UT AgResearch

25th Milan No-Till Crop Production Field Day

TOUR REPORT

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TOUR A – BIOENERGY OVERVIEW

Bioenergy: Where We Are and Where We Should Be

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The expansion of biofuels has increased the utilization of grains, oilseed by-products and sugar. Coincidentally, prices of agricultural commodities have substantially increased. Changes in land use driven by high prices are pressuring the expansion of agriculture into environmentally sensitive areas. Such expansion is leading some to question the sustainability of biofuels as a desirable source of energy.

However, the increased utilization of agricultural commodities for biofuels can not completely explain the higher prices; indicating that there are other structural forces in agriculture, besides biofuels production, that need to be included in the debate. Land use, crop mix, crop production methods and changes in food consumption patterns must also be part of the biofuels debate.

It is very important to situate biofuels within the context of what is happening in agriculture, and to discuss avenues to enhance the sustainability of agriculture and biofuels.

A key role in enhancing the contribution of biofuels to economic and environmental sustainability, and at the same time to contribute to food security, is the implementation of second-generation biofuels, and the utilization of switchgrass and other cellulosic feedstocks.

Second-generation biofuels and switchgrass, are going to reduce the pressure that current ethanol production is exerting into a single feedstock – corn. Second-generation biofuels will distribute this pressure through the agricultural and forest sectors, softening the impacts upon feed and food prices, and enhancing the contribution of agriculture to the energy supply.

Additionally, current crop price increases could create the right economic environment to invest in new agricultural practices and alternative inputs with the potential to simultaneously increase production and improve the environmental performance of both crop agriculture and livestock production.

Finally, potential changes to current legislation will be discussed. This includes government incentives, trade and mandates.

Carbon Storage in Switchgrass

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The objective of our research at Milan is to understand how switchgrass affects soil carbon and how management decisions such as choice of cultivar or fertilization regime affect the storage of carbon in soil by switchgrass. Our work is aimed at understanding the fundamental processes that control carbon storage in soils so we can better manipulate those processes to enhance carbon storage. We are interested in enhancing carbon storage in soils because increasing soil carbon is an attractive way to reduce atmospheric CO_2 and thus lessen global warming. Carbon storage in soils is the process of pulling CO_2 from the air

(using photosynthesis) and putting that carbon into the soil in a form that stays in the soil for many years.

While increasing carbon storage in soils can't by itself solve all our greenhouse gas/global warming problems, it can make a major contribution and has many desirable features – low or no cost, improved soil quality and improved productivity. This research is sponsored by the U.S. Department of Energy's Office of Science. It is a collaborative, team effort involving the University of Tennessee and three Department of Energy (DOE) Laboratories – Oak Ridge National Laboratory in Oak Ridge, TN; Argonne National Laboratory in Downers Grove, IL; and Pacific Northwest National Laboratory in Richland, Washington.

We chose to study switchgrass because (1) it could become a major new crop if the U.S. keeps its commitment to produce 36 billion gallons/yr of biofuels by 2022 and (2) switchgrass is a native prairie grass with a deep perennial root system that is known to increase soil carbon. So the opportunity exists for switchgrass to help reduce global warming by both displacing fossil fuels and increasing soil carbon.

Our field research at Milan has been focused around five themes:

1. Aboveground and belowground switchgrass productivity – How much carbon is being taken from the atmosphere and how is the plant allocating that carbon? How much goes to the stem, the leaves and roots and how much is left in the field after harvest? How big is the litter layer?
2. Soil structure – Soil structure can be thought of as the "clumpiness" or "crumbliness" of the soil. Our research involves what controls the structure of soil. How does soil structure affect the longevity of soil carbon? How does management affect soil structure?
3. Microbes – How do microbes, both bacteria and fungi, in the soil decompose the raw plant material? Which microbes are there? How do different cultivars or fertilization regimes affect microbial communities?
4. Humification – Humification is the process by which carbon compounds become chemicals that are resistant to decomposition. Which conditions promote humification? Where in the soil profile is humification occurring? How does management affect humification?
5. Carbon movement in the soil profile – How does carbon move deeper into the soil profile? Since we know deep soil carbon lasts longer, if we understood which physical/chemical conditions move carbon deeper into the soil, we could increase soil carbon storage.

We are investigating these questions by taking detailed measurements in a cultivar trial and in a fertilizer trial (0, 60, 120 & 180 lbs N/yr) that the University of Tennessee established in 2004. We started our fieldwork in spring 2007, focusing on the cultivar trial to test methodology and becoming more familiar with switchgrass systems in a West Tennessee setting. In 2008 and 2009, we are focusing on the fertilizer trial, where we are taking measurements not only from soils and plant material, but also on soil-water chemistry. In addition to carbon, we are also tracking nitrogen, because it is important in understanding carbon dynamics.

We are still analyzing the first-year data from the cultivar trial, but we do have some results to report. We found that 53 percent of total biomass of these 4-year-old switchgrass plants was in the roots in July, just as the plants were starting to set seed, and plants were 6 to 7 feet tall. After July, although height growth stopped, the plants continued to increase in mass both above and belowground. The total mass of roots in October was 8.0 dry tons/acre and the aboveground portion of the plant (stems, leaves) was 9.3 dry tons/acre. The nitrogen concentration of the

aboveground plant tissue decreased between April and October, from 0.44 to 0.31 percent. Even though these are low nitrogen concentrations, harvesting all the aboveground material would still remove 55 pounds of N per acre from the site. The data we are collecting should be helpful in quantifying the carbon storage and GHG benefits of producing switchgrass for biofuels and in providing insight on how to manage these systems for enhanced carbon storage as well as high yields.

University of Tennessee Biofuels Initiative

Kelly Tiller, Director of External Operations, UT Office of Bioenergy Programs
Sam Jackson, Research Associate, UT Office of Bioenergy Programs

The University of Tennessee Biofuels Initiative (UTBI) is a research and business model presented by the University of Tennessee that will position the state as a leader in the nation's efforts toward reduced dependence on petroleum.

The plan outlines the construction and operation of a pilot biorefinery to demonstrate and refine biofuels production technology in East Tennessee. The plant will produce cellulosic ethanol. Unlike traditional corn ethanol, cellulosic ethanol is fuel made from biomass sources such as switchgrass, wood chips and other non-food plant material. Because it does not compete with food or feed uses, planting dedicated energy crops like switchgrass on marginal cropland is widely seen as a way to produce affordable, sustainable and renewable biofuels without raising food or feed costs.

Cellulosic ethanol production can also benefit the environment, since it emits fewer greenhouse gasses than traditional gasoline. Many dedicated energy crops, such as switchgrass, have positive effects on the environment, including carbon sequestration and soil stabilization.

Funding for the UTBI comes via a $70 million commitment over five years from the state of Tennessee. In 2007, the Tennessee Legislature appropriated $40.7 million for capital and $8.25 million for research, farmer incentives and operating expenses for the Biofuels Initiative. Also contributing to the effort will be UT's technology partner(s) in the development of the cellulosic biorefinery.

Part of the state's commitment includes funding for a switchgrass incentive program. This comprehensive program will pay farmers near the plant location on a per-acre basis to produce switchgrass in advance of a mature market for the new energy crop. Participating farmers will receive high-quality switchgrass seed for planting, as well as research and technical support related to switchgrass production.

To operate at full capacity, the plant will require many tons of biomass per day. With that in mind, the university has contracted with local farmers, planting 723 acres of switchgrass in the spring of 2008, with an additional 2,000 to 3,000 acres expected to be planted in spring 2009 and another 2,000 to 3,000 or more acres to be planted in spring 2010. Subsequent rounds of applications will be accepted for switchgrass production in the pilot program for the 2009 and 2010 planting seasons.

Commercialization
With continued improvements in production technology and economics, it is expected that government and private partners would invest in multiple commercial-scale biorefineries across the state. Potential benefits from commercial implementation of the business model include numerous new jobs, increased state and local tax payments, new farm income and many others. Tennessee has the potential to produce 1 billion gallons of cellulosic ethanol. This level of production would displace approximately 30 percent of Tennessee's present gasoline consumption.

Extension and Farmer Role in Bioenergy

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Jon Walton, UT Extension Area Specialist – Biofuels, Eastern Region
Clark Garland, Professor, UT Agricultural Economics

Farmers in Tennessee are working in partnership with personnel in the Institute of Agriculture and other partners to develop switchgrass as a dedicated energy crop. Two major switchgrass for bioenergy projects are underway. The West Tennessee Switchgrass Project is being conducted in cooperation with five farmers in Henry and Benton counties, the U.S. Department of Energy and Alabama Power. The University of Tennessee contracted with the farmers to establish, grow and harvest switchgrass for biomass on 91 acres. This is the fourth and final year for the official project. Goals of this effort include demonstrating switchgrass production under a variety of conditions and evaluating agronomic, logistics, energy conversion and farming systems issues associated with developing a biomass energy industry. Alabama Power is producing green electricity from the switchgrass. These on-farm demonstrations and other research conducted by UT personnel provided valuable information and a foundation for producing switchgrass as part of the Tennessee Biofuels Initiative.

Switchgrass will be used as a major feedstock for the new cellulosic biofuels industry in Tennessee. A 17-member, multi-disciplinary Biofuels Farmer Education Team provides leadership to overall educational programming with the Tennessee Biofuels Initiative. The team and other authors have developed a series of eight factsheets ranging from "Growing and Harvesting Switchgrass for Ethanol Production in Tennessee" to "Biofuels 101." The team also developed guideline switchgrass budgets and switchgrass-contracting documents. In the fall of 2007, six listening sessions and focus group meetings were conducted with farmers to obtain their input on desirable features to include in a switchgrass production and harvesting contract. Farmers have expressed a strong interest in growing switchgrass for the production of ethanol. In January 2008, more than 180 potential growers participated in switchgrass production interest meetings.

Switchgrass for biomass is a new crop in East Tennessee. In the farmer focus group meetings and contracting sessions, farmers expressed major concerns about production, price and financial risks. Between October 1, 2007 and January 9, 2008, variable input costs associated with switchgrass establishment increased more than 24 percent and projected annual variable expenses associated with switchgrass production and harvesting increased by more than 20 percent. Major efforts have been taken to help farmers manage risks associated with switchgrass production. Initial contracts have been finalized with 16 farmers, and switchgrass production is underway on 723 acres. The acreage of switchgrass per farm ranged from 15 to 136 acres. The Initiative's goal is to plant an additional 2,000 acres in the spring of 2009 and another 4,000 acres in 2010. The initial contracts cover a three-year period. To receive a contract, the farm must be within 50 miles of the cellulosic ethanol research facility, to be located in Vonore, Tennessee. In the first round of contracts, farmers will receive $450 per acre plus a potential energy adjustment based on the change in diesel fuel prices.

The market for switchgrass as an energy crop remains limited. Producing switchgrass for energy generally occurs under some form of contractual arrangement with the end user. Having a firm and satisfactory contract in place is recommended prior to planting switchgrass for bioenergy.

TOUR B – SWITCHGRASS PRODUCTION AND MANAGEMENT

Switchgrass Production Research

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Roland K Roberts, Professor, UT Agricultural Economics
Daniel F. Mooney, Research Associate, UT Agricultural Economics

Scientists, industry leaders and, of course, agricultural producers are interested in switchgrass as a potential feedstock for the emerging biofuels industry. While switchgrass may soon become an attractive crop for some farmers, information on optimal production practices is lacking for soils and landscape positions common in Tennessee. Experiments were initiated in Milan, TN to obtain information on varietal performance, optimal seeding and nitrogen fertilization rates, and estimated production costs. Four locations were selected, including (1) a moderately well-drained level upland, (2) a well to moderately well-drained bottomland, (3) a moderately well to somewhat poorly drained eroded sloping upland, and (4) a poor to somewhat poorly drained bottomland. The two well-drained locations represent high-yielding environments. The two less well-drained locations have a root restrictive hardpan and represent intermediate and marginal yield environments, respectively.

In the first experiment, plots were established in 2004 with the Alamo variety using five different seeding rates of 2.5, 5.0, 7.5, 10.0 and 12.5 lbs/acre pure live seed (PLS). Starting in the second growing season, N fertilizer was applied annually at rates of 0, 60, 120 and 180 lbs/acre. Plots were harvested annually after the first killing frost. In 2006, the well-drained level upland location had the highest yields, between 9.4 and 10.7 tons/acre. The lowest yields were obtained at the poorly drained bottomland location between 3.5 to 5.2 tons/acres. Yields for 2007, a dry year, will also be presented at the field days. The effect of seeding rate varied slightly across locations, but lower rates were sufficient. Yield response to N was more variable, with 60 lbs/N sufficient on the well-drained locations and slightly higher N rates on the poorly drained location.

Switchgrass production and harvesting costs were estimated for 5- and 10-year stand lifespans. Cost estimates for the 10-year lifespan ranged from $45/ton in the well-drained upland location to $70/ton in the marginal, poorly drained flood plain. A breakdown of these costs into major components showed that harvesting costs represented 41-56 percent of total costs. Establishment and annual maintenance costs represented 7-9 and 10-13 percent of total costs, respectively. Land costs represented the remaining 29-31 percent of total cost. Costs for the 5-year stand lifespan were $5/ton to $8/ton higher relative to the 10-year lifespan.

Prior to 2004, the lowland Alamo variety was shown to be the most suitable commercially available variety. In a second experiment at the same locations, Alamo was compared with three improved cultivars, two from Dr. Joe Boughton at the University of Georgia and one from Dr. Charles Taliaferro at Oklahoma State University. All three improved cultivars were more vigorous in growth habit as compared to Alamo in the first two years of production. By the third year of production, Alamo yields had equaled or surpassed yields of the improved varieties on all but the poorly drained bottomland location.

As switchgrass becomes a viable alternative crop, we hope to provide effective and economical production recommendations to Tennessee

producers. In addition, future research based on these findings will seek new strategies to increase yields and minimize production costs.

Switchgrass Weed Control

Neil Rhodes, Professor, UT Plant Sciences
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High and volatile energy prices, coupled with national security concerns, have increased the interest in a greater degree of energy independence in the United States. In his 2007 State of the Union Address, President George Bush outlined his "20 in 10" target, which would replace 20 percent of our nation's transportation fuels with renewable sources by 2017. Similar targets, such as the United States Department of Energy's "30 by 30" goal, have also been articulated in recent years. Biofuels, according to some experts, can play a large role in this process. Currently, corn-based ethanol and soy-based biodiesel are two of the most widely produced biofuels. In 2006, the United States produced 4.9 billion gallons of ethanol, primarily from corn. It is widely acknowledged, however, that there is a limit to corn-based ethanol production, due to potential disruption of the agricultural sector, high input costs and relative lack of efficiency of producing ethanol from corn. Because of this, interest has increased in the manufacture of ethanol from cellulose produced by herbaceous and woody plants. Because of its wide geographic adaptability, relatively low input requirements, ability to grow well on marginal soils and high tonnage per acre, most current research and development is with switchgrass (Panicum virgatum).

Our previous experience with switchgrass establishment for wildlife food plots revealed that the stand is slow to establish, and weed problems during the first year can be severe. While it was found that most broadleaf weeds can be effectively managed with existing herbicides used in grass pastures and hay fields, grass weeds such as large crabgrass, broadleaf signalgrass, goosegrass and johnsongrass are more challenging. Weed control, particularly grass control, is critical during the first two years of establishment. Outright stand failures can occur if weeds are not effectively managed during this period.

Greenhouse tolerance studies conducted at Jackson in 2006 revealed that Envoke (0.5 oz/A), Beacon (1.52 oz/A), Oust (1 oz/A), Select (6 oz/A) and Poast (16 oz/A) severely injured (80 percent or greater) seedling switchgrass. Accent (0.67 oz/A) and Osprey (4.75 oz/A), however, were much less injurious (less than 20 percent). A field study conducted at Milan the same year showed that Accent (0.67 oz/A) effectively controlled broadleaf signalgrass (greater than 80 percent) with no injury to seedling switchgrass. In a 2007 field study at Milan, Accent (0.67 oz/A), Accent (0.67 oz/A) + Direx (1 pt/A), atrazine (2 pt/A), and Plateau (4 oz/A) caused 13, 0, 17 and 30 percent injury, respectively, to seedling switchgrass. Goosegrass control was 50, 7, 53 and 66 percent, respectively.

Research is currently being conducted here at Milan, and in several locations in East Tennessee on Research and Education Centers at Knoxville and Greeneville, and on fields owned by farmer cooperators. Trials currently underway are focusing mainly on the use of Accent, Paramount, Resolve and various combinations of these graminicides with atrazine, for control of crabgrass, broadleaf signalgrass, johnsongrass and other weeds, and for safety on switchgrass. We are also currently working closely with the Tennessee Department of Agriculture and the United States Environmental Protection Agency in an attempt to secure registrations that would allow the use of some of these herbicides in switchgrass.

A 24(c) label for atrazine has recently been obtained.

Integrating Forage and Biofuels

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*Pat Keyser, Associate Professor and Director, UT Center for Native Grasslands Managem*ent

Switchgrass is a warm-season perennial grass native to much of the United States. Over the last few years it has received renewed interest as a renewable fuel source, since it produces large amounts of cellulose that can be digested and converted to ethanol. The high yields and environmental adaptability of switchgrass make it an excellent choice for biofuel production.

While there has been a great deal of media attention on the merits of switchgrass as a biofuel feedstock, many are less familiar with the potential of switchgrass as a forage crop. Switchgrass, like a number of other native warm-season grasses (NWSG), can actually produce high-quality forage. Yields of 2-5 tons per acre can be expected, depending on rainfall and soil type, as well as other environmental conditions. The nutrient content of this forage can be as high as 16-17 percent crude protein, if harvested correctly.

Characteristics that make switchgrass attractive as forage crop

1. High yields − Switchgrass grown for forage can produce up to twice as much as tall fescue on an acre of land. Research in Tennessee has shown that, if grown exclusively for hay, 4-5 tons per acre are not uncommon. If switchgrass is planted primarily for biofuels production, there is potential to harvest the early growth through haying or grazing, then managing the remainder of the season's growth for biofuels.
2. Summer production − Since switchgrass is a warm-season grass, it is adapted to hot, summer conditions. As peak growth occurs from May through September, it is easy to produce hay because of better drying conditions. It is not unusual to find switchgrass hay that is better quality than the average tall fescue hay. This is not because switchgrass as a species is better than tall fescue, but because haymaking conditions are better during the switchgrass-growing season and because rain and cool temperatures often delay cutting tall fescue. Delayed tall fescue harvest results in decreased protein and energy.
3. The summer growth of switchgrass also makes switchgrass an excellent forage for grazing. Since most cattle operations in the Mid-South use tall fescue as their primary pasture grass, there is limited forage production during summer. This limited production reduces the performance of grazing cattle, and may lead to overgrazing and weakened stands of tall fescue. Switchgrass can provide good-quality forage for grazing animals and provide the opportunity to rest tall fescue pastures during a stressful time of the year.

Research has shown switchgrass can be grown successfully as both a biofuel and forage crop. There is no need, however, to grow it as only one or the other. There is the possibility of having switchgrass as a "dual purpose" crop. The early growth of the forage, which is generally the highest quality, can be hayed or grazed. The later growth can be allowed to mature and harvested after frost as a biomass crop. Biomass production will be lower under this scenario, but, depending on the objectives and needs of the producer, this may be a useful strategy.

TOUR C
BIOFUEL FEEDSTOCKS – STORAGE, PROCESSING AND ALTERNATIVE

Switchgrass Harvest and Storage Costs and Bale Quality

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Daniel F. Mooney, Research Associate, UT Agricultural Economics

Switchgrass may have great potential as a feedstock for energy production and is well-suited to growing conditions in Tennessee. As with hay crops, weather will affect how much switchgrass is produced in any one year. In addition, weather will also affect switchgrass dry matter and quality losses during storage before it is shipped to the processing facility. Therefore, information is needed on the impact of different harvest and storage methods on switchgrass production costs in Tennessee. This research uses data from a switchgrass harvest and storage study conducted at the Research and Education Center at Milan (MREC) located in Milan, Tennessee.

The main objectives of this project are to:

1. Provide a cost-effective method for estimating the composition of stored biomass,
2. Enable future feedstock supply personnel to visually estimate the quality of stored biomass without having to repeat expensive wet chemical analyses and rigorous sampling and archiving protocols,
3. Provide compositional analyses for correlation of potential ethanol content with weather, percent moisture, moisture mitigation strategy, storage format, and storage location,
4. Maintain an archived series of biomass samples that can be used to evaluate specific storage experiments for later NIR, thermo-chemical, or other analyses, and
5. Calculate switchgrass harvest and storage costs under alternative treatments and conditions (English, et al. 2008).

Variables analyzed in the study include harvest method, storage time and storage method. Harvesting methods included round (4x5') bales and rectangular (4x4x8') bales. Storage times in the experiment were: 100±10 days, 200±10 days, 300±10 days, 400±10 days and 500±10 days. Storage method treatments included covered and uncovered bales on one of three storage surfaces: (1) well-drained ground, (2) a gravel surface, or (3) a wooden pallet. The tarps used for the covered bale treatments were 5-ft by 9-ft 8.25 millimeter ultraviolet-resistant black polyethylene plastic tarps affixed with nail clips. Tarps are reusable with a useful life of five to 10 years. Additional bales were wrapped in polyurethane for ground storage and will be sampled at 200, 400 and 500 days.

Bales for each treatment were obtained from switchgrass plots at the RECM. The bales for the experiment were placed into the storage experiment on January 24-25, 2008. Each of the square and round bales were randomly selected and placed into a treatment. Each treatment was replicated three times. The 108 large round bales and the 78 large square bales were weighed and samples for determining dry matter were drawn from each bale as they were placed into storage. At each storage time interval, three bales representing a particular treatment are weighed, mechanically separated in two halves, photographed and proportionally sampled based on a visual estimate of weathered areas. Costs of harvest and handling for each treatment are estimated.

During the first sampling period, round covered bales showed little signs of weathering, and bale weights decreased by an average of 37 lbs/bale. Uncovered round bales showed 5"-10" of weathering along the bale's outer edge, and average weights increased an average of 117 lbs/bale. Weathering on covered rectangular bales was more variable, with significant decomposition observable along the bottom edge and exposed sides of most bales. Average bale weights decreased 113 lbs/bale. All uncovered rectangular bales became waterlogged, with average bale weights increasing 1360 lbs/bale. Mold was also observable in many uncovered rectangular bales upon mechanical separation. Data collected from future sampling periods and compositional analysis will provide Tennessee farmers with optimal on-farm switchgrass storage solutions.

Switchgrass Harvest/ Processing Equipment: Systems Strategy

Al Womac, Professor, UT Biosystems Engineering & Soil Science
Willie Hart, Professor, UT Biosystems Engineering & Soil Science

The success of the biofuel industry depends to a large extent on the efficient supply of an enormous amount of consistent, predictable feedstock to the plant. For example, the 5-million gallon/ year demonstration plant of the Tennessee Biofuels Initiative – which is 1/10 or smaller than a viable commercial-scale plant – will require the annual equivalent of a stack of switchgrass (let's say in 4x4x8' square bales) that is 32 feet tall (this is 2x higher than most stacks) over an area of more than 10 acres! How do we efficiently supply this? Let's start by looking at the industrial plant needs.

Biofuel industrial plant processes generally require the input of chopped or ground biomass ranging from 1 inch to 0.04 inch (1 mm) nominal particle sizes into the "throat" of the process. Generally, the smaller the particle size, contact improves between biomass and pretreatment liquids, which increase conversion efficiency to make ethanol. Also, smaller particles require shorter contact time, smaller vat space and a smaller industrial plant footprint. One approach tried grinding baled biomass in multiple passes through a tub grinder – which is a short-term option, but in the long term it is inefficient and creates a high amount of dust losses.

Our research has shown that a two-stage process with knife-mill chopping followed by hammer-mill grinding can be tailored to produce desired particle size distributions of switchgrass, corn stover and wheat straw. A demonstration trailer with knife mill, hammer mill and disc refiner was used to directly measure mechanical input energy into the size reduction process. Energy efficiency (typically 36-288 MJ/MT) was extremely sensitive to tonnage throughput without blockage of biomass, usually on the inlet side. Generally, optimum throughput was about 70 percent of maximum to enable wider rpm operation (reduced energy with reduced rpm) and to minimize blockage. The increase in tonnage throughput rate diminished as speed increased, thereby resulting in less energy efficiency. This dispelled an industry notion that increased speed proportionately increased tonnage-throughput at similar energy efficiency.

A model of an alternative linear knife grid was tested and it only required 4.5 and 3.6 MJ/dry Mg on high-moisture (51 percent wet basis) and low-moisture (9 percent w.b.) switchgrass, respectively. Scaling up the linear knife grid device for larger product sizes greater than 100 mm can be readily adopted. Linear knife grid is an efficient first-stage size reduction, especially well-suited for packaged (baled) biomass. More details are at http://biomassprocessing.org/

Now consider the systems strategy, starting at harvest. We have both hay and forage equipment on display to demonstrate our direction. Due to

relatively high yields of switchgrass (4-5+ ton/acre), using standard hay equipment has challenges due to the low ton/h (<20) capacity for which hay equipment is designed. This causes issues with raking, feeding and slow baler speeds (and low ac/h), to name a few. Our ongoing research is determining how to optimize bale systems – but it should be realized that there are inherent limitations in capacity. These limitations and the promise of increased switchgrass yield potential lead us to consider alternatives. Forage systems may play an important role, because they have high ton/h capacity, and they are providing the all-important first-chop process. Our ongoing research is addressing how to optimize forage systems for switchgrass, including low-cost storage and transport. It should be noted that field-chopped switchgrass will likely not rely on ensiling, because of added issues with storage and variable product degradation between silo and industrial plant (besides the fact of hauling a high amount of water). Also, our Biosystems Engineering students have developed a scaled-model of a cotton module builder and loader to use as a tool addressing switchgrass module integrity. Full-scale modules of switchgrass tend to fall apart. This may be a viable option for bulk handling.

So, the efficient, low-cost supply of biomass should consider the entire supply system – from harvest to processing. The final solution may combine the best attributes of various systems to form one integrated system. Using this system's strategy considers the impact all along the supply chain.

Alternative Biofuel Crops

Dennis West, Professor, UT Plant Sciences
Fred Allen, Professor, UT Plant Sciences

In the United States there is a vast amount of interest in reducing our nation's dependence on foreign oil. One part of the solution is to produce biofuels from renewable plant feedstocks. At present, corn is the primary feedstock for ethanol production in the U.S. and soybean is the primary feedstock for producing biodiesel. However, there are considerable research efforts in the U.S. and other countries being devoted to other plant sources as feedstock for both ethanol and biodiesel. Switchgrass has received the most attention in the U.S. as a non-food crop feedstock for making ethanol from cellulosic material. Several presentations at this field day showcase the various research efforts that are underway at UT dealing with everything from production to the conversion process of switchgrass to ethanol.

This presentation will present some pros and cons of other alternative crops that are being considered for producing ethanol and biodiesel. For example, Brazil has used the syrup from sugarcane as their primary feedstock to make ethanol since the mid-1970s. Because sugarcane is a tropical crop, it is limited in its geographic areas of production in the U.S. to Southern states such as Florida, Louisiana and Texas. On the other hand, there is considerable interest in a similar crop, sweet sorghum, because it is a temperate crop that is adapted to large areas of the U.S. Because plants are composed of high amounts of cellulose and lignin, basically any plant material can be used as a feedstock for cellulosic ethanol production, including municipal waste-wood. In addition to switchgrass, another plant that is receiving a considerable amount of research attention is Miscanthus gigantus. It too is a perennial grass that produces a large amount of biomass each year and can be used as a feedstock for cellulosic ethanol.

In terms of biodiesel production, any plant oil or animal fat can be used as a basic feedstock to convert to biodiesel. For that reason, most any of the oil seed crops such as Canola, sunflowers, cotton, flax, oil palm, olives, castor bean, Camelina and others are alternatives to soybean. For example, it is reported that Brazil is looking strongly at castor bean as an oilseed crop

feedstock for biodiesel production, because it is a non-food crop that has a fair amount of drought and heat tolerance and can be produced in semi-arid regions. In most countries, the oilseed crops under consideration are the ones that are grown and best adapted to that region. Some of the pros and cons for the above crops will be given during this presentation.

The most likely future scenario for biofuel crops is that there will be multiple crops used as feedstocks for both ethanol and biodiesel. The ones used in any particular region of the U.S. or other parts of the world will be those that are the most productive and well-adapted to that particular region.

Cotton Production in 15- and 30-inch Rows

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Tennessee cotton producers are interested in planting in narrow rows and skip-row patterns as possible ways to improve their production systems. Planting in narrow rows may be suitable for fields where wide-row (38-40 inch) cotton may not lap the row middles. However, ultra-narrow row (UNR) cotton planted in 7½- to 10-inch rows may pose problems due to seed costs and fiber quality discounts associated with stripper harvesting. It is possible, however, to spindle-pick cotton in 15-inch rows with a John Deere Pro-12™ VRS cotton picker. With this system, producers can gain some of the yield and earliness advantages of UNR without sacrificing fiber quality. With the high cost of planting seed, gene technology and seed treatments, producers want to plant no more seed than necessary to optimize yield, earliness and quality. Costs can be reduced by skipping rows or by reducing the seeding rate in planted rows, but very low plant populations can reduce yields, delay maturity and invite weed problems.

This study was conducted at the Research and Education Center at Milan in 2006-08 to evaluate cotton response to 15- and 30-inch row widths, solid and 2+1 skip-row patterns, and seeding rates of 1 and 2 viable seed per foot of row.

In 2006, 'ST 4357B2RF' cotton was planted in a non-irrigated field on May 19, and in a pivot-irrigated field May 22. Plant populations ranged from 10,300 to 64,200 plants /ac. All non-irrigated plots were harvested on October 6, and irrigated plots on October 23, with a 15-inch row spindle picker. Lint yields were similar in irrigated and non-irrigated fields in 2006, although cotton grew taller and matured later under irrigation. Lint yields, earliness and weed suppression generally improved with narrower rows, solid planting, and higher seeding rate. The highest lint yields and gin turnouts were recorded for 15- and 30-inch solid plantings and 15-inch 2+1 skip rows, all with 2 seed /ft. Plant populations in these three combinations exceeded 32,000 plants /ac, and they yielded 29 percent more than cotton in 30-inch skip rows with 1 seed /ft. Combinations of wider rows, skip-rows and lower seeding rates tended to lower gin turnout and delay maturity. Cotton in all row widths and patterns produced lint of similarly high quality.

In 2007, 'ST 4554B2RF' cotton was planted in both fields on May 15, and all plots were harvested on October 15 with a 15-inch row spindle picker. Stand establishment was lower and more irregular than in 2006 due to unfavorable weather. Final plant populations ranged from 8,000 to 39,000 /ac. Lint yields in the irrigated field averaged 1487 lb / ac, while non-irrigated plots averaged 550 lb /ac. Under irrigation, lint yields exceeded 1,500 lb /ac in 15-inch solid and skip-row plantings with 1 seed /ft row. Without irrigation, yields were 16 to 22 percent higher in 15-inch than in comparable 30-inch rows with 1 seed /ft row. Fiber quality differences were small. Results suggest that Tennessee producers interested in 15-inch cotton may want to consider planting in 2+1 skip-rows to reduce costs without reducing yield or quality.

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Spider Mite Management in Cotton

Sandy Steckel, Research Specialist II, UT Entomology and Plant Pathology
Lucas Owen, Research Assistant, UT Plant Sciences

In recent years, two pests in cotton have become more problematic in the North Delta Region in general and in Tennessee in particular. The first is glyphosate-resistant horseweed, which is now a problem in all row crops in Tennessee. The other is the increased frequency of early-season mite infestations on cotton. The increased frequency of these two pests in cotton production systems may or may not be a coincidence. Henbit and other winter annual weeds such as horseweed (marestail) are known to be over-wintering hosts for two-spotted spider mites. Each year, producers burn down fields with herbicides prior to planting cotton. Herbicide applications close to planting eliminate green vegetation harboring spider mite populations and could create a "green bridge" for mites to infest emerging cotton. Therefore, a study was initiated to evaluate the effect of spring burndown timings on spider mite populations within a field.

Three application timings were evaluated: late February, late March and at planting. The late February application consisted of Gramoxone Inteon @ 48 oz/ac +Valor @ 2oz/ac + Clarity @ 8 oz/ac + 0.25% NIS. The March application consisted of 22 oz/ac Roundup WeatherMax + Clarity @ 8 oz/ac. The at planting application was a tank-mix of Gramoxone Inteon @ 48 oz/ac + Caparol @ 16 oz/ac + Cotoran @ 16 oz/ac + 0.25% NIS. The study was a randomized complete block design (RCB) with four replications at one location and three replications at the other. Plot size was 24 38-inch cotton rows by 300 ft long. Also, one-third of each plot (8 rows) was treated with a miticide (dicofol 4) at planting. Mite samples were collected from native vegetation at each application date. Also, for the first 3-5 weeks after cotton emergence, 10 cotton plants were sampled from each plot not treated with the miticide.

Results from this research will be discussed, as well as glyphosate-resistant horseweed burndown strategies and spider mite management recommendations. We will also discuss the efficacy of early-season miticides and recommended treatment threshold in cotton.

Non-Glyphosate Weed Control Options in Cotton

Chris Main, Assistant Professor, UT Plant Sciences
Darrin Dodds, Assistant Professor, Plant & Soil Sciences, Mississippi State University

Palmer amaranth (pigweed) has been found in several cotton-producing states that can survive applications of glyphosate. This stop on the tour will discuss biology, physiology and control practices for this troublesome weed. Discussion of soil residual and postemergence herbicide use will focus on starting the season weed-free and maintaining the crop weed-free throughout the growing season.

Performance and Economics of Onboard Module-Building Cotton Pickers

Herb Willcutt, Professor, Agricultural & Biological Engineering, Mississippi State University
John D. Anderson, Associate Extension Professor, Mississippi State University
Matthew Farrell, Graduate Assistant, Agricultural Economics, Mississippi State University

Both John Deere and Case IH have introduced new cotton pickers with the potential to lower production costs. Both new systems do this by

eliminating the separate module-building crew and machinery that is normally associated with a cotton picker. Instead, both new systems build a smaller module that is ready to be delivered to the gin.

The Deere system builds a round module that is roughly a quarter the size of a conventional module. The Case IH system builds a half-size module that is rectangular. Because the modules are being built onboard, time spent picking is increased over what a conventional picker can do. The new Case IH system only has to stop picking to unload the half module. The new Deere system has the ability to carry a completed round module in addition to the one being formed. This results in the Deere system seldom having to stop. The greater field efficiencies in both systems results in more acres harvested in the same amount of time when compared to a conventional system.

Because both new systems build a module onboard, the fuel use is higher on a per-hour basis when only looking at the pickers. However, when factoring in the fuel use by the boll buggy tractor and the module builder tractor, as well as the higher field efficiencies, both new systems have a lower fuel use on a per-acre basis. This is one of the ways the new systems save money. As mentioned earlier, the new systems also eliminate the labor and machinery costs associated with the boll buggy and the module builder.

The new systems do have some higher costs. The new pickers have a higher list price than the conventional systems, which negates some of the savings of the boll buggy and the module builder. In addition, the Deere system wraps the modules in plastic, which adds to the initial costs.

This presentation shows some of the initial work looking at selected costs for new Case IH and Deere systems as well as the conventional system. The initial work will help to highlight some of the areas where each system is strong and where they are weak.

Dectes Stem Borer

Kelly Tindall, Research Entomologist, University of Missouri Delta Research Center
Tim Campbell, UT Extension Agent & County Director, Dyer County

Researchers in the 'hot spot' areas (Tennessee, Kentucky, Arkansas, Missouri and Kansas) have been conducting research with Dectes texanus, the soybean stem borer. Entomologists in both Tennessee and Missouri conducted a survey last year to determine the extent of the infestation in several counties (Table 1). Data show that the soybean stem borer is widespread and infests approximately 50 percent of soybean fields. The infestation rates ranged from 0 percent infested to 100 percent infested.

A few additional things that were discovered from these surveys:

1. There are at least two parasites of Dectes in soybeans; however, the rate of infestation is low. Data suggest that the parasites are easily able to find larvae.
2. Only 30 percent of the tunneled stems had larvae present (Table 1). Whether the larvae were in the top of the plant when the beans were harvested, a parasite consumed the Dectes, the Dectes died of other causes and desiccated to the point of being non-recognizable, if there was a partial second generation or another cause is not known. However, Missouri data show that of the larvae that were recovered, there is a high survival, which means they are likely to be problematic this year.
3. In the literature, it states that "moisture" may reduce survival of Dectes. Initially, we agreed with this statement, as larvae appeared dead when sampling wet fields. However, when we sampled fields in the Mississippi River bottom in Missouri, after the flood waters receded, we found live larva. Subsequent studies have shown that larvae are alive after being under water for 4-6 weeks. Therefore, the numbers in Table 1 for survival may be higher than shown, because we were not aware that larvae appearing dead may have been alive.
4. Whole beans left in the ground as CSP land do not necessarily provide more protection from the environment as stubble beans. In one field, we had 85 percent infested stems in beans not harvested versus 85 percent in stubble 2-4 inches high.

Table 1. Regional survey of soybean fields to determine infestation rates of the Dectes stem borer.

Location	Number of Fields Sampled	% Infestation	Range of Infestation (Lowest-Highest)	% larvae Recovered
TN				
Carroll	6	38	7-60	17
Crockett	6	64	40-100	42
Dyer	7	67	17-90	33
Gibson	6	49	17-90	44
Haywood	3	48	27-60	21
Lauderdale	2	90	90	
Madison	2	7	3-10	17
Obion	6	69	23-80	37
Weakley	6	53	3-87	39
Total/Average	45	54	3-100	31
	Number of Fields Sampled	% Infestation	Range of Infestation (Lowest-Highest)	% larvae Recovered
Missouri				
Dunklin	8	59	9-76	21
Mississippi	10	22	0-78	47
New Madrid	16	70	40-95	34
Pemiscot	6	52	14-78	37
Scott	4	83	75-89	21
Stoddard	13	36	4-68	52
Total/Average	57	54	0-95	35

Managing Soybean Stands

Eric Walker, Soybean Agronomist, USDA-ARS
Trey Koger, Associate Extension Professor, Soybean Specialist, Mississippi State University

Recent field study results suggest that soybean producers are obtaining current soybean yields with less than realized soybean populations. In addition to early-season stand losses caused by seedling diseases and insects, plant attrition throughout the season often results in significantly reduced stands at harvest. This in-season attrition of plants has been largely unrealized because the assumption has been that plants that have survived seedling diseases and early-season insects and appear healthy and vigorous at early vegetative stages (when most stand counts are taken and reported) will survive throughout the season and contribute to final yields. However, field studies at the University of Tennessee Research and Education Center at Milan have revealed attrition rates ranging from 0-30 percent when early-season stand counts are compared to final stand counts. Since soybean plants compensate for reduced stands with increased branching, soybean yields among differing final plant populations are often similar, and this loss of plants throughout the season is seldom realized. Although soybean yields may not reflect the loss of plants, in-season plant attrition reduces profitability because seed utilization has not been optimized. This is particularly evident in higher planting populations, where in-season attrition rates tend to be high, likely resulting from self-thinning due to intraspecific competition.

Research supported by the Tennessee Soybean Promotion Board is ongoing to document and

determine the causes of in-season attrition of soybean. Application of these findings will improve profitability of soybean production by optimizing crop inputs, such as seed and pesticide treatments. In the meantime, producers should base seeding rates on final stand, targeting 100,000 plants per acre at harvest and assuming a loss of a third to a fourth of the seed planted due to seed germination percentage and vigor, seedbed condition and plant attrition, resulting in a seeding rate of approximately 150,000 seed/acre for MG IV and V and 180,000 for MG III. Also, producers should ensure a good stand by treating seed with a fungicide and considering an insecticide seed treatment if planting early. Finally, producers should be vigilant throughout the season, scouting for insect and disease infestations and treating when thresholds are reached.

Tennessee Soybean Breeding Programs: Targeting SCN Resistance for the Mid-South Region

Vince Pantalone, Professor, UT Plant Sciences
Prakash Arelli, Soybean Breeder, USDA, Jackson, TN
Catherine Nyinyi, Graduate Research Assistant, UT Plant Sciences
Lisa Fritz, Research Associate, USDA, Jackson, TN

Our breeding programs are actively developing high-yielding soybean cyst nematode (SCN) resistant germplasm lines and varieties for Tennessee and the Mid-South Region. The Mid-South has more acreage planted with soybean than any other crop. Soybean ranked first in cash value among row crops produced in West Tennessee in recent years. High yields are critical to soybean producer profit margins. However, diseases have suppressed soybean yields every year. Soybean cyst nematode especially has caused significant yield losses each year, currently estimated at 4 percent yield loss or nearly $15 million for Tennessee alone. These losses have remained relatively stable, primarily with the use of resistant varieties.

Current varieties have a very narrow source of nematode resistance and trace their resistance to Peking and/or PI 88788. Nematodes can adapt to resistant varieties because of the limited genetic base of plant resistance. Additionally, more aggressive and yield-suppressing nematode populations recently identified in West Tennessee are adapting to resistant sources commercially available today. We are stacking resistance genes from traditional sources together with further resistance genes identified from unique and new source for developing broad resistance. These new sources were recently identified from soybean lines from China, Japan and South Korea. Combined technologies of classical breeding and recent biotechnological methods are used to transfer nematode-resistance genes into high-yielding Tennessee soybeans among maturity groups III, IV and V. The biotechnological methods used essentially increase efficiency and cut duration and cost for production of new SCN-resistant soybeans. Using biotechnology, we already have released two high-yielding soybeans, JTN-5303 and JTN-5503 with resistance to SCN for the Mid-South. Soybean line JTN-5203 will be released soon and more favorable resistant materials are in the pipeline. Thus, Tennessee soybean producers will have reduced risk of economic loss by SCN and will benefit by having productive, adapted, high-yielding, SCN-resistant varieties developed in cooperation with the Tennessee Agricultural Experiment Station and USDA-ARS in Jackson, TN.

TOUR F – NO-TILL CORN PRODUCTION

Optimal Seeding and Nitrogen Rates in Corn

Angela Thompson, Associate Professor, UT Plant Sciences

Although commodity prices are exciting right now, the cost of inputs is also on the increase, which reduces potential profit per acre. Producers have seen a significant cost increase in corn production, especially nitrogen and seed technology traits. The potential economic benefits of optimizing nitrogen and seeding rates have drastically increased as input costs continue to rise. Crop inputs can be optimized by applying crop inputs based on yield response to both seeding and nitrogen rates.

A long-term study at the Milan Research and Education Center has incorporated variable nitrogen and seeding rates across different soil landscapes. Each soil type has different yield potentials. Therefore, our objective is to determine the optimum nitrogen and seeding rate based on variations in yield potential.

Seeding and supplemental nitrogen rates were varied in large plots (100 ft x 16 rows) distributed in an even grid across the field. Nitrogen rates of 90, 130, 170 and 210 lbs/ac were applied to each of the large-scale plots. Seed spacing was varied to achieve seeding rates of 17,800; 23,300; 28,900; and 34,400 seeds/ac.

Results of this study will be discussed along with data from other seeding rate studies that evaluated seeding rates vs. actual stands and impact on optimal yields. Additionally, the Nitrogen Rate Calculator, a new tool for corn nitrogen management that is being developed by UT, will be discussed.

New Insect Control Technologies in Corn – Bt Corn

Scott Stewart, Associate Professor, UT Entomology and Plant Pathology

Gene Miles, Area IPM Specialist, UT

This presentation addresses the efficacy of new Bt corn traits on lepidopteran pests in corn, including southwestern and European corn borer, corn earworm and fall armyworm. Corn varieties that have multiple Bt traits are under development. YieldGard VT Pro® produces two Bt toxins, Cry1Ab and Cry1A.105, that have activity on lepidopteran pests. In contrast, currently available Bt corns with activity on lepidopteran pests produce only one toxin (i.e., Cry1Ac in YieldGard® and Cry1F in Herculex®). The cry1A.105 gene found in YieldGard VT Pro is a synthetically derived hybrid of cry1A and cry1F. YieldGard, Herculex and YieldGard VT Pro have excellent activity on European and southwestern corn borer. YieldGard VT Pro is more toxic to fall armyworm relative to the original YieldGard technology. YieldGard VT Pro also has considerably better activity on corn earworm, i.e., bollworm, than YieldGard or Herculex corn.

For YieldGard VT Pro, Monsanto is petitioning the Environmental Protection Agency to decrease non-Bt refuge requirements in corn, proposing a minimum 20 percent refuge in the Cotton Belt and a 5 percent refuge in the Corn Belt. Current non-Bt corn refuge requirements in the Cotton and Corn Belt are 50 and 20 percent, respectively. In areas where corn borers typically cause yield loss, corn growers could benefit from these relaxed refuge requirements. Annually, corn may also produce 50 to 80 percent of bollworms within the landscape of some cropping environments. The percentage of bollworm moths originating from corn, as opposed to other hosts, may be even higher at certain times of the season. Cotton growers may benefit from reduced numbers of

bollworms emigrating from corn into cotton if these new Bt corn technologies are widely adopted. However, corn is an important host of bollworm. Because new, stacked-Bt technologies have greater efficacy on bollworm, and because similar Bt traits are present in cotton, the impact on Bt resistance management for bollworm should be considered.

Utilizing Fertilizer More Effectively

Lloyd Murdock, Extension Soils Specialist, University of Kentucky, Plant & Soil Sciences

Fertilizer prices have increased dramatically and resulted in producers being more concerned about using fertilizers as efficiently as possible. There are many ways to improve fertilizer efficiency. A number of the ways are very simple techniques that we have known for many years and others involve the use of fertilizer additives that change the mode of action or reduce the chances of losing fertilizer.

The simple things involve maintaining a proper pH, which is very helpful with phosphorus, soil testing yearly or bi-yearly, fertilizing according to recommendations proven to use fertilizer efficiently and using row fertilizers to reduce P and K broadcast amounts. For N fertilizers, such things as proven recommended rates, sidedressing and legume cover crops can be used to improve N fertilizer efficiency.

Inhibitors and additives can be used to improve fertilizer efficiency. Many but not all of them are effective. Many times these are not needed, depending on the type and method of fertilizer application as well as the environmental conditions.

Avail is an additive that has recently been released to improve the efficiency of P fertilizers. Research results with the compound have been mixed. Some trials have found a positive response, but most of the third -arty research has not been as positive. It seems to be more effective when the soil pH is below 5 or above 7.

N fertilizers that are urea -ased (urea and UAN) can result in substantial losses from volatilization (the conversion to ammonia gas). This loss can be substantial if the application is made when weather conditions are right for loss (moist soils that are warm and drying). There is little or no loss if the fertilizers are placed or tilled into the soil or if rain or irrigation occurs within two days. It is most probable with surface applications of urea or UAN on sidedressed corn or pastures after May 1. A number of urease inhibitors may be added to the fertilizers to prevent or reduce this loss. Ammonium sulfates or ATS (ammonium thiosulfate) help but are not strong inhibitors. NBTP (N-butyl thioposphoric triamide) does an excellent job. It is sold as Agrotain®. It has a long and proven record to reduce volatilization loss. Nutrisphere nitrogen is also sold for this. It is a new product that does not have a long history of research. The research results on this are somewhat mixed. There are both positive and negative results. Third-party research tends to be less supportive of the product. At this time, it might be said that this product is somewhat inconsistent and further research is needed. There are other products sold for this purpose that have not been proven effective.

A new plastic-coated urea product is on the market that is a slow-release nitrogen product. It also is helpful in reducing losses of N. Due to these slow-release characteristics and requirements for moisture and warm temperatures for N release, application timing is an important consideration for this fertilizer.

There are a number of things that a producer can consider when trying to reduce fertilizer purchases and increase fertilizer use efficiency. Many of them are simple things we have known but forgotten. There are also a number of additives that are helpful under certain conditions. It is important to know which ones work and when they are needed.

TOUR G – NO-TILL WEED CONTROL

New Herbicide-Resistant Traits on the Horizon: Liberty Link Soybeans and Dicamba Soybeans

Bob Scott, Professor, Department of Crop, Soil & Environmental Science, University of Arkansas
Larry Steckel, Associate Professor, UT Plant Sciences
Bob Hayes, Director, UT West Tennessee Research & Education Center

Over the last decade, weed control has become greatly simplified by the wide-spread adoption of Roundup Ready soybeans. This simplification of basically relying on one herbicide has also seen the development of glyphosate-resistant weeds. In the north Delta region, horseweed, Palmer amaranth, waterhemp, giant ragweed, common ragweed and most recently Johnsongrass have evolved biotypes that are glyphosate-resistant. One answer to manage these glyphosate-resistant weeds has been the development of new herbicide-resistant traits. The Liberty Link trait, which will be offered in soybeans for the first time next year, and the dicamba tolerance trait that will be offered in 2013 can help manage these glyphosate-resistant as well as other difficult-to-control weeds.

Weed management in soybeans with the Liberty Link trait has been tested in Arkansas for two years and Tennessee for one. Using Ignite herbicide on Liberty Link soybeans in this research has shown that it can successfully control, under warm conditions, glyphosate-resistant horseweed and giant ragweed. Research in Arkansas has also shown that Ignite used in Liberty Link soybeans can provide good control of Palmer amaranth provided the plants are less than 4 inches tall. Research conducted this year is looking at application timings as well as tank-mix partners with Ignite in a Liberty Link soybean weed control system.
Weed management in soybeans with the dicamba tolerance trait has been tested in Arkansas for one year and Tennessee for two. Dicamba mixed with glyphosate applied to dicamba and Roundup -olerant soybeans has shown that it can provide good control of glyphosate-resistant horseweed and giant ragweed.

New Herbicide-Resistant Traits on the Horizon: Roundup Ready2Yield Soybeans, GAT Corn Hybrids

Tom Mueller, Professor, UT Plant Sciences
Greg Armel, UT Extension Weed Specialist, Horticultural Crops and Invasive Weeds

The use of herbicide-tolerant crops has revolutionized weed control and allowed much more widespread adoption of no-tillage production systems. New developments in this technology will be highlighted in this tour stop. Monsanto initially launched RoundupReady soybeans in the mid-1990s at the Milan No-Till Field Day. RoundupReady2Yield Soybeans provide high levels of glyphosate tolerance with enhanced yield potential in soybeans. This is an important aspect of any production system, since maximum yield is the most important attribute desired by producers.

GAT corn hybrids are being developed by Pioneer Hi-Bred. This proprietary glyphosate-tolerance trait disables glyphosate so it is not harmful to plants and also confers resistance to ALS herbicides. It will offer broad weed-control options without fear of chemical injury to crops. The benefits of the Optimum GAT® trait are a new choice in glyphosate tolerance that helps maximize yield and productivity, while improving crop safety and expanding weed-control options. This trait allows for multiple modes of action to provide farmers with longer-lasting, broader-spectrum weed control under more conditions. Pending

regulatory approval, Pioneer anticipates a U.S. limited release of Optimum GAT soybeans in 2009 and a U.S. commercial launch for corn in 2010.

Weed Management in Wheat during the Fall and Non-GMO SB Weed Control

Susan Scott, Ag Agent, Lonoke County, AR
Drew Ellis, Research Associate, UT Plant Sciences

Wheat acres in the Mid-South have increased greatly over the past couple of years due to rising wheat market prices. The increase in wheat acreage has growers focusing more on maximizing their production methods to receive top dollar for their crop. Weed control is one of the most important factors in protecting the wheat crop. The top weeds that are most common in wheat fields are ryegrass, wild onion/garlic, henbit, deadnettle, cheat and chickweed.

Ryegrass and wild onion/garlic are the most common problematic weeds encountered and are the most detrimental to wheat yields. Ryegrass will typically germinate in the fall, but a second flush can occur in early spring. The best option is to use a preemergence herbicide such as Hoelon, Finesse or Axiom to provide some residual control throughout the season. However, rainfall activation is required for control of ryegrass with the preemergence herbicides. If a preemergence herbicide is not utilized, then the postemergence application of Osprey, Hoelon, Axial XL or Finesse G&B can clean up the infestation quite nicely. The important thing to remember with the POST applications is make them in a timely manner. The most optimum timing is when ryegrass is 1 to 4 lf; any later and ryegrass is more difficult to control.

Growers should be aware that ACCase (Hoelon)-resistant ryegrass is present in many fields throughout the Mid-South and if this is the case, extra precaution is to be used when selecting herbicide programs. Osprey, Finesse G&B or Axial XL provide effective control of Hoelon-resistant ryegrass. Ryegrass is very prone to developing resistance if consistent use of the same mode of action is used. Therefore, alternating herbicide modes of action, whether by using a residual herbicide like Prowl H20 or Axiom or by switching from Osprey one year to Axial XL the next, will help conserve the technology in place currently. Harmony Extra is effective in controlling wild onion/garlic and offers some control of horseweed, which may be of interest if a grower is double-cropping with soybeans. Finesse can provide some preemergence control of horseweed as well, but if Finesse is applied, then STS beans must be planted. For a heavy horseweed infestation, apply Clarity or 2, 4-D in the fall or early spring. If planting conventional soybeans, it is recommended to burn down any existing vegetation using a broad-spectrum burndown herbicide such as Gramoxone Inteon, Glyphosate or Ignite. Include in the burndown a preemergence herbicide such as Dual II Magnum, Prowl H2O, Pursuit, Sonic or Canopy. For broadleaf control, apply either AIM (from V-3 to V10), FirstRate, Reflex, Classic (good on sicklepod) or Cobra. Use any graminicide for grass weed escapes.

Beef Cattle Price Insurance – What Is It and How Does It Work?

Emmit L. Rawls, Professor, UT Agricultural Economics
Tammy McKinley, Extension Assistant, UT Agricultural Economics

Livestock Risk Protection (LRP) insurance became available in Tennessee on July 1, 2007. Recent history would certainly indicate that there is risk in the cattle markets, both for feeder cattle and fed cattle. LRP is available for feeder cattle, fed cattle and swine. Here we will only deal with feeder cattle and fed cattle. If LRP is purchased, it pays a producer if a regional/national cash price falls below a set price called the coverage price. LRP should be viewed as "price insurance" or much as one would view insurance on the pickup truck.

Anyone can participate who owns cattle in an LRP state. The cattle must be in a state offering LRP, but the owner can be in another state. For example, the cattle may be in Iowa or Kansas with the owner remaining in Tennessee. In that case the LRP insurance must be purchased from an insurance agent authorized to sell in the state where the cattle are located. To purchase the insurance, one must apply for it and fill out substantial beneficial interest forms. These may take a week to process, but are required. They do not obligate one to buy insurance. The insurance is sold through crop insurance agents who have been trained to sell LRP insurance. The insurance provides protection against price declines during the insurance period, but does not cover any other peril, such as mortality, disease, physical damage, etc.

There are limitations on the number of cattle that can be insured per year and per policy. For feeder cattle, the limit is 1,000 head per specific coverage endorsement (policy) or 2,000 head per year (July 1 to June 30 of following year). For fed cattle, the limit is 2,000 head per coverage endorsement or 4,000 head per year. Fed cattle may be steers or heifers, while feeder cattle may be steers, heifers or dairy steers. One very convenient aspect of LRP is that any number of cattle may be insured as long as the number does not exceed the numbers just stated. This allows more flexibility than the futures or options market.

Producers have the opportunity to purchase different coverage levels of insurance. These generally range from 99 to 80 percent of the appropriate futures prices, depending on the month in which the policy ends. Those coverage prices, which are higher, cost more, as might be expected. A feeder cattle indemnity is paid when the feeder cattle price index is below the coverage price on the ending date of the policy. It is important to understand that the feeder cattle price index is not based on feeder cattle prices received on Tennessee auctions. It is a 7-day moving average price based on 12 Midwestern states, with Missouri being the closest to Tennessee. The index does include prices from auctions, video sales, Internet sales and direct sales. With increasing trucking rates to haul cattle to the feedlots, it is important to make a basis or location adjustment to the coverage price to know exactly which level of price protection one has. That basis adjustment is available from the UT Extension. While there are not many Tennessee producers who finish cattle, for those who do, it is important to know that the indemnity for fed cattle is based on the weekly 5-area, weighted-average, direct-slaughter cattle price published each Monday by the USDA Market News Service.

LRP insurance coverage prices are available from 3:30 p.m. Central Time until 9:00 a.m. the following morning. They are available until 9:00 a.m. on Saturday morning, but not on Sunday, Monday or holidays. Producers can go to the Internet and find out which coverage prices are available and the rates being charged. The Internet address is www.rma.usda.gov. The Risk Management Agency pays the insurance commission, which is 5 percent. They also subsidize 13 percent of the premium cost. Insurance agents have an incentive to sell the higher-priced levels of coverage. In contrast to crop insurance, the premium must be paid upfront and the check must be good or one will be prevented from further use of the LRP or other insurance products.

There is one very important regulation that must be followed. The cattle cannot be sold more than 30 days prior to the ending date for the policy. If part of the cattle are sold more than 30 days prior to the ending date, the producer loses coverage and whatever premium was paid on those cattle. There is no requirement that the cattle be sold, other than that 30-day rule. The producer must be able to verify that he or she owns the cattle, either through documentation such as bills of sale from previous owners or statements from feed suppliers or veterinarians.

It is expected that lenders will view LRP favorably and may offer better financing arrangements with the cattle secured, at least as far as price is concerned. Premiums paid for LRP insurance are tax deductible. Furthermore, the indemnity payments are taxable on a cash basis, i.e., income applies to the year it is received.

Finally, LRP has great flexibility in terms of the number of cattle covered or number of policies purchased. It only protects against a decline in the feeder cattle price index. It must be purchased from a crop insurance agent. Again, the cattle cannot be sold more than 30 days prior to the ending date of the policy or coverage will be lost on all or that portion sold. It does not guarantee the cash price one will receive for the cattle. Sales of the insurance may be suspended if the futures market moves the limit on consecutive days or if a significant event occurs that might affect the markets in a dramatic way.

The Beef Checkoff – How Is the Money Being Used?

Stephen Worley, Beef Producer, former board member of Tennessee Beef Industry Council, Hampshire, TN

Since the U.S. Congress passed the Beef Promotion and Research Act of 1985, $1 has been collected from each head of cattle sold in or imported into the United States. These assessments, typically about $82 million per year, are controlled by the Cattlemen's Beef Promotion and Research Board, more commonly known as the "Beef Board" or "CBB," under the oversight of the United States Department of Agriculture. In Tennessee, the checkoff is collected by the Tennessee Beef Industry Council, which remits 50 cents of the dollar to the CBB and uses the other 50 cents for state or national beef promotion programs. Forty-four other states have similar Qualified State Beef Councils that operate under the oversight of the CBB and USDA.

States are represented on the CBB in proportion to the number of cattle in the state. Tennessee currently has two representatives on the 104-member board − Bob Fugate of Greenback and Rob Reviere, Jr. of Ripley.

The 1985 Act limits expenditures of checkoff funds to six promotion and research categories. The average percentage of checkoff funds (both state and national) used in each of these categories during the period 2003-2006 is noted in parentheses.

1. Promotion (46 percent) − This category includes radio and print advertising and promotions aimed at increasing the presence of beef on restaurant menus. Television advertising has been used in the past but has been discontinued due to a lack of the funding needed to make it cost-effective.
2. Research (10 percent) − Three general types of research are funded in this category: Product Enhancement projects look for new ways to improve the quality and uniformity of beef. Human Nutrition projects produce data that demonstrate the healthy aspects of beef consumption, which are used to promote beef consumption and to refute the claims of anti-beef and anti-meat organizations. Market Research is used to guide and evaluate promotion programs to achieve efficient use of funds.
3. Consumer Information (16 percent) − This category funds the development and dissemination of data and other information that assist consumers in making decisions regarding the purchasing and preparing of beef.
4. Industry Information (5 percent) − This category funds programs that will lead to the development of new markets, marketing strategies and increased efficiency. The Beef Quality Assurance program is included in this category, as well as crisis management programs that are ready to roll to maintain consumer confidence in beef in the event of a crisis, such as an outbreak of Foot-and-Mouth Disease.
5. Producer Communications (6 percent) − This includes expenditures to communicate about promotional programs to the producers who pay for them.
6. Foreign Marketing (8 percent) − The U.S. Meat Export Federation has offices around the world that seek to promote sales of U.S.-produced beef and provide helpful information to consumers and purveyors of U.S. beef.

Checkoff funds are also expended for administrative expenses (7 percent), the expense of collecting the assessment (2 percent), program development (<1 percent), and to reimburse the USDA for its expenses in overseeing the program (<1 percent).

Checkoff funds cannot be used for lobbying, for research that primarily involves production or marketing of live cattle or for deceptive marketing practices of any kind. Specific brands or trade names of beef products cannot be promoted without specific approval of the CBB and USDA.

Better Utilizing Available Feed Supplies – What Is Available and How Much Can Be Utilized?

Jim Neel, Professor, UT Animal Science
Clyde Lane, Professor, UT Animal Science

The '07 Drought" created one of the greatest challenges faced by Tennessee cow-calf producers, that of limited to no feed available to winter their cow herds. This caused the producers to consider alternative feeds to either supplement or replace the typical winter feed of hay. Surveys revealed that hay was the winter feed of 91 percent of Tennessee cow-calf producers. Many Tennessee cow-calf producers successfully either replaced or supplemented their hays with alternative feeds such as corn stalks, corn gluten feed, corn, soybean hulls, distillers by-products and other feed resources such as candy and cookies.

Several alternative feeds are available in Tennessee to serve as a winter feed for beef cattle. The kind and availability will vary across the state. Some will fit individual situations better than others. Producers should inventory both the number of cattle they will "carry through the winter" as well as evaluating their feed supply before the winter feeding period gets underway and determine if supplemental feeds would be needed. Producers should evaluate the potential feed as to the

availability of nutrients and if it would be economical to use. Several criteria should be considered to develop an economical winter-feeding program.

Management Considerations for Beef Producers When Input Costs Are High

James B. Neel, Professor, UT Animal Science
Clyde D. Lane, Jr., Professor, UT Animal Science

The weather conditions across most of the state appear to be resulting in "more" rainfall, which has generated some optimism for Tennessee cow-calf producers. That is the "good news."

Now, for the "bad news" and it is really not news. The increased price of fuel, fertilizer and other inputs required for cattle production has negatively impacted profitability and has cow-calf producers making adjustments in both cattle and forage management. Producers should evaluate their operations and decide which practices will produce the largest reduction in costs.

1. Depopulate as needed to match forage supply. Candidates for "depopulating" would be those that have "attitude problems," cows 10 years or older, cows with physical problems and other faults that limit their productivity and value. Do not feed a non-productive cow high-priced feed.

2. Evaluate winter feed needs in late spring or early summer. You do this by first determining what kind and number of cattle you plan to carry through the winter. Now, what feed supply do you have on hand? Plan for what will be, not what you hope for. If there is the need to purchase feed, get it done early.

3. Control weeds. Weeds compete with forage for water and plant nutrients. In addition, they reduce the space where forage can grow or, in the case of thistles, prohibit cattle from grazing for several feet adjacent to the plant. As the weed population increases, the cost of forage produced goes up. Using herbicides for control will be less expensive than clipping.

4. Lengthen the grazing season. Establish either stock-piled fescue or small-grain pastures, such as ryegrass, this fall. Cattle can harvest the forage at a substantially lower cost than harvesting, storing and feeding hay. If either stockpiling or establishing small-grain pastures, the first step in reducing cost is to soil test and follow recommendations.

5. Consider early weaning of calves. Wean calves at 4 to 5 months of age instead of 7 to 9. A dry, pregnant cow's feed needs will be reduced 25 to 30 percent. Late fall/early winter-dropped calves would be excellent calves for weaning. Calves can make more efficient use of the better-quality feed and also reduce the total feed cost than if left out on their dams. These cows can also utilize the lower-quality forages and gain in both weight and body condition. This practice makes good economical sense. It will add value to the calves, allow the dams to improve reproductive potential and, if fencing is available, allow some rest for the pastures that could later be available for stockpiling and/or hay.

Review these tips and other suggestions for application and value to your individual situation. Contact your local UT Extension office for additional information.

TOUR J – AGRITOURISM AND DIRECT MARKETING

Agritourism in Action – Lessons from an Agritourism Entrepreneur

Rose Ann Donnell, Donnell Century Farm Adventure, Jackson, TN

Donnell Century Farm is a real working farm in Madison County in West Tennessee. Billy and Rose Ann Donnell and their son Andrew raise cotton, corn, soybeans, hay and registered Angus cattle. The farm is located on land that has been owned and farmed by the Donnell family for more than 170 years. In 2001, Rose Ann, a farmer's wife, mother and daughter, began an agritourism business that now offers group tours and Saturday fall family festivals. The educational farm tours are primarily for elementary school children; however, church groups, birthday parties, Girl and Boy Scout troops, business groups with families and baseball teams visit the farm.

Rose Ann is very involved in the West Tennessee State Fair, Farm Bureau and other agricultural activities. The restoration of their old mule barn prompted Rose Ann to launch her agritourism business. Her mission to educate children about agriculture stems from her days in the TN Farm Bureau's Young Farmers and Homemakers. "They used to tell us," Rose Ann said, "if you don't tell the story of agriculture, who will?" With a shoestring budget, borrowed animals and an old mule barn, the Donnell Century Farm Adventure was born.

Tours include several learning centers. The farm basket activity has students move through the food chain where they become farmhands on a make-believe farm. The students deliver and sell their goods at a farmers market. Fall and spring curriculum-based learning centers use hands-on activities where children learn about plant science and commodity products. The animal exhibit features a goat walk, a traditional hen house, donkeys and several other animals. Germ City helps students learn how to wash their hands effectively. Older students travel on The Wonder Trail Adventure where students become investigators and are challenged to answer the questions to break a secret code and win a treat. Tours typically end with lunch.

The focus of this agritourism business is to provide a premier educational farm experience that is so much fun the children and adults will not realize they are learning. The adventure provides added farm income and educates future citizens and voters on the importance of agriculture "from farm gate to dinner plate."

In this session, Rose Ann Donnell will discuss her enterprise and lessons learned through her experience that may be helpful to other entrepreneurs. Topics covered will answer questions: why she began the agritourism enterprise, how it started, what happens on the venue, the challenges the business has faced, which things happened that were unexpected, resources used to help in the operation and the importance of the Tennessee Agritourism Association.

Tips for Direct Marketing Success

Megan L. Bruch, Marketing Specialist, Center for Profitable Agriculture

Direct marketing is any marketing method whereby farmers sell their products directly to consumers. Direct-marketing channels may include roadside stands, on-farm retail stores, pick-your-own operations, farmers markets, Community Supported Agriculture programs (CSAs), Internet sales, mail order sales and more.

Producers may choose to direct market their products for several reasons. Farmers typically direct market in an effort to earn a retail price for products by cutting out middlemen in the supply chain. The main goal for these producers is to increase revenues and profit. Direct marketing may also allow farmers to test market products and develop a customer base to expand their operations. In addition, direct markets are often viable outlets for farmers producing volumes of product too small to market through wholesale channels.

The number of farmers direct marketing to consumers and the value of products sold directly to consumers is growing. The 2002 Agricultural Census shows that the number of Tennessee farmers participating in direct farm sales to consumers increased by 698 farmers or 25.9 percent between 1997 and 2002. The value of agricultural products sold by Tennessee farmers direct to consumers grew by $2,847,000 between 1997 and 2002, an increase of 34 percent.

Consumer trends are favorable for farmers interested in direct marketing. Studies show consumers associate quality with local products and are willing to pay more for quality. Consumers value products that are fresh, ripe, harvested nearby and authentic. Consumers are also interested in supporting their local economies and preserving values associated with agriculture. In addition, consumers value "the story" behind the product and the producer.

Direct marketing does pose some challenges for producers. It is labor intensive, and therefore requires increased labor costs, and requires people skills and marketing savvy. Additional regulatory and risk considerations often arise as well.

Ten tips for successful direct marketing are:

1. Produce a quality product
2. Produce a quality product consistently
3. Learn and follow necessary regulations (processing, weights and measures, labeling, etc.)
4. Assess and manage risk (food safety protocol, insurance, business structure)
5. Identify your competitive advantage and market niche(s)
6. Make your product look good/merchandise effectively
7. Develop and tell your story
8. Provide excellent customer service
9. Foster relationships with customers
10. Create experiences for customers

Agritourism and Direct Marketing Resources from the Tennessee Department of Agriculture

Pamela Bartholomew, Agritourism Coordinator, Tennessee Department of Agriculture Agritourism Coordinator

Market Development Division is the agricultural industry development and marketing arm of the Tennessee Department of Agriculture. It is the Tennessee Department of Agriculture's primary means to work with farmers, agribusinesses, commodity organizations and consumers. The mission of the Market Development Division is "to maximize economic opportunities for Tennessee farmers and agribusinesses through innovative and effective marketing and promotional services." Its aim is to increase farm income. During this part of the session you will get an overview of the tools and programs the Market Development division has to offer to agritourism operators. Learn how to promote your farm or products on TDA's Web site, Tennessee Agriculture Enhancement Program Producer Diversification Program, upcoming Agritourism Workshops and Conferences and much more.

Tennessee Farm Fresh – A New Marketing Program for Direct Marketers

Tiffany Mullins, Tennessee Farm Fresh Coordinator, Tennessee Farm Bureau Federation

This program is designed to promote on-farm and local farmers markets through individual producers who participate. Tennessee Farm Fresh promotes direct retail marketing to consumers, and is a joint effort between the Tennessee Farm Bureau Federation and the Tennessee Department of Agriculture. The Tennessee Farm Bureau has watched similar programs in neighboring states for years. When the TDA encouraged our involvement to complement the broad-based efforts of the department, TFBF started the program.

Producers of agricultural products who sell products from their own production directly to the consumer can participate in Tennessee Farm Fresh. This program is inclusive of conventional, natural, organic, etc., production techniques. Producers of fresh fruits and vegetables, dairy products, farm-fresh meats, nursery items and other commodities are well-suited for this program.

It is very important to maintain a strong agricultural community in Tennessee. Promotion of Tennessee farm products, the producers who are committed to the local market and the consumer purchase experience is the primary goal. Tennessee Farm Fresh will expand that goal with consumer education, economic growth for agriculture and improved local lifestyles in its promotion of local farmers.

Buying locally is beneficial in many ways. Buying locally benefits the local farmers, the local economy and agriculture; not to mention that people are buying local for other reasons as well. Products are so much fresher when purchased nearby, and have a longer life span than those that have traveled a long distance. This aspect affects some attitudes toward food safety. Consumers are also looking for the experience of visiting a local farm or farmers market. Education about farming and communication with the producer are just a few of the reasons why more people want to buy from local producers.

The major benefits of this program will be the value added from advertising of the program itself, which in return will advertise Tennessee Farm Fresh producers. Advertising will be done through radio, cable television, newsletters, brochures, Web site listings, and others. Also, there will be opportunities for producers to attend workshops offered by the University of Tennessee Center for Profitable Agriculture; which will share helpful information on agricultural marketing. Tennessee Farm Fresh participants will also receive a marketing package that includes 1- and 5-inch stickers, table tents / product labels, a 2X4 foot banner and pens (all of which identify the producer with the program logo).

TOUR K – CORN AND SOYBEAN DISEASE CONTROL

Foliar Fungicide Test Results for Corn and Soybeans

Melvin A. Newman, Professor, UT Extension, Entomology and Plant Pathology
Bob Williams, Area Grain Specialist, UT Extension, Dresden, TN

Many producers are considering spraying their corn and soybeans with a fungicide to control diseases and increase yields. This interest has been spurred by higher grain prices and increased disease pressure. Replicated tests conducted over the last two to three years at the Research and Education Center at Milan have shown an increase in yields and a decrease in the severity of foliar diseases such as gray leaf spot (GLS) on corn and frog eye leaf spot (FLS) on soybeans when sprayed with certain fungicides.

In 2006, a corn hybrid highly susceptible to GLS was sprayed with either Headline or Quadris at the tasseling stage (VT). Yields were increased over the side-by-side untreated check by 36 bu/a and 31 bu/a, respectively. On a moderately susceptible hybrid, yields were increased by 38 bu/a with Quadris and 13 bu/a with Headline. On a tolerant hybrid, yields were still increased by 11 bu/a acre with Headline and 22 bu/a with Quadris. In 2007, yields were increased by 25 bu/a with Quadris and 16 bu/a with Headline on the same susceptible hybrid. On the moderately susceptible hybrid, yields were increased by 17 bu/a with Quadris and 9 bu/a with Headline. With the tolerant hybrid, yields were increased by 12 bu/a with Quadris and 7 bu/a with Headline. These tests were conducted on irrigated land that has been in continuous no-till corn production for three years with a history of GLS.

Soybean tests sprayed with selected foliar fungicides increased yields from 7 bu/a to 14.7 bu/a on the average for three years, depending on the fungicide used and the number of spray applications. Soybean plots were sprayed at the R3 growth stage with Quadris, Headline, Headline SBR, Quilt and Stratego. Each fungicide was also sprayed at the R3 and R5 growth stage. All fungicides increased yields with one application. However, all fungicides, except for Stratego, increased yields even more with the second application. The highest yield increases occurred when fungicides containing either Headline or Quadris were sprayed twice at the R3 and R5 growth stage. These tests were conducted on irrigated land using a FLS susceptible variety. This land has been in continuous no-till soybean production for four years and has a history of FLS, brown spot and anthracnose.

Producers may want to consider spraying their soybeans or corn with foliar fungicides, specifically if they are using varieties that are susceptible to foliar diseases and when planting the same crop year after year. Generally, the higher the yield potential, the greater is the percentage of yield increase. Extremely dry weather, especially during the reproductive growth stages, may reduce the increase in yield from the use of foliar fungicides since most foliar diseases are dependent on ample moisture.

The most important factors to remember when considering spraying foliar fungicides are disease susceptibility of the variety, lack of crop rotation, type of tillage system (no-till or conventional), weather conditions, fungicide selection, timing of application (growth stage), amount of spray volume used and the coverage obtained with the fungicide spray.

Soybean Seed Quality as Affected by Maturity Group and Fungicides

Alemu Mengistu, Research Plant Pathologist, USDA ARS, Crop Genetics and Production Research Unit, Jackson, TN
Melvin A. Newman, Professor, UT Extension Entomology & Plant Pathology
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Phomopsis seed decay of soybean is caused by a fungus Phomopsis longicolla, but is also caused by other fungal species of Phomopsis and Diaporthe spp. Infected seeds may have reduced germination, split more readily and suffer other quality losses compared to non-infected seeds. Severely infected seeds are shriveled, elongated and cracked and appear white and chalky. Seeds also may be infected and not show symptoms. Seed infection may cause pre- and post-emergence dampening-off, and under severe conditions, stands can be reduced enough to lower yield. Generally, Phomopsis seed decay is enhanced by delayed harvest, provided fall weather conditions are favorable for seed infection.

In 2006 and 2007, more than 100 cultivars of different maturity groups were evaluated to address two major objectives: 1) to identify if there are sources of resistance within these cultivars, and 2) to determine if Phomopsis seed decay can be reduced through fungicide treatment. Our data suggested that early-maturing cultivars had greater level of Phomopsis seed decay than later, full-season maturity group cultivars. Early-maturity cultivars express greater incidence because such cultivars are likely to mature during periods of higher air temperature and relative humidity. Late-maturing cultivars may escape severe infection. Our data also suggested that there are very few tolerant lines within the commercial varieties tested.

Since no resistant commercial soybean cultivar for Phomopsis seed decay is available, management of this disease can primarily be achieved by having high-quality seeds relatively free of the pathogen. A foliar fungicide can be used if the risk of seed infection is high. It is also important to harvest soybean seeds promptly at maturity. Foliar-applied fungicides are most practical for the production of seed rather than cash grain. A single application of fungicide at R5 can significantly reduce seed infection.

Guess Who Is Coming To Dinner – Corn Nematodes

Pat Donald, Research Plant Pathologist/ Nematologist, USDA ARS, Crop Genetics & Production Research Unit, Jackson, TN
Jamal Faghihi, Research and Extension Nematologist, Entomology Department, Purdue University, West Lafayette, IN

Higher corn prices along with increased demand are causing corn producers to try to limit yield loss and boost corn yield in any way they can. One of the yield-limiting factors is the damage caused by the plant parasitic nematodes. Nematodes are under a spotlight again, partly because of the diminishing number of insecticides/nematicides, which were commonly used to manage soil insects and nematodes. These pesticides are no longer available due to environmental concerns and their high toxicity. Recently, there has been renewed interest toward corn parasitic nematodes by the chemical industry. Several companies are either marketing or testing new products to help with the management of plant parasitic nematodes. Corn surveys are being carried out to determine the distribution of plant parasitic nematodes throughout the Midwest.

Corn parasitic nematodes are transparent and not visible through routine root observations. They require extraction and microscopic examination of the nematodes from the soil. Symptoms of

nematode damage to corn are often non-descriptive, so nematode damage is often attributed to other problems. These symptoms are usually present in patches and can include stunted growth, foliar symptoms similar to nutrient deficiency and possibly including root deformity. Sometimes examination of the affected roots may look like rootworm damage when certain plant parasitic nematodes are present. Nematode activity usually starts when soil temperatures reach 50 degrees F. Nematodes commonly attacking corn growing in sandy soil often do their damage early in the season and cannot be detected later in the season. Soil sampling with inclusion of plant roots is important in determining whether poor corn growth is caused by plant parasitic nematodes. Most damage to corn by plant parasitic nematodes is not dramatic enough to cause plant death, but yield loss is still present.

Some plant parasitic nematodes like Lesion nematodes feed by entering the root system, others like Needle nematodes feed from outside or Lance nematodes are capable of doing both. Regardless of their feeding habit, plant parasitic nematodes suck the juice out of the corn root with the aid of hollow needle-type mouth parts.

Recently a new discovery of a cyst nematode in Tennessee has caused serious concerns. Cysts were found on roots of stunted corn plant in West Tennessee in the summer of 2006. Since that time, host studies have been conducted as well as morphological and molecular biological studies to determine the identity of this nematode. The nematode reproduces well on commercial corn varieties as well as more distant corn relatives and ancestral corn. No other field crops have been found to be hosts. The nematode has tentatively been identified as a member of the genus Cactodera. Members of this genus primarily attack members of the Caryophyllidae and grains, with most species having marked host specialization. Nematodes belonging to Cactodera have been found in the Americas and Eastern Europe but may be cosmopolitan. Little work has been done on these nematodes with field crops until they were found on small grains in Mexico.

TOUR L
NUTRIENT MANAGEMENT – EFFICIENT USE OF LIME AND FERTILIZER

General Guidelines for Efficient Fertilizer Use

Hugh Savoy, Associate Professor, UT Biosystems Engineering and Soil Science
Jeff Lannom, UT Extension Agent and County Director, Weakley County

Dramatic increases in fertilizer prices are causing producers to look more thoroughly at their nutrient management programs. Soil testing is the first step in determining the need for a fertilizer material and the proper rate of application to ensure economical returns to that fertilizer investment. The soil testing protocol, especially depth of sampling, is critical to obtaining meaningful results. Research results have demonstrated higher returns on recommendations generated at the University of Tennessee laboratory compared with those from other non-university laboratories. Agricultural limestone should be applied if the soil test results show that the soil is too acid and proper credits given for past production practices. In some cropping systems, producers may consider leaving out phosphorus and/or potassium fertilizer materials for a couple of years where soils test "high" or better in those nutrients. For most crops, the probability is low that this will result in any loss of yield or quality.

Potassium Fertility for Hybrid Bermudagrass Hay

Neal Eash, Associate Professor, UT Biosystems Engineering and Soil Science
Eric Caldwell, Graduate Assistant, UT Biosystems Engineering and Soil Science

High rates of potassium are currently recommended for production of hybrid Bermuda grass hay on "low" testing soils in Tennessee. Increasing costs for potassium fertilizer have indicated a need to re-evaluate these recommendations. A K–rate study has been established in 2006, at the Highland Rim Research and Education Center, on a Staser silt loam soil with rates of 0, 60, 120 and 240 pounds of K_2O applied annually. Yield is determined by cutting and weighing the center of the 20 foot plots every 30 days during the growing season. Plant analyses are done on all the samples and soil tests are run every year. Preliminary results are indicating that economical production of hybrid Bermuda grass hay, on "low" testing soils, can be accomplished with much lower levels of potassium fertilization than currently recommended. Large amounts of potassium are being sold off in the hay at the currently recommended rate of 240 pounds of K_2O per acre at no increased value to the hay. Nitrogen use efficiency was lowered where potassium was deficient.

Variable Rate Liming

Amy Johnson, Assistant Professor, UT Biosystems Engineering and Soil Science
Richard Buntin, UT Extension Agent & County Director, Crockett County

Variable rate lime application is now commercially available and allows producers to more precisely apply correct amounts of lime to smaller areas of fields. This results in better correction of soil acidity problems in specific areas as compared to using a field average rate, which usually results in under-applying in very acid areas and over-applying in less or non-acid areas. The field average rate used was determined using a sampling procedure that attempted to sample the smallest reasonable area and minimize sample analysis

costs. Also, it was generally assumed that this average included areas of potentially higher and lower pH. In other words, the pH variability across each sampling area was not known.

The eventual lime recommendation was made based on a number of assumptions, including land ownership and lime application as a long-term, five to six years or longer, investment. Presently, many acres of land are rented or leased by producers making some assumptions about economics of liming different from in the past. A grid or stratified sampling for pH in fields also allows us to more precisely determine the variability across smaller field areas. With these changes, a re-evaluation of lime recommendations relative to amount and sampling procedure was needed.

We began a study of variable rate liming on 25-acre field of double-cropped wheat and soybeans in the spring of 2003. The field was initially sampled in 12.5 acre blocks and no lime was indicated to be needed in the field. When the field was sampled on a grid of 50 feet wide by 100 feet long, more than half of the field was shown to need lime and more than one-third needed two tons per acre or more. The recommended rates of lime across the field ranged from 1 to 4.5 tons per acre. Areas requiring each of the rates of lime were alternated with two treatments, no lime and the recommended rate for that individual area. The lime was spread using a commercial applicator supplied and programmed by a local lime distributor. Wheat and soybean yields are being yield monitored to compare crop response to lime application, rate and subsequent change in pH, exchangeable aluminum and manganese. Data are indicating no yield loss until the pH falls below about 5.5. These data should assist in refining our lime recommendations to better reflect expected crop response to lime at different soil acidity levels and better inform producers on the economics of lime application in different management scenarios.

TOUR M
NUTRIENT MANAGEMENT – ALTERNATIVE NUTRIENT SOURCES/ ENHANCEMENT PRODUCTS

Improving Efficient Use of Urea N (urease inhibitors)

Richard Joost, Professor, UT Martin, Agriculture and Natural Resources
Frank Yin, Assistant Professor, UT Plant Sciences

Surface applications of urea fertilizer to turf, pastures or in no-till situations where there is substantial plant residue on the soil surface promotes the loss of nitrogen (N) through volatilization. Surface applied urea is easily converted to gaseous ammonia (NH_3) by the urease enzyme that is found naturally in plant tissues. This process can potentially result in a loss of 40 percent of applied urea. If urea is incorporated by rainfall or tillage, the released ammonia is rapidly converted to the ammonium (NH_4^+) ion that is not subject to volatilization losses. In the soil, ammonium is naturally converted by soil bacteria into nitrate (NO_x^-), which is available to plants, but can also be lost due to leaching. Nitrate can also accumulate in plants when environmental conditions don't favor plant growth, potentially resulting in nitrate toxicity in livestock allowed to graze the forage.

Urease inhibitors, including commercially available Agrotain (NBPT), can be used to inhibit urease activity and the conversion of urea to ammonia. This material is typically added to granular urea as a liquid before fertilizer application. This inhibitor has successfully been used in numerous trials, resulting in urea being as efficient an N source as ammonium nitrate. Nitrogen recovery efficiency by Caucasian bluestem in a Missouri trial was 36 percent for ammonium nitrate and 34.5 percent for urea + Agrotain, while recovery of N from applied urea alone was only 26.7 percent of applied N.

Nitrogen uptake efficiency of ammonium nitrate is generally considered to be very good, since half of the applied N is in the ammonium form and half is in the nitrate form, both of which are available to plants. During the current season, urea cost at the dealer was $0.58/lbs N while ammonium nitrate was $0.68/lbs N. However, if 40 percent of the applied urea is lost, the cost goes up to $.97/lbs N.

Nitrification inhibitors have commonly been used to reduce the loss of nitrate from applied ammonium N sources on sandy soils due to volatilization. Another potential use is to reduce the accumulation of nitrate in forages. For the past two years, we have conducted a trial in Martin to evaluate the use of a commercially prepared urease/nitrification inhibitor compared to the urease inhibitor with urea in an attempt to reduce nitrate accumulation in bermudagrass. Over both years of the study (2006-2007), bermudagrass supplied with N from urea treated with either of the inhibitors accumulated significantly less nitrate than bermudagrass supplied with N from ammonium nitrate.

Nutrisphere-N for urea is another type of urease and nitrification inhibitors working at the molecular level. It is a liquid of polymer applied as a coating on granular urea before fertilizer application. Field investigations in other states have shown that Nutrisphere-N can be used to slow down the conversion of urea to ammonia and ammonia to nitrates, and thus provides crops with a better access to stable forms of nitrogen after urea is applied to the soil. In this way, Nutrisphere-N can reduce the volatilization and nitrification losses of nitrogen and accordingly increase the nitrogen use efficiency of urea.

The use of urease and nitrification inhibitors can successfully improve N use efficiency and ultimately reduce N application costs. The use of inhibitors can also reduce nitrate accumulation in forages, reducing the potential for nitrate toxicity in livestock.

Use of Poultry Litter in Production Fields

Forbes Walker, Associate Professor, Biosystems Engineering and Soil Science
Constance M. Hugo, Graduate Assistant, Biosystems Engineering and Soil Science

In the United States, the production of broiler chickens is concentrated in the Southeast. Increases in global oil prices and an increased demand for fertilizers from some developing countries have resulted in dramatic increases in fertilizer prices in the past 12 months. Many agricultural producers are looking for locally available, cheaper fertilizer sources. Poultry litter is an excellent alternative fertilizer source that can be used on both forages and row crops.

Poultry litter is a mixture of manure excreted by the birds and bedding materials used in the poultry house. The nutrient content of poultry litter varies depending on the type and size of poultry being raised, the type of bedding material, the age of the litter and how it was handled and stored after being removed from the poultry house. The most readily available type of poultry litter available in Tennessee is broiler litter. Rice hulls, sawdust and wood shavings are some of the types of bedding materials that are used in different parts of the state. The age of the litter may vary and have an impact on nutrient content. Typically decaked litter is removed between grow-outs and stored before land-application in the spring or fall. Additionally, growers will remove all the litter from the house after several grow-outs. How the litter is managed, handled and stored before land application can have a significant impact on its value as a fertilizer.

Before applying poultry litter as a fertilizer source, it is recommended that producers follow the University of Tennessee soil test recommendations from soil samples taken from each field where litter is to be applied. It is recommended that a litter analysis be conducted to determine the nitrogen, phosphorus and potassium content of the litter. A typical broiler litter will have a nitrogen (N), phosphorus (P) and potassium (K) content similar to a 2-2-2 or 3-3-3 NPK fertilizer, or around 30 lbs of plant-available nitrogen and 40 to 60 lbs of phosphorus (as P_2O_5) and potassium (as K_2O) per ton. At current prices, this represents a nutrient value of approximately just above $40 per ton. Storage of litter will often increase phosphorus and potassium concentrations.

It is important to base the application rates of alternative fertilizer materials on nutrient analyses and crop requirements determined from soil test recommendations. Application methods should be selected that do not negatively impact the environment or the crop quality. The application of poultry litter to meet crop nitrogen needs will over-apply both phosphorus and potassium, and may negatively impact forage quality through the luxury uptake of potassium. It is recommended that poultry litter applications be made to meet the crop phosphorus or potassium needs and that crop nitrogen requirements be supplemented with a commercial nitrogen fertilizer. For corn, it is recommended that a pre-sidedress nitrate soil test be taken to determine any additional nitrogen requirements that the crop may require. For fescue hay or pasture fields forage samples will determine the potential risk from grass tetany, especially on soils that test high or very high for potassium.

Nitrogen from Cover Crops – Economic Value

Paul Denton, Professor, UT Plant Sciences
John Campbell, UT Extension Area Specialist Farm Management

One of the many potential benefits of cover crops in agriculture is the use of legume cover crop species as a source of nitrogen. Long-term research at the University of Tennessee has shown that a vigorous cover crop of crimson clover or vetch can replace much of the nitrogen fertilizer needed by the following crop. The current recommendation is that a good cover crop of hairy vetch or crimson clover can replace 50 to 80 pounds of nitrogen for the next crop.

The use of legume cover crops as a source of nitrogen has long been recognized by farmers. However, with the relatively low fertilizer prices of the last half of the 20th century, generally it was felt that it was more economical to add more N fertilizer than to attempt to produce a legume cover crop. As a result, there was little use of this practice. Studies of the economics of cover crops often showed that they had potential to increase profits, but the expense of establishment and the extra management required discouraged their use.

The recent increases in fertilizer prices are encouraging a new look at the use of legume covers as a source of nitrogen. At current prices, the value of 50 to 80 pounds of N is from $30 to $60, depending on the source of N used for fertilizer. This contrasts with the situation a few years ago, when this value was less than half of these levels. Even with increased fuel and seed costs, the potential to reduce production costs and increase profit by use of legume cover crops in the current economic environment is clear.

Results of long-term studies at the University of Tennessee with vetch and crimson clover will be presented, with estimates of their potential to replace nitrogen fertilizer in cotton and corn production. In addition, results from economic analyses of cover crop use at differing nitrogen costs will be presented. Management considerations for maximizing the benefit of the covers will also be discussed.

TOUR N
ADVANCED TECHNOLOGIES FOR ROW CROP PRODUCTION

Optimizing Seeding and Nitrogen Rates with Variable Rate Technology (VRT)

John Wilkerson, Interim Assistant Dean, UT Agricultural Experiment Station
Philip Allen, Research Associate, UT Biosystems Engineering & Soil Science

The potential economic benefit of variable rate technology (VRT) increases as input costs and in-field yield potential increase. Producers have seen a significant cost increase in all inputs to row crop production, creating a renewed interest in VRT. Crop inputs can be optimized by applying crop inputs site-specifically based on yield response to both seeding and nitrogen rates.

Systems are commercially available to vary on-the-go seeding and nitrogen rates based on digital application maps. These maps are typically created based on historic information such as previous years of yield data and soil maps. Cotton yield monitoring is the best technique for analyzing the post-season and year-to-year cotton yield-variability within fields. Other technologies for assessing in-field yield potential will be discussed, such as soil electrical conductivity, remote sensed imagery and real-time crop canopy sensors.

An ongoing study in a 50-acre production cotton field at the Research and Education Center at Milan has incorporated all of the fore-mentioned systems. The field selected has a wide range of yield potential, primarily based on variability of rooting depth within a field. Seeding and supplemental nitrogen rates were varied in large plots (100 ft x 12 rows) distributed in an even grid across the field. Nitrogen rates of 30, 60, 90 and 120 lbs/ac were applied to each of the large-scale plots. Seeding spacing was varied to achieve seeding rates of 16,700, 32,400 and 52,225 seeds/ac. Results of this study will be discussed, along with the various technologies necessary for optimizing the benefits of VRT.

Fertilizer Application Using Variable Rate Technology

Mike Buschermohle, Professor, UT Biosystems Engineering & Soil Science

Most previous studies for site-specific, variable-rate applications of crop nutrients showed only modest returns when compared to whole-field management. However, with the recent increase in fertilizer costs, there is a greater chance that more efficient fertilizer use and its associated cost savings can overcome the labor, sampling and application costs associated with site-specific management. To determine if specific management and variable rate technology on a farm are profitable, there are a number of issues that must be addressed: agronomic, economic and technology. Initially, there must be some basis for varying the rate of inputs across the field. The most common basis is on some type of field map that identifies different areas or management zones.

Field maps can be developed in a number of ways. One of the most commonly used methods for developing field maps is directed soil sampling. There are two types of soil sampling techniques used to direct site-specific application: grid and zone. Grid sampling uses a systematic approach that divides the field into squares or rectangles of equal size, usually referred to as "grid cells." Soil samples collected from within each of these "cells" are analyzed for soil fertility levels. This method is used when variability of soil pH and immobile

nutrients within fields cannot be easily identified. The second type of soil sampling technique, zone sampling, uses a more subjective and intuitive approach to divide fields into smaller units. One technique used to create zones in a field uses spatially referenced yield data to develop a map of the field showing high-, medium- and low-yielding areas. Another technique measures the electrical conductivity (EC) of the soil with a sensor-based machine to develop maps related to physical characteristics of the soil.

Field maps can also be developed using a variety of remote sensing techniques to assess plant vigor. Remote sensing methods that can be used to assess crop growth include satellite imagery (less common), aerial imagery (more common) or ground-based imagery used to assess individual plant needs. Field maps using these imagery methods can identify areas in the field that have very vigorous growing plants as well as areas with less vigorous plants. Regardless of which technique is used to develop the map, the goal is to identify areas within a field that have similar levels of yield-limiting variables. A prescription is then developed for applying inputs to each management zone in such a way that yield is increased and/or the level of applied inputs is reduced.

This tour stop will present information on the potential profitability of variable rate fertilizer application. In addition, up-to-date information will also be presented from field-scale research conducted at the Research and Education Center at Milan on field mapping techniques used for developing variable rate prescription application maps.

Software & Sensor for Irrigation Management of Tennessee Row Crops

Brian Leib, Associate Professor, UT Biosystems Engineering & Soil Science
John Buchanan, Associate Professor, UT Biosystems Engineering & Soil Science

The MOIST (Management Of Irrigation Systems in Tennessee) program has been used by Tennessee row-crop producers for the past four growing seasons and is available for download from the Internet as an Excel spreadsheet (http://bioengr.ag.utk.edu/weather/). MOIST is designed to help you decide when to irrigate and how much water to apply to obtain maximum yield without wasting water. Initially, you will have to enter your soil water-holding capacity, soil depth, crop type, planting date, expected harvest date and irrigation system application rate for MOIST to start a water balance and estimate your crop water use rate on a weekly basis.

MOIST calculates crop water use from weather data at different locations in Tennessee and adjusts these estimates by your crop's stage of growth. Also, an automated weather station located in Haywood County has been linked to MOIST and the Internet so you can obtain real-time weather and crop water-use information (http://bioengr.ag.utk.edu/weather/). As the growing season progresses, you will need to enter the amount of rainfall received and the amount of irrigation applied for MOIST to estimate the present soil moisture status of your crop. During this session, you should gain an understanding of what is required to operate the MOIST software.

MOIST represents a water-balance method of estimating soil water content. Another method is to directly measure soil moisture with sensors. WaterMark sensors have been used by West Tennessee producers with University of Tennessee assistance to monitor row crops in more than 10 fields over the last four years. WaterMarks are electrical resistance sensors that determine soil tension (how difficult it is for plants to draw water

away from the soil) and read in units from 0 to 200 centibars (cb). This tensions range can roughly be interpreted as follows: at 0 cb the soil is saturated, at 20 to 30 cb the soil is at field capacity (the greatest amount of water the soil can hold under free draining conditions), at 60 to 80 cb irrigation should be triggered in row crops and at 200 cb yield can be substantially reduced even though some soil water is still available to the plant. During this segment, you will learn where to place the sensors, how to install them and what the senor readings mean.

At the same time MOIST and WaterMarks were being used by West Tennessee producers, experiments were being conducted at the Milan and the West Tennessee Research and Education Centers to investigate optimal irrigation strategies for row crops under local conditions. These experiments vary the timing and amount of water applied to obtain the highest yield with the least amount of water required. Optimum irrigation strategies are being determined by comparing the yield results from the experiments with the output from MOIST and WaterMarks. By the end of this session, you should be better prepared to manage irrigation for optimum return on your investment.

TOUR O
TENNESSEE PARTNERS PROJECT: PROVIDING DUCK FOOD AND HUNTING OPPORTUNITIES ON YOUR LAND

Benefits of Tennessee Partners Project

Tim Willis, Regional Biologist, Ducks Unlimited

The Tennessee Partners Project (TPP) is a cooperative effort between private landowners, Tennessee Wildlife Resources Agency (TWRA), USDA Natural Resources Conservation Service (NRCS), Ducks Unlimited (DU), U.S.D.A., U.S. Fish and Wildlife Service (FWS), Tennessee Department of Agriculture (TDA), Chickasaw-Shiloh RC&D Council (RC&D) and University of Tennessee Extension. The purpose of the TPP is to assist with enhancement, restoration and management of wetland habitat for waterfowl and other wildlife on private lands. Efforts of the TPP are consistent with the Lower Mississippi Valley Joint Venture (LMJV), the North American Waterfowl Management Plan and the Ducks Unlimited Conservation Plan.

All partners involved have a mutual interest in providing habitat for waterfowl and other wetland wildlife. Since more than 70 percent of North America's remaining wetlands exist on private lands, efforts like the TPP provide an effective and cost-efficient means of providing habitat for migrating and wintering waterfowl, shorebirds and other wildlife.

Participating landowners agree to manage the project consistent with a 10-year "Wetland Habitat Development Agreement." The landowner agrees to impound shallow water on his/her property from October 1, or immediately following harvest of crops, until March 1, annually. In return, landowners receive technical assistance (i.e., management recommendations) and water control structures (WCS) at no cost. A management plan can also be prescribed for specific habitats. The TPP also provides cost-share assistance for new dike construction activities. Landowners can receive 75 percent cost-share (maximum of $2,000) assistance for new dike construction projects completed after January 1, 2003.

The TPP provides excellent wildlife habitat and improves water quality. Sedimentation rates can be significantly reduced by over-winter flooding of crop fields. According to research conducted by S.W. Manley (Mississippi State), the use of winter flooding can reduce sediment export by more than 97 percent. These winter water impoundment structures also serve as a secondary treatment reservoir to process pollutants derived from agriculture pollutants. According to a 1981 Missouri research project conducted by D.L. Rausch and J.D. Schreiber, a small flood retention reservoir trapped 85 percent of incoming sediment, 77 percent of the total sediment-borne phosphorus and 37 percent of the inorganic nitrogen. An additional recent research finding indicates that over-winter flooding of fields can significantly lower the amount of herbicides needed for weed control for spring crops.

The Tennessee Partners Project has been in existence since 1993. The partnership began with nine landowners placing 350 acres under contract. Since that time, 350 landowners have placed more than 14,000 acres of privately owned land under contract that has been enhanced through the installation of winter water management practices. Since the inception of the program, it is estimated that approximately 360,000 tons of soil have been kept in the field and out of surface water.

Managing Agricultural Fields for Ducks

Matthew Gray, Assistant Professor, UT Forestry, Wildlife and Fisheries
Melissa A. Foster, MS Candidate, UT Forestry, Wildlife and Fisheries

Thousands of waterfowl migrate through and winter in Tennessee each year. Most of these birds are produced in Saskatchewan (27 percent), Manitoba (19 percent) and Ontario (15 percent0. During their long flight south, waterfowl burn lots of energy, arriving to Tennessee nutritionally depleted and hungry! Additional energetically demanding events occur while waterfowl are in Tennessee during winter, including accelerated heat loss on cold days and courtship activities. Waterfowl also need foods that are high in protein, because they replace some of their feathers in winter. Farmers in Tennessee can take an active role in providing food resources that waterfowl need to survive winter and return to their Canadian breeding grounds in good condition for another year of duckling production. Active management of your lands for ducks also can provide hunting opportunities for your family or additional revenue through hunting leases. The progressive landowner provides a combination of agricultural foods and natural wetlands when managing for ducks.

Ducks are seed eaters and readily consume agricultural grains. However, not all grains are nutritionally equivalent for ducks. Among the common crops, corn, rice and grain sorghum (milo) are nutritionally superior to soybeans. Yields in unharvested fields and waste grain in harvested fields also differ among crops. Research performed by the University of Tennessee Wetlands Program indicates that average yields in unharvested corn and grain sorghum fields are 7300 and 2000 lbs per acre, respectively. These yields equate to having the ability to energetically sustain 460 and 120 ducks per acre per day for 90 days during winter. Grain on the ground following harvest in corn, grain sorghum and soybean fields was 270, 500 and 100 lbs per acre, which equates to the potential of sustaining 3, 6 and 1 duck per harvested acre per day for 90 days. Grain in harvested fields also disappears rapidly due to germination, decomposition and consumption by wildlife other than waterfowl. Research at UT revealed that most waste grain is gone within two months post-harvest.

Therefore, the best way to provide agricultural food for ducks and attract them to your land for hunting is leaving unharvested crops. Ducks will not land in unharvested fields that are not flooded; therefore, the capability to flood is necessary. Programs, such as the Tennessee Partners Project (contact: Tim Willis, 731-668-0700, twillis@ducks.org), will provide landowners financial and technical assistance to build levees and install water-control structures on your land. Most often, strips of unharvested crops are left for waterfowl at the low end of a production agriculture field, where flooding is most feasible. It is recommended that fields are flooded from mid-November through February, during the period when waterfowl numbers are greatest in Tennessee.

Ducks cannot survive on agricultural grains alone; therefore, the proactive farmer also manages for native wetland plants (often called moist-soil plants). Seed from moist-soil plants contain essential minerals and nutrients that are absent in agricultural grains. Also, when moist-soil plants are flooded, aquatic insects that are high in protein flourish. Ducks eagerly consume these insects. Most often, a strip of moist-soil plants is managed at the lowest end of a field below the unharvested crops that are left for waterfowl. At a minimum, a 30-ft wide strip of moist soil plants is recommended, with 30-60 ft of unharvested crops located directly above it. Demonstration plots can be seen on Tour O during the Milan No-Till Field Day.

Management of moist-soil plants is simple, given that seeds typically are naturally found in the soil.

Management includes a combination of flooding, drawing down water and periodic disking. When water is lowered in late February for preparation of annual field planting, it is recommended that at least 1 ft of water is left over the moist-soil zone. If water has not evaporated by the end of June, the remaining water should be drawn down. Moist-soil plants (e.g., barnyard grass, flat sedge and smartweed) will naturally germinate and establish during the remainder of the growing season. Every three years, the moist-soil zone should be disked (2-3 passes) following drawdown to prevent trees, such as willows, from establishing. By providing a combination of agricultural grains and native moist-soil plants, landowners will provide a well-balanced diet for ducks, and be guaranteed to attract the greatest number of birds!

If hunting occurs on your land, it is recommended that at least three days per week are designated as no-hunting. This will ensure that ducks have periods that are free of disturbance, and continue to use your land. Another strategy is not allowing hunting on parts of your land. It is recommended that one-quarter to one-third of your property is designated as a refuge if waterfowl hunting occurs over four days per week. As per federal law, hunting can occur over standing crops or fields harvested with a combine. Hunting cannot occur over agricultural crops that are bush-hogged or knocked down. Hunting over naturally germinated moist-soil plants that are mowed to create openings for ducks to land following flooding is permitted.

For more information or management guidance on your land, contact:
Matthew J. Gray, Ph.D.
University of Tennessee Wetlands Program
865-974-2740
mgray11@utk.edu
http://fwf.ag.utk.edu/personnel/mgray.htm

TOUR Q – RISK MANAGEMENT

Crop Economics – What Is the New Break-Even?

Chuck Danehower, Area Specialist – UT Farm Management
Jimmy Castellaw, Area Specialist – UT Farm Management

In 2007, we saw the start of the increase in crop prices, which gave producers in Tennessee the hope that sustainable profitability had arrived. Although crop prices were improved, weather-related problems caused below-average yields and resulted in financial losses and negative cash flows. Still, crop prices continued to improve, which led to cautious optimism for 2008. As we have progressed in 2008, we have continued to see input prices increase at an alarming rate. For instance, nitrogen costs have increased 50 percent, potash - 127 percent, DAP - 114 percent, lime – 22 percent and farm diesel – 100 percent. From 2007, the fixed and variable cost of production has increased 31 percent for cotton, 63 percent for corn, 52 percent on grain sorghum, 57 percent for soybeans and 56 percent for wheat. Through deals made with their input supplier, some producers have been able to secure input prices at lower levels than are used in these calculations. However, these costs do reflect the current replacement cost for inputs and can give a glimpse as to the break-evens needed for 2009.

This increase in crop prices as well as input prices has created a new break-even of yields and prices. Table A illustrates the break-even yields and prices for 2007 and 2008. Also included is the five-year average yield for Tennessee. The break-even yields were calculated using the NASS 2007 market price, and the midpoint prices of current USDA projections adjusted for Tennessee. The UT Extension crop budgets were used as a guide in estimating costs. Twenty-five percent of gross income was estimated as a land cost in computing breakevens. Break-even is defined as the yield at the average price received to cover fixed and variable costs and land costs. Break-even prices are the prices needed using the five-year average yield to cover fixed and variable costs and land costs.

It is obvious from Table A that the break-evens needed for both yields and prices have increased. The break-even yields for corn, grain sorghum and soybeans are all below the five-year average. However, cotton and wheat break-even yields are greater than the five-year average. This leads to several observations: Yields are still important. Above-average production is still needed for sustained profitability.

1) With increased input costs, marketing the crop has become even trickier. Market too soon and increasing input costs could make what appeared to be a great price only fair.

Table A	2007	2007	2008	2008	5 Year
	BE Yield	BE Price	BE Yield	BE Price	Average Yield
Cotton	878 lbs.	$.67 lb.	974 lbs.	$.86 lb	823 lbs
Corn	106 bu.	$3.14 bu.	110 bu.	$5.11	125 bu.
Grain Sorghum	66 bu.	$ 3.00	76 bu.	$5.00	84 bu.
Soybeans	23 bu.	$6.77	29 bu.	$9.61	36 bu.
Wheat	55 bu.	$5.27	55 bu.	$8.03	51 bu.

2) Continue to watch for opportunities to lock in inputs at lower than market levels. Every year there are opportunities for producers who plan ahead to make favorable arrangements.
3) Net profit margins may be reduced by higher input costs. Much more is at risk due to the higher input costs. Crop insurance may be a necessity, especially if leverage is high.
4) Don't put all your eggs in one basket. We don't know which crop will have the best yield or price, so spread your risk among the crops you can raise.
5) It is important for producers to develop their own budgets and costs of production and incorporate this into a whole farm financial plan. A whole farm financial plan will give producers the ability to know where they are and in which direction they are going. For assistance in whole farm financial planning, contact your county Extension office or call the Tennessee MANAGEment Information line at 1-800-345-0561.

Crop Price Outlook

Delton Gerloff, Professor and Interim Head, UT Agricultural Economics

Unprecedented crop price movements in 2008 have generated both opportunities and challenges for Tennessee farmers. From cotton's short-lived price rally in early March to record high grain prices this spring, 2008 has so far been filled with market uncertainty. Many questions have surfaced regarding this year's market:

1) Why have prices rallied to the extent they have?
2) Will these prices fall or are we at a "new price plateau"?
3) How can farmers capture the current prices for this fall's harvest?

Fundamentally, prices reflect a demand-driven market rally that began almost two years ago. This rally began in the corn market, as the agricultural industry realized there would be a substantial shortfall of corn in the U.S. in 2007 unless corn acreage increased dramatically. The shortfall was a result of strong export demand and an increasing offtake of corn into the ethanol industry. Corn prices rose during the winter of 2006/07 and more than 15 million acres switched over to corn in 2007, with most of the acres coming from soybeans. With lower soybean production, ending stock projections for U.S. soybeans fell well below 200 million bushels for the 2007/08 marketing year. As soybean stock levels dropped, export demand continued to be very strong, and the ethanol industry expanded capacity again. All these factors combined in the winter of 2007/08 to establish record high prices for wheat, soybeans and corn.

As land rents and input prices increased this past year, the cost to grow row crops rose dramatically. In the short run, however, the cost of growing a crop has little to do with how it is priced. A return to output prices of only a couple of years ago could put farmers in a net loss scenario based on the level of current input prices. There is no guarantee that output prices will stay at their current levels. In fact, substantial price rallies have historically been short-lived and may only provide higher price levels for two to three growing seasons. Additionally, input prices do not necessarily drop when crop prices decline. A cost/price squeeze could result at the end of this price rally.

Whether a result of higher transportation cost, commodity fund investments or local buyers passing on more market risk to farmers, basis levels have weakened dramatically over the past two years. As a result, traditional marketing tools have become very risky or expensive, compared to the past. Option premiums have increased, along with margin requirements on hedging accounts. Cash-forward contract prices have dropped well below harvest-futures prices for grains. These factors make the marketing decision more challenging for Tennessee farmers.

The tour stop will include a summary of how the market arrived at its current level, plus outlook information about prices this fall and winter. The latest information for various pricing tools will be used to compare possible marketing scenarios for the 2008 crop.

Farm Bill Policy Issues

Harwood Schaffer, UT Agricultural Policy Analysis Center

The 2008 Farm Bill takes an evolutionary approach to changes in agricultural and does not represent the sea change that some hoped for and others feared. The presentation will look at the assumptions behind the last three farm bills and how they relate to the long-term rationale for farm legislation. One of the key issues is agricultural trade and trade policy issues and the impact they might have on agricultural markets and the effectiveness of the policy instruments in the 2008 legislation

The 2008 Farm Bill

W. T. Hime, County Executive Director, Obion/ Lake County TN Farm Service Agency

The Food, Conservation and Energy Act of 2008, better known as The Farm Bill, has finally become law. Many of the provisions are either the same or very similar to those used in the 2002 Farm Bill. However, there are some marked differences in the two bills as well. Highlights of some of those similarities and differences follow.

Crop bases and yields will basically remain the same as they were for 2007. There will only be adjustments made for expiring CRP contract lands. For the 2009 and future crop years, rice will be divided into long grain and medium grain for base and yield purposes. Bases and yields will also be established for chickpeas, dry peas and lentils to be used during the 2009 and future crop years.

The bill prohibits payments to a producer on a farm if the sum of the bases on the farm is 10.0 acres or less, unless the producer is a socially disadvantaged or a limited resource farmer.

Direct payment rates were not changed. However, the payment percentages did change. For 2008 the direct payments will be paid on 85 percent of the base acres. For 2009 through 2011 they will be paid on 83.3 percent of the base acres. Then in 2012 they will go back to 85 percent of the base acres. The advance direct payment percentage is 22 percent for 2008 – 2011. Advance payments will not be available for 2012.

Counter Cyclical (CC) payments will be available if the effective price for the commodity is less than the target price. There is no change in the way they are calculated. Advance payments equal to 40 percent of the projected rate will be available for 2008 – 2010.

The target prices have been and will be as follows:

Crop	2007	2008-2009	2010-2012
Wheat	$3.92	$3.92	$4.17
Corn	$2.63	$2.63	$2.63
Sorghum	$2.57	$2.57	$2.63
Cotton	$.7240	$.7125	$.7125
Soybeans	$5.80	$5.80	$6.00

The national loan rates will remain the same as in the previous program, except the wheat loan rate increases by 19 cents per bushel. The loan program will remain basically the same. Loan Deficiency Payments (LDPs) will be available if prices were to fall below loan rates. The Posted County Price (PCP) will be based on a 30-day average market price instead of a daily market price.

Payment limitations will be unchanged for 2008, but will change for 2009 and future years. The payment limits for a person or legal entity for 2008

will be $40,000 in direct payments, $65,000 in CC payments and $75,000 in LDPs and/or marketing loan gains. Payment limits are the same for direct and CC payments during the 2009-2012 crop years. There will be NO limit on LDPs and/or marketing loan gains during those years.

For 2009 and future years, the three-entity rule has been eliminated. All payments will be traced back to an individual's Social Security number. When that ID number reaches the limit, payments will be stopped. This will drastically impact producers farming as an individual and as a member of one or more corporations or LLCs. The husband and wife rules remain intact.

Adjusted Gross Income (AGI) rules remain the same for 2008, with the limit at $2.5 million three-year average income per individual or entity. This limit is reduced for 2009-2012, with the limit being a $750,000 AGI from farming or a $500,000 AGI from non-farm income sources.

There is a new addition called the Average Crop Revenue Election (ACRE) for the 2009-2012 crop years. Details of this program as I currently know them to be are as follows:

1. All producers on a farm must enroll or none can enroll.
2. All crop bases on a farm must be enrolled (can't just pick and choose crops).
3. Can enroll for 2009, 2010, 2011 or 2012, but once the farm is enrolled it is enrolled through 2012.
4. Enrolling will require a 20 percent reduction in the direct payments and a 30 percent reduction in the loan rates for the farm. The farm will not be eligible for CC payments.
5. Each farm will establish a yield by crop based on the previous five crop years (dropping the highest and lowest years).
6. Each state will establish a yield by crop using the same method and NASS data.
7. Prices used in calculating guarantees will be the most two recent crop years.
8. Both the state's revenue for a crop and the farm's revenue for the crop must fall before a payment will be made.
9. For the 2009 – 2011 crop years, ACRE payments would be made on 83.3 percent of the planted acreage of the crop on the farm, and for 2012 on 85 percent of the acreage.
10. There will be much more information available about this new program before the 2009 signup begins.

Thank you for your interest and participation in the No-Till Field Day. Your local Farm Service Agency office should be periodically providing you with more details as they become available.

Crop Insurance Overview

Read Jordan, Senior Risk Management Specialist, USDA – Risk Management Agency

The role of USDA's Risk Management Agency (RMA) is to help producers manage their business risks through effective, market-based risk management solutions. RMA's mission is to promote, support and regulate sound risk management solutions to preserve and strengthen the economic stability of America's agricultural producers. As part of this mission, RMA operates and manages the Federal Crop Insurance Corporation (FCIC). RMA was created in 1996; the FCIC was founded in 1938.

RMA, via the FCIC, provides crop insurance to American producers. In addition to crops, there are some insurance plans available to livestock producers. Private-sector insurance companies sell and service the policies. RMA develops and /or approves the premium rate, administers the premium and expense subsidies, approves and supports products, and reinsures the companies. In addition, RMA sponsors educational and outreach programs and seminars on the general topic of risk management.

As an incentive to encourage producers to purchase crop insurance, Congress provides a subsidy to the crop insurance premium. At the catastrophic level of insurance (50 percent of the expected yield and 55 percent of the expected price), this subsidy pays the entire premium. An administrative fee of $100 per crop per county applies. At both the 65 and 70 percent level of coverage, the subsidy is 59 percent of the premium for most plans of insurance. The amount of subsidy is a smaller percent for other levels of coverage. A $30 administrative fee per crop per county applies.

What is risk management? Risk management is the treatment of loss exposures, of which insurance is only one technique. Loss exposure is a set of circumstances that presents the possibility of loss.

Effective risk management is accomplished by identifying the risk, selecting a technique or combination of techniques to handle the loss exposure, implementation of the chosen technique and monitoring the decision and the implementation of the technique.

With this in mind, the post-loss objectives include survival of the business, continuity of operations, earning stability and continued growth. The pre-loss objectives include economy, reduced anxiety and meeting externally imposed obligations.

Techniques used to treat loss exposures include avoidance, loss control techniques to reduce frequency of loss or reduce the financial impact of a loss, transfer and retention. Transfer includes both insurance and non-insurance transfers. Retention may be intentional or unintentional.

RMA has several plans of insurance available. There is a choice of available plans for many major crops, while some crops may have only one plan available. Multiple coverage levels are available within each plan. RMA provides insurance for more than 100 crop commodities; insurance is not available for all crops in all counties. If a producer wants insurance for a crop that is insured in other counties, the producer may be able to obtain the insurance if allowed by the crop policy, if a timely request is made through his or her insurance agent.

The following plans of insurance are available for one or more crops in this area:
Actual Production History (APH), Crop Revenue Coverage (CRC), Revenue Assurance (RA), Group Risk Plan (GRP), Group Risk Income Plan (GRIP), Adjusted Gross Revenue-Lite (AGR_L).

Livestock Risk Protection Insurance Plan is available for Fed Cattle, Feeder Cattle and Swine.

For more information, contact a crop insurance agent or go to www.rma.usda.gov.

TOUR R – NEW TECHNOLOGY IN STORED GRAIN

New Technology in Stored Grain

Russ Patrick, Professor, UT Entomology and Plant Pathology

New and innovative methods are being used to control insects in stored grain. At this tour stop, some of them will be presented. Although some of these methods may not be usable, it will give you a chance to see what other states are doing and how they are doing it. One of the latest that I found at a National Stored Grain Conference at Stillwater, OK was the use of infrared heat to kill insects in grain as well as fruits and vegetables. Russ Patrick, Kathy Flanders and Jim Osment will be providing you with some interesting information on stored grain insect control.

Grain Bin Fumigation

Kathy Flanders, Professor, Entomology Department, Auburn University

There is some truth to the old saying "an ounce of prevention is worth a pound of cure," but in the case of grain bins, prevention often isn't enough. As a first line of defense against insects and molds, farmers should vacuum or sweep empty grain bins thoroughly to remove insect debris and any remaining grain before new grain is stored. Additional steps, such as loading the grain at the appropriate moisture level and treating the empty bin and grain with EPA-approved insecticides, also prevent or discourage the development of stored grain insects.

All too often, though, it will be necessary to go a step farther and fumigate the grain to eliminate bugs. But while fumigation is a common practice throughout the South, where pests and molds are a perennial threat to bins, it still carries more than its share of risks. The most common fumigant used for on-farm grain bins is aluminum phosphide, which breaks down into phosphine gas, a highly toxic, reactive and potentially explosive gas −-the reason why careful planning and monitoring are essential.

A carefully worked out fumigation plan should reflect an understanding of the chemical properties and safety issues associated with the fumigant of choice. The plan also should outline all the steps that should be taken before, during and after fumigation. Without such careful planning, employers can place themselves at serious and even life-threatening risk. In fact, the law requires a fumigation plan − a fact many farmers may not be aware of because the requirement has been in effect only a few years. In mapping out their plan, producers first should consult the Applicators Manual, a multi-page guide that comprises part of the fumigant's EPA-assigned label.

Monitoring gas concentrations is also critical. For safety's sake, it's important to monitor this gas to make sure it's not escaping and spreading into other areas of the farm, such as the farm office, which may be located nearby. Anyone who fumigates is required to keep a log of the concentration of phosphine gas at critical locations during the fumigation progress.

Preparing the grain bin for treatment is another critical part of the fumigation process. If the grain bin can't be sealed, fumigation will be ineffective and unsafe. All openings should be sealed with caulk, expandable foam or duct tape and plastic. If the roof and eaves of the bin can't be sealed, a plastic tarp can be placed over the surface of the grain to keep the fumigant inside the bin.

The Alabama Cooperative Extension System's stored grain Web site features a variety of printed, audio and video media on stored grain: http://www.aces.edu/dept/grain/StoredGrainInformation.php

Fumigation Management Plan

James Sharpe, Southeast Regional Manager, DeGesch America, Louisiana

In 1998, Degesch America and the other phosphine manufacturers were required by the U.S. Environmental Protection Agency to complete a re-registration of phosphine products. The agencies' intent was to insure phosphine products were being used in a safe and effective manner. Through this review process the agency, Degesch America and the other phosphine registrants agreed a written management plan assisting the fumigators would be an effective tool to achieve safer fumigations. Through the efforts of the USEPA and the phosphine industry, the Fumigation Management Plan was developed and incorporated into the new label language. It was published in the September 2003 Federal Register. The FMP was added to all phosphine fumigant labels and as a result the development of a written FMP is required for all phosphine fumigations as mandated by federal law.

In this presentation, Jim Sharpe, the Southeast regional manager for Degesch America, will explain the many advantages of having an FMP and will instruct the audience on the proper way to set up a Fumigation Management Plan using a computer-based template developed by Degesch.

TOUR S – FORESTRY

How to Grow Quality Hardwood Trees

Wayne K. Clatterbuck, Professor, UT Forest Management and Silviculture

Grade1 logs from highly valued species such as oak, poplar, cherry and ash are worth three to eight times more than lower grade (grade 3) logs of the same species. Unfortunately, because of past cutting practices, most forests in Tennessee contain a majority of trees with lower-grade logs and less-valued species. What factors are involved in growing high-quality timber of desirable species? Two factors, tree density (spacing) and sunlight requirements, are key to growing high-quality timber. How these factors are manipulated during forest management prescriptions to yield high-grade logs will be discussed. Low-quality and less-valued trees take just as long to grow as better-grade trees. Considering the greater value of high-quality trees, knowing how to grow high-quality hardwood timber is necessary for greater monetary returns from trees on your property.

High Cost of High-Grading

Larry Tankersley, Extension Forester, UT Forestry, Wildlife and Fisheries

High-grading, a.k.a. select cutting, and/or diameter-limit cutting are common methods of removing timber. Typically, this involves removing the best trees in an area and leaving the rest. The best trees are large and defect-free individuals of a high-valued species. The rest are typically the same age as the larger trees but slower growing, poorly formed and undesirable species.

While immediate cash flow may be large sums, characteristics of the residual stand may be such that future timber harvests will be less valuable. With no consideration or provision for the next "crop" of trees, a timber stand can effectively be "out of business."

High-grading can be "mining" and is often not sustainable in terms of a continuous supply of quality sawtimber. Certain species, especially oaks on relatively good sites, are often replaced by maples and beech that are lower in value when they do reach merchantable size. Smaller, lower-grade trees often never grow into quality trees.

It's important to recognize that as trees grow they move into more valuable product classes. Cutting trees too soon misses that future value. Also, cutting too soon may forego opportunities to naturally regenerate the area to desirable species for the future. Restoration will cost money and time.

Using Wood for Cellulosic Ethanol

Adam Taylor, Assistant Professor, UT Forestry, Wildlife and Fisheries

There is growing interest in developing sources of renewable energy. One option is to convert cellulosic materials into ethanol. Although annual crops such as switchgrass and crop residues such as corn stover contain suitable cellulose, wood from trees is an abundant resource in Tennessee and the wood industry is already a big user of wood for energy. If cellulosic ethanol becomes established in Tennessee, wood will very likely be a major feedstock.

Wood – and all other plant biomass – is ultimately the product of photosynthesis in living plants. The sun's energy is combined with carbon dioxide (CO_2) and water to form simple sugars. These sugars are then converted biochemically in trees to form wood. While wood is a remarkably durable

and potentially long-lasting biomaterial, the sunlight energy can be released (along with the CO_2 and water) when we want to use wood as a fuel.

Wood has been used as a source of heat for warmth and cooking throughout history. Despite the widespread use of wood for other purposes and the dominance of fossil fuels for energy today, fuel remains the main use of wood in the world. More than 50 percent of the trees harvested globally are used for firewood. Wood is also one of the largest renewable energy sources in the United States. A major use of wood in the United States is for the production of heat and electricity at industrial locations. Wood fuels are dominant energy sources for energy-intensive wood processing operations such as the kiln drying of lumber and drying newly formed paper.

Wood is commonly used as a fuel with little or no modification. Firewood is simply cut, dried and burned. Waste materials from wood processing are also usually burned to release their heat. The concept of making ethanol or other liquid fuels from wood is different from traditional wood fuels in that the wood structure itself is converted to new chemicals before it is used as a liquid fuel.

Ethanol is an alcohol that can be used as a liquid fuel for vehicles. Wood does not contain ethanol, but ethanol can be made from the sugars that are in wood. Ethanol is created when yeast ferment free sugars, such as glucose. The starch in corn kernels is one example of a source of sugars for the production of ethanol. The cellulose in wood (about 50 percent of the wood substance) is pure glucose. However, this sugar is bonded in special ways in wood, and is protected by the lignin and other substances. In order for the glucose to be available for attack by the yeast and conversion to ethanol, the wood must first be broken down. This breakdown can be achieved in various ways, using heat and chemicals or enzymes.

The technology for the breakdown of wood to fermentable sugars and ethanol production is being continually refined, but wood may one day provide a significant source of raw material for manufacturing fuels. Wood has a number of advantages as a biomass raw material for liquid fuel production, including

1. Trees are all around us and can be grown with very few 'inputs' of fertilizer, irrigation, etc.
2. Trees can be harvested year-round, with many years of wood production combined in one harvest. In this way, a forest can accumulate and store its potential fuel energy for decades,
3. Wood is a relatively high-density fuel that can be harvested and stored for relatively long periods of time without decomposing,
4. In addition to being a source of renewable raw materials for the production of carbon-neutral fuels[11], forests provide many other products and benefits, such as wildlife habitat and recreational opportunities.

Wood is a concentrated form of stored sunlight (solar energy). This energy can be released and used as a fuel. Wood has always been an important source of energy for people. Today, wood is an important source of renewable energy in the United States and a primary source of fuel for much of the world. Whether it is as simple as a campfire, or as sophisticated as producing ethanol, wood has a number of inherent advantages that ensure it will continue to be an important bio-fuel in the future.

[1] Because trees capture and store carbon-dioxide to make wood, the burning of that wood is not considered to add to the carbon dioxide emissions that contribute to the greenhouse effect and global climate change.

Adding Income Using Farm Ponds

Ron Blair, County Extension Director, Area Fisheries Agent, Henderson County

Even though there are more than 190,000 ponds in Tennessee, very few landowners make any attempt to realize any income from them. The following discussion will outline three options or opportunities to take advantage of this underutilized resource. Whether your approach is strictly fish production or leans toward agri-tourism, landowners must focus on marketing. Landowners are urged to check local and state laws, product liability, risk insurance, feasibility and start-up cost as part of a sound business plan.

1. Fee Fishing – Bird Watching – Rural Tourism:
   There is little doubt the general public will pay for a pleasurable, relaxing visit to the country. Planning for visitors to fish or bird watch includes tidy grounds, helpful hosts, restroom facilities and perhaps supplies for sale or rent, including rod and reels, refreshments, bait and guides. Focus on a quality experience and word-of-mouth to advertise. Fee-fishing operations will more than likely use a private consultant for stocking and feeding regimes. Urban sprawl and hectic lifestyles give this option great potential for expansion.

2. Prawns:
   Commercial production of the Malaysian freshwater prawn has had varying levels of success in Tennessee. Marketing and lower-than-expected production have hindered large-scale operations. This annual crop is best marketed fresh from the pond bank in September. To help offset production costs, one may consider a companion species in cages such as catfish or tilapia.

3. Cage Culture:
   The ability to grow relatively large numbers of certain fish species in cages lends itself to on-farm production without specialized harvest equipment and labor. Tilapia can be raised at 300-400 pounds per cubic meter with 3- to 5-inch fingerlings being stocked in early May and harvested before water temperatures fall below 60 degrees in the fall (mid-October). This tropical fish will not overwinter.

Channel catfish can also be cage-reared, with 400 6- to 8-inch fingerlings stocked per cubic meter fed with a self-feeder and harvested in early winter of the same growing year. Yield should be 350 1-pound fish annually.

Rainbow trout – cages used for tilapia and or catfish can be double cropped with rainbow trout for winter production. Stocking density and feeding are similar to catfish production, with a spring harvest before the water temperature warms to 60 degrees F.

Each state Extension program has developed budgets for these and other enterprises. The Southern Regional Aquaculture Center (SRAC) is an excellent source of specific fact sheets on production specifics.

When Tornado Strikes: What to Know about Claiming a Casualty Loss

David Mercker, Extension Forester, UT Forestry, Wildlife and Fisheries

Risk is inherent to long-term investments. Perhaps no risk is more greatly feared by timberland owners than a direct tornado strike. Damage is normally so devastating that the decrease in timber value reaches 70 to 100 percent loss. Landowners are often left confused about how to proceed, particularly on how to claim a casualty loss.

The IRS recognizes a casualty loss as the "actual loss of tangible or measurable property, which is evidenced by a closed and complete transaction, fixed by identifiable events, and actually sustained during the taxable year." The casualty must be a

natural or other external force, acting in a sudden, unexpected and unusual manner. Therefore, tornados and fires qualify; insects and drought don't. The amount deductible as a casualty loss is the lesser of: 1) the decrease in fair market value of the timber as a result of the casualty, or 2) the adjusted tax basis in the timber, less any salvage revenue.

Arriving at the decrease in fair market value (FMV) requires an inventory and appraisal normally conducted by a professional forester. Essentially it's the difference between the timber value directly prior to and directly following the casualty. Foresters can estimate these two values. If salvage income was realized from the damaged timber, this must be included in the calculation. Logging tickets and receipts should be saved to aid the forester in estimating the decrease in FMV.

Arriving at the adjusted tax basis is normally more challenging. Essentially, the tax basis is the investment value or the amount invested in a capital item. When the property is sold, or when there is a loss, or the property (the timber) is used up, the basis is depleted by recovering it through deductions to gross income on tax returns. The original tax basis varies according to how the property was acquired, whether purchased, inherited or gifted. In cases of purchased property, the basis is the total acquisition cost of the timber. With inherited property, the basis can be stepped up to the FMV at the time of the donor's death. When property is gifted, the recipient obtains the donor's basis. With most ownerships, the basis exists, but was never allocated at the time of land acquisition. In other words, a forester did not appraise the timber. In such cases, a forester can make a current inventory of the timber, then adjust the current volume and value back to the time of acquisition and arrive at the basis. If timber has been logged between the time of acquisition and the casualty, the basis would then be adjusted down to reflect the depleted trees.

Once the decrease in FMV and the basis are known, casualty loss can be figured. It is the lesser of these two. Normally if the casualty is extensive, the decrease in FMV will exceed the basis and a landowner will not be able to recapture the full loss from the tornado. If the basis is zero, the casualty loss is zero. Situations where the basis might be zero (or negligently low) might include:

1. Timberland that was acquired many years ago that has grown considerably (i.e., timber value was insignificant at the time of acquisition);
2. Timber that had naturally regenerated after acquisition (for instance, after a clearcut or after a field was abandoned) with no owner investment in the new trees;
3. Reforested land where costs were recovered through tax credits, deductions or government cost-sharing;
4. Property that was gifted and the giftor's basis was low or zero;
5. The basis account has already been fully depleted from prior timber sales.

Casualty losses are reported on IRS Form 4684. If a casualty loss can't be claimed, and salvage revenue was received, the income must be reported as a capital gain. Likewise, if salvage revenue exceeds the basis, this excess is a taxable capital gain.

Claiming a casualty loss is a complicated process. Unless landowners have considerable knowledge of timber inventory and appraisal, they should work with experienced foresters and tax accountants. Finally, it is good business to have timber appraised shortly after acquisition, to establish a tax basis, thereby making the process described here much easier. For more information, refer to the National Timber Tax Web site – www.timbertax.org.