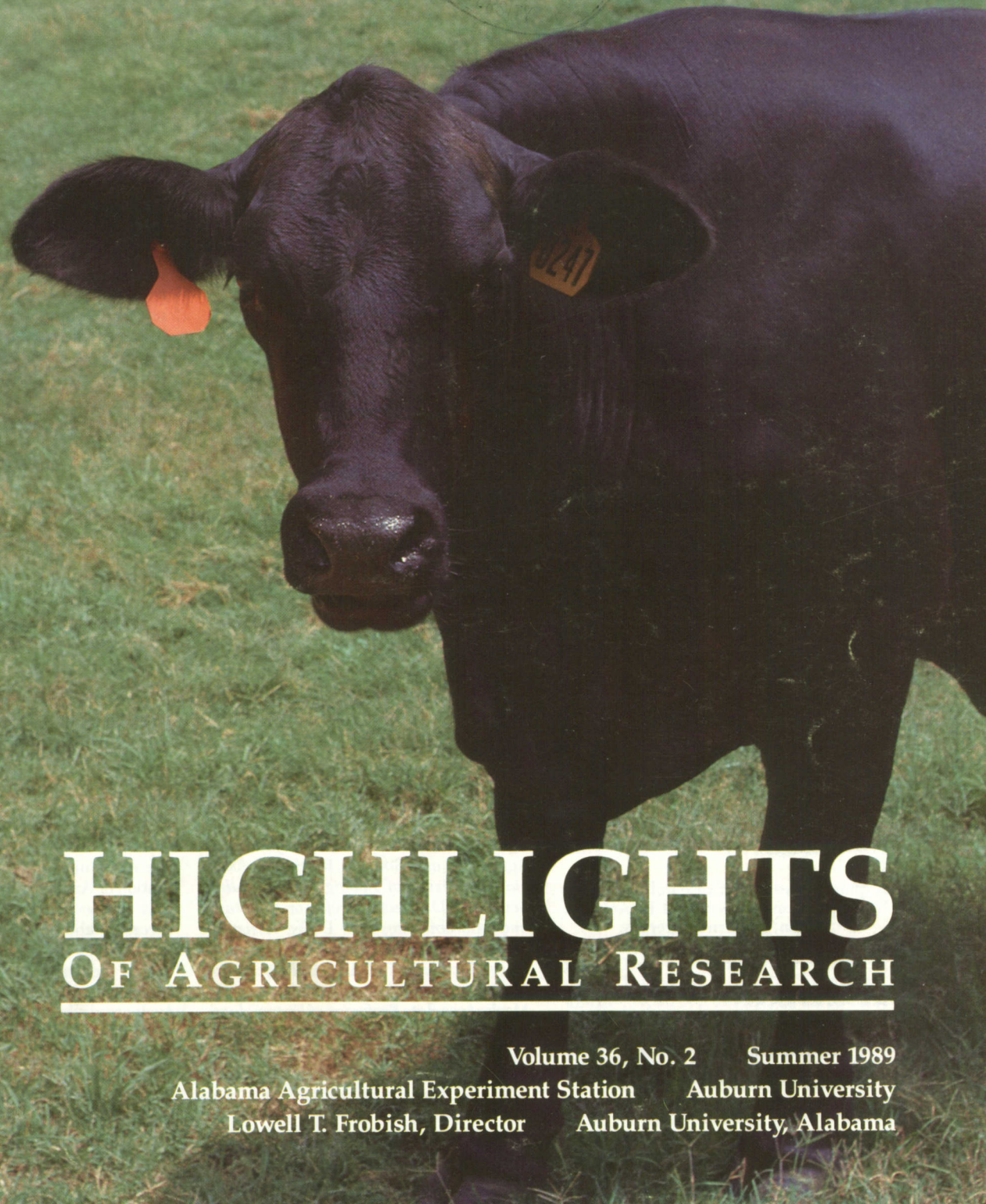


Spec



# HIGHLIGHTS

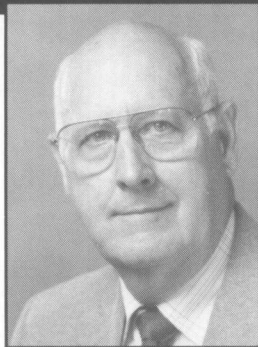
## OF AGRICULTURAL RESEARCH

---

Volume 36, No. 2      Summer 1989  
Alabama Agricultural Experiment Station      Auburn University  
Lowell T. Frobish, Director      Auburn University, Alabama

# REFLECTIONS ON ALABAMA'S POULTRY INDUSTRY

**T**HE DEVELOPMENT of Alabama's poultry industry, which paralleled that of the United States, is the perfect example of American agribusiness success. The nation's poultry industry consists mostly of chicken meat (broilers), table-eggs, turkeys, and ducks, while Alabama mainly produces broilers. Commercial duckling production is the oldest segment of the poultry industry in this country, but it has never been important in Alabama. Although we generally think of poultry as a "new" agricultural commodity, income from chickens and eggs accounted for more farm income than any other U.S. farm enterprise in the mid-1800's. The evolution of vertical integration in broilers, and to a lesser extent in table-eggs, has been a major contributing factor in the survival of the family farm in the Southeast and to the broiler industry's rapid development.



CLAUDE H. MOORE

Poultry production was of little value in Alabama until the 1950's. However, the Alabama Agricultural Experiment Station began poultry research in 1924 with the construction of one of the most modern research facilities in the South. This facility was useful until 1977 when it was replaced with a new research unit that is now the envy of research scientists around the world. Research at Auburn has attempted to parallel needs of the industry. Much of the early work concerned upgrading nutrition, managing farm flocks (including light management) to produce eggs the year round, and force molting for off-season production. Early recognition that diseases and parasites must be controlled influenced the direction of ongoing research. Genetic resistance to diseases and parasites was demonstrated here and foundation breeding stock from the Auburn Leghorn was supplied to commercial breeders of table-egg stock.

With limited financial and faculty resources, research emphasis began to shift from table-eggs to poultry meat in the 1950's. This has continued to the present, with current emphasis being on reproductive efficiency, health management, nutrition, and body composition. The major problem of eggshell formation in table-egg production still is a major thrust. We continue to see rapid expansive poultry meat production and will continue to have problems evolve as a result of expansion. In a highly competitive industry I see the need for research to continue on performance parameters and on waste management.

In reflecting on my tenure at Auburn, I can truly say I am honored to have been associated with research, teaching, and extension faculty who have shown full dedication to the State's dynamic poultry industry.

Claude H. Moore

## CONGRATULATIONS TO...

Dr. Claude H. Moore, Associate Dean for Research in the Auburn University College of Agriculture, who retires July 1 after 33 years of service to Auburn's agricultural teaching and research programs.

Most of Moore's service (1959-86) was as head of the Department of Poultry Science, where he directed Auburn's poultry teaching and research activities. Since 1986 he has served as Interim Associate Dean for Research, a position in which he has used his expertise in research organization and management to help coordinate research efforts between the College of Agriculture and Alabama Agricultural Experiment Station.

A native of Cullman County, Moore graduated from Auburn in 1947, after which he did his M.S. study at Kansas State University and Ph.D. work at Purdue University. He joined the Auburn faculty in 1956 as Associate Professor, and was promoted to Professor and Department Head in 1959. His 27-year tenure as Department Head places him among an elite group of long-serving department heads in Auburn's history.

An active member of the Poultry Science Association since 1949, Moore was elected President of that scientific organization in 1980.

Best wishes for a rewarding retirement.

Lowell T. Frobish  
Director



**ON THE COVER.** Experimental ear tags gave good control of horn flies in tests at the Lower Coastal Plain Substation. (See story on page 4.)

SUMMER 1989 VOL. 36, NO. 2

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

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

**Editorial Committee:** Lowell T. Frobish; D. I. Bransby, *Associate Professor of Agronomy and Soils*; N. R. Holler, *Associate Professor of Zoology and Wildlife Science*; J. D. Weete, *Professor of Botany and Microbiology*; P. A. Duffy, *Assistant Professor of Agricultural Economics and Rural Sociology*; R. T. Lovell, *Professor of Fisheries and Allied Aquacultures*; T. P. Mack, *Associate Professor of Entomology*; R. E. Keith, *Associate Professor of Nutrition and Foods*; D. B. South, *Assistant Professor of Forestry*; D. A. Stringfellow, *Assistant Professor of Microbiology*; and R. E. Stevenson.

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

# CLOXACILLIN TREATMENT OF DRY COWS EFFECTIVE AGAINST MASTITIS

**M**ASTITIS is the single biggest cause of lost revenue for dairymen. Losses are estimated to be as much as \$1 billion per year for the U. S. dairy industry.

Many cases of mastitis (inflammation of the mammary gland) are caused by infection with microorganisms that are resistant to antibiotic treatment during lactation. The result is chronic mastitis, which alternates between signs of the disease followed by periods of apparently normal milk secretion.

The microorganisms responsible for most chronic mastitis are *Staphylococcus aureus*, which are resistant to penicillin. They can imbed themselves in the tissue of the mammary gland and "hide" from antibiotics infused into the ducts of the gland. In general, these infections can only be treated during the dry period when lactation has ceased. However, the dry period is also a time of high risk of new infections developing.

The primary antibiotic used to treat mastitis during the dry period is cloxacillin, a synthetic penicillin that is effective against the microorganisms that cause chronic mastitis. It is administered in a base that is slowly absorbed and cleared from the mammary gland. This allows time for the antibiotic to penetrate the tissue and kill the infecting microorganisms. Approximately 75% of existing infections can be eliminated during the dry period with this treatment. Since the 2-3 weeks immediately after drying off are high risk times for new infections, repeated infusions of cloxacillin during this period have been suggested as a way to reduce occurrence of infections.

Repeated infusions of cloxacillin during the dry period were tried in an Alabama Agricultural Experiment Station study. The purpose was to determine the effectiveness in eliminating existing infections and preventing the development of new infections.

Ninety Holstein cows were divided into 30-cow groups for these treatments:

(1) no treatment of dry cows, (2) one infusion of cloxacillin, and (3) three infusions—one each at the last milking, 1 week later, and 2 weeks after drying off. All infusions were 500 mg (milligrams).

Milk samples were collected for analysis of somatic cell count and culture of bacteria 1 week before drying off, at drying off, 3-5 days after calving, and 7-10 days after calving. Milk production was recorded each day and somatic cell count once per month in the lactation following treatment. A given species of microorganisms had to be isolated twice from two sequential quarter-samples for the quarter to be considered infected.

There was no difference in milk production or somatic cell count among the treatment groups during the lactation following the dry period. However, increasing cloxacillin infusion decreased the number of infected quarters per cow immediately post-calving.

The number of cows per group with mastitis in the first 30 days post-calving was higher in the group that was not treated in the dry period than the two groups that did receive treatment, as shown by data in the table. There was no difference among groups in the number of staphylococcus species-infected quarters at drying off, but the treated cows had a lower number of infected quarters post-calving than those not treated with cloxacillin. Multiple dry-cow treatment also decreased the number of quarters infected with various other species post-calving, which resulted in fewer total infected quarters in the multiple infusion group post-calving.

EFFECTIVENESS OF DIFFERENT NUMBERS OF CLOXACILLIN INFUSIONS ON MASTITIS OCCURRENCE

Measurement	Result, by number of infusions		
	None	1	3
Infected quarters per cow post-calving . . . . .	2.4	1.6	1.2
Number of cows with mastitis first month after calving . . . . .	9	5	5
Number of quarters infected with coagulase-positive staphylococcus			
Drying off . . . . .	11	13	13
Post-calving . . . . .	10	4	4
Number of other species of microorganisms <sup>1</sup>			
Drying off . . . . .	40	40	43
Post-calving . . . . .	44	38	24

<sup>1</sup>*Streptococcus, Corynebacterium, Bacillus, Pseudomonas, and coagulase-negative staphylococci.*

The majority of the *Staphylococcus* infections (7 of 10) post-calving in the untreated group were new infections that developed during the dry period. Only two of three infections persisted during the dry period among all treatment groups, including those that received no cloxacillin treatment. The remainder were eliminated by the cow's natural immune process or by the antibiotic treatment. Thus, the major effect of cloxacillin treatment on number of infected quarters appears to be the prevention of new infections during the dry period.

Results of dry-cow treatment with cloxacillin can be summarized by these four statements:

1. Dry-cow treatment with cloxacillin is an efficient way to reduce *Staphylococcus* infections.
2. Dry-cow treatment decreases the number of quarters post-calving that are infected with other species of organisms.
3. Multiple infusions do not give better results than a single infusion as far as number of infected quarters post-calving are concerned.
4. Multiple treatments do not provide benefits to justify the added expenses and labor required.

Cummins is Associate Professor and McCaskey is Professor of Animal and Dairy Sciences.

# NEW INSECTICIDAL EAR TAGS

## Show Promise for Controlling Pyrethroid-resistant Horn Flies



**E**AR TAGS impregnated with pyrethroid insecticides appeared to be the solution for horn fly control in 1980 when the tags were labeled for beef cattle. One tag per animal kept horn fly populations under control for 5-6 months. But such results were short-lived. Resistance to pyrethroids began showing up by 1982, and this has continued to be a problem for cattlemen in Alabama and other cattle-producing states.

Several tags have been labeled in recent years, and other experimental ones are being evaluated. Some of these have given good results in Alabama Agricultural Experiment Station tests.

The ear tag tests were done at the Lower Coastal Plain Substation, Camden. The newly labeled tags were evaluated with four Angus cow/calf herds, while the experimentals were tested on four Charolais cow/calf herds. Horn fly problems vary among cow breeds, so no direct comparisons are made between the experimental and labeled groups of ear tags. However, results do give valid comparisons among the different treatments applied to each breed group.

Control was measured by counting the horn flies that could be seen on one side of each of 10 animals (reported as flies per side). Binoculars were used in counting. Pre-treatment counts were made May 24, 1988, and ear tags were put in place the following 2 days on cows in the herds. Tags were not placed on calves. Details of the tests are reported separately for each cow breed. As a point of reference, an average of 50 flies per side is considered the economic treatment threshold.

**ANGUS HERDS.** Treatments (newly labeled tags) were as follows:

Herd 1—Tomahawk® (Primophos methyl), 2 tags/cow

Herd 2—Max-Con® (Dursban, Cypermethrin, and PBO), 2 tags/cow

Herd 3—Terminator® (diazinon), 2 tags/cow

Herd 4—Terminator (diazinon), 1 tag/cow

Tomahawk and Max-Con lost control at the 10-week count with an average of 180 and 141 flies per side, respectively, figure 1. Both were terminated at 12 weeks when flies per side reached 250. Resistance to insecticides was severe at the Lower Coastal Plain location, as suggested by better control from these two tags at other locations.

Terminator tags gave excellent control for about 5 months when used at the rate of two per cow. One tag per cow held fly populations below 50 per side for 16 weeks, figure 1.

**CHAROLAIS HERDS.** Experimental tags were used as follows:

Herd 1—YT 609 (diazinon), 2 tags/cow

Herd 2—YT 609 (diazinon), 1 tag/cow

Herd 3—YT 607C3 (diazinon), 2 tags/cow

Herd 4—YT 802B1 (malathion), 2 tags/cow

Experimental tag YT 609 gave excellent control for about 5 months at both one and two tags per cow, figure 2. Tag YT 607C3 at

two tags per cow gave comparable control. In contrast, experimental tag YT 802B1 was terminated after 4 weeks with an average of 91 flies per side, indicating it would not reduce numbers below the threshold level.

Y-Text Corporation received EPA labeling for the experimental tag YT 609 in January 1989, which will be sold under the trade name Optimizer®.

Strother is Associate Professor of Entomology; Little is Superintendent of the Lower Coastal Plain Substation.

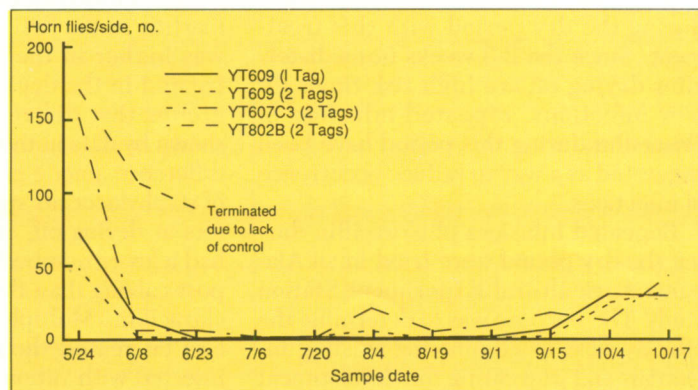
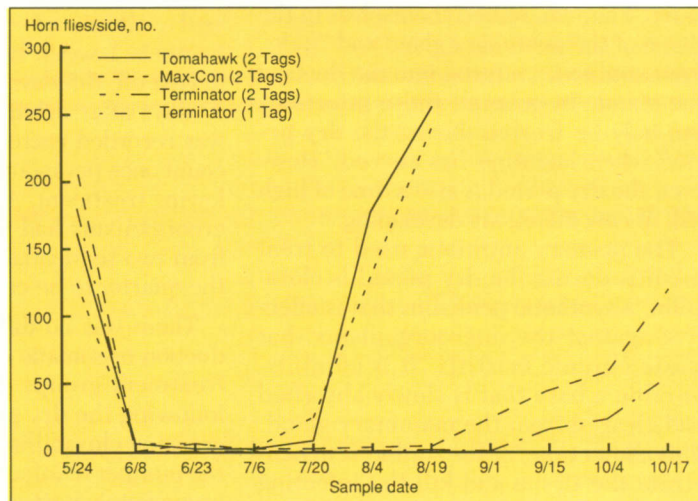


FIG. 1 (top). Horn fly control on Angus cattle with recently labeled tags. FIG. 2 (bottom). Horn fly control on Charolais cattle with experimental tags.

# PHOSPHORUS SOURCE MAY BE THE CAUSE OF SOME MYSTERIOUS POULTRY LEG PROBLEMS

**L**EG PROBLEMS continue to be a concern for poultry producers in Alabama and across the country. Chickens that are fed nutritionally balanced diets and raised under optimum management conditions, and which appear normal, often end up with broken legs and wings in the processing plants. The end result is condemnation or downgrading of poultry meat. Alabama Agricultural Experiment Station research suggests that the source of phosphorus in the diet of chickens may be the cause of some leg problems when disease and poor management are ruled out as causes.

Most leg problems associated with nutrition are attributed to deficiencies of calcium, phosphorus, and vitamin D, or an improper balance among these nutrients. Calcium and phosphorus are required for strong bone formation, and vitamin D enhances the absorption of these nutrients.

In poultry diets, calcium and phosphorus can be supplied from either or-

ganic or inorganic sources. Bone meal is an organic source, and its phosphorus has been considered to be 100% available to chickens. However, there are reports of variations ranging from 5% to 30% in phosphorus availability from bone meal. Because of these variations, errors may be made when bone meal is included in diets for meat-type chickens.

In the Auburn research, particle size and source of bone meal were evaluated as factors influencing phosphorus availability. Data obtained were compared with those using a standard, dicalcium phosphate, an inorganic phosphorus supplement of excellent phosphorus availability that is commonly used in poultry diets.

In the first and second experiments, table 1, bone meal was prepared from chicken bones and screened into three particle sizes (coarse, granular, and fine). This was fed to chickens (males and females in experiment 1 and males only in experiment 2) from 1 day to 3 weeks of age. In the third experiment, table 2, bone meal was prepared separately from bones of chicken, catfish, swine, and cattle. The bone meals were added to corn-soybean diets and fed to male chickens from day old to 3 weeks of age. Bone criteria provide the most sensitive measure of phosphorus availability, so the results reported are based on bone weight, strength, and ash.

Particle size of bone meal influenced phosphorus availability to some extent in experiment 1, but the same trend was not observed in experiment 2. There was no difference in phosphorus availability among bone meal sources. However, phosphorus from the different bone meal sources was 6-12% less available than that from dicalcium phosphate. This means that chickens fed organic phosphorus supplements might be receiving marginal levels of phosphorus, if availability values of 100% are used. The degree of deficiency would be dependent upon the percent of total dietary phos-

phorus supplied by the organic sources.

While the phosphorus available under these conditions could readily support body weight and feed efficiency, it might not be adequate to support maximum bone development. This may explain why some leg problems occur when broilers are raised under seemingly optimal nutrition and management conditions.

This research indicates that phosphorus availability values of 90-95%, instead of 100%, may be used in diets containing organic phosphorus sources to reduce otherwise unexplained leg problems in chickens.

Orban is Graduate Research Assistant and Roland is Professor of Poultry Science.



DCP



CBM



FBM



SBM



BBM



MBM

Calcium and phosphorus sources fed to chickens: (from top) DCP, dicalcium phosphate; CBM, chicken bone meal; FBM, fish bone meal; SBM, swine bone meal; BBM, cattle bone meal; and MBM, mixed bone meal.

TABLE 1. AVERAGE PHOSPHOROUS AVAILABILITY FROM BONE MEAL AS INFLUENCED BY PARTICLE SIZE

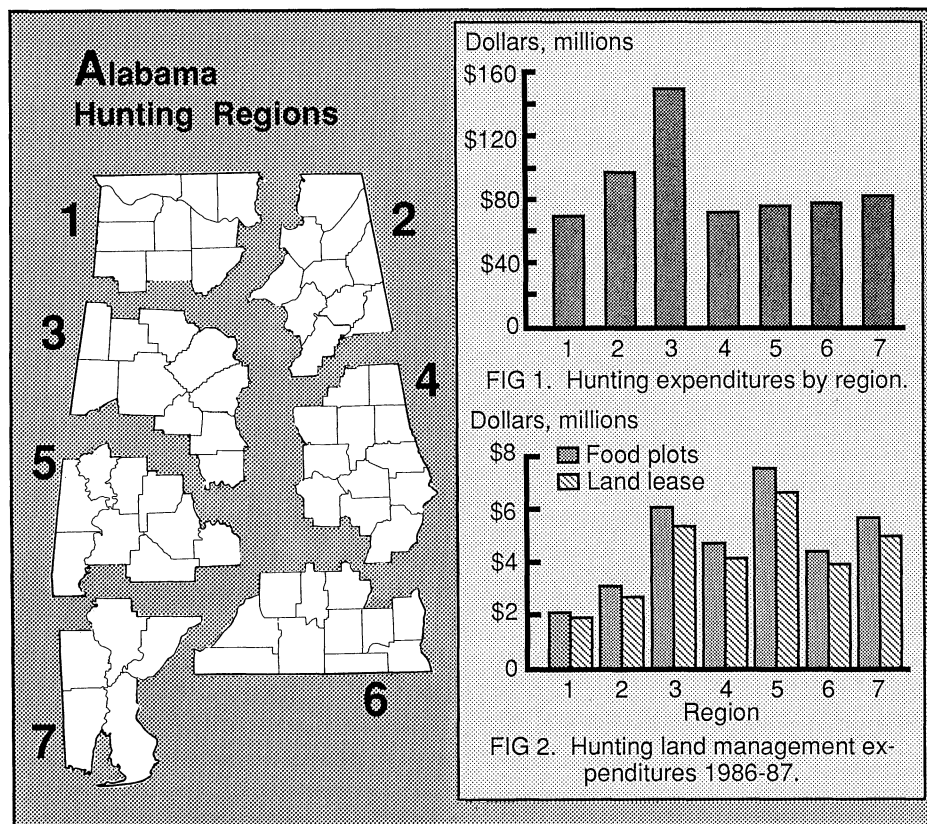
Bone meal particle size	Experiment 1	Experiment 2
	Pct.	Pct.
Coarse . . . . .	83.0	90.6
Granular . . . . .	91.0	90.6
Fine . . . . .	88.1	90.1

TABLE 2. AVERAGE PHOSPHOROUS AVAILABILITY FROM BONE MEAL AS INFLUENCED BY SOURCE OF BONE MEAL

Bone meal source	Experiment 3
	Pct.
Chicken bone meal . . . . .	93.8
Fish bone meal . . . . .	88.5
Swine bone meal . . . . .	90.8
Cattle bone meal . . . . .	93.2
Mixed bone meal <sup>1</sup> . . . . .	92.8
Standard <sup>2</sup> . . . . .	100.0

<sup>1</sup>Mixed bone meal is a mixture of chicken, fish, swine, and cattle bone meals (1:1:1:1).  
<sup>2</sup>Standard = dicalcium phosphate.

# HUNTING IS BIG BUSINESS IN ALABAMA



Expenditures were greatest in north central Alabama (Region 3), with \$148.7 million spent on hunting and related items, figure 1. This region contains the major population centers of Birmingham and Tuscaloosa. Most expenditures fell into the category of equipment (guns, clothes, vehicles, etc.). There was little difference among the other regions of the State, with expenditures ranging from about \$68 million to \$96 million annually.

Deer and turkey hunting accounted for most of the hunting effort across the State, as reflected in the expenditures. For example, most of the money spent on hunting leases, fees, and food plots occurred in west-central Alabama (regions 3 and 5) where the best deer and turkey populations have traditionally occurred, figure 2. The west-central Alabama area ranked highest in hunting lease expenditures. The 9-county Region 5 area ranked well above other regions, with more than \$6.7 million spent annually on hunting leases. Similar size areas of northern Alabama (regions 1 and 2) accounted for the smallest portion of hunting lease expenditures (from \$1.9 to \$2.7 million per year), but deer and turkey populations in north Alabama are generally lower than other parts of the State.

The amount spent for hunting leases across the State exceeded \$25 million. However, the amount spent on planting crops for wildlife was even greater, \$34 million. In every region, more money was spent to provide food for wildlife than was spent on hunting leases. This is because many landowners who do not lease their land to others for hunting spend money to feed, attract, and hold wildlife on their property for themselves, their families, and friends. Most of the \$34 million spent on food plantings probably flowed into local economies near a hunting area because of associated transportation costs of bulky items such as seed, lime, and fertilizer, as well as large pieces of planting equipment.

**D**EER AND TURKEY are more plentiful in Alabama than in many other states. However, maintenance of such wildlife populations requires conservation of habitat on which they depend. Today's high demand for converting land and water resources to alternative uses means wildlife must compete with other uses of available land and water. Therefore, it is essential to document the economic value of Alabama wildlife before these habitats are converted to other land uses.

A recent study showed that more than \$600 million are spent each year in all segments of the Alabama economy on hunting and hunting-related activities. Because hunting is only one aspect of wildlife utilization, expenditures on other wildlife-related activities, such as bird watching or bird feeding, would push this figure even higher. The study by the Alabama Agricultural Experiment Station documented the amount spent,

location of expenditures, and merchandise purchased relative to hunting and hunting-related activities in the State.

Hunting expenditures were determined by surveying individuals who purchased hunting licenses during the 1986-87 hunting season. A random sample of individuals holding resident or nonresident hunting licenses was questioned by mail. Nonrespondents were sent follow-up mailings. Questions on all types of hunting expenditures and where expenditures occurred were covered. Final response was 40%.

Total hunting-related expenditures amounted to \$617,978,433. Specific expenditures included:

Equipment .....	\$90,217,192
Clothing .....	27,063,694
Hunting dogs .....	39,394,188
4X4 trucks .....	252,299,818
Off-road vehicles .....	57,107,418
Vehicle operation .....	56,945,798
Lodging .....	4,592,227
Land lease/fees .....	29,956,312
Food plots .....	33,957,721
Other .....	26,444,065

Stribling is Assistant Professor and Wallace is Graduate Research Assistant of Zoology and Wildlife Science; Clonts is Professor of Agricultural Economics and Rural Sociology.

# ALABAMIANS CONCERNED ABOUT HAZARDOUS WASTE

**E**VERY YEAR, approximately 300 million tons of hazardous waste are generated in the United States. This is approximately 1 ton for every man, woman, and child in this country. Disposing of this material is a serious national problem.

The hazardous waste issue is of particular relevance to Alabamians since the State hosts the nation's largest off-site commercial landfill in the United States. This facility, located near Emelle in Sumter County, accepted over 500,000 tons of hazardous waste for disposal in 1987.

As part of a larger, ongoing study conducted by the Alabama Agricultural Experiment Station, Alabama residents were surveyed to determine public awareness and opinion on the hazardous waste issue. Some 1,600 questionnaires were mailed in the summer and fall of 1988 to three target populations: a random statewide sample; a smaller sample of Sumter County residents; and members of the Alabama Chapter of the Sierra Club, a conservation organization presumed to have above average environmental awareness. Of these, 595 questionnaires were returned.

The responses reflect the relative seriousness with which Alabama residents regard hazardous waste and general environmental issues compared with other issues of national concern. Nearly 80% of Alabama residents responded that hazardous wastes are either "very serious" or "extremely serious" problems at the national level, far surpassing concerns over unemployment, the budget deficit, or the arms race. Only drugs (93%) were regarded as more serious national problems by Alabama residents. A similar pattern emerged among Sumter County residents, though both drugs and crime were regarded more seriously than hazardous wastes by this group. But, when asked how serious a threat hazardous waste was to their specific community, Sumter County residents were much

more likely to consider this an extremely serious or very serious threat than were respondents from the state-wide sample (77% versus 66%). More than 81% of the Sierra Club sample believed hazardous waste to be an extremely serious or a very serious threat to their community.

Respondents also were asked which government agency they thought should make decisions on hazardous waste management affecting their own county, see table. Interestingly, despite the criticism received by the regulatory agencies in recent years, all three samples indicated stronger approval for both Federal (Environmental Protection Agency) and State (Alabama Department of Environmental Management) regulatory agencies making such decisions than any other governmental bodies. Furthermore, when asked who should be responsible for making decisions regarding

## **Alabamians are evidently unwilling to relegate all power and authority to others outside the local community.**

the location of treatment facilities, scientific experts were strongly favored over other decision makers. Virtually no one approved of private industry being responsible for site selection.

Respondents also were asked how strongly they would favor or oppose a hazardous waste facility locating in their community under specific circumstan-

APPROVAL OF AGENCIES FOR MAKING HAZARDOUS WASTE MANAGEMENT DECISIONS

Agency	Percentages approving or strongly approving <sup>1</sup>		
	State (N = 399) <sup>2</sup>	Sumter Co. (N = 69)	Sierra Club (N = 127)
EPA .....	58.5	66.1	57.8
U.S. Congress .....	30.0	25.0	33.9
Alabama Governor .....	52.0	47.7	32.3
Alabama Attorney General .....	41.1	39.7	45.0
ADEM .....	78.2	64.5	61.7
State Legislature .....	34.9	44.2	21.7
Local Government .....	56.7	49.2	51.6

<sup>1</sup>A five-point Likert scale was used with the range of possible answers including: Strongly Approve; Approve; Undecided; Disapprove; Strongly Disapprove.

<sup>2</sup>Number of respondents.

ces. Those circumstances included the creation of new jobs by the facility, lowering of property taxes, paying for fire protection, provisions for local monitoring of the facility, and having the facility operated by various Federal, State, and private agencies.

In none of the three samples did a majority favor the location of such a facility in their community under any specified circumstances. Sierra Club respondents characteristically oppose such a facility more strongly than do the other two samples regardless of the circumstances. All three samples, however, were least opposed if a local committee monitored safety precautions. Hence, in spite of the apparent trust in scientific experts reported above, Alabamians are evidently unwilling to relegate all power and authority to these experts and others outside the local community.

These public opinion highlights suggest that, while the environment and hazardous waste are regarded as serious national issues, there are other national concerns, particularly drug abuse, which are regarded as substantially more serious by Alabama residents.

Faupel is Assistant Professor of Sociology; Bailey is Associate Professor of Agricultural Economics and Rural Sociology; Holland and Waren are Graduate Students in the interdepartmental Sociology/Rural Sociology graduate program.

# NEWLY DISCOVERED FUNGAL PATHOGEN MAY HELP CONTROL THREECORNERED ALFALFA HOPPER

**A**N INSECT-INFECTING fungus, previously undiscovered in North America and one of the most deadly natural enemies of the threecornered alfalfa hopper, has been found in Alabama. The good news is that it may offer new control methods for one of the State's most destructive soybean pests.

The threecornered alfalfa hopper typically feeds on soybean stems, eventually girdling the stem and reducing the flow of nutrients within the plant. The bottom line is reduced yields and increased problems with lodging.

In a 2-year study to identify the natural enemies of this pest, the Alabama Agricultural Experiment Station found that the most important mortality factor of the threecornered alfalfa hopper was a fungus (scientific name *Erynia delphacis*). This fungus had been isolated previously from three species of plant-hoppers, three species of leafhoppers, and an aphid, all in Asia.

When the fungus was found in threecornered alfalfa hoppers taken from two fields sampled in Alabama in 1985 and 1986, this was the first association with a member of the treehopper family (Membracidae) and the first record of its existence in North America. It is very species specific and is not detrimental to beneficial insects.

Weekly samples of threecornered alfalfa hoppers were collected from soybean fields at the Plant Breeding Unit near Tallassee in 1985 and at the Black Belt Substation near Marion Junction in 1986. Adult threecornered alfalfa hoppers were collected with a sweepnet and immatures were obtained from whole plants that were removed from the field and examined in the laboratory.

Individuals of each stage were held in the laboratory to determine natural mor-

tality factors. Several adults collected August 16, 1985, exhibited symptoms typical of an insect pathogenic fungus infection. Field-collected immatures were also found to be infected by the same fungus. These insects were found attached to plants by their claws and mouthparts, as well as by intertwined growths of fungal hyphae under their bodies.

Subsequent field samples revealed that the infection continued in threecornered alfalfa hopper populations through the end of September 1985 and from September 18 through October 10, 1986. Periodic samples of field-collected insects taken through the growing season showed fungus-induced mortality levels reaching approximately 20%. The highest insect mortality occurred at the end of September in both 1985 and 1986.

The fungus was isolated in the laboratory on agar using fungal propagules extracted from dead insects. Infection of adult threecornered alfalfa hoppers was achieved by exposing the insects to fungus from the culture or field-infected insects for 48 hours.

Adult threecornered alfalfa hoppers infected in the laboratory were used in a greenhouse study to observe differences between infected and noninfected insects. This study revealed that infected



An adult threecornered alfalfa hopper infected with pathogenic fungus.

insects positioned themselves most often low (mean height  $7.3 \pm 4.2$  in.) on the plant and less than 3 in. from the mainstem. In contrast, uninfected insects were most often found higher on the plant (mean height  $10.7 \pm 6.1$  in.) and more than 3 in. from the mainstem.

The change in relative position on the plant caused by infection with this fungus would make the insects less accessible to sweepnet sampling and could lead to underestimation of the percent of infected insects present in the field. It could also help explain why the fungus has not been reported previously.

This fungus may have an even greater impact on reduction of threecornered alfalfa hopper populations in soybean fields in Alabama. Its impact might be increased by using narrow row spacing and an early planting date to cause plant canopy closure earlier in the growing season. The resulting increase in humidity within the canopy, a condition that favors development of this group of fungi, should promote infection and result in higher and earlier levels of natural infection in threecornered alfalfa hopper populations. But, this practice can also promote the growth of plant parasitic fungi and bacteria.

Miller is Laboratory Technician and Harper is former Professor of Entomology.



# FORMOSAN TERMITES NOW IN ALABAMA

## *Tolerance to High Temperatures Makes These Termites a Threat to South Alabama*



Soldier stages of Formosan (left) and eastern (right) subterranean termites.

tation, have been near ports or inland waterways. The Auburn infestation was caused by the movement of infested railroad ties and is now thought to be eradicated.

Because of its economic importance, the Formosan subterranean termite was studied in research by the Alabama Agricultural Experiment Station. Its distribution in Ala-

bama was determined by sampling populations in the State's coastal regions. In addition, physiological factors that may reflect the behavior and distribution of this pest were contrasted with those of the native eastern subterranean termite that is commonly found in Alabama and throughout the United States.

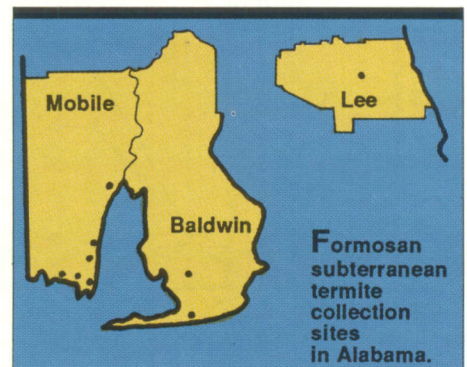
Formosan and eastern subterranean termites can be easily distinguished by the appearance and behavior of the soldier and alate (winged reproductives) stages. Formosan subterranean termite soldiers have bulbous pear-shaped heads and are fairly aggressive. They appear in large numbers when a colony is opened. Eastern subterranean termite soldiers have rectangular heads and are typically less aggressive. In native areas, termites start new colonies by swarming. Alate reproductives are formed in the colony and swarm when environmental conditions are optimal. Formosan alates swarm in the early evening, frequently after summer rains, and fly to lights as many moths do. Eastern subterranean alates swarm during the day in the spring, usually in the morning or early afternoon.

Since Formosan subterranean termites fly to lights, they can be captured with mosquito light traps. With help from the Mobile County Health Department Bureau of Vector Control, samples

were obtained from light trap locations throughout Mobile County. Termites were also obtained from insect samples sent to the Cooperative Extension Service. As shown on the map, Formosan subterranean termite alates were captured at many locations in Mobile and Baldwin counties. There are likely many more infestations than just those found by the light traps. Another infestation was identified in Auburn May 6, 1989, also from used railroad ties.

Because the Formosan subterranean termite is distributed in warm, usually humid regions and frequently near water, aspects of their temperature relations were investigated and compared to the native eastern subterranean termite. Termites were heated or cooled at a constant rate (3.4°F per minute) to determine the temperatures at which they lost the ability to move (knock down temperature). Formosan subterranean termites were knocked down at about 3.4°F hotter temperatures than the native eastern subterranean termites. However, the Formosan termites were more susceptible to cold temperatures. This implies that Formosan subterranean termites may be better adapted to warm climates than eastern subterranean termites and may not become established in the northern climates of Alabama and the United States because of their vulnerability to cold.

Appel is Assistant Professor and Sponsler is Laboratory Technician III in Entomology.



**T**HE FORMOSAN subterranean termite has arrived in Alabama, bringing new concerns for homeowners. This termite forms faster growing and larger colonies and feeds more actively than other termite species, making it one of the most destructive termite species worldwide. It is an important pest in tropical and subtropical areas such as Guam, Taiwan, the Philippines, and Hawaii. It is estimated that in Hawaii alone, more than \$60 million is spent annually to control the Formosan termite.

This important pest has been reported in the continental United States at scattered sites along the Gulf Coast from Houston, Texas, to central Florida and from Charleston, South Carolina, to Memphis, Tennessee. There are no estimates of Formosan subterranean termite damage in Alabama, although the termite has been reported in Mobile and, in 1987, as far north as Auburn.

The Formosan subterranean termite was probably introduced into the Southeast with infested marine cargo in ships returning from the Pacific Theater at the end of World War II and the Korean Conflict. Subsequent infestations have been caused mainly by transportation of infested wood. All reports of Formosan subterranean termite infestations in the United States, except the Auburn infes-

# REDUCING HANDLING STRESS AIDS IMMUNE FUNCTION IN CALVES

**S**TRESS is a physiologic condition produced by the actions of corticosteroids and other hormones that are released when an animal senses a potential threat to its safety. Stress hormones are beneficial under most circumstances because they cause biochemical changes that increase the likelihood of survival in life-threatening situations. However, stress hormones, particularly corticosteroids, can interfere with the ability of the animal's immune system to protect against harmful viruses and bacteria. Routine livestock management practices that trigger a stress response in calves may temporarily decrease their natural resistance to infection.

In the current feeder calf marketing system, calves are weaned, transported to a sale barn, and then shipped to distant feedlots where they are processed and started on feed. Sickness and death are highest within 2 weeks after the calves arrive at a feedlot. Most deaths are attributable to respiratory disease. Feeder calves encounter many potential stressors during the first few days after weaning. It is widely believed that stress predisposes those calves to infectious

disease by impairing their immune system. However, few studies have actually demonstrated a correlation between a naturally induced stress response and a decrease in the competence of the immune system.

Results of research underway at the Alabama Agricultural Experiment Station have shown that the rise in corticosteroid hormone level in calves exposed to a stressful stimulus lasts only a few hours. As expected, the high corticosteroid concentration coincides with a reduced activity of an important immune cell type (lymphocyte), resulting in an increased susceptibility to infections.

One study examined the effects of routine surgical castration of 5-month-old beef calves on blood hormone concentrations. Corticosteroid concentration, leukocyte (white blood cell) concentration, and the ability of lymphocytes (white blood cells with immune functions) to respond to a chemical stimulus were measured in blood samples collected before and after castration.

Corticosteroid concentration increased sharply immediately after surgery, but dropped back to nearly normal by the next day. Concentration of neutrophils (white blood cells that battle bacteria) was higher in the blood after castration, while lymphocytes were lower, probably caused by a rerouting of leukocytes to different areas of the body. Lymphocytes responded normally to a chemical stimulus 30 minutes after surgery, but displayed depressed activity in most castrated calves within 24 hours. Within 48 hours after castration, lymphocyte responses were nearly normal again. Lymphocyte activity re-

mained within normal limits in uncastrated calves.

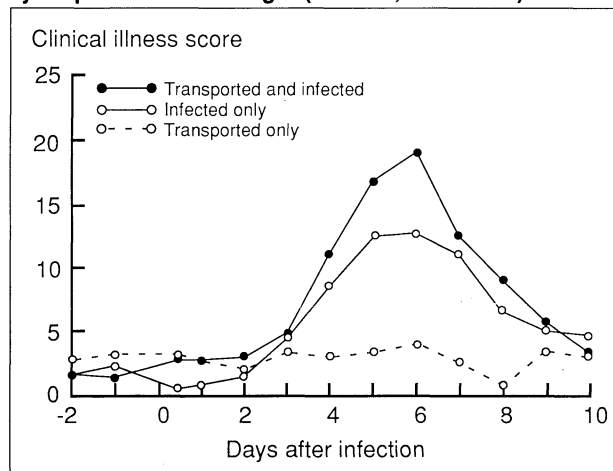
The second study evaluated transportation's impact on calves' resistance to experimentally induced respiratory disease. Five-month-old Holstein steers were hauled in a stock trailer for 2 hours on country roads. After being returned to their pens, the calves were given aerosol inoculations of infectious bovine rhinotracheitis (IBR) virus and *Pasteurella haemolytica* bacteria, two microorganisms commonly associated with feedlot respiratory diseases in calves. A group of control calves that had not been transported but had been experimentally infected were used for comparison.

Corticosteroid concentration in the blood was high in the transported calves during the journey and immediately after unloading, but returned to normal by the next day. A stress-associated increase in neutrophils was observed in the blood samples taken after unloading calves. Clinical illness (signs of illness such as watery eyes and runny noses) was more severe in the transported calves than in the control calves, as shown in the figure. Peak corticosteroid concentration was only slightly higher after castration than after trucking.

In both studies, calves were haltered and handled daily for a week before sample collection began. This conditioning helped reduce the added stress response animals typically have to unaccustomed handling, even when it is gentle.

The endocrine and immune changes observed in these studies suggest that immune function is briefly suppressed following common livestock handling practices. An association between the release of stress hormones and temporary depression of immune function helps to explain the high incidence of respiratory disease in newly received feeder calves. Since this stress response is unavoidable but predictable, possible control measures may include preweaning or preconditioning calves before additional stress is added. Special attention to infectious disease control when handling stressed calves and judicious use of prophylactic antibiotics are measures currently available. In the future, calves will probably be given short-acting drugs that stimulate the immune system during the immediate post-stress period.

**Clinical illness in transported and control calves following experimental respiratory infection. The score is based on severity of specified disease signs (0 = none, 25 = severe).**



Brunner is Assistant Professor of Pathobiology.

# SOME FARMERS DON'T SHARE PUBLIC CONCERN ABOUT ANIMAL WASTE MANAGEMENT

**F**ARMERS FACE an increasingly critical public as the environmental consequences of many present day farm practices, including animal waste treatment and disposal, are measured and recognized. Concerns about environmental pollution and runoff into streams from animal housing and confinement areas and overloaded waste treatment and storage facilities are causing greater scrutiny of the way farmers manage animal waste. Despite this increased awareness, some farmers don't share the public's concern, according to a recent Alabama Agricultural Experiment Station survey.

In the summer of 1988, 753 questionnaires were sent to a random sample of farmers in Cullman and Blount counties in north Alabama. The 357 farmers who responded to the survey described the animal waste disposal facilities on their farms and the way they usually managed their animal waste. From these responses, researchers developed consensus perceptions by farmers on several waste management issues.

The table shows the percentage distribution of the 357 responses to several statements about the animal waste issue. Results reveal that few respondents saw a need to make changes in the way animal waste is handled on their farms, since only 7.7% acknowledged the need for action. About 14% saw farm animal waste as a major pollution problem in the county's streams and rivers and 18% regarded animal waste as a serious water quality problem. Similarly, 19% felt that the government should pay farmers to practice pollution control.

New regulations for drinking water and waste treatment are causing significant new costs for animal producers, and this was evident in the survey. Although about one-third of the respondents felt that new regulations are badly needed, about the same percentage felt that environmental controls are making it harder to run a farm. And, about 47% felt that concern for pollution control is often carried too far. However, about

65% agreed that farmers who pollute streams should be financially penalized. Over 68% believed that their neighbors properly dispose of their animal waste, while 74% responded that farmers in the surveyed counties generally do a good job of managing their animal waste.

The results illustrate a gradient of opinion about on-farm environmental management that is consistent with previous research on conservation practices. Only a few respondents acknowledged the necessity of making changes in the way animal waste is handled on their farms. Most farm operators have an optimistic perspective for themselves and their peers, and they do not recognize the potential of their present management practices to generate pollution. Moreover, many are unsure about the importance of environmental measures, which not only benefit the general public, but also farmers, their families, and surrounding communities.

Other industries have achieved high levels of compliance with environmental regulations, whereas farmers have long been able to forestall constraints on the way they grow crops and raise animals. Today, concerns about public health, water quality, and species diversity have at least equal footing with the farmer's right to make a profit. New rules about how agriculture can affect the environ-

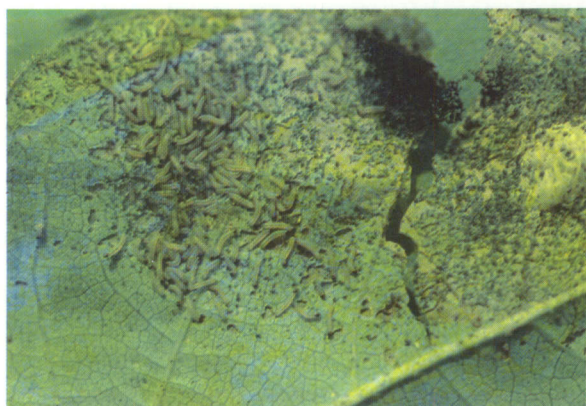
ment and better enforcement of the old ones are facts of life for today's farm operators.

FARMER PERCEPTIONS OF ANIMAL WASTE ISSUES, BLOUNT AND CULLMAN COUNTIES, 1988

Statement	Agree Pct.	Uncertain Pct.	Disagree Pct.
I know I must make some changes in the way animal waste is handled on my farm	7.7	18.0	74.3
Farm animal waste is a major source of pollution in this county's rivers and streams	14.6	28.6	56.8
Farm animal waste is a serious water quality problem . . . . .	18.4	42.1	39.5
The government should pay farmers to practice pollution control . . . . .	19.2	29.2	51.6
Laws regulating water pollution from farm animals are badly needed . . . . .	32.9	41.0	26.1
Environmental controls are making it harder for me to run my farm . . . . .	34.5	34.2	31.3
Given the economic realities, concern with pollution control is often carried too far . . . . .	47.2	26.4	26.4
Farmers who pollute streams should be financially penalized . . . . .	65.0	25.8	9.2
Most of my neighbors properly dispose of their animal waste	68.5	21.1	10.4
Farmers in this county generally do a good job of managing their animal waste	74.0	21.5	4.5

**T**oday, concerns about public health, water quality, and species diversity have at least equal footing with the farmer's right to make a profit.

## DISEASES, PARASITES HELP CONTROL BEET ARMYWORMS IN COTTON



Beet armyworms hatching on underside of cotton leaf.



Beet armyworm killed by a viral disease.

**T**HE BEET ARMYWORM has been a sporadic pest of cotton for many years, with large population outbreaks often occurring in years with dry summers. During these dry years, beet armyworms attack cotton as early as the seedling stage of the crop. However, there is usually little damage because the insects mainly feed on foliage and are controlled by natural biological agents.

It was a different story in 1988, with major damage from the pest occurring on large acreages in the State. Beet armyworms were first observed feeding on seedling cotton in Monroe County on May 18. By mid-June, this pest had severely defoliated several fields in Lee County. During the last 2 weeks of June, these worms were feeding on both foliage and squares in most fields in the sandy soil areas of southeastern Alabama.

The first 1988 outbreaks in most communities were in fields with sandy soils, where the plants were under stress from the drought. These infestations declined slightly in early July, only to reappear 2 weeks later. Growers immediately tried to control the young worms, but insecticidal treatments were less effective than those applied in June. No insecticide consistently reduced populations to below economic injury levels.

During mid- to late July, beet army-

worms fed heavily on squares and blooms. At this time, some growers began abandoning fields in which all fruit had been destroyed.

Beet armyworms spread throughout Alabama and the Midsouth in early August. Ultimately, this pest caused economic loss on approximately 50,000 acres of cotton in southeastern Alabama, and smaller populations infested the rest of the State's acreage.

Because of poor control obtained with insecticides, and because natural mortality factors have previously controlled beet armyworms effectively, research on natural control was begun by the Alabama Agricultural Experiment Station. The studies were meant to identify natural mortality factors impacting the pest and to seek methods of using them to advantage. In many of the most heavily attacked fields in east-central Alabama, many worms were attacked by a disease and by small, parasitic wasps. Incidence of the disease, which was caused by an insect virus, was extremely variable.

In late July, over 70% of beet armyworms in some fields died from disease, but by the time their populations declined in early August, only about 30% of the worms were infected. In southeastern Alabama, only about 10% of the worms were infected in August.

A field test conducted near Dothan provided preliminary information on the

efficacy of the virus. In this test, treatment with any of three rates of the virus, which was isolated from field-collected worms, caused significantly higher beet armyworm mortality (range = 31% to 45% and 51% to 69% at 1 and 5 days post-treatment, respectively) than in untreated plots (5% and 10% at 1 and 5 days post-treatment). Mortality due to parasites in these plots ranged from 8% to 24%.

Several species of parasites were reared from field-collected worms, but only two species were common. These have no common names, but are known by the scientific names *Cotesia marginiventris* and *Meteorus rubens*. In areas where the virus was most prevalent, about 11% of the worms were also parasitized by these wasps. In southern Alabama, where the virus was less prevalent, 23% to 43% of the worms were parasitized.

Together, the virus and parasites controlled most beet armyworm populations in August. Unfortunately, this was too late to prevent substantial damage to many fields. Thus, although the combination of disease and parasites offers considerable promise for controlling this pest on cotton, better ways of utilizing these factors are needed.

Smith is Professor, Harper is former Professor, and Gaylor is Associate Professor of Entomology.

# GROWTH REGULATORS FOR AFRICAN VIOLETS

## *Use Increases Number of Plantlets and Weight of Propagated Plants*

**C**HEMICAL GROWTH regulators are widely used to improve quality of numerous florist crops. Now there is research evidence that such chemicals can be used to advantage in propagating African violets, one of America's most popular houseplants. Both number of plantlets and dry weight of propagated plants were increased by growth regulator sprays in Alabama Agricultural Experiment Station research.

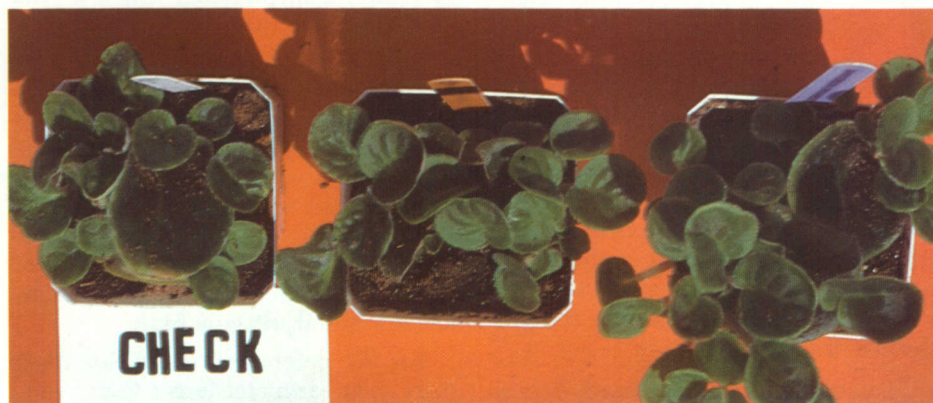
Two growth regulators, GA (gibberellic acid) and PBA<sup>1</sup> (a cytokinin that increases cell division in plants), were evaluated in the tests. The chemicals were sprayed on developing shoots from leaf blade cuttings of the Minnesota cultivar. Comparisons were made with shoots from rooted leaf cuttings that received no treatment and others in which the leaf was broken. (Details about African violet propagation methods are described in the box.)

Two cuttings were placed in a tent-like position in a 4-in. pot containing equal volumes of sphagnum peat moss and perlite amended with fertilizer and a wetting agent. Cuttings were propagated November 20 under high humidity at 72°F minimum night temperature at 5,000 ft.-candles illumination. Spraying of developing shoots (½ in. long) followed on January 29.

Spray treatments were: (1) spraying with 50 p.p.m. (parts per million) GA, (2) spraying with 100 p.p.m. PBA, and (3) spraying with 50 p.p.m. GA followed by 100 p.p.m. PBA. Spray was applied until runoff, using a manually operated, low-pressure sprayer.

The leaf breaking treatment involved manually reducing the leaf area by one-half across the midvein.

Spraying with the combination of 50 p.p.m. gibberellic acid and 100 p.p.m. PBA increased the number of plantlets and plantlet dry weight more than any



Growth differences illustrate effects of growth regulator treatments: left—no treatment; middle—leaf break; right—50 p.p.m. GA then 100 p.p.m. PBA.

EFFECT OF PLANT GROWTH REGULATORS ON NUMBER OF PLANTLETS AND PLANTLET DRY WEIGHT PER TWO ROOTED AFRICAN VIOLET LEAF BLADE CUTTINGS

Treatment	Plantlets	Dry wt.
	No.	Grams
Check (no treatment) . . .	5.8	1.0
50 p.p.m. GA . . . . .	7.5	1.4
100 p.p.m. PBA . . . . .	8.1	1.4
50 p.p.m. GA + 100 p.p.m. PBA . . . . .	10.2	1.5
Leaf break . . . . .	8.5	1.4

other treatment. Extent of this increase is established by data in the table and illustrated by the photograph. GA alone and PBA alone caused some increase in plantlet number and weight, as did the labor-intensive leaf breaking treatment.

The GA treatments tended to elongate leaves and stems, resulting in taller plantlets. In one or two instances, GA-treated plantlets produced flowers.

Results of this research indicate that the combination GA-PBA spray can be successfully used to increase the number of plantlets produced from African violet leaf blade cuttings. This treatment was more effective than the leaf breaking method, and labor requirements should be less with the spray treatment.

<sup>1</sup>N-(phenylmethyl)-9 (tetrahydro-2H-pyran-2-yl-9H-purin-6-amine).

Sanderson is Professor of Horticulture and McGuire is Head of Research Data Analysis.

## Propagation of African Violets

African violets are propagated by leaf cuttings, with or without a stem. Those propagated without stems produce more small plants (plantlets) or crowns.

One method used to increase plantlet numbers is to break the leaf blade in half at rooting as the new shoots emerge.

Developing plantlets and shoots with roots are usually divided into young plants.

Some growers remove the roots from shoots, and the graded shoots are rerooted to obtain uniform plants.

# PINE SEEDLING ROOT GROWTH IS REDUCED BY DEFOLIATION AND SHADING

**G**OOD SURVIVAL after transplanting depends largely on a pine seedling's ability to quickly produce new roots to reestablish an intimate root/soil contact. Therefore, many seedlings that die during the first year after transplanting do so because they cannot extract sufficient soil water. Pine seedling physiology research at the Alabama Agricultural Experiment Station indicates that both shading and defoliation reduce the production of new roots.

Many tree planters mistakenly believe that growth of pine roots depends only on existing food reserves stored in the root system. Though a large, fibrous root system is important, it does not always guarantee abundant root production

soon after transplanting, which is vital for seedling survival.

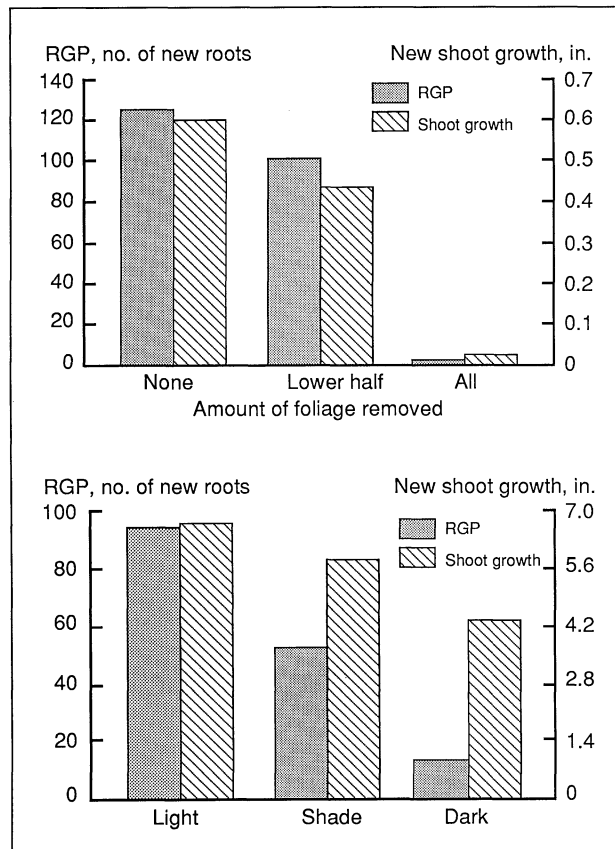
Auburn greenhouse studies were used to determine some of the factors that affect the potential of seedlings to produce new roots. The number (or weight) of new roots produced during a 3- or 4-week period in the greenhouse is referred to as the root growth potential (RGP) of the seedling. This technique was used to determine the effect of defoliation and shading on RGP.

For the defoliation study, seedlings (root collar diameter larger than 1/8 in.) were sampled from a loblolly pine nursery in December 1986. All the foliage was stripped from 40 seedlings, while none was removed from 80 seedlings. Another 80 seedlings had the lower half

of the seedling reduced the number of new roots by 19%, figure 1, and the dry weight of new roots by 35%. Removal of all the foliage resulted in almost no new root or shoot growth. Previous studies have demonstrated that girdling loblolly pine seedlings at the root collar also will prevent new root growth. These results suggest that new root growth of loblolly pine is dependent on current photosynthate instead of stored carbohydrates in the root system. Therefore, a second study was conducted to determine if seedlings with intact foliage would produce new roots in total darkness.

Shading seedlings reduced RGP by 44%, figure 2. Although seedlings kept in total darkness did produce a few new roots, these roots could have been produced from photosynthate produced during the few days before seedlings were placed in the dark. In contrast, new shoot growth was reduced by only 13% by shading or 38% by complete darkness. The differential effect of shade on new shoot growth indicates that new shoot growth is not as dependent on current photosynthate as is root growth.

It is important that tree planters understand how loblolly pine seedlings produce new roots. Photosynthesis and new root growth can be reduced if the seedlings are chlorotic, if the stem is injured to the point of inhibiting translocation, if seedlings are allowed to dry out before planting, or if lateral roots are removed prior to planting. Root growth also will be reduced if the seedling is planted under tall weeds that provide dense shade or if foliage is eaten by rabbits, deer, or insects. Avoiding such abuses should help improve survival when seedlings are planted on marginal crop land or in years of below normal rainfall.



**FIG. 1 (top).** Effect of defoliation on root growth potential and shoot growth of loblolly pine seedlings. **FIG. 2 (bottom).** Effect of light intensity on root growth potential and shoot growth of loblolly pine seedlings.

(52%) of the foliage removed. All seedlings were root-pruned to 7 in. below the root collar and any new white root tips were removed prior to potting. The containers were kept on a heated rooting bed (at about 77°F) for 28 days. After removal from the cartons, the number and weight of all new roots were recorded.

For the shading study, 30 container-grown seedlings (root collar diameter greater than 3/16 in.) were placed in a hydroponic RGP tank in March 1987. One-third of the seedlings were placed in the dark, while another one-third were placed in a shaded area. The temperature of the seedlings was maintained at 77°F. The amount of new shoot growth and the number of new roots were recorded after 21 days.

Removing foliage from

Larsen is Associate Professor, South is Associate Professor, and Williams is Research Specialist of Forestry.

# TOMATO SPOTTED WILT VIRUS STILL A THREAT TO PEANUTS

**T**OMATO SPOTTED wilt virus (TSWV) was found for the first time in peanuts in Alabama in 1986 (as reported in the Spring 1987 issue of *Highlights*). A survey conducted that summer indicated the disease was widely distributed throughout the major peanut-production areas of the State. Because of this widespread occurrence of the virus and its potential to cause significant damage to the peanut crop, surveys were continued in 1987 and 1988. So far, however, TSWV has not been a serious yield-limiting disease for Alabama peanut growers.

Similar to 1986, one field for each 5,000 acres of peanuts per county was surveyed, with a minimum of three fields per county. In each field, plants showing TSWV symptoms were counted in each of five randomly selected areas. Each area consisted of 100 ft. of two adjacent rows for a total of 1,000 row-ft. per field. Leaves and shoots of plants suspected to be diseased were collected and returned to Auburn for testing for TSWV by enzyme-linked immunosorbent assay. Stand density in each field was estimated by counting the number of plants in 1 row-ft. from randomly selected areas in each field.

Symptoms observed on diseased plants in 1987 and 1988 were similar to those seen in 1986. Included were ring-spotting and mottling of foliage, stunting of limbs or whole plants, seed coat mottling, and death of plants.

In 1987, TSWV-infected peanuts were found in 33 of 68 fields, and in at least one field in 10 of the 11 counties surveyed, table 1. Incidence of virus-diseased plants was low, ranging from 0 to 0.27% within fields and averaging only 0.024% across all fields and counties.

The survey was expanded to 81 fields in 12 counties in 1988. Peanut plants infected with the virus were found in 73 of the 81 fields, involving all 12 counties, table 1. Incidence of diseased plants, although higher than in 1987, was again

**Though occurrence of tomato spotted wilt virus is widespread, damage from the disease remains low in Alabama.**

low in 1988, averaging 0.20% for all fields and ranging from 0 to 1.57% within fields.

Summarizing the results of all surveys taken to date, TSWV-infected peanut plants were found in 157 of 203 fields, or 77% of the fields surveyed during 1986-88. The highest incidence of diseased plants by fields (94%) and within fields (0-3.11%; average 0.49%) occurred in 1986, the year that TSWV was discovered in peanuts in the State, table 2.

Fortunately, heavy losses to TSWV have not occurred in Alabama peanuts. However, the potential for a widespread disease outbreak clearly exists given the general occurrence of the virus and the abundance of insects that carry the disease, primarily western flower thrips and tobacco thrips. TSWV reportedly caused significant losses in peanuts in Texas in 1985 and 1986. Consequently, the occurrence of TSWV and the size and species of thrips populations in Alabama will continue to be monitored.

Hagan is Associate Professor, Gudauskas is Professor, Gazaway is Professor, Shelby is Research Associate, and Mullen is Extension Associate of Plant Pathology; Weeks is Associate Professor; French is Professor of Entomology.

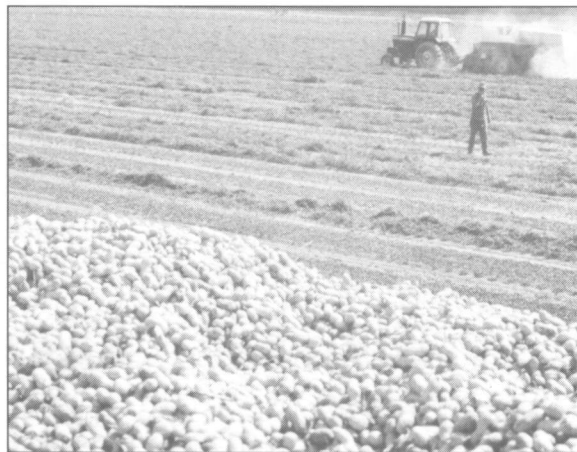


TABLE 1. OCCURRENCE OF TOMATO SPOTTED WILT VIRUS IN PEANUTS IN ALABAMA

County and year	Fields with diseased plants <sup>1</sup>	Frequency of diseased plants	
		Range	Mean <sup>2</sup>
		Pct.	Pct.
<b>1987</b>			
Barbour .....	1/5	0 - 0.02	0.01
Bullock .....	2/3	0 - .07	.05
Coffee .....	2/8	0 - .04	.01
Covington .....	4/5	0 - .06	.03
Crenshaw .....	2/3	0 - .03	.02
Dale .....	2/6	0 - .03	.01
Geneva .....	7/10	0 - .11	.03
Henry .....	2/10	0 - .05	.01
Houston .....	8/10	0 - .08	.04
Pike .....	3/5	0 - .27	.07
Russell .....	0/3		
<b>1988</b>			
Barbour .....	5/6	0 - .30	.12
Bullock .....	2/3	0 - .32	.17
Butler .....	2/3	0 - .50	.34
Coffee .....	5/9	0 - .31	.09
Conecuh .....	3/3	.05 - .83	.37
Covington .....	4/4	.08 - .44	.18
Crenshaw .....	3/3	.02 - .54	.34
Dale .....	6/6	.02 - .47	.12
Geneva .....	11/12	0 - .22	.09
Henry .....	11/11	.02 - 1.57	.24
Houston .....	14/15	0 - .36	.11
Pike .....	6/6	.05 - .42	.24

<sup>1</sup>Fields with diseased plants/total fields surveyed.

<sup>2</sup>All fields surveyed.

TABLE 2. OCCURRENCE OF TOMATO SPOTTED WILT VIRUS IN PEANUTS IN ALABAMA, 1986-88

Year	Fields with diseased plants	Incidence of diseased plants	
		Range	Mean
		Pct.	Pct.
1986 .....	94	0 - 3.11	0.49
1987 .....	41	0 - .27	.02
1988 .....	90	0 - 1.57	.19

# SOIL SOLARIZATION/CHICKEN MANURE POSSIBLE ALTERNATIVE WEED CONTROL



Effects of different lengths of solarization and chicken manure on germination of sicklepod and morningglory seed.

**S**OIL SOLARIZATION is the process of using clear polyethylene plastic film during summer fallow periods to capture solar energy and produce soil temperatures high enough to control many annual weeds and kill some disease-causing organisms. In tests at the Alabama Agricultural Experiment Station, soil solarization in combination with chicken manure effectively controlled sicklepod and morningglory.

In the Experiment Station tests, chicken manure was mixed with sterilized soil at the rate of 8 tons per acre. The manure generated high concentrations of ammonia for better soil pest control and provided fertilizer for subsequent crops. The chicken manure/soil solarization treatments were subsequently rated for sicklepod and morningglory control.

Twenty weed seeds for each species were planted in the chicken manure-soil mix in PVC pipe cylinders (15 in. long

and 6 in. in diameter) in field plots during mid-June. Clear plastic was then placed over the drip irrigated cylinder plots. Rubber bands held the clear plastic onto the cylinders, which extended 2 in. above the soil line. Immediately following solarization periods of 2, 4, and 6 weeks, the plastic film was removed and weed species were counted and recorded. Results are given in the table.

The solarized chicken manure-soil mix provided 99% control of both weed species after a 4-week solarization period. These results were comparable to those where weeds were grown in the absence of chicken manure, but under the same solarization treatments. Unsolarized chicken manure-soil mix provided 41% and 49% control of morningglory and sicklepod, respectively. Plots without chicken manure and solarization resulted in no weed control (rated as 100% weed populations).

Temperatures recorded at 6-in. soil

depths in solarized and unsolarized plots with chicken manure averaged 25°F and 10°F higher, respectively, than in plots with no chicken manure or solarization exposure. High temperatures are probably responsible for weed control in the study, which corresponds with the findings of numerous investigators who also attributed the control of weed populations to elevated soil temperatures.

Despite the high cost of plastic, this weed control method may be economically feasible for home gardens and small acreages (1-5 acres) of field or horticultural crops. The ability of this cultural practice to control weeds offers an alternative to the use of expensive and restricted pesticides. In some areas of Alabama, where disposal of chicken litter is a problem, it may provide a worthwhile use for this poultry industry byproduct.

Brown is Assistant Professor of Horticulture; Patterson is Assistant Professor of Agronomy and Soils; Caldwell is Research Associate of Horticulture.

EFFECT OF CHICKEN MANURE (CM) AND SOIL SOLARIZATION (SS) ON WEED SEED GERMINATION AND CONTROL

Treatment <sup>1</sup>	Weed control	
	Morningglory	Sicklepod
	Pct.	Pct.
CM .....	41	49
CM + 2-week SS .....	76	68
CM + 4-week SS .....	99	99
CM + 6-week SS .....	100	100
2-week SS .....	75	76
4-week SS .....	96	96
6-week SS .....	89	90
No CM, no SS .....	0	0

<sup>1</sup>Twenty seed each of morningglory and sicklepod planted in each field cylinder.

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

Lowell T. Frobish, Director  
POSTMASTER—Address Correction Requested

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