24th Milan No-Till Crop Production Field Day

TOUR REPORT

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TOUR A – SWITCHGRASS PRODUCTION

The Potential Role of Agriculture in the Production of Renewable Energy

Burt English, Professor, UT Agricultural Economics
Daniel De La Torre Ugarte, Associate Professor, UT Agricultural Economics

Recently, policy initiatives to spur the development and use of bioenergy and bioproducts using starch, cellulose, oil, etc. have been enacted or proposed. The Energy Act of 2005 encourages the development of more renewable energy and expedites the development of environmentally responsible renewable energy projects on federal lands. In addition, the act established a renewable fuel content requirement for the nation's fuel pool, mandating 7.5 billion gallons of renewable fuels by 2012. While ethanol is the primary focus, biodiesel is also defined as an eligible renewable fuel.

While ethanol is currently produced largely from corn, the future predictions are that ethanol will be produced from wood and dedicated energy crops like switchgrass. Analysis conducted by Daniel G. De La Torre Ugarte and Burton C. English indicates that the South, and in particular Tennessee, could play a huge role in meeting future renewable energy goals through the production of dedicated energy crops such as switchgrass. Tennessee has the opportunity to lead the nation in the production of these dedicated energy crops such as switchgrass. If done correctly, production will increase Tennessee farm income and reduce erosion.

In addition to playing a large role in developing a national energy security, bio-fuel and bio-power production is a win for agriculture by increasing farm income, for rural development through the development of jobs, and for the environment by changing current high-input agricultural production practices to ones that involve lower-input perennials.

Producing Switchgrass: A Summary of the Findings from UT's Research Projects

Don Tyler, Professor, UT Biosystems Engineering and Soil Science
Chris Walker, Sr. Plot Caretaker, UT Plant Sciences

Switchgrass is a perennial grass that produces large biomass yields for potential conversion to energy by co-firing, conversion to ethanol, etc. Considerable research has been done on numerous high-yielding grasses. Switchgrass was chosen as the most viable species for widespread use as a biomass crop in the U.S. Research in the past has considered many questions about switchgrass production, but specific recommendations for Tennessee soils and climate relative to seeding rate, nitrogen fertilization and weed control were lacking. The lowland Alamo variety had previously been shown to be the most suitable selection that was commercially available. Breeding research on switchgrass had been done by Joe Bouton, University of Georgia and Charles Taliaferro, Oklahoma State University. They selected breeding lines from their work for us to compare to the naturally selected Alamo variety.

We compared the Alamo variety with three selected cultivars, two from Georgia and one from Oklahoma. All three were more vigorous in growth habit as compared to Alamo and were higher-yielding than Alamo on some of the four soil-landscape positions studied. These included a moderately well-drained soil on a level upland, an eroded moderately well-drained sideslope, a well to moderately well-drained bottomland, and a somewhat poor and poorly drained bottomland. These four soil and landscape position combinations are representative of the positions common in West Tennessee.

On each of these four positions we also established a seeding rate-nitrogen fertilizer rate interaction study. In the year of establishment, we used five different seeding rates of the Alamo variety of 2.5, 5.0, 7.5, 10.0 and 12.5 lbs. pure live seed (PLS) per acre.

No nitrogen fertilizer is recommended in the year of establishment. In the second growing season, we applied four rates of nitrogen fertilizer, 0, 60, 120 and 180 lbs. N/acre on each of the seeding rates. The effect of nitrogen and seeding rates varied across sites but on the most productive sites, the lower seeding and fertilizer rates were sufficient in the second growing season. Weed competition was one of the reasons for the low productivity of some sites.

Very few herbicides are available for weed control in switchgrass. Weed control research has been initiated by Larry Steckel, Assistant Professor, UT, on weed-control strategies in both the establishment year and second growing season, with emphasis on control of very competitive problem grasses such as broadleaf signalgrass and crabgrass. Control of grass competition in heavily infested areas is essential for good switchgrass establishment and subsequent future production. Weed control options have been identified, but most are not currently legally labeled for switchgrass.

If switchgrass becomes a viable alternative crop, we hope to have effective and economical production strategies developed for Tennessee producers.

Growing Switchgrass in Tennessee from a Farmer's Viewpoint

Ken Goddard, Henry County Director, UT Extension
Tony Brannon, Dean, School of Agriculture, Murray State University & Henry County Farmer

Switchgrass is an alternative energy source. It is a "**Green Energy**" crop, offering characteristics that researchers feel can significantly increase the production and use of bio-energy and bio-products by 2030.

Switchgrass is a native warm-season perennial. Its potential usage is attractive to farmers because it:

- has a low fertilizer cost
- grows quickly with minimal management
- produces a high yield (five to 10 tons of dry matter per acre)
- grows well on a variety of soil types
- can produce 100 gallons of ethanol from one ton
- has no insects/diseases at this time
- requires no specialized equipment

Producers are interested in all these characteristics if viable markets become a reality. The UT Institute of Agriculture is cooperating with Oak Ridge and the National Renewable Energy Laboratories in a switchgrass production program funded in part by a grant from the Department of Energy.

More than 35 acres were planted at the Research and Education Center at Milan in 2004. An additional 92 acres were planted by five farmers in Henry and Benton counties in northwestern Tennessee in 2005. During the winter of 2004-2005, farmers within a five-county area were asked to bid an annual per-ton plus a per-acre gross income from switchgrass over a four-year period to be considered as cooperators in this study. Bid prices were to reflect prices competitive with traditional row crops. Fields following corn or soybeans were preferred. The DOE grant funds became the "**market**" for those five farmers.

Switchgrass establishment considerations:

1. A drill with a small seed hopper is adequate for establishing switchgrass. No-till is preferred.
2. Planting dates range from late April to mid-June.
3. Phosphorus and potash are not needed in soils testing medium or higher for these primary nutrients.
4. No lime is needed at pH levels above 5.0.
5. Do not use nitrogen the first year. This only increases competition.
6. Plant shallow when moisture is available with eight pounds viable seed per acre.
7. Chemical weed control options need further study plus product labels are needed (Accent, Cimarron, Crossbow, 2-4D).
8. Annual grasses (signalgrass, large crabgrass) become major establishment problems.
9. Sixty pounds nitrogen per acre suggested for year two and subsequent years.

10. A one-cut harvest after frost when plants senesce is suggested.
11. Large round or square bales are used for transporting.
12. Leave a 5-inch stubble to avoid tire punctures starting in year two.
13. Nutrients return to soil in a one-cut system.
14. Research indicates 30 percent of potential yield in year one and 60 percent in year two. One-hundred percent production potential expected in year three and beyond.

Problems during switchgrass establishment:

- Tillage created added competition.
- Annual grasses canopied switchgrass seedlings. Total stands can be lost.
- Broadleaf weeds created lesser problems but should be kept in check.
- Difficult to establish good stands in wet soils.

Other problems to be addressed:

- Transportation
- Storage
- Markets and market location

TOUR B – NO-TILL COTTON PRODUCTION

Producing Cotton in 15- and 30-inch Rows

Owen Gwathmey, Associate Professor, UT Plant Sciences
Larry Steckel, Associate Professor, UT Plant Sciences
Jerry Parker, Lauderdale County Director, UT Extension

Tennessee cotton producers are interested in narrow-row and skip-row cotton as possible ways to improve their production systems. Narrow rows (<30 inches) have advantages on certain upland soils where traditional wide-row cotton may not lap the row middles. However, ultra-narrow row (UNR, 7- to 10-inch row) cotton has encountered problems due to high seed costs and to fiber quality discounts associated with stripper harvesting. Newly developed John Deere Pro 12™ VRS cotton picker units offer Tennessee producers the possibility of planting in 15-inch rows for spindle picking. Producers can potentially gain some of the yield and earliness advantages of UNR cotton without sacrificing fiber quality. Given the high cost of cotton seed, seed treatments and gene technologies, it is essential to plant no more seed than necessary for optimum yield and quality. One possible way to reduce these and other in-row costs is by skip-row planting. Research is needed to evaluate alternative row spacings and seeding rates for Tennessee cotton and to develop appropriate weed control strategies for them.

In 2005, a study was initiated in two similar fields at the Research and Education Center at Milan to evaluate cotton response to 15- and 30-inch rows planted in solid and skip-row patterns. One field was pivot irrigated and the other was not irrigated. In each field, replicated small plots of DP 444 BG/RR were planted in two row widths (15 and 30 inches), each in a solid planting, a 2+1 skip-row, and a 2+2 skip-row pattern. Plots were planted with a John Deere 7300™ planter equipped with finger pickup units. Plots were harvested with a John Deere 9930™ picker equipped with Pro 12™ VRS cotton picker units set on 15-inch centers. Seedcotton samples from each plot were ginned at the West Tennessee Research and Education Center, and fiber properties were analyzed at the USDA-AMS Cotton Classing Office in Memphis, Tenn.

Under 2005 growing conditions, lint yields were 20 percent higher in the irrigated than in the non-irrigated field, but the relative response to row treatment was similar in the two fields. Three combinations of row spacing and planting patterns produced similarly high yields: 15-inch solid, 15-inch 2+1 skip row and 30-inch solid planting. Lint yield of this group averaged 1315 lb/ac, while plant population density ranged from 52,800 to 80,200 plants/ac. Yield per plant was lower in the 15-inch solid planting than in the others. The highest yield per plant in this group was obtained in 15-inch 2+1 skip rows, suggesting this configuration would have a lower seed cost + tech fee than other row patterns that produced equivalent yields. Yields declined significantly as skip-rows increased from a 2+1 to 2+2 pattern. Cotton in all row widths and patterns produced similarly high quality of lint. Results suggest that Tennessee producers interested in 15-inch cotton may consider planting in a 2+1 skip-row configuration to reduce seed costs and tech fees.

The 2006 field study is comparing in-row plant spacings for cotton in 15- and 30-inch rows, each planted in solid and 2+1 skip-row patterns, to determine economic optimum rates for irrigated and non-irrigated fields. The cultivar, ST4357B2RF, was planted with a John Deere 7300™ planter equipped with finger pickup units calibrated to plant either one or two viable seed per foot row. Seeding rates ranged from 11,600 seed/acre in 30-inch 2+1 skip row cotton with one viable seed/ft row, up to 69,700 seed/acre in 15-inch solid cotton with two viable seed/ft row. Plots will be spindle picked with Pro 12™ VRS units set on 15-inch centers to determine lint yield, fiber quality and crop value relative to seeding cost.

Acknowledgments
This research is supported in part by Cotton Incorporated Project No. 06-768TN, and by John Deere & Co. Material support for this study was furnished by John Deere, Tennessee Tractor LLC, and AgCenter, Inc. We appreciate donation of planting seed for this research from Delta and Pine Land Co. and from Stoneville Pedigreed Seed Co.

Weed Control in Cotton

Bob Hayes, Director, UT West Tennessee Research and Education Center
Drew Ellis, Research Associate, UT Plant Sciences

Just when everyone thought that glyphosate and Roundup Ready™ cotton would solve all of the weed control problems, along came horseweed and its 'barnyard companion' pigweed. It seems that just as we think we have the solution to our weed problems, up jumps the devil. It seems that we rarely get or can afford 100 percent control of all weeds, yet that seems to be our goal, especially in cotton production systems. We run into problems when we shave herbicide rates to save a few bucks or the weather deals us a bad hand. Most companies know this and tend to label near minimum rates to get economic control in most cases.

Also, weather plays a huge role in the activity of post-emergence herbicides. Plants must be actively growing to translocate systemic herbicides such as dicamba (Clarity, Rifle, *et al.)* and 2,4-D. Timely rainfall and proper quantity are necessary to achieve optimum performance of residual herbicides. Our weather this spring has been uncooperative as far as herbicide performance goes.

Field comparison of weed management programs on Liberty Link and Roundup Ready Flex varieties will be viewed and discussed, with emphasis on glyphosate-resistant horseweed and pigweed control. Horseweed control 44 days after treatment with Roundup WeatherMax was 53 percent, compared to 88 percent with Roundup WeatherMax + Clarity. At 65 days after treatment, the only treatment with near complete control was Touchdown Total + Clarity followed by Gramoxone Inteon + Caparol. Residual herbicides provide slight improvements in horseweed control over Roundup WeatherMax + Clarity. These residuals may also reduce early-season competition of weeds to allow for more timely postemergence treatments. Sequence applied early postemergence provides some residual control of pigweeds.

While Roundup Ready Flex cotton offers the producer additional flexibility in application timing and as a late-season weed management tool, it will not be sustainable without judicious use in a well-planned program integrating other mode-of-action herbicides. Some of these weed-resistance management strategies will be discussed.

Insect Control in GMO Cotton

Scott Stewart, Associate Professor, UT Entomology and Plant Pathology
Gene Miles, Area Specialist, UT Extension

This stop will address how transgenic Bt cotton traits impact insect control. Bt cotton provides control of lepidopteron pests such as bollworm, tobacco budworm and armyworms. Several cotton varieties, including Bollgard II, Widestrike and non-Bt cotton, are planted to determine the relative level of insect control provided by these new technologies. Both insecticide-treated and untreated plots are scouted weekly to determine the levels of insect infestations, and yield data will be collected to determine how Bt and non-Bt cotton affect the profitability of cotton production.

TOUR C – NO-TILL SOYBEAN PRODUCTION

Soybean Planting Date, Maturity Group, Seeding Rate and Row Spacing

Eric Walker, Research Soybean Agronomist, USDA-ARS
Trey Koger, Research Soybean Agronomist, USDA-ARS, Stoneville, MS

Significant changes in soybean production practices are currently taking place in Tennessee. Many producers are planting soybeans earlier than ever, with some planting before the University of Tennessee-recommended beginning planting date of April 25, while others are planting after the recommended final planting date of June 15. Also, producers are planting earlier-maturing cultivars from maturity groups (MG) II and III and planting more MG IVs and less MG Vs. In addition, variability in seeding rate exists among producers, and the threat of Asian rust has led to renewed discussion concerning row spacing. All of these factors affect soybean yield, and, with the exception of row spacing, modification of these factors requires little or no increase in input costs and potentially offers increased yields and/or net profits. Therefore, numerous field studies are being conducted at the University of Tennessee Milan and West Tennessee Research and Educational Centers to re-examine the effects of soybean planting date, MG, seeding rate and row spacing on soybean yield in an attempt to increase and stabilize soybean yields in Tennessee and increase net profits. Results from the first year of field studies in 2005 suggest the following:

- May was the optimum planting date, and producers should consider shifting mid-June and later plantings to late April.
- MG III, IV and V cultivars produced similar yields, while MG II produced lesser yields. When double-cropped behind wheat, a MG V cultivar produced higher yields than MG III and late IV cultivars.
- The optimum seeding rate for MG IV and V cultivars was approximately 120,000 seed/acre, while the optimum seeding rate for MG III was about 160,000 seed/acre.
- Soybean planted on 15-inch rows produced higher yields than soybean planted on 30-inch rows.

These data are from one year of testing only and are not recommendations. Field studies in 2005 experienced an abnormal precipitation pattern, and these studies are currently being repeated to more accurately evaluate the effects of soybean planting date, MG, seeding rate and row spacing on soybean yield. The tour stop discussion will incorporate data and results from 2006 and provide information to assist in future soybean production decisions.

This research is supported in part by the Tennessee Soybean Promotion Board.

Soybean Improvement for Tennessee and the Mid-South Region

Vincent R. Pantalone, Associate Professor, UT Plant Sciences
Prakash Arelli, Supervisory Research Geneticist, USDA-ARS-MSA, Jackson, TN

Our breeding programs are actively developing high-yielding soybean varieties for Tennessee and the Mid-South Region. In 2006, the Tennessee Agricultural Experiment Station released the variety 'Allen', a mid-group V Roundup Ready variety that exhibits excellent seed yield and higher-than-average seed protein concentration. We are currently working on development and release of a new group IV Roundup Ready and conventional varieties. Many of our newest breeding populations target resistance for multiple races of soybean cyst nematode (SCN). The soybean cyst nematode has been found in much of Tennessee and the Mid-South region where soybeans are produced. The annual losses caused by SCN in Tennessee are nearly $7 million, and SCN losses in the South account for some $65 million. The use of resistant cultivars helps to minimize these losses and to keep them relatively stable. But SCN can quickly

adapt to overcome resistant varieties, especially since all varieties derive resistance from very few sources. Therefore, yield losses continue in the South and losses are rapidly increasing in the Midwest and northern soybean production regions.

New sources of resistance will provide durable resistance. We have identified several new sources for use in breeding high-yielding, SCN-resistant varieties in various maturity groups. Recently, we released two conventional soybean germplasm lines adapted to Tennessee and the Mid-South region, JTN-5303 and JTN-5503. These lines combine high yields with excellent resistance to nematodes and fungal pathogens. They are currently being used by commercial and public breeders to develop SCN-resistant varieties for our region. Several additional germplasm lines are in the pipeline. Our breeding methods combine both traditional and molecular marker technologies for increased efficiency. The collaboration between the University of Tennessee and the USDA Agricultural Research Service has been outstanding for soybean breeding research and development.

IPM – Managing Insects in Soybean

Gus Lorenz, Professor and IPM Coordinator, Department of Entomology, UA Cooperative Extension Service
Billy Hanks, Research Technician, UT Entomology and Plant Pathology

The potential value of insecticidal seed treatments such as Gaucho and Cruiser will be discussed. Seed treatments provide potential control of bean leaf beetle, thrips, three-cornered alfalfa hopper and other early-season pests of soybean. However, more data are needed to determine if and when these treatments give a positive economic return. Other topics covered at the tour stop will include the general management of mid- and late-season insects, especially stink bugs, in soybean. At this time of year, stink bugs are the pest most likely to reduce soybean yields. Information on scouting techniques, treatment thresholds and insecticide selection will be presented.

Correct Uses for Harvest Aids and Importance of Spray Coverage in Soybean

Angela Thompson, Extension Soybean Specialist, UT Plant Sciences
Jeff Lannom, Weakley County Director, UT Extension

Using Harvest Aids

The University of Tennessee is currently re-evaluating the use of harvest aids for something more than late-season weed control in soybean production. With the recent trend towards planting more acres of indeterminate (Maturity Group III and IV) varieties and fewer determinate Group V varieties, harvest aids may play a role in improving the quality of harvest in some fields when applied at the correct time. Research results from southern universities will be presented that identify when to consider using harvest aid products, correct timing of use and cost effectiveness of products such as paraquat and sodium chlorate.

Spray Coverage in Soybean

When soybean rust arrives in the United States, spray coverage will be the most essential element to stemming its spread and lessening its impact until resistant varieties can be identified. Previous spray coverage research indicates the difficulty in adequately covering the lower leaves of the canopy where soybean rust starts. The University of Tennessee is continuing its research in spray coverage from the standpoint of penetration in the top, middle and bottom leaves of the soybean canopy. Preliminary results of coverage with the basic nozzle types air induction, flat fan, hollow cone and twin flat fan indicated that twin flat fan and flat fan nozzles gave better plant coverage from top to bottom than the drift control nozzles that were evaluated. Hollow cone nozzles also worked well but drift was an issue.

Other work evaluated canopy penetration with a flat fan nozzle in an indeterminate (Group IV) variety and a determinant (Group V) variety at different row spacings and plant populations. Row widths were 7½-inch drill, 15-inch and 30-inch rows. Plant populations were the optimal 150,000 seeding rate and a high population rate of 200,000. Coverage was

measured with both 15 and 20 gallons of water for application, and was generally better with 20 gallons of water than 15 gallons, particularly in drilled beans, and with the optimal plant population versus the high seeding rate. Coverage was also better in the Group IV beans at 30-inch rows than with 15-inch rows, but not in the Group V bean, which produced more branching in the wider rows.

A demonstration of spray coverage with different nozzle types will be provided at the field day stop. Important research results from the University of Tennessee and other universities will be discussed, as well as strategies for improving sprayer coverage for the 2006 season.

TOUR D – NO-TILL WEED CONTROL

Soybean Weed Control

Tom Mueller, Professor, UT Plant Sciences
Andy Bailey, Assistant Professor, UT Plant Sciences
Larry Steckel, Assistant Professor, UT Plant Sciences

Soybean weed control over the last decade has been greatly simplified and improved by the widespread adoption of Roundup Ready soybeans sprayed with glyphosate post. This system still provides many producers with excellent results, although some weeds have developed tolerance/resistance to glyphosate. Several years ago, horseweed (mares tail) was confirmed not to be controlled by glyphosate as it had previously been. Glyphosate-tolerant horseweed is now widespread over the Mid-South area, and is especially important in no till/reduced tillage production systems. Although other weeds are of interest to farmers, this tour stop will focus on horseweed management.

Field studies were established to determine crop safety as producers plant soon after early preplant burndown applications. The herbicide treatments include Clarity (8 fl oz), 2,4-D amine (2 pts), 2,4-D ester (2 pts) and Ignite (2 pts), with application timings 4, 3, 2, 1 and 0 weeks before planting. Soybeans were no-till planted on May 23, 2006. Data collected included visual soybean damage and horseweed control.

Herbicide applications made at or just before planting provided the best horseweed control, although all treatments provided > 80 percent control eight days after soybean emergence. However, Clarity and 2,4-D applied 14 days or less prior to soybean planting injured soybeans, with some injury > 20 percent. Within an application timing, Clarity tended to injure soybeans more than 2,4-D ester or amine. Ignite prior to planting did not injure soybeans, which is expected since the active ingredient (glufosinate) has no residual soil activity.

Care should be taken to read and follow all label instructions on preplanting intervals for these herbicides. At times, farmers wish to plant prior to the period allowed, but they risk soybean injury if environmental conditions favor herbicide persistence and disfavor early-season soybean growth.

Pigweed Identification and Management

Larry Steckel, Assistant Professor, UT Plant Sciences
Andy Kendig, State Extension Weed Specialist, University of Missouri Delta Center

Amaranthus is the genus for the pigweed family. The word is derived from the Greek word amarantus, which means "everlasting." Most growers would agree that this is a very accurate description for the pigweeds. Over the last decade, pigweeds have become a major weed pest in row crops and pastures. Of the 865 members of this family, eight pigweeds are commonly found as weeds in Tennessee. These eight weedy pigweeds can be separated into three distinct groups. These groups are broken up by their growth and flowering habit.

Group I: Tall, Upright Growing Pigweeds with Male and Female Flowers on the Same Plant

The first group includes **redroot pigweed** (*Amaranthus retroflexus*), **smooth pigweed** (*Amaranthus hybridus*) and **slender amaranth** (*Amaranthus gracilis*). These have been the most common pigweeds in Tennessee row-crop agriculture for the last 50 years. Redroot pigweed can be found throughout much of Tennessee, but usually is not the dominant pigweed found in cropping systems. Smooth pigweed has been the pigweed in crop production. Slender amaranth can also be a problem in row-crop agriculture, though not to the extent of smooth pigweed. These three species of pigweeds have similar upright growth habits, are difficult to distinguish in seedling stage, compete very well with most crops and have both male and female flowers on the same plant (monecious).

Group II: Tall, Upright Growing Pigweeds with Male and Female Flowers on Separate Plants

The second group of pigweeds includes **Palmer amaranth** (*Amaranthus palmeri*) and **common water hemp** (*Amaranthus rudis*). They originated in the Southwest and Midwest and are relative newcomers to Tennessee. **Tall water hemp** (*Amaranthus tuberculatus*) is very closely related to common water hemp and is also a member of this group. Tall water hemp is considered to be native to the Mississippi flood plain. These three pigweed species have separate male and female plants (dioecious), have an upright but somewhat branched growth habit and are very competitive with crops. They are a very diverse group and differ widely in branching and coloration of leaves/stems within species. Common and tall water hemp are very difficult to distinguish from each other and can be found in small numbers in West Tennessee. Therefore, many researchers now have simply lumped them into one species, common water hemp. Palmer amaranth is closely related to water hemp and has long been the dominant pigweed in the Southwest. It is the most competitive and rapidly growing species of the weedy pigweeds. Over the last few years, Palmer amaranth has become one of the most troublesome weed problems in row crops throughout West Tennessee.

Group III: Prostrate Growing Pigweeds with Male and Female Flowers on the Same Plant

The third pigweed group includes **spiny amaranth** (*Amaranthus spinosus*), **tumble pigweed** (*Amaranthus albus*) and **prostrate pigweed** (*Amaranthus blitoides*). These pigweeds are similar in that they are somewhat prostrate, usually have substantial branching and are not as competitive to row crops as the other weedy pigweeds. Of these, spiny amaranth is the most predominant weedy pigweed across Tennessee. It is the only pigweed commonly a problem in both row crops and pastures. Prostrate and tumble pigweed can be found occasionally in pasture, row crop and waste areas in Tennessee.

Management

Pigweed control is possible with a number of effective herbicides available. The pigweed species in general can best be managed when a pre-applied herbicide is followed by a post or when a post-applied herbicide is followed by another post-applied that contains some type of residual product to control pigweeds.

Herbicides such as Dual II Magnum, Cinch, Degree, Harness, Outlook, Fultime and Frontier are in many premixes and will provide residual control of pigweed in corn. Atrazine will provide both contact and residual activity on small pigweed. The plant growth regulator herbicides like Distinct, Clarity and 2,4-D are other options in corn. Callisto is a new post-applied herbicide for corn that has very good activity on pigweed. Finally, a relatively new technology, Roundup Ready Corn, can be used. Roundup (glyphosate) is a very effective pigweed herbicide.

In soybeans, Dual, Prowl and Spartan will all provide residual control of pigweed. Glyphosate is a very good control option for pigweed postemergence. The diphenyl ethers like Reflex, Blazer and Cobra will also control pigweeds post provided they are 4 inches in height or smaller. Treflan is still a very good option in conventional-till soybeans.

As with soybeans, glyphosate is the backbone for weed control in cotton. Glyphosate will control pigweeds if there is thorough spray coverage. However, it does not have residual activity and Cotoran, Caparol, Dual Magnum, Direx and Valor, or premixes that contain these products, should be considered to acquire consistent control.

Weed Control in Pastures and Hay Crops

Neil Rhodes, Professor and Head, UT Plant Sciences
Gary Bates, Professor, UT Plant Sciences

Cattle producers in the Mid-South are heavily dependent upon grass pastures and hay as crucial parts of their overall operations. Pastures need to be productive from both grass yield and quality standpoints to optimize grazing efficiency. Unfortunately, broadleaf weeds reduce pasture quality and grazing efficiency. Likewise, broadleaf weeds reduce the quality of hay. Not all broadleaf weeds are created equally. Some, such as buttercup, thistle, cocklebur and ragweed, may be easily controlled. On the other hand, troublesome weeds such as horse nettle (bull nettle), tall ironweed, curly dock and pokeweed are not controlled by a number of popular herbicides.

Recently, new herbicide chemistry developments and registrations have resulted in new products that not only are effective on the easy-to-control species, but also do a good job on a number of the more difficult-to-control species. Equally as important, the situation has improved for those cattle producers who have cotton and other sensitive crops nearby. These new products (registered within the last year) are described below.

Milestone (aminopyralid) – Milestone is a liquid formulation containing 2 lbs. of aminopyralid per gallon of product. The typical use rate for Milestone is 3 to 7 oz. per acre, and it should always be applied with nonionic surfactant at 1 qt. per 100 gal. of spray solution. Milestone should be used only in permanent grass pastures. Due to soil residual, it should not be used in a rotational system. In University of Tennessee research, Milestone has given good to excellent control of weeds such as horse nettle, tall ironweed, curly dock and pokeweed, in addition to cocklebur, ragweed, thistle and buttercup. It is also a good choice for use in areas where, due to sensitive crops such as cotton nearby, 2,4-D cannot be used. Milestone will kill all desirable pasture legumes. However, they can be re-seeded later. Research is currently being conducted to determine if a waiting period of longer than one year is needed before re-seeding.

ForeFront (aminopyralid + 2,4-D) – ForeFront is also a liquid formulation, and it contains 0.33 lb. of aminopyralid (the active ingredient in Milestone) and 2.67 lb. of 2,4-D per gallon. As is the case with Milestone, nonionic surfactant at 1 qt. per 100 gal. of spray solution should be used with every application. ForeFront should be used only in permanent grass pastures. Due to soil residual, it should not be used in a rotational system. ForeFront is a broader-spectrum herbicide than is Milestone. It controls the same weeds, but it also controls certain weeds that are relative weaknesses for Milestone. Two of these are common in the Mid-South, these being buckhorn plantain and broadleaf plantain. The impact of ForeFront on legumes is the same as that of Milestone.

As is always the case, producers are strongly encouraged to read and thoroughly understand the labels of these and other crop-protection chemicals. We also encourage you to contact the local University of Tennessee Extension office in your county if you have any questions.

TOUR E – ENHANCING BEEF CATTLE PRODUCTION IN TENNESSEE

Tennessee Agriculture Enhancement Program

Charles Hord, Cattle Improvement Initiative Program, TN Department of Agriculture

Cattle Improvement Initiative Program

The program has two major components: a cattle genetic improvement program and a cattle-handling facilities program. Both programs utilize cost-share incentives to encourage producers to improve herds and facilities.

The program is designed to improve farm income in Tennessee and to facilitate participation with the national animal identification program. These goals will be achieved by providing cost-share funds for cattle producers to upgrade the genetics of their cattle and install cattle-handling equipment. Funding for this program was provided within Governor Bredesen's budget and approved by the General Assembly.

Agriculture Growth Initiative: Producer Diversification Cost-Share Program

The purpose of this program is to encourage producers to expand into diversified agricultural products to improve farm income and help producers remain on the farm. These goals will be achieved by providing cost-share funds for producers to purchase or upgrade facilities, equipment or aid in marketing farm products.

Animal Health Initiative

The goal of this program is to safeguard animal and public health. This program will aid in the implementation of the National Animal Identification System. This program will provide a faster, more efficient I.D. system in order to minimize disease threats and reduce negative impact on all parties involved. It also provides a system to aid producers in meeting export and value-added requirements.

Safeguarding Agriculture: Premises and Animal Identification

Charles Hatcher, Coordinator-Livestock Identification, TN Department of Agriculture

The first step in implementing a national animal identification system (NAIS) is identifying and registering premises that are associated with the animal agriculture industry.

The number of animal-disease outbreaks that have been reported around the globe over the past decade have greatly intensified public interest in developing a national animal identification program to protect animal health. The European Union, Canada and Australia already have animal identification systems in place. A strong U.S. identification system is in increasing demand as a necessary component of our nation's agricultural infrastructure.

The U.S. Department of Agriculture (USDA) has made the implementation of an NAIS one of its top priorities. When fully operational, the NAIS will be capable of tracking a sick animal or group of animals back to the herd or premises that is the most likely source of infection. The system will also be able to trace potentially exposed animals that were moved out from that herd or premises. The sooner animal health officials can identify infected and exposed animals and premises, the sooner they can contain the disease and stop its spread.

Since 9/11 and the potential threat of bioterrorism, the outbreak of foot-and-mouth disease in the United Kingdom and our recent experiences with BSE in the United States, our ability to track the spread of disease in this country has become really important. Our goal would be able to trace a disease outbreak within 48 hours. The NAIS has been developed to help us accomplish this goal. It would also strengthen the American consumer's confidence in the safety of our food supply.

The NAIS is being implemented in two steps. Step one is the registration of premises housing cattle, bison, swine, sheep, goats, horses, poultry, deer, elk, llama and emus within Tennessee. Step two is individual animal identification and tracking. As we begin, we will concentrate on step one and register as many premises as possible. USDA is currently suggesting January of 2008 to begin mandatory registration of premises and individual identification of livestock, and January of 2009 for full implementation of the National Animal Identification System. At that point, the agency will re-evaluate whether additional measures need to be taken to accomplish its goals.

To start the registration process, you can obtain a premises registration application form from your local Farm Service Agency office, Tennessee Farm Bureau office, local Tennessee Farmer's Co-Op or UT Extension office. You may also download the form from the Web site: www.tennessee.gov/agriculture/tpis/index.html The application form asks for information to set up an account so that you can access your account over the Internet when we offer that capability. It also asks for premises information and has space to add additional premises if you have more than one that is managed separately. After the form is processed, you will be mailed your unique premises ID number on a durable plastic card. For more information, contact the state veterinarian's office at (615) 837-5120 or e-mail tnpremises.id@state.tn.us.

Using Electronic ID to Expand Market Opportunities

Emmit L. Rawls, Professor,
UT Agricultural Economics

The National Animal Identification System (NAIS) is still a work in progress. We have more than 8,000 premises registered in Tennessee, which is ahead of many other states. Educational programs and demonstrations such as these have been conducted across the state to familiarize producers with the technology. Producers have many concerns about liability and privacy of data. We are told some of these are being addressed by the Congress. Here in Tennessee, our own legislature passed laws this year regarding the privacy of data related to animal identification. Under the NAIS, the purpose of registration is to be able to trace an animal's movement over its lifetime and to have that information within 48 hours. The sole intent is to deal with animal-health issues such as a foreign animal disease like foot-and-mouth disease or some bioterriorism event.

Under the current plan, an animal would only need to be identified when it entered commerce. In other words, if an animal did not leave the farm on which it was born, it would not have to be identified. The beef cattle working group has recommended that radio frequency identification (RFID) tags be used. They will cost about $2.50 to $3 per tag and should only be put in when required and then just prior to the animal leaving the farm, to reduce the likelihood of losing the tag. USDA's latest request for funding is being acted on by Congress. The latest report is that Congress wants a definite plan available for public

comment before it releases additional funds. The RFID tags that may eventually be used in the NAIS can also be used to identify cattle moving to feedlots and packers. In this way, it can benefit the marketing of feeder cattle. Placing a tag in a calf's ear does not cause anything else to happen. It does not assure that performance data or carcass data will be returned to the owner. That can happen if and only if all parties involved want it to happen. Through the use of RFID and the Internet, large amounts of data and information can be transferred to buyers, feedlots and packers, if the owner of the cattle wants it to happen. We are finding that feeder cattle that have good performance data to back them up sell higher in the market. It still takes a load of similar cattle to obtain the full benefit of value-added cattle. What is the benefits package that goes with your cattle? Have they been preconditioned? Are they source- and age-verified? Is there any performance history on feedlot gain or carcass traits? Will the cattle allow the buyer to obtain any brand premium such as Certified Angus, Certified Hereford or other brand designation?

Animal identification is becoming very important to buyers of beef, both here in the U.S. and in our overseas customers. McDonald's Corporation has made their wishes very clear about the need for an animal identification system to help scientists, USDA and FDA have the tools to solve any problems that might occur. An animal identification system would also help the United States get back into some lost export markets. Japan is requiring beef only from animals under 21 months when it reopens its markets to U. S. beef. Tennessee has just organized the Tennessee Livestock Network, which will allow beef producers to market Process Verified Program feeder cattle that can be age- and source-verified. This program requires training, record keeping on birth dates, identification of calves and annual audits or verification of records on 10 percent of the producers. It should help beef producers be prepared to market feeder cattle, which would meet the requirements of the Japanese market when it reopens.

Feeder cattle buyers are willing to pay more for cattle that will have greater value to them. Feeder cattle preconditioned with a good weaning, feeding and health program; of known genetics; and with some prior knowledge of performance will bring higher prices in the market. Will you be ready with the cattle?

Considerations When Selecting a Commercial Squeeze Chute

Clyde Lane, Jr., Professor, UT Animal Science
Steve Glass, Decatur County Director, UT Extension
Scott Reese, Humphreys County Director, UT Extension

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

General Considerations

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

After evaluating the requirements for the chute, cost needs to be considered. There is a considerable range in price from a simple manual chute to a complete hydraulic chute. After the decision is made as to the amount of money that can be spent, it is time to start looking at features of available squeeze chutes. All chutes have the same basic features; however, the

ease of use and functionality can vary. Take time to operate all features to determine if they are easy to use. If a wheel kit will be purchased, detach and reattach the wheel kit before the check is written. Do not purhcase a wheel kit that is uncomfortable to use.

Headgates

When evaluating the squeeze chute, a decision must be made about the type headgate that will be attached. Most chutes available in Tennessee come equipped with either a self-catching or a scissors-type headgate. If a producer is working cattle alone, the self-catching may be the headgate of choice. It must be remembered that this type headgate must be adjusted properly so the shoulders of the animal will cause the headgate to close. If improperly adjusted, the animal may be caught at the hips instead of the shoulders, resulting in a potentially dangerous situation.

The self-catching headgate should be easy to adjust. If adjustments are difficult to make, then a different brand may need to be evaluated. The mechanism used to hold the headgate closed should be protected so an animal cannot accidentally cause the headgate to open. Look at the bottom of the headgate to see if there is the potential for an animal to catch its feet when pushing back. The headgate should be constructed so that an animal can not put its feet through an opening where the feet will have to be removed prior to opening the gate.

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

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

Chute

The framework holding the sides of the chute should be attached to the headgate in a manner that will allow easy access to the neck area. If the chute does not allow easy access to give injections in the neck, it is advisable to look at different models. The bottom of the chute sides should be adjustable in width to accommodate different size animals. The adjustment mechanisms should be easy to operate and recessed so an individual will not trip over them while working cattle. Sides of the chute should have bars that can be dropped to allow access to the animals. Chutes differ with regard to bar systems and length. Determine if the bars are too high or too low to allow access to the animals that you will be working. Are the bars easy to raise up and let down? A drop-down panel should be on the bottom to allow access to the underside of animals. This panel should be strong enough to prevent bending, but light enough to be easily opened and closed.

The chute should have at least one side that will open to release a downed animal. Be sure the site selected for placement of the chute will allow for the opening of one or both sides. Be sure that the floor of the chute has traction bars or another mechanism to prevent the animals from slipping.

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

Back Gate

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

Palpation Cage

Squeeze chutes can be purchased with or without a palpation cage. It is strongly recommended that a palpation cage be purchased. The palpation cage provides easy access to the rear of animals for such practices as castration, pregnancy checking and artificial insemination. The palpation cage should be large enough to provide easy access to the animal and have a door that will swing away from the chute and latch across the alley. This will provide protection from the next animal to come into the chute while working with the animal in the chute. Consider whether the palpation cage should have doors on both sides to provide easier access.

Scales

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

Additional Facility Components

A crowding alley and tub should also be considered as essential components for the handling facilities. These can be purchased or made from materials available on the farm. They need to be positioned to provide stress-free movement of animals into the chute.

Summary

The purchase of a squeeze chute is a large investment for most beef producers. A careful evaluation of all components of the squeeze chute should be done before purchase. Make sure the correct decisions are made before the check is written, since the purchased unit will be used for a long time before being replaced.

Conducting A Herd Evaluation: Selection Decisions and Actions to Meet Production Goals

F. David Kirkpatrick, Professor, UT Animal Science
Kevin Thompson, Manager of Producer Genetics, Tennessee Livestock Producers

Goal: Increase uniformity of calf crop.
Actions:
1. Shorten calving season.
2. Consider color in sire selection.
   - Black is dominant
   - Red is easiest color to fix
   - Solid-colored bull to cover spotting
3. Cull open and late-calving cows.
4. Save replacement heifers from earlier-calving cows.
5. Frame size needs to be considered if calves' frames are either too small or too large.
   - Calves need to be upper range of medium frame to middle range of large frame.
   - Frame score is highly heritable.

Goal: Increase weaning weight.
Actions:
1. Select sire with excellent weaning and yearling weight EPDs.
   - at least breed average or above for both.
2. Pay attention to birth weight EPD to insure against dystocia.
   - particularly in single-sire herds where mature cows and heifers bred to same bull.
   - needs to be below breed average for heifers

3. Consider higher milk EPD if additional feed resources can be met.
   - needs to be considered if saving replacement heifers.
   - if replacement heifers are not saved, no need to consider milk EPD.
4. Consider crossbreeding to capitalize on hybrid vigor.

Goal: Increase percent calf crop weaned.
Actions:
1. Pregnancy check cows.
2. Pay attention to birth weight EPD.
3. Make sure maternal milk level and feed resources are compatible.
4. Have breeding soundness exam performed on bull annually.
5. Follow recommended health and vaccination program by local veterinarian.
6. Identify cows and calves and record breeding and calving dates.
7. Evaluate body condition score (BCS) of cows at calving and weaning
8. Utilize crossbred cows to take advantage of maternal heterosis.

Goal: Retain ownership.
Actions:
1. All above need to be considered.
2. Consider carcass EPDs to be compatible with grid market target.
   - Marbling EPD for quality (at least breed avg.).
   - REA and fat for quantity (at least breed avg.)

TOUR F – NO-TILL EQUIPMENT DEMONSTRATIONS

William Hart and Joe Sarten

French Implement Company

Martin Planter Attachments

MMS Equipment

TOUR G – SOIL AND NUTRIENT MANAGEMENT – FERTILIZER, MANURE, BIOSOLIDS, CROP ROTATION AND COVER CROPS

Improving Nitrogen Fertilizer Use Efficiency

Hubert J. Savoy, Associate Professor, UT Biosystems Engineering and Soil Science
Paul Denton, Professor, UT Plant Sciences

Anhydrous is generally the least expensive and most concentrated source of nitrogen, but due to availability and difficulty in handling and application, it is the least-used source in Tennessee. Ammonium nitrate is the most extensively used source, followed by urea and liquid nitrogen. Soil moisture and depth of placement are important considerations for efficient use of anhydrous. Nitrogen loss by volatilization is important to address when urea or urea-containing liquid nitrogen is surface-applied and not incorporated by tillage and rainfall. Today, potential volatilization losses can be avoided by treatment of the urea materials with a commonly available urease inhibitor. Generally fewer problems are associated with application or loss of nitrogen from ammonium nitrate, but that material's tendency to rapidly absorb water from the atmosphere can make storage and handling problematic.

Nitrogen cannot be efficiently used when crops are stressed by low soil pH or other nutrient deficiencies. Investment in seed, herbicide and time spent in preparation can all be lost simply because the field is too acid (low soil pH). Year after year, soil samples from problem fields come into the lab where crops have failed to thrive because attention was not given to identifying and amending soil pH, phosphorus or potassium before planting and applying nitrogen fertilizers. Often, additional nitrogen fertilizer is applied to try and correct a problem that has nothing to do with lack of nitrogen. Properly soil testing before planting and application of nitrogen fertilizers is strongly encouraged to ensure the most efficient use of nitrogen in crop production systems.

Nitrogen rate of application should follow closely with university-recommended rates. These rates of application have been determined through field testing in farm fields and on fields at the many Research and Education Centers located throughout Tennessee. This is an ongoing process that continually affirms and refines our recommendations for rates of nitrogen to use with specific cropping systems in Tennessee.

Appropriate credits for expected nitrogen released from legumes or applied biosolids should be taken off the recommended nitrogen rate. For example, the University of Tennessee currently recommends 50 to 70 pounds N/acre credit off the nitrogen rate for corn following a good cover crop of crimson clover or hairy vetch. Generally, credits for applied biosolids are determined through testing of those materials and then taking an appropriate portion of that total N found in the material as being available to the plant that season. This portion can vary from 20 to as much as 50 percent or more of the total N.

Timing of nitrogen application is important for efficient use in our crop production systems. Nitrogen release and conversion to the highly available nitrate form should closely coincide with the time of greatest plant need for nitrogen. Too early an application can result in excessive N loss due to denitrification or leaching. In corn production systems, UT research has shown a delayed application of nitrogen to be more efficiently used than application at planting.

Using Alternative Sources of Fertilizers: Manures, Litters, Biosolids

Forbes Walker, Associate Professor, UT Biosystems Engineering and Soil Science
Neal Eash, Associate Professor, UT Biosystems Engineering and Soil Science

Recent increases in the cost of commercial fertilizers have renewed interest in alternative sources of fertilizer. The most commonly available alternative fertilizer sources for many farmers are animal manures and poultry litters from livestock operations, biosolids (or treated sewage sludge) from municipal waste water treatment operations and legume winter cover crops.

The nutrient content of animal manures varies depending on the species and age of the animals, their diet and how the manure is handled and stored. During the normal handling and storage of many dairy and swine manures, water is added, making it difficult to estimate nutrient content without conducting a laboratory analysis. In most cases, it is not economical to transport liquid manures more than a few miles from where they are produced. On the other hand, poultry litter is a relatively dry material consisting of the mixture of bedding materials and manure from the broiler operations. 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 $30 to $40 per ton. Storage of litter will increase phosphorus and potassium concentrations.

Biosolids are often available at no cost from local water treatment plants. Biosolids have to meet federal standards for pathogens and heavy metal concentrations before they can be used as fertilizer sources. Class A biosolids can be land-applied with few restrictions, whereas Class B biosolids have some use limitations. Quick lime is commonly used in the processing of many biosolids. Lime-stabilized biosolids can be used as an alternative lime source, source of organic matter, phosphorus and to a lesser extent, nitrogen.

Winter legume cover crops such as hairy vetch (*Vicia villosa* Roth) or crimson clover (*Trifolium incarnatum* L.) have been demonstrated to reduce crop nitrogen needs for a following crop by up to 60 lbs of nitrogen fertilizer per acre. The costs associated with cover crops include the cost of the legume seed. An additional benefit with cover crops is the protection of soil and reduction in erosion over the winter months.

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 biosolids to meet crop nitrogen needs will over-apply phosphorus and may negatively impact the environment. The application of manures and 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.

Effects of Combinations of Cropping Sequences of Corn, Soybean, Cotton and Bio-covers on Soil Carbon Sequestration, Yield and Cyst Nematodes

Fred Allen, Professor, UT Plant Sciences
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Jenny Noe, Graduate Research Assistant, UT Plant Sciences

There is widespread concern over increases in the atmosphere of so-called "greenhouse gases" (CO_2, SO_2, NO_x, etc.) because of their purported enhancing effects on "global warming." One of the concerns relates to increased CO_2 levels in the atmosphere. Because CO_2 is the C source in the photosynthetic pathway of plants, there is great interest in finding ways to utilize forests, forages and crop plants to

maximize the capture and storage or "sequestration" of CO_2 from the atmosphere. The U.S. is developing a system of rules and guidelines for carbon sequestration (Section 1605b, 1992 Energy Policy Act). Part of these guidelines is a voluntary CO_2 emission and sequestration reporting system. This system has led to the creation of a "carbon credit system," which would give incentives to agriculture and forestry for increasing C sequestration and to industry for reducing CO_2 emissions. The credit system is designed to compensate consumers of CO_2 from the atmosphere (agriculture and forestry) for practices that lead to capture and storage. The program is administered by the USDA through the NRCS.

No-till farming has been shown to increase soil carbon in comparison to conventional tillage. In Tennessee and many other states, no-till has been shown to reduce soil erosion, improve water quality, benefit soil quality and potentially improve yield. Additionally, a carbon credit system would directly benefit no-till farmers by compensation for additional carbon stored in the soil.

This study involves no-till production of Roundup Ready® corn, cotton and soybeans in 13 different cropping sequences combined with four bio-covers (i.e., fallow, poultry litter, vetch and wheat). Each crop sequence/bio-cover treatment is replicated four times. The study was initiated in 2001 and will run through 2009. ***The 52 different cropping sequence/bio-cover combination treatments are being studied to determine: (1) if soil carbon levels can be enhanced by choosing specific cropping sequences/bio-covers, (2) if yields can be maintained or enhanced with sequence/covers, and (3) if soybean cyst nematodes (SCN) build up under some sequences/covers.***

The cropping sequences were chosen to be representative of many that are possible for Tennessee producers growing corn, soybeans and cotton. Three sequences – continuous corn, continuous cotton and continuous soybeans – serve as controls for the cropping sequences. Round-up Ready® varieties of corn, cotton and soybean were used because of the widespread adoption of this gene technology by producers in Tennessee and in the U.S. The bio-covers were chosen to represent the most common practice of winter cover, winter weeds, (fallow) to serve as a control; a legume that produces a lot of biomass and fixes relatively high amounts of N (hairy vetch); a common winter grain cover crop (wheat) used by producers; and a soil amendment, poultry litter, because of its availability as a waste byproduct in many row-crop areas in Tennessee. The corn, cotton and soybean plots were planted in strips in an east-west orientation across the field and the bio-covers were applied perpendicular in a north-south orientation across the row crops.

Results from the soil analyses of 2002 and 2004 indicate that carbon generally decreased slightly from 0.91 to 0.81 percent in the top 6 inches of soil across all cropping sequence/bio-cover combinations. This represents a loss of approximately 900 lbs/acre/year on average in the top 6 inches of soil. Continuous cotton lost the most carbon. Bio-cover did affect soil carbon at the 0-2" depth. Sequences in which litter or wheat was used as a bio-cover lost less carbon in the top 2 inches of soil than those having vetch or left fallow. Vetch and fallow lost 415 lbs/acre/year, while losses of 185 and 250 lbs/acre/year were seen for litter and wheat, respectively. To date, quantities of carbon lost are relatively minor, with the most distinct trends being due to different bio-covers. Typically, fluctuation in soil carbon under no-tillage systems is slow, and takes longer than two years to compare differences among treatments. Soil samples from the fourth year of cropping sequences (2006) are being analyzed to provide a longer-term view of carbon change.

Grain and cotton yields have been tracked each year to determine the relative advantage/disadvantage of sequence/cover treatments. In the first four years, there was no significant advantage to rotating cotton; however, a difference in covers was apparent. On the other hand, rotation of soybean and corn did have a positive effect upon yield. With bio-covers in relation to soybean and corn, there was no clear trend of any one cover being significantly better than another. Another issue of interest in this study is how

cropping sequences/covers affect SCN populations. To date, the sequences with the most frequent plantings of soybean had the highest numbers of SCN. Those with more cotton and corn had low SCN populations. The bio-covers also have had an affect on SCN numbers. Sequences high in soybean had significantly lower nematode populations if they were left fallow or amended with poultry litter. Those planted with wheat or vetch had higher nematode populations. Others have reported that vetch can serve as an alternate host for SCN.

Take-home message:
In Phase 1 of this study, with just two years of 13 cropping sequences and four bio-covers, there was a surprising decline in soil carbon levels. Bio-covers affected soil carbon, with less loss occurring for poultry litter or wheat than vetch or fallow. Corn and soybean yields were positively impacted by rotation, whereas cotton did not show this trend. Continuous soybeans and cropping sequences that had a higher frequency of soybeans tended to have increases in SCN populations. SCN populations increased when vetch and wheat were used as bio-covers in comparison to poultry litter and fallow. Phase 2 of this study includes four more years of the same cropping sequences/bio-covers.

Economics of Selecting Appropriate Soil Fertility/Cropping Program

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Nitrogen is an essential input in the production of corn and cotton. Unfortunately, farmers are currently faced with rapidly increasing nitrogen costs. In 2003, University of Tennessee Extension budgets listed the price of nitrogen at $0.26 lb. The price of nitrogen in 2006 has increased to $0.48 lb – nearly double the price of nitrogen only three years ago. It has become essential that farmers evaluate the amount of required nitrogen, not only from a yield-maximizing standpoint, but also from a profit-maximizing perspective. Soaring nitrogen costs also encourage farmers to look for alternative methods to reduce the amount of required nitrogen for their crops.

Three nitrogen fertilizer price scenarios and their impact on the profit-maximizing nitrogen rate, nitrogen costs and crop net revenues will be discussed. The three nitrogen price scenarios are a low nitrogen price, the current nitrogen price and a high nitrogen price. Scenarios will be evaluated for both corn and cotton.

This presentation compares yield- and profit-maximizing nitrogen rates for corn and cotton. The effects of nitrogen usage, net revenues and the potential benefits of using legume cover crops to replace fertilizer usage and precision farming to make more efficient use of expensive fertilizer nitrogen will be discussed.

The presentation will show that when the price of nitrogen remains low, very little difference exists between net revenues received with the yield-maximizing and profit-maximizing rates of nitrogen. However, when the price of nitrogen rises, the profit-maximizing rate of nitrogen resulted in substantially less nitrogen fertilizer being used. The yield-maximizing rate of nitrogen did not result in an increase large enough to offset the increased cost of nitrogen.

Legumes can add nitrogen to the soil, thereby decreasing the amount of nitrogen needed. Using precision farming also allows farmers to target nitrogen application to areas of the field where nitrogen is most needed and potentially reduces the total amount of nitrogen fertilizer required in a field.

TOUR H – SOYBEAN DISEASE CONTROL

Asian Soybean Rust

Melvin Newman, Professor, UT Entomology and Plant Pathology
Tim Campbell, Dyer County Director, UT Extension

Asian Soybean Rust (ASBR), caused by the fungus *Phakospora pachyrizi* was first discovered in Tennessee in samples of soybean leaves sent to Dr. Melvin Newman from the AgriCenter International in Shelby County near Memphis on December 1, 2004. The samples were quickly sent to USDA-APHIS personnel in Beltsville, Maryland, where they were confirmed by using a quick PCR procedure. Since the growing season was already over, there was no loss in production. Tennessee was the ninth state to confirm the presence of ASBR in the United States mainland since November 9, 2004, when the first samples were confirmed in Louisiana. Other states where ASBR has been confirmed include Alabama, Arkansas, Florida, Georgia, Mississippi, Missouri and South Carolina.

Asian Soybean Rust is a serious disease of soybeans that can quickly destroy soybean yields by causing severe defoliation of the entire plant (from 10 to 80 percent loss in yield in many areas of the world). In recent years, ASBR has moved from South Africa to South America and now into the southern US. There are no resistant varieties and there is little hope of obtaining durable resistance in the near future. The first line of defense against this wind-blown pathogen is the timely use of foliar fungicides. No one knows for sure where or when spores of this fungus will be deposited on Tennessee's crop. It has over-wintered in the extreme southern areas of the US where freezing temperatures rarely occur. There are 95 species of plants that are host to ASBR including kudzu, winter vetch, lima beans, dry beans and lupines. These hosts will surely play a role in the rust's ability to survive and spread into the soybean-growing areas of the country. Southerly winds might carry rust spores hundreds of miles and be deposited in a large area all in the same event. Soybean rust can reproduce in just a few days under warm, moist conditions and then spread even farther into other soybean-growing areas. The amount of spread and damage will depend largely on the environmental conditions in the spring and summer.

Two hundred first detectors and triage personnel were trained during 12 sessions across the state to help producers identify the rust disease. Approximately 70 producer meetings were held on soybean rust across the state, with about 2000 in attendance. In 2005, 33 sentinel plots of early-maturing, early-planted varieties were established and monitored across the state for an early-warning system to help producers decide if spraying a fungicide was necessary for rust control in their soybean crop. Although soybean rust was found in several Gulf Coast states, none was found in Tennessee in 2005. In 2005, several trips were made to the Gulf Coast and three trips to the soybean-growing areas of Brazil to learn more about soybean rust and its control. Before 2005, there were only three fungicides cleared and registered (azoxystrobin, chlorothalonil and pyraclostrobin) for control of soybean rust in the U.S. Section 18 exemptions for seven triazole fungicides were submitted by the UT Extension plant pathologist in October 2003-4. To date, all of the seven fungicides have been cleared. A second list of fungicides for section 18 registration has now been submitted to EPA for rust control for the 2006 growing season.

To effectively control soybean rust, producers must spray fungicides before the rust pathogen gets started. Producers in Brazil report that they had success in 2004 with only two applications in most cases. But the first application must be sprayed on the soybeans before infections reach the 5-10 percent level. It will be very difficult for the untrained person to recognize early rust infections, since the symptoms are very much like other diseases that are common in Tennessee soybean fields. However, if producers wait until symptoms are obvious, then it will be much more difficult to control and might take more fun-

gicide sprays for less control. Since this disease has never been seen by most producers or researchers, it will be extremely difficult for most producers to accurately identify soybean rust in time to effectively spray a fungicide.

If soybean rust is identified, producers will have to react very quickly to spray fungicides to protect their soybean crop from yield losses. University of Tennessee Extension has developed an action plan for this purpose. We want to reduce the critical time lost due to confusion and misinformation once rust is re-confirmed in Tennessee or in surrounding states. It is critical that fungicides be applied before rust infections get started.

The plan was implemented through the development of an alliance of first detectors. These are professional or semi-professional people who routinely work with soybeans out in the fields, such as Extension agents, seed and chemical company representatives, consultants, producers, CCA's and many others who want to learn how to identify soybean rust. The first detectors were trained the last two weeks of March 2005 to recognize all the major soybean diseases that occur in Tennessee, including soybean rust. They received training on how to take suspect soybean samples and where and how to deliver them for confirmation. They used cell phones, e-mails and conference calls to keep in touch with trained soybean specialists and diagnosticians. Secondly, triage personnel across the state were trained by UT soybean specialists and pathologists to be able to give positive diagnosis of soybean samples submitted by the first detectors. Many Extension agents have microscopes in their offices and were trained to recognize soybean diseases. In addition, labs already in use in Jackson (WTREC), Knoxville (Entomology and Plant Pathology Dept. at UT) and the main plant pest diagnostic lab in Nashville served as centers for diagnosis and training.

Additional comments will be made concerning fungicides and control of soybean rust during the field day stop on soybean diseases.

Management of Nematodes on Soybean and Rotational Crops

Idris Abdi, Research Associate, USDA-ARS
Allen Wrather, Professor, Division of Plant Sciences, University of Missouri

Food and reproduction are keys to nematode survival. Soybean cyst, root-knot and reniform nematodes are the major nematodes that attack soybean in the Midwest and Mid-South. Reproduction only follows if the nematode can extract enough food from the host plant to support reproduction, thus food is the major determining factor in management of plant parasitic nematodes. Food for the nematodes, through choice of crop –either soybean or a rotational crop – can be regulated by the producer. However, crops or plants that do not support establishment of feeding sites by the nematodes, thereby starving the nematodes, can be of low economic value for the producer. Therefore, despite a fairly wide choice of rotational crops from the nematode food standpoint, the economic return for the investment severely limits the choice of rotational crops. Poor hosts and resistant varieties do not support establishment of adequate feeding sites, and reproduction, when it does occur, results in few eggs. The next hurdle with rotational crop selection is the longevity of certain nematodes within the soil reservoir despite the absence of plant hosts. Soybean cyst nematode has survived in a field site more than a decade without plant hosts present.

Once soybean or a rotational crop has been selected, cultural management strategies can further influence reproduction of the nematode. Our data have shown that changing from a no-tillage situation to a tilled scenario can increase soybean cyst nematode reproduction eight-fold. This response indicates to us that changes in the soybean rhizosphere are responsible for the increased reproduction. We are looking at the interaction of rhizosphere bacteria, fungi and nematodes, along with the soil chemical composition to identify relationships in the rhizosphere niche that drive soybean cyst nematode reproduction.

Charcoal Rot and *Phomopsis* Seed Decay of Soybean in the Midsouthern USA

Alemu Mengistu, Research Plant Pathologist, USDA-ARS
Jason Deffenbaugh, Biological Science Technician, USDA-ARS

Charcoal rot, caused by the fungus *Macrophomina phaseolina,* occurs throughout both the southern and northern regions of the U.S. and in the world. Charcoal rot causes disease in more than 500 crop and non-crop species, including soybean, maize and cotton. Corn, grain sorghum and cotton generally support lower populations of micro-sclerotia in soil than does soybean. Charcoal rot ranks second among economically important diseases in the Mid-South US, next to soybean cyst nematode. Public and commercial breeders are increasingly concerned about the emerging importance of this disease. The pathogen enters the plant through the root system and colonizes the stem. Infected tissue appears gray due to the dark micro-sclerotia produced by the fungus. It is a disease that causes pre-mature plant senescence and can be seed-borne.

Phomopsis seed decay is another major disease of soybean that is caused primarily by *Phomopsis longicolla*. *Phomopsis longicolla* has become an increasing problem for soybean growers, and results in significant economic losses. Heavy infection of seed by *P. longicolla* directly impacts market grade by increasing the number of moldy beans, and indirectly affects grade by lowering test weight or increasing the number of split beans. When harvest is delayed and conditions are wet, seeds may be infected throughout the plant. In our research we intend to focus on *Phomopsis longicolla*, the primary causal agent for soybean seed decay.

Charcoal rot and the *Phomopsis/Diaporthe* complex are generally overlooked because symptoms are not conspicuous. Signs and symptoms of these diseases typically are not noticed until plants have matured. The main effect of charcoal rot diseases appears to be pre-mature plant senescence, which curtails yield potential by limiting grain development and filling, while Phomopsis seed decay adversely affect seed quality in crops produced for seed.

Reduced tillage, coupled with no or little soybean rotation in the Mid-South area and shortened crop rotation elsewhere, places greater emphasis on resistance as a means to reduce risk of these diseases. Most soybean cultivars currently grown in the Mid-South region or anywhere else do not possess resistance to charcoal rot and the Phomopsis seed decay. Resistant cultivars offer growers broad-spectrum protection against these two diseases. However, adequate methods and specific protocols for screening breeding lines and germplasm are lacking. We intend to develop protocols to screen soybean lines for multiple resistance to these diseases. The protocols will maximize selection efficiency and resistance screening, helping to accelerate the development of multiple disease-resistant soybean cultivars in breeding programs.

Frogeye Leaf Spot

Bob Williams, Area Specialist, UT Extension
Philip Shelby, Gibson County Director, UT Extension

Frogeye Leaf Spot or Cercospora Leaf Spot caused by the fungus *Cercospora sojina* was first reported on soybeans in Japan in 1915 and first observed in the U. S. in 1942. While primarily a foliage disease, it can also affect the stems, pods and seed. Fungus can be present on seed but primarily on infested soybean residue. Seed quality can be severely reduced under heavy disease pressure.

Frogeye symptoms first appeared on the upper leaf surface as small circular/angular spots expanding with an ashen center and a distinct purple to reddish-brown margin. Several infection sites may coalesce to form large irregular spots that cause premature defoliation.

Young expanding leaves are extremely susceptible to infections from the fungus (conidia) that are carried short distances during warm, humid conditions. Visible lesions may be seen nearly two weeks after sporulation; consequently, lesions are never seen on

young expanding trifoliates. Trifoliates that emerge and expand during weather conditions unfavorable for sporulation may remain relatively disease-free.

Numerous races of the pathogen are known to exist and variety resistance is variable. For the past three years, (2003-2005) this foliar disease has reduced soybean yields statewide by an average of 7 percent, despite efforts in variety selections. While lack of crop rotation and planting of susceptible varieties have attributed to continued loss of yield, an increase in the number of reported races of this fungus may also play a significant role.

For the past three years, several experiments have been conducted at the Research & Education Center at Milan, supported by the Tennessee Soybean Promotion Board and led by Dr. Melvin Newman, Extension plant pathologist, to evaluate variety response, fungicide efficacy, timing and rates. Each year soybean producers are provided a new list of soybean varieties with (current) disease ratings. Producers have the results of this work either in hard copy or the Internet at utcrops.com to aid in variety selection and/or fungicide application decisions. This can be a tremendous aid in reducing disease and increasing soybean yields.

At the stop, we will be discussing variety ratings, resistance and fungicide use.

TOUR I – PROFITABLE IRRIGATION OF ROW CROPS

Should I Purchase a Pivot?

Chuck Danehower, Area Specialist-Farm Management, UT Extension
Scott Stiles, Extension Economist, University of Arkansas

In an effort to increase their farm profitability, producers in Tennessee are exploring the feasibility of irrigation on their farms. Irrigation is a management tool that can help reduce risk and enhance yields.

Irrigation is useful as a tool to enhance yields. In the surrounding states of Arkansas and Missouri, irrigated crops have had increased yields over non-irrigated crops the last seven years as follows: Cotton – 223 lbs. with a minimum of 138 lbs. and a maximum of 365 lbs; Corn – 46 bu. with a minimum of 34 bu. and a maximum of 64 bu.; Soybeans – 16 bu. with a minimum of 10 bu. and a maximum of 28 bu. An irrigation survey of Tennessee producers indicated that in 2005, irrigated cotton yields were 169 pounds higher than dryland, irrigated corn 37 bu. higher than dryland and irrigated soybeans were 18 bu. higher than dryland. These numbers are based on averages, with some producers not experiencing these increases and other producers having a greater yield increase. On the average, these yield increases can be useful in determining the feasibility of irrigation.

One of the first steps in determining the feasibility of an irrigation system is to obtain a cost estimate for the system and water source as well as acres irrigated. Most irrigation systems have a useful life of moe than 15 years; however, they generally have to be paid back over five to 10 years, with seven years being the most common. Although in the long run, an irrigation system may be profitable, it is important to examine the short-run, cash-flow implications. If the system can not generate enough additional revenue to cover the annual loan or lease payments, the producer must be able to cover the difference until the system is paid off. Use realistic prices along with the estimated yield increase when determining feasibility.

Other considerations include increased costs of production from seed, fertilizer, chemicals, fuel and labor. These increased costs, as well as the costs to run the system, need to be included when examining the payback of a system. The after-tax benefits of purchasing or leasing an irrigation system should also be considered. Producers purchasing an irrigation system would generate tax benefits in the way of depreciation and or Section 179 deduction (increased to $108,000 for 2006) and an interest write-off. If leased, the lease payment would be a tax-deductible expense.

Landowners and producers renting the farmland are increasingly examining ways to irrigate. The most common method has been to split the irrigation payment in the same proportion as the crop is shared, although other equitable splits also exist and are occurring. When both parties increase their net income, it is a win-win situation. It is important to structure your written lease detailing how this arrangement will work and what will happen if the lease is terminated.

Irrigation can be a profitable investment for producers and landowners, but is one that needs to be evaluated on a farm-by-farm basis. For assistance in evaluating irrigation on your farm, contact your local UT Extension office.

When Should I Irrigate and How Much Water Should I Apply?

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

The **MOIST** (**M**anagement **O**f **I**rrigation **S**ystems in **T**ennessee) program has been used by Tennessee row-crop producers for the past two 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's 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 in order for MOIST to estimate the present soil-moisture status of your crop. MOIST allows you to implement your own soil-moisture management goals that will keep you from stressing your crop while maintaining enough storage space to capture and utilize rainfall.

MOIST represents a water-balance method of estimating soil water content. Another method is to directly measure soil moisture with sensors. The neutron probe, tensiometers and resistance sensors (watermarks) are fairly common to irrigation scheduling. However, there are many new instruments coming to the market that measure the capacitance/dielectric constant of the soil. These include EnviroScan, AquaTel, AquaFlex, Moisture Point and others. Much of our research has shown that these sensors can be effectively used in irrigation scheduling, even if the sensors do not produce the exact same measurements. One goal of this session is to inform you of the different sensor characteristics and costs so you can make an informed decision when purchasing this type of irrigation scheduling tool. Placement of sensors, interpretation of the readings and actual readings from a nearby plot will also be discussed.

What is the Cost and Potential of Precision Pivots?

Earl Vories, Agricultural Engineer, USDA-ARS
Daniel Stephenson, Cropping Systems Agronomist, University of Arkansas

Farmers across the US are adopting aspects of site-specific management commonly called precision agriculture. For some, it may have started with their consultant offering to grid-sample fields to save money on fertilizer or lime with variable-rate application. Many cotton growers in the Mid-South now use variable-rate application for seed, fertilizer, plant growth regulators and defoliants. However, some of the potential benefit of variable-rate application can be masked by applying a uniform rate of water across the field.

While producers have known that different parts of their fields need different amounts of water, there hasn't been an easy way to apply variable irrigation rates. Center pivot manufacturers have controllers that can be programmed to vary the pivot speed in different portions of the circle, thereby applying more or less water. However, the application amount is still constant along the length of the pivot, so many variability situations couldn't be addressed by the systems. Until recently, no commercial systems were available for adapting an existing center pivot to true variable-rate application.

The University of Georgia Precision Farming team at the National Environmentally Sound Production Agriculture Laboratory (NESPAL) in Tifton, Georgia and their collaborators developed a system called Variable-Rate Irrigation (VRI). The system varies the amount of water applied to different portions of a field by varying the system speed and pulsing individual sprinklers. Prototype systems were installed and tested, and recently a private company (Hobbs and Holder, LLC, Ashburn, Ga.) began selling and installing a system for existing pivots based on the NESPAL design. In some areas, cost-share money for potential water savings through improved irrigation management is available to producers who install the VRI system. The cost for a producer to convert

a center pivot to VRI will vary greatly, depending on how many individual "zones" he or she wants to control independently and whether he or she qualifies for cost-share funds.

What situations in the Mid-South would benefit from VRI? Almost every field has variable soils. Unusually shaped fields may have a towable center pivot with a large overlap area. One pivot-irrigated field may be planted to both corn and cotton. If the crops are divided into quarters of the field it can be easy to manage; however, in many cases it may be desirable to irrigate both crops at once with different application amounts. For rolling fields like those in much of West Tennessee, it would be beneficial to apply different amounts to the sloping and flat portions of a field.

In 2006, one of the VRI systems was installed on a quarter-mile-long center pivot irrigating a cotton field on the Judd Hill Plantation near Trumann, Arkansas. The field has variable soils and overlapping areas from two adjacent pivots. The system will be programmed to apply variable irrigation rates based on the soils, overlap areas and irrigation studies in the field. In this way the potential of VRI in the Mid-South will be evaluated.

TOUR J – NO-TILL CROP VARIETY DEMONSTRATIONS

Delta and Pine Land Company

Monsanto

UniSouth Genetics

TOUR K – STORED GRAIN INSECTS, UPDATES, FUMIGANT WORKSHOPS AND PRODUCT INFORMATION

Charles R. Patrick, Professor, UT Entomology and Plant Pathology
Kathy Flanders, Extension Entomologist, Auburn University
Jeff Waggoner, Regional Manager, Fumigation Service and Supply

Stored grain insects cause millions of dollars in yield losses to grain producers who try to store their grain for better selling prices at a later date. This tour will introduce you how to better store your grain in addition to fumigation efforts and their dangers and shortcomings. However, if fumigation is properly executed it will become a valuable method of eliminating insects already stored with grain in the bin. One of the most used fumigants is phostoxin, which will be explained by a representative of a fumigant company that does fumigation across the United States and abroad.

TOUR L – FORESTRY AND WILDLIFE

Hardwood Timber Price Trends

Adam Taylor, Wood Products Extension Specialist, UT Forestry, Wildlife and Fisheries

Timber prices have risen over the past few decades, with higher-quality products seeing the largest increases. The timber market is volatile and the outlook for the future is uncertain due to many variables; however, it is likely that forest management including the production of high-quality timber will provide significant financial returns.

The South currently provides 60 percent of the wood used in the United States and 18 percent of the world's supply. Tennessee in particular is an important wood products producer – the state ranks #2 in hardwood lumber production and #1 in hardwood flooring. The Tennessee wood products industry is large, with roughly 1000 companies involved, and varied, with loggers, hardwood and softwood sawmills, furniture makers, pulp and paper plants, log home factories and many others.

Despite the harvest of trees on approximately 235,000 acres each year to supply the large forest products industry, Tennessee forests are growing about twice as fast as they are being cut. This suggests that harvest levels are sustainable, and could increase significantly. In fact, one estimate forecasts more than a 50 percent increase in harvest levels over the next 25 years. In contrast, the quality of the timber resource is not necessarily getting better: the proportion of oak logs that are top quality has fallen by 30 percent over the past 25 years.

Even though the forest supply is growing, timber prices have increased significantly. Price trends have been unstable but, overall, stumpage rates have risen faster than inflation since 1980. Increases have varied by product type, with the biggest rises occurring in higher-quality oak sawtimber. Mixed hardwood sawtimber prices have been relatively flat.

Given the past timber price trends and the increasing global demand for forest products, prices for wood in Tennessee should continue to rise. However, there are many uncertainties. The population of the state is increasing, and this is putting other demands on the forest resource. Urban sprawl converts forests to houses, stores and parking lots. Increasing numbers of people living in the suburbs can restrict the ability of loggers to harvest timber on the forests surrounding cities. At the same time, population growth is increasing demand for forest products around the world.

Imports are currently only a small part of the domestic wood products markets but, with increasing globalization, more imported wood products will be sold in Tennessee. However, the future balance between supply and demand in the world is not yet known. Russia and tropical countries have enormous forests, and highly productive forest plantations are being established throughout the world. On the other hand, deforestation is a serious problem in some countries and developing economies in China and India may provide a huge demand for wood, even for exports from the United States.

The Tennessee wood products industry is changing. The furniture and pulp industries have traditionally been the largest consumers of Tennessee wood. Recently though, the furniture industry has shrunk dramatically, with production moving overseas. The pulp and paper industry is also contracting and this downward trend is expected to continue. On the other hand, plans are underway to build more oriented strandboard (OSB) mills in the South. These mills will be large buyers of logs from the region. There is also much discussion of the possibility of using wood and other "biomass" as a source for fuel and other products. How these changes play out and what happens to demand for logs in Tennessee remain to be seen.

Despite the many uncertainties, it is likely that forests and forest products will continue to be important in Tennessee. There are abundant timber resources in the state and, if past trends continue, prices for wood products will increase. Traditionally, high-quality sawlogs have commanded top prices and prices for these logs have risen the fastest. This suggests that forest management that emphasizes production of quality timber will continue to provide the best monetary returns.

Forestry as an Investment

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

Landowners have a number of choices when it comes to using the acres that we own. For many, livestock production, hay and other crops are annual activities. Many farms, however, own more land than is used for active production. Many other families are reducing the number of acres they own due to a lack of interest in annual costs and time associated with active production.

Planting tree seedlings on these acres as an investment creates incentives for continuing ownership while reducing the annual costs associated with livestock or crop production.

Trees grow and with time become large enough to produce wood products. Price increases are typically at or above inflation. Periodic income from the sale of these trees can be managed. Using compound interest methods, we can estimate the dollar value of the anticipated cash flow from timber sales.

Our analyses indicate that rates of return for planting hardwood seedlings ranged from 6.5 to 10.8 percent over a 45-year planning horizon. Higher returns resulted from planting on better sites for modest establishment costs and where current demand for timber is high. Cost-sharing, reforestation tax incentives and long-term capital gains treatment of income are available to increase returns from tree planting. Lower returns resulted from spending "too much" on establishment, poor growing sites and lower current standing timber values. Higher discount or "cap" rates also resulted in lower returns.

Controlling Non-Native Invasive Forest Plants

Sam W. Jackson, Research Associate; Southeastern Sun Grant Center

When someone begins talking about non-native invasive plants, several questions come to mind. These include questions like: Exactly what is a non-native invasive plant? What makes these plants invasive? and most importantly, How do I control these plants on my property? To find out, let's start with some basic definitions.

The vegetation historically found in a local area is termed native vegetation. These plants have traditionally been found in the area and are well-suited to maintain themselves in their environs. Exotic plants are those plants found in a particular area, but which originated in another continent or country. These plants can also be referred to as non-native. However, non-native plants are not always exotic. Non-native plants may also be native elsewhere in the same country, but not found in the local area. For example, redwoods are native to California and would be non-native in Tennessee, but not exotic. Invasive plants are plants, native, non-native or exotic, that can cause significant ecological or economic damage. Invasive plants can out-compete more ecologically and economically valuable plants. These plants are typically characterized by a rampant rate of spread. This rate of dispersal is due to both human activity and vegetative characteristics. Humans play a large role in the dispersal of plants by moving plant materials to and from locations. Humans also cause significant disturbances to native plant communities that provide opportunities for the establishment of exotic and/or non-native invasives. The seeding and sprouting characteristics of the plants and their roots also significantly contribute to the rate of dispersal. Though a negative term, "invasive" plants can also be native plants that we usually do not consider to be a

problem. Examples of this type of native plant are sumac (*Rhus spp.*), poison ivy (*Toxicodenron radicans*) and redbud (*Cercis canadensis*).

Controlling these plants can be a difficult task. Although cutting and mowing vegetation will retard the growth and competitiveness of invasive plants, they never really solve the problem. Most professionals recommend using an herbicide to control invasive plants. Herbicides, when used properly, have several benefits in controlling problem plants. When applied, the chemicals are absorbed by the plant through leaves, bark or cuts in the wood and are translocated to the root of the plant. The biggest advantage of systemic herbicide use on invasive plants is that they kill the root of the plant, not just the aboveground vegetation, eliminating any chance of re-sprouting. Another advantage is the ability of certain herbicides to be selective about which plants are killed. For example, many herbicides only kill woody plants and leave herbaceous plants untouched. Sometimes, multiple applications of herbicide are needed to control certain plants. No matter which herbicide is used, it is important to read the product label and consult with a professional for application rates and other details. Herbicides differ in selectivity, method of plant kill and their duration in the soil. Most herbicides recommended for use in this publication are to be specifically applied to the plant that is to be removed. They are not to be applied in a broadcast fashion. Each situation must be carefully evaluated before any herbicide is used.

During this presentation, we'll look at the identification and control of some of the common non-native invasive forest plants in Tennessee and some of the common control measures used to treat them.

Forest Certification and Private Forest Landowners

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

As forest certification has grown as a tool to foster sustainable forest management, questions have arisen about the potential and suitability of forest certification for nonindustrial private forest (NIPF) ownerships. This ownership category is particularly important in the United States, where it comprises the majority of the forest land and contributes the greater part of the nation's annual timber removal. Little is known of who among this diverse and sizable group will adopt forest certification on their lands and why, and what they believe it will accomplish. This information is important if viable certification programs are to be developed and implemented.

NIPF owners in West Tennessee with 40 acres or more of forest land were surveyed to evaluate their awareness, acceptance and perceived benefits of forest certification. The results indicate that the largest majority of NIPF landowners had very little knowledge of forest certification. Even so, when provided with a definition of certification, the majority seemed willing to consider it. Those willing to consider certification agreed that it could improve forest management and that it would lessen the need for forestry regulation. They were more likely to be well-educated professionals who were new to land ownership. Those who have received information or advice about forestry were most accepting of certification, and they trust the State Division of Forestry and consulting foresters as potential third-party certifiers. The preference for ways to learn about certification included the passive methods of visiting a Web site and viewing a videotape at home, and the active methods of attending an on-site forestry field day and talking with professional and other landowners.

Controlling Beavers in Tennessee

Aubrey Deck, Wildlife Extension Assistant,
UT Forestry, Wildlife and Fisheries
David B. Lingo, Wildlife Biologist,
USDA-APHIS-Wildlife Services

The beaver, once eliminated from Tennessee due to over-harvest, is now flourishing throughout the state and stirring land manager's emotions. Beaver behaviors are viewed as beneficial by some, but also known as destructive to many agriculture and natural resources managers and road construction engineers. In fact, a beaver dam that is merely a couple of feet tall could flood hundreds of acres, especially in West Tennessee. Those desiring to manage the land for waterfowl probably love this rodent because of its ability to create impoundments. Others, however, are sickened at the sight of clogged culverts, debarked trees and flooded timber and agricultural lands (especially during the growing season). The USDA-Wildlife Services recently completed an environmental assessment in Tennessee. **During a five-year period, individuals contacting Wildlife Services regarding damage caused by beavers reported approximately $1 million/year in damages in Tennessee.** The decision as to whether beavers are beneficial or problematic to the Tennessee landowner/land manager is a matter of perspective, but one thing is for certain, most opinions are highly sensitive.

To effectively manage beaver damage, an individual needs to have knowledge of the animal itself. Beavers are the largest North American rodent, weighing in at up to 85 pounds. Beavers can traverse on land, but are built for swimming with webbed feet and a flat, paddle-shaped tail used as a rudder. They are mammals, and therefore must breathe air. However, they can survive underwater more than six minutes at a time. They are true vegetarians whose diet primarily consists of cambium, bark, twigs and leaves of hardwoods. Their favorites are sweetgum, cottonwood, willow and alder. They will occasionally eat pine bark and roots of other plants (including agricultural crops). However, the majority of damage occurs when they flood an area to gain access to new food. As mentioned, beavers can travel on land to new food, but it makes much more sense for them to flood a new area so they can swim to their meal. The beaver is one of the few species, like humans, who can modify its habitat to suit itself.

If you have beavers on your land you have **3 choices: 1) do nothing, 2) make the beavers work for you or 3) maintain a control program with multiple implements**. Some may have the opinion that beavers were here first, and who are we to interfere in their land management! In this case, they would do nothing, allowing the beavers to dam up areas, eat trees in the area until they exhaust their food supply and move on to the adjacent property. Inadvertently, the long-term effects of the beaver activity will benefit the land. The ponds will slow run-off, thereby reducing sedimentation in streams below the beaver dams. In fact, old ponds will sometimes fill up with silt and produce extremely fertile valleys. During drought periods, these ponds can be invaluable waterholes for livestock and wildlife. Some even become fish-rearing areas. Ironically, some farmers will irrigate from these beaver ponds when in need.

Others may be avid duck hunters or bird watchers and see the beaver as a cheap way to manage their hobby. By drawing the ponds down (with water-control structures) and planting Japanese millet or other crops, you may produce ideal habitat for migratory ducks and other waterfowl. This can be taken a step further for resident wood ducks by erecting nest boxes for brooding habitat. If you personally would be interested in hunting/bird watching these areas on your land, you've just potentially saved hundreds to thousands of dollars in land clearing and bull-dozer work. If you are not personally interested, with very little effort on your part you can increase your income because sports men and women will often pay a premium to lease these lands.

Or, if beavers are critically interfering with your land management plan, you can control them with a dedicated effort of routine maintenance and multiple simultaneously implemented control measures. Possible control techniques include dam destruction,

habitat alteration, tree protection, water control structures, trapping and shooting. No single control measure is guaranteed nor works best alone. The best control program is that which includes several techniques customized to your objectives and budget that is within the legal limits. If a control program is right for you, it is important that you realize that whether you harvest one of 10 beavers in an area or nine of 10, you will have similar results. Your control efforts will not be successful until you rid your localized area of **all** beaver activity. If one is left, it can rebuild a dam overnight. More importantly, even if you are successful in extirpating beavers from your land, how long do you think it will be until more immigrate back to your property? You must maintain these control efforts on a regular basis to be successful.

Establishing Native Warm-Season Grasses within One Growing Season

Mike Hansbrough, Biologist, NRCS

The planting of nwsg and establishment will generally occur in two types of existing field conditions, cropland or existing vegetation (sod). Techniques will differ slightly for planting in cropland vs. planting in existing sod or other vegetation. Select the seedbed preparation technique based on the land condition. Reshape gullies and rills just prior to planting. Apply herbicides according to label directions for weed control. Planting can occur from March to June, with April and May being the preferred months to plant nwsg. June planting should only occur on bottomlands or other sites that retain soil moisture.

Key Points to Successful Establishment:

- Plant early (April – May)
- Use high-quality seed
- Apply weed control techniques
- Obtain good seed-to-soil contact

Establishment in Cropland Residue

No-Till Drilling. Bluestems, Indiangrass and sideoats grama and nwsg mixes of these are all considered light, fluffy seeds that need a drill specifically designed for nwsg. Planting nwsg in crop residue or in fields with little vegetation can be very successful, with some of the best stands occurring in these areas.

- If green plants exist (winter annuals and other weeds) apply glyphosate herbicides such as (GLY-4, ACCORD or ROUNDUP PRO) at 24 to 64 oz/A plus 4 to 8 oz/A of imazapic (e.g., PLATEAU) or 11 oz. of Journey herbicide with an appropriate amount of non-ionic surfactant or spray adjuvant, to these areas prior to no-till drilling.
- If mostly bare ground exists in the crop field, apply 4 to 8 oz/A of imazapic (PLATEAU) or 11 oz./A of Journey herbicide before planting.
- Rills or small gullies areas should be removed before planting, using disking, harrowing or other techniques.
- After the rills are removed and herbicides have been sprayed, plant nwsg seed at a depth of ¼ inch using a specialized nwsg no-till drill.
- Do not attempt to plant if wet or damp conditions exist in the crop field, as soil will build up on drill and clog tubes. Wash drill thoroughly with garden hose or high-pressure washer before and after each use to remove dirt from moving parts.

Establishment in Sod

No-Till Drilling Existing vegetation should be mowed, burned, hayed or grazed (check USDA program restrictions) prior to herbiciding and planting. If cool-season grasses are present, apply herbicides in the fall (October is preferred) when they are actively growing and less than 10 inches in height. In the spring after vegetation has been removed or burned, no-till nwsg using a specialized nwsg drill in the treated area to a depth of ¼ to ½ inch. Apply 6-8 oz. of imazapic (Plateau) or Journey (11-22 oz.) per acre preemergence to help control weeds. Nwsg establishment may be sparse if no-till drilling occurs in vegetation that is still **actively** growing, or if dead vegetation is thick and hasn't been prescribed burned or removed, or if planting occurs late in the planting season on droughty soils.

Managing Native Warm-Season Grasses for Wildlife

Craig Harper, Associate Professor,
UT Forestry, Wildlife and Fisheries

Native warm-season grasses (nwsg) can provide quality early successional cover for many species of wildlife. Depending on the composition and structure of vegetation and the amount of grassland present, various wildlife species are attracted. Pure grass stands may attract eastern meadowlarks, Henslow's sparrows, and, if large enough, grasshopper sparrows. Fields containing nwsg along with several forbs and shrubs, however, are much more attractive to a wider variety of wildlife species. Bobwhite quail, indigo buntings, field sparrows, yellow-breasted chats, blue grosbeaks, dickcissels, wild turkeys, eastern cottontails, white-tailed deer, and many others prefer fields containing nwsg, forbs (such as ragweed, beggar's-lice, pokeberry, partridge pea, native lespedezas), and scattered shrubs (such as sumac, wild plum, blackberry). Nwsg provide cover and nesting structure. Forbs and shrubs provide cover and nesting structure, *as well as food* (seed and soft mast). **The ideal composition for the greatest number of wildlife species is about 50 percent native grass and 50 percent forbs, with desirable shrubs scattered widely throughout the field**.

Balancing vegetation composition within a field is very important if you want to make it attractive and productive for many wildlife species, including bobwhites. Management is required. If fields are left unmanaged for several years, they typically become rank with dense grass growth and undesirable woody encroachment. The field at ground level is choked with thatch and it becomes difficult for small wildlife (such as quail broods) to use the field. There is no dusting space available and the seedbank is suppressed. Desirable seed (if present) is largely unavailable to birds because it is buried in the grass thatch. When adjacent to woods, saplings from red maple, boxelder, sweetgum, winged elm, locust and others can become established and overtake the field.

Fields must be disturbed periodically to set back succession and maintain optimum structure and composition. This is best accomplished with prescribed fire and disking. Fire consumes dead vegetation and stimulates fresh growth. This creates open space at ground level, enabling small wildlife to travel through the field easily. Burning also stimulates the seedbank and recycles nutrients, increasing forage quality for rabbits, deer and groundhogs. Disking also stimulates the seedbank, facilitates decomposition of dead vegetation and creates an open structure at ground level. Disking can be used to thin grass cover and promote additional forb cover. Selective herbicides also can be used to promote desirable plants and eradicate undesirable species (such as tall fescue, orchardgrass, bermudagrass, johnsongrass, crabgrass and sericea lespedeza). **Bushhogging (mowing) is not recommended**. Mowing only accumulates additional thatch and debris on top of the ground, suppresses the seedbank, makes seed unavailable to birds and destroys usable cover. If conducted during summer, mowing also destroys wildlife directly, as nests, hatchlings, fawns and rabbits are commonly killed.

Fields should be managed on rotation to ensure different successional stages are available. Brooding cover and forage are optimum the growing season after burning. Nesting cover is optimum 2-3 years after burning. Escape cover might be optimum 3-4 years after burning. By the fifth year, if not before, succession should be set back with fire or disking. Instead of burning the entire field in one season, burn half the field and burn the other half the following year. If you have multiple fields, burn individual fields every 2-3 years, burning a different field each year. Fire can easily be contained in the area you intend to burn by disking a firebreak one or two tractor widths wide around the area before burning. Fields can be broken into sections that can be managed on a different rotation using firebreaks. Firebreaks can be planted as food plots if desired for a supplemental food source. Clovers and wheat provide quality cool-season forage. Cowpeas, soybeans and lablab provide quality warm-season forage. Sunflowers, Egyptian wheat, milo, buckwheat and millets can provide supplemental seed.

Season of management influences vegetation composition and structure. Burning in February – early April favors nwsg growth. Woody saplings may be top-killed when burned at this time, but expect them to re-sprout. Burning in September effectively kills the majority of woody encroachment. In fact, September burning is as effective as herbicide applications in killing woody species. If September burning is not possible, repeated annual dormant-season burning for 3-5 years will reduce woody cover dramatically. Disking in the fall and winter generally favors desirable forbs; however, disking in the spring may promote undesirable grasses, such as johnsongrass and crabgrass.

Unfortunately, many people think fields managed for wildlife are ugly or "*snaky*." Yes, there may be rat snakes and kingsnakes in these fields, eating the voles and other rodents present. That's good. However, these fields would more accurately be termed "*quaily*," "*rabbity*" or "*birdy*" because that's what they hold an abundance of! If you are interested in seeing more quail, more rabbits and more songbirds in your fields, get rid of the tall fescue and bermudagrass, and manage your fields with the appropriate composition of nwsg, desirable forbs and scattered shrubs. The difference is amazing.

Managing the Habitat Needs of Wild Bobwhites

Roger Applegate, Small Game Coordinator, Tennessee Wildlife Resources Agency

The northern bobwhite has been decreasing in numbers for more than 40 years throughout its range in North America. This decline ensued shortly after World War II as a result of many land-use factors. World War II taught much of the free world the need to become independent producers of food and fiber, which resulted in many of the world's nations adopting a policy of maximizing agricultural production on every available acre of land. The price we have paid for this policy has been loss of habitat for wildlife species by intensification of agricultural production.

Two additional interrelated changes have taken place. Much land within the range of the bobwhite has become urbanized or suburbanized. Other lands, less productive of agricultural outputs, have increasingly become forests. These forests, either planted or natural regeneration, are now maturing to a stage more suitable to white-tailed deer and wild turkey rather than bobwhites and cottontail rabbits. Increased deer and turkey numbers have led to increased human interest in managing for these species rather than for bobwhites and other closely associated grassland and shrubland species.

To be successful in recovering bobwhites to some semblance of their former abundance, it will be necessary to focus on the broad needs of these birds for nesting cover, brood-rearing cover, escape/thermal cover, food and space. The relative importance of these cover types is dependent on both farm-level and landscape-level conditions. Efforts to incorporate only one type of cover within a farm or landscape cannot be expected to produce and increase in bobwhite numbers. Each land unit must be carefully assessed to determine deficiencies in habitat need. For example, it is very popular to plant food plots of various annual plants such as crops (corn, milo) or agronomic plants such as Egyptian wheat, cowpeas, millets and many others. Often, food plots are planted in areas where sufficient foods already exist. Another example is planting of grasses for nesting or brood-rearing cover. Sometimes such plantings are made in situations where sufficient habitat already exists for these purposes, or where other habitat needs such as food or escape/thermal cover do not exist. In other words, bobwhite habitat is a **package deal**. You have to have everything they need or you get nothing.

With all of that as background, we can now focus on what each necessary habitat component is.

N**esting/brood rearing cover**: Generally consists of grasses and a wide variety of forbs (broad-leaved plants). Other presentations on this tour are discussing this cover type adequately and in great detail, but I would like to emphasize a few key points. First of

all, to be of value, grass plantings need to be diverse, that is, made up of several grass and forb species. They can be grazed, but only moderately, and can be mown, as for hay, but not 100 percent hayed unless after mid-August.

Escape/thermal cover: This cover type needs to be scattered about the landscape so that nesting birds have access near nesting cover and winter coveys have access near winter food supplies. Generally speaking, this cover consists of low shrubs and vines, brushpiles and similar structures that provide protection from predators and assist in ameliorating the effects of temperature extremes.

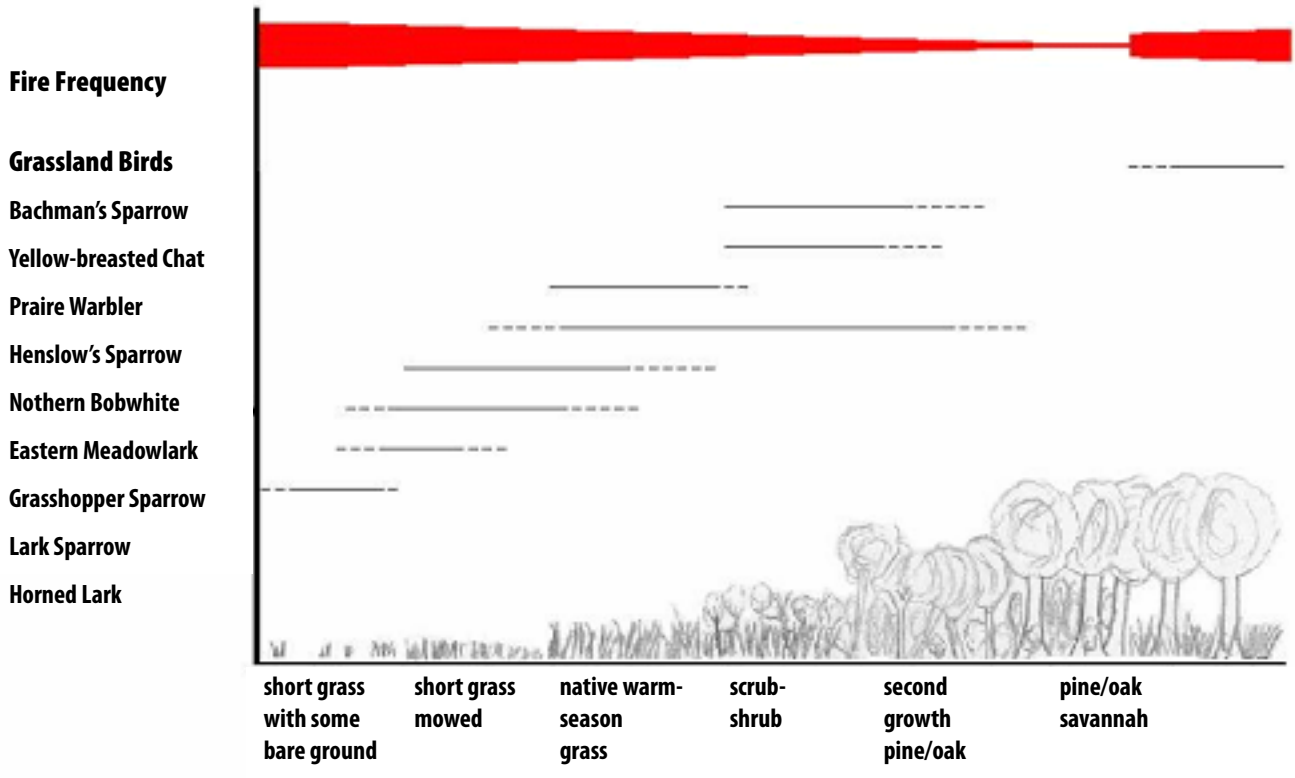
Food: The need for food is self-evident. However, it is important to realize that food is often available within all of the other cover types needed by quail. Many plants growing in nesting/brood cover supply edible greens or seeds, OR, less appreciated, the substrate for producing insects needed by chicks for growth and development. Escape-cover plants can also provide stores of food.

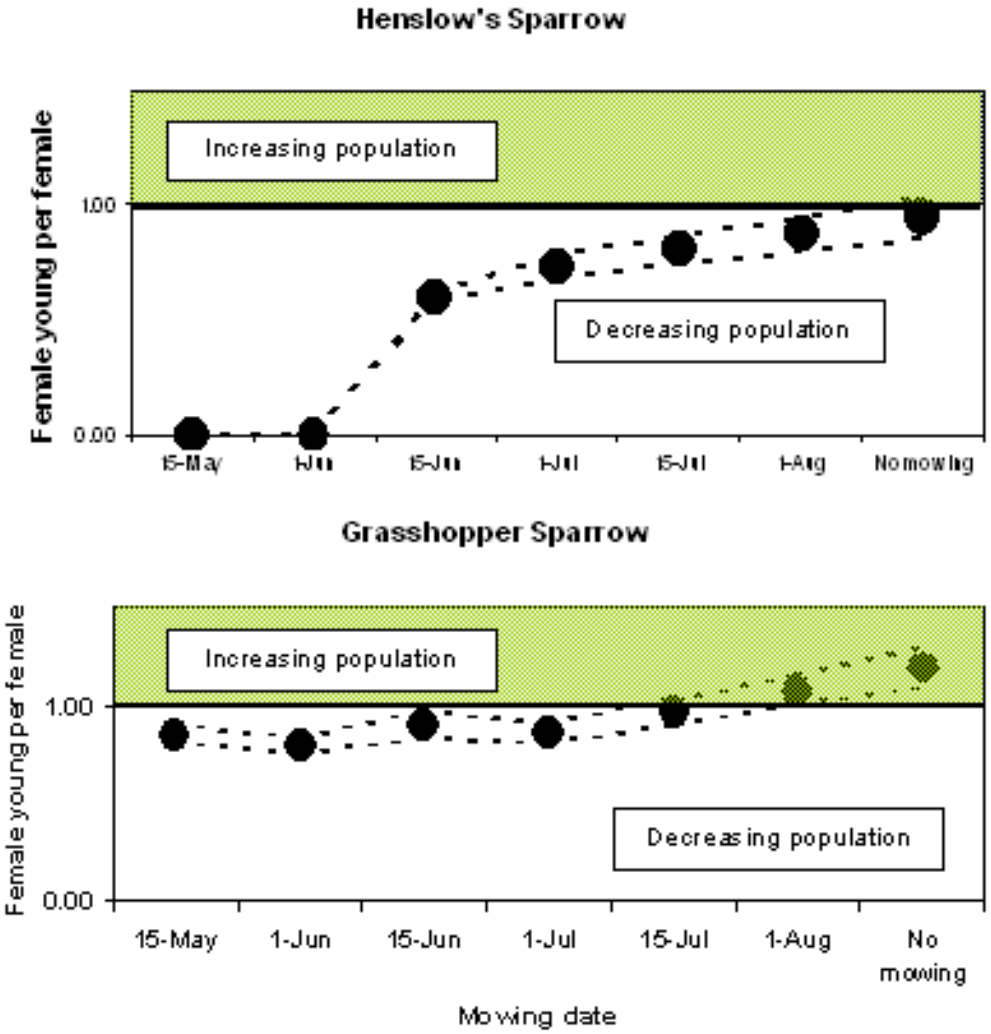
Space: Space is less understandable than the other habitat types because it is not necessarilly a concretely defined structure or grouping of plants. Space simply shows that bobwhites need to have the ability to safely move about the landscape and to disperse from nesting cover to winter covey habitat as the season dictates. Mobility is critical to bobwhite survival and habitat must support this mobility.

Managing for Grassland Songbirds

James Giocomo, Post Doctoral Research Associate, UT Forestry, Wildlife and Fisheries

Grassland songbirds and other early-successional birds use a variety of habitats, but many have very specialized habitat requirements that rely upon the time since disturbance (e.g., fire, mowing) to maintain the required habitat conditions. Some grassland birds, like grasshopper sparrows and Eastern meadowlarks, will only use large fields (> 100 acres) with very few tall trees.

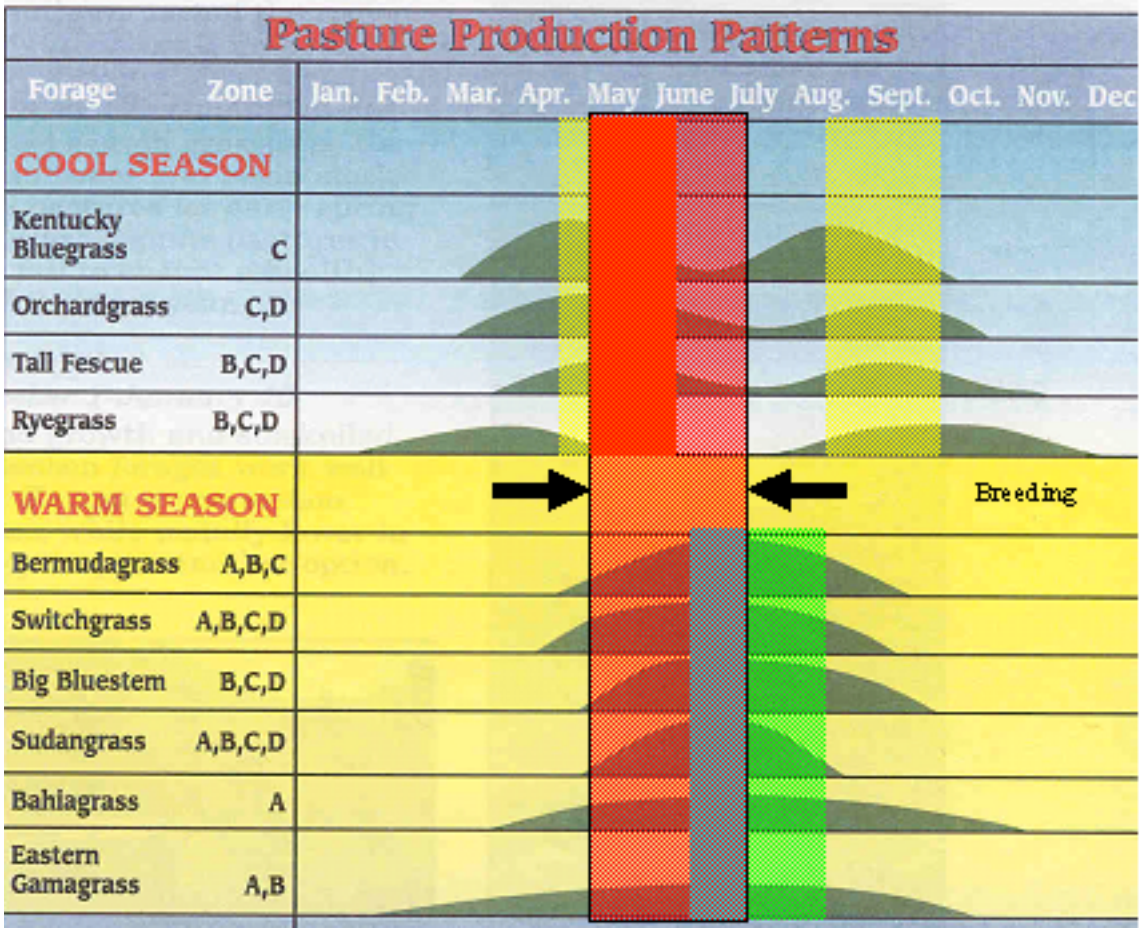




Productivity during the breeding season is one of the major factors influencing population persistence. Nesting in grasslands is much more difficult than nesting in forests. There is less area to conceal a nest because of the lack of vertical structure. As a result, grassland birds, such as Eastern Meadowlarks and grasshopper sparrows, experience higher predation rates than many birds that nest in trees. To compensate for the higher predation rates, most grassland songbirds are prolific breeders and can make eight or more nesting attempts within a season. The lucky pairs can produce between two and three successful broods, each containing 3-5 young, within each nesting season. Even though some pairs can produce up to 15 offspring within a season, most populations, under favorable conditions, are just barely replacing themselves each generation.

Using information collected from more than 1,400 nests monitored in fields at Fort Campbell Army Base on the border of Kentucky and Tennessee, we were able to create population models to simulate the impacts of different field management dates on grassland bird populations. In most cases, we found whole field management in May, June and July had serious negative impacts on bird populations within the fields. Stable populations became populations that could not replace themselves even with birds re-nesting immediately after the field management. Avoiding management between April 15 and August 15 will allow most birds to successfully fledge their young, and most stable populations can remain stable or increase.

To manage for maximum benefits for nesting birds and other wildlife, mowing for aesthetic reasons during the songbird breeding season (April 15-August 15) should be avoided. If hay production is an objective along with providing wildlife habitat, native warm-season grasses are recommended because peak growth time for haying is later with these grasses than with cool-season grasses. Delaying mowing until early-August will have a reduced effect on grassland bird populations.



Prescribed Fire for Managing Wildlife Habitats

William G. Minser, Research Associate/Instructor, UT Forestry, Wildlife and Fisheries

Fire has been used for thousands of years in shaping the landscape of North America. American Indians burned the land as much as twice a year to attract game for hunting (that came to the fresh green forage re-growth after fire), to open the landscape for ease of travel, to clear the land for agriculture, as an offensive weapon against other Indians, to drive game for harvest, and other reasons. Settlers and farmers continued to use fire to clear the land and improve grazing for free-ranging livestock into the 1900s. Persistent use of fire created open, grassy landscapes across the continent, including the South. Patches of open prairies and oak and pine savannahs dotted the countryside. These habitats supported elk, bison and even prairie chickens in Tennessee. Bison were found as far south as Florida. A three-million-acre prairie existed from just north of Nashville to near Paducah, Kentucky in what was known as the Kentucky Barrens. It was said that a man could ride a horse through the Barrens for 20 miles and not see a tree and that a horse and wagon could be driven through oak savannah forests with ease.

When fire burns the landscape, nutrients are released from the burned plant material that serve as a fertilizer for natural re-growth of native grasses and annual weeds (forbs). Annual fire or fire every 2-3 years in a field or thinned forest will favor native grasses and forbs and limit shrubs and trees. The habitats that result from frequent use of fire are the types of habitats that are often in the shortest supply on private lands in Tennessee and those most needed at various time of the year for many species of game

and non-game. Deer, wild turkeys, bobwhites, several reptile and amphibian species and many species of songbirds like indigo bunting, yellow-breasted chat and song sparrow use these early plant successional habitats. But the practice of managing the land with fire has declined greatly in the last 50 years. Most of the native prairies were converted to pastures and rowcrop fields. With the decline in the use of fire in the oak and pine savannahs, the understories of the forest grew thick, tree densities increased and savannahs disappeared. As a result, remnant prairies and savannahs are now the rarest habitats on the continent and species like the bobwhite and other grassland birds have declined by as much as 80 percent and are still going down.

For landowners interested in providing old-field, native warm-season grassland (nwsg) or savannah habitats on part of their land, prescribed fire is a critically important tool. Fire keeps those habitats in early succession more efficiently and more cost effectively than any other tool. Bush-hogging leaves a thatch of mulch, making travel for ground-nesting birds difficult. It also does a poor job of releasing nutrients, and does not result in the desired plant community, nor does it control woody vegetation. Herbicides can be effective in managing plant succession, but are expensive. Discing is another practice that should be considered as part of field management for wildlife and is discussed in the management of nwsg field section of this report.

The more frequently the land is burned, the more likely that grasses and forbs will dominate the plant community. The more years fire is kept out, the more shrubs and trees will dominate and grasses will decline. Old fields and native warm-season grass fields should be burned annually to every three years or as needed to hold back shrubs and tree re-growth. To create a savannah, half or more of the forest canopy should be removed (logged); prescribed fire should be applied every 1-3 years to stimulate native grasses and forbs and to hold back woody re-growth. An August or September burn can be used in dry weather to effectively kill back unwanted tree invasion such as sweetgum and boxelder. Winter burns to kill these are often less effective. It may take 10-20 years to develop a grass-dominated understory. It is recommended not to burn all your fields or forest habitats each year. One-third to one-half of your habitats should be left unburned to provide wildlife with nesting, travel and feeding cover.

Effective use of prescribed fire requires experience and expertise. Contact the Tennessee Wildlife Resources Agency or Natural Resources Conservation Service in your region for advice. A burning plan for land you wish to burn is suggested and a burn permit from the Tennessee Division of Forestry is required from October 15 to May 15 and can be obtained by phone. It is recommended that an experienced prescribed burner help you if you lack experience.

Speakers

Idris Abdi, Research Associate, USDA-ARS

Fred Allen, Professor, UT Plant Sciences

Roger Applegate, Small Game Coordinator, Tennessee Wildlife Resources Agency

Prakash Arelli, Supervisory Research Geneticist, USDA-ARS-MSA, Jackson, TN

Andy Bailey, Assistant Professor, UT Plant Sciences

Gary Bates, Professor, UT Plant Sciences

Tony Brannon, Dean, School of Agriculture, Murray State University & Henry County Farmer

John Buchanan, Assistant Professor, UT Biosystems Engineering and Soil Science

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Kathy Flanders, Extension Entomologist, Auburn University

James Giocomo, Post Doctoral Research Associate, UT Forestry, Wildlife and Fisheries

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Charles Hatcher, Coordinator-Livestock Identification, TN Department of Agriculture

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Roland K. Roberts, Professor, UT Agricultural Economics

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