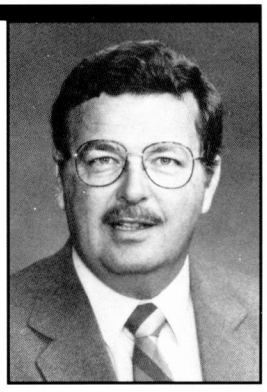
Volume 38, No. 2
Summer 1991
abama Agricultural Experiment Station
Lowell T. Frobish, Director
Auburn University
Auburn University, Alabama

HIGHLIGHTS

OF AGRICULTURAL RESEARCH

DIRECTOR'S COMMENTS



LOWELL T. FROBISH

WEBSTER DEFINES planning as "the establishment of goals, policies, and procedures for a social or economic unit." All of us do some planning—where to go on vacation, when to buy a house or car, and many other such things. Rarely do we just do something on the "spur of the moment." The research reported in this issue of *Highlights* resulted from planning by scientists to answer specific questions.

Planning of research must occur at all levels, from the scientist through administration. One type of planning, the development of a strategy, has occurred recently in the Experiment Station. A Task Force of agricultural leaders within and external to Alabama was formed and asked to:

- look to the future and consider the forces of population changes, introduction of existing and new technology, changes in public policies, and other factors that affect agriculture and forestry production and research;
- review and evaluate the strengths of the existing research program within the Experiment Station and identify areas of strength for a leadership role;
- establish research objectives and goals to direct required changes; and
- identify priorities among the research objectives.

On April 4, 1991, a symposium, "Agricultural Research for the Twenty-First Century," was held and the Task Force presented its findings and recommendations. The Task Force concluded that agriculture and forestry will continue to have an enormous economic impact upon the State and its citizens. The report further concluded that the Experiment Station's research programs have contributed to the production and sale of higher quality, safer, more economical, and more convenient food and other agricultural products and have addressed problems relating to the use of the State's natural resources. All of the Experiment Station's research was deemed valuable, but areas meriting greater relative emphasis included: fisheries and aquaculture, poultry, forestry, horticultural crops, forages, processing to add value to primary products, food safety and quality, natural resource conservation, and agricultural sustainability.

The next step in the planning process involves the development of specific strategies to meet the goals identified by the Task Force. Teams comprised of scientists from Auburn University and state agencies and representatives from agribusinesses, commodity organizations, and producers will be formed to develop these strategies. One goal of *Highlights* is to present some results of our research efforts and another is to solicit your input into problems that need to be investigated. Your comments will be evaluated and incorporated into the strategies where feasible. The final plan will be ALL OUR plan.

MAY WE INTRODUCE

Dr. David Weaver, Associate Professor of Agronomy and Soils and leader of the Experiment Station's soybean breeding program. A native of Braselton, Georgia, Weaver earned a B.S.A. degree in agriculture and an M.S. degree in agronomy from the University of Georgia. He also earned a Ph.D in agronomy from Purdue University. After completing his graduate work at Purdue, Weaver joined the Auburn faculty in 1981.

His research at Auburn led to the release of Stonewall, a Group VII Maturity soybean variety. Though bred specifically for Alabama growing conditions, Stonewall has performed well throughout the Southeast. In fact, it is currently used as the standard, or check, variety for Group VII soybeans in tests throughout the Southeast.

One aspect of Weaver's research is reported in an article, "Determinate Versus Indeterminate Cultivars For Late Planting of Soybeans," on page 6 of this issue of *Highlights*.

ON THE COVER. Red claw, a giant crayfish from Australia, has great promise for Alabama's aquacultural industry, according to research reported on page 9 of this issue of *Highlights*.

Summer 1991 Vol. 38, No. 2

A quarterly report of research published by the Alabama Agricultural Experiment Station, Auburn University.

C. H. BURMESTER, C. W. WOOD, and C. C. MITCHELL

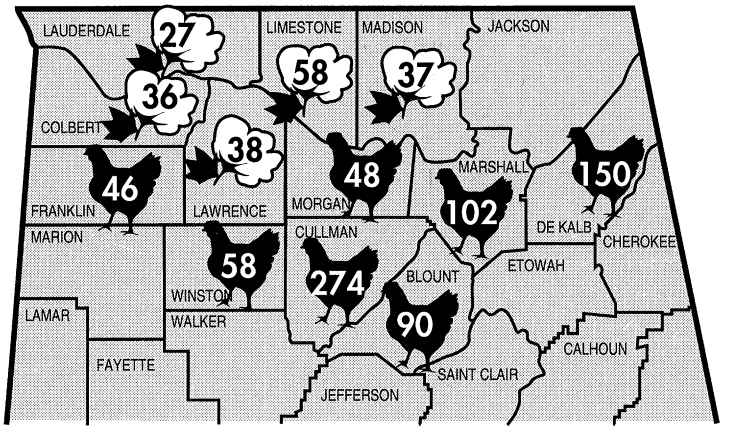
BROILER LITTER PROMISING AS NITROGEN SOURCE FOR COTTON

ALABAMA'S POULTRY industry produced an estimated 1.7 million tons of chicken litter in 1990. This litter contains large amounts of nitrogen (N), phosphorus (P), and potassium (K), which could make it a valuable fertilizer for row crops, pastures, and hay crops. Since litter has the potential for environmental pollution if over-used, both crop response and environmental protection are important in choosing the rate of litter application to soil.

The Tennessee Valley Region in northern Alabama, where cotton is the major crop, may provide an opportunity for use of large amounts of litter. In addition to being an intensive row crop farming area, the region's proximity to the major broiler litter producing counties (identified on the map) offers an advantage for large volume litter use on crops such as cotton.

Broiler litter has been successfully used to fertilize grasses and other crops which do not require precise N fertilization. Litter use with cotton would require much more precise application rates since excessive N promotes rank vegetative growth that can increase boll rot, delay maturity, and cause poor defoliation. Cotton regrowth can be a problem if excessive N is left in the soil after defoliation.

Research to address some of the potentials and concerns about cotton fertilization with broiler litter was begun by the Alabama Agricultural Experiment Station in 1990 at the Tennessee Valley Substation, Belle Mina. Additional research was done on a farm in Cullman County and another in Lauderdale County.



Relationship between broiler litter production (thousands of tons) and cotton acreage (thousand of acres) in north Alabama, 1990.

Broiler litter was weighed, spread, and incorporated prior to planting at each test location. Treatments compared were 2, 3, and 4 tons per acre of broiler litter and 0, 60, and 120 lb. per acre of commercial N (from ammonium nitrate). The commercial N rates were split—half applied preplant and the remainder sidedressed at early squaring. Requirements for P and K were met with 400 lb. per acre of 0-20-20 fertilizer applied preplant.

Analysis of the broiler litter indicated that the 2-ton-per-acre rate provided 113 lb. of N, 73 lb. of $P_2 0_5$, and 61 lb. of $K_2 0$ per acre. Normal fertilizer recommendations call for 60-90 lb. of N per acre for cotton. Availability of N and other plant nutrients from broiler litter is unknown, but the rates used (2, 3, and 4 tons per acre) should meet or exceed requirements.

Soil samples to a depth of 2 ft. were taken for determining nutrient movement in the soil. Cotton leaf samples were collected at early bloom to measure nutrient concentrations. Cotton production measures were plant height and seed cotton yield.

Dry weather from mid-July to early September greatly affected cotton yields and response to broiler litter application. However, results obtained provide useful information.

Cotton treated with broiler litter was growing well at all locations before dry weather occurred. Height and node measurements indicated that the litter-treated cotton was growing slightly faster than cotton getting commercial N fertilizer. No detrimental effects on cotton growth were found with the broiler litter, and no additional weed pressure was noted.

As demonstrated by data in the table, dry weather eliminated most treatment differences. Only at the Tennessee Valley Substation were near normal yields recorded. At all sites, the 2-ton-per-acre rate of broiler litter produced yields equivalent to the 60- and 120-lb. N fertilizer treatments. Increasing rates of broiler litter beyond 2 tons per acre did not increase yields. Cotton leaf analysis showed that litter-treated cotton contained similar concentrations of N, P, K, magnesium, calcium, iron, and zinc as cotton treated with commercial N.

Based on these data, it is concluded that application of broiler litter provided a good source of N for cotton. However, since 1990 was a drought year, the potential problems of rank and late season cotton growth caused by broiler litter could not be evaluated. Any residual effects of broiler litter on succeeding crops will become apparent in 1991 and later.

YIELDS[1] AND PLANT HEIGHT[2] AS AFFECTED BY N FERTILIZER AND BROILER LITTER APPLICATION, 1990

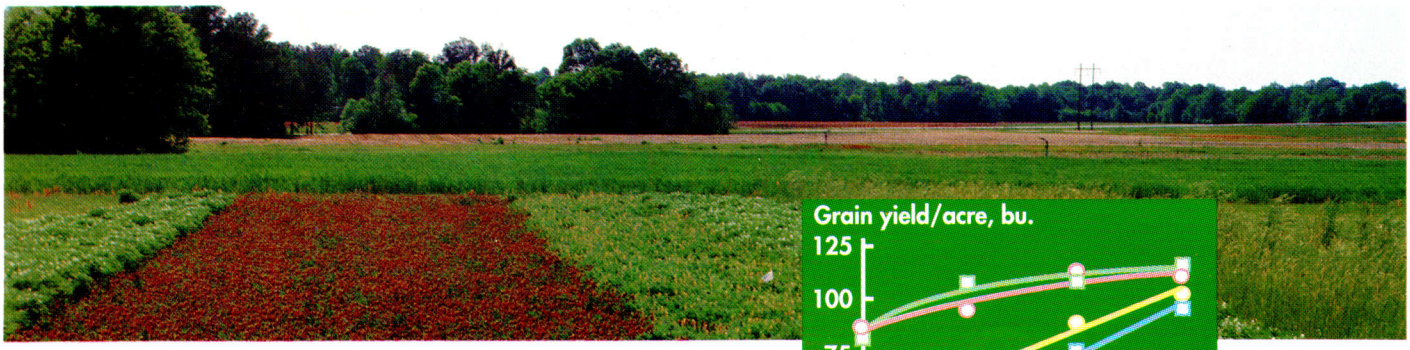
Treatment/acre	Tenn. Vall. Sub.		Cullman Co.		Lauderdale Co.	
	Yield/ acre	Plant height	Yield/ acre	Plant height	Yield/ acre	Plant height
	Lb.	*In.*	*Lb.*	*In.*	*Lb.*	*In.*
No N	1,840	22	910	21	850	21
60 lb. N	2,230	24	1,210	21	1,160	23
120 lb. N	2,450	26	1,330	23	1,280	23
2 tons litter	2,460	29	1,250	24	1,100	24
3 tons litter	2,560	27	1,200	25	1,220	26
4 tons litter	2,520	28	1,320	25	1,280	27

[1]Seed cotton yield.
[2]Cotton height measured in mid-June.

Burmester is Agronomist, Wood is Assistant Professor, and Mitchell is Assistant Professor of Agronomy and Soils.

D. W. REEVES and J. T. TOUCHTON

Deep Tillage Ahead of Cover Crop Planting Reduces Soil Compaction for Following Crop



Corn grain yield response to applied N as affected by cover crop, 1988-90 average.

COARSE-TEXTURED Coastal Plains soils are subject to compaction by tillage, traffic, and rainfall. Such compaction limits crop production and reduces efficiency of nitrogen (N) use.

Deep tillage in the spring before planting can help overcome compaction problems, but such land preparation is not always practical. Therefore, there has been interest in growing rotation crops that have roots which can penetrate compacted zones (referred to as "biological plows") and lead to increased rooting depth of following crops.

This possibility was examined in a cooperative project by the Alabama Agricultural Experiment Station and USDA Agricultural Research Service at the E.V. Smith Research Center, Shorter. The study was designed to determine if winter cover crops either alone or in combination with deep tillage (paraplowing) in the fall could reduce soil compaction for the benefit of a following corn crop. The objective was to improve corn growth and yield and increase N use efficiency by the corn.

The study was conducted for 3 years (1988-90) on a Norfolk sandy loam with a well-developed hardpan 7 to 13 in. below the surface. Treatments consisted of fall tillage (disking or disking plus paraplowing) prior to planting winter cover crops of crimson clover, cereal rye, or Tifwhite-78 white lupin and a winter fallow check. The lupin was included because reports from Australia indicated that at least one species could improve rooting of a subsequent crop.

Cover crops were killed with Gramoxone® 11-14 days before planting corn each spring. Prior to planting DeKalb 689 corn, the plots were disked to a depth of 4 to 5 in. Cover crop plots were subdivided and randomly assigned fertilizer treatments of 0, 50, 100, or 150 lb. N per acre. The N (ammonium nitrate) was applied to the corn banded beside the row, with one-third applied at planting and the remainder applied 5 weeks later.

Soil strength readings taken with a penetrometer at corn maturity each year showed that rye and clover moderately increased soil strength at depths of 3-7 in., compared to lupin and winter fallow. However, the reduction in soil compaction at 7- to 17-in. depths resulting from paraplowing was still evident at corn harvest.

Although fall paraplowing prior to planting the cover crop had a strong residual effect in decreasing soil strength, data in the table show a trend for corn grain yields to be lower with paraplowing. This was likely due to increased infiltration and leaching of N as evidenced by reduced earleaf N with paraplowing compared to disking. The effect was greatest in 1989, an extremely wet growing season. Further evidence of increased infiltration in paraplowed plots was demonstrated in 1990, following 9.8 in. of rain in a 48-hour period; soil water content in the 8- to 16-in. depth increased 34.8% in disked plots compared to 46.7% in paraplowed plots.

Corn grain yields were increased by the two legume cover crops, as illustrated by the graph. Optimum yields were obtained with 50-100 lb. N per acre for clover and lupin, while top yields following rye and fallow required 150 lb. N per acre.

Based on grain yields and earleaf N data, white lupin compared favorably with crimson clover in N production and resultant benefit to a corn crop. Nitrogen response and penetrometer and soil water data, however, indicated that none of the cover crops acted as a "biological plow."

Results show that paraplowing prior to planting a fall cover crop reduced compaction for the subsequent corn crop, but this beneficial effect did not result in increased corn yield. Data suggest that increased water infiltration and N leaching from paraplowing offset any yield response from reducing compaction.

Reeves is Adjunct Associate Professor (Coop. USDA-ARS-NSDL) and Touchton is Professor and Head of Agronomy and Soils.

Effect of Cover Crop Tillage on Following Corn Crop

Tillage	Earleaf N content			Grain yield/acre		
	1988	1989	1990	1988	1989	1990
	Pct.	*Pct.*	*Pct.*	*Bu.*	*Bu.*	*Bu.*
Disk	2.87	2.19	2.62	87	86	94
Paraplow	2.78	2.14	2.59	80	76	93

L.V. PURVIS, B.K. BEHE, and C.H. GILLIAM

Consumer Survey Identifies Most Popular Plant Containers

PRODUCT packages and containers are known to influence a consumer's decision to make a purchase. For nursery trees and shrubs, this influence has not yet been defined. Some garden centers report that customers want larger, more mature plants which can instantly fill a need or a void in the home landscape, and will pay a higher price to obtain them.

Traditionally, nursery trees have been grown in the field, dug from the ground, and wrapped in burlap. Today, many plants are grown in polyethylene containers instead of in field soil. Now available is a third type of container, called a grow bag. The young plant is grown in a bag which can be placed in the ground at planting, a system which offers advantages of both field and container methods. The new grow bag produces a top quality plant, but is usually covered with soil. A recent Alabama Agricultural Experiment Station project was conducted to determine consumer preferences for ornamental trees grown in these three types of containers.

Seventy-four consumers participated in a personal interview and written questionnaire study at two garden centers on two Saturdays in Montgomery in October and November, 1989. Consumers were asked questions pertaining to their perceptions of certain plant and container characteristics and several demographic characteristics, such as age, education, household size, gender, and income. Finally, the participants were asked to view magnolias and photinias in each of the three container types and select one plant from each group that they would most prefer to buy if making a purchase that day.

Respondents varied in age from 26 to 79 and averaged 49 years of age; 17% were 25-34, 36% were 35-49, and 47% were 50-79 years old. Seventy-five percent of the respondents had completed some college or had earned a college degree. Fifty-one percent stated that their households contained only two people and the average household size of the respondents was 2.4 people. The average household income of the respondents was $49,000. The majority of the respondents (63%) were female and 41% of the participants had purchased a plant in the previous year for use outside the home.

Consumers were asked to rank the importance of several plant and package characteristics on a 9-point scale. Ninety percent of the respondents indicated that health of the plant was an important attribute, while 49% felt price was an important characteristic. The type of container in which the plant was sold was considered important by only 18% of the respondents. Thus, price was a chief concern to some respondents, but purchasing a high quality plant was important to more consumers.

Magnolias in three types of containers.

Respondents were then asked to choose which plant they would purchase if buying one for themselves that day. For the magnolia plants, 48% chose the plant in the polyethylene container, 19% chose the field-grown plant in the ball and burlap container, and 27% chose the magnolia in the grow bag. For the photinias, 69% chose the plant in the plastic container, 14% chose the plant in the ball and burlap container, and 11% chose the photinia in the grow bag.

These results indicate that consumers prefer plants in the polyethylene containers more than plants in ball and burlap containers or grow bags. Plants in the polyethylene containers may have appeared healthier and of higher quality to the respondents because the plastic containers hold more water, causing the plants to look fuller and more vigorous. In addition to being more attractive and healthier-looking to consumers, plants in polyethylene containers require less labor by the nursery to keep them watered than those in traditional ball and burlap containers.

The container does not appear to play a direct significant role in the consumer purchase decision. However, it may influence consumers' perceptions of quality, most likely by influencing the growth of the plant itself. Therefore, container selection is important to both producers and retailers of perennial and annual bedding plants.

Purvis is Graduate Assistant, Behe is Assistant Professor, and Gilliam is Professor of Horticulture.

D. B. WEAVER, R. L. AKRIDGE, and C. A. THOMAS

Determinate vs. Indeterminate Cultivars for Late Planting of Soybeans

PLANTING SOYBEANS later than mid-June usually results in short plants that are difficult to harvest and are low yielding. Since planting is often this late in double-cropping systems, which accounts for much of Alabama's soybean acreage, the poor performance of late-planted beans is a serious problem.

One potential way to overcome the problem is to shift away from determinate varieties that are generally planted. These varieties are used because they are well adapted to Alabama conditions, but their problem is that plants stop growing when flowering starts. Thus, late-planted crops do not have enough time for plants to grow large enough for efficient combining or to produce high yields.

With the other type varieties, called indeterminate, plants continue to grow vegetatively during the flowering and fruiting periods, thereby compensating for the late planting. These are the type varieties grown in the Corn Belt, where they are adapted. The currently available indeterminate varieties are not suited for production in the Southeast, but efforts have been underway in recent years to develop adapted indeterminate varieties.

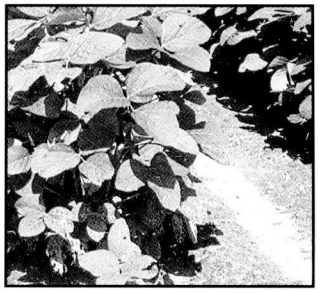
Two experimental indeterminate genotypes have been evaluated in Alabama Agricultural Experiment Station management tests since 1986. The two experimental lines from the University of Georgia (G82-8468 and G84-9006), developed specifically for late planting, were compared with determinate cultivars Braxton and Kirby. Braxton is a Maturity Group VII cultivar, while the others are Group VIII[1].

Response to row spacing and planting dates were compared between the two variety types in the 1986-89 test at the Plant Breeding Unit, Tallassee. Row widths tried were 12 and 24 in., with in-row spacings of 4 or 8 plants per foot of row. Planting dates were approximately mid-June and early July. Data were collected on yield, plant height, days to maturity, days to canopy closure, and lodging. In addition, data on factors related to yield, such as number of branches per plant, number of pods per plant, and seed size, were collected.

Row spacing had little effect on yield or other variables except days to canopy closure. Twelve-in. rows had fewer days to canopy closure than 24-in. rows, but this did not result in higher yield for the narrow rows. Therefore, data for yield and other characteristics were averaged over row spacings.

Determinates yielded more than indeterminates overall. As noted by data in the table, however, indeterminate cultivars suffered less yield loss because of delayed planting. Average yield per acre of determinates was 44 bu. from the mid-June planting date and 34 bu. from the early July planting date, a decrease of 23% due to delayed planting. For indeterminates, yields averaged 39 and 32 bu., respectively, for the mid-June and early July planting, a decrease of 18% due to delayed planting.

These results established that amount of yield reduction caused by delayed planting was dependent upon growth habit. The indeterminate genotype G82-8468 was competitive with the determinates in yield from the early July planting and only suffered a 15% yield reduction due to delayed planting.



Effect of Planting Date on Yield and Plant Height of Determinate and Indeterminate Soybeans, 1986-89

Variety or line	Result, by planting date			
	Mid-June		Early July	
	Yield/ acre	Plant height	Yield/ acre	Plant height
	Bu.	*In.*	*Bu.*	*In.*
Braxton	45.4	29	34.8	25
Kirby	43.0	31	34.0	27
G82-8468	39.2	41	33.4	33
G84-9006	39.1	39	30.5	32

Effect of planting date on plant height at maturity also was dependent upon growth habit. Plant height was greater for indeterminates than determinates at both planting dates. Plant heights from the mid-June planting date were adequate for both growth habits, but the determinate plants averaged only 26 in. if planted in early July. This short height could lead to problems with mechanical harvesting. However, the indeterminates were adequately tall at both planting dates. Height of the indeterminates planted in early July was greater than for the determinates from the mid-June planting date.

In spite of greater plant height, yield of the indeterminates at both planting dates was somewhat disappointing. Part of this problem could be related to variety since the indeterminate genotypes are experimental lines. For example, it was noted that the determinates, although shorter, branched more profusely than the indeterminates. Thus, they were more than able to make up for the height disadvantage by producing more branches.

It was concluded that row widths narrower than 24 in. provide no yield advantage in late-planted environments. Determinates, although shorter, were superior in yield from the mid-June planting date, and G82-8468 had yield equal to the determinates when planted in early July. Indeterminates were taller, which may provide some yield advantage where poor harvesting efficiency of determinates results in low harvested yield.

[1]Soybeans are divided into Maturity Groups according to their relative maturity dates. In Alabama, the most commonly grown Maturity Groups are V, VI, VII, and VIII (latest maturing).

Weaver is Associate Professor, Akridge is former Graduate Student (presently plant breeder with FFR Cooperative), and Thomas is Research Specialist of Agronomy and Soils.

J. C. JACOBI, P. A. BACKMAN, R. RODRIGUEZ-KABANA, and D. G. ROBERTSON

BAHIAGRASS IN ROTATIONS SHOWS PROMISE FOR BOOSTING PEANUT YIELDS

SOILBORNE diseases of peanuts are on the increase in Alabama. Both white mold and limb rot have become more severe problems as irrigated acreage has increased and rotation use and length of rotation have declined. The bottom line has been a gradual but consistent decline in peanut yields over the past few years.

Unfortunately, fungicidal control for soilborne diseases is limited. Terraclor® is the only fungicide currently recommended for control of white mold, but it does not control limb rot. The experimental fungicides Folicur® and Spotless® have given excellent control of peanut leafspot, white mold, and limb rot in field trials, but these materials are not registered for use on peanuts.

Under existing conditions, crop rotations appear to offer the best bet for reducing severity of soilborne peanut diseases, and this approach is being emphasized in Alabama Agricultural Experiment Station (AAES) research. Suitable rotations are being sought despite the problems of (1) a lack of economically attractive rotation crops, and (2) the broad host ranges of both white mold and limb rot.

Peanut rotations commonly used in Alabama include either corn, cotton, sorghum, or soybeans. Since previous AAES research has shown that bahiagrass reduces root-knot nematode populations, bahiagrass was included, along with corn, in a long-term rotational study with irrigated peanuts at the Wiregrass Substation, Headland.

Results indicate that either a 1-year rotation with corn or 1- and 2-year rotations with bahiagrass did not significantly reduce white mold severity, table 1. Rotations of 1-2 years between peanut crops are not long enough to reduce white mold severity due to the ability of the white mold pathogen to remain in the soil for 3-4 years. Three- and 4-year rotations between peanut crops are generally required to reduce white mold severity.

Limb rot severity was reduced 16 and 43% by 1- and 2-year rotations, respectively, with bahiagrass when compared to continuous peanuts. A 1-year rotation with corn did not significantly reduce limb rot severity, because corn is a host of the causal fungus. All rotations increased yields over continuous peanuts, table 2. Peanut yield following a 2-year rotation with bahiagrass was 44% higher than nonrotated peanuts.

The effects of the nematicide Temik® and the fungicide Folicur also were evaluated for each rotational system. Chemical treatment increased yields and reduced soilborne disease intensity, regardless of crop rotation. However, yield increases with these chemicals were higher for rotated peanuts than nonrotated peanuts. In several cases, yields were increased by 1,000 lb. per acre. Similar yield increases with Folicur have been seen in tests conducted across the Southeast. However, until Folicur is registered by the EPA, growers must rely largely on management practices, like rotation, to minimize yield losses to soilborne diseases.

These preliminary results indicate that 1- or 2-year rotations with bahiagrass can significantly increase yield over continuous peanut production. While the reasons for yield increases with bahiagrass rotations are not entirely understood, reduced severity of soilborne diseases along with enhanced soil physical properties are thought to be important factors. Although white mold severity was not significantly reduced in either bahiagrass rotation, rotations longer than 2 years between peanut crops may reduce white mold disease severity.

Jacobi and Robertson are Research Associates and Backman and Rodriguez-Kabana are Professors of Plant Pathology.

TABLE 1. EFFECT OF CROP ROTATION AND CHEMICAL TREATMENT ON DISEASE INTENSITY OF WHITE MOLD AND RHIZOCTONIA LIMB ROT IN IRRIGATED FLORUNNER PEANUTS

Crop rotation[1]	Treatment[2]	White mold hits[3]	Limb rot lesions[4]
Peanuts-peanuts-peanuts	(-)	32.9	10.5
	(+)	9.4	6.8
Peanuts-corn-peanuts	(-)	37.5	10.0
	(+)	7.8	6.1
Peanuts-bahiagrass-peanuts	(-)	35.9	8.8
	(+)	7.8	3.8
Bahiagrass-bahiagrass-peanuts	(-)	32.9	6.0
	(+)	4.0	3.8

[1]Crops grown in 1988, 1989, and 1990, respectively.
[2](-) = no Temik, no Folicur; (+) = Temik applied at-plant at 3 lb. a.i. per acre in an 8-in. band, and Folicur applied twice during the season at a rate of 0.225 lb. a.i. per acre.
[3]Average number per 100 ft. of row.
[4]Number per 5 lateral limbs.

TABLE 2. EFFECT OF CROP ROTATION AND CHEMICAL TREATMENT ON YIELD OF IRRIGATED FLORUNNER PEANUTS

Crop rotation[1]	Treatment[2]	Pod yield/ acre	Change in yield over continuous peanuts[3]	Additional yield with Folicur-Temik[4]
		Lb.	*Lb.*	*Lb.*
Peanuts-peanuts-peanuts	(-)	2,693	—	
	(+)	3,327		+ 634
Peanuts-corn-peanuts	(-)	2,978	+ 285	
	(+)	4,547		+1,569
Peanuts-bahiagrass-peanuts	(-)	3,127	+ 434	
	(+)	4,075		+ 948
Bahiagrass-bahiagrass-peanuts	(-)	3,878	+1,185	
	(+)	2,693		+1,122

[1]Crops grown in 1988, 1989, and 1990, respectively.
[2](-) = no Temik, no Folicur; (+) = Temik applied at-plant at 3 lb. a.i. per acre in an 8-in. band, and Folicur applied twice during the season at a rate of 0.225 lb. a.i. per acre
[3]Change in yield per acre from continuous peanuts due to rotation effect.
[4] Per acre yield increase with chemical treatment for the same crop rotation.

L.D. PLOPER, N. KOKALIS-BURELLE, P.A. BACKMAN, and R. RODRIGUEZ-KABANA

Biological Control Agents Show Promise Against Foliar Diseases of Fruits and Vegetables

THE POTENTIAL for using biological control agents to replace chemical pesticides is an exciting prospect. Both farmers and nonfarmers view biological control as a practical method of protecting the environment. Agriculturists also see such control methods as eliminating the worry about pesticides being restricted on short notice, a fear that has been realized on numerous occasions in recent years.

One of the big needs is for biological agents to replace fungicides for controlling diseases of fruits and vegetables. This is being addressed in Alabama Agricultural Experiment Station research on the use of microbial antagonists to reduce disease severity on edible plant parts. The research involves the modification of aerial plant surfaces to favor beneficial microorganisms that suppress plant disease.

Biological control of foliar diseases has been less successful than biological control of soilborne diseases. One of the main obstacles has been that potential biocontrol agents have survived poorly on the leaf surface after application. Low nutrient availability, intense solar radiation (including ultraviolet and infrared), and stress from moisture fluctuations between day and night are some of the difficulties confronting beneficial microbes on leaves, stems, and fruits. Previous research demonstrated that improved establishment and survival were achieved by applying antagonists with a nutrient source. However, in all cases this was only a short-term effect, probably because the nutrients were water-soluble or were quickly digested by leaf microbes, or both.

Suspensions of water-insoluble polymers were evaluated in an effort to provide potential antagonists with a food source that would have long-term availability. Chitin, chitosan, cellulose, and carrageenan were some of the polysaccharides tested for their effect on natural microbial populations and on selected added microorganisms. Preliminary observations have shown that some of these polymers not only provide a source of carbon and nitrogen, but also shelter the microorganisms from adverse conditions. In addition to the food amendment, the formulations tested included a sticker, such as a soybean oil-surfactant blend, and a buffering agent to maintain the formulation at an acceptable pH range for microorganisms.

In 1990, evaluation of leaf and fruit samples from tomato, potato, and apple experiments indicated that significant changes occurred in the levels and composition of microbial populations as a result of the application of these formulations, particularly chitin and cellulose. Increases of 50 to 300% in total bacterial populations were found on amended leaves. Populations of chitinolytic microorganisms (producing enzymes that degrade chitin) increased from less than 3% to 45% when a chitin leaf amendment was applied. When chitinolytic microorganisms were isolated from amended leaves and used in field tests, the survival of the microorganism was improved by the amendment. Chitin is a major component of some fungal pathogen walls and chitinolytic microorganisms offer the potential for biocontrol. An advantage to using chitin is that it is an environmental waste product of the seafood industry.

Early blight on tomatoes and potatoes and flyspeck and sooty blotch on apples were all found to be reduced with these biological control formulations, figures 1 and 2. Although they did not perform as well as chemical fungicides, the amendments reduced disease levels during the life of the crop without the addition of selected organisms. However, as the crops neared maturity, pathogens seemed to overcome some effects of the amendments and disease levels increased. Preliminary evaluations indicate that application of chitinolytic microorganisms along with the amendment helps to reduce this late season loss of control. Research effort is continuing to develop this technology to the point that it will provide commercial levels of control for fruit and vegetable diseases.

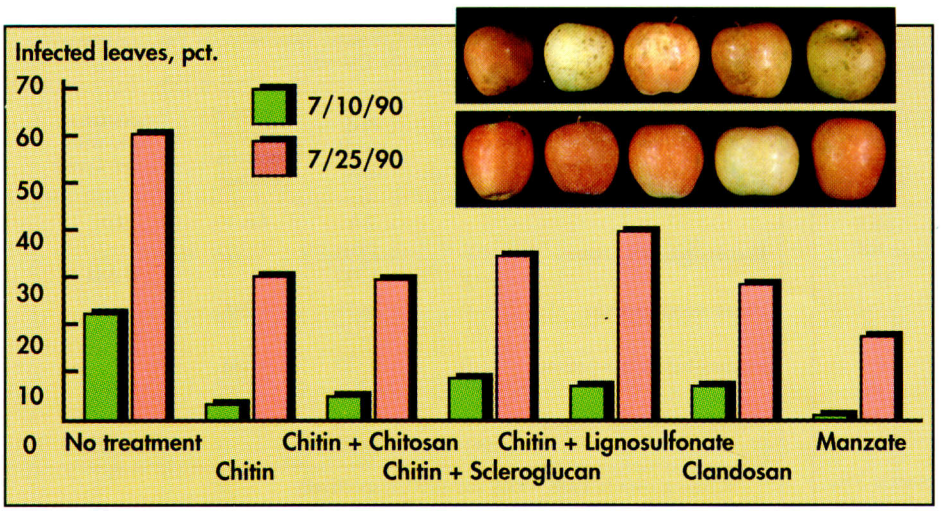


FIG. 1. The graph illustrates tomato early blight infection on two dates, at E. V. Smith Research Center, Shorter. FIG. 2 (inset). Top–untreated apples; bottom–treated with chitin plus scleroglucan.

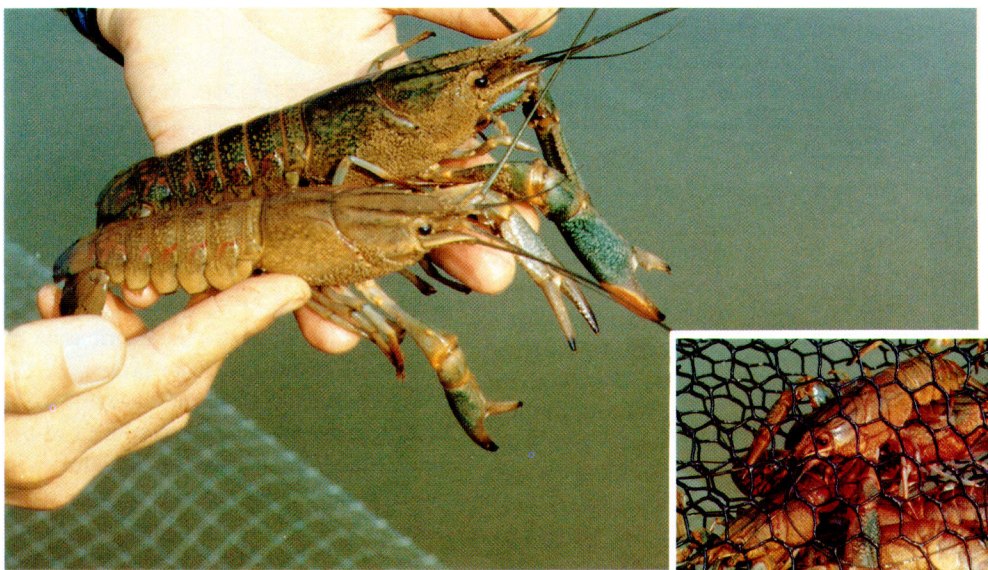
Ploper is Post Doctoral Fellow, Kokalis-Burelle is Graduate Research Assistant, and Backman and Rodriguez-Kabana are Professors of Plant Pathology.

D. B. ROUSE

Australian Crayfish Promising for Alabama Aquaculture

AFTER EVALUATING three species of crayfish from Australia, an orange and blue crustacean, called red claw, shows the most promise for inclusion into Alabama's aquacultural industry. Red claw grows to about 1/4 lb. in one growing season in Alabama, is easy to culture, and thrives on a variety of food sources.

In 1986, a program was initiated at the Alabama Agricultural Experiment Station to evaluate Australian crayfish for culture in Alabama. During the past 5 years, three different species have been studied. Each comes from a different part of Australia and each has different traits.



Male red claw (top) and females reproduce easily in captivity, which will be a big advantage in commercial production.

Red claw can be harvested in trap nets, or at the end of season by draining ponds and seining.

The first Australian crayfish studied was marron, which is a giant crayfish capable of growing to over 5 lb. Unfortunately, marron grow too slowly in Alabama, require slightly salty water, are difficult to breed in captivity, and cannot tolerate the hot summer temperatures in the State.

A second Aussie species, yabbie, proved to be a hardy crayfish capable of withstanding a wide variety of conditions experienced in culture ponds. However, yabbie is difficult to breed in captivity and only grow slightly larger than native crayfish. Yabbie also are notorious excavators, or burrowers, capable of doing great damage to earthen dams.

Red claw, the third species evaluated, is native to northern Australia. They are warmwater crayfish that grow best in the summer, but tolerate water temperatures near 50°F. In an Alabama growing season, stretching roughly from late April to mid-October, red claw can grow to about 1/4 lb. In tests at the Experiment Station, red claw grew well on a variety of feed sources, ranging from bermudagrass hay to formulated diets. During tests in the summer of 1990, researchers produced 1,200 lb. of red claw per acre using available commercial feeds.

Red claw proved relatively easy to reproduce in captivity. They require about 7-8 months to reach sexual maturity. Once mature, they are capable of mating several times a year without sophisticated environmental controls. Maintaining water temperatures about 75°F seems to be the main requirement. From 400 to 600 eggs usually are produced from each mating, which can occur every 3-4 months. Inability to survive normal winter water temperatures in Alabama virtually prevents red claw from becoming established and surviving throughout the year in the State's lakes and streams.

Auburn research indicates a two-phase culture cycle will be necessary, if red claw is to be acceptable as a commercial species in the State. In such a system, young crayfish would be produced during the winter in indoor hatcheries. The young crayfish then would be stocked into culture ponds as temperatures reach 70°F in April or May. Market size crayfish could be harvested in the fall by draining ponds, since red claw don't burrow like native crayfish. Auburn research indicates all crayfish should be removed from ponds before water temperatures fall below 60°F.

The market potential of these 1/4-lb. crayfish, often called freshwater lobsters, has not been fully tested. In addition to being five times as large as native crayfish, red claw has twice as much edible meat per pound of live weight. Some test marketing in New York City in summer 1990 showed that red claw can be sold live to restaurants for as much as $6-$10 per pound.

Culture of native crayfish, with over 130,000 acres in production, is second only to catfish in the U.S. aquacultural industry. Whether red claw will "fit" in Alabama's aquacultural industry is not certain, and there is still much to learn about these new crayfish from Australia. If red claw do prove to have the needed traits, they may be an exciting culture species for Alabama.

Rouse is Associate Professor of Fisheries and Allied Aquacultures.

W.R. EGBERT, D.L. HUFFMAN, and C.M. CHEN

AU Lean Combines Low Fat and Desired Quality for Acceptable Ground Beef Product

MORE THAN 7 billion lb. of ground beef are consumed annually in the United States and ground beef constitutes almost half (44% in 1990) of the total fresh beef market. These products generally contain between 20 and 30% fat, yet today's health conscious consumers are asking for lower fat ground beef products, a trend which can be expected to expand. If consumer acceptance of ground beef products is to be retained, the red meat industry must respond to consumer demands by developing low-fat ground beef products tailored to meet these demands.

Simple fat reduction would be the most efficient method of producing low-fat ground beef products. However, reducing the fat content decreases product palatability, flavor intensity, juiciness, and tenderness. Therefore, research was initiated at the Alabama Agricultural Experiment Station to develop a low-fat ground beef product that contains less than 10% fat but retains the positive sensory characteristics of higher fat ground beef.

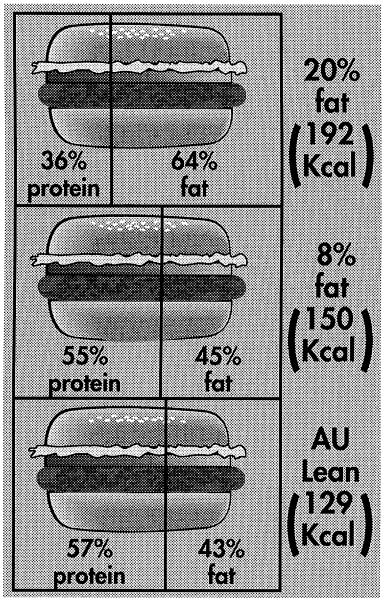
An initial study showed that the most acceptable ratings for ground beef were with 20% fat, and this level was used as a control from which a new product could be developed. Studies were implemented to evaluate the effect of particle size, flavor enhancers, and food gums on the sensory properties of low-fat ground beef.

It was found that overall palatability could be improved slightly by final grinding the beef through a 3/16-in. grinder plate rather than a 1/8-in. plate. Results indicated that use of a 2:1 ratio of salt to hydrolyzed vegetable protein (HVP) produced flavor characteristics similar to those of the 20% fat control product. Juiciness and tenderness scores similar to the control level were achieved by adding iota carrageenan and water to the low-fat product.

The final product, known as AU Lean, contains 8% fat and is formulated from 92% lean beef trimmings with 10% added water, 0.5% carrageenan, 0.4% encapsulated salt, and 0.2% HVP.

A trained sensory panel evaluated AU Lean compared with patties containing 20% and 8% fat. AU Lean was rated juicier and more tender than either the 20% or 8% patties, with the 8% fat patties being rated lowest for juiciness. Lower juiciness scores were expected for low-fat patties; however, the use of carrageenan and water corrected this problem in AU Lean. Panelists rated AU Lean patties higher in beef flavor intensity and overall acceptability than the 20% or 8% fat patties. Salt and HVP incorporation enhanced the beef flavor intensity in AU Lean.

On a cooked basis, AU Lean patties had a higher moisture content and lower fat content compared to the 8% and 20% patties, respectively. AU Lean patties had a similar protein content to the 20% fat patties, resulting from the retention of added moisture. AU Lean patties also were lower in cholesterol content than the other two patty formulations, as shown by data in the table, probably caused by the retained water which diluted cholesterol levels.



Distribution of calories from fat and protein in cooked patties, comparison of AU Lean with 20% and 8% fat ground beef.

The figure illustrates the distribution of calories from fat and from protein in the cooked patties at all three fat levels. AU Lean had the lowest caloric content of the three. Sixty-four percent of the calories in the 20% fat patties came from fat, while only 43% of the calories in AU Lean are from fat. Substituting a 4-oz. AU Lean patty (pre-cooked weight) for a 20% ground beef patty of the same size would provide 33% fewer calories and a 58% reduction (7 grams) in fat intake. As part of a lower fat diet, AU Lean should enable consumers to lower their cumulative fat intake so their overall daily fat intake falls within the 30% recommendation.

These results suggest that AU Lean is a viable alternative for the ground beef consumer interested in a low-fat product. The product is now available throughout Alabama and in U.S. grocery store chains. Interest in this product has been evident and illustrates the opportunity for the red meat industry to meet the needs of consumers.

SENSORY AND COMPOSITIONAL PROPERTIES OF COOKED BEEF PATTIES

Measure	Rating, by product: 20% fat	8% fat	AU Lean
Sensory traits[1]			
Juiciness	5.8	4.6	6.7
Tenderness	5.6	5.2	6.6
Beef flavor intensity	5.2	4.6	6.4
Overall acceptability	5.4	4.6	6.8
Cooked composition			
Moisture, pct.	55.8	63.6	66.3
Fat, pct.	19.2	9.8	8.2
Protein, pct.	24.8	26.6	24.5
Cholesterol, mg/100 g	86.3	83.1	72.2

[1]Juiciness, tenderness, connective tissue, mealiness, and beef flavor intensity were rated on an 8-point scale where 1 = extremely dry, extremely tough, abundant, abundant, extremely bland and 8 = extremely juicy, extremely tender, none, none, and extremely intense, respectively.

Egbert is Research Associate, Huffman is Professor, and Chen is Research Associate of Animal and Dairy Sciences.

J.D. HOUGH, W.O. HERRING, and R.L. MCGUIRE

REDUCING LENGTH OF BULL TESTING PRODUCES SIMILAR RESULTS LESS EXPENSIVELY

CUTTING costs while increasing efficiency should be the goal of every business. While these strategies are usually related to corporate enterprises, this same philosophy is prevalent now, more than ever, in the livestock industry.

Central bull tests have proven to be an effective way to evaluate the efficiency of animals. Such tests provide purebred beef cattle producers a means for evaluating performance within uniform environmental conditions and are a means of advertisement and healthy competition. These tests are expensive, so there is interest in shortening them to reduce cost.

The Auburn University Bull Test Station at Auburn is the oldest continuous central bull test in the United States, possessing modern facilities that can measure both gain and feed efficiency. By using the Bull Test program, Alabama producers have made considerable genetic progress, and this progress has been illustrated by a steady increase in post-weaning performance over the years of the testing program.

While such testing has been effective, there has been increased interest in making the bull test more efficient by reducing test lengths from 140 to 112 days. This change could result in decreased test costs and leaner bulls with less finish which can perform better for purchasers.

To determine if this decrease in test length would be practical, an Alabama Agricultural Experiment Station test collected data on 1,901 bulls from the Auburn testing program dating back to 1972. During these years, 15 breeds were represented in the test, 87% of which were Angus, Charolais, Polled Hereford, Simmental, or Santa Gertrudis breeds. An average of 100 bulls started the test each year.

Tests begin in early September and end in early January with a sale held in late January of each year. Bulls are acclimated to the environmental conditions for 21 days before being placed on the traditional 140-day test. Performance information is collected every 28 days.

To compare the relationship between the 140-day test and a 112-day test, a correlation was established between the two scenarios. A correlation coefficient ranges from -1 to +1, where 0 indicates no relationship between the two measurements. A correlation close to +1 indicates two measurements are positively related and nearly the same.

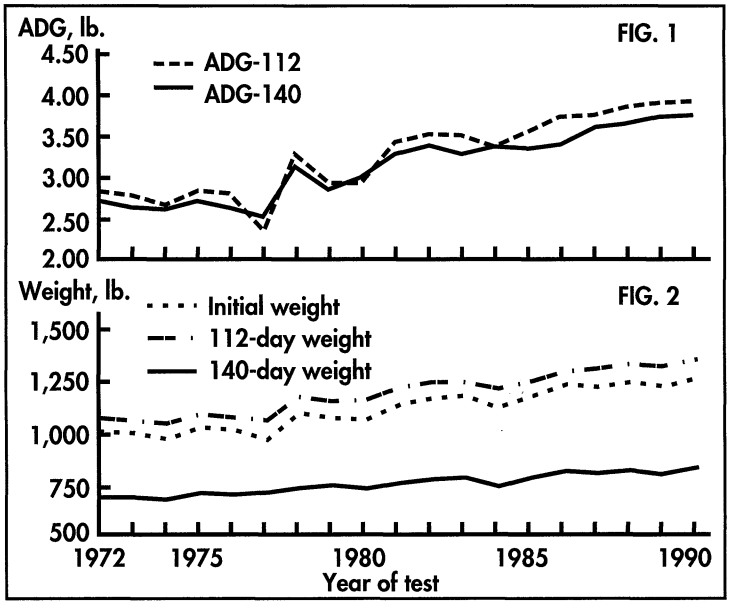


FIG. 1 (above). Phenotypic trends for average daily gain (ADG) between 112- and 140-day tests, 1972-90. FIG. 2 (below). Trends for initial weight on test and 112- and 140-day weights, all breeds, 1972-90.

Results showed that correlations between 112- and 140-day measurements for weight, weight per day of age, and average daily gain for all bulls tested were 0.98, 0.98, and 0.94, respectively, indicating that measurements from either test length were very similar.

Figure 1 shows the actual 112- and 140-day average daily gain trends from 1972 through 1990. Measurable (phenotypic) trends for gains over time (by year) provide a method for determining the progress made through time. For average daily gain through 140 days, the average phenotypic trend was 0.068 lb. per day per year. Figure 2 shows the trends for on-test (day test began), 112-day, and 140-day weights, the average being 8.2, 16.8, and 17.9 lb. per year, respectively. The increasing phenotypic progress made by the bulls since 1972 is shown by comparing 1972 weights to 1990 weights. In 1972, the average on-test, 112-day, and 140-day weights of bulls were 693, 1,011, and 1,073 lb, respectively. These respective weights were 830, 1,268, and 1,355 in 1990.

These findings indicate that a similar relationship exists between 112- and 140-day measurements. The 112-day test is now recommended by the Beef Improvement Federation and many central bull tests, including the Auburn test. In 1990-91, Auburn decreased its test length to 112 days. This, coupled with the increased performance of bulls through the years, will hopefully provide producers a more accurate and less costly method of selecting sires with true genetic gain potential. Even shorter tests may some day be possible, though current results indicate that 112 days provide the optimal length of time for efficient use of feed and facilities while retaining useful measurements.

Hough is Assistant Professor, Herring is Graduate Student, and McGuire is Professor of Animal and Dairy Sciences.

M.G. PATTERSON, E.P. WEBSTER, B.E. NORRIS, JR., and W.R. GOODMAN

Single Postgrass Herbicide Application Economically Controls Johnsongrass in Cotton

JOHNSONGRASS has been a problem in cotton fields for many years. This large, perennial grass can compete intensely with cotton if not removed early in the season. Johnsongrass remaining in cotton fields at harvest can cause lint staining and interfere with harvest.

The introduction of postemergence grass specific (postgrass) herbicides in the early 1980's provided cotton growers with a better means of controlling johnsongrass. However, johnsongrass continues to infest many cotton fields. Postgrass herbicides are relatively expensive and their use usually results in an additional herbicide application during the season. Therefore, growers need to know how to economically use these new herbicides to control johnsongrass.

Alabama Agricultural Experiment Station field experiments were conducted from 1987 through 1989 at the Tennessee Valley Substation, Belle Mina, to investigate the costs of johnsongrass control systems in conventional tillage cotton. Cotton was planted into an area seeded each year with johnsongrass. Additionally, johnsongrass rhizomes were planted along cotton rows each year at the rate of one rhizome per 6 ft. of row, ensuring that the test was representative of a natural infestation.

A basic weed control program consisting of Cotoran® applied preemergence, Bladex® plus MSMA® applied postemergence directed, and two cultivations was used in all plots except the hoed control and weedy control plots. Extra johnsongrass control treatments, involving Treflan® (trifluralin) preplant incorporated and the postgrass herbicides Fusilade® and Poast® applied in a 16-in. band over the row, were added to this basic program. Johnsongrass treatments were maintained on the same plots each year. All other production inputs, including fertilization, liming, and insect control, were maintained for optimum cotton production.

Postgrass herbicides help control johnsongrass in cotton.

Visual weed control ratings and seed cotton yields were obtained each year. Average prices for herbicides and general production budgets prepared by the Alabama Cooperative Extension Service were used to calculate net returns for each weed control system.

Treflan preplant incorporated (PPI) provided an average of only 48% johnsongrass control over the 3-year period. The results were the low seed cotton yields and negative net returns shown in the table. The addition of a single postgrass herbicide treatment (Poast or Fusilade), applied over the top when johnsongrass was approximately 12 in. tall, provided 92% control, significant yield increases, and average net returns of $74.58 per acre per year. This additional treatment cost $12 per acre each year, including $4 for application. Treatments using single or sequential postgrass applications without Treflan also provided positive net returns.

These results show that johnsongrass can be economically controlled in conventional cotton systems with one timely, banded application of a postgrass herbicide.

Johnsongrass Control, Cost of Treatment, Seed Cotton Yields, and Net Returns, 1987-89

Treatment[1]	Cost/acre[2]	Johnsongrass control	Seed cotton/ acre	Net return[3]
	Dol.	*Pct.*	*Lb.*	*Dol.*
Trifluralin-PPI	3.00	48	1,296	-(124.65)
Trifluralin-PPI + Postgrass-OTT	15.00	92	2,404	74.58
Postgrass-OTT	12.00	77	2,404	76.25
Postgrass-OTT + Postgrass-OTT	21.00	90	2,471	76.09
Hoed control	335.00	94	2,382	-(250.17)
Weedy control	0	0	343	-(160.21)

[1]Additional treatments applied for johnsongrass control above the basic program described in text. Trifluralin rate = 0.5 lb. active ingredient per acre. Postgrass herbicides used at labeled rates for single and double applications. PPI = preplant incorporated, OTT = over the top.

[2]Includes cost of application plus chemical costs for postgrass herbicide treatments.

[3]Net returns above variable cost based on 35% gin turnout, $0.55 per pound for lint, and $0.05 per pound for seed. No government program participation.

Patterson is Assistant Professor and Webster is former Graduate Research Assistant of Agronomy and Soils; Norris is Assistant Superintendent of Tennessee Valley Substation; Goodman is Assistant Professor of Agricultural Economics and Rural Sociology.

L.L. HYCHE

Sawflies: Potential Pests of Ornamental Hardwoods in the Urban Forest

STREET trees, shade trees, and all city trees are now referred to as the urban forest. In Alabama, this urban forest is composed primarily of the same native tree species that occur in surrounding non-urban forests; consequently, the insect species found in both forests are largely the same. However, the pest status of the insects, for example sawflies, within the two forest settings may be greatly different.

Sawfly larvae consume tree foliage and, if abundant, may completely defoliate trees. Historically, sawflies have not been considered major pests in Alabama's natural hardwood timber stands; however, in the urban forest, defoliation by sawflies seriously reduces the aesthetic value of trees. In studies conducted by the Alabama Agricultural Experiment Station, isolated infestations have been noted regularly on some shade and ornamental hardwoods. Research was initiated to identify these species and study their life habits.

Butternut woollyworm.

Dusky birch sawfly.

Blackheaded ash sawfly.

To date eight species have been identified. The five in the photos appear to have considerable potential as pests of shade and ornamental trees. These species with their host trees are:

Dusky birch sawfly —river birch

Butternut woollyworm —black walnut and butternut

Blackheaded ash sawfly —green and white ash

Spiny ash sawfly—green and white ash

Slug oak sawfly—scarlet and several other oaks

The general life cycles of these sawflies are similar. The female cuts slits in leaf tissue with her ovipositor, an egg-laying structure, and deposits one egg in each slit. Following egg hatch, larvae feed in groups, usually beginning on leaves in which eggs were deposited. In most cases, early-stage larvae feed by cutting holes in leaf tissue and late-stage larvae consume entire leaves (the slug oak sawfly is an exception). Larvae are active for 3-6 weeks, depending on the species and time of year. Fully-grown larvae move from foliage to the duff and litter or upper layer of soil and construct cocoons in which to pupate. Generally, most species overwinter as larvae in the cocoons and pupation occurs in spring.

Spiny ash sawfly.

Slug oak sawfly.

While the life cycles are similar, feeding habits, time of year of activity, and number of generations per year may vary among the species. Butternut woollyworm has one generation per year. Females lay eggs in the midrib of leaflets during May. Larvae are covered with white waxy filaments and are present from mid-May through June in the Auburn vicinity. The dusky birch sawfly appears to have at least two generations per year in Alabama. Larvae feed on the margins of leaves and are most commonly present in early and late summer. Blackheaded ash sawfly and spiny ash sawfly may be pre-sent on the same host at the same time. Larvae are present mainly in April in Auburn; each species has one generation per year. Slug oak sawfly larvae are leaf skeletonizers. Larvae are usually present in early summer and in late summer and early fall, indicating two generations per year.

Urban shade trees attacked by these sawflies generally survive. However, loss of foliage to larval feeding may seriously reduce their ornamental value. Knowledge of the life habits of these urban forest pests is necessary for development of safe and effective methods of control.

Hyche is Associate Professor of Entomology.

N.A. WAER, H.L. STRIBLING, M.K. CAUSEY, and W.C. JOHNSON

ANNUAL CLOVER/RED CLOVER PLANTINGS PROVIDE HIGH QUALITY DEER FEED

ALABAMIANS spend over $35 million annually on food plantings for wildlife, with about 75% spent on plantings for deer. A study by the Alabama Agricultural Experiment Station, in cooperation with the Alabama Department of Conservation and Natural Resources and the U.S. Department of Defense, showed a combination of red clover and annual clovers can provide over 10 months of high quality feed for deer in Alabama's Piedmont region.

At the Piedmont Substation in Camp Hill, seasonal and yearly performance of four annual cool season clovers—including Yuchi arrowleaf, Bigbee berseem, Tibbee crimson, and Mt. Barker subterranean—were tested. Perennial ladino clover varieties Osceola, California, Regal, and a blend of 60% Regal and 40% California ladinos also were studied, as was a biennial red clover (Redland II).

Clovers were established in 5 X 20-ft. plots in September 1989, and plots were protected from deer by an electric fence. At approximately 6-week intervals (nine times total), plots were clipped from November through September to determine herbage production and crude protein content, figures 1 and 2.

Little production was obtained from any of the clovers during the first few months after planting. By February, the clovers began noticeable growth, and by midspring, each variety was producing at least 800 lb. of dry matter per acre. At this time, ladinos and red clover reached peak season production of about 1,100 and 1,400 lb. of dry matter, respectively, per acre.

All annual clovers had matured seed and died by July. Ladinos had become essentially dormant by this time because of extreme drought during 1990. Total rainfall for July-September was 4.9 in., compared to the long-term average of 17.3 in. Red clover is deeper rooted than ladino clovers and continued to grow throughout the summer.

All clovers contained relatively high levels (about 25%) of crude protein in late February. This peak in protein content is associated with rapid vegetative growth by annual clovers during April and by ladino clovers and red clover during May.

By April, all clovers contained crude protein levels of 24-25%. In May, crude protein content of annual clovers dropped to 17%, coinciding with decreased vegetative growth, followed by flowering and seed production. Crude protein content of ladino clovers and red clover also began to decrease at this time, reaching about 19% and 17%, respectively.

Throughout the summer, ladino clovers and red clover continued to decrease in protein content and by September contained 18.0% and 15.5%, respectively. While ladinos tended to be 2-3% higher in crude protein content throughout the season, it is important to note the difference in production between the ladinos and red clover. During the dry summer months, the ladinos were dormant and exhibited almost no vegetative growth (approximately 100 lb. per acre), whereas red clover continued a reduced, but comparatively high, level of production throughout the summer. Based on these results, it is important to consider both crude protein content and herbage production to accurately judge the value of a deer planting.

The highest levels of production occurred during April for annual clovers and May for ladinos and red clover. Red clover continued to produce well into the summer season, while ladino clover essentially stopped production. The annual clovers produced seed and died before summer. Crude protein levels varied among types and seasons (25.0-15.5%). Protein levels were highest just before peak vegetative growth in all clovers in spring. Crude protein content of the clovers generally was highest from February to April and lowest from July to August. Red clover generally was 2-3% lower in protein than ladino clovers, but from May through September ladinos were marginally productive.

The performances of the perennial ladinos and biennial Redland II are expected to change after the first year. Red clover should decline drastically during the second year, and will likely be gone completely thereafter, while ladino clovers have the potential to persist indefinitely.

Assuming the management objective is to provide a year-round forage supply, tests indicate a combination of annual clover and red clover could produce adequate quantities of forage from December through September on typical Piedmont soils for at least 1 year, even through some dry summer conditions.

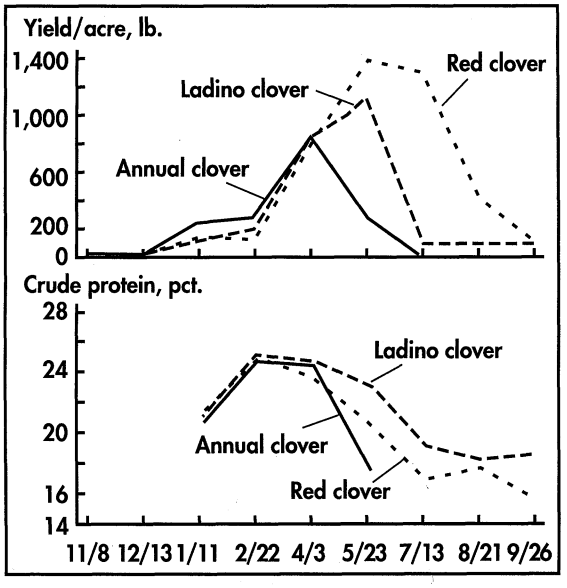
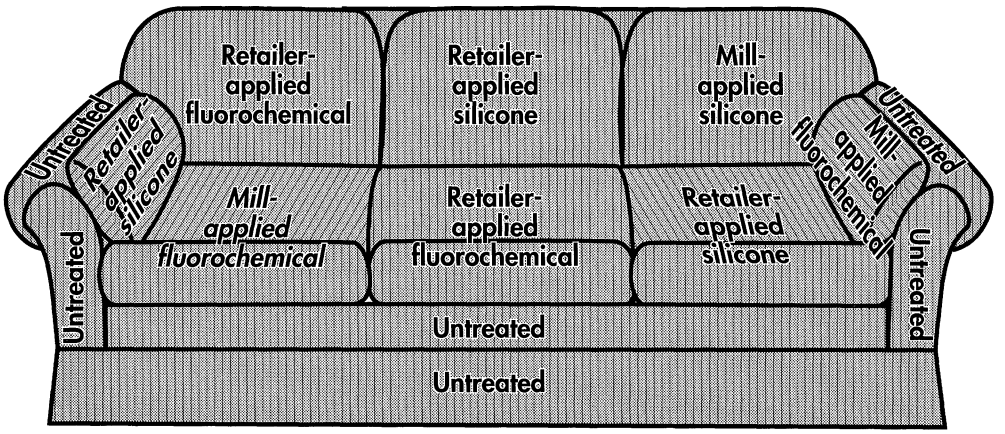


FIG. 1 (top). Seasonal production of annual, ladino, and red clovers, at Piedmont Substation, Camp Hill, 1989-90. FIG. 2 (bottom). Protein content of clover at 1989-90 harvests at Piedmont Substation, Camp Hill.

Waer is Graduate Research Assistant and Stribling and Causey are Assistant Professor and Professor of Zoology and Wildlife Science; Johnson is Professor of Agronomy and Soils.

C.L. WARFIELD

RETAILER-APPLIED STAIN-REPELLENT FINISHES OFFER PROTECTION FOR UPHOLSTERY FABRICS



Location of treatment areas on wear study sofa.

UPHOLSTERED furniture is a sizable financial investment for most families. To preserve the appearance of this investment, many consumers seek the protection of stain-repellent finishes. The two basic types of stain-repellent finishes are silicone and fluorochemical. They are primarily applied either in the mill or at the retail store. Fluorochemical finishes repel oil and water-based soils. Silicone finishes repel water-based soils. Some of the finish manufacturers also claim their products repel dry soil.

Retailers sometimes suggest applying a stain-repellent finish at the store even when the fabric has had a stain-repellent finish applied at the mill. The retailer-applied finishes often offer a cleaning service as part of the warranty for consumers who cannot satisfactorily clean a spot or stain out of the finished fabric. The wide variety of finishes with different names, types of application, and proclaimed benefits leave many consumers confused as to which one is best for them.

To evaluate different types of stain repellent finishes, a consumer wear study using upholstered sofas was developed by the Alabama Agricultural Experiment Station. Eight three-cushion sofas were used in the experiment. Four of the sofas were upholstered in a light beige velvet fabric. The other four were upholstered in a multi-colored beige tone flame stitch fabric—a rough textured fabric due to the large yarns which make up the pattern.

Each sofa was finished with four different finishes: unfinished, mill-applied fluorochemical, retailer-applied fluorochemical, and retailer-applied silicone. The location of finishes, shown in the drawing, was random for each sofa. For example, the fabric on the frame of one sofa was unfinished, while the fabric of another frame had a retailer-applied finish. Each cushion had a different finish. These sofas were placed in high-use areas for 2 years, and the consumers were directed to care for the sofa as if it were their own. They did not know what types of finishes were present on their sofa.

Every 3 months the sofas were inspected to check for evidence of appearance changes, including soiling, matting, and pilling of the fabric. The inspectors also looked for fabric or cushion deterioration such as seam breakage, pile loss, or cracking or powdering of the latex on the back side of the fabric. Photographs and a checklist were used to document observations of damage or appearance change.

The velvet sofas showed extensive soiling, both localized and overall. Arms and bottom cushions were soiled and stained most heavily. The unfinished fabric showed the most extensive soiling and staining, and it was more difficult to clean than were the finished fabrics. Rubbing the velvet with the cleaning solutions caused rough spots on the velvet. There was no noticeable difference in soiling and staining among the stain-repellent finishes.

The rough texture and multi-colored appearance of the flame stitch fabric helped hide the stains and soil. However, overall soiling was evident, producing a general color change in the fabric. The rough texture made this fabric harder to clean than the velvet. The cushions or sofa parts treated with the mill-applied stain-repellent finish remained the cleanest. There was no significant difference in the degree of soiling and staining among the other three types of finishes. The fabric with the flame stitch pattern showed extensive pilling (little balls of fiber on the fabric surface), regardless of the finish used. The latex on the back of the fabric cracked and powdered out regardless of the type of finish used. The powdering out was most severe on the arms and front of the seat cushions, producing an "open" look in the fabric.

These results indicate that stain-repellent finishes will not repel all soil and stains, and stain repellency tends to decrease somewhat with normal wear. One stain-repellent finish did not perform noticeably better than another in this study. Neither mill-applied nor retailer-applied stain-repellent finishes are a panacea. However, the presence of a stain-repellent finish generally makes it easier for consumers to blot up liquid soils before they penetrate the fabric and become stains. Therefore, if consumers will do their part, the stain-repellent finishes can help prolong the attractiveness of upholstery fabrics.

Warfield is Associate Professor of Consumer Affairs.

D.T. CRAWFORD and B.G. LOCKABY

LOBLOLLY PINE GROWTH RESPONSE FAVORS TVA EXPERIMENTAL FERTILIZER

TRADITIONALLY, foresters have been reluctant to use fertilizers due to the cost, even though trees normally show a growth response to nitrogen. However, forest fertilization has become more common over the past two decades as more reliable diagnostic techniques have been developed to determine nutrient deficiencies. Recent Alabama Agricultural Experiment Station research with an experimental fertilizer is helping to identify fertilizer sources which are more effective at promoting growth responses.

Urea has been the primary nitrogen source of choice in forestry due to its high nitrogen analysis. However, urea has two potential major disadvantages: (1) high ammonia losses under conditions of high soil temperature, and (2) toxicity of urea to seed and seedlings due to potentially high concentrations of ammonia.

Urea nitric phosphate (UNP), a granular fertilizer of grade 27-9-0, is an experimental fertilizer that has been proposed by the Tennessee Valley Authority as an alternative to urea-phosphate blends. Studies have shown that UNP has the potential to reduce ammonia loss by as much as 50% over urea, due to a relatively low pH, a significant fraction of the nitrogen in the nitrate form, and free calcium that can react with carbonate from hydrolyzed urea. There are also indications that UNP has fewer adverse effects on seed germination than urea.

A 14-year-old loblolly pine stand, located on a Piedmont site near Auburn, was used to compare growth response (height, diameter, and bole dry weight) to UNP and urea plus triple superphosphate (TSP). The growth response of these two fertilizers also was compared to an unfertilized control. The actual fertilizer treatments consisted of: (1) no fertilizer, (2) 200 lb. per acre N and 67 lb. per acre P_2O_5 from UNP, and (3) 200 lb. per acre N as urea, plus 67 lb. per acre P_2O_5 from TSP.

Field plots (0.05-acre measurement plots within 0.25-acre treatment plots) were established in the winter of 1988 and inventoried for diameter, height, and bole dry weight. Fertilizer treatments were applied the following spring and the plots were inventoried again in the winter of 1989 to assess 1-year response. Average diameter, height, and bole dry weight results from the winter of 1989 are listed in the table.

Although no differences in response were apparent for diameter after one growing season, the UNP treatment was greater than the unfertilized control for both height and bole dry weight. The urea plus TSP application resulted in intermediate height and bole weights, showing no difference from either the UNP or the control treatment. Although large treatment responses are not yet apparent, these first-year results indicate that, in this situation, UNP did produce a growth response and was the preferable fertilizer treatment.

Crawford is Research Associate and Lockaby is Associate Professor of Forestry.

GROWTH RESPONSE OF LOBLOLLY PINE TREATED WITH NO FERTILIZER, UREA NITRIC PHOSPHATE, AND UREA PLUS TRIPLE SUPERPHOSPHATE

Treatment	Diameter	Height	Tree bole dry wt.
	In.	*Ft.*	*Lb.*
UNP	5.7	43.5	107.3
Urea + TSP	5.7	42.8	105.8
Control	5.6	42.5	103.5

ALABAMA AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY
AUBURN UNIVERSITY, ALABAMA 36849-5403

Lowell T. Frobish, Director
POSTMASTER-Address Correction Requested

NON-PROFIT ORG.
POSTAGE & FEES PAID
PERMIT NO. 9
AUBURN, ALA.