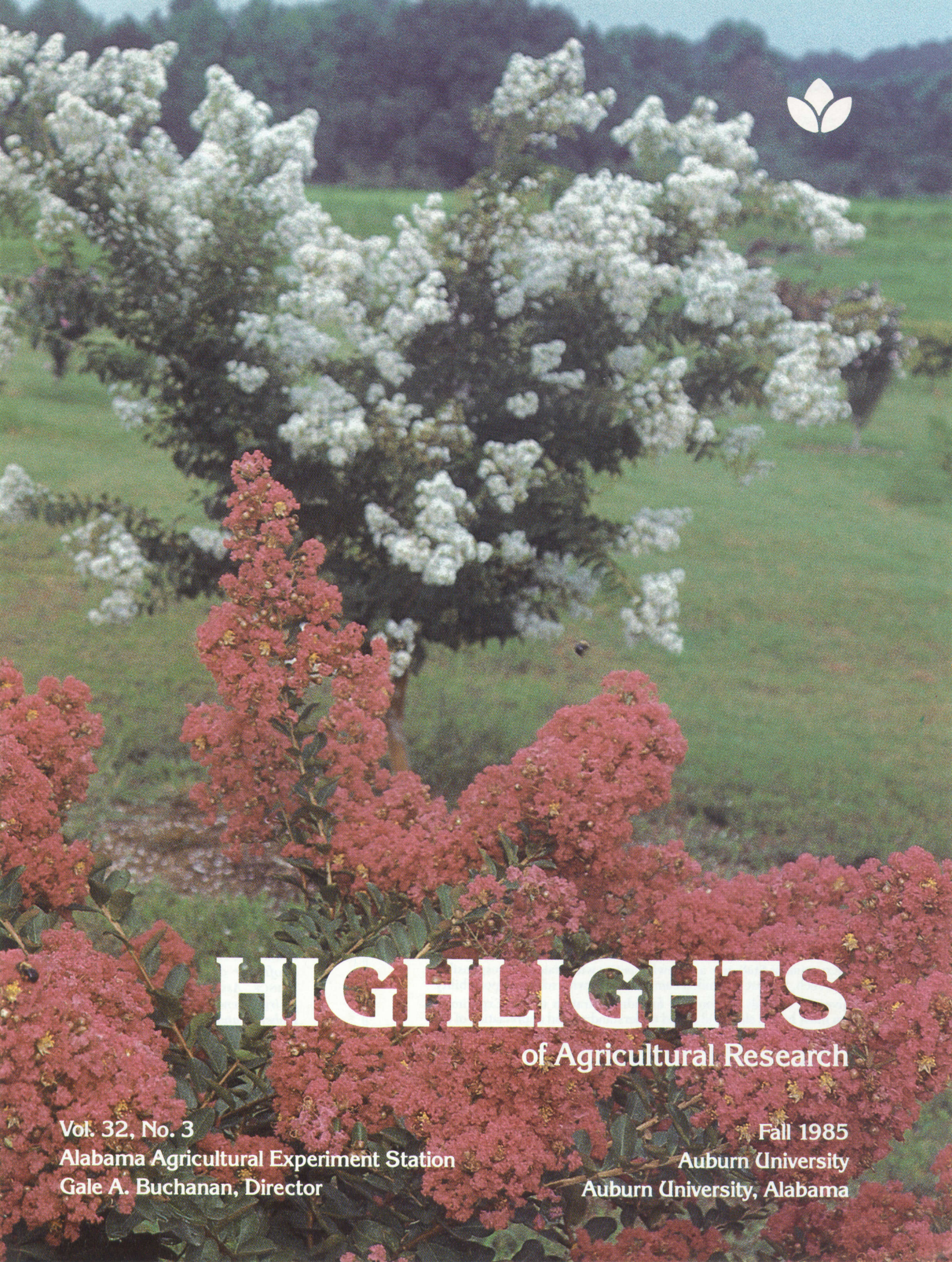

HIGHLIGHTS

of Agricultural Research

Vol. 32, No. 3
Alabama Agricultural Experiment Station
Gale A. Buchanan, Director

Fall 1985
Auburn University
Auburn University, Alabama

DIRECTOR'S COMMENTS

A NEW BOOK, "A History of the Alabama Agricultural Experiment Station: 1883-1983," was released on September 8, 1985. Author of the book is Dr. Norwood Kerr, a graduate of Auburn University's Department of History. It gives a full account of the first 100 years (1883-1983) of the Experiment Station, beginning with the turbulent conditions and problems of agriculture in the 1870's and 1880's, which provided the rationale for legislative action leading to the creation of the State Experiment Station System.

In reviewing this interesting and colorful book, it is readily apparent that the creation and subsequent development of the Alabama Agricultural Experiment Station and our nationwide system for agricultural research represent some of the most enlightened legislation conceived by man. It is a system admired by most countries throughout the world. While many countries have tried to emulate this system, it is still remarkably an American institution.

One is immediately struck with the question, "Why has the Experiment Station System been so successful?" Basically, the answer lies deep within the American phenomenon. Perhaps many of the things that make America unique also account for the strength of the State Agricultural Experiment Station System.

GALE A. BUCHANAN

While many points could be made that would support such an hypothesis, three points are central to this matter.

First, the concept of the Agricultural Experiment Station was conceived by the people who needed help--farmers. It was translated into an organization through the legislative process by elected representatives of the people.

Secondly, the State Agricultural Experiment Station System, as it exists in the United States of America today, represents one of the finest examples of synergism of the State/Federal partnership. I suspect that the expenditures of this partnership are among the best spent Federal dollars today.

Finally, the State Agricultural Experiment Station has from the beginning, and continues to this day, constantly evolved to more effectively serve its clientele. This evolution includes land use, equipment, chemicals, personnel, programs, and even organization. Most of these evolutionary steps have led to a strengthening of the State Agricultural Experiment Station System to the point that it is stronger than ever before in history.

The Alabama Agricultural Experiment Station is an integral part of this network that currently has such an awesome responsibility. Everyone has a role to play and a responsibility to keep such a worthwhile institution strong and responsive to the people it was created to serve. The scientists and all support personnel in the Experiment Station must be dedicated in carrying out clearly defined research missions that lead to productive, permanent, and effective agriculture and forest activities in the State.

All of the clientele groups served by the Experiment Station must be careful to keep expectations in a proper perspective. The Experiment Station cannot change the price of soybeans, beef, or any other commodity. It cannot solve many of the problems of agriculture as we know them today. The Legislature must not lose sight of the fact that the Alabama Agricultural Experiment Station is a statewide entity with statewide responsibilities. As such, it must be funded commensurate with such a responsibility.

University officials responsible for administration of the Experiment Station must have a clear and sound understanding and appreciation of the Experiment Station and its role in the State. It is imperative that they realize and respond accordingly to the responsibility for which they are entrusted. Failure to do so will inevitably lead to the splintering, partitioning, and ultimate destruction of this important system.

In summary, it is entirely appropriate to mention Dr. Kerr's book on the history of the Alabama Agricultural Experiment Station. It is a well-told recognition of the contributions that have been made and a delineation of the expectations for the future.

may we introduce

Dr. Tim Mack, assistant professor of entomology. A native of New York, Dr. Mack came to Auburn in 1981 from Pennsylvania State University, where he worked as a research technologist while completing his Ph.D. in entomology. He also earned an M.S. degree in entomology from Penn State and a bachelors degree in biology from Colgate University.

While at Penn State, Dr. Mack worked extensively on problems with potato insects. Much of this experience has been applied to peanuts and soybeans in Alabama, where he has helped build a nationally recognized program on insect pest research. His work on lesser cornstalk borer damage in peanuts is reported on page 8 in this issue of Highlights.

Dr. Mack is a strong supporter of the use of computer technology in research. He has been instrumental in developing computer programs for predicting buildups of peanut pests. When operable, this program has the potential to save peanut farmers millions of dollars annually in reduced pesticide cost and improved insect control, plus, providing inherent ecological benefits from more timely and efficient use of pesticides.

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ON THE COVER. Crapemyrtles in full bloom at the Piedmont Substation in Camp Hill, see story on page 4.

Thirty Years of Soil Testing in Alabama

C.C. MITCHELL, JR., and C.E. EVANS
Agronomy and Soils Research

ON FEBRUARY 1, 1953, the Alabama Agricultural Experiment Station at Auburn University officially opened its Soil Testing Laboratory for the ". . . purpose of analyzing farmers' soil samples and determining . . . the lime and fertilizer needs of farmers' fields by means of chemical methods that have been correlated with crop response in the field." Since then, over 760,000 samples have been tested for pH, lime requirement, and extractable nutrients.

Objectives of the soil testing project are: (1) to promote the most economical use of fertilizer and lime on Alabama farms, (2) to continue to work on the correlation of soil test with crop response, and (3) to collect information by summarizing soil test data which may be used for educational purposes. Field and laboratory research continues to support the first two objectives. Soil test summaries, the third objective, provide a means of observing trends in fertilizer and lime effectiveness from year to year and over several decades. The following trends were taken from annual soil test summaries covering three decades of soil testing in Alabama.

The number of soil samples has increased from 9,118 in 1954 to a record 71,747 samples in 1977, figure 1. In 1984, one sample was taken for every 30 acres of peanuts, 43 acres of cotton, 50 acres of corn, and 87 acres of soybeans planted. This falls far short of the ideal ratio of one sample for every 10 acres, but the ratio has improved concurrently with the increase in soil samples.

Early summaries indicated that few samples tested high or very high in phosphorus (P) or potassium (K) and about 28% had a pH below 5.5, figure 2. Actually, over 80% of the early samples had a pH below 5.8 and needed lime. Almost 70% needed P and over 90% needed K.

Expanding use of higher analysis fertilizers, an aggressive liming program, and a shift toward more intensive management of fewer acres of cropland contributed to the increase in samples testing high and very high in P and K and to the decrease in the percentage of samples needing lime. By 1968, 50% of the samples tested needed lime, and 49 and 46% tested high or very high in P and K, respectively.

The trend toward higher soil pH levels and higher P and K analysis ended in the early 1970's--about the time of rapid expansion of soybean acreage in Alabama, when new fields and unfertilized woodlands were brought into production. Trends are not as obvious in the yearly summaries, but are pronounced when observed over a 10-year period. Total sample numbers increased, as did the percentages of samples needing lime, P, and K. During this period, the acreage planted to soybeans in Alabama increased from 310,000 acres in 1966 to over 2.2 million acres in 1980. In 1966, soil samples for soybeans accounted for only 5% of the total samples tested but had increased to 17% of all samples by 1980. Soybeans currently rank with pasture and forage crops as the crop for which fertilizer recommendations are most frequently made, figure 1.

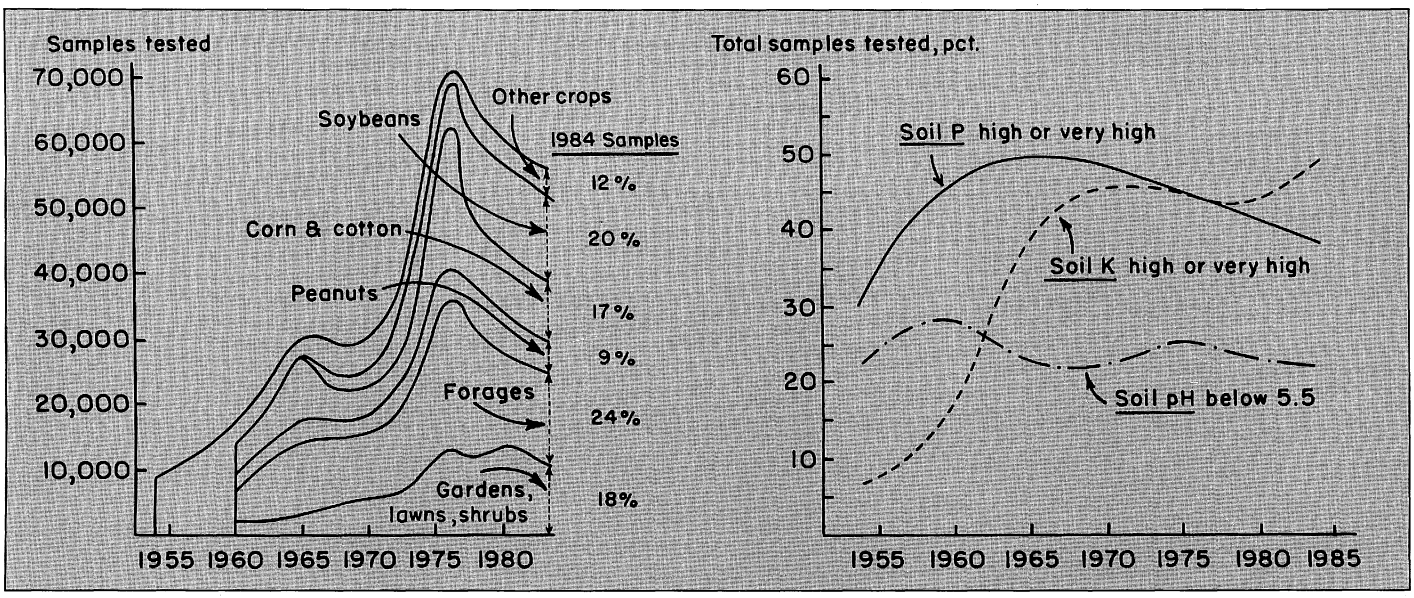
Another trend reversal occurred in the late 1970's. Once again, more samples were testing high in K with higher soil pH. However, this trend was not observed for P. An increasing number of samples from the sandy, Coastal Plains soils and the fine-textured soils of the Tennessee Valley region were testing low and medium in P, indicating a greater need for this nutrient on most crops. The number of samples from these regions testing low to medium in P has increased from 48 to 66% in the Coastal Plains and from 31 to 55% in the Tennessee Valley over the past 7 years. There does not appear to be a simple explanation for this trend based on cropping systems or fertilizer practices.

Three factors, however, may have contributed largely to this change in soil test P. One is deeper tillage that mixes the fertilizer with more soil, and another is soil erosion. The Lower Coastal Plains and Tennessee Valley regions have been targeted as areas where cropland erosion has been excessive. A third possible factor is underfertilization. Fertilizer sales indicate less fertilizer is being used than is needed based on soil-test recommendations.

Soil testing continues to be an excellent tool in soil fertility management and has potential for greater use by producers attempting to supply adequate nutrients to their crops.

FIG. 1. Use of soil testing by Alabama farmers grew rapidly from 1955 to 1977, and has dropped since that time.

FIG. 2. Changing fertilizer use and shifts in cropping systems show up in 30-year trends in soil test results.



Crapemyrtle: Promising New Selections for Southern Landscapes

D.C. FARE, C.H. GILLIAM, and H.G. PONDER, Horticulture Research
W.A. GRIFFEY and H.E. BURGESS, Piedmont Substation

CRAPEMYRTLE (*Lagerstroemia indica*) is commonly classified as a deciduous shrub, but it may also be developed into a single or multi-trunk tree reaching up to 30 ft. in height. Crapemyrtles are used as accent trees in formal or informal gardens and in street and highway plantings. *L. fauriei*, another cultivated crapemyrtle, has similar landscape potential. Both species have year round landscape attractions. In the summer, flower color may be red, pink, white, or lavender. During October and November, leaf coloration of yellows, oranges, and reds are found in irregular patterns on the same tree. During winter the smooth, exfoliating bark is a mottling of tans and greys.

An evaluation of ornamental and shade trees is being conducted at the Piedmont Substation in Camp Hill. Included in this Alabama Agricultural Experiment Station evaluation are 30 selections of crapemyrtles. These include some of the plants with the most desirable characteristics for homeowner use in Alabama.

Three outstanding white flowering crapemyrtles are *L. fauriei*, Natchez, and Byer's Wonderful White. These crapemyrtles have vigorous growth habits, lengthy flowering periods, and cold tolerance. *L. fauriei* has a flowering period from late June to early September and its flowers have a light lemon fragrance, figure 1. Natchez is the earliest to bloom of the white flowering selections and it has thick tapered panicles, figure 2. Byer's Wonderful White has panicles up to 11 in. with sparse flowers. In tests at the Piedmont Substation, *L. fauriei* and Natchez are both averaging 1½-2 ft. growth in height per year. Byer's Wonderful White is less vigorous, averaging about 1 ft. a year.

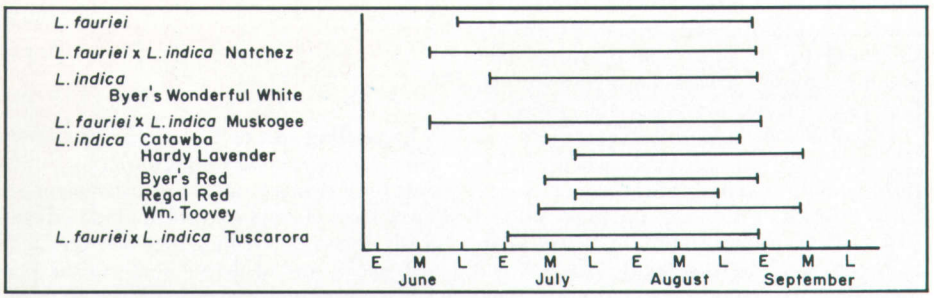


FIG. 1. Flowering duration of *Lagerstroemia* species and cultivars.

Muskogee, Hardy Lavender, and Catawba have lavender flower panicles. Muskogee has light lavender to pink flowers and blooms 55-60 days during the summer, figure 3. Hardy Lavender and Catawba have darker lavender flowers but have a shorter bloom period. Hardy Lavender and Muskogee are both upright vigorous trees, averaging 2 ft. growth a year. Catawba has a global or round-headed canopy and grows less than 1 ft. a year, figure 4.

Red flowering crapemyrtles showing the most potential in this study are Byer's Red, Regal Red, and Wm. Toovey. Wm. Toovey has the longest bloom period, which ranges from mid-July to early September. Regal Red has the darkest red flowers of this group but has the shortest period of flowering. These red flowering crapemyrtles are averaging 1½ ft. a year in height growth.

Overall, the pink flowering crapemyrtles have not been as prolific in flowering or as vigorous in growth. Tuscarora, a recently developed pink crapemyrtle, is showing promise in both flowering and growth rate. Tuscarora's flowering period is about 60 days in which the individual flowers of the panicle open about the same time, giving it a heavy bloom effect.

Winter damage was assessed on the crapemyrtles following the winter of 1983-84. Byer's Wonderful White and *L. fauriei* had no winter damage, while other white flowering selections had some stem dieback. Hardy Lavender and Catawba were not damaged but other lavender flowered crapemyrtles had some dieback. Pink flowering crapemyrtles were the least cold hardy, with branch dieback to the soil line or death. Tuscarora was an exception with little damage. Overall, the red flowering crapemyrtles were the most cold hardy; only Byer's Red suffered terminal stem dieback of about 25 in.

Research data suggest that the more recently developed crapemyrtle cultivars, Muskogee and Natchez, and the seedling selections, Hardy Lavender and *L. fauriei*, have more vigorous growth with respect to height and caliper, while *L. fauriei*, Muskogee, and Natchez have the longest flowering period. Pink flowering crapemyrtles are the least cold hardy, having branch dieback to the soil line, while red flowering crapemyrtles are the most cold hardy.

FIG. 2. Natchez crapemyrtle at the Piedmont Substation.

FIG. 3. Muskogee crapemyrtle in early July at the Piedmont Substation.

FIG. 4. Catawba crapemyrtle in late July at the Piedmont Substation.

Eggshell Pimpling Reduced by Decreasing Dietary Vitamin D_3 Levels

R. GOODSON-WILLIAMS and D.A. ROLAND, SR., Poultry Science Research
J.A. McGUIRE, Research Data Analysis

MOST CONSUMERS never see a severely pimpled eggshell, figure 1. These rough-textured eggshells are separated from market eggs during processing, not because of their appearance but because the pimples are easily broken, creating leakers.

In hens laying pimpled eggshells, a brownish-white material has been observed on the inside and outside of tissue lining the isthmus and uterus. A similar material is also found in the pimple cavities on eggshells. Because this material, isolated from the uterus and pimple cavities, contained 14 and 32% calcium, respectively, it was hypothesized that these partially calcified materials (possibly fragments of the oviduct or oviduct secretions) attach to the egg between the shell membrane and the exterior surface of the shell. The site of the pimple depends on the first area of contact. Although this explains how pimpling occurs, it offers no information as to what causes the brownish-white calcified tissue deposits in the oviduct of problem hens. Recent studies at the Alabama Agricultural Experiment Station have brought about insight into one factor, vitamin D_3, which causes soft tissue calcification and influences pimpling.

Vitamin D plays an integral part in calcium transport and calcium metabolism and therefore influences eggshell quality. Older hens have been shown to be most apt to demonstrate excessive pimpling problems. This may be associated with excessive levels of D_3 in the diet, because poultrymen normally feed D_3 at levels four to eight times the National Research Council's (NRC) recommended level and it is stored in the liver.

Excessive levels of vitamin D have been shown to cause soft tissue calcification in rats, dogs, and monkeys. Vitamin D_3's main role in calcium metabolism in the hen is to increase intestinal absorption of calcium; by so doing, vitamin D_3 increases the quantity of calcium available to the uterus for eggshell calcification. However, there may be a point at which excessive D_3 creates a greater calcium supply to the uterus than can be utilized by the bird, hence bringing about pimpling. The pimples observed on the surface of eggshells have been defined as calciferous deposits containing approximately 30% calcium. The deposition of this calcium may be facilitated by excess calcium in the uterus following eggshell calcification.

This study, which was designed to investigate the relationship between dietary level of D_3 and eggshell pimpling, involved single comb White Leghorn hens, 78 weeks of age, which were fed rations containing eight different levels of vitamin D_3. These levels ranged from 0 to 88,000 IU per kg. The NRC recommendation for D_3 is 500 IU per kg. This range of vitamin D_3 in the diet was sufficient to allow reduction or acceleration of eggshell pimpling, if influenced by vitamin D_3.

The experiment was conducted for a 10-week period with egg production, egg weight, egg specific gravity, and egg pimple scores determined bi-weekly. Eggshell pimpling was determined using a visual scoring of the eggs by an established scoring method. At the termination of the study, serum calcium, uterine calcium, sodium, and potassium levels were assayed.

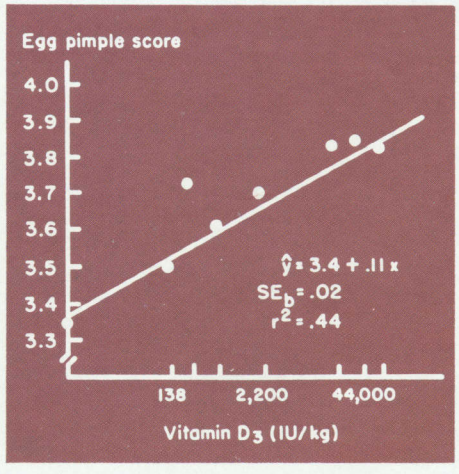


FIG. 1 (above). Severely pimpled eggshells.
FIG. 2 (right). Influence of vitamin D_3 level on eggshell pimpling.

The results revealed a significant linear relationship between vitamin D_3 level in the diet and the degree of pimpling, figure 2. As D_3 level in the diet increased, eggshell pimpling increased. This indicates that eggshell pimpling could be reduced by lowering the D_3 level in the diet or accelerated by increasing the D_3 level. Egg specific gravity was improved with increased levels of D_3. Egg production was maintained with 275 IU per kg or greater. Uterine ash and uterine calcium increased with increased D_3, indicating greater tissue calcium levels which can lead to eggshell pimpling.

Producers of table eggs may be able to significantly reduce their monetary losses due to eggshell pimpling when dealing with problem flocks. Dietary levels of D_3 may be reduced to the NRC recommendation (500 IU per kg) for those flocks with severe pimpling problems; however, if thin shells are noted in a flock, higher levels of D_3 would be necessary. The level of vitamin D_3 supplied in the ration of laying hens would be dependent on the situation, remembering that eggshell pimpling and egg specific gravity are directly related to level of D_3 in the diet.

Sensory Evaluation Establishes Value of Forage-Fed Beef

M.F. CHASTAIN and S. BERTRAM, School of Home Economics
D.L. HUFFMAN, Animal and Dairy Sciences Research, W.A. GRIFFEY, Piedmont Substation

FINISHING BEEF CATTLE on forage makes economic sense for Alabama and other Southern States. Soils and environment are better suited to forage production than to grain production, and costs should be lower than for traditional grain finishing. The only problem is the general belief that forage-fed beef is inferior in quality, a belief that has resulted in price penalties for forage-fed carcasses.

To answer questions about quality of forage-fed beef, studies were conducted by the Alabama Agricultural Experiment Station to determine (1) if differences between forage and grain-fed beef of similar weight, grade, and age could be detected by sensory evaluation, and (2) if lean flavor, fat flavor, tenderness, juiciness, and cooking losses of steaks and roasts differed between grain and forage feeding regimes. Results indicated only subtle quality differences.

Ten 18-month-old crossbred steers were divided into two groups of five each for the test. The forage group was finished to market weight on rye-ryegrass-Yuchi arrowleaf clover pastures. The feedlot-finished animals were grown out in the same pastures and then given a 90-day period of feedlot finishing on a conventional high-energy finishing ration.

All cattle were slaughtered at about 1,000 lb. body weight. Age at slaughter was about the same for both groups of cattle, although rate of gain averaged slightly higher for those finished on grain than for those slaughtered directly off pasture. USDA grades for individual animals ranged from low Good to low Choice, with no differences as a result of finishing system.

RESULTS OF PANELISTS' COMPARISON OF FORAGE- AND GRAIN-FED BEEF

Meat cut	Correct identification of sample	
	After 5-6 mo. storage	After 7-8 mo. storage
Rib roast	54%	61%
Rib steak	57%	55%
Shoulder roast ..	47%	44%

The following forequarter retail cuts were used for this study: rib roasts (5th-7th ribs, one from each side); rib steaks (1 in. thick from 10th, 11th, and 12th ribs, three from each side); and shoulder arm roasts, 2 in. thick, taken from the arm side of the standard square cut chuck (two from each side). All meat was freezer wrapped, frozen, and stored at -15°F for subsequent evaluation.

The method initially used to detect differences between pasture-fed and grain-fed steaks and roasts is known as "triangle testing." For this type of test, a sensory panel member is presented with three samples, two of which are the same. The panelist is then asked to select the sample that is different. These tests were conducted after two storage periods, 5-6 months post-mortem and 7-8 months post-mortem.

Panelists have a 33% chance of guessing the correct answer in this type test. As shown by data in the table, percentages of correct answers ranging from 44 to 61% in this study represent real differences and did not occur by chance.

Therefore, the data indicate that differences were detected between forage-fed and grain-fed beef after both storage periods, and detectable differences were greater after the longer storage period. The panelists detected less differences in shoulder roasts between the feeding treatments than were shown by the rib cuts. The differences evident at 5-6 months in the shoulder roasts tended to disappear after 7-8 months of storage.

Judges were able to distinguish between forage-fed and grain-fed rib cuts in approximately 57% of the total judging sessions. In contrast, the differences in shoulder roasts were apparent in only 46% of the judging sessions. These findings indicate the possibility that cooking methods emphasized flavor differences. Rib cuts were cooked by dry heat to the medium done stage, whereas shoulder roasts were cooked by moist heat to the well-done stage. Another explanation for the difference between shoulder and rib cuts could be the higher fat content of the rib sections. Since most flavor components are fat soluble, a higher fat content could mean a greater concentration of substances contributing to flavor.

After the initial triangle testing, the taste panel scored the rib steaks and shoulder roasts for flavor of lean, flavor of fat, tenderness, and juiciness on a 9-point scale. Rib steaks from grain-fed cattle rated slightly higher than those from forage-fed cattle in flavor of both lean and fat but slightly lower in tenderness and juiciness. Shoulder roasts from grain-fed animals rated slightly higher in flavor of lean and fat and also were judged to be slightly more juicy. Tenderness scores were slightly lower for shoulder roasts from grain-fed beef.

All scores indicated that meat from both feeding regimes was acceptable. The panel did not detect any differences in the steaks, but did rate the shoulder roasts from grain-fed animals slightly higher than those from forage-fed cattle for all attributes except tenderness.

Rib cuts (roasts and steaks) from forage-fed cattle showed slightly higher total cooking losses (25.9%) than did similar cuts from grain-fed cattle (24.3%). Rib roasts lost more weight than did rib steaks (27.2% vs. 23.0%). Shoulder roasts from both feeding regimes showed higher cooking losses than rib cuts (38.5% vs. 25.9%). The higher losses with the shoulder roasts can be attributed to longer cooking times and the moist heat method of cookery in contrast to the dry heat used for rib steaks and roasts.

Results from this study indicate there is little difference in beef quality between grain-fed and forage-finished cattle. Although subtle differences in flavor do exist between beef cuts from forage and grain-fed cattle, finishing on forage certainly does not render the cuts unacceptable.

EFFECTS OF ACID RAIN ON SURFACE WATERS IN ALABAMA

CLAUDE E. BOYD, Fisheries and Allied Aquacultures Research

THERE ARE MANY reports, primarily from the Northeastern United States, eastern Canada, and northern Europe, demonstrating adverse effects of acid rain on aquatic ecosystems. Extensive media coverage of the problem has caused considerable public concern over the possible impact of acid rain on fish in Alabama. A survey was conducted by fisheries researchers at the Alabama Agricultural Experiment Station to determine the effects of acid rain on ponds and streams in the State.

Acidity usually is expressed in terms of the negative logarithm of the hydrogen ion concentration, or pH. The pH scale extends from 1 to 14. A solution of pH 7 is neutral; it is neither acidic nor alkaline. A solution with a pH less than 7 is acidic, while one with a pH greater than 7 is alkaline. Solutions are more acidic or more alkaline depending on how far the pH is below or above 7. Fish and other aquatic organisms grow best at pH values between 6 and 9; pH values below 4 and above 11 are quickly lethal, see figure. When the pH of bodies of water falls below 5, there is a marked reduction in the abundance, production, growth, and diversity of plants and animals. Fish suffer acute mortality, reduced growth, reproductive failures, and skeletal deformities, and sensitive species disappear.

Some may be surprised to learn that rainwater is normally acidic. Rainwater is saturated with carbon dioxide that makes it acidic. The pH of uncontaminated rain is about 5.6. The combustion of wood, coal, and petroleum releases potentially acidic compounds into the atmosphere. These substances oxidize in the atmosphere to form sulfuric, nitric, and hydrochloric acids—primarily sulfuric acid. These acids dissolve in rainwater and depress its pH.

Rainfall at many locations in the Northeastern United States has annual mean pH values as low as 4, and rain from individual storms may be even more acidic. The average annual pH of rain at Auburn, Alabama, during 1984 was 4.51. The pH of rain from individual storms ranged from 3.52 to 5.61. Therefore, rain at Auburn, and presumably at other places in Alabama, is contaminated with strong acids. The degree of acidity is, however, somewhat less than that of rain in the Northeastern United States.

The influence of acid rain on surface waters depends on the degree to which water can resist pH change when acid is added. The total alkalinity of water provides an index of its ability to neutralize acids. Surface waters with total alkalinities less than 10 parts per million (p.p.m.) are classified as highly sensitive to acidification; those with total alkalinities of 10 to 20 p.p.m. are classified as moderately sensitive; waters with total alkalinity values above 20 p.p.m. are considered resistant to acidification.

Results of a survey of total alkalinity in ponds and streams on the five major soil areas of Alabama are shown in the table. Most waters of the Coastal Plains, Piedmont Plateau, and Appalachian Plateau are highly or moderately sensitive to acidification. The most acid resistant waters are in the Prairies, but this soil area comprises only a small portion of the State.

Many surface waters in Alabama potentially could be impacted by acid rain, but at present, there is no evidence that acid rain has caused any adverse changes in aquatic ecosystems within the State. Hopefully, regulations on emissions from the combustion of fossil fuels are adequate to prevent rain in Alabama from becoming more acidic. Fortunately, the atmospheric flow pattern over Alabama usually does not transport air pollution from heavily industrialized areas into the State.

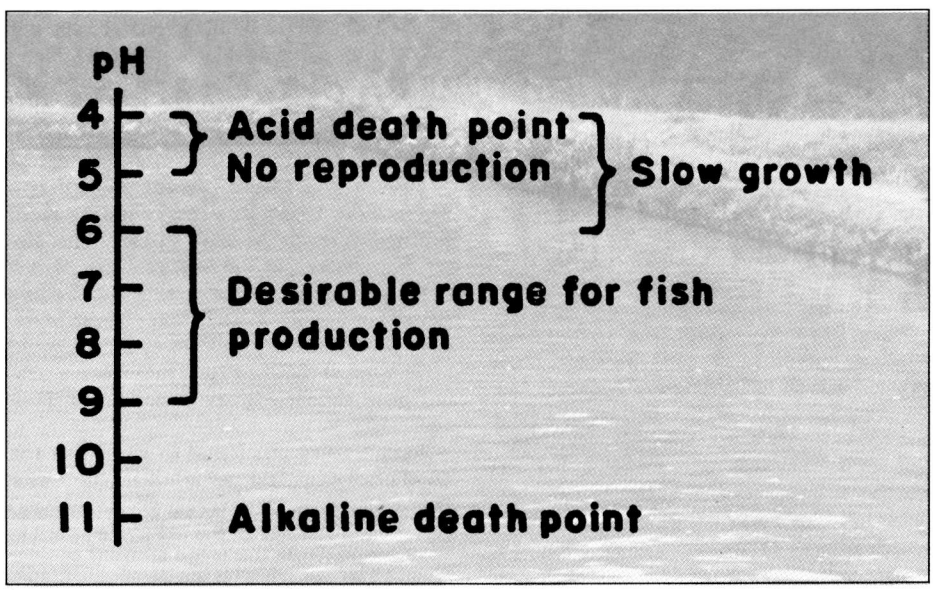
Ponds are important both for recreational value and for commercial fish production in Alabama. If total alkalinity is less than 20 p.p.m. in ponds, agricultural limestone applications are recommended to neutralize acidity and improve conditions for fish production. Sport fish ponds are fertilized with nitrogen and phosphate fertilizers. On an annual basis, acidity resulting from the nitrogen in fish pond fertilizer is 15 to 30 times greater than the input of acidity from acid rain. Therefore, acid rain is of little concern in the management of sport fish ponds in Alabama. Agricultural limestone applied to counteract other sources of acidity in ponds will mitigate any potential influence of acid rain.

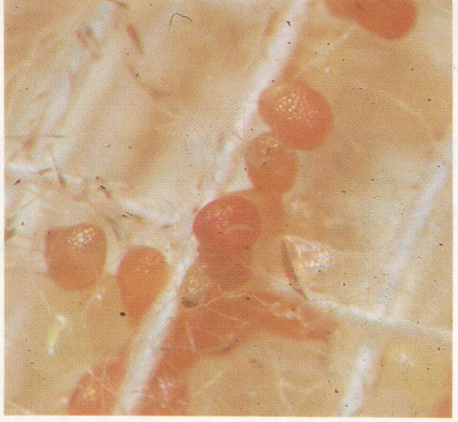
Of course, liming can and has been used to counteract the effects of acid rain in large lakes and streams in regions where acid rain is impacting aquatic ecosystems. However, large amounts of lime are often required and the applications must be repeated every few years. Economic considerations likely will prohibit the use of liming as a preventative measure for acid rain in all but highly valued bodies of water.

TOTAL ALKALINITY OF PONDS AND STREAMS OF MAJOR SOIL AREAS OF ALABAMA

Soil area	Av. total alkalinity	Samples below 10 p.p.m.	Samples with 10 to 20 p.p.m.
	p.p.m.	*Pct.*	*Pct.*
Prairies	55.5	8	8
Limestone Valleys and Uplands	49.2	11	20
Appalachian Plateau	22.0	24	32
Coastal Plains	12.9	43	46
Piedmont Plateau	12.3	36	56

Water pH range for fish production.





Why are lesser cornstalk borers a hot and dry weather pest of Alabama peanuts?

T.P. MACK, C.B. BACKMAN, and H.W. SMITH, Zoology-Entomology Research

FIG. 1. Lesser cornstalk borer eggs, larvae, and adults. The pupal stage is not illustrated. From top to bottom, eggs are shown in 1A, larvae, with characteristic silken tube, in 1B, adult males in 1C, and adult females in 1D. Photos courtesy of John French and Max Bass.

LESSER CORNSTALK BORER is a major insect pest of peanuts in Alabama, with damaging population outbreaks typically occurring in hot, dry weather, and on sandy soils. In the drought plagued season of 1980, lesser cornstalk borers caused over $43 million in damage to peanut crops in Alabama, Georgia, Oklahoma, and Texas. Why it is more severe in hot, dry weather is being studied at the Alabama Agricultural Experiment Station as part of a research project to develop a microcomputer-based model that will predict when damaging populations of lesser cornstalk borers will occur. To do this, the life cycle of the lesser cornstalk borer was studied in detail.

Eggs of the insect, figure 1a, are laid singly within ¼ in. of the soil surface under the peanut canopy. Newly hatched larvae crawl across the soil from the oviposition site and feed on a peanut plant or other edible organic matter. Larvae spend most of their time below the soil's surface and construct a silken tube, figure 1b, interwoven with soil particles, which is attached to the plant. Pupation occurs in the soil, and the adult moths, figures 1c and 1d, are active at night. Female moths appear to lay eggs only at night, and may spend a significant amount of time away from peanut fields.

Since lesser cornstalk borers are cold-blooded, temperature changes will definitely affect their rate of growth and development. The growth rate and hence the feeding rate of lesser cornstalk borers were found to be temperature dependent, with hot weather greatly increasing lesser cornstalk borer feeding.

Lesser cornstalk borers spend most of their life cycle as larvae, figure 2. This stage lasts 455 F degree days. The lower developmental threshold for lesser cornstalk borers has been determined to be 59°F, so it would take 13 days with an average daily temperature of over 94°F [(94 - 59) X 13 = 455] for a newly emerged lesser cornstalk borer larvae to reach pupation. An average temperature of 94°F would be difficult to achieve, since it would require a daily maximum of 112°F and a minimum of 76°F [(112 + 76) ÷ 2 = 94]. These are soil temperatures, however, that can be reached in July and August when peanuts begin to wilt from lack of moisture.

Leaves of a wilted peanut plant droop when under moisture stress, allowing more sunlight to reach the soil's surface. This significantly increases soil temperatures, which in turn will increase the growth and feeding rate of any lesser cornstalk borer larvae in the soil. So, lesser cornstalk borer larvae could be feeding at their greatest rate when a peanut plant cannot withstand significant damage.

Temperature was found to also affect the number of eggs laid per adult female lesser cornstalk borer. In a laboratory study at Auburn, adult females laid two times more eggs, at a two times faster rate when they were held at a constant temperature of 89°F, compared to those held at a constant temperature of 72°F. Thus, hot temperatures are conducive to the laying of a large number of lesser cornstalk borer eggs.

High soil moisture has been known to inhibit the development of lesser cornstalk borer populations, but the mechanisms for this have, until recently, been unknown. Research has shown that small larvae emerged from the soil when it was moist, and either stayed on the soil's surface or attacked the plant above the soil line. This behavior exposed the larvae to predation by big-eyed bugs. Soil moisture-holding capacity is directly related to soil type, with sandy soils having the least soil water-holding capacity. Thus, sandy soils dry out the fastest, indicating that small lesser cornstalk borers in sandy soils would be exposed to predation less than those in high clay content soils.

Soil moisture may also affect oviposition. Lesser cornstalk borers laid 98% of their eggs in the soil when it was dry and only 55% in wet soil. The other eggs were laid on the plant, where they would be exposed to egg parasites and predators.

So, why *do* lesser cornstalk borer outbreaks occur in hot and dry weather, and typically on sandy soils? It appears that the effects of temperature on the total number of eggs per female, the number of eggs laid per day, and the growth and feeding rate of the larvae are important. Also, the effects of soil moisture on the behavior of small larvae and on the oviposition site selection by the adults are important. Since lesser cornstalk borers have two to four generations during the peanut growing season, hot and dry weather must coincide with a major moth flight to produce a damaging outbreak.

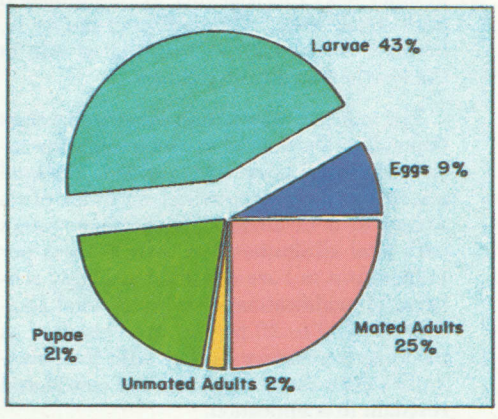


FIG. 2. Life cycle of the lesser cornstalk borer and the percentage of the life cycle spent in each stage. Note the large amount of time spent as larvae, which is the damaging stage.

COGONGRASS and TORPEDOGRASS TROUBLESOME IN COASTAL AREA

J.W. WILCUT, B. TRUELOVE, and D.E. DAVIS
Botany, Plant Pathology, and Microbiology Research

COGONGRASS AND TORPEDOGRASS, troublesome weed pests in many areas of the world, are now subjects of concern in the Deep South. Introduced into the United States from Southeast Asia in the mid- to late 1800's and early 1900's, these perennial grasses have become serious weed problems in Florida and along coastal areas of Alabama and Mississippi. In fact, torpedograss is now considered the most serious grass weed in Florida.

One reason for concern about cogongrass is the fairly rapid spread in recent years, which has been confirmed by Alabama Agricultural Experiment Station research. As noted in the maps, this spread has been northeastward along Interstate 85 from Mobile to Montgomery, carried by prevailing winds off the Gulf or distributed through ornamental nursery stock contaminated with rhizomes or seed of the grasses.

There is concern about the spread because of the extensive rhizome systems of both weeds, and seed production of cogongrass. However, other Experiment Station studies have shown that these grasses are held back by cold weather, which should slow its spread northward.

Cogongrass can be controlled by cultivation, so it is more troublesome in perennial crops that receive little cultivation, or along rights-of-way. It also could be a serious pest in minimum-tillage cropping systems. The upright-growing plant (title photo) is highly inflammable, even when green, so it represents a fire hazard. It flowers in May, producing 90% viable seed which are a factor in its spread.

Torpedograss is a wiry, erect or creeping grass that spreads only by rhizomes. It has been found as far north as Lee County. This grass is primarily a weed of roadsides, drainage ditches, yards, and orchards, but it has the potential to become a pest of row crops. Unlike cogongrass, it is not controlled by cultivation. Instead, cultivation tends to spread torpedograss.

Results of Experiment Station research help explain why cultivation controls cogongrass but spreads torpedograss. Cogongrass rhizomes usually form buds that can grow into new plants only near the apices of rhizomes growing vertically towards the soil surface. Cutting off the apical 1-in. portion of these vertically growing rhizomes was found to destroy the rhizome's ability to produce new plants. The remainder of the rhizome generally does not produce buds and thus cannot produce new plants.

In contrast, torpedograss was found to have buds capable of producing new plants along the entire length of the rhizome. Cutting the rhizomes or breaking them up by cultivation results in many fragments, each capable of regenerating into a new plant.

Another aspect of the study revealed that burying cogongrass rhizomes deeper than 2-3 in. greatly reduces the production of new aerial shoots. Therefore, cultivation may kill cogongrass by burying it at depths below those at which it can emerge. Torpedograss, on the other hand, had emergence reduced only by burying at depths greater than 3-6 in.

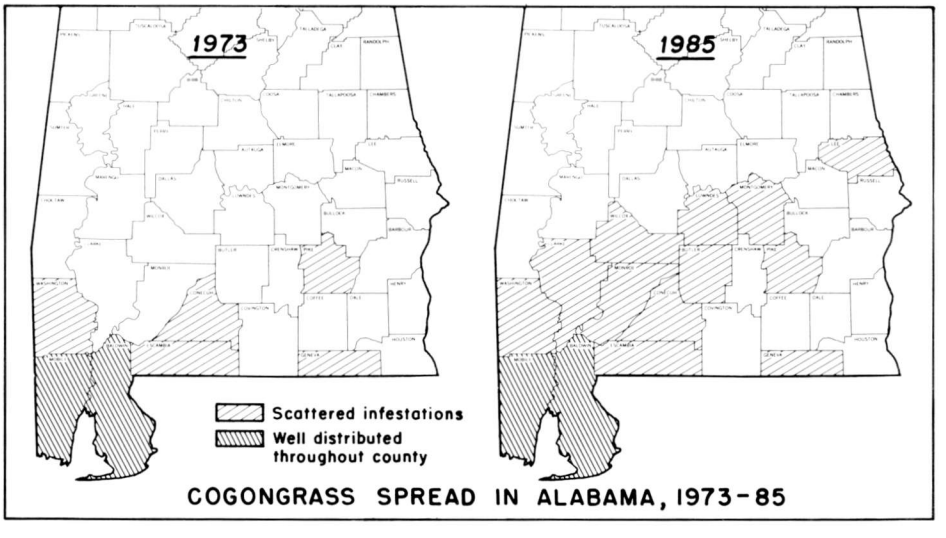
The effects of temperature are illustrated by the finding that rhizomes of both grasses are killed by 24-hour exposure to 23-25°F. This sensitivity to low temperatures, coupled with the fact that buds of cogongrass and torpedograss will not emerge if they are buried too deeply, makes it unlikely that the rhizomes of these grasses could survive the winters of more northerly states.

While low temperature sensitivity may limit the geographical range or distribution of a species, average temperatures of the warmest portion of a growing season may also be low enough to reduce competitiveness. When studied at different temperatures, it was found that growth of both was substantially decreased by temperatures like those of the Midwest and further north, see table.

Based on the Experiment Station studies, it appears that cogongrass and torpedograss are unlikely to become a serious weed problem out of the Gulf Coast region. Cogongrass is presently a more widespread problem than torpedograss, probably because torpedograss is not distributed by seed. However, it is anticipated that both grasses will continue to extend their range within the region and become increasingly troublesome.

EFFECTS OF TEMPERATURES ON GROWTH OF COGONGRASS AND TORPEDOGRASS 56 DAYS AFTER PLANTING

Species	Dry matter production at different day/night temperatures		
	86°/77°F	81°/72°F	75°/64°F
	Grams	*Grams*	*Grams*
Cogongrass	2.90	2.06	1.60
Torpedograss ..	3.42	2.59	1.80



COGONGRASS SPREAD IN ALABAMA, 1973-85

More Knowledge of Estate Planning Needed by Alabama Farmers

S.C. BELL and A.A. O'MARY
Agricultural Economics and
Rural Sociology Research

FARM ESTATE PLANNING is concerned with creating and implementing a plan for the future of a farm business. Among the potential benefits, the chance to minimize estate taxes offers a strong incentive for farmers to do some estate planning.

With such obvious advantages, why is estate planning used so little? Lack of knowledge about the general subject, which showed up in an Alabama Agricultural Experiment Station study, is a likely reason.

Data on estate planning were collected by questionnaire from farmers throughout Alabama (total of 200). The questionnaire not only measured farmers' knowledge about objectives of estate planning, but also determined their understanding of specific legal areas by presenting yes or no type questions based on hypothetical "fact situations."

A total of 32 fact situations was used, divided into 13 groups. Answers given were checked in conjunction with Alabama statutory law and case laws to determine correctness. The percentage of correct answers ranged from a low of 19 for the area of "marital deduction" to 88 for "current use valuation," as given below:

Subject area and number of fact situations	*Pct. correct answers*
Land ownership (5)	54
Life estate (3)	60
Business organizations (2)	53
Intestate succession (3)	59
Distributive share (2)	31
Deeds (2)	84
Gifts (5)	35
Life insurance (2)	59
Marital deduction (1)	19
Current use valuation (2)	88
Generation skipping (1)	60
Trusts (2)	51
Simultaneous death (2)	68

LAND OWNERSHIP included five fact situations. Both the high and low correct percentages for this subject area were about tenants in common. Farmers had least understanding about the fact that tenants in common can will their interest in property to whomever they choose. In the area of joint tenancies, farmers understood fairly well that a joint tenant with "right of survivorship" will get the property even though it was given to someone else by will. They seemed to understand that the deed, in this case, determines who gets the property rather than the will.

LIFE ESTATE had three fact situations, one of which concerned the clear-cutting of timber by a life tenant (one who holds the property until his death). Only 19% of the farmers got this situation correct, indicating that farmers lack knowledge about the rights of a life tenant where standing timber is involved. The life tenant has the responsibility to keep real property in a reasonable state of maintenance; he can't clear cut timber and sell it without the permission of the remainderman (the other person having legal right to the property).

BUSINESS ORGANIZATION had two fact situations, with farmers having a high score of 64% correct for the situation on corporations and a low of 41% correct on the situation about limited partnerships. The important point is that, if a limited partner takes an active part in management, he will lose his limited liability status and become liable the same as a general partner.

INTESTATE SUCCESSION was fairly well understood although many farmers were not aware of the revised laws on the subject. One new provision is that if a person dies without a will, with a wife and one son, the wife only gets $50,000 plus one-half of the balance of the estate. In one of the situations on distributive share, the husband tried to disinherit his wife by willing his farm to his parents. Many farmers knew they could not completely disinherit their wives, as indicated by the 57% correct responses. The situation which dealt with a wife having a separate estate larger than her husband's estate had only 5% correct answers, the lowest of all of the 32 fact situations. In this situation, if the husband leaves his wife out of his will the wife cannot get any of her husband's estate.

CURRENT USE VALUATION provisions were generally well understood. The two fact situations dealt primarily with the question of whether the farmer was qualified to use this method of valuing his farm, not with the details of actually valuing the farm.

DEEDS covered two fact situations. One of these situations dealt with a person giving a quitclaim deed to transfer property with a mortgage. Most farmers, 95 percent, knew this deed only transferred one person's right to the property and did not give a clear title. The other situation, which dealt with the fact that usually whoever records a deed first has the best title, received 72% correct answers.

GIFTS had low correct answers in the area of current law that husband and wife are able to give $10,000 to each child tax free. This fact is important if a person has a large estate.

LIFE INSURANCE questions only covered two fact situations. Most (73%) knew that if a person transfers ownership of an insurance policy to someone else, the insurance proceeds will not be included in his estate.

MARITAL DEDUCTION had only one fact situation, and farmers had little knowledge about the revised law which gives the surviving spouse an unlimited marital deduction.

GENERATION SKIPPING had only one fact situation because it was not one of the major estate planning tools covered in the study. Six out of 10 respondents knew if the father was given a life estate and the grandson was given title to the property, the property would not be taxed in the son's estate.

TRUSTS were covered by two fact situations, one on revocable trusts and the other on irrevocable trusts. Farmers scored average correct responses of 51% for these two situations even though only 2.5% had made use of trusts in their estate planning.

SIMULTANEOUS DEATH was the last area. Farmers had an average of 68% correct responses for the two fact situations cited. An absence of prior planning for simultaneous death could cause unnecessary disagreement among the beneficiaries and result in property being distributed contrary to the wishes of the decedent.

This study found only a fair level of legal knowledge about the broad field of estate planning among farmers. Thus, there is a need for farmers to be more knowledgeable about the most recent laws on estate planning. Such knowledge can, in many instances, save a substantial amount in estate taxes, especially if there is a large estate involved.

WHEAT vs. CORN for Growing-Finishing Beef Diets

D.A. DANILSON, Animal and Dairy Sciences Research
W.B. WEBSTER and V. CALVERT, Tennessee Valley Substation

INCREASING THE NUMBERS of fed cattle in the Southeast is a major ingredient in the development of a feedlot-finishing industry for this region. Lack of fed cattle is due mainly to the corn grain deficiency status of the region, in addition to the tradition of finishing cattle in Corn Belt and Southwestern feedlots.

The use of alternative grains in beef cattle finishing rations is one method of increasing cattle finishing capacities in the Southeast. Recent competitive pricing relationships between wheat and corn, combined with the wheat production capabilities in the region, indicate the need for further evaluation of wheat as a major feed grain source in diets of beef cattle.

A study at the Tennessee Valley Substation, Belle Mina, compared the effects of wheat and corn, fed at various levels and in different forms, on feedlot performance and carcass characteristics of 80 head of crossbred beef cattle. A two-phase growing-finishing system was used in comparing four wheat- or corn-based rations.

In the 84-day growing phase, corn silage supplemented with either corn or wheat at 1% of body weight (dry matter basis) was fed. In the 112-day finishing phase, cattle were shifted to high concentrate diets based on the same grain sources as previously provided in the growing phase.

The finishing-phase dietary treatments, which comprised 85% of the ration, were (1) cracked corn; (2) whole wheat; (3) rolled wheat; and (4) rolled wheat/cracked corn mixture with equal proportions of each grain. Cottonseed hulls and molasses comprised 12.5% of the finishing-phase rations. A protein-mineral-Rumensin mixture was supplemented during both feeding phases at the rate of 0.5 lb. per head per day.

In the growing phase, steers fed whole wheat plus corn silage exhibited poor performance, see table. In contrast, steers fed rolled wheat plus corn silage gained 9% faster, were 29% more efficient, and cost 8.8% less to produce than steers fed whole wheat. It is thus apparent that in high roughage rations, especially those utilizing corn silage, wheat grain must be processed to achieve optimum and economical performance. The cracked corn and rolled wheat-cracked corn treatments were similar to the rolled wheat diet in the growing phase, however, cattle consuming the rolled wheat tended to express a slight advantage in all growing-phase performance variables.

In the finishing phase, no significant differences were found for the feedlot performance variables. However, steers fed whole wheat and rolled wheat diets tended to grow slower, were less efficient, and more costly than steers fed rolled wheat-cracked corn and cracked corn diets. The cracked corn diet produced a slightly greater average daily gain (ADG) during the 112-day finishing phase than the rolled wheat-cracked corn treatment, but feed efficiencies were identical and the rolled wheat-cracked corn diet was slightly more economical. In the whole wheat and rolled wheat treatments, performance levels of the majority of individual steers were similar to steers in the rolled wheat-cracked corn and cracked corn treatments. However, approximately 30% of the steers in whole wheat and rolled wheat finishing treatments had an ADG of only 2.15 lb. This may indicate an acidosis problem, which is known to occur on high wheat diets.

Steers fed whole wheat produced carcasses which were lighter in weight than carcasses from steers on the other diets. Lower adjusted backfat levels and lack of any Yield Grade 4 or 5 carcasses indicated these steers had leaner carcasses than other treatment steers. In addition, whole wheat carcasses tended to have a higher quality grade, whiter fat color score, and higher carcass value per hundredweight. However, steers on the whole wheat diet returned less total value, due primarily to lower carcass weight. This was a reflection of the poor feedlot performance exhibited by these steers during the feeding phases. Although there were no significant differences in other carcass traits among the treatments, rolled wheat-cracked corn and rolled wheat treatment carcasses tended to be slightly fatter than cracked corn and whole wheat carcasses, as indicated by greater amounts of subcutaneous fat cover (adjusted backfat) and also greater number of Yield Grade 4 and 5 carcasses.

Steers on the cracked corn and rolled wheat-cracked corn diets returned the greatest total value. For steers on the cracked corn diet, this was due to greater lean yield; in the case of steers on the rolled wheat-cracked corn diet, it was due to higher average quality grade.

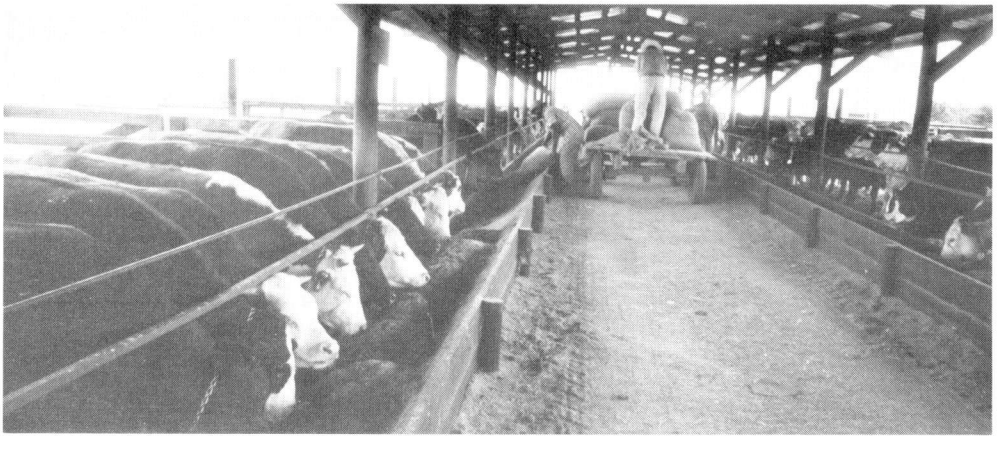
These Alabama Agricultural Experiment Station results show that wheat is effective as a major source of grain in growing and finishing diets of beef cattle. The overall poor performance of steers fed whole wheat indicates that wheat must be processed prior to feeding. In this study, rolled wheat yielded excellent performance and was economical in both the growing and finishing phases. This was especially evident, however, in the corn silage based growing ration.

Rolled wheat-cracked corn, in the 50/50 combination used as the grain source in the finishing phase, supported excellent performance and efficiency. From a total performance standpoint, it was the most economical diet in this study.

DIETS, PERFORMANCE, AND COSTS[1]

Treatments	Growing phase			Finishing phase			Total	
	84-day ADG	FE[2] (DM)	Cost[3] /lb. gain	112-day ADG	FE[2] (DM)	Cost[3] /lb. gain	196-day ADG	Cost[3] /lb. gain
	Lb.		*Dol.*	*Lb.*		*Dol.*	*Lb.*	*Dol.*
Cracked corn	2.64	6.8	0.407	2.86	7.5	0.548	2.77	0.491
Whole wheat	2.07	9.2	.551	2.67	9.2	.617	2.41	.593
Rolled wheat	2.90	6.5	.374	2.60	8.3	.575	2.73	.484
Wheat/corn	2.78	6.6	.395	2.79	7.5	.533	2.79	.474

[1]Values based on treatment means, 20 steers/treatment, 2 replicates/treatment.
[2]Feed efficiencies calculated from pen averages.
[3]Cost per lb. gain, based on wheat and corn priced at $3.15 per bu. and corn silage at $20 per ton.



Relationship Between Grain Moisture and Harvestable Sorghum

J.T. TOUCHTON, Agronomy and Soils Research
D.P. MOORE, Prattville Experiment Field

ALLOWING GRAIN SORGHUM to dry in fields can result in yield losses through bird depredation and grain deterioration. Harvesting high moisture grain, however, requires expensive drying facilities or chemical preservatives. In recent years, there has been some interest in spraying the head and upper leaves with sodium chlorate prior to harvest to desiccate green stemmy material and speed up grain drying, which would permit easier and earlier harvesting.

The purpose of this study at the Alabama Agricultural Experiment Station was to determine the effects of sodium chlorate on grain moisture and yields. Results indicate sodium chlorate has little effect on grain moisture, but it may facilitate harvesting by desiccating the green leaves and stems in the upper part of the plant.

The sorghum, Northup King Savanna 5, was planted April 16, 1984. Row width was 24 in. and seeding rate was 80,000 seed per acre. Treatments consisted of five application dates (1 week between treatments) for sodium chlorate (6 lb. active ingredient per acre), which began just prior to maturity.

Two rows were harvested weekly from the control and from each treatment for 6 weeks after treatment application. The sorghum heads were cut by hand and threshed on a stationary thresher; consequently, reported grain yield, table 1, would reflect grain produced and not necessarily the amount that could be harvested by a combine. Grain moisture, table 2, was determined and grain yield calculations were adjusted to 13% grain moisture.

Based on yield data, table 1, the grain sorghum reached maturity approximately July 27. From July 20 to 27, grain yields increased 40 bu. per acre. During this 1-week period, grain moisture dropped 9 percentage points. During the 1-week period between July 27 and August 3, there was a decrease in harvestable grain of 3.4 bu. per day, but grain moisture dropped only 2 percentage points. From August 3 to 10, grain moisture decreased 11 percentage points, but grain losses were not significant. During the 49 days between August 10 and September 28, there was a slow but steady decline in grain moisture of 0.11 point per day and in harvestable grain of 0.33 bu. per day. Judging from multiple regression models, the moisture level at which maximum harvestable grain was obtained was 31.2%. Harvestable grain decreased 1.5 bu. per acre for each 1 point drop in moisture below the 31.2% moisture level.

Applying sodium chlorate prior to maturity (43.4% grain moisture) enhanced grain drying. Seven days after application, grain moisture was 4% lower with (30%) than without (34%) sodium chlorate, and after 14 days, grain moisture was 7% lower with (25%) than without (32%) sodium chlorate. After 21 days, grain moisture was approximately the same (20%) for the treated and untreated sorghum. Applying sodium chlorate just prior to maturity did not reduce grain yields. As with non-treated sorghum, grain yield declined rapidly (4.1 bu. per day) from July 27 to August 3.

Applying sodium chlorate after grain moisture dropped to 34% or lower did not affect grain moisture. Regardless of date of application, sodium chlorate was eventually detrimental to yields. From 4 to 6 weeks after application, the sodium chlorate resulted in rapid loss in grain yields. The loss was due primarily to stem breakage at the flag leaf collar. After initiation of rapid head breakage, yield loss within the first 7 days averaged 29 bu. per acre.

The results of this study suggest that the use of sodium chlorate will have little effect on actual grain moisture. However, it may desiccate the green leaves and stems in the upper part of the plant, which should facilitate harvesting. If it is used, the sorghum should be harvested within 3 weeks after application to prevent excessive yield losses. The results also suggest that maximum harvestable grain occurs at moisture levels exceeding 30%; and allowing the grain to dry to 14% moisture can reduce harvestable yields over 30%. There is a possibility the results from this study are variety specific, and the relationship between grain moisture and harvestable grain may be different for other varieties. In addition, drying cost and combine inefficiency may offset the yield advantage associated with harvesting at high grain moisture.

TABLE 1. GRAIN SORGHUM YIELDS AS AFFECTED BY HARVEST DATE AND SODIUM CHLORATE APPLIED AT VARIOUS GRAIN MOISTURE LEVELS

Harvest date	Grain yield/acre[1], by moisture at treatment					
	Check	43%	34%	32%	20%	17%
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
July 20	96					
27	136	140				
Aug. 3	112	111	119			
10	106	108	100	116		
17	108	108	106	105	104	
24	96	94	96	98	93	91
31	96	63	55	68	98	99
Sept. 7	100		60	66	104	90
14	104			74	92	96
21	91				70	94
28	90					76

[1]Grain yields are adjusted to 13% moisture.

TABLE 2. MOISTURE IN SORGHUM GRAIN ON VARIOUS HARVEST DATES AS AFFECTED BY SODIUM CHLORATE APPLIED AT VARIOUS GRAIN MOISTURE LEVELS

Harvest date	Grain moisture at harvest, by moisture at treatment					
	Check	43%	34%	32%	20%	17%
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
July 20	43.4					
27	34.0	30.2				
Aug. 3	31.6	25.0	32.3			
10	20.0	19.2	19.4	19.6		
17	17.4	15.0	15.8	16.8	17.0	
24	18.8	18.0	16.9	17.9	18.6	18.4
31	16.0	15.7	16.3	16.3	15.0	15.4
Sept. 7	15.3		15.6	15.7	15.5	16.2
14	15.6			15.5	15.6	15.9
21	16.5				15.7	16.2
28	14.7					14.8

Temperate Zone Woody Plants for Interior Landscapes

G.J. KEEVER, Horticulture Research
G.S. COBB, Ornamental Horticulture Substation

Variegated pittosporum that were grown under three production light levels are shown following 3 months in an interior environment.

MOST PLANTS used in interior environments are tropical or semi-tropical in nature and adapt well to conditions of relatively low light, warm temperatures, and low humidities. Proper light acclimatization during commercial production increases quality and survival of these plants when maintained under low interior light levels.

Many temperate zone woody plants prefer or will tolerate low light conditions in the exterior landscape and, if adaptable, could increase the selection of plant material for the interior environment. Research by the Alabama Agricultural Experiment Station has evaluated selected temperate woody ornamentals and found that most species responded well when placed in the interior environment.

In experiment 1 of this study, 30 uniform 3-in. liners each of fatsia, dwarf gardenia, variegated pittosporum, Japanese yew, and Asiatic jasmine were potted July 22, 1983, in 6-in. pots. In experiment 2, uniform liners of dwarf Japanese euonymus, Wheeler's dwarf pittosporum, Okinawan holly, leatherleaf mahonia, and Chinese mahonia were potted April 6, 1984, in 6-in. pots. Plants of each species were divided into 3 groups and grown outdoors under the following light conditions: (1) full sun; (2) 47% shade; and 3) 64% shade. On October 23, 1983, and August 8, 1984, plants were transferred to an interior room with fluorescent lighting (50 footcandles), 12-hour photoperiod (6 a.m.-6 p.m.), 70°F, and 80% RH, and over the following 3 months plants were evaluated periodically for sustained quality and growth.

Foliage of all species except Japanese yew was light green and thicker when plants were grown in full sun. Foliar tipburn occurred on sun-grown fatsia, the two mahonia species, and Wheeler's dwarf pittosporum. Generally, plant quality of all species was higher when plants were shaded during production.

After 15 weeks in the interior environment, fatsia produced in 64% shade were larger than those produced in 47% shade or full sun. Production size of Chinese mahonia increased as shade level increased, but after 15 weeks in the interior environment all plants were of similar size, regardless of production light level. Other species retained their same relative sizes after being placed indoors.

Leaf drop, an important criterion for interior plant selection, was least with shade-grown dwarf gardenia, variegated pittosporum, Chinese mahonia, and Asiatic jasmine produced under 64% shade. With other species, leaf drop did not vary with production light levels.

Quality rating considered numerous plant characteristics, including habit of growth (density), leaf spacing, leaf drop, foliage color, and overall appearance, and was deemed the primary factor determining a plant's potential for interior use. At the end of the 15-week interior period, the quality of Japanese yew was good for plants grown under all production light levels, while quality of Wheeler's dwarf pittosporum was higher when plants were grown under shade. Plant quality of shade-grown fatsia, dwarf gardenia, variegated pittosporum, and both mahonias was good to excellent.

Quality of all sun-grown plants, except Japanese yew and Wheeler's dwarf pittosporum, was unacceptable. Quality of Asiatic jasmine, Okinawan holly, and euonymus was poor, primarily due to heavy leaf drop. With Okinawan holly, 60% of plants grown in full sun, 30% grown in 47% shade, and 50% grown in 64% shade died in the interior environment.

Results of this Alabama Agricultural Experiment Station study indicate that temperate zone woody ornamentals can be successfully used in interior landscapes. This can provide a new market for woody ornamental growers, increase the plant selection available to interior landscapers, and provide a more diverse interior environment for all to enjoy.

SIMULATION OF NONPOINT SOURCE POLLUTION FROM COTTON TILLAGE SYSTEMS

K.H. YOO, Agricultural Engineering Research, J.T. TOUCHTON, Agronomy and Soils Research, J.M. SOILEAU, Tennessee Valley Authority

EXCESSIVE SOIL EROSION and subsequent topsoil loss and nonpoint source pollution from cropland are serious concerns in Alabama. Average soil erosion from cropland in Alabama exceeds 9 tons per acre per year, which is 4 tons per acre per year higher than the tolerance level to maintain the long-term productivity of the crop field. Runoff water and eroded soil carry valuable nutrients and pesticides downstream, causing high production cost and polluting water systems in the State.

The Alabama Agricultural Experiment Station and the Tennessee Valley Authority jointly initiated a 6-year soil erosion study in 1983 at the Gilbert Farm in Colbert County to determine the effects of tillage systems for cotton on soil erosion, water runoff, and nutrient losses. Conventional tillage practices will be used for the first 3 years (1984, 1985, and 1986) and conservation tillage practices for the second 3 years (1987, 1988, and 1989). The study area is a 9.4-acre natural watershed and is equipped with a Parshall flume water measuring device and an automatic runoff sampler. In addition to measuring soil and water losses, runoff samples are analyzed for sediment and nutrient (N, P, K, Mg, and Ca) concentrations in the runoff.

The results of conventional tillage in 1984 are shown in the table. Total sediment loss was well below the average soil erosion rate reported in Alabama. One of the reasons is that the estimated soil erosion rate does not account for the deposition of sediment commonly encountered in a field. The measured data only include soil moving out of the field. Also shown in the table are nutrient losses from the watershed.

Water quality problems and their solutions are not fully described or understood and are often costly to study by on-site monitoring studies alone. To help fill the need for quick and inexpensive methods of assessing and evaluating nonpoint source pollution from agricultural watersheds, several simulation models have been developed. These models vary widely in their objectives. Basically, they are used to simulate runoff, sediment, nutrient, and pesticide losses from different types of watersheds. However, without verification and validation the results are questionable.

A model selected for this study was a watershed and water quality model developed by the Agricultural Research Service of the USDA. The model, CREAMS (Chemical Runoff and Erosion from Agricultural Management Systems), was developed to assemble state-of-the-art mathematical concepts to evaluate nonpoint source pollution for field-scale areas.

The CREAMS model is composed of three components: hydrology, erosion-sediment, and chemistry. The hydrology component simulates the amount and rate of water movement on the surface and through the subsurface. All major hydraulic processes which occur during a rainstorm can be simulated in detail with current knowledge of hydraulics. The main processes in the erosion-sediment component are overland flow, concentrated flow, and impoundments. The chemistry component consists of nutrient and pesticide submodels. The nutrient submodel is an accounting and transport model to estimate nitrogen and phosphorus losses from fields. The pesticide submodel is a transport model which accounts for pesticide concentration on foliage and in the active soil surface, transport into water, and adsorbed phases of soil particles.

Data collected from the watershed at the Gilbert Farm were used to calibrate the model parameters and to evaluate the performance of the model simulation. The results of the simulation are shown in the table. The tillage practice used in the simulation was conventional tillage with moldboard plow and disk after harvest. Most of the initial parameters were based on the physical and climatic conditions of the watershed and the initial values recommended in the model. The parameters were varied around the initial values to obtain the best fitting of the monthly simulation to the observed data while maintaining reasonable field conditions.

Simulated runoffs were generally lower than observed runoffs. Due to the simulation of mono-crop conditions of the watershed, the grassed waterway used at the end of the watershed could not be adequately considered in the model. The grassed waterway could have acted as sediment and runoff detention causing high deposition rates. The simulated output from the nutrient submodel under the conventional practice is shown in the table. The pesticide submodel was not tested due to lack of input information. The high nutrient loss during May was caused by fertilizer application on April 27. Two tillage practices, chisel plow after harvest and no tillage before planting, were tested to simulate their effects on erosion control while maintaining the same hydrologic conditions. The last two columns of the table show the simulated effect of the alternative tillage practices on soil losses. Conservation tillage practice reduced the annual soil loss by 30% and no tillage by 53% as compared to conventional tillage practices.

In summary, a watershed and water quality model was used to simulate nonpoint source pollution from a natural watershed planted to cotton. The model was also used to evaluate the effect of different tillage practices on soil losses from the watershed. Although mixed results were obtained, the model showed a potential of assessing and evaluating nonpoint source pollution problems and their control practices for Alabama agricultural fields.

OBSERVED AND SIMULATED RUNOFF, SEDIMENT, AND NUTRIENT LOSSES FROM THE WATERSHED IN 1984

Month	Rainfall, in.	Losses with conventional tillage								Sediment loss, simulated/acre	
		Runoff		Sediment/acre		Nitrogen/acre		Phosphorus/acre			
		Obser.[1]	Sim.[2]	Obser.	Sim.	Obser.	Sim.	Obser.	Sim.	Conservation tillage[3]	No tillage[4]
		In.	*In.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Jan.	2.51	0.14	0.11	1.7	84.9	0.01	0.13	0	0.06	90.0	81.4
Feb.	3.14	0	.03	0	11.7	0	.04	0	.02	12.0	12.2
Mar.	3.53	0	.06	0	33.6	0	.08	0	.03	35.5	31.4
Apr.	5.31	2.18	.81	—[5]	1,220.6	—	1.29	—	.60	769.5	491.5
May	7.47	2.48	1.44	1,172.6	1,927.4	4.86	2.14	.52	.89	1,329.2	854.9
June	1.82	0	0	0	0	0	0	0	0	0	0
July	4.87	.57	.06	22.3	31.7	0	.08	.01	.03	33.7	35.0
Aug.	2.68	.02	0	0	0	0	0	0	0	0	0
Sept.	.28	0	0	0	0	0	0	0	0	0	0
Oct.	8.18	.53	.66	34.6	672.0	.17	.88	.11	.38	516.6	348.2
Nov.	6.29	.47	.77	15.2	943.5	.12	1.04	.19	.46	705.6	460.9
Dec.	1.64	0	0	0	0	0	0	0	0	0	0
TOTAL	47.72	6.39	3.94	1,246.4	4,925.4	5.16	5.68	.83	2.47	3,492.1	2,315.5

[1]Observed data.
[2]Simulated data.
[3]Chisel plow after harvesting.
[4]No tillage before planting.
[5]Data not available.

Vitamin E Supplementation Shows Potential Value for Human Health

R.E. KEITH, M.C. CRAIG-SCHMIDT, and M. van den REEK
Home Economics Research

VITAMIN E IS AN important nutrient, but its specific functions in the body have been hard to define. Deficiencies of vitamin E are known to cause such disorders as muscular dystrophy, heart disease, encephalomalacia, and sterility in rats, chickens, ruminants, and swine. However, these conditions generally do not occur in humans with low vitamin E status.

Several studies have looked at the effects of dietary vitamin E on serum cholesterol, a known risk factor for cardiovascular disease. Results have varied, with some reports stating that supplementation of diets with vitamin E lowers serum cholesterol and others noting no effect of the vitamin on blood lipids. Vitamin E supplements have also been shown to improve immune response in several animal species and increase the life span of some animals, although work in this area is not completely convincing.

Exercise is another factor that has been reported to favorably affect blood cholesterol levels. Exercise seems to raise the levels of high density lipoprotein (HDL) cholesterol and lower the levels of low density lipoprotein (LDL) cholesterol in the blood. This would tend to reduce a person's chances of developing heart or vascular disease. Regular exercise has also been reported to increase the percentage of animals reaching maximum life span, although exercise has not been shown to increase the maximum life span. Few studies have looked at the possible interactions between vitamin E and exercise.

In light of the research that has been reported, nutrition research at the Alabama Agricultural Experiment Station is being done to assess the effects of supplemental vitamin E with and without exercise on the serum cholesterol levels, body weight, and mortality of a group of male hamsters fed a high cholesterol diet.

In the current study, 63 mature male hamsters were fed a semi-purified diet containing 0.5% cholesterol and two levels of vitamin E. Animals were randomly assigned to one of four groups: control (20 IU vitamin E per kg of diet, no exercise); supplemental vitamin E (200 IU vitamin E, no exercise); a control diet with exercise; and a vitamin E supplemented diet with exercise. Hamsters were exercised on a small treadmill at moderate intensity for 15 minutes, 3 days a week for 11 weeks. Body weight and food intake were recorded twice each week. A record of the survival rates of the different groups was also kept. At the end of the experiment the animals were put to sleep. Blood was withdrawn and analyzed for total serum cholesterol.

As noted from data in the table, animals consuming the supplemented vitamin E diets gained less weight despite similar food intakes. Serum cholesterol values of the vitamin E supplemented groups were somewhat lower than control diet groups. The exercise program did not seem to affect weight gain or cholesterol values.

There seemed to be an interaction between vitamin E and exercise on mortality. The vitamin E supplemented-exercise group had no mortality, while mortality ranged from 12% to 19% in all other groups.

In the current experiment, animals fed extra vitamin E gained less weight despite similar food intakes. Therefore, the gain to feed ratio for these animals was lower. The reasons for this occurrence and whether this phenomenon has practical value are unknown at present. Vitamin E supplementation did show a mild serum cholesterol lowering effect in the hamsters fed a high cholesterol diet. However, this reduction could only be considered moderate and cholesterol values for all the animals were still in the high range. The vitamin E supplemented exercise groups experienced reduced mortality. This finding would tend to support a positive relationship between vitamin E and exercise on the health of the animals. However, more precise work needs to be done in this area before any firm conclusions can be reached.

Results of the present study cannot be directly related to humans. However, vitamin E has also been shown to favorably affect serum cholesterol levels in a few studies. Thus, vitamin E may have potential in humans in the area of cardiovascular disease prevention and enhancement of immune function.

EFFECTS OF SUPPLEMENTAL VITAMIN E AND EXERCISE ON WEIGHT GAIN, FOOD INTAKE, AND SERUM CHOLESTEROL IN ADULT MALE HAMSTERS FED A HIGH CHOLESTEROL DIET

Group and number of animals	Gain:feed ratio	Weight gain	Food intake/day	Serum cholesterol
		Grams	*Grams*	*mg/dl*
Control (7)	4.7	38	8.0	407
Control/exercise (6)	4.9	38	7.7	408
Vitamin E supplemented (7)	3.8	30	7.7	379
Vitamin E/exercise (7)	4.2	32	7.5	375

The pupal, or flaxseed, stage of Hessian fly is shown in the inset of this field of undamaged wheat in Baldwin County.

Alabama Small Grains Damaged By Hessian Fly

P.M. ESTES, Zoology-Entomology Research
WILEY JOHNSON, Agronomy and Soils Research
JOE LITTLE, Lower Coastal Plain Substation
DON MOORE, Prattville Experiment Field

THE HESSIAN FLY is a destructive pest of small grains throughout most of the United States. Although it is not usually a serious pest in Alabama, over the past 3 years infestations have increased in several areas of the State.

During the 1984-85 growing season, severe infestations occurred in west-central Alabama involving more than 10,000 acres of wheat. Researchers from the Alabama Agricultural Experiment Station evaluated Hessian fly damage in small grain variety trials conducted at the Lower Coastal Plain Substation, Camden, and the Prattville Experiment Field. After the grain in these trials had matured, random replicated samples were collected from each variety, and examined for larvae and pupae of the Hessian fly. The average percent infestation and the grain yield at each location are given in the table. Damage was severe at Camden and light at Prattville.

PERCENT OF STEMS INFESTED BY HESSIAN FLY AND YIELD OF WHEAT AND TRITICALE VARIETIES, CAMDEN AND PRATTVILLE, 1985

Variety	Prattville		Variety	Camden	
	Stem infection	Yield per acre		Stem infection	Yield per acre
	Pct.	*Bu.*		*Pct.*	*Bu.*
Tyler	35.0	53.1	Coker 983	92.5	41.4
Terral 821	30.0	59.4	HW 3022	90.0	23.1
Scotty	30.0	58.3	Saluda	81.7	42.5
HW 3022	26.7	51.4	Coker 916	81.7	24.6
Pike	26.7	41.0	Pike	81.7	14.1
Coker 68-15	26.7	46.5	Scotty	81.7	28.1
Coker 983	26.7	64.3	Terral 812	80.0	25.8
Hunter	26.7	65.6	Florida 302	76.7	31.0
HW 3021	23.3	74.3	Caldwell	73.3	29.6
Coker 916	20.0	67.0	Coker 762	65.0	30.3
Coker 762	20.0	66.3	Hunter	53.5	26.6
Florida 302	20.0	59.4	HW 3015	58.3	45.6
Florida 301	13.3	68.1	Trical B631[1]	50.0	31.0
Caldwell	13.3	57.3	McNair 1003	48.3	42.1
Bradford	13.3	61.1	Florida 301	45.0	13.0
Saluda	10.0	65.3	Trical 476M[1]	45.0	18.3
HW 3015	3.3	76.7	Morrison[1]	40.0	49.3
McNair 1003	3.3	65.3	Compton	13.3	41.2
Pioneer 2550	.0	59.0			
Stacy	.0	62.5			
Massey	.0	64.2			

[1]Triticale.

Data in the table show that even though the infestation levels at the two locations were different, many of the varieties had similar relative infestations. HW 3022, Coker 983, and Pike were heavily infested at both locations, whereas Compton (not in the Prattville test) and McNair 1003 were not. Yield data were somewhat inconsistent but generally decreased with increased infestations. In general, these data show that Stacy, Pioneer 2550, and McNair 1003 have shown some resistance to Hessian fly. Past research indicates that an infestation as low as 5% can reduce grain yield.

The three triticales (Trical 476M, Trical B631A, and Morrison) generally yielded less than the wheat varieties, and were also damaged by the Hessian fly.

Hessian flies can develop on all small grains except oats, but show a preference for wheat. This minute, black, gnat-like fly lays eggs on the upper surface of leaves of small grains in the fall or spring. Maggots soon hatch, crawl into the leaf whorls, and feed by abrading leaf tissue and sucking plant juices. Plants infested by Hessian fly exhibit lodging, reduced tillering, and stunted growth. The maggots feed for 3 weeks to a few months and then transform into the pupal, or "flaxseed," stage, see figure.

Hessian flies are primarily cool weather insects and pass the summer as pupae hidden within straw. Adult flies emerge from pupae only when temperatures begin to decrease in the fall or increase in the spring. In the major small grain growing areas of the United States, such as the Great Plains, Hessian fly adults emerge over a relatively short period in the fall. In these areas, the pest can be controlled by delaying fall planting until the date at which danger of fly oviposition is past. This is known as the "fly-free planting date."

Because of the moderate fall and winter temperatures in the Southeastern United States, adult flies are present almost every month during the period in which small grains are planted. Although planting date cannot be used as a reliable method of management of Hessian fly in Alabama, later planted small grains often are less damaged by this pest. Many small grain varieties have been developed that exhibit some form of resistance to Hessian fly and their use is one of the best methods of controlling this pest.

Lead Shot Ingestion Affects Captive Mourning Dove Survival and Reproduction

T.T. BUERGER, R.E. MIRARCHI, and M.E. LISANO
Zoology-Entomology Research

ABOVE. Outdoor cages that simulated natural weather conditions were used in the survivability study.

SPENT LEAD SHOT enters the environment as a result of hunting game animals with shotguns. Lead shot is sometimes accidentally ingested by birds as food, or as grit which is necessary to grind food in the gizzard. Such lead ingestion often results in death and has caused large-scale die-offs in waterfowl. However, relatively little is known about the effects or incidence of lead poisoning in upland game birds, even though several species, including mourning doves, have been reported to ingest lead shot. In studies throughout the Southeast, the incidence of lead shot in the gizzards of wild mourning doves has ranged from 1% to 6.5% of birds examined.

Lead shot is accessible to mourning doves because they are hunted over fields in which they feed. Large quantities of lead shot (up to 43,560 shot per acre) have been found on recently hunted dove fields and as managed dove field use increases, more doves probably will be exposed to lead shot. Thus, Alabama Agricultural Experiment Station researchers decided to investigate the effects of lead shot ingestion on the survivability and reproductive success of mourning doves.

In the survivability study, doves were housed in outdoor cages to simulate natural weather conditions. Seventy-five doves (25 birds per treatment) were force-fed either 1, 2, or 4, #8 size shot (1 shot = 72.0 mg). An additional 25 control birds received a browntop millet seed. Treatments were assigned randomly regardless of sex. The experiment was conducted from January 9 to February 12, 1983.

There were no differences between sexes in mortality rates. Doves dosed with lead shot suffered higher mortality than control birds, and those receiving 2 or 4 lead pellets had greater mortality than those dosed with a single lead shot, see table. Mortality began 2 days after dosing, and 97% of the doves that died did so within 11 days. Tissue lead determinations indicated that doves that were treated with lead shot and died had significantly higher kidney, liver, and bone lead concentrations than control or treated birds that survived.

Cold temperatures and diet may have influenced the results. Ninety-one percent of the doves died on days when the minimum temperature was 32°F or below. In addition, the doves were fed a predominantly corn diet. Corn diets may increase mortality because they require more gizzard activity, thereby increasing lead pellet erosion and allowing more lead to enter body tissues.

In the reproductive study, doves were housed indoors under a natural lighting regime. Male-female pairs were formed and after acclimation the females of each pair were treated. The 25 treated birds were each force-fed a single #8 lead shot and the 25 control birds were each given a browntop millet seed. Paired doves were allowed to conduct reproductive activities from January 31 to September 26, 1982. Eggs were collected, placed in an incubator, and candled after 7 days to determine fertility. After 14 days of incubation, eggs were placed in a hatcher.

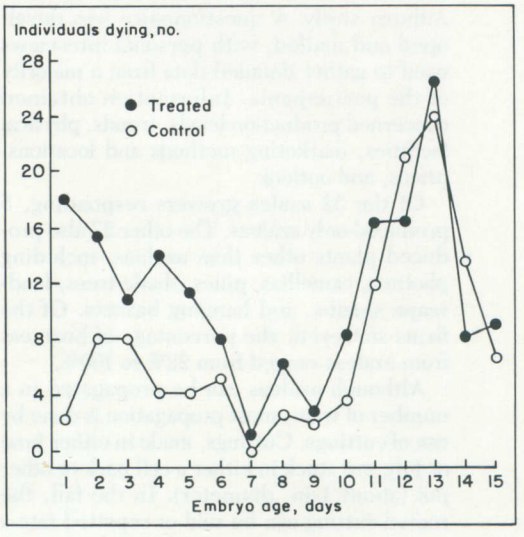
No mortality was observed in this experiment, probably due to the moderate temperatures and a soft, pelleted diet. There were no differences in egg measurements (length, width, weight) or squab weight between treatments. In addition, lead dosing of females had no effect on productivity or fertility of the eggs. However, eggs produced by treated doves had lower hatchability than those from the control group (62% vs. 79%). When the mortality of control and treatment embryos was plotted, there was higher mortality among 1- to 9-day-old embryos from treated females than from controls, see figure. There were no differences between treatments from 10 to 15 days after laying. Lead may have been transferred from the adult female to the egg where it may have been toxic and increased embryonic mortality early in incubation.

The findings indicate that wild mourning doves may suffer high mortality if they ingest lead shot, and if they survive lead shot ingestion may later suffer detrimental reproductive effects. This information suggests that closer attention should be paid to lead shot as an environmental contaminant so healthy mourning dove populations can be maintained.

MORTALITY OF MOURNING DOVES AS A RESULT OF INGESTED LEAD SHOT

Number ingested lead shot	Number of birds treated	Mortality	
		Number	Pct.
0	25	0	0
1	25	6	24
2	25	15	60
4	25	13	52

BELOW. Mortality of embryos from control and treated female mourning doves.



Azaleas Important Crop in Baldwin and Mobile Counties

M.L. HILL and L.E. WILSON, Agricultural Economics and Rural Sociology Research, R. SHUMACK, Cooperative Extension Service

ALABAMA'S NURSERY industry may be the State's best-kept secret. This specialized agricultural business had grower-level sales of $90 million in 1983 (up from $11.6 million in 1965), ranking it seventh among agricultural income sources that year.

Although there are many woody ornamental plants produced in the State, azaleas rank among the most important nursery crops. Production of azaleas is concentrated in Mobile and Baldwin counties (mostly in Mobile County). Growers in these two counties had $15-$17 million in azalea sales in 1983, which accounted for 16-18% of the State's total nursery sales. This supports the belief that the Mobile-Baldwin County area is the most concentrated azalea production area in the United States.

Despite the industry's size and importance, little was known about production and marketing of azaleas in Alabama until a 1984 Alabama Agricultural Experiment Station study characterized the industry. Information gained in the Alabama portion of a regional study on woody ornamental production and marketing should help in decision making about industry growth prospects in Alabama and the South. Knowledge of resources committed to azalea production provides a partial basis for evaluation of potentials in terms of individual firm adjustments, industry structure, and future technological possibilities.

Forty certified nurseries which produce most of the azaleas grown in Baldwin and Mobile counties were selected for the 1984 Auburn study. A questionnaire was developed and mailed, with personal interviews used to gather detailed data from a majority of the participants. Information obtained concerned production levels, trends, physical facilities, marketing methods and locations, prices, and outlook.

Of the 32 azalea growers responding, 5 produced only azaleas. The other 27 also produced plants other than azaleas, including photinia, camellias, pines, shade trees, landscape shrubs, and hanging baskets. Of the firms surveyed, the percentage of business from azaleas ranged from 22% to 100%.

Although azaleas can be propagated in a number of ways, most propagation is done by use of cuttings. Cuttings, made in either June or July, are stuck in either a cell pack or other pot (about 1-in. diameter). In the fall, the rooted cutting can be sold or repotted into a larger container, usually a 1-gal. container, to be held until spring for sale. Alternative cultural regimes are used by different nurseries in preparing plants for sale in the various container sizes.

Single proprietorship was the major form of business organization, reported by 23 growers. There were seven corporations and two partnerships, which were grouped together and called corporations for the analysis. Although corporations comprised 28% of the respondents, they reported 65% of sales. The proprietorships tended to specialize more in azalea production, while corporations were more diversified.

TABLE 1. PERCENTAGE AND VALUE OF AZALEA SALES BY ORGANIZATIONAL TYPE, ALABAMA, 1983

Type of azalea	Sales		
	Proprietorship	Corporation	Total
	Thous.	*Thous.*	*Thous.*
Indica	$ 607 (15.1%)	$1,456 (19.9%)	$ 2,063
Dwarf, semi-dwarf	3,329 (83.1%)	5,388 (73.6)	8,717
Other[1]	70 (1.8%)	480 (6.5%)	550
TOTAL	4,006 (35.0%)	7,324 (65.0%)	11,330

[1]Includes florist and satsuki azaleas.

A total of 342 acres of azaleas was in production by the 32 firms. Twenty growers reported 5 acres or less, six reported 6 to 15 acres, and another six had more than 15 acres of azaleas. All growers reported using greenhouses, with 15 growers having over 25,000 sq. ft. of greenhouse space. With minimum temperatures averaging 20-30°F in the area (climatic zone 9), some winter protection is necessary for azaleas.

Azalea plants were grouped into three plant types: semi-dwarf and dwarf, indica, and other (florist and satsuki). Semi-dwarfs and dwarfs comprised 78% of sales and indicas 16% , table 1.

The most popular container size was the 1-gal. (38% of sales), with liners second in sales, table 2. Corporations tended to concentrate mainly on plant sales in the 1- and 3-gal. containers, while proprietorships sold mostly 1- and 2-gal. sizes.

Market areas can be delineated by climatic conditions. Azaleas grown in south Alabama are adapted to climatic zones seven, eight, and nine, which include the majority of the Southeastern States. Distance from the production area and shipping costs also affect the extent of the market. Major markets and percent of sales by states were: Texas, 16.5%; Georgia, 13.0%; Alabama, 12%; Tennessee, 10.9%; and Louisiana, 7.8%. Growers shipped into a total of 21 states with some sales as far away as Michigan, Pennsylvania, and New York.

Sales peaked in February, March, and April, with about one-fourth of all sales made in March. A second seasonal peak occurred in October. Sales seasonality was greater for proprietorships than for corporations. The most commonly reported sales methods were wholesale selling at the grower location and telephone sales by the grower. Also, selling was conducted through salesmen, brokers, mail order catalogs, and trade shows. Major customers included other nurseries, discount stores, garden centers, and rewholesalers.

Growers stated that competition has increased in the industry, but they were generally optimistic about future sales expansion.

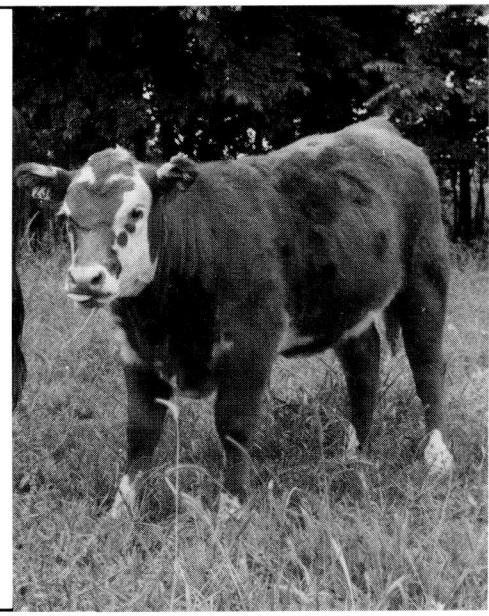
TABLE 2. NUMBER OF AZALEAS MARKETED AND AVERAGE PRICE, BY CONTAINER TYPE, ALABAMA, 1983

Container size	Number sold in 1983[1]	Average price
Rooted cuttings	727,000 (7.7%)	$0.15
Liners	3,510,000 (37.3%)	.37
Quarts	499,200 (5.3%)	.57
1-gal.	3,575,699 (38.0%)	1.28
2-gal.	445,816 (4.7%)	2.83
3-gal.	652,857 (7.0%)	4.48
TOTAL	9,410,572 (100%)	

[1]Retail sales are not included.

Feedlot Finishing after Weaning Better for Heavy Crossbred Calves

S.P. SCHMIDT and T.B. PATTERSON
Animal and Dairy Sciences Research
L.A. SMITH, H.W. GRIMES, and J.L. HOLLIMAN
Black Belt Substation



FEEDLOT FINISHING of heavy crossbred calves immediately after weaning was more profitable than using a stockering program ahead of finishing in Alabama Agricultural Experiment Station research. This was true of all breed crosses in the test at the Black Belt Substation, Marion Junction, Alabama. However, there were performance differences among breeds. Calves out of Simmental-Hereford cows were 70 lb. heavier at slaughter than calves out of Angus-Hereford cows regardless of postweaning management.

An earlier *Highlights* story (Winter 1983) reported preweaning performance of calves out of Angus-Hereford and Simmental-Hereford cows bred to Angus or Polled Hereford bulls. This report is a follow-up, giving postweaning data of calves from the above matings.

Two postweaning management systems for growing the calves to slaughter weights were studied in this 2-year experiment, using steers and heifers representing each breed: (1) 174 head were put directly into the feedlot at weaning where they were full-fed a high-corn diet for an average of 152 days; and (2) 86 head were placed on fungus-free fescue pastures for an average grazing period of 302 days including winter (86 animals on two 24-acre pastures).

During the 60-day winter period when forage was not available, the calves were fed hay free-choice and a corn-cottonseed meal supplement (12% protein) at 1% of body weight. When the fescue began its summer dormancy, about June 1, the calves were put into the feedlot and fed the same high-corn diet for an average of 88 days. All calves were slaughtered when their backfat thickness was 0.45 to 0.55 in. as determined by a probe.

Calves out of Simmental-Hereford cows were almost 50 lb. heavier at weaning and 70 to 80 lb. heavier at slaughter than calves out of Angus-Hereford cows, see table. Breed of sire had no effect on either weaning or slaughter weight of the calves in either system.

As would be expected, calves going directly to feedlot had faster feedlot gains and better feed efficiencies than the heavier calves that grazed before finishing. Within each postweaning management system, feedlot daily gains did not differ among breeds. When assigned to feedlot immediately after weaning, calves out of Simmental-Hereford cows took 14 days longer to finish and gained 42 lb. more than calves out of Angus-Hereford cows. This difference did not exist in the group grown out on pasture.

The management system that included pasture took 390 days postweaning (302 days on pasture plus 88 days in the feedlot) to reach the desired finish. As a result, calves were 239 days older at slaughter than those fed out after weaning. However, there were no differences in quality or yield grades between the two groups.

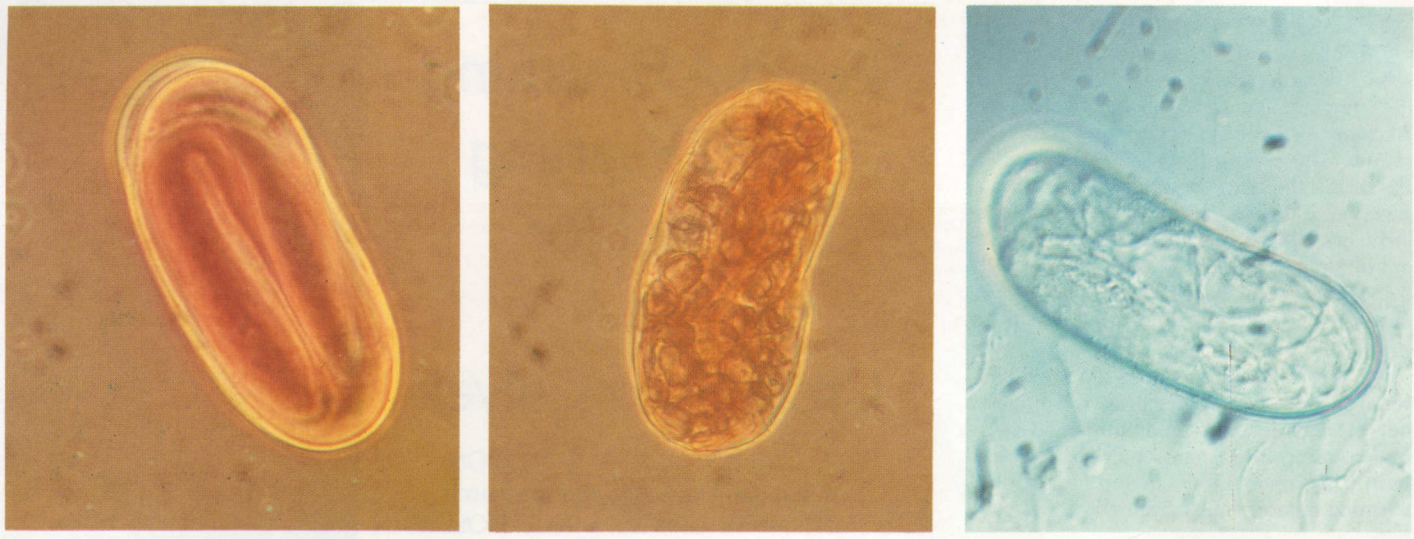
Average slaughter weight was 982 lb. for calves fed out immediately after weaning. This was nearly the same as the other groups averaged at the end of grazing (1,007 lb.) and 226 lb. lighter than their slaughter weight. Carcasses that are too light (less than 600 lb. for steers and 550 lb. for heifers) are often discounted $3 to $5 per hundredweight. Among those finished immediately after weaning, 62% out of Angus-Hereford cows and 34% out of Simmental-Hereford cows had light carcasses. None of the cattle that went through the postweaning growing phase on pasture had light carcasses.

Returns above feed and pasture costs were greatest for calves put directly into the feedlot, for two reasons. First, beef prices are usually higher during the winter months when calves in the feedlot-only group were slaughtered than during late summer when the grazing plus feedlot calves were slaughtered. Second, this type of calf (600 lb. weaning weight and genetic potential for rapid growth) may not fit a typical stockering program and should be managed for continued rapid growth postweaning. Even though calves out of Simmental-Hereford cows were heavier than those out of Angus-Hereford cows, average returns by breed of dam were not different. Angus-sired calves were more profitable than Polled Hereford-sired calves, largely a reflection of higher carcass grades.

POSTWEANING TRAITS AND GROSS ECONOMIC RETURNS FOR CROSSBRED CALVES PUT EITHER DIRECTLY INTO THE FEEDLOT AT WEANING OR ONTO PASTURE FOLLOWED BY FEEDLOT FINISHING

Test group	Weight			Av. daily gain		Feed/ lb. gain	Age at slaughter	Quality grade[1]	Profit[2]
	At weaning	End of grazing	Final	Grazing	Feedlot				
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Days*		*Dol.*
DIRECTLY TO FEEDLOT AT WEANING									
Av. by breed of dam									
Angus x Hereford ..	580	—	941	—	2.54	6.32	391	10.6	72.19
Simmental x Hereford	620	—	1,024	—	2.63	6.39	401	10.6	78.73
Av. by breed of sire									
Angus	599	—	982	—	2.58	6.25	397	11.0	87.05
Polled Hereford ...	602	—	985	—	2.60	6.46	395	10.2	64.61
GRAZE THEN TO FEEDLOT									
Av. by breed of dam									
Angus x Hereford ..	569	980	1,173	1.36	2.17	10.00	634	10.9	14.94
Simmental x Hereford	621	1,035	1,245	1.37	2.28	10.20	636	10.6	(-) 3.77
Av. by breed of sire									
Angus	598	1,006	1,205	1.35	2.21	10.06	637	11.3	18.74
Polled Hereford ...	590	1,008	1,211	1.39	2.25	10.14	632	10.2	(-) 7.13

[1]Quality grade: 10 = average Good, 11 = high Good, 12 = low Choice.
[2]Return per animal over value at weaning and pasture and feed (including mixing) costs. Selling price based on grade and yield carcass value. Average carcass value for the feedlot group was $95.45/cwt. and for the graze then feedlot group was $89.93/cwt.



Fungi as Antagonists of Cyst and Root-Knot Nematodes

G. MORGAN-JONES and R. RODRIGUEZ-KABANA, Botany, Plant Pathology, and Microbiology Research

Healthy egg of root knot nematode (left), compared to eggs pierced by hyphae of fungal pathogens (middle and right).

WITH THE REMOVAL from the market of key nematicides and restricted usage of others by the Environmental Protection Agency, farmers are left with few alternatives in controlling nematodes. One alternative being studied at the Alabama Agricultural Experiment Station is using fungal parasites to control nematodes. Though nematode-destroying fungi are common and relatively abundant in agricultural soils, their total contribution to soil biology, and thus to controlling nematodes, is not known.

Predacious or trapping forms of fungi are most commonly associated with nematodes, but attempts to establish them in soil to effect biocontrol have been unsuccessful. Attempts to use endozoic parasitic fungi for nematode control have likewise been unsuccessful, primarily due to the difficulty in growing them in a pure culture away from nematodes.

Auburn researchers recently found that many opportunistic soil fungi attack reproductive structures. Both cysts and eggs of cyst and root-knot nematodes are vulnerable to attacks by such fungi. By chemically altering nematode physiology and physically disrupting their reproductive cycle, fungi can effectively suppress build-up of nematode populations. There is now increasing evidence from both field and greenhouse studies that the phenomenon of nematode-suppressive soils is in part due to the activity of fungi.

A survey of fungi associated with cysts and eggs of root-knot and cyst nematodes in Alabama and other Southeastern States has indicated the consistent presence of several fungi, including *Exophiala pisciphila*, *Gliocladium roseum*, *Paecilomyces lilacinus*, and several species of *Verticillium*. Such fungi have been observed to regularly colonize cysts, enter through the natural orifices, and directly penetrate nematode eggs. Larvae are also colonized in some instances. Eggs colonized by fungi frequently become swollen or distorted and fungal hyphae are readily observed within them.

Research indicates nematode eggs and cysts can be damaged or destroyed by several means. Enzymes can alter eggshell permeability, causing abortion of embryonic development and destruction of unhatched larvae. The same results can be attained by increased permeability, allowing toxic metabolites synthesized by fungi to penetrate the egg.

Ultrastructural studies have shown that changes in eggshell structure of root-knot nematodes occur following exposure to actively growing mycelium of both *Paecilomyces lilacinus* and *Verticillium chlamydosporium*. Hyphae of both these fungi are capable of penetrating the various eggshell layers and entering the egg center. Hyphae are also able to pierce the cuticle of second stage, fully developed larvae within mature eggs. This physical disruption in addition to exposure to disorganizing enzymes and toxic metabolites leads ultimately to the death of fully formed larvae and embryos in early stages of development.

Preliminary greenhouse studies indicate that several fungal species, or biotypes within particular species, have potential for development as biocontrol agents of plant parasitic nematodes.

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

Gale A. Buchanan, Director
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