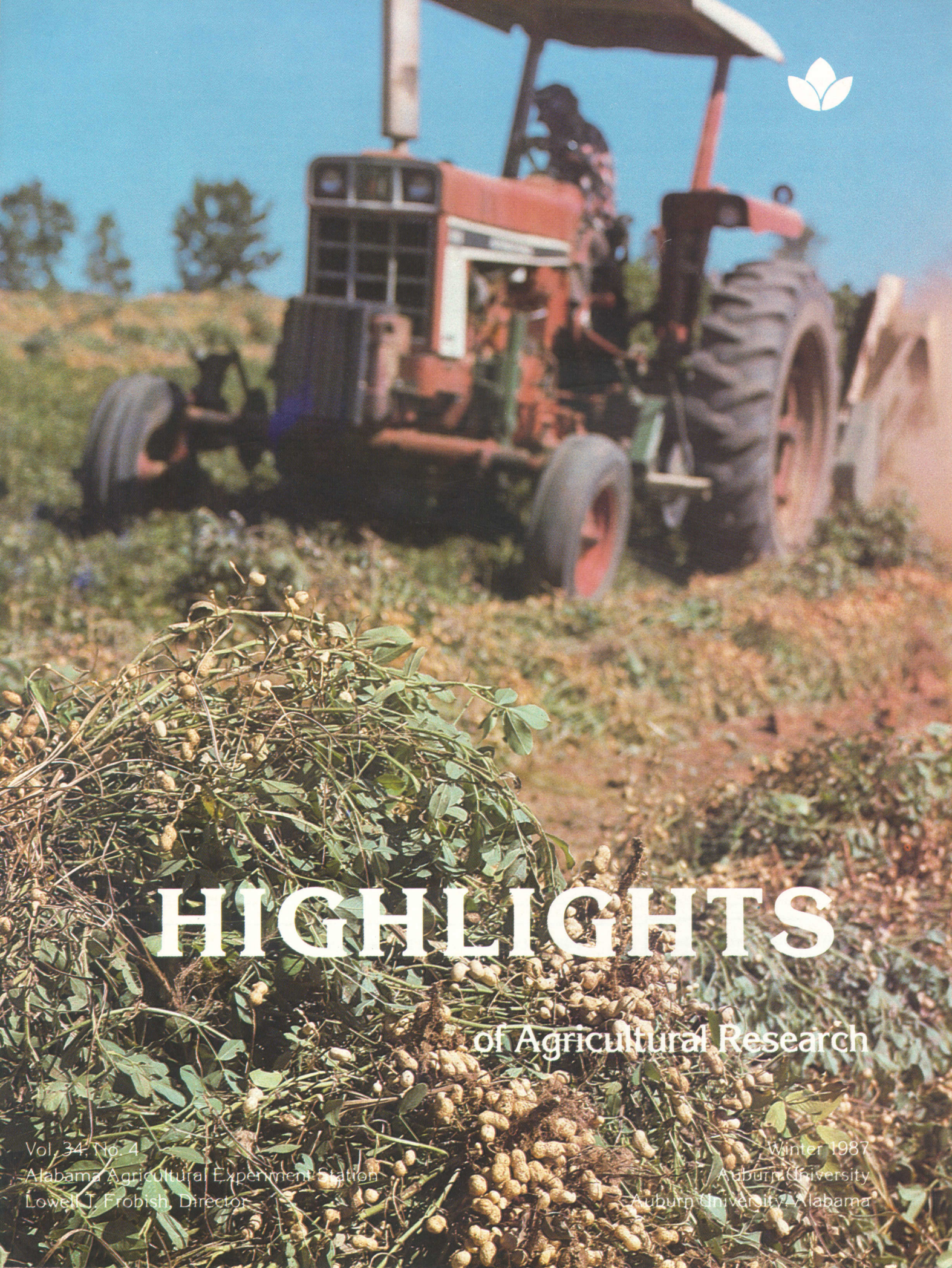

HIGHLIGHTS

of Agricultural Research

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Alabama Agricultural Experiment Station
Lowell T. Frobish, Director

Winter 1987
Auburn University
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Forestry at Auburn University

EMMETT F. THOMPSON

FORESTRY is Auburn's newest school, having been established by the Board of Trustees on October 1, 1984. Prior to that date, forestry had been a department in the School of Agriculture and Alabama Agricultural Experiment Station. By establishing a separate school, the Board recognized the importance of forestry and the forest products industry to Alabama's economy and way of life. Two-thirds of the State is forested and forest products represent Alabama's largest manufacturing industry. The School of Forestry's programs are central to a healthy forest resource and strong forest-based industry. School status brings more visibility and responsibility but does not change the basic mission to provide education, research, and service to the citizens of Alabama.

Forestry research is conducted in cooperation with the Agricultural Experiment Station and covers most areas of establishing, growing, harvesting, and processing timber, as well as the effects of forestry operations on the environment and the effects of the environment on forest production. The School's graduate teaching program is important to this research effort, with all theses or dissertations based on faculty research which is part of the Experiment Station's efforts.

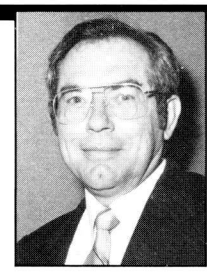
Over the years, the School's research emphasis has evolved from essentially applied research to a mixture of applied and basic thrusts. For example, wood products research has evolved from an emphasis on testing building products made from various raw material mixtures to a program which emphasizes mathematical modeling to estimate long-term reliability of new wood products as well as basic chemical/mechanical interactions to assess the end-use effects of various preservative or retardant treatments.

Forest biology research has developed from applied studies of various land management and forest stand treatments to an emphasis on the role of basic physiology in tree and forest development. This emphasis has allowed the faculty to increasingly attract extramural support. For example, major grants have been obtained to study the effect of atmospheric deposition on tree development and growth. This research has also had a spin-off of additional emphasis on basic tree nutrition and the effects of various soil chemical properties on forest production.

While the School will continue to graduate well-qualified individuals, provide new technology through basic and applied research, and transfer this technology to various users, change will be the underlying force influencing our activities. The concepts and technologies studied and taught in the near future will be much different from those occupying our classrooms and laboratories today.

Emmett F. Thompson, Dean
School of Forestry

MAY WE INTRODUCE



Dr. Ray Dickens, professor of agronomy and soils. A native of northwest Arkansas, Dickens earned a B.S. degree in agronomy from the University of Arkansas. He came to Auburn University as a National Defense Education Act Scholar and earned M.S. and Ph.D. degrees in agronomy here. Dickens became the first State Extension Weed Control Specialist in 1965, and joined the Agronomy and Soils Department staff in 1968 as Assistant Professor. He was promoted to Professor in 1981.

Dickens was instrumental in establishing the Turfgrass Research Unit on the Auburn campus, where most of the turfgrass research in the State is now conducted. Though much of Dickens' work at the Turfgrass Unit involves solving specialized weed problems associated with growing turf, he was instrumental in selecting and developing AU Centennial, a new, improved centipedegrass variety. He was also instrumental in developing the data needed to secure a label for Princep® , which has become the most commonly used herbicide for weed control in bermudagrass turf.

Dickens research on some old and new herbicides used to control common bermudagrass is reported on page 4 of this issue of *Highlights of Agricultural Research.*

ON THE COVER: Yields from Alabama peanut fields, such as this one in Houston County, may get a boost from improved disease and nematode control. See related stories on pages 12 and 13.

WINTER 1987 VOL. 34, No. 4

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LOWELL T. FROBISH . . . . . Director
DAVID H. TEEM . . . . . Assistant Director
R.E. STEVENSON . . . . . Editor
ROY ROBERSON . . . . . Associate Editor
TERESA RODRIGUEZ . . . . Art Designer

EDITOR'S NOTE. Mention of trade names does not indicate endorsement by the Alabama Agricultural Experiment Station of one brand over another. Any use of pesticide rates in excess of labeled amounts in research reported does not constitute recommendation of such rate. Such use is simply part of the scientific investigation necessary to evaluate various materials. No chemical should be used at rates above those permitted by the label. Information contained herein is available to all without regard to race, color, sex, or national origin.

FARM FINANCIAL CONDITION SHOWS IMPROVEMENT

SINCE THE EARLY 1980's, many farmers have faced serious financial adjustments with some being forced out of farming. In recent months, however, some changes have brought a degree of optimism. There is evidence that the decline in farm income may be turning around as evidenced by higher prices for poultry, cattle, and hogs. Government subsidies in the form of deficiency payments, Payment-in-Kind Program, and Conservation Reserve Program have benefited farmers. Farm input costs, such as fertilizer, fuel, feed, and interest rates, have declined to help hold down the cost of production. There is some indication that the decline in farm land values has slowed and may be leveling off.

COMPARISON OF SELECTED FINANCIAL MEASURES, ALABAMA FARMERS, 1986 AND 1987

Item	Unit	1986	1987
Commercial farmers surveyed	No.	810	580
Farmers with no debt	Pct.	45.1	46.4
Farmers with debt:			
Average D/A ratio[1]	Pct.	34.8	27.0
Proportion of farmers with D/A ratio:			
25% or less	Pct.	22.3	30.0
26% to 40%	Pct.	6.3	7.8
41% to 70%	Pct.	19.0	10.5
Over 70%	Pct.	7.3	5.3
Delinquent on debt payment	Pct.	8.3	4.8
Average amount owed (farmers with debt)	Dol.	138,000	94,900
Average value of assets (farmers with debt)	Dol.	396,600	351,700
Average amount of interest paid in previous year:			
Farmers with debt	Dol.	13,561	10,153
Farmers reporting net profit preceding year	Pct.	74	70

[1]Ratio of total debt to total assets expressed as a percentage.

J.H. Yeager, W.E. Hardy, and J.L. Johnson

To determine the prevailing financial position of Alabama farmers, a survey was taken of 2,915 farms, which represented the largest 25,000 farms in the State. Researchers received back about 20% of the mailed surveys for evaluation. A similar survey of the same representative sample of the State's largest 25,000 farms had been taken in 1986 and these data were used for comparison.

Analysis of the data by the Alabama Agricultural Experiment Station indicates that the average debt-to-asset ratio (D/A) for farmers in the State with debt declined from 1986 to 1987, see table. Only 5.3% of the farmers with debt had a D/A of over 70% in January 1987, compared to 7.3% in 1986. A D/A of 70% or over generally indicates that a farmer is highly leveraged and likely has problems in meeting principal and interest payments. The proportion of farmers with D/A ratios of 40% or less showed an increase from 1986 to 1987.

Only 4.8% of the farmers with debt were delinquent in debt payment the first part of 1987, compared to 8.3% approximately a year earlier. Not only was the delinquency rate lower, but also the average amount of debt declined during the past year.

With the overall decline in farm real estate and other asset values, the total value of farm assets declined about 11% during the past year, according to the values reported by farmers. The average amount of interest paid on farm loans was reported as $10,153 for 1986 and $13,561 for 1985. The proportion of farmers reporting no debt outstanding was consistent for both years.

At the start of 1987, the proportion of farmers with debt outstanding did not vary greatly by geographic area of the State. However, farmers in southwest Alabama, including the Gulf Coast region, had the highest average debt load. Their average D/A ratio of 31.9% was also the highest of any region.

For farmers with debt, average government payments exceeded average net farm profit in two geographic areas, (1) the Northern Valley (primarily Tennessee Valley), and (2) Coastal Plains and Gulf Coast. These are areas in which cash crops are relatively important.

Off-farm income was also important to Alabama farmers in meeting financial demands. Average off-farm income varied by regions from $11,014 to $16,869 per farmer. In three of the six regions in the State, average off-farm income exceeded average net farm profit per farm in 1986.

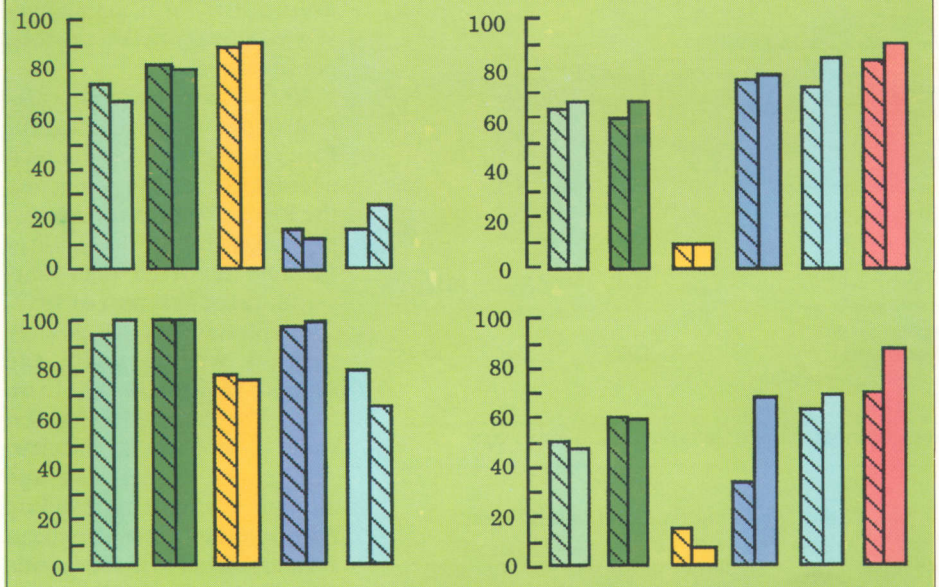
Livestock producers represented the lowest percentage of farmers with debt, the lowest average debt outstanding, and the lowest D/A ratio. Almost three-fourths of the poultry farmers reported debt outstanding the first part of 1987. The average debt for poultry farmers was $111,115, the second highest of all farm types. They also had the highest D/A ratio. Crop farmers had a slightly higher average amount of debt outstanding than poultry farmers. Soybean farmers included in the sample had an average D/A ratio of 42% and an average of almost $160,000 in total debt outstanding. Government payments averaged almost $17,000 per farm for crop farmers, more than twice the average for all types of farms.

Size of farm in terms of acres operated is a variable that frequently is related to financial factors. The 1987 data indicated that the percentage of farmers with debt outstanding increased as size of farm increased. However, D/A ratios did not increase consistently with size, probably an indication of good farm and financial management. In general, net farm profit increased and average off-farm income declined as farm size increased.

There is some evidence that the financial picture for farmers is somewhat improved compared to 1985-86. Nevertheless, it is important for farmers to analyze their financial position and to practice sound financial management.

Yeager is Head and Hardy is Professor of Agricultural Economics and Rural Sociology, and Johnson is Extension Economist-Crops and Farm Management.

Available Herbicides Offer Only Temporary Control of Common Bermudagrass in Sod Production Fields



Effects of midsummer herbicide applications and subsequent disking on control of common bermudagrass in mid-October.

Effects of midsummer herbicide applications and subsequent disking on the amount of common bermudagrass cover the following summer.

Sodium TCA 50 lb./acre
Roundup 5 lb./acre
Verdict 1/2 lb./acre
Disked
Sodium TCA 100 lb./acre
Dowpon 5 lb./acre
Untreated
Undisked

R. Dickens, D.L. Turner, and J. Baird

COMMON BERMUDAGRASS is an excellent grass for many turf areas, including roadsides, airports, and athletic fields. However, this same species is the most serious weed problem in southern sod fields. Common bermudagrass is more vigorous and competitive than such turfgrasses as zoysia and centipedegrass under conditions of high light intensity, adequate moisture, and high levels of nitrogen fertility. These are the exact conditions present in a well managed sod field.

Sodium TCA® and Dowpon® were the recommended herbicides for control of common bermudagrass from the 1950's until the introduction of Roundup® in 1973. Although these herbicides produced 80 to 98% reductions in bermudagrass stands, control was short lived in sod fields. Sod production requires complete eradication and not simply temporary control.

Experiments were conducted by the Alabama Agricultural Experiment Station at a local sod farm and at the Piedmont Substation to evaluate Verdict® , Roundup, sodium TCA, and Dowpon applied alone and in various combinations. Verdict, a new herbicide, has shown excellent control of bermudagrass in certain row crop situations. The foliar absorbed herbicides (Verdict, Roundup, and Dowpon) were applied on June 26, 1984, and August 13, 1985, with the second application of split application treatments applied 10-14 days after the initial treatment. The soil active sodium TCA was applied July 13, 1984, and September 4, 1985. One-half of each plot was disked thoroughly 10-14 days after application of the sodium TCA. The plots were evaluated for percent green bermudagrass cover in the fall after treatment and again the following summer.

Sodium TCA and Roundup produced good to excellent initial control of the above-ground portion of bermudagrass, see graph, in both years. Dowpon and Verdict were more variable in their action, producing poor initial control the first year and poor to excellent control in the second. No combination of herbicides produced results superior to the best entry applied alone. Therefore, only performance data for the individual herbicides are reported here. The more important measure of herbicide efficacy was obtained when bermudagrass stands were evaluated the following summer, approximately 1 year after application. Only Roundup had reduced the bermudagrass stands on June 1, one year after application, see graph. It is important to note that although stands were reduced by Roundup, 9-16% cover was present 1 year after treatment, which is not acceptable in sod fields.

The application of soil active sodium TCA did not enhance final control from any of the foliar absorbed herbicides. Nor was there any apparent advantage of disking after herbicide applications. Results of these studies indicate that more effective herbicides are needed to solve the problem of common bermudagrass encroachment in sod fields.

Dickens is Professor, Turner is Research Associate, and Baird is Graduate Student of Agronomy and Soils.

Superior Flowering Pears Identified for Southern Landscapes

D.C. Fare, C.H. Gilliam, H.G. Ponder, and W.A. Griffey

BRADFORD, an ornamental pear tree variety, has become a popular tree for urban landscapers in the Southeast. However, since its release in the early 1960's, 12-15 new and potentially superior ornamental pear varieties have been marketed for landscape use. In 1980, an Alabama Agricultural Experiment Station study was begun at the Piedmont Substation in Camp Hill to evaluate these new varieties. As still newer varieties have become available, they have been added to the test.

All trees in the Auburn test are flowering selections of Callery pear. Among these varieties, Bradford has become the most popular because of its reputed resistance to leaf blight, fireblight, diseases and insects, and its vigor and uniformity of growth. It is one of the earliest flowering pear varieties. Trees are covered with spur-borne white flower clusters that develop in late March or early April. Summer leaves change to reds, yellows, and burgundies from mid-October to mid-November, with duration depending on fall weather conditions. It has been reported that Bradford pears don't have the same brilliant fall colors in Northern States as seen in the South.

During the first 7 years, Bradford trees in the Auburn test are averaging 25-27 in. of height growth annually and trees have developed a broad oval shape with an upright canopy. Severe splitting reported on older trees has not occurred in the Auburn test. This splitting problem is often reported as storm damage, but is likely caused by unnoticed splitting prior to storms due to the acute crotch angles of the branches. As a result of this problem with Bradford trees, newer varieties with different branching habits, canopy shape, flowering, and fall coloring have been introduced.

In contrast to Bradford, Aristocrat is a less dense growing tree with a broad pyramidal form. Crotch angles are less acute, allowing the tree to have a more open and potentially stronger growth habit. It appears that this selection will make a much larger tree than Bradford. The annual average growth rate is about 36 in., compared to 25-27 in. for young Bradford trees. Leaves are more tapered at the apex but still have the same glossy green surface as Bradford. Generally, good fall leaf color is absent with leaves turning from dark green to brown, though Aristocrat is reported to have excellent fall color farther north.

Fruiting (nonedible) of Aristocrat pear is heavier than all other cultivars in the test, but not extremely showy. In late autumn, the small pears (3/8 in.) attract birds and are usually eaten before the fruit falls. Flower color and size are similar to Bradford and other selections. One major difference is time of flowering, with Aristocrat peaking 10 to 14 days after Bradford. Fireblight was observed during 1987 on most of the Aristocrat trees; however, the incidence of fireblight was limited to the terminal 12-15 in. of scattered branches.

Autumn Blaze, a newer pear selection, is similar to Bradford in flowering characteristics and time of flowering. Autumn Blaze trees are averaging 25-27 in. a year in height growth. Leaves are not as ovate as Bradford and not as tapered as Aristocrat, but still have the glossy green foliage of most ornamental pears. Fall color is brilliant red occurring about early October, 3 to 4 weeks earlier than Bradford pear. Subsequently, leaf drop from Autumn Blaze is earlier in the fall. This selection develops a dense pyramidal canopy similar to Bradford, but with less acute branching habits.

Autumn Blaze occasionally has thorns on branches, resulting from the parent species (Callery) which has an abundance of thorns. Other than the few thorns found on Autumn Blaze, this tree has proven to be one of the best pear cultivars tested. Fireblight was limited to 1 or 2 twigs on one Autumn Blaze tree.

Redspire is similar to Bradford in flowering characteristics, but has a more upright, columnar canopy than the previously mentioned pears. Because it is not as broad, this selection can be used in smaller urban areas compared to the other pear cultivars. Height growth averages about 30-32 in. annually. Fall color in more northernly locations is reportedly similar to the reds of Autumn Blaze, but in the Auburn test, fall leaf color has more orange and yellows, much like Bradford. This selection has an excellent branching habit and should not have splitting problems with age. Redspire appears to be an outstanding upright selection.

Newer pear cultivars appear to be similar to Bradford in many respects, but offer different canopy forms with perhaps stronger branching characteristics.

Fare is Research Associate, Gilliam is Associate Professor, and Ponder is Professor of Horticulture and Griffey is Superintendent of the Piedmont Substation.

Economies of Size Identified for Swine Waste Management Systems

J.R. Crews, V.W.E. Payne, L.G. Hix, and N.R. Martin, Jr.

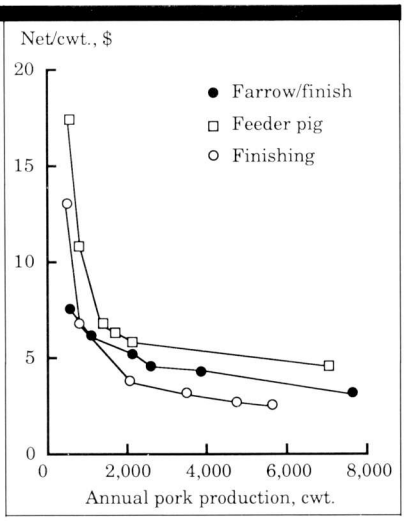


FIG. 1. Net cost of waste management for varying sizes of specified swine production systems.

THE WATER QUALITY Branch of Tennessee Valley Authority, the Soil Conservation Service, and Alabama Agricultural Experiment Station recently conducted a cooperative research study to evaluate the effects of alternative waste management schemes on various swine production systems. With all disposal systems studied, cost economies resulted from increasing size of operation.

There are three distinct production systems prevalent within the swine industry. Feeder pig systems involve the farrowing and growth of pigs up to an approximate weight of 50 lb. Feeder pig finishing involves the purchasing of feeder pigs and taking them up to slaughter weight. Farrow-to-finish systems include the entire production process, taking pigs from farrowing to slaughter weight.

Acceptable waste management systems and practices were identified that meet pollution abatement standards. A microcomputer model (WASTECON I: SWINE) was developed to assist in the design and economic evaluation of alternative waste management systems. The model is inclusive of the collection, transfer, treatment, storage, and distribution application phases of handling swine wastes from any type production system.

The microcomputer model was developed utilizing LOTUS-123™ software. The "macro" features of this software were utilized extensively to facilitate the running of the program and also to create a user-friendly environment. The three major components of the model include the system design, application/distribution, and economic summary. A comprehensive waste management analysis would involve all three components, but each component can be run as an independent, stand-alone program for partial analyses.

The microcomputer model was used to analyze various production phases and sizes, treatment/storage, distribution, and application systems. The economic measure used for system comparisons was annualized net cost/benefit. This common measure took into account both operating and ownership costs as well as recognizing accrued nutrient benefits. Six different size feeder pig, farrow-to-finish, and feeder pig finishing operations were analyzed to examine the influence of economies of size for a specified collection, transfer, treatment/storage, and application/distribution system (flushing to a two-cell anaerobic lagoon with recycling of waste water and tractor pulled liquid spreader). All production phases displayed substantial cost economies as size (or volume of wastewater) increased, figure 1.

Waste management costs (on an annual pork production basis) were generally highest for feeder pigs, followed by farrow-to-finish and finishing-out feeder pigs for the output levels examined. Results indicate, however, that for production systems less than 50,000 lb. per year, the farrow-to-finish could have lower per unit waste management costs than the other two production phases.

Because the value of the primary output (pork) is not constant among all production phases, waste management costs were evaluated as they relate to a percentage of output value. Pork production levels between 50,000 and 170,000 lb. revealed that feeder pig operations were below farrow-to-finish and finishing-out feeder pigs in in terms of waste management costs as a percentage of the weighted average output value.

Beyond this output range, feeder pig finishing operations achieved the lowest percentage followed by feeder pig and farrow-to-finish systems.

Similar analyses were undertaken to see if economies of size could be found among different treatment/storage systems for a particular production phase. Grass filter, storage pond, anaerobic and aerobic lagoons, recharge pit, and storage pit systems were evaluated for five farrow-to-finish operation sizes. Cost economies held for all systems as size was increased, with the aerobic lagoon (the highest cost system throughout) showing the greatest cost sensitivity.

Crews is Extension Economist, Payne is Civil Engineer with Soil Conservation Service, Hix is Microcomputer Specialist of University Computing, and Martin is Professor of Agricultural Economics and Rural Sociology.

CULTURE SUMMARY

- Seed started in greenhouse January 15, 1986.
- Transplanted May 1, 1986, in 4-in.-deep furrow with plants 14 in. apart in 5-ft. rows.
- 20 tons chicken manure applied December 20, 1985, and 500 lb. 13-13-13 per acre before planting.
- Underground trickle irrigation used as needed, up to 1 in. per week.
- 1.5 gal. Amiben® preplant and 0.5 lb. Fusilade® a.i. (active ingredient) per acre used for weed control, beginning the second year.

Asparagus Varieties Perform Well in North Alabama Tests

J.L. Turner, J.T. Eason, M.E. Ruf, D.Porch, and M.E. Marvel

VEGETABLE GROWERS in Alabama are in need of alternative crops to replace less lucrative ones and to fill voids in harvesting schedules. While backyard gardeners in the State have grown asparagus for home use for many years, several new male sterile hybrids may make it feasible for commercial vegetable growers to produce it for early spring markets.

Alabama Agricultural Experiment Station researchers are currently testing five new male sterile hybrids selected based on tests in Oklahoma — the nearest Southern State with production data. Of the five hybrids tested at the Sand Mountain Substation in Crossville, Green-wich and UC 157 produced the highest yields of 6- to 8-in. spears in limited first season harvesting, see table.

The five hybrids were started from seed in a greenhouse at Auburn in the winter of 1985 and transplanted at the Sand Mountain Substation after the last killing frost date. Asparagus was not harvested the first year after planting to allow new fern growth to provide nourishment for the crown, which increased spear production for the second year harvest. Harvesting the second year was limited to four cuttings. Asparagus takes 3-5 years of growth to produce maximum (25-30) cuttings during a productive year. A well managed planting can remain productive for 15 years or longer.

Seedlings were grown in 2 x 2-in. seedling trays similar to other greenhouse produced vegetable transplants. Asparagus ferns, or tops, cannot survive below 32 degrees F, therefore young plants must be protected from freezing temperatures. Transplants were placed in 4-in.-deep furrows and roots covered with 2 in. of soil. Transplants were 6-8 in. tall and well branched at planting time, and as the tops grew, additional soil was added to the furrow until it was filled.

Chicken manure at 20 tons per acre was applied as a topdress in the fall of 1986 and 1987, and will be applied throughout the life of the planting to provide better water holding capacity and texture to the soil and provide some of the nutrients needed by the asparagus. Soil tests are taken yearly and lime is applied when needed to maintain a soil pH of 6.0-6.5.

Asparagus at the Sand Mountain Substation was planted on a well drained soil, which is a must for the crop. Recommended fertilizer, irrigation, and pesticide schedules were closely monitored. Subsequent tests are planned to establish production, marketing, and variety selections, which are necessary before large commercial plantings are feasible.

MARKETABLE YIELDS FOR ASPARAGUS VARIETIES, CROSSVILLE, 1987[1]

Variety	Acre yield	Acre yield by harvest dates			
		3-25	3-31	4-14	4-21
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
UC 157	1,162	47	209	256	650
Green-wich	1,104	35	99	473	497
G-27	842	13	93	261	475
Brocks	837	24	59	335	419
Jersey-Giant	831	31	125	166	507

[1]Soil test: P 100 (M); K = 110 (M); pH = 6.1.

Turner is Research Associate of Horticulture, Eason is Superintendent, Ruf is Associate Superintendent, and Porch is Research Associate of the Sand Mountain Substation, and Marvel is Director of International Programs.

Obscure scale poses serious problem to landscape plantings of pin oak in Alabama




H.J. Hendricks and M.L. Williams

PIN OAK is one of the most widely used red oaks in commercial landscape, golf course, lawn, park, and street border plantings because of its fine bronze and red fall color, distinctive pyramidal shape, relative freedom from pests and diseases, and low mortality in transplanting. Alabama is well below the natural range of pin oak, and its introduction into the State's unfavorable growing conditions has resulted in increased susceptibility to diseases and phytophagous insects, especially obscure scale, *Melanaspis obscura*, figure 1. Obscure scale is the primary insect pest of pin oak, causing rapid decline in plantings of this oak in the South. A survey of the Auburn University campus, where pin oak is one of the most common shade trees, has shown that more than 90% of 305 pin oaks are infested with obscure scale.

As its name implies, obscure scale is difficult to detect, particularly when it occurs on hosts with dark-colored bark. The cover is typically dark gray but is often the same color as the bark. Infestations are more apparent on branches encrusted with old scale covers and resemble a "roughened deposit" on the bark. Heavy infestations often become more noticeable on branches because of small white spots which occur when older scale covers fall off.

Obscure scale crawlers begin feeding and forming their protective covering within an hour after settling. Females will continue feeding throughout their life; however, males stop feeding after the second stage of development. Obscure scale will infest all parts of the tree, except leaves and leaf stems; like all armored scale insects, it feeds on the sap of the host tree. The continual drain of sap from the scale's feeding and the disruption of the photosynthetic and respiratory functions of the bark due to encrustation weaken the infested tree. Obscure scale infestations seldom kill the tree, but can cause extensive dieback of branches and make the tree more susceptible to secondary infestation by other insects and diseases, figure 2.

Research at the Alabama Agricultural Experiment Station found that in Alabama, obscure scale produces one generation a year and overwinters as second-stage males and females. Obscure scale females go through three developmental stages and males five. Adult females become active in early February and are present to early October. Beginning in mid-March, second-stage males enter the prepupal stage. Pupation begins within a week after the prepupal stage. Emerging adult males are present from early April to late April. Adult males live less than 24 hours, their sole purpose being to seek out the female and mate. Eggs are deposited from early June through early September. By mid to late June, crawlers begin to emerge and continue through late October. Second-stage males and females begin to appear in late June to early August.

Contact sprays timed to kill the obscure scale have generally proven unsuccessful. Several factors contribute to the difficulty of controlling this insect with pesticides: (1) the scale's waxy cover provides protection against pesticide exposure, (2) crawlers tend to settle under the protection of older scale covers, producing a layering or encrusting effect, and (3) crawler activity extends over a long period of time, which makes timing of spray applications difficult. A concern to the economic entomologist is that pesticide applications timed at crawler and adult male activity overlap parasite emergence and predator activity. Thus, spray aimed at the pest may have a detrimental effect on its natural enemies as well.

From left to right — FIGS. 1-4: Female obscure scale with protective scale covering removed, obscure scale infested pin oak tree showing complete defoliation in midsummer, immature of a predacious plant bug feeding on obscure scale, and fruiting bodies of the fungus, *Nectria diploa*, feeding on obscure scale.

Biologically, there are several predators and parasites that have an important impact on scale populations, figure 3. Auburn researchers have observed the parasitic wasps, *Coccophagoides fuscipennis* and *Encarsia berlesii*, and the predacious plant bugs, *Corticoris siqnatus, Eurychilopterella luridula, Lidopus heidemanni* and *Myiomma cixiiforme*, feeding on developing obscure scale. The fungus, *Nectria diploa*, figure 4, has been observed attacking large numbers of obscure scale; however, it is not known whether this species is saprophytic or parasitic.

Once the scale population becomes well established, control is difficult by conventional means. Research indicates that early detection of infested pin oak is necessary for best control of obscure scale and that infested branches should be pruned from the tree and destroyed before scale populations reach injurious levels.

Hendricks is a Graduate Student and Williams is Associate Professor of Entomology.

Continuous Irrigation Protects Container-grown Landscape Plants Against Sub-freezing Temperatures

Gary S. Cobb and Gary J. Keever

PRODUCTION of woody ornamentals in containers accounts for the majority of nursery crops grown in south Alabama. Historically, if minimal precautions are taken, overwintering of nursery crops has not been a limiting production factor, as it often is with container-grown plants in northern climates. However, the occurrence of severe freezes in the South in recent years has forced growers to reevaluate their winter protection strategies.

In Alabama Agricultural Experiment Station research, continuous irrigation during freezing conditions was found to effectively buffer canopy and growth medium temperatures and protect roots, stems, and foliage of several woody ornamentals when ambient air temperatures dropped as low as 3 °F.

In late March, 112 uniform liners each of Japanese holly, dwarf Burford holly, azalea, pittosporum, and euonymus were potted in 3-qt. black, polyethylene containers using milled pine bark growth medium amended with dolomitic limestone, gypsum, and slow-release fertilizers. Plants were placed outdoors on a white clam shell mulch in full sun under overhead sprinkler irrigation and maintained according to conventional nursery practices.

In early December, the following winter protection treatments began and continued until the end of January: (1) plants temporarily covered with 6-mil (0.1006-in.) white plastic film during freezing temperatures; (2) plants irrigated for 10 min. on and 50 min. off until irrigation heads froze, beginning when canopy temperature dropped to 33 °F; (3) plants irrigated continuously during freezing temperatures and subsequent thaw; and (4) plants unprotected. Treatment 2 resulted in the formation of a 1- to 2-in. layer of ice over plants and containers.

To monitor medium and canopy temperatures during the study, thermocouples were placed at a 4-in. depth, 1 in. from the south wall of the pots and in the center of the plant canopy, 4 in. above the medium.

On January 30, following the coldest temperatures of winter, plants were moved into a 60 °F heated glass greenhouse. On February 19, foliage and stems were rated for desiccation and cold injury. Bark splitting occurred only on stems of azaleas and was rated at this time.

During the winter, minimum ambient air temperature was recorded on January 20 and January 21; low temperature was 3 °F. During this period, canopy temperatures within the unprotected and thinly iced treatments closely followed air temperatures. Minimum growth medium temperatures were 23 °F in unprotected containers and 25 °F in pots of plants thinly iced (Treatment 2). Canopy temperatures under white plastic fluctuated widely (from 14 °F to 55 °F on January 21), particularly on cloudless days. Growth medium temperatures ranged from 30 °F to 45 °F during this 2-day period. When plants were continuously irrigated during freezing temperatures and thaw, neither canopy nor growth medium temperatures dropped below 32 °F.

No limb breakage resulted from either icing treatment or from coverage with plastic film. Root injury was least to plants of all species continuously irrigated and to plants covered with white plastic film, the two winter protection treatments in which the highest minimum temperatures were recorded in the growth medium. A thin ice cover provided some protection to the roots of azalea, Japanese holly, and dwarf Burford holly, while root injury to pittosporum and euonymus was similar to injury observed with unprotected plants.

Foliar and stem injury, as indicated by foliar ratings, was most severe to unprotected plants. A thin ice cover reduced the foliar and stem injury to azalea, euonymus, and pittosporum, while a covering of white plastic film or continuous irrigation protected leaves from desiccation and bark from splitting. Foliage of Japanese and dwarf Burford hollies was not injured.

Bark splitting occurred only on azaleas and was most severe to plants covered with a thin layer of ice. Moderate bark splitting of the main trunk and secondary branches resulted from covering plants with white plastic film, while only slight splitting of the main stem occurred to unprotected plants. Continuous irrigation protected bark of most plants from splitting, although there was splitting of secondary branches on isolated plants.

Continuous irrigation during subfreezing conditions effectively buffered canopy and growth medium temperatures and protected roots, stems, and foliage of several woody ornamental species when ambient air temperature dropped to 3 °F. Protection was derived from the heat of water raising ambient air, foliage, and medium temperature, combined with the heat of fusion released during the formation of ice. A white plastic covering protected plant parts of all species except bark of azalea. A thin covering of ice provided little or no protection to euonymus and pittosporum, whereas bark splitting of azalea was more severe than to unprotected plants.

Cobb is former Superintendent of the Ornamental Horticulture Substation and Keever is Associate Professor of Horticulture.

Public Supports Farmers on Soil Erosion Issues

J.J. Molnar and P.A. Duffy

FARMERS PROBABLY HAVE a more pervasive effect on the environment than any other occupational group. Subsequently most environmental issues have significant agricultural implications and many agricultural policies are shaped, at least in part, by environmental concerns.

Farmers may be perceived as individuals in tune with nature who have a beneficial effect on the environment. On the other hand, concerns about soil erosion and nonpoint source pollution may cast farmers in the role of an environmental spoiler.

While some consumers may be sensitive to the problems of soil erosion, rigorous protection of the environment cannot be achieved without cost. Concerns about the inevitable effect of environmental regulation on food prices may moderate public concern about agricultural production practices and what, if anything, should be done.

To determine public perceptions of farmers' environmental behavior, a nationwide sample of American households was contacted in a spring 1986 mail survey by the Alabama Agricultural Experiment Station. Questionnaires were available for 3,239 respondents, a 46% completion rate accounting for refusals, deceased, and bad addresses. In the analysis, statistical weighting was employed to improve the representativeness of the sample.

In the table, patterns of response to six soil resource-related survey items in the national survey are presented. More than 90% of the respondents felt that landowners are obliged to protect soil resources for future generations.

Almost two-thirds of the sample felt that most farmers take good care of the soil. Nevertheless, about 57% thought that laws regulating excess soil erosion are badly needed. About 40% thought the government should pay farmers to practice soil conservation. A similar proportion supported applying financial penalties to farm operators who fail to adopt needed soil conservation practices. Neither penalties nor conservation payments received majority support.

Only about 25% thought soil conservation programs were carried too far. The public seems ready to consider stronger steps to stem soil erosion, given the economic realities of farming.

Soil conservation is a widely held value in American society, and the Auburn study indicates most people have confidence that producers act responsibly with respect to our soil heritage. Thus, there seems to be clear consensus about the importance of a long-term perspective on resource use.

According to survey responses, differences widen over the role of government and the kind of measures that should be taken to conserve the soil we have. Many were undecided whether erosion laws were badly needed, or that such laws might involve financial penalties. Thus, the public may be thought to regard soil abuse as a misdemeanor, not a felony. Furthermore, such perceptions are accompanied by a great deal of uncertainty over the level of sanction to be applied. In fact, almost 25% of the respondents felt that present programs involving voluntary and noncoercive payment systems were excessive. The general public is not fully aware of the array of program incentives for conservation. Conservation compliance is only beginning to emerge as a policy tool, as under current law the filing of a conservation plan does not become a requirement for commodity program participation until 1990, although so-called sodbuster and swampbuster provisions are in effect now.

The loss of soil does not present a tangible threat to life and limb, but it does represent a logical concern for all Americans. Thus, farmers may face an increasingly restive public as the environmental consequences of many present-day farm practices are measured and recognized. Although it may be simplistic and unfair, some citizens may perceive soil-abusing farmers as being similar to the occasional truck driver who breaks the speed limit to increase profits.

PERCEPTIONS OF HOW FARMERS TREAT THE SOIL: NATIONAL SAMPLE, 1986 (N = 3,239)

Item	Response			
	Agree	Undecided	Disagree	No Answer
	Pct.	*Pct.*	*Pct.*	*No.*
1. Land owners have responsibilities to protect soil resources for future generations	94.0	4.2	1.9	35
2. Most farmers take good care of the soil	64.4	24.5	11.2	48
3. Laws regulating excess soil erosion are badly needed	56.9	35.5	7.6	88
4. The government should pay farmers to practice soil conservation	40.4	29.0	30.6	58
5. Farmers who fail to adopt needed soil conservation practices should be financially penalized	37.7	33.5	28.8	53
6. Given the economic realities, soil conservation programs are often carried too far.	24.5	34.2	41.2	56

Molnar is Professor and Duffy is Assistant Professor of Agricultural Economics and Rural Sociology.

Supportive Friends and Educational Programs Increase the Duration of Breastfeeding by Low Income Mothers

S.P. Barron, H.W. Lane, and T.E. Hannan

BREASTFEEDING, which is promoted by the American Dietetic Association, American Academy of Pediatrics, the U.S. Department of Agriculture, and the Department of Health and Human Resources, has been established as the most effective mode of infant feeding for the first 6 months of life. Though breastfeeding is increasing overall, studies indicate that low income mothers tend to terminate breast feeding earlier than middle class women. Studies by the Alabama Agricultural Experiment Station indicate occurrence and duration of breastfeeding by low income mothers was increased by the presence of supportive individuals in the home and by encouragement from breastfeeding friends. Breastfeeding duration was longer for those women who participated in educational food supplementation programs.

The Auburn study consisted of a survey and follow-up contacts with 40 low income (less than $16,000 annual family income) mothers between 16 and 40 years of age, without college degrees. Each of these women had delivered full term healthy babies and was breastfeeding at hospital discharge. Each mother was interviewed shortly after delivery to determine if she was eligible to continue or join a food supplementation program called the USDA Women, Infants, and Children (WIC) program. Each subject was then contacted by phone every 2 weeks to determine if breastfeeding was continuing.

Once the infant reached 3 months of age or was totally weaned, a second interview with the mother was conducted. Researchers sought to determine whether a support person, called a doula, was present, whether friends or family members were available for guidance and help immediately following delivery, how comfortable the mother was breastfeeding in front of various people, and the reasons for terminating breastfeeding.

Average breastfeeding duration was 20.5 weeks. Forty percent of the women interviewed terminated before 2 months and 40% were still breastfeeding after 3 months.

Participation in the WIC program, whether due to a heightened interest in breastfeeding or to qualify for the food subsidy, had a positive affect on duration of breastfeeding. The WIC program included at least one basic nutrition education contact that encouraged breastfeeding. Sixty-seven percent of the women participated in WIC, 55% during breastfeeding and 47.5% during pregnancy. More long-term breastfeeders participated in WIC than did short-term breastfeeders.

When a doula was present, the average duration of breastfeeding was 23.4 weeks, compared to 12.3 weeks when one was not present. More mothers of the breastfeeders were present during the first 2 weeks after delivery for the long-term breastfeeders than for the short-term breastfeeders. The presence of a supportive individual was associated with continued lactation, while the absence of a supportive individual was associated with early termination. The presence of a support person, frequently the mother of the new mother, to support the new mother and help with household duties increased the duration of breastfeeding by allowing the new mother to relax, establish her milk supply, and become adjusted to her infant's needs, thereby decreasing the incidence of the mother's perception of insufficient milk. The inability to relax due to the lack of support may affect the neurological control over the let-down reflex, which is necessary for mothers milk to be ready for the infant.

The number of breastfeeding friends was positively correlated with the duration of breastfeeding. Women who breastfed longer than 2 months sought help from friends and felt more comfortable breastfeeding in front of female and male friends. Those women breastfeeding 2 months or less generally did not have breastfeeding friends, and did not breastfeed in front of friends. Short-term breastfeeders often sought help from friends who were not breastfeeders, reinforcing their decision to terminate breastfeeding early.

Several reasons were given for termination of breastfeeding. More women breastfeeding 2 months or less quit due to perceived milk insufficiency than did those breastfeeding longer than 2 months. Three women, all breastfeeding for longer than 3 months, gave no reason for termination. Seven women remained breastfeeding at study completion. Other reasons for termination included return to work and school, inverted nipples, the inconvenience of breastfeeding, advice of a physician, medications, pregnancy, infant biting nipples, and decreased interest in breastfeeding by the infant.

Barron is a former Graduate Student and Lane is Professor of Nutrition and Foods and Hannan is Assistant Professor of Family and Child Development.

Control of Peanut Soilborne Diseases May Afford Yield Breakthrough

P.A. Backman

IMPROVED MANAGEMENT practices by Alabama growers have increased State peanut yield averages by almost 1,500 lb. per acre since 1970, to a current level of nearly 3,000 lb. per acre. Despite this increase, yield losses of 20-30% to soilborne diseases, such as white mold, limb rot, pod rot, and root rot, still occur statewide. Currently available fungicides provide only 40-60% control of these diseases, but Alabama Agricultural Experiment Station tests indicate more promising materials are on the way for peanut growers.

Spotless® and Folicur®, unlabeled triazole fungicides, have provided leafspot control comparable with Bravo® for several years, when applied in a season-long schedule. Because of their activity on white mold, limb rot, pod rot, and root rot-causing fungi, Spotless and Folicur-treated peanuts routinely outyielded Bravo-treated fields by 400-1,200 lb. per acre.

Since development of fungicide-tolerant strains of fungi has occurred where other triazole fungicides have been used, Auburn researchers also evaluated alternative treatment schedules that will allow growers to benefit from soilborne disease control from the triazole materials, but also utilize Bravo during times of the season when leafspot is the only problem. Additional benefits are to delay resistance development to the triazoles and to reduce the overall cost of the fungicide program. Bravo is likely to be less expensive than the new triazole fungicides.

Research on midseason applications of Spotless and Folicur indicate that both fungicides do an excellent job of controlling white mold, either when banded as granules over the row or directed-sprayed onto the crown of the peanut plant, table 2. Since the product is delivered in a narrow band where white mold is most active, disease control is achieved at lower use rates than when the same products are applied broadcast with a leafspot sprayer.

Flutolonil (no trade name yet) is a relatively new compound that is licensed in Japan as Morestan. When used for soilborne disease control, this product can be mixed with Bravo and applied with a leafspot sprayer, can be banded sprayed as was done with the triazoles, or can be applied as a granule. Unlike the triazole fungicides, there is no effect on peanut leafspot. In all cases, it has been found to be highly effective in controlling white mold and suppressing the *Rhizoctonia*-induced diseases. Yields have often been improved by more than 1,000 lb. per acre in fields with only moderate disease severity, table 3.

All of the fungicides tested and reported here have activities to several of the soilborne diseases. It is not always possible to quantify their impact on each disease nor to tell if these represent all of the fungi that are being controlled. These fungicides are highly active on a group of fungal diseases that are largely ignored by peanut farmers in the Southeast. These new fungicides should dramatically increase the profitability of peanut production, despite an estimated $30-40 per acre cost.

Backman is Professor of Plant Pathology.

TABLE 1. EFFECTS OF FULL-SEASON SPRAY PROGRAMS ON PEANUT YIELDS AND WHITE MOLD

Treatment*	Yield, lb./acre					White mold (hits/40 ft. row)				
	1984	1985	1986	1987	Av.	1984	1985	1986	1987	Av.
Bravo 1.1 lb.	4,737	3,666	3,763	2,459	3,656	7.0	2.0	5.7	18.0	8.2
Spotless 0.12 lb...	5,944	4,167	4,054	3,497	4,415	.7	1.0	2.8	3.7	2.1
Folicur 0.22 lb. ..	5,917	4,589	4,380	3,545	4,608	.2	.3	4.0	6.3	2.7

TABLE 2. EFFECTS OF ONE APPLICATION OF FUNGICIDES[1] AT TWICE THE RATE USED FOR CONTROL OF PEANUT LEAFSPOT

Treatment*	Yield, lb./acre				Soilborne diseases					
					1985		1986		1987	
	1985	1986	1987	Av.	White mold	Pod rot	White mold	Pod rot	White mold	Pod rot
No treatment.....	2,650	2,750	3,001	2,800	6.5	3.6	6.2	4.0	10.2	3.3
Terraclor 10 lb....	3,129	3,513	3,448	3,363	6.0	3.5	3.0	2.9	4.2	2.9
Spotless 0.25 lb...	4,015	3,436	4,144	3,865	.8	3.0	4.0	2.9	2.4	2.7
Folicur 0.44 lb....	3,583	—	—	3,583	1.5	2.4	—	—	—	—

[1]Applied in a 12- to 16-in. band at pegging over the row, using either a granule or directed (crown) spray.

TABLE 3. YIELD RESPONSE OF PEANUTS FOLLOWING TREATMENT WITH FLUTOLONIL FUNGICIDE

Treatment*	Yield, lb./acre				White mold (hits/40 ft. row)				
	1985	1986	1987	Av.	1984	1985	1986	1987	Av.
No treatment	2,920	2,520	3,001	2,814	4.0	5.1	13.5	11.5	8.5
Terraclor 10 lb....	3,294	3,513	3,448	3,418	2.7	1.9	6.2	3.9	3.7
Flutolonil 1.0 lb. .	3,219	3,775	4,586	3,860	1.1	1.9	5.7	3.0	2.9
Flutolonil 2.0 lb. .	3,763	3,674	4,876	4,104	1.0	1.5	5.8	2.0	2.4

*All rates in pounds active ingredient per acre

Novel Rotations and Organic Materials Show Promise for Management of Nematodes

R. Rodriguez-Kabana and G. Morgan-Jones

PLANT PARASITIC nematodes are a limiting factor in food and fiber crop production in Alabama and most subtropical and tropical regions of the world. Yield losses in some crops are so severe that continued production is not feasible. In the Southeast, soybean, peanut, and vegetable and ornamental crop production is severely limited by nematodes.

Soybean producers have traditionally used resistant varieties that have low susceptibility to nematode attacks or are tolerant of nematode damage. However, total dependence on resistant varieties is not practical because some nematodes, like the cyst nematode, are able to adapt so quickly to resistant varieties that new 'resistance-breaking' races quickly appear in soybean fields. Also, nematode resistant varieties of soybeans aren't necessarily the most productive, nor the most resistant to or tolerant of other insects and diseases.

Unlike soybean growers, Alabama peanut growers have traditionally used chemical nematicides to combat nematodes. The best and most economical of these materials, EDB (ethylene dibromide) and DBCP (dibromochloropropene), were recently banned by the Environmental Protection Agency. Currently there are about 12 nematicides available to growers, but the future availability of many of these materials is uncertain at best.

Crop rotation is another popular method of nematode control, but it too has problems. The most popular rotation crops grown with soybeans and peanuts are grain sorghum and corn. Except for a few cases in the Southeast, it is not economically feasible to grow corn and sorghum, because of crop losses due to climate and pests and the low return these commodities bring to farmers.

Thus, there is currently a need to develop alternative and novel methods for the management of nematodes. Nematology research at the Alabama Agricultural Experiment Station has shown that it is possible to reduce populations of plant parasitic nematodes in soil by using some traditional or new crops in rotation, or by introducing organic amendments which enhance the activity of nematode antagonists.

Recent research has shown that several forage and row crop species can be used in rotation with Florunner peanuts to reduce populations of root-knot nematode (*M. arenaria*), table 1. Castor bean (*Ricinus communis*) and sesame (*Sesamum indicum*) are row crops that are as effective as cotton (a non-host) in reducing nematode numbers when planted in rotation with Florunner peanuts. Data also show that joint vetch (*Aeschynomene indica*) and partridge peas (*Cassia fasiculata*), two potential forage legumes, are equally effective in reducing nematode numbers. Other experiments have shown that another legume, hairy indigo (*Indigofera hirsuta*), and bahiagrass (*Paspalum notatum*) are also promising forage crops for the management of nematodes.

Table 2 reports results of a 2-year peanut/cotton rotation which resulted in good control of root-knot nematodes and increased peanut yields. Current research efforts are designed to determine precisely the long-term effects of rotation crops on nematode populations and their influence on other plant pathogens, insects, and weeds, and on physical and chemical soil properties. The results thus far indicate that it may be possible to maintain root-knot nematodes at economically tolerable levels through the use of these plant species in rotation schemes.

Addition of certain types of organic matter to soil can result in reductions or elimination of plant parasitic nematodes. Chitin, for example, a constituent material of shrimp and crab shell, when appropriately formulated, can be added to soil to reduce damage by root-knot nematodes. Considering that shrimp and crab shells are waste products from our fishing industry, potential for their economic utilization as soil amendments is obvious. Auburn research has shown that these "waste materials," when added to soil, can provide a solution to the nematode problems facing home gardeners. Auburn research has shown that chitin stimulates the type of microorganisms in soil that are antagonistic to nematodes. This discovery represents successful and consistent biological control of plant-parasitic nematodes.

TABLE 1. EFFECT OF SEVERAL ROW CROP AND FORAGE PLANT SPECIES ON JUVENILE POPULATIONS OF ROOT-KNOT NEMATODE (*MELOIDOGYNE ARENARIA*) IN FIELD EXPERIMENT AT THE WIREGRASS SUBSTATION

Crop	Nematodes per pint[1]
	No.
Florunner peanut	568
Castor bean	.3
Joint vetch	.4
Partridge pea	.0
Sesame	8
Cotton	.0

[1]Juvenile nematode numbers determined 6 weeks prior to harvest.

TABLE 2. EFFECT OF CROP ROTATION ON ROOT-KNOT NEMATODE (*MELOIDOGYNE ARENARIA*) JUVENILE POPULATIONS AND YIELDS OF FLORUNNER PEANUT IN A FIELD EXPERIMENT AT THE WIREGRASS SUBSTATION

Crop and treatment		Nematodes/ 16 pints	Yield
1985	1986		
		No.	*Lb./acre*
Peanuts	peanuts	340	2,614
Cotton	peanuts	194	3,123

Rodriguez-Kabana and Morgan-Jones are Professors of Plant Pathology.

Milk Hauling Rates Are Adequate for Profit by Efficient Operations

L.E. Wilson and Durden Lee

FARM ASSEMBLY of milk continues to be a major marketing cost for dairy farmers. In the Midsouth, farm-to-market assembly costs paid by farmers range from less than 5% to over 10% of the farm level value of milk. Research at the Alabama Agricultural Experiment Station indicates that under existing hauling rate structure, efficiently operated routes are profitable for haulers and that rates paid by cooperatives to contract haulers are in line with costs of efficient operations.

Changes in conditions affecting milk producers, haulers, and the market create the need to periodically assess the charges for milk assembly and transport. Recently, a major dairy cooperative requested assistance from the Alabama Agricultural Experiment Station to study milk hauling costs. Purpose of the study was to determine costs, revenues, and efficiencies in the farm assembly and transport of milk. Results from the study provided haulers with information useful to evaluate their operations to make adjustments to reduce costs and/or increase revenues. Also, the study provided the cooperative with information to be used in evaluating the need to adjust hauler and producer rates.

As a result of periodic studies over the past 15 years conducted by southern dairy cooperatives and the Alabama Agricultural Experiment Station, a hauling rate system for milk assembly has been developed. Forms of the system are being used by most cooperatives and proprietary handlers operating in the Midsouth. Rates established per hundredweight are based on producer volume (the larger the volume, the lower the rate) and distance of the farm from the market (rates increase with distance). Purpose of the volume-distance scale has been to provide a rate structure that is fair to the individual producer and to the hauler. Initially, the scale was used to establish rates paid by individual producers and is still used in this manner by some proprietary handlers. Ordinarily, cooperatives use the scale as a guide to establish an amount to pay their contract haulers for deliveries to specific locations or to allocate revenues to their hauling operations when using the cooperative's equipment. Each route has several alternative rates for deliveries to a list of markets. The hauler delivers to the market specified by the cooperative. Delivery locations may change several times during a month. Because of the way cooperatives move milk among markets, as well as balance supplies, it is impractical for the cooperatives to charge individual producer members the full costs of day-to-day assembly and movement of their milk. Instead, in cooperatives the producer members as a group or subgroups, such as a division, pay the total costs of milk assembly and transport.

A questionnaire was administered to seven contract haulers employed by the cooperative. The individual haulers operated 2-13 routes for a total of 42 routes to assemble milk from approximately 300 dairy farmers located in Alabama, Tennessee, and Georgia. Deliveries of raw milk were made to fluid milk plants located in these states and Florida and periodic deliveries of milk were made to cheese plants. Study periods were September-December (three haulers) and May-August (four haulers). Individual analyses were prepared for each operation, reviewed by the hauler for accuracy of results, and revisions made where needed.

Initial analyses of the survey data show route characteristics and relate overall costs of operation to hauling revenues received by each hauler.

Average load was 45,797 lb., 88% of tank capacity. Among the seven haulers, loads ranged from 43,300 lb., or 83.9% of capacity, to 48,200 lb. and 91.3 of capacity. Average round-trip mileage including farm pickup was 834 miles, ranging from 603 to 889 miles for the individual haulers.

Selected measures of average costs include: operating the routes $721.90 per route day, $0.870 per round-trip mile, and $1.576 per hundredweight. Approximately 31% of costs were labor, operating or variable costs were 42%, and fixed costs were 27%. Costs to assemble and transport 100 lb. of milk 100 miles averaged $0.189 for the seven firms. Among the haulers, these costs ranged from $0.167 (average routes of 889 miles) to $0.222 (690 miles per route). Some cost differences can be related to length of routes, while other significant cost ranges were attributed to differences in operational efficiencies among the firms.

Although revenue received by haulers exceeded all costs by 1.2%, some haulers enjoyed substantial returns on their operations. Others were not covering all costs. Net income to the seven haulers ranged from a 17% loss to a positive return exceeding 12%. Three haulers experienced losses. The loss elements were identified to the three haulers and adjustments were made so that break-even operations or small net incomes were achieved as a result of the study.

Selected Measures of Costs and Revenue for Seven Contract Haulers, 1985-86

Item	Av. cost or revenue per		
	Route day	Round-trip mileage	Hundredweight
	Dol.	*Dol.*	*Dol.*
Cost			
Labor	222.73	0.268	0.486
Operating	300.60	.363	.656
Fixed	198.57	.239	.434
Total	721.90	.870	1.576
Revenue	730.93	.881	1.596

Wilson is Professor of Agricultural Economics and Lee is Hauling and Transportation Coordinator, Southeast Division of Southern Milk Sales.

Survival of Loblolly Pine Seedlings on Adverse Sites Is Influenced by Initial Height

C.L. Tuttle, M.S. Golden, D.B. South, and R.S. Meldahl

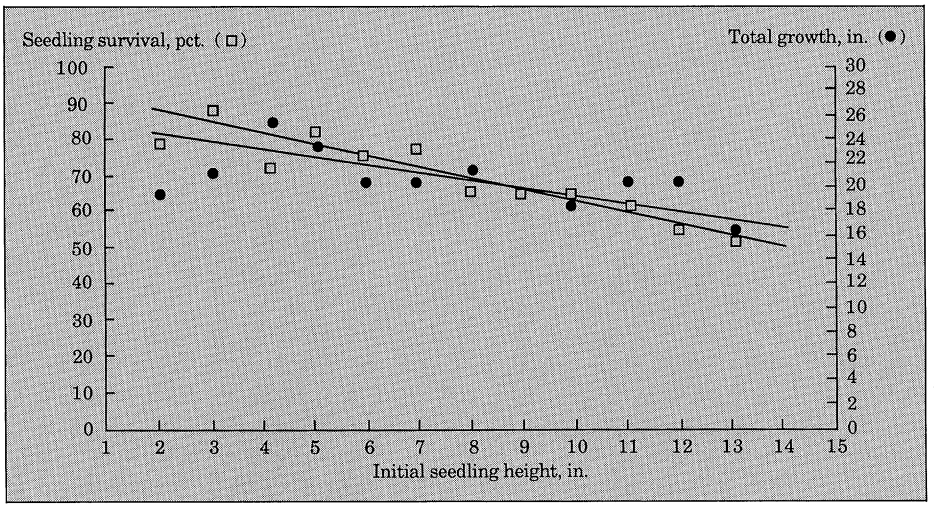
THE CONSERVATION Reserve Program is increasing the amount of tree plantings on some of Alabama's more erodable land, but to receive payment through the program, tree seedling survivability must be adequate. Research in the Alabama Agricultural Experiment Station indicates that planting pine seedlings deeper, or where deeper planting is not done, planting shorter seedlings, can increase survivability on adverse planting sites.

Some sites to be planted have compacted topsoil, while others have sandy soil textures and do not hold water well. During dry years, survival on the sites may be reduced due to a lack of moisture. Seedling survival also can be affected by how well the seedlings are planted and how much shoot is exposed after planting. On well drained sites, planting pine seedlings deeper than normal will usually increase survival. This can easily be done when planting with machines that make a deeper planting hole. However, hand planters sometimes object to deep planting due to the extra time required to make a deeper, larger planting hole. Therefore, when hand planting seedlings at normal depths (root collar at ground level or slightly below ground level), the height of the seedling planted could affect survival on adverse sites.

To determine the effect of seedling height on survivability, researchers collected data from one site located in the lower Piedmont and two in the Hilly Coastal Plain of Alabama. The sites were hand planted at a 6-ft. x 8-ft. spacing with 1-0 planting stock using dibbles. During planting operations, planters were instructed to plant the seedlings to normal, or root collar, depth.

The sites were defined as adverse, since second-year survival was below 75% and total 2-year height growth was less than 30 in. Adverse conditions included low soil water holding capacity (resulting in droughty conditions), thin topsoils (due to erosion), or severe compaction (from harvesting). Average survival, total seedling height, and total growth (for 2 years) were calculated for the various height classes.

Seedling heights immediately after planting ranged from 2 to 14 in. Survival was negatively related to initial seedling height after two seasons, with taller planted seedlings having lower survival than shorter ones, see figure. Second-year survival on adverse sites was 18% higher for 8-in. seedlings than for 14-in. seedlings. Therefore, on the adverse sites examined, there was no apparent advantage in using taller bare-root seedlings. On these sites, shorter seedlings likely undergo less transplant shock, resulting in better survival.



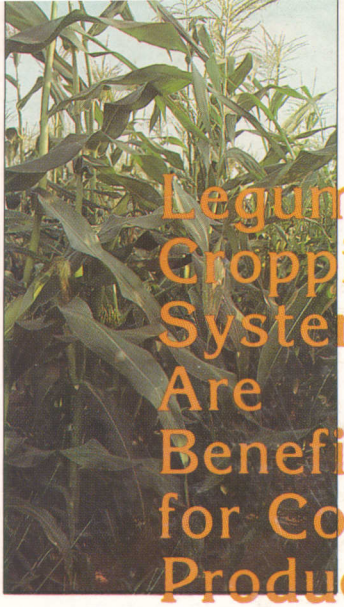
Pine seedling survival and growth.

Total loblolly pine seedling height growth after two growing seasons also was correlated to planting height, see figure. On these adverse sites, total growth was negatively related to initial seedling height. However, total seedling height after two seasons (total 2-year growth plus initial seedling height) was not significantly related to initial seedling height. The shorter seedlings grew faster and were able to equal the heights of the slower growing taller seedlings.

For many years, foresters have known that seedlings of the same height with large root collar diameters will perform better than seedlings with smaller diameters. Seedlings with large root collars (greater than 3/16 in.) and with good lateral roots are recommended for greater survival or growth. However, this study indicates that when referring to seedling height, the use of taller seedlings does not necessarily mean better growth and survival. When other morphological characteristics, such as collar diameter and root mass, are similar, planting a taller seedling on an adverse site may result in lower survival.

The Auburn research indicates planting crew supervisors should be aware of the interactions between site and seedling heights and should attempt to identify adverse sites prior to planting operations. On adverse sites, seedling survival can be increased by deep planting (placing the root collar below the soil surface), but where deep planting is not practiced, planting short (less than 10 in. tall) seedlings with good root systems should result in increased survival.

Tuttle is Research Associate, Golden is Associate Professor, and South and Meldahl are Assistant Professors of Forestry.



Legume Cropping Systems Are Beneficial for Corn Production

L.J. Oyer and J.T. Touchton

EARLY-MATURING winter legumes can be used as the sole nitrogen (N) source for summer crops that have a low N requirement or that have a relatively late optimum planting date. These legumes, however, do not provide sufficient N for corn, a crop with a high N requirement that must be planted early. In addition, comparing current legume seed and seeding costs to commercial N prices shows that the legume must provide about 80 lb. N per acre to cover production costs. If reseeding legumes can be used, however, production costs can be greatly reduced.

A good crop of soybeans can provide one-fourth to one-third of the total N needed by a subsequent corn crop. Since soybeans do not have to be planted until mid-May, it is possible to reseed legumes in a soybean-winter legume-corn rotation. Alabama Agricultural Experiment Station research conducted at the Sand Mountain and Wiregrass substations was aimed at the development of legume reseeding systems that can eliminate or greatly reduce N fertilizer requirements of corn.

Legume cropping systems and rotations tested were: (1) continuous corn with no winter crops, (2) soybean-corn rotation with no winter crops, (3) continuous corn with fall-planted crimson clover, and (4) soybean-corn rotation with seeded clover the fall prior to planting soybeans with reseeded clover the second fall. Nitrogen fertilizer (ammonium nitrate) was applied to corn at rates of 0, 60, 120, and 180 lb. N per acre. Soils at both locations rated high in P, K, Ca, and Mg.

At the Sand Mountain Substation, corn (RA 1502) was planted during mid-April in 36-in. rows; irrigation was not available. At the Wiregrass Substation, corn (DeKalb T1230) was planted in late March using twin 7-in. rows on 36-in. centers with irrigation. All tests were planted with an in-row subsoiler.

Reseeded clover behind soybeans produced more dry matter and total N than planted clover following corn, table 1. Greater weight and total N with the reseeded clover is most likely due to earlier establishment and more fall growth than planted clover.

At the Sand Mountain Substation, corn grain yields peaked at 120 lb. N per acre regardless of cropping system, table 2. However, cropping systems changed yield potentials. The highest yielding system was the soybean-reseeded clover-corn rotation with 156 bu. per acre, compared to 110 bu. per acre with continuous corn.

At the Wiregrass Substation, corn grain yields were not greatly affected by cropping systems when N was at optimum levels, table 2. It appears that the soybean-reseeded clover system, but not the clover-only or soybean-only systems, reduced N fertilizer requirements for corn.

Judging from data collected from this study and other studies conducted in recent years, it may be best not to reduce the N fertilizer rate for corn rotated with soybeans or following a winter legume. Further evaluation of the potential benefits of reseeding systems, production cost reductions, increase in yield potential, and reduction in N fertilizer requirements will be continued.

Oyer is a Graduate Student and Touchton is Professor of Agronomy and Soils.

TABLE 1. DRY WEIGHT AND N CONTENT OF CLOVER AT CORN PLANTING AS AFFECTED BY LOCATION AND PREVIOUS CROP

Location and previous crop	Clover wt. and N content		
	Dry wt./ acre	N content	N/acre
	Lb.	*Pct.*	*Lb.*
Sand Mountain Substation			
Corn	3,198	2.91	93
Soybeans	4,237	2.86	121
Wiregrass Substation			
Corn	1,103	4.19	46
Soybeans	2,425	3.76	91

TABLE 2. CORN GRAIN YIELD, BY LOCATION, AS AFFECTED BY CROPPING SYSTEM AND N TREATMENT

Location and cropping system	Grain yield/ per acre			
	0 N	60 N	120 N	180 N
	Bu.	*Bu.*	*Bu.*	*Bu.*
Sand Mountain Substation				
Continuous corn	12	67	110	110
Soybeans-corn rotation	39	102	123	135
Clover-corn	53	104	132	131
Soybeans-reseeded clover-corn	81	135	156	155
Wiregrass Substation				
Continuous corn	61	138	155	186
Soybeans-corn rotation	89	125	165	171
Clover-corn	85	139	152	164
Soybeans-reseeded clover-corn	139	170	182	163

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AUBURN UNIVERSITY
AUBURN UNIVERSITY, ALABAMA 36849-5403

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