



# HIGHLIGHTS

of Agricultural Research

Vol. 33, No. 2  
Alabama Agricultural Experiment Station  
David H. Teem, Acting Director

Summer 1986  
Auburn University  
Auburn University, Alabama

## A WORD WITH THE EDITOR

**I**F YOU ASKED a million Americans what they considered to be this nation's single greatest strength, you might get thousands of different responses. Most of these would be thoughtful answers, representing important components of our national greatness. Unfortunately, however, most answers would probably be wrong.

The best response to this question would be "U. S. agriculture." There is no doubt that farmers and their affiliated businesses that supply farm needs and process and distribute agricultural products make up the most productive component of the nation's economy. Agriculture's productivity and efficiency made possible our development into a nation that combines industrial and technological greatness with an agriculture that is unsurpassed in the world. Since most of us never have to worry about having enough food and other agricultural products to not only meet our needs but also to satisfy our every wish, the majority of our productive work force can be utilized in producing the goods and services that make the U. S. lifestyle the envy of the world.

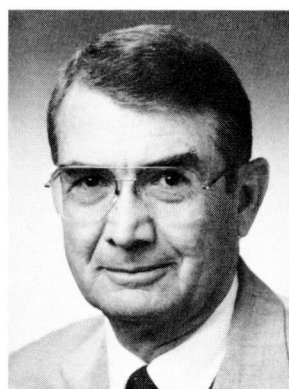
Most *Highlights* readers probably would agree that agricultural superiority has been this nation's strongest weapon in major wars the United States has fought. This productive capacity also allowed us to feed the hungry around the world while their nations recovered from the ravages of war or other calamities. Our international struggles of today are of a different nature than wars of the past, but our agricultural productivity is a strong weapon in ideological competition with Russia and her satellites.

The highly productive agriculture we take for granted did not happen just because we are the "good guys" and deserve it. It developed because of the scientific base on which agriculture depends—a base that is available because of the U.S. commitment to science and education that began with the Land Grant College movement in 1862 and the subsequent addition of research and extension units to serve agriculture's scientific and human needs.

With farmers becoming such a minority in the U. S. population, there is legitimate concern about maintaining national support for agricultural science. Fortunately, Americans still view farming in a favorable light (see story on page 14). However, this opinion may not automatically continue. Each generation of Americans is further removed from its agricultural roots, making it harder for the non-farm majority to understand and appreciate agriculture and its unique problems. Elected officials can be expected to pay even less attention to the agricultural minority unless convinced that what is good for agriculture is good for all Americans.

That, then, is the task facing all segments of agriculture: to sell agriculture. We must convince government and the public that a healthy agriculture is essential for a successful America, that food is the greatest weapon in our arsenal for defense. Funds for agricultural research and development are just as important as funds for weapons and armaments in our struggle for freedom around the world. This "food for defense" concept has not been heard lately, but it should be trumpeted in this time when hard decisions are being made about the division of government funds. Even though controlling government spending is a noble cause that must be addressed, the critical importance of agriculture to the nation mandates that agricultural programs not be singled out for unfair cuts.

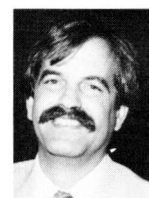
The big need is for all agricultural interests to join forces in informing the public about agriculture's importance to the nation and about its need for scientific support. There is too much at stake to back off from this job.



R.E. STEVENSON

## *may we introduce*

Dr. David South, faculty director of the Southern Forest Nursery Management Cooperative and Assistant Professor of Forestry. A native of North Carolina, Dr. South earned



B.S. degrees in both wildlife management and forestry from North Carolina State University and a masters degree in forestry there. He came to Auburn University in 1975 as a research associate and completed his Ph.D. in forestry here, specializing

in tree physiology.

Dr. South has been instrumental in the development of the Southern Forest Nursery Management Cooperative which conducts research in the 13 Southern States. The 32-member cooperative is made up of representatives from universities, state forestry organizations, and the forest industry. Such participation has helped spread Auburn's reputation as a national leader in forest nursery herbicide research. This research has helped to register over 10 herbicides for use in forest nurseries, saving more than \$2 million annually in weed control costs.

An example of Dr. South's cooperative research is reported on page 5 of this issue of *Highlights*. Improving seed efficiency of pine nurseries is only one of many facets of overall nursery improvement being explored by South and other forestry researchers at Auburn.

SUMMER 1986

Vol. 33, No. 2

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

DAVID H. TEEM ..... *Acting Director*  
R.E. STEVENSON ..... *Editor*  
ROY ROBERSON ..... *Associate Editor*  
TERESA RODRIGUEZ ..... *Art Designer*

**Editorial Committee:** DAVID H. TEEM; W.D. DAVIES, *Professor of Fisheries and Allied Aquacultures*; J.E. DUNKELBERGER, *Professor of Agricultural Economics and Rural Sociology*; C.E. JOHNSON, *Professor of Agricultural Engineering*; G.J. KEEVER, *Assistant Professor of Horticulture*; R.E. KEITH, *Associate Professor of Home Economics Research*; A.J. LATHAM, *Associate Professor of Botany, Plant Pathology, and Microbiology*; CHRISTINE SUNDERMAN, *Assistant Professor of Zoology-Entomology*; J.W. ODOM, *Associate Professor of Agronomy and Soils*; T.J. PRINCE, *Associate Professor of Animal and Dairy Sciences*; J.A. RENDEN, *Associate Professor of Poultry Science*; and R.E. STEVENSON.

Information contained herein is available to all without regard to race, color, sex, or national origin.



**S**WINE AND CATTLE producers are currently seeking methods of producing leaner, more muscular market animals to meet consumer demand for low fat and high protein diets. Recent changes in backfat standards for the USDA grades of market pigs require that producers sell pigs with less than 1 in. of backfat and adequate muscling to receive the U.S. Number 1 grade and top market price. Production of leaner, more muscular animals should also result in more efficient growth since a greater quantity of energy is required to produce a pound of fat than a pound of lean.

Genetic selection programs effectively produce low fat, heavy muscled market animals, but take many generations to appreciably alter fat and protein content. Therefore, researchers have been actively seeking ways of directing energy consumed by an animal away from fat production and towards muscle growth.

Recently, a group of biologically active compounds, beta-adrenergic agonists, which trigger increases in muscle growth of animals while reducing carcass fatness, was identified. These compounds, similar in structure and function to epinephrine (also known as adrenalin), effectively alter the way energy intake is partitioned between lean and fat tissue in animals, thus they are more commonly referred to as repartitioning agents. A research project recently completed at the Alabama Agricultural Experiment Station demonstrated the effectiveness of the repartitioning agent Cimaterol® in increasing muscle and decreasing fatness in pigs.

One hundred and eighty Hampshire x Duroc x Landrace pigs were allotted to five treatments with increasing levels of Cimaterol added to a 16% protein, corn-soybean meal diet. Cimaterol was added to the diet at mixing and fed to the pigs throughout the finishing period. Four treatments consisted of adding Cimaterol to the diet to supply 0, 0.25, 0.50 and 1.0 p.p.m. of the compound. In a fifth treatment, pigs were fed the diet containing 1 p.p.m. until 7 days prior to the end of the test period. The pigs were then fed the basal diet without Cimaterol for the final 7 days of the study.

Six pigs (three barrows and three gilts) weighing 120 lb. initially were allotted to each pen. Pigs were housed in a curtain-sided finishing house and allowed free access to their diets. Pigs were removed from the test at a pen average weight of 230 lb. and slaughtered to determine carcass composition.

Average daily gain decreased when Cimaterol was added at 1.0 p.p.m. but not when fed at 0.25 or 0.50 p.p.m. (see table). This effect appeared to be due to a decrease in feed intake at the highest level of addition. Feed to gain ratios were not significantly affected by the level of Cimaterol but tended to be im-



## Repartitioning agent alters carcass composition in pigs

T.J. PRINCE and D.N. MARPLE

proved when the compound was added to the diet. Average daily gains of pigs fed 1.0 p.p.m. Cimaterol until 7 days prior to slaughter were greater than those of pigs fed 1.0 p.p.m. with no withdrawal. However, this difference in gain cannot be attributed to the performance during the 7-day withdrawal period since the difference in performance during the final week of the test between the 1.0 p.p.m. treatments with or without withdrawal was too small to pass the statistical test for differences.

Average backfat depth, tenth rib fat depth, and leaf fat weights decreased with addition of Cimaterol, while loin eye area increased with increasing levels of the compound. Further indications of the increase in muscling in the pigs fed Cimaterol were shown by increases in weight of the ham and loin as a percentage of carcass weight. Pigs withdrawn from Cimaterol for the last 7 days of the test had increased average and tenth rib backfat thickness. This compensatory deposition of

fat is likely due to an increase in feed (energy) intake as well as removal of the inhibitory effects of Cimaterol on fat deposition. Thus, the number of days Cimaterol is withdrawn from the diet prior to slaughter will be important to improvement in carcass composition.

Feeding a repartitioning agent to finishing pigs resulted in increased muscle content of the carcasses with corresponding decreases in carcass fatness. Reduction of backfat by 0.1 to 0.2 in. as seen in this experiment could result in improvement of the U.S. grade for a market pig. Repartitioning agents appear to be a management tool that can be used in conjunction with genetic selection programs to improve performance and carcass quality of market animals. This improvement in carcass quality should result in an increase in value of the animal for the producer and a leaner, higher protein meat product for the consumer.

Prince is Associate Professor and Marple is Professor of Animal and Dairy Sciences.

EFFECTS OF FEEDING CIMATEROL ON PERFORMANCE AND CARCASS COMPOSITION OF PIGS<sup>1</sup>

Item	Level of Cimaterol, p.p.m.				
	0	0.25	0.50	1.0	1.0 <sup>2</sup>
Av. daily gain, lb. ....	1.83	1.82	1.81	1.73	1.86
Av. daily feed, lb. ....	6.44	6.24	6.11	5.95	6.06
Feed to gain ratio ....	3.53	3.45	3.37	3.45	3.27
Leaf fat weight, lb. ....	2.84	2.57	2.47	2.13	2.50
Av. backfat, in. ....	1.06	.99	.96	.94	1.00
Tenth rib fat, in. ....	.98	.89	.88	.78	.87
Loin eye area, in. ....	4.98	4.96	5.08	5.08	5.21
Pct. ham and loin ....	41.8	42.4	42.6	43.4	43.2

<sup>1</sup>Each mean represents six pens of six pigs per pen.

<sup>2</sup>Cimaterol withdrawn from diet last 7 days of test.



# Avian Cryptosporidiosis

## An Emerging Poultry Disease?

B. L. BLAGBURN, D.S. LINDSAY, F. J. HOERR,  
J.J. GIAMBRONE, and C.A. SUNDERMANN

ALABAMA'S BROILER industry, the third largest in the nation, currently markets about 10 million birds per week. Due to research-developed technological advancements these birds can now be marketed in 47 days, compared with 70 days 30 years ago. But as old problems are solved, new ones occur, such as *Cryptosporidium*, a little known parasite of chickens which has been detected in increasing numbers in Alabama in the past 5 years.

Most coccidians infect specific hosts, but *Cryptosporidium* organisms are unusual because they infect a wide variety of hosts including mammals, birds, reptiles, and fish. Until recently, the importance of cryptosporidiosis (disease caused by *Cryptosporidium* organism) in poultry was virtually ignored because it was thought to attack only non-vital organs. However, in certain birds it has been found to cause major problems by infecting the respiratory tract, and it is now included in the respiratory disease complex, a collection of diseases that results in condemnation of 25,000 Alabama broilers per week.

A review of Alabama poultry cases submitted to the C.S. Roberts Veterinary Diagnostic Laboratory in Auburn from October 1, 1982, until November 30, 1984, revealed *Cryptosporidium* infected birds on 19 farms under contract to six broiler companies in Alabama. The actual prevalence of cryptosporidiosis in Alabama broilers is unknown, but infected poultry exists in both northern and southern production areas.

Current studies at the Alabama Agricultural Experiment Station are intended to clarify the role of *Cryptosporidium* as a primary disease agent in broiler chickens, and to determine the susceptibility of other avian and mammalian species to it. Results of these studies indicate that severe and sometimes fatal disease occurs following inoculation of cryptosporidial infective stages into the res-

piratory tract of 7-day-old chicks. Infected birds are listless, hang their heads (as shown in the photograph), and exhibit other clinical signs such as sneezing, labored breathing, and reluctance to move. Mortalities are usually less than 10%, but morbidity, lowered weight gains, and increased susceptibility to other disease agents should be considered.

Inoculation of *Cryptosporidium* at three levels into the respiratory tract of chickens resulted in significantly lower weight gains during the acute phase of the infection (2-3 weeks after inoculation), as reported in the table. Although feed to gain ratios were significantly different for only one of the groups, lowered values evident in the other groups compared to control birds suggest that when other stresses or disease agents are included, feed efficiencies could decrease to values that are significantly lower than noninfected birds. As noted in the table, color scores of infected birds killed 35 days after inoculation were significantly lower in infected chicks, regardless of the treatment level.

Results of transmission studies using the chicken isolate of *Cryptosporidium* indicate that it is not transmissible to mammalian hosts under most conditions. Researchers established respiratory infections in chickens using the calf isolate of *Cryptosporidium*, but only in a minority of birds and at extremely low levels. Further studies are needed to clarify similarities and differences

of the calf and chicken species. Preliminary information suggests that avian *Cryptosporidium* is not transmissible to humans who are likely to encounter the organisms during production or processing of infected birds. Other susceptible avian host species include ducks and turkeys. Respiratory disease in turkeys is similar to that induced in chickens, indicating that the organism may be important under certain conditions in this host.

Blagburn is Assistant Professor of Animal Health Research, Hoerr is Adjunct Assistant Professor of Pathology and Parasitology, Lindsay is a Research Associate of Animal Health Research, Giambrone is Associate Professor of Poultry Science, and Sundermann is Assistant Professor of Zoology-Entomology.

EFFECTS OF RESPIRATORY CRYPTOSPORIDIOSIS ON WEIGHT GAINS, FEED CONVERSION, AND CARCASS QUALITY FOR 32 SAMPLES OF BROILER CHICKENS

Infection level	Wt. gain <sup>1</sup>	Feed/gain ratio	Roche color score <sup>2</sup>
Oz.			
Noninfected . . . . .	12.1	1.84	3.59
Low . . . . .	9.3	3.02	2.66
Medium . . . . .	8.5	2.11	2.36
High . . . . .	9.5	2.41	2.69

<sup>1</sup>14-21 days after inoculation.

<sup>2</sup>Index of shank color at termination of experiment using color fan to measure shades of yellow from 0 lightest to 10 darkest.

Seven-day old chicks show clinical signs of infection by avian *Cryptosporidium* parasite.





## Seed Efficiency in Southern Pine Nurseries

D.B. SOUTH and H.S. LARSEN

**T**HE FOREST industry in the South invests millions of dollars each year to improve the genetic potential of loblolly pine seed. However, few organizations have invested additional money in their nurseries for conserving this valuable seed. Some use essentially the same equipment and practices they use to grow seedlings from inexpensive, unimproved seed. These practices can often result in poor seed efficiency which lowers the potential economic gains from the tree improvement program. Research by the Alabama Agricultural Experiment Station has attempted to define the range of seed efficiencies<sup>1</sup> present at forest nurseries.

In 1984, one pound of genetically improved loblolly pine seed (from clone 8-74) was purchased for \$83.58. There were 13,137 seeds per pound, but 10% floated when soaked in water. Removal of the empty seeds that floated resulted in 11,823 seeds with a germination rate of 99%, for a cost of 0.7¢ per pure live seed. These seeds were stratified and sown at seven forest nurseries, two in Alabama, two in Florida, two in Louisiana, and one in Mississippi.

At each nursery, one small plot was established by precision sowing 768 seeds by hand. Six of the nursery plots were sown during a 6-day period in April, while the seventh plot was sown about a month later. Plots were mulched with pine bark after sowing. Normal nursery practices were conducted during the growing season and all seedlings from each plot were lifted between December 26 and 29.

Seed efficiency of the plots, see table, varied from a high of 92% to a low of 41%. The

<sup>1</sup>Seed efficiency is defined as the number of plantable seedlings in a nursery bed at time of lifting expressed as a percentage of the number of viable seeds sown (one requirement of a plantable loblolly or slash pine seedling is that it have a root-collar diameter of 1/8 in. or greater).

low seed efficiency from nursery G was related to the late sowing date. For the remaining nurseries (B-F), seed efficiency ranged from 60% to 72%. The average seed efficiency for all seven plots was 66%. The plot from nursery A had low mortality as well as a low percentage of cull seedlings. This plot demonstrates that a seed efficiency of 90% or greater is possible. A few nursery managers have reported operationally obtaining this level of efficiency with certain seed lots.

The present value of a pound of genetically improved seed is based on the worth of the extra wood produced at the end of the rotation, discounted to the present. Though \$300 is the present value often mentioned for a pound of seed from a rogued, first-generation loblolly pine seed orchard, some companies have determined the present value of seed from certain clones to be worth in excess of \$1,000 a pound. Therefore, the present value of a single viable seed from a rogued seed orchard could range from 3¢ to 10¢. When a viable seed has a present value of 3¢ each, poor seed efficiency can lower present values by as

much as \$43 for each 1,000 plantable seedlings produced, see table. Therefore, if a nursery with a seed efficiency of 41% produced 13 million genetically improved seedlings out of a total production of 26 million, it could amount to an annual loss in present value of over \$500,000 a year.

For many established nurseries in the South, the cost of producing improved seed can easily account for 30% to 50% or more of the total cost of seedling production. Therefore, reducing seed cost by increasing seed efficiency can be an effective way to lower the cost of seedling production. The seed cost per thousand plantable seedlings at Nursery A was 22% to 34% less than for nurseries B-F. At \$83.58 per pound for seed, this means a savings of \$54,860 to \$103,740 for a nursery growing 26 million seedlings. It is apparent that when valuable seed are used, improving nursery practices to keep seed efficiency high can be economically beneficial.

South is Assistant Professor and Larsen is Associate Professor of Forestry.

SEED EFFICIENCY FROM SMALL PLOTS AT SEVEN NURSERIES IN 1984

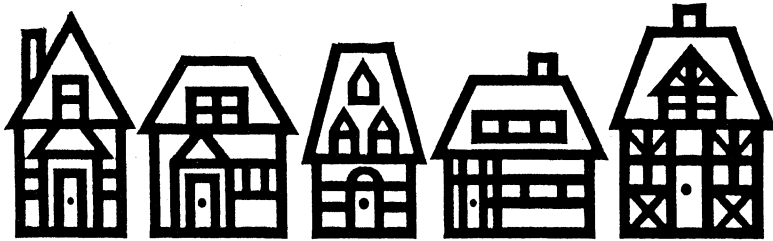
Nursery	Date sown	Pure live seed sown/sq. ft.	Total density/sq. ft.	Plantable seedlings/sq. ft.	Cull percent	Total mortality	Seed efficiency	Loss in present value of future volume gains/1,000 plantable seedlings	Seed cost/1,000 plantable seedlings <sup>2</sup>
		No.	No.	No.	Pct.	Pct.	Pct.		
A	4/25	30.2	29.2	27.8	5	3	92	\$ 2.61	\$ 7.60
B	4/23	30.2	27.9	21.7	22	8	72	11.67	9.71
C	4/23	30.2	27.9	21.0	25	8	69	13.48	10.05
D	4/19	30.2	24.9	20.6	17	18	68	14.12	10.25
E	4/19	30.2	23.6	19.0	20	22	62	18.39	11.11
F	4/20	30.2	21.8	18.2	16	28	60	20.00	11.59
G	5/17	30.2	17.6	12.6	28	42	41	43.17	16.68

<sup>1</sup>Assuming a present value of 3¢ per pure live seed.

<sup>2</sup>Assuming a cost of 0.7¢ per pure live seed.

# HOUSING PRACTICES IN ALABAMA'S RURAL COMMUNITIES

J.O. BEAMISH and M. ALLEN



**M**ANY COMMUNITIES in Alabama offer a variety of programs, policies, and community practices to better meet the housing needs of their citizens. However, it is often assumed that small rural communities do not have these programs, thus their citizens face a variety of housing problems. To determine the validity of this perception, a survey was conducted in 54 non-metropolitan communities in the State to determine the availability of various housing programs.

## Areas studied

All incorporated areas of 2,500 to 10,000 population in non-Metropolitan Statistical Area (non-MSA) counties were included in the Alabama Agricultural Experiment Station study. Incorporated county seats with populations ranging from 1,000 to 2,500 were also included if they were in non-MSA counties that did not have a town with a population of 2,500 to 10,000.

County supervisors for the Alabama Cooperative Extension Service, Farmers Home Administration (FmHA) supervisors, regional planners, local lenders and realtors, and town mayors or managers in each community were contacted via a mail questionnaire. Respondents were asked if: (1) alternative financing practices, (2) housing programs, (3) local regulations, and (4) alternative housing types were available or pres-

ent in their community. Extension and FmHA personnel had the highest response rate at 94%, followed by planners, lenders, and mayors at 70%, and realtors at 56%. All communities were represented with responses from at least two respondent types and 61% had responses from five or more respondents.

Results were analyzed and a scoring system developed with a top score of 34<sup>1</sup>. Total scores for the communities ranged from 7.2 to 20.1. Of the communities sampled, 11% had scores above 18.1 and 9% had scores below 12.1, table 1.

## Highest and lowest scores

Communities with such alternative housing types as active and passive solar housing, earth sheltered housing, manufactured housing, apartments, townhouses, and mobile home subdivisions scored highest. Typically these communities also had housing for the elderly, housing assistance programs, energy efficiency incentives, community development block grant programs, and public utilities. Low scoring communities were notably lacking in housing alternatives, local regula-

<sup>1</sup>A score of 34 would be achieved if all respondent types in a community reported that all practices and programs asked about on the survey existed in the community.

tions, and a variety of financial programs, such as state or local bond money, builder-assisted loans, self help housing, and alternative mortgage plans.

Location and population did not seem to affect the scores of communities with the highest and lowest scores. Communities in both categories were located in various parts of Alabama. Although the communities with larger populations tended to have higher scores on the index, several of the highest scores came from communities with populations of 2,000 to 3,500; however, low scores also came from this population level.

## Alternatives in financing and ownership

Most communities had a variety of housing programs, but few alternative financing practices and alternative forms of ownership. They often had some local regulations, such as building codes and zoning ordinances, but few had codes or regulations that permitted non-traditional or non-standard spacing of housing. The number of reported housing alternatives varied considerably and ranged from 1.3 to 7.2 out of 11. Apartments or other multi-unit complexes and manufactured housing were the most frequently reported alternatives.

Extension and FmHA personnel had consistently similar ratings on all sections, table 2. Their ratings were also higher than the responses of the other respondents. Lenders and realtors had fairly high and consistent ratings, though lenders reported fewer financing alternatives. Mayors also reported fewer financing and housing alternatives than did other respondents. Regional planners reported the lowest number of financing alternatives and the fewest local regulations.

Further study will be undertaken by Alabama Agricultural Experiment Station researchers to closely examine factors and conditions present in communities offering a variety of housing practices that encourage affordable housing. More information about economic perceptions and attitudes about housing is needed to better understand the variations in the housing practices of rural communities in Alabama.

Beamish is Assistant Professor and Allen is a Graduate Research Assistant in Home Economics Research.

TABLE 1. PERCENT OF RURAL COMMUNITIES IN ALABAMA BY NUMBER OF AVAILABLE HOUSING PRACTICES

Number of available housing practices	Percent of communities (N = 54)
Less than 12.0	5
12.1 - 14.0	22
14.1 - 16.0	39
16.1 - 18.0	19
More than 18.1	11

TABLE 2. MEAN SCORES OF NUMBER OF AVAILABLE HOUSING PRACTICES BY RESPONDENT TYPE, SECTION, AND TOTAL SCORES

Respondent type	Finance practices (N = 8)	Housing programs (N = 7)	Local regulations (N = 8)	Housing alternatives (N = 11)	Total score (N = 34)
Extension	2.7	5.5	4.4	4.0	16.6
FmHA	2.6	5.1	4.0	4.0	15.7
Realtors	2.6	4.6	3.9	3.8	14.9
Mayors	2.1	4.8	4.4	3.2	14.5
Lenders	2.2	4.6	3.7	3.7	14.2
Planners	2.0	4.8	3.3	4.0	14.1

**D**EMAND FOR container-grown pecan trees has increased rapidly in recent years, primarily because trees can be transplanted year round and with greater success than field-grown, bare root trees. However, there are two potential drawbacks: (1) kinking and circling of major roots are common with tap-rooted trees in containers, and (2) since container-grown pecans are typically produced by budding or grafting the desired cultivar onto 1- to 2-year-old seedlings, at least one additional growing season is required before marketing. Results in a 2-year study at the Alabama Agricultural Experiment Station indicate that by manipulating cultural practices, larger seedlings with well-branched root systems can be grown, budded, and marketed within 1 year.

The effects of nut size, container size and shape, and root pruning on growth of pecan seedlings prior to budding were evaluated with the objective of minimizing the time required to reach the budding stage. Nuts from seedling and Jackson pecan trees located at the Gulf Coast Substation were collected in the fall of 1983, and graded by size. Average weight per nut was 0.13 oz. for small nuts (119 nuts per lb.), 0.23 oz. for medium nuts (70 nuts per lb.) from seedling trees, and 0.45 oz. for large nuts (36 nuts per lb.). Nuts were stratified for 6 weeks at 44°F and sown February 1984 in 1-gal. pots of amended pine bark. Pots were placed in a heated greenhouse and, after germination, fertilized weekly with 100 p.p.m. N from 20-20-20 soluble fertilizer. On May 15, 1984, seedlings were root pruned (tap root pruned 3.5 in. below the nut) and transplanted into 5-gal. pots of amended milled pine bark-sandy loam growth medium. Pots were placed outdoors in full sun, drip irrigated, and fertilized 2 weeks later with 18-7-10 (9 lb. per cu. yd.). In September 1984, tree height and caliper, top

# Optimizing production of container-grown pecans

G.J. KEEVER and G.S. COBB

and root dry weights, and number of main roots per tree were determined.

Nut size significantly affected all measured parameters. With increasing nut size there was an increase in tree height, caliper, number of main roots per tree, top dry weight, and root dry weight. These results agree with previous findings and are possibly explained by the dependency of early growth on stored reserves within the nut.

Root growth in the non-pruned treatment generally resulted in a single tap root that was twisted and knotted at a depth corresponding to the bottom of the propagation container. The tap root circled the bottom of the container with secondary and feeder roots developing in greatest numbers toward the distal end. When the tap root was pruned at transplanting, 3 to 4 main roots developed, all of which produced secondary and feeder roots. No twisting of the main roots occurred, and there was less root circling in the bottom of the container than with non-pruned treatments.

In a second experiment, Elliott pecans were sown February 1983 in 1-gal. pots of amended pine bark. Pots were placed in a heated greenhouse, fertilized weekly, and transplanted in April into the different sized containers listed in the table. In August, Cheyenne pecan scion wood was patch-budded onto the Elliott stock.

Greatest tree caliper and height occurred in 10-gal. and shallow 5-gal. pots; however, all trees were of sufficient size for budding (penicil diameter or larger) in July 1983. Ninety-six

percent of attempted buds were still green after budding, with no treatment effect noted.

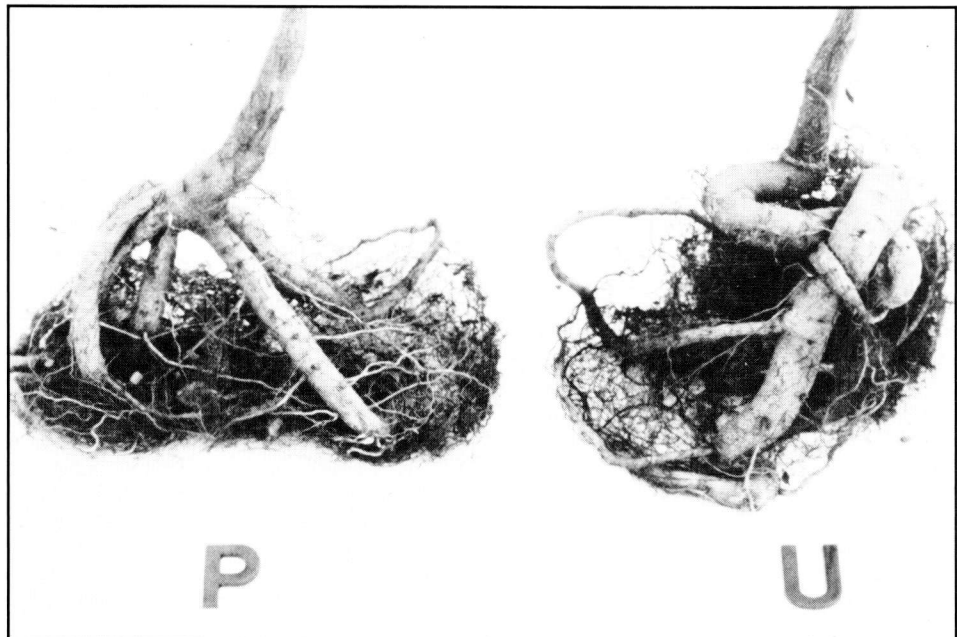
Container-grown seedling pecans can be sown and budded in one growing season. Since early budding is limited by seedling size, this study indicates that shallow containers at least 5 gal. in volume and larger nuts should be used to maximize growth. Budded trees in 1 year would allow earlier field transplanting of younger trees which should enhance survival. Root pruning at transplanting can increase branching of the tap root and produce a more desirable root system for subsequent field transplanting without reducing top growth.

EFFECT OF CONTAINER SIZE AND SHAPE ON CALIPER (8 IN. ABOVE THE MEDIUM) AND HEIGHT OF ELLIOTT SEEDLING PECANS 7 MONTHS AFTER SOWING

Container size		Trunk caliper	Tree height
Volume	Dimension (width x ht.)		
<i>Gal.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>
10	17 X 15	0.38	27.0
5	13 X 11¾	.35	24.3
5	9 X 20	.30	19.4
3	10½ X 9	.29	19.8
3	9 X 15	.28	19.4

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

Pruned (left) versus unpruned pecan seedlings.





## New fungicides for blackspot control in roses

A. HAGAN, C.H. GILLIAM,  
and D.C. FARE

**B**LACKSPOT is a common disease of roses in Alabama landscapes, but it can be controlled with season-long fungicide sprays. A group of systemic fungicides called sterol inhibitors may prove superior to labeled fungicides. One of them, triforine, is already marketed under the trade names Funginex Rose Disease Control® and Triforine EC®. Research at the Alabama Agricultural Experiment Station shows that several experimental sterol inhibiting fungicides also control rose blackspot. Tests were conducted to compare efficacy of registered materials, Daconil 2787® and Triforine EC, with non-labeled sterol inhibiting fungicides.

Queen Elizabeth grandiflora rose bushes were planted in August 1983 in a 4:1 mixture of sandy loam soil and peat moss. Each bush was fertilized every 2-3 months with 8 oz. of 8-8-8 fertilizer and regularly pruned. Water was applied as necessary with overhead sprinklers. Blackspot severity was determined using a 1-5 scale with 1 = no disease to 5 = severe leaf drop.

In 1984, Triforine EC 18.2E, Daconil 2787 4.17F, Rubigan® 12.5E, Maag RO® 15-1297 4E, Ortho XE779® 25W, and RH 3866® 2E were evaluated for blackspot control. Each

TABLE 1. BLACKSPOT CONTROL WITH REGISTERED AND NEW STEROL-INHIBITING FUNGICIDES, 1984

Treatment		Disease severity <sup>1</sup>		
Fungicide	Rate	May 29	June 21	August 9
RO 15-1297 4E	1.4 fl. oz.	1.1	1.4	2.1
RO 15-1297 4E	2.7 fl. oz.	1.1	1.1	1.4
Rubigan 12.5E	6.8 fl. oz.	2.1	2.0	3.1
Daconil 2787 4.17F	2 pt.	1.6	1.1	1.3
Triforine EC 18.2E	0.75 pt.	1.6	1.1	1.3
XE 779 25W	1.8 oz.	2.3	2.5	3.4
XE 779 25W	3.2 oz.	2.3	2.6	3.1
XE 779 25W	6.4 oz.	2.1	2.0	2.9
XE 779 25W	12.8 oz.	2.1	1.6	2.3
RH 3866 2E	0.5 fl. oz.	1.6	1.1	2.4
RH 3866 2E	1.0 fl. oz.	1.3	1.0	1.9
RH 3866 2E	2.0 fl. oz.	1.5	1.0	1.3
Unsprayed control		3.4	3.9	4.3

<sup>1</sup>Rating scale 1 = no disease, 5 = severe leaf drop.

TABLE 2. EFFECT OF SPRAY INTERVAL ON BLACKSPOT CONTROL, 1985

Treatment			Disease severity		
Fungicide	Rate/100 gal. water	Spray interval, weeks	Aug. 30	Sept. 27	Oct. 25
RO 15-1297 4E	1.4 fl. oz.	1	1.8	1.5	2.3
RO 15-1297 4E	2.7 fl. oz.	1	1.4	1.3	1.5
RO 15-1297 4E	1.4 fl. oz.	2	2.3	2.8	3.3
RO 15-1297 4E	2.7 fl. oz.	2	1.5	1.9	2.5
Daconil 2787 4.17F	2.0 pt.	1	1.0	1.1	1.3
Daconil 2787 4.17F	2.0 pt.	2	1.8	1.5	1.9
Triforine EC 18.2E	0.75 pt.	1	1.1	1.1	1.5
Triforine EC 18.2E	0.75 pt.	2	1.6	2.8	3.1
RH 3866 40W	2.5 oz.	1	1.4	1.8	2.1
RH 3866 40W	5.0 oz.	1	1.4	1.4	1.4
RH 3866 40W	2.5 oz.	2	2.0	2.3	2.8
RH 3866 40W	5.0 oz.	2	1.3	1.6	1.8
Unsprayed control			3.3	3.9	4.1

fungicide was applied weekly from March 22 to August 17 to eight rose bushes. Of these materials, Daconil 2787 and Triforine EC are currently labeled for use on roses.

Daconil and Triforine provided good season-long disease control. Little evidence of blackspot was found on leaves of roses sprayed with either fungicide from May through August, table 1.

Maag RO 15-1297 and RH 3866 maintained the best disease control of the experimental sterol inhibiting fungicides. All rates of both fungicides controlled as well as Daconil or Triforine in June. A breakdown of disease control with the lower rates of Maag RO 15-1297 and RH-3866 was noted through the summer. By late August, these treatments no longer provided effective disease control. The high rates of Maag RO 15-1297 and RH 3866 continued to control blackspot through August.

Rubigan and XE 779 reduced blackspot damage below levels on the unsprayed roses. Neither fungicide controlled blackspot as well as Daconil or Triforine.

In 1985, blackspot control by RH-3866 25W, RO 15-1297 4E, Daconil 2787 4.17F, and Triforine EC 18.2E was evaluated at 1- and 2-week spray intervals. All fungicide treatments were applied from April 11 through October 11, following the procedures already outlined. Disease severity was as-

sessed using the same rating scale as the previous year.

In late August, weekly applications of Daconil, Triforine, and the high rate of RH 3866 and RO 15-1297 were the most effective treatments, table 2. Later in the fall, disease severity on all treatments increased. However, disease ratings of all fungicides remained below those of the unsprayed roses. Weekly applications of Triforine, Daconil, and the high rate of RH 3866 and RO 15-1297 provided the best blackspot control. Disease control with the low rate of RH 3866 and RO 15-1297 applied weekly was not acceptable.

As the spray interval lengthened from 1 to 2 weeks, blackspot severity increased. Despite higher disease ratings, Daconil and the high rate of RH 3866 proved effective against blackspot when applied at 2-week intervals.

Results of these tests show that the available fungicides, Daconil and Triforine, control blackspot on roses as effectively as new materials under development. Weekly applications of Triforine and Daconil resulted in the best disease control. Research indicates if homeowners must spray at 2-week intervals, Daconil offers the best protection against rose blackspot.

Hagan is Extension Plant Pathologist, Gilliam is Assistant Professor and Fare is Research Associate of Horticulture.



**T**HERMAL BLAST PEELING is a patented process developed in the Horticulture Food Science Laboratory at the Alabama Agricultural Experiment Station. It could, by reducing peeling losses and providing a product better suited for further processing operations such as canning or freezing, provide the consumer more food from crops.

The thermal blast process rapidly and efficiently removes outer coverings and other inedible portions from food products by heating only the inedible outer portion of the food at such a rapid rate that the heat does not penetrate to underlying edible tissues. During this heating process the food is contained in a closed, pressurized vessel and subjected to infra-red heat from the vessel wall and conductive heat from the superheated steam pressurizing medium. This intense, rapid heat treatment partially dries and increases the plasticity of the peel tissues, thus facilitating their removal. In the process, a film of heated moisture immediately subtending the peel is heated to a temperature in excess of the boiling point of water at atmospheric pressure and peels are removed by instantly opening the vessel following this brief heat treatment. The result is an explosion that blows the product from the vessel and simultaneously blasts the covering from the food by the violent expansion of the highly energized moisture immediately beneath the covering. The plasticized peeling offers resistance to rupture which allows steam to spread laterally and pressure to build beneath the peeling, thus facilitating complete separation from the edible product.

The thermal blast process has several operational advantages over caustic and conventional high pressure steam peeling systems now used in the food industry. Caustic chemicals such as lye are used to peel some food crops, but such peeling requires prolonged exposure to hot caustic solutions and usually results in a softened product with relatively large losses of edible tissue. Processing waste streams which require subsequent cleanup are also generated in conventional peeling systems.

With conventional high pressure steam peeling, pressure and time control the peeling. Pressures up to 300 lb. per sq. in. (p.s.i.) are often required to reduce processing times to an acceptable level, making it difficult to process delicate or fragile foods.

# THERMAL BLAST PEELER

## Increases Food Processing Efficiency

D.A. SMITH and H. HARRIS

LOSS FROM PEELING AND SHELLING OPERATIONS

Product	Pct. lost from raw product		
	Thermal blast	Lye	Saturated steam
Apple	2	14	7
Kiwi	6	NP <sup>1</sup>	NP <sup>1</sup>
Peach (pitted)	4	20	NP
Pear	4	17	10
Plum	3	NP	NP
Avocado	3	NP	NP
Mango	12	22	NP
Tomato	4	15	9
Sweet potato <sup>2</sup>			
½-1 in.	9	NP	NP
1-1½ in.	7	26	25
1½-2 in.	5	24	21
2-2½ in.	4	20	18
2½-4 in.	3	18	17
Irish potato	4	23	22
Carrot	5	28	25
Beet	3	14	8
Rutabaga	2	12	7
Eggplant	2	21	17
Cucumber	3	NP	NP
Pimiento pepper <sup>3</sup>	25	36	NP
Pumpkin	11	NP	28
Onion	5	NP	NP
Shrimp <sup>4</sup>	45	NP	NP
Catfish <sup>5</sup>	42	NP	NP
Chestnuts	21	NP	NP

<sup>1</sup>Not practical to peel by the above method.

<sup>2</sup>Canning stock of different size grades peeled to a cork layer peel. Size grades smaller than 1 in. in diameter are not practical to peel by present commercial methods.

<sup>3</sup>Loss includes the inedible core, which is removed during peeling.

<sup>4</sup>Loss includes head and vein, which are removed during peeling.

<sup>5</sup>Loss includes head, viscera, and fins.

In contrast, the thermal blast processing treatments and their effects are controlled in a manner that produces the precise results sought by independently controlling steam temperatures and pressures while maintain-

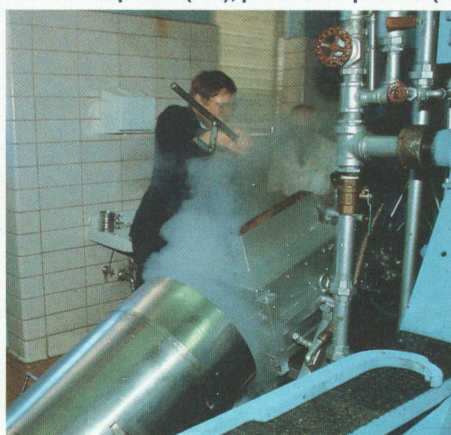
ing minimal processing times. Temperatures as high as 1,000°F may be used while limiting pressures to between 30 and 100 p.s.i. for processing times of 4 to 20 seconds. These lower pressures represent a considerable economy in steam generation and allow efficient peeling of the most delicate and fragile foods.

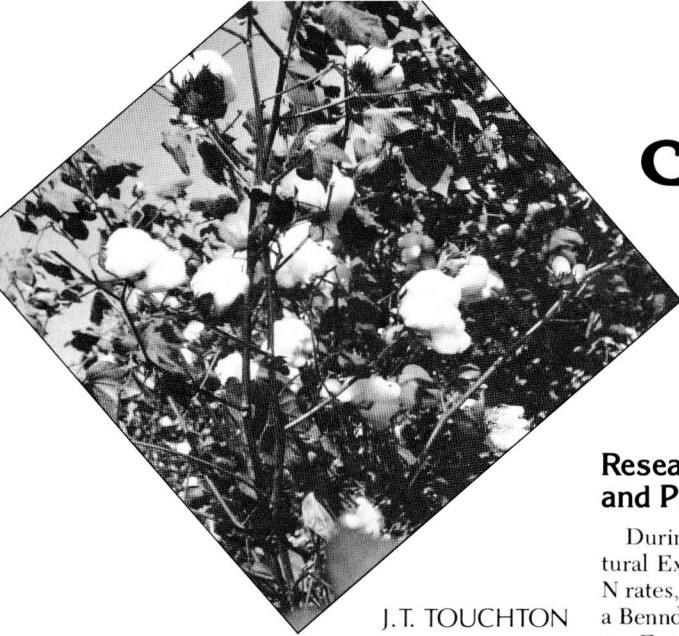
The thermal blast process has been proven effective in peeling of fruit and vegetable crops, coring of peppers, shelling of legume seed pods, shucking and silking of corn, skinning of onions, shelling of nut crops, skinning of beef and swine tongues, scaling and skinning of fish, and the removal of shells from shellfish. In contrast, conventional peeling processes are generally limited in application to particular types of foods.

The table lists a few of the food crops which have been successfully peeled or shelled using the thermal blast process in Alabama Agricultural Experiment Station research. Losses from the thermal blast process are contrasted with the peeling loss from conventional lye and saturated steam peeling processes. High peeled yields have been achieved for most food products, and entirely new processed products, such as canned, peeled plums, can be produced from crops which were not previously practical to peel. In the case of pimiento and bell peppers, the inedible core is also blown free of the edible pod during the thermal blast treatment. Undersized sweet potatoes, now left in the field, may be peeled efficiently and utilized as canning stock. The color and texture of most thermal blast peeled commodities is superior to produce peeled by conventional means.

Smith is Associate Professor and Harris is Professor Emeritus of Horticulture.

Durward Smith (left) and Hubert Harris load thermal blast peeler (left), produce explosion (center), and examine processed apples (right).





J.T. TOUCHTON

# Crop rotations and Pix® make N management difficult

**N**ITROGEN FERTILIZER management for cotton production is often puzzling and difficult. As with all non-leguminous crops, N fertilizer is essential for profitable cotton yield. Unlike in most crops, excessive N can indirectly result in yield reductions in cotton by causing excessive vegetative growth (rank growth). This can make insect and disease control difficult, cause lower bolls to shed, create problems with boll rot, delay maturity, and decrease picker efficiency, especially on highly productive soils and in years with above average rainfall.

Recommended nitrogen rates, which vary from location to location throughout the Cotton Belt, are based on years of field research and, combined with proper crop rotation and other proven production practices, will usually produce the most profitable yield. In years where climatic conditions for cotton production are excellent, the recommended rates may be too low. Yet, applying more N than the recommended rate in hopes of an ideal growing season can create problems in years with excessive moisture. There is, however, a possibility of offsetting this effect, if the stimulative effect of N on vegetative growth can be reduced.

Crop rotation is another complicating factor in nitrogen fertilizer management, especially when soybeans precede cotton, because it is difficult to determine how much N a preceding soybean crop will contribute to cotton. Yet to maintain highest production levels, crop rotations are essential.

The proper use of plant growth regulators such as Pix® (mepiquat chloride), which restricts plant growth, theoretically should eliminate the adverse effects that excessive N, crop rotations, and highly productive soil can have on cotton. During the past few years, both research data and farmer experience have illustrated that Pix will restrict plant growth, and may either increase yield, have no effect on yield, or decrease yield. The unpredictable effect of Pix on cotton yield can make its use as risky as excessive N.

## Research at Brewton and Prattville

During 1984 and 1985, Alabama Agricultural Experiment Station research with Pix, N rates, and crop rotations was conducted on a Bennedale fine sandy loam soil at the Brewton Experiment Field and on a Lucedale fine sandy loam soil at the Prattville Experiment Field to determine the interacting effect of these treatments. Nitrogen rates were 0, 30, 60, 90, and 120 lb. per acre. The N source, ammonium nitrate, was applied in a band beside the row approximately 4 weeks after planting. Pix was applied as a split application, 1 pt. at first bloom and ½ pt. 10-14 days later. Cropping systems were continuous cotton and cotton following soybeans. Recommended N rates for cotton on these soils is 90 lb. per acre for continuous cotton and 60 to 70 lb. per acre for cotton following a good crop of soybeans.

At both locations, cotton plant height at maturity increased as N rates increased, but generally leveled off at the 90 lb. per acre N rate. Cotton following soybeans was 3 in. taller than continuous cotton (39 vs. 36 in.) and was 7 in. shorter with Pix than without it. The effects of any one treatment, however, were not strongly related to the effects of any other.

Rainfall distribution was adequate for excellent cotton yields at both locations in both years. As reported in the table, cotton following soybeans produced 336 lb. per acre more seed cotton than continuous cotton. For cotton following soybeans, 90 lb. per acre N was adequate for top yields, but 120 lb. per acre N was required for top yields in three out of

the four tests with continuous cotton. The relationships between Pix and yields were not dependent on N rates, which agrees with most of the reported research on Pix-N rate interactions. The effects of Pix on yields were dependent on previous crops at Brewton, but not at Prattville, where yields averaged 330 lb. per acre higher with Pix than without it (3,660 vs. 3,330 lb. per acre seed cotton). At Brewton, Pix reduced yields of continuous cotton 185 lb. per acre, but had no effect on yields of cotton following soybeans.

## Results

The results of the Auburn tests support research in other states in that there is not a strong relationship between N rates and the need for Pix. The N rates used, however, were not high enough to result in yield reductions in these tests. Yield reductions caused by Pix applied to continuous cotton, regardless of N rate, suggest that high N rates cannot be used to offset the detrimental effects of Pix. The effects of Pix on yield when cotton was rotated with soybeans indicate the potential need for it when cotton is rotated with soybeans.

When working with biological systems, it is almost impossible to establish firm rules or guidelines that will produce consistent results each year. However, results of the Auburn tests support those found elsewhere which indicate: (1) usage of Pix should not be based on N rates, (2) with continuous cotton, Pix should only be used on bottomlands or other areas where rank growth always occurs, and (3) when cotton is rotated with soybeans and early season growth is adequate, Pix probably should be applied.

Touchton is Associate Professor of Agronomy and Soils.

SEED COTTON YIELDS AS AFFECTED BY APPLIED N (3 HIGHEST N RATES) AND PIX

Location	Year	Previous crop	Seed cotton/acre by N rate and Pix <sup>1</sup>				
			N rates, lb.			Pix	
			60	90	120	No	Yes
Brewton	1984	Cotton	2,690	3,000	3,160	2,910	2,680
		Soybeans	2,830	3,330	3,270	2,980	3,030
	1985	Cotton	2,440	2,630	2,760	2,220	2,070
		Soybeans	2,900	3,370	3,200	2,710	2,860
Prattville	1984	Cotton	4,040	4,240	4,470	3,910	4,190
		Soybeans	4,230	4,370	4,320	3,980	4,310
	1985	Cotton	3,270	3,600	3,850	3,080	3,430
		Soybeans	3,770	4,000	4,080	3,550	3,910

<sup>1</sup>Yields for N rates are averaged over Pix rates and yields for Pix are averaged over all N rates.

**M**UCH HAS BEEN WRITTEN in the media about the rising incidence of crime in the United States. Alabama, too, has experienced increasing levels of criminal activity, although at a lower rate than that of most other states. By the mid-1980's crime rates had leveled off nationwide, but the amount of crime today is still alarmingly high and of widespread concern.

A statewide crime and victimization survey was conducted in winter 1984-85 by the Alabama Agricultural Experiment Station. Among the responding households were 174 farm households from across the State. This sample of farms included 44 (25%) full-time and 130 part-time operations. The majority of these full-time farms (77%) were large, consisting of 250 acres or more, while 93% of the part-time farms were smaller than 100 acres.

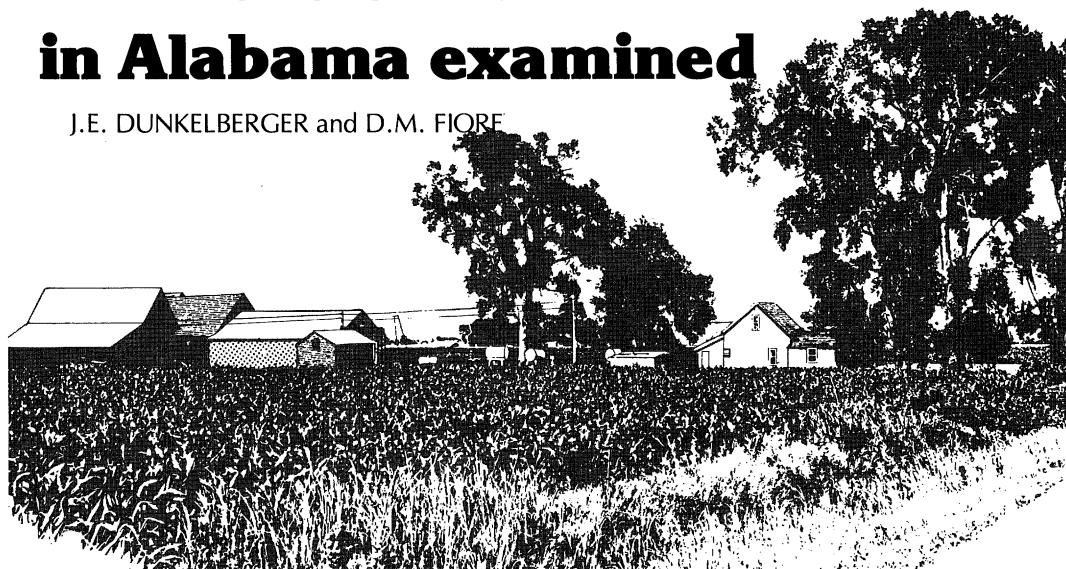
Victimization of these farm households was examined in terms of property theft, burglary, and vandalism on the farm or home place. Other crimes involving the theft of motor vehicles and self-propelled farm machinery or thefts occurring off the farm are not considered. Only one farmer reported the theft of a tractor in 1984.

### Property theft

Theft of property kept around the home includes such things as farm tools, machinery, livestock, crops, and personal items. Within the 12 months prior to the survey, 20% of the farmers indicated they had experienced such a property theft. In 63% of these property thefts, the loss was estimated at less than \$100. In the previous 5 years, 30% indicated property loss of \$100 or more. The incidents of property thefts over this longer period are probably under-reported because of the \$100 minimum value placed on the property stolen. Taken together, however, 40% of these farmers reported at least one incident of

# Farm theft and vandalism in Alabama examined

J.E. DUNKELBERGER and D.M. FIORE



property loss in the past 6 years, and about half of these had been victimized more than one time.

Part-time farmers reported more property theft than did full-time farmers. Also, farms located near large population centers were most likely to have experienced property theft. Only one-third of the full-time farmers located in nonmetro counties reported property loss during the past 6 years, compared to 40% of part-time farmers in the same counties. On the other hand, all farms located in metro counties were operated by part-time farmers and 55% of these experienced some form of property theft.

### Burglary

Burglary is a special type of property crime involving the breaking into and entry of the house. Only 7% of these farm households had experienced a forced entry within the past 12 months. Most of these burglaries occurred during the daytime. The value of property stolen was \$1,000 or more in one-fourth of these crimes. For the previous 5 years, the proportion of burglarized farm homes was 15%, with 29% of these reporting more than one forced entry.

### Vandalism

Vandalism of private property is not included in government crime statistics, but is something that many Alabama farmers experience and represents a problem about which little factual information is available. Results of this survey indicated that 11% of the farmers reporting had been victims of vandals at least one time during the previous 12 months. When property losses due to vandalism are limited to those amounting to \$100 or more, 17% of these farmers had experienced such a

loss during the previous 5 years. Farmers located in metropolitan areas were most likely to be victimized, with 23% reporting such occurrences during the past 12 months.

Farm property losses resulting from vandalism in the past 12 months were estimated to be less than \$300 in half of the cases, while 21% of the losses amounted to \$1,000 or more. The time of occurrence was almost equally divided between daytime (42%) and nighttime (47%), with the remainder unknown. Half of the property vandalized was located outside the house contrasted to vandalism of either the house or its contents. In only three instances was the vandalized property covered by insurance. Virtually all victims (84%) had reported the vandalism to the police.

That farms involved with certain types of enterprises or combinations of enterprises are more vulnerable to acts of vandalism than are others is illustrated by data in the table. During the previous 12 months, 68% of farmers with livestock enterprises reported incidents of vandalism. Farms with grain enterprises also ranked high (37%), followed by those with poultry, grain, vegetable, timber, and fruit enterprises. This relationship between farm enterprises and associated acts of vandalism shows a somewhat different pattern of enterprise vulnerability when a 5-year period is considered and the minimum loss is restricted to \$100 or more. Farms with livestock and timber are most vulnerable to larger value losses from vandalism. Both livestock and timber enterprises require less intensive management and are most compatible with part-time farming, important factors in their greater vulnerability to vandalism.

PERCENTAGE OF 174 SURVEYED FARMS EXPERIENCING VANDALISM 1979-84 BY SELECTED FARM ENTERPRISES

Farm enterprise	Reporting farm vandalism	
	Past 12 months	Previous 5 years <sup>1</sup>
	Pct.	Pct.
Livestock .....	68.4	46.4
Grain .....	36.8	21.4
Poultry .....	14.3	3.6
Vegetables .....	12.5	17.9
Timber .....	11.4	35.7
Fruits .....	11.1	7.1
Dairy .....	5.3	10.7
Cotton .....	5.3	7.1

<sup>1</sup>Incidents of vandalism during the previous 5 years were limited to those occurrences with losses valued at \$100 or more. No value restriction was placed on incidents of vandalism for the past 12 months. The two percentages are not directly comparable.

Dunkelberger is Professor and Fiore is Graduate Research Assistant of Agricultural Economics and Rural Sociology.

# INSECTS THAT CAN'T SMELL

# DON'T MATE

R.S. BERGER and D.A. RIDER

**E**NTOMOLOGISTS have long recognized the ability of insects to use a sensitive olfactory sensory system to detect odors from volatile chemicals. Current research in the Alabama Agricultural Experiment Station is seeking ways to block or jam this sensory system to disrupt the reproductive cycle of certain economically damaging insect pests.

By absorbing special chemicals known as sex pheromones from the air into their antennae and recognizing these as unique markers, insects can distinguish potential mates from many other species in the field and continue their reproductive cycle. Auburn researchers were the first in the world to identify and chemically synthesize sex pheromone of an economically damaging insect pest (the cabbage looper). Current research is underway to use the sex pheromone in combination with other chemicals to jam reproductive signals of this frequent pest of vegetable crops and occasionally of soybeans and cotton.

Researchers first tried to block the ability of male cabbage loopers to detect sex pheromone by synthesizing chemical compounds

that contain characteristics of both the toxic part in three insecticides and the specific portion of the sex pheromone. The rationale was that these compounds would be carried to the same site in the nerve cells where the pheromone molecule is recognized by the insect. The 'toxic tail' would then jam the important components that must act to transmit the necessary information to the brain of the insect. Although the toxic principle of each of the three different insecticides was explored, none was effective.

A second group of compounds was copied from chemicals known to occur in certain plants that have been used as spices and in folk medicine. These are 'hot' when chewed,

EFFECT OF N-BUTYLMALIMIDE ON MATING OF CABBAGE LOOPER MOTHS

Treatment	Pairs producing fertile eggs
Control .....	Pct. 81
Males treated .....	0
Females treated .....	100

Male cabbage looper scanning the air with its antennae.



cause a numbing in the mouth, and have been used to relieve the pain of toothache and bronchitis. These compounds, known as isobutylamides, were made to imitate the structure of the pheromone molecule, but they were also ineffective.

A third group of compounds, known as thiol-inhibitors, specifically N-butylmaleimide, which chemically binds to certain sulphur-containing substances, was used. Research by others had shown that the ability of insects to taste could be blocked with mercury-containing compounds that are known to react with sulphur. N-butylmaleimide was dispersed as a vapor in much the same way sex pheromones are distributed in the air, providing dramatic initial results.

An oscilloscope was used to monitor treated insects. Typically when antennae of male cabbage loopers were stimulated by pheromone vapor, blips showed up on the oscilloscope, much like heart beats show up when patients are monitored in a hospital. After exposure to the thiol-inhibiting vapor, male cabbage loopers showed no blips on the monitor.

If the antenna shows no response, does this mean the insect can no longer smell? Apparently it cannot. Insects that were exposed to doses of the chemical sufficient to abolish essentially all electrical response in the antennae were unable to locate a source of synthetic pheromone when placed downwind from it in a wind tunnel. Normally about 80% of males will fly directly to the source when placed in the plume of pheromone.

The final test was to determine if blockage of an insect's antennae impaired its ability to locate and mate with a suitable partner. Single pairs of cabbage looper moths were placed in cages with a potted collard plant. Either the male or the female of each pair was treated with a dose of chemical sufficient to block their antennae. The results of these studies are listed in the table. Treatment of males completely destroyed their ability to locate females and mate with them, resulting in no viable eggs being produced.

Further studies are currently underway to develop practical means for getting the chemical to males in the field. The feasibility of combining the inhibitor with sex pheromone in a lure that would result in males picking up the chemical as they follow the plume of pheromone is being investigated.

Berger is Professor and Rider is a former Graduate Student in Zoology-Entomology.

**T**HE DEVELOPMENT of low tannin varieties of sericea lespedeza is expected to spur efforts by cattlemen and dairymen in Alabama and the Southeast to become more self sufficient in livestock feeding. Improving seedling establishment of low tannin varieties, such as AU Lotan, released by the Alabama Agricultural Experiment Station in 1980, is key to more efficient usage of this new variety.

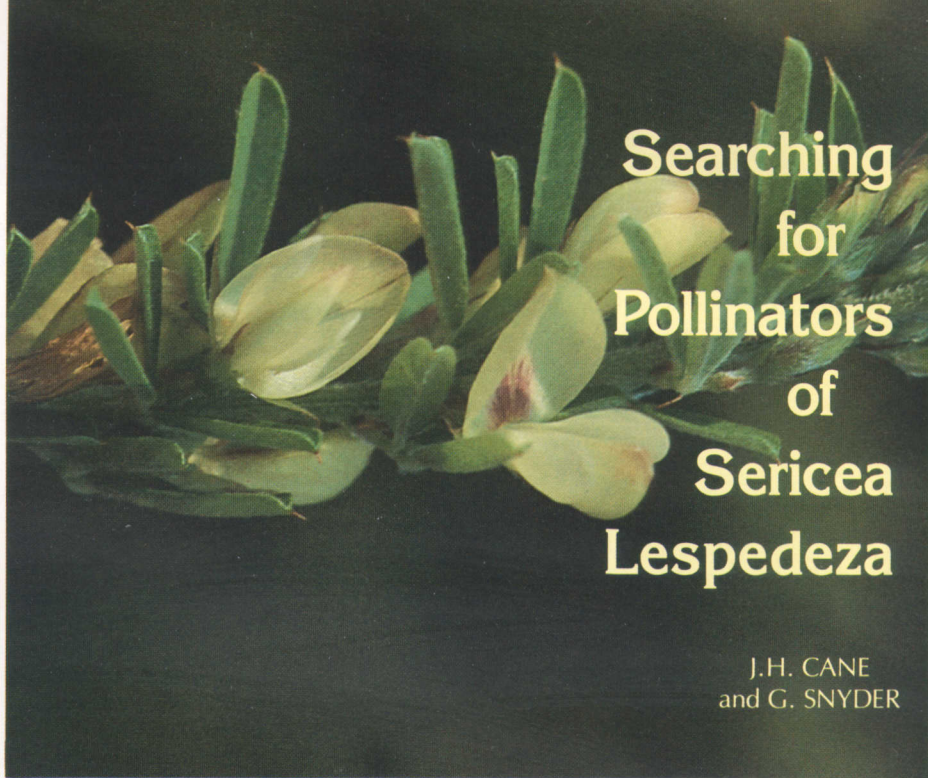
Poor seedling vigor may be symptomatic of inbreeding necessary to initially select this line, and the subsequent lack of outcrossing reflects sericea's floral biology. Lespedezas produce two floral types: (1) cleistogamous, which remains closed and self-fertile, and (2) chasmogamous, figure 1, which is showy and requires insect visitation for pollination. Chasmogamous flowers must be 'tripped', as by the landing of an insect, to expose the anthers and stigma. If visiting insects bring pollen to chasmogamous flowers from other sericea plants, the resulting seed may show hybrid vigor. This can lead to dramatic improvements in seed and foliage production and seedling viability.

Sericea lespedeza blooms in Alabama from July through September, making it ideal for bees because of a lack of floral competition during these months. In the Auburn study, sericea attracted a diversity of bees, including sweat bees, honey bees, leaf-cutter bees, bumblebees, carpenter bees, and alkali bees. Nine of every 10 bees carried more than 95% lespedeza pollen and only 1 in 50 carried less than 75%. All of these bees occur in Alabama, so the potential for natural pollination of sericea is available and abundant.

Bees visit sericea flowers from 9:00 a.m. until 3:00 p.m., being most abundant around mid-day during calm, sunny, warm (up to 95°F) days. Pollinators seem scarce in fields of sericea receiving insecticide application during flowering. Though bees get a meager reward of nectar (less than 1/100 milliliter) and pollen (3,800-5,300 grains) per flower, they exhibit good fidelity to lespedeza when it is available.

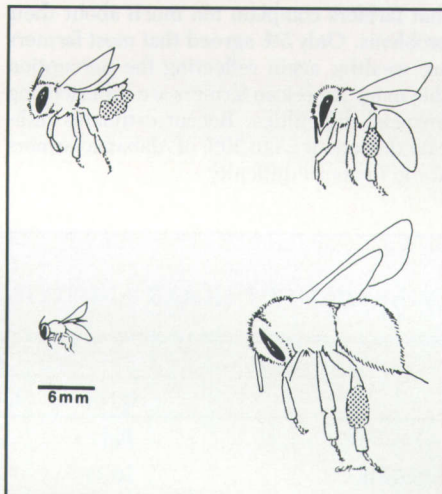
Sweat bees were the most common pollinators for sericea and generally predominated at a given time. They gather pollen, unlike some species that only gather nectar. Sweat bees and leaf-cutter bees are an ideal size for sericea, unlike larger visitors, figure 2. Sweat bees were slow, taking an average of 4.3 seconds per flower, compared to 1.8 to 2.7 seconds for other species. Pollen collecting bees traveled between flowers in 1-2 seconds. Auburn researchers plan to combine these data with more difficult to obtain flight distance and pollen carryover estimates to determine pollination values of various bee species to sericea.

Both social (bumblebees, honey bees, and some sweat bees) and solitary species were among bees visiting sericea. The majority are ground-nesting, forming tiny subterranean



## Searching for Pollinators of Sericea Lespedeza

J.H. CANE  
and G. SNYDER



**Fig. 1 (above) Chasmogamous floral type of lespedeza, which requires insect visitation for pollination.**

**Fig. 2 Silhouettes of bees that commonly visit lespedeza flowers: (top left) *Megachile*, (top right) *Apis*, (bottom left) *Dialictus*, and (bottom right) *Bombus*.**

chambers for their pollen and nectar provisions. Carpenter and leaf-cutter bees prefer to nest in hollow twigs of sumac, blackberry, and elderberry. Most of these sericea visitors have several generations per year and need alternative floral resources before July. Many wildflowers and cultivated clovers are used, since these bees are floral generalists.

Management prospects for some bee species that pollinate sericea are hopeful. Besides the honeybee, related species of both alkali and leaf-cutter bees are already managed in the West for alfalfa seed production. Sweat bees will naturally nest in clay banks (as along streams). Some species will even nest in greenhouses in large buckets filled with heavy soil. Specific nesting requirements will need to be ascertained for management of bees for sericea seedling production.

If improved pollination proves successful in increasing seedling establishment of low tannin sericea varieties, observations by Auburn researchers indicate management of bees can be enhanced by: (1) leaving adjacent fallow areas or hedgerows for alternative pollen sources during spring and summer, (2) encouraging stands of sumac, elderberry, and other pithy-stemmed plants for nesting sites, and (3) minimizing usage of insecticides, such as carbaryl, malathion, and parathion, during the July-September bloom period for sericea.

Cane is Assistant Professor and Snyder is a Research Assistant of Zoology-Entomology.

### BEES VISITING LESPEDEZA FLOWERS

(In decreasing order of abundance by genus)

- (1) *Dialictus* (*versatus*, *imitatus*, *atlanticus*, *raleighensis*, and *pilosus*)—sweat bees
- (2) *Apis mellifera*—honey bee
- (3) *Megachile* (*mendica*, *petulans*, *concinna*, *brevis*, *rotundata*, *ingenua*)—leaf-cutter bees
- (4) *Bombus*, (*pennsylvanicus*, *griseocollis*, *impatiens*)—bumble bees
- (5) *Xylocopa virginica* and *Ceratina* spp.—carpenter bees
- (6) *Nomia* (*nortoni* and *manei*)—alkali bees
- (7) *Chalicodoma* (*campanulae* and *exilis*) bees
- (8) *Anthidiellum perplexum* bees

# Public Concerned Over Plight of Alabama Farmers

J.J. MOLNAR and L. EDDY

**T**O DETERMINE public attitudes toward the current rural crisis that threatens the livelihood of many farm operators, responses of the 293 Alabamians who participated in a larger national survey were examined at the Alabama Agricultural Experiment Station. The public response contained elements of both sympathy for farm difficulties and concern about government spending and the treatment of agriculture relative to other industries.

The table shows patterns of response to selected items in the study. Over 79% of the respondents felt that the family farm is an important part of our national heritage and should be preserved (Item 2). Only 26% responded that efficiency in food production was more important than the preservation of the family farm (Item 7). About 55% believed that farms should be treated like other busi-

nesses by the government (Item 3), and 43% thought farmers should operate within free markets, without government support (Item 5).

On the issue of government benefits, over 49% felt that large farms are presently receiving too many government benefits (Item 4), but item 6 shows that only 27% believed that farmers in general get too much money from government programs. Only 24% felt that farmers get more than their fair share of government benefits (Item 8).

About 70% believed that most farmers are in financial trouble, yet only 23% thought that farmers complain too much about their problems. Only 5% agreed that most farmers are wealthy, again reflecting the perception that many American farmers are experiencing financial difficulties. Recent estimates indicate that about 25 to 30% of Alabama farmers are in financial difficulty.

The results show that the family farm maintains its special place within American society. Feelings are mixed regarding government support and involvement in agriculture, although most felt that the farmer is not exploiting governmental assistance. The farm financial crisis is acknowledged as a problem. Because most farmers are not believed to be wealthy, it is easy to understand the perception that most agricultural producers are experiencing difficulty. The public seems to recognize the importance of family farming, the financial problems of agriculture, and the need for a continuing role for government in agricultural production.

Molnar is Associate Professor and Eddy is a former Graduate Student in Agricultural Economics and Rural Sociology.

PUBLIC PERCEPTIONS OF THE FARMER'S SITUATION IN ALABAMA<sup>1</sup>

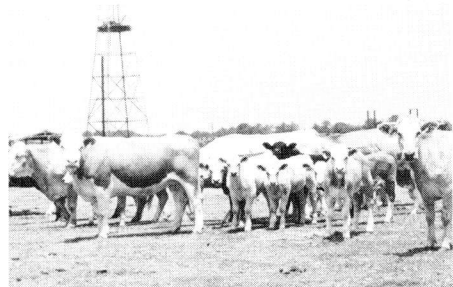
Item	Response			(Number)
	Agree	Uncertain	Disagree	
	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	
1. Today, most farmers are in financial trouble .....	70.6	12.2	17.2	(319)
2. The family farm must be preserved because it is a vital part of our heritage .....	79.0	8.2	12.8	(319)
3. The government should treat farms just like other businesses .....	55.9	14.7	29.4	(320)
4. Large farms get too many government benefits .....	49.7	32.5	17.8	(320)
5. Farmers should compete in a free market without government support .....	42.6	23.5	33.9	(319)
6. Farmers get too much money from government programs .....	27.0	27.0	46.0	(319)
7. Obtaining greater efficiency in food production is more important than preserving the family farm .....	26.3	20.9	52.8	(316)
8. Farmers get more than their fair share of government benefits .....	24.1	25.4	50.5	(319)
9. Farmers complain too much about their problems .....	23.4	15.0	61.6	(320)
10. Most farmers are wealthy .....	4.7	5.0	90.3	(318)

<sup>1</sup>Questions were part of a survey submitted to 9,250 people nationwide. Results are from Alabamians (325) answering the national survey conducted in spring 1986.

**K**EEPING MORE Alabama cattle on the farm until slaughter, instead of sending them out of state for finishing, is one way to maximize profits for State producers. To determine some alternatives for birth to slaughter feeding, the Alabama Agricultural Experiment Station compared two beef cattle production systems in a 2-year test at the Wiregrass Substation in Headland.

# Beef Cattle Production Systems Evaluated

E.E. THOMAS, D.L. HUFFMAN, R. RUSSELL, and J.G. STARLING



## SYSTEM I

In system I, 25 large frame-size beef cows and their calves grazed Coastal bermudagrass in the summer and the same area overseeded with cool season annual forages during the winter and early spring. They also had access to 4-6 hours of limited grazing of rye during the fall. In addition to grazing, calves had access to a cracked corn based diet in a self feeder while grazing from birth until slaughter.

Postweaning gains favored the system I calves and averaged 2.08 lb. per day in contrast to only 1.46 lb. for system II calves. Gains of system II calves during the summer months were approximately 1.0 lb. per day while they were grazing Tifleaf-1 pearl millet which contributed to the lower overall postweaning performance. A longer post weaning time was required to achieve the desired fat thickness in system II, compared to system I, evidenced by the age at slaughter (554 vs. 719 days). The final weight of system I cattle averaged 1,292 lb. compared to 1,319 lb. for system II. This difference in final weight is commonly found when cattle are allowed to graze forages for an extended period before entering the feedlot for finishing.

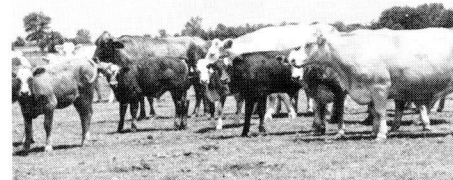
As seen in table 2, cattle from both groups were slaughtered at similar backfat thicknesses which averaged 0.5 in. The similarity of fat thickness and muscling of the carcasses resulted in yield grades averaging 2.6 for both groups. The quality grades, however, differed to a larger degree. During the first year, 56% of the cattle in system II graded below the "Good" quality grade. Most of these cattle were females and had developed "hard bone" in their carcasses which put them in the grade "C" maturity classification.

This resulted in a rather large price penalty as seen by comparing the carcass price of \$1.05 per lb. for the system I cattle during the first year with \$0.78 for system II. This resulted in a depression of carcass value of more than \$200 each. Maturity and carcass quality grades during the second year were similar between the systems.

## CONCLUSION

In conclusion, preweaning growth of calves was similar in both production systems. Post weaning growth rate of system I calves was greater, as reflected by a shorter time to slaughter compared to system II in which slow growth was achieved while grazing Tifleaf-1 pearl millet during the summer. Carcasses from both groups were similar in fat thickness, ribeye area, yield grade, and quality grade with the exception of 1981-82 system II in which a large percentage of the carcasses were graded as "C" maturity. Carcasses from system II averaged 21 lb. heavier at slaughter in this study.

Thomas is Associate Professor, Huffman is Professor, and Russell is Assistant Professor of Animal and Dairy Sciences, and Starling is former Superintendent of the Wiregrass Substation.



## SYSTEM II

In system II, 25 cows grazed pastures similar to those described for system I, except no limit grazed rye was available. Following weaning, supplemental grain was removed and the calves were allowed to graze Tifleaf-1 pearl millet rotationally through the summer followed by cool season annual forages from fall through the next spring. In late spring, calves were placed in the feedlot and fed a corn-based diet until slaughter. Calves from both systems (I and II) were slaughtered when they had an average minimum backfat thickness of 0.4 in.

Growth rates of calves from birth until weaning were similar in both systems, table 1. Calves in system I grew an average of 2.30 lb. per day during this period compared to 2.25 for the system II calves. Weaning weights of calves in system I averaged 639 lb. at 238 days compared to 615 lb. for the calves in system II.

TABLE 1. GROWTH DATA OF CALVES<sup>1</sup>

System and year	Weaning		ADG B-W Lb.	Slaughter		ADG W-SL Lb.	ADG B-SL Lb.
	Age Days	Wt. Lb.		Age Days	Wt. Lb.		
<b>System I</b>							
1981-82	228	659	2.5	556	1,297	1.95	2.18
1982-83	248	618	2.1	552	1,286	2.20	2.16
Average	238	639	2.3	554	1,292	2.08	2.17
<b>System II</b>							
1981-82	238	624	2.4	713	1,316	1.45	1.74
1982-83	244	605	2.1	724	1,322	1.49	1.69
Average	241	615	2.25	719	1,319	1.47	1.72

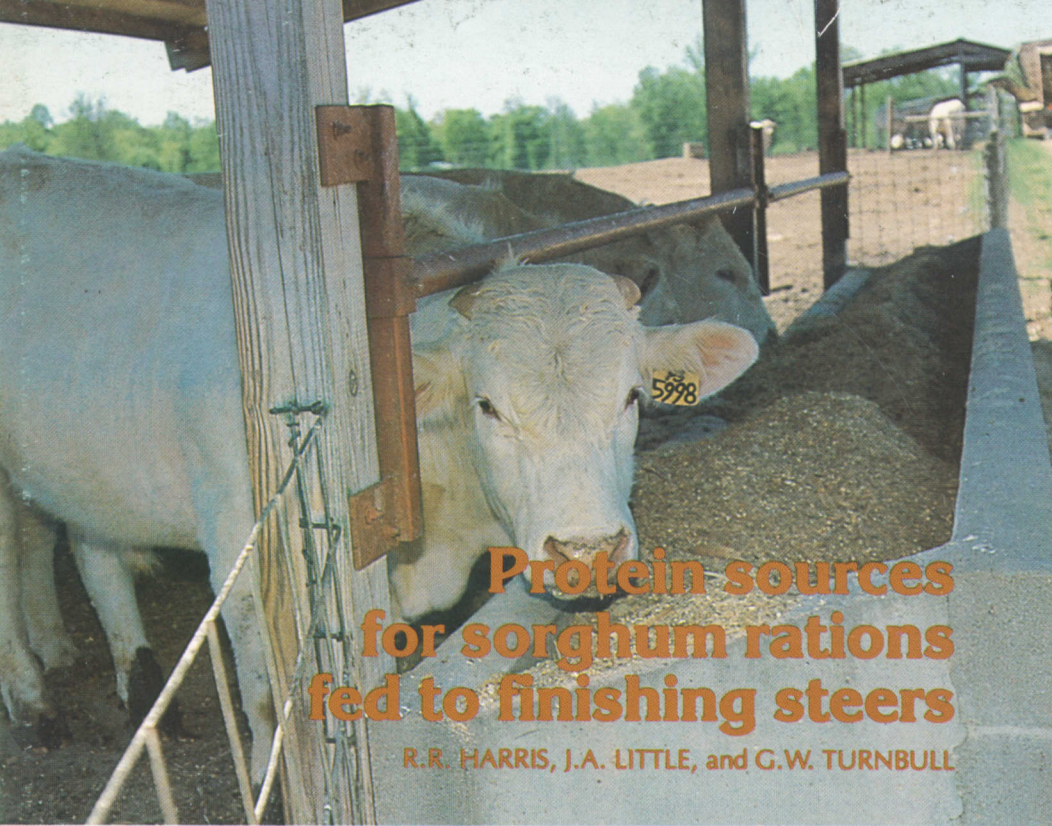
<sup>1</sup>ADG = average daily gain, B = birth, W = weaning, SL = slaughter.

TABLE 2. CARCASS TRAITS AND VALUE

System and year	Quality grade <sup>1</sup>	Yield grade	Backfat In.	REA <sup>2</sup>	Carcass wt. Lb.	Price/ lb.	Value
<b>System I</b>							
1981-82	9.5	2.7	0.57	14.7	807	\$1.05	\$847
1982-83	10.1	2.5	.44	13.5	755	.99	749
Average	9.8	2.6	.51	14.1	781	1.02	798
<b>System II</b>							
1981-82	5.5	2.4	.45	14.7	793	\$ .78	\$619
1982-83	10.4	2.7	.52	14.1	810	.88	714
Average	7.95	2.6	.49	14.4	802	.83	667

<sup>1</sup>Quality grade: high Good = 11, Good = 10, low Good = 9, high Standard = 8, Standard = 7, low Standard = 6, high Commercial = 5.

<sup>2</sup>REA = ribeye area in square inches.



## Protein sources for sorghum rations fed to finishing steers

R.R. HARRIS, J.A. LITTLE, and G.W. TURNBULL

**C**ORN IS THE predominant grain used to finish cattle in Alabama, though most animals are shipped out of state for finishing. In recent years, grain sorghum production, and subsequently its use as cattle feed, has increased in Alabama. Research by the Alabama Agricultural Experiment Station has determined which protein supplements result in optimum utilization of this alternative grain source.

The logical choice of a protein supplement would be cottonseed meal or cottonseed. Cottonseed and urea used as a protein source have been cost effective recently. Broiler litter, a by-product of Alabama's huge poultry industry, has great potential as a protein source for ruminants and is available in large quantities at low cost.

In the Auburn study, conducted at the Lower Coastal Plain Substation in Camden, urea, broiler litter, cottonseed, and cottonseed meal were compared as protein sources in steer fattening diets in which the primary grain was sorghum. Three replicates of six steers each were fed each diet for each of 3 years. Sorghum silage with a protein content of 2.42% (32% dry matter basis) was fed in conjunction with a concentrate mixture so that the protein and energy contents of the resultant rations were similar. The concentrate mix included coarsely ground sorghum grain, plus required minerals, and the appropriate protein source. The average daily intakes of sorghum silage and the concentrate mix are shown in the table. When the concentrate portion was combined with the silage, the resulting complete ration contained approximately 12% crude protein on a dry basis and about 75% digestible dry matter.

Test steers had average initial weights of

about 675 lb. and final weights averaged slightly less than 1,000 lb. Cattle were fed until a probe indicated 0.4 in. of backfat. This

measurement was used as an indicator that most of the cattle would produce Choice grade carcasses. The average time required to reach this end-point was 124 days.

As noted in the table, rate of gain varied from 2.02 lb. daily on the broiler litter ration to 2.62 lb. per day on the ration containing cottonseed. Steers gained at similar rates on the cottonseed meal and urea-containing rations (2.37 vs. 2.35 lb. ADG). Feed to gain conversions were 9.0, 9.9, 10.0, and 12.0 for cottonseed, urea, cottonseed meal, and broiler litter rations, respectively.

All carcasses were desirable with an average quality grade of low Choice and a yield grade of 2, with no significant difference due to diet. Dry matter digestibility of diets varied only slightly (74 to 78%) and differences in gain could not be explained on the basis of volatile fatty acid content of rumen fluid. Results showed that broiler litter, urea, or cottonseed can be effectively utilized as a source of nitrogen (protein) in predominantly sorghum silage + sorghum grain rations, if adjustments are made so that the energy contents of the diets are adequate.

Harris is Professor of Animal and Dairy Sciences, Little is Superintendent of the Lower Coastal Plain Substation, and Turnbull is a former Graduate Student in Animal and Dairy Sciences.

RATIONS AND PERFORMANCE DATA, LOWER COASTAL PLAIN STUDY, 3-YEAR AVERAGES, 1982-84

Item	Sorghum silage + urea	Sorghum silage + broiler litter	Sorghum silage + cottonseed meal	Sorghum silage + whole cottonseed
Initial weight, lb. ....	675	678	674	675
Final weight, lb. ....	969	928	965	1,000
Gain, lb. ....	294	250	291	325
Days ....	124	124	124	124
Average daily gain, lb. ....	2.37	2.02	2.35	2.62
Daily silage, lb. ....	25.5	13.6	28.1	26.6
Daily concentrate, lb. ....	17.6	20.5	16.9	14.5
Dry matter per lb. gain, lb. ....	9.9	12.0	10.0	9.0
Digestibility of dry matter, pct. . .	76	74	76	78
Carcass quality grade ....	12.2	11.9	11.8	11.7

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

David H. Teem, Acting Director  
PUBLICATION—Highlights of  
Agricultural Research 6/86  
Penalty for private use, \$300

11M

**BULK RATE  
POSTAGE & FEES PAID  
USDA  
PERMIT No. G269**