut banks), stabilization practices may be installed to prevent future erosion. Bank stabilization approaches vary in scale and materials, but all follow three rules of thumb: 1) protect the toe, 2) cover the face, and 3) buffer the bench. First, protect the bank toe from scouring using large stone or woody debris. The bank toe runs along the bottom of the stream bank, where the stream bed meets the bank, and erosive flow velocity often occurs at this inflection in the stream cross-section. Next, cover the face of the bank with vegetation or other natural materials that create a rough but protected surface. Many woody species can be propagated and established at a new site as "live stakes." If erosion persists and a more resistant surface is needed, root wads or revetments (instead of rip rap) will hold up to higher flows. Generally, a bank slope of 3:1 with established grass vegetation is stable. Use coconut coir fabric matting over native grass seed and straw to hold in place during establishment. Last, buffer the bench (or floodplain) from agricultural practices, such as herbicide spraying, fertilizing and tilling, and establish a planted riparian buffer.

Keeping Nutrients on the Field

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

The combined use of high-yield crops, fertilizers and improved crop management has allowed agricultural production to keep up with demand for food, feed, fiber and biofuels. However, one of the main detriments to increasing production is export of nutrients (primarily nitrogen and phosphorous) from fields to urban and other natural ecosystems, which can have continental scale effects. For example, according to the National Research Council (2009), the largest portion of the nitrogen delivered to the Gulf of Mexico via the Mississippi River came from land under corn and soybean cultivation (52 percent). And the largest contributor of phosphorous was pasture and rangeland (37 percent). Such large outputs of nitrogen and phosphorous are driving the zone of hypoxia in Gulf waters.

The biggest losses of nitrogen from the field occur as nitrate is either leached through the soil profile or lost in runoff. Additionally, biological soil

processes such as the conversion of ammonium to nitrate (nitrification) and the conversion of nitrate to atmospheric nitrogen (denitrification) produce nitrogen trace gases (nitrous oxide) that are also greenhouse gases. Because of microbial biology, seemingly small changes in soil moisture can have large effects on the amount of mineral nitrogen in the soil and its form (ammonium and nitrate). Therefore, alteration in the timing and frequency of fertilization and irrigation can reduce the export of nutrients from the field.

Soil processes, both physical and biological, can be integral to keeping nutrients in the field. Soil organic matter and a functioning microbial community can act as a buffer preventing nutrient losses from the field and as a reservoir of plant-available nutrients, releasing them slowly over time. Conservation tillage, cover crops and crop residue management are all methods that can promote soil organic matter accumulation, which in turn stimulates microbial immobilization and fixation of nutrients to soil mineral particles.

This session will explore the various pathways of loss of nutrients from the field with particular attention paid to the role of water in driving loss and retention of nutrients. Common practices for retaining nutrients also will be discussed.

Stormwater and Row-Crop Production — What's Going Down Stream?

John R. Buchanan
Associate Professor
UT Department of Biosystems Engineering and Soil Science

For row crop producers, the weather is nearly always part of the dinnertime conversation. The production of food and fiber is dependent upon sunshine and rainfall. If we do not receive these two weather elements in the right proportion, a crop failure is ensured. Producers mostly are concerned about the weather during the growing season. However, weather events during the off-season are still important. In the southeastern U.S., most of our rainfall occurs during the winter and spring. We depend on this rain to recharge the reserve of soil moisture that provides water to the crops between summer rain events. However, these offseason storm events also can be responsible for the transportation of soil, nutrients and pesticides off of the fields and into nearby water resources. Stormwater control on farm fields is a full time activity — not just during the growing season.

We usually measure rainfall by depth of precipitation (typically in inches). When we have a depth of rainfall, we also have a volume (gallons, cubic feet, or acre-inch) of water. For example, 1 inch of rain over 1 acre of ground produces 1 acre-inch, 3,630 cubic feet, or 27,156 gallons. A second measure of rainfall is intensity, or rate of rainfall. Typically measured in inches per hour, this is the rate that a volume of water reaches the soil surface. We know that high-intensity rain events produce flooding and can erode tremendous volumes of soil. This phenomenon is easy to explain, there is more water coming in (rainfall) than can be moved away (drainage).

Strong storm events are a big concern for row crop producers. The wind, hail and rain can be very damaging to the crop and to the land. Other than crop insurance, there is very little we can do to protect ourselves against strong weather conditions. Lesser rain events are the focus of this session. Rain events that are more frequent and less intense create less visible damage. However, uncontrolled, these events can slowly rob the land of soil, nutrients and valuable pesticides. Rainwater can transport these products from the field to local surface water. At this point, these products become pollutants.

The soil surface is where stormwater control begins. Water on the soil surface either can infiltrate through the surface, or it can accumulate on the surface. No-till and conservation tillage practices help to provide protection to the soil surface. These practices maintain infiltration so less of the rainfall becomes runoff. With less runoff, there is less soil loss and less nutrient transport. This session will focus on conservation practices that help control stormwater on cropland.

TOUR N: NO-TILL BASICS

No-Till Basics

Richard Buntin
Director
UT Extension Crockett County

Greg Allen
Director
UT Extension Lake County

Jake Mallard
Agent
UT Extension Madison County

William Hart
Associate Professor
UT Department of Biosystems Engineering and Soil Science

Darol Copley
Senior Farm Crew Leader
UT AgResearch and Education Center at Milan

Like the title says, this tour is for those wanting to learn the basic principles of no-till crop production. Though intended for those who are not currently practicing no-till production, experienced no-tillers may still pick up a pointer or two. The information provided will attempt to explain the basics of no-till planter components, settings and adjustments. Information on weed and insect control also will be available. View plots that show what happens when a field is worked too wet or planted too wet. See what effect crop residue has on planting conditions. Our goal is to answer your questions related to beginning no-till production.

TOUR O: CROP VARIETY DEMO

Augusta Seed

Pioneer Hi-Bred

Monsanto

Terral Seed Inc.

UniSouth Genetics

TOUR P: BEST MANAGEMENT PRACTICES FOR ON-FARM STORED GRAIN

Kathy Flanders
Professor
Department of Entomology and Plant Pathology
Auburn University

Jim Sharpe
Southeast Regional Manager
Degesch America

Grain quality never improves during storage. But with a little knowledge it is possible to maintain the quality by minimizing losses to insects, molds and other factors.

Here are some important things to know:

1) Insects will not grow if the grain temperature is below 60 degrees F.

2) The drier the grain, the less problem you will have with insects and molds.

3) Most of the insect problems are homegrown. That is, insects reside in or around the storage bins ready to infest the grain when it is placed in the bin.

4) A grain bin is a dangerous place.

The best management practices are centered on these facts. Here are some best management practices:

1) Clean all grain bins prior to storage to reduce insects and molds.

2) Apply an insecticide on the inside surfaces of the empty grain bin. Also apply the insecticide around the base of the bin on the outside.

3) Keep the area around the bin clear of debris and weeds since these can harbor insects.

4) Make sure the grain is at the proper moisture content before loading into the bin.

5) Do not over fill the bins. Grain should not be placed in the peak of the grain bin. The empty head space is necessary for proper air flow.

6) Level the surface of the grain. The grain "peak" accumulates moisture, and moisture encourages insects and molds.

7) If the grain will be stored for more than a month, consider applying an insecticide on the grain. This is called a grain protectant.

8) Consider applying a "top-dress" treatment to the top 4 inches of the grain.

9) Run the aeration fan to equalize the moisture in the bin, and cool the grain to the surrounding temperature. A grain thermometer can help you determine that the fans have been run long enough. As soon as the weather starts to cool down, run the fan to cool the grain. Keep up this step until the grain temperature is below 60 degrees F.

10) Check the grain frequently for moisture, insect or mold problems. Use a brass grain trier to take samples of the grain, so you can look for insects. Or use some probe traps, which capture insects moving through the grain.

11) If insects are found, it may be necessary to fumigate.

12) Fumigation can be accomplished safely and effectively if you have a fumigation management plan. It is also a legal requirement that you have such a plan.

13) Use a safety harness when entering a bin filled with grain.

14) Make sure someone knows you are entering a bin.

15) Make sure there is no possibility that the unloading auger can be turned on while you are in the bin.

16) Run the fans shortly before entry to minimize any harmful gases or mold spores that have accumulated in the head space.

More information can be found at http://www.aces.edu/dept/grain/StoredGrainInformation.php.

TOUR Q: FORESTRY AND FISHERIES

The High Cost of High-Grading

Larry Tankersley
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UT Department of Forestry, Wildlife and Fisheries

What is High-Grading?
A timber harvest that removes the trees of commercial value, leaving small trees, as well as large ones of poor quality and of low-value species. High-grading reduces the value of the woods by removing the largest, most valuable trees and increasing the composition of the poor quality and traditionally low-value species, e.g., red maple, beech, elm.

How does it occur?
High-grading occurs when landowners sell infrequently, are unaware of the consequences of how the trees are removed and have immediate needs for income. High-grading is also common where we have poor markets for smaller and lower quality trees but good markets for high quality trees. Communication is also confused when terms like selective cutting are used to imply good management while removing the best trees.

Since trees in most wood lots are the same age, cutting the biggest trees does not leave young ones to grow. Rather, these cuttings take out the fastest growing trees, leaving slow-growing, less vigorous trees of the same age as those removed.

Why is it a big deal?
In most cases high-grading results in a greater harvest volume and value from the first cutting, compared to forests managed silviculturally. However, neither harvest volume nor timber quality is sustained over the long run. After a high-grade harvest, the forest provides:
- Less total volume because of slow-growing trees and irregular spacing between them.
- Less volume from large trees of the more valuable size classes (16 inches +, veneer).
- More volume from poor-quality trees and low value species.
- Less frequent opportunities to return for another harvest.

How do you tell if your place has been high-graded? High-grading is highly variable. In some instances it is really not that bad with a lot of pretty good trees left after the cut. In other instances, there is often not much left to work with when all the "good" trees are gone. High-graded woods have:
- Few "good" trees remaining.
- More "poor" trees remaining.
- Patchy distribution, dense clumps, wide openings.
- Lots of area in skid trails.

What to do?
Hire a competent forester to:
- Develop a plan.
- Mark trees to remove or keep.
- Require good skidding.
  - Mark trails.
  - Include penalties in sale contract.
- Regularly inspect the logging job and communicate with the crew.

Restoration Strategies
If your forest has been high-graded, you need to improve the growing stock by favoring better species and encouraging good spacing.

How we do this will depend on the extent of the high-grading. The extent of the high-grading will depend on the number of desired stems left after the harvest.

Where more than 50 good trees per acre are left, you are in pretty good shape and can do a bit of improvement cutting and let the trees grow. Where you have 20-50 good trees remaining you should consider some type of regeneration cut in the near future, merchandising or deadening larger residual trees and releasing desirable seedlings and sprouts.

Where you have 5-20 good trees per acre left, you are definitely looking to regenerate the stand and even consider supplemental planting.
Where less than 5 good trees per acre are left you may be out of the timber business or looking to regenerate or plant.

Insect Pests of Tennessee Timber — An Update

Adam Taylor
Associate Professor
UT Department of Forestry, Wildlife and Fisheries

Insects are a normal part of forest ecosystems. For the most part, trees co-exist successfully with insects. Stressed or old trees more often die with insect infestations rather than because of insect attack directly. However, there are a few high-profile insect pests of trees that are worth discussion.

Walnut twig beetle. *Pityophthorous juglandis* is a small beetle that carries a fungus (*Geosmithia morbida*) that causes cankers in the cambium of walnut species. Numerous cankers gradually coalesce to girldle the tree, eventually killing it. This thousand cankers disease (TCD) has been observed killing many walnut trees in the western United States. In 2010, TCD was confirmed on black walnut trees in Knoxville for the first time east of the Mississippi. It has subsequently been found in nearby areas in Tennessee, and in Pennsylvania and Virginia. No proven treatments are available, and the potential for spread is not yet known. Eight counties in East Tennessee are subject to a quarantine on walnut wood products. Monitoring, treatment and phytosanitation research efforts are ongoing.

Emerald ash borer. *Agrilus planipennis* was first discovered in Michigan in 2002. It is an exotic pest, believed to have been introduced from Asia through wood packaging material. The insect attacks the cambial layer and rapidly kills ash species. It has spread to numerous eastern states including Tennessee (2010). No effective insecticide treatments exist for this pest, and mitigation efforts are focused on limiting its movement by restricting the transport of infested wood products, especially firewood. Thirteen counties in East Tennessee are subject to a quarantine on ash wood products.

Southern pine beetle. *Dendroctonus frontalis* is a native insect pest of pine trees. The beetles tunnel in the cambial region, eventually killing the tree. Outbreaks of the insect are cyclical (about every 12 years) and are a greater risk to stressed trees. Numerous trees in one location can be affected, and the dead trees are rapidly degraded by decay and stain that reduce the wood's commercial value. Managing this pest involves practices that encourage tree vigor and sanitation. Monitoring efforts are ongoing; predictions for this year are for low activity.

Hemlock wooly adelgid. *Adelgis tsugae* is an exotic, aphid-like insect that attacks hemlocks. It was first discovered in Tennessee in 2002 and has been spreading rapidly throughout the range of hemlocks. The insect attacks the foliage and can kill infested trees in four to 10 years. Insecticidal sprays and injections can be effective but re-infestation of the pest is possible. Biological control through the release of predatory beetles is being attempted. Some states have quarantines on hemlock wood and nursery stock that affect Tennessee.

How to Successfully Regenerate Oaks Through Natural Reproduction

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UT Department of Forestry, Wildlife Fisheries

To regenerate oak and for oak to be present in future stands, sufficient size and number of oak advance reproduction must be present before the overstory is removed. Often though, advance regeneration of oak is present, but is very small in stature and will not grow fast enough to compete with faster growing vegetation. A midstory removal is used to provide adequate sunlight to promote the growth of oak advance reproduction (intermediate light tolerance) and discourage growth of shade intolerants (yellow-poplar) and shade tolerant species such as beech and maple. Once oak seedlings are of sufficient size and number, the overstory can be removed in stages (shelterwood) or entirely (clearcut) to release the oaks. Regenerating oaks is a process more than an event because sufficient size and number of oak advance reproduction must be cultured prior to the regeneration harvest so oak can compete with other species. Thus, oak advance reproduction must be developed over time (a process of establishment, development and release) rather than just expecting oaks to compete successfully from seed after a regeneration harvest (an event).

Recreational Pond Management

Ron Blair
Director
UT Extension Henderson County

Tennessee has approximately 200,000 small lakes and ponds. With proper planning and management, landowners can enjoy years of good fishing, enhancement of wildlife habitat, and other recreational opportunities.

While a well-managed pond can provide aesthetics and increased property value, a poorly managed pond can be a source of constant aggravation and costly remedies.

Proper planning begins well before land preparation and site selection. Managing this new or existing pond requires a base knowledge of aquatic plants, animals, nutrient management and harvesting strategies.

Landowners attending this session will learn key management steps for weed control, maintaining balance, improved water quality, enhancing wildlife and avoid common mistakes that prevent sustained fishing and recreation in small lakes and ponds.

Exotic Invasives: Coming Soon to a Location Near You

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UT Department of Forestry, Wildlife and Fisheries

An exotic invasive is a species that has been introduced to a location, area or region where it did not previously occur naturally; becomes capable of establishing a breeding population in the new location; and grows into a pest, threatening the local biodiversity. Since the mid-1800s, exotic invasive pests have experienced exponential growth in the United States, initiated through international trade and exacerbated with rapid methods of transportation. In the forestry community, some of the more traditional, visible and problematic species include kudzu, privet, tree of heaven and the elm bark beetle (vector for the Dutch elm disease). Recently in Tennessee other exotic invasives are emerging, including emerald ash borer, Bradford pear, tall fescue, Japanese stiltgrass, woolly adelgid and wild boars. The term exotic invasive is somewhat subjective. Not all exotic species are considered pests, and therefore invasive. Some are even viewed as beneficial. Examples include ringneck pheasant, orange daylilies, European honey bees, cotton and even domesticated cats. Still, many exotic invasives interfere with both the natural ecology and the production of food and fiber. In some cases, their effect can be enormous and even threaten extinction of native species. Further, the investments for control can be enormous, increasing the cost of societal goods. This presentation creates an awareness of the problem of exotic invasive pests in woodland settings, helps identify the major pests, and suggests means of their control. With 53 percent of Tennessee's landscape covered in trees and with a forest industry so dependent upon those trees, both the growers (landowners) and the receivers (society) should be aware of the problem. Correction begins with awareness.

TOUR R: FARMERS VS. HUNGER

Chuck Danehower
UT Extension Area Specialist — Farm Management

Sponsored by Tennessee Soybean Promotion Council and Gibson County Hunters for the Hungry. Other sponsors will be listed at the Field Day.

The Farmers vs. Hunger tour 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 that hunger. This stop features a hands-on activity where participants will participate in an assembly line and assemble a soy meal protein and vitamin-enriched macaroni and cheese product that is a substantial meal for children and adults. The soybean ingredient is a vital component of this meal and helps provide a nutritious and affordable meal. Soybeans are grown on 1.3 million acres in Tennessee and are the largest row crop in the state.

In Tennessee, 17.6 percent of the state's population is food insecure and can't afford enough food to consistently meet their basic needs. Children are the hardest hit group as 25.1 percent are classified as food insecure. In Gibson County, home of the Milan No-Till Field Day, 19.8 percent of the population and 27.2 percent of the children are considered food insecure. The meals packaged at this stop 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.

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