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Lowell T. Frobish, Director

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Dr. Lowell T. Frobish named AAES Director

Dr. Lowell T. Frobish, former Animal Science Department Head at Clemson University, is the new Director of the Alabama Agricultural Experiment Station at Auburn University. Effective date of his appointment was October 1, 1986.

The new Director brings a wide range of experience in research and administration gained in USDA Agricultural Research Service and Land Grant College Experiment Station assignments. He has also been responsible for animal science teaching and extension activities in his department head assignment at Clemson University.

A native of Illinois, Frobish was educated at Illinois State University, University of Illinois (B.S. in Agricultural Science 1962), and Iowa State University (M.S. in Animal Science 1964 and Ph.D. in Animal Science 1967). He served as Graduate Assistant and Research Associate while at Iowa State.

Upon completion of his doctorate, Frobish began a highly successful 13-year career with the USDA Agricultural Research Service. His initial assignment, in 1967, was Research Animal Scientist in the Swine Research Branch. Five years later he was promoted to Laboratory Chief of the Nonruminant Animal Nutrition Laboratory and then became Acting Assistant Administrator of ARS in 1980. He moved to Clemson University in 1981 as Animal Science Department Head, a position he held until being named Experiment Station Director at Auburn.



DR. LOWELL T. FROBISH

As Department Head at Clemson, Frobish reviewed all animal science research projects and served as a facilitator in developing the department's total research program. He was also responsible for the department's extension activities for the State of South Carolina, and for the on-campus teaching program in animal science.

Frobish served in several special leadership assignments at Clemson. He was chairman of the intra-departmental animal physiology graduate program, the College of Agricultural Sciences Fellowship Committee, and a task force that reviewed and made recommendations for the animal physiology research program of the College of Agricultural Sciences. Among his many other professional activities, he was a team leader for U.S. scientists presenting seminars on swine production to Russian scientists, Editor and Section Editor of *Applied Animal Science* for the American Society of Animal Science, and Chairman of the Examining Board for American Registry of Professional Animal Scientists.

A prolific writer, Frobish was senior or junior author of more than 80 research publications, most in refereed journals such as *Journal of Animal Science* and *Poultry Science*.

may we introduce

Dr. Carol Warfield, associate professor of consumer affairs. She came to Auburn in 1977 after serving nearly 10 years on the faculty at the University of Illinois-Urbana. In addition to teaching both undergraduate and graduate courses in textiles, she directed graduate textile research work at the University.



Dr. Warfield earned a B.S. degree in home economics education from South Dakota State University in Brookings, South Dakota, where she later taught high school economics. She earned an M.S. degree in textiles and clothing and the Ph.D. in family and consumptive economics from the University of Illinois.

Her article on off-the-farm employment of Alabama farm wives on page 3 of this issue of Highlights focuses on a possible side effect of the economic plight of the nation's farmers.

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

ON THE COVER. AU Triumph tall fescue makes good use of nitrogen in winter when Kentucky 31 is dormant (see story on page 4).



INCREASING EMPLOYMENT of farm wives in off-farm jobs reflects changing patterns of farm operations. Back in 1960, only 19% of farm wives were employed off the farm. This grew to 40% by 1976. On a regional basis, more farm women in the South held off-farm jobs than was true in other regions. Data on Alabama were not available in the 1976 national summary, but results of a new Alabama Agricultural Experiment Station study indicate that large numbers of Alabama farm wives hold full-time or part-time jobs that make important contributions to the family's economic situation.

The Alabama survey was part of a regional research project, "Effect of Farm Wife's Off-the-Farm Employment on Family Economic Status and Family Functioning." In February 1985, questionnaires were mailed to both husband and wife in 1,000 randomly selected Alabama farm families. The questionnaires requested information about off-farm employment of husband and wife and time and task allocation of family members, as well as demographic information. Only 129 questionnaires were returned by female respondents, but these are considered representative of the sample.

Of the 129 responding, 90% were older than 40, as indicated by the following:

Age range	Percent
20-30	2
31-40	8
41-50	14
51-60	34
61-70	16
71-80	8
81 and older	2
No response	16

Data on marital status of the respondents show that 116 were married and 5 were widows. One had never married and seven did not indicate their marital status. Ninety percent of these women considered themselves farmers, and they described their farm jobs as follows: 24%, manager; 9%, tractor/machinery operator; 9%, day worker; 5%, bookkeeper/secretary; 5%, errand person; and 31%, homemaker.

Forty-two percent of the sample (54 women) held jobs off the farm. Nearly three-fourths (69%) of these held full time jobs of 40 or more hours per week. Approximately half of those employed off the farm had worked at their off-the-farm job 50-52 weeks in the previous

Off-farm employment of wives is important to Alabama farm families

C.L. WARFIELD

year; the other half had worked 20 or more weeks.

Data on length of employment indicate the women in this sample did not begin working off the farm because of the current farm crisis. Only 5% had held an off-the-farm job 2 years or less, whereas 41% had held such jobs for 5-15 years, 26% for 15-25 years, and 17% for more than 25 years. Of the employed women in this sample, 24% held professional jobs, 39% had clerical or office jobs, and 22% classified themselves as laborers. One woman was self-employed.

In response to a question about the most important reason they worked off the farm, three-fourths of the working women replied that it was to supplement the farm income, and 16% said they enjoyed working or were not satisfied with being at home. In comparison, 30% of those who were not working off the farm indicated they did not have time to work off the farm, 10% cited health reasons as preventing them from working off the farm, and another 10% indicated their spouses did not want them to work. Almost one-fourth of those who were not working off the farm reported they were retired.

How the wife's salary contributes to total family household income is indicated by data in the table. These data also indicate the wide range of salary earned.

Of all the women in the study, 60% responded they were dissatisfied with their farm incomes. Only 22% were satisfied or very satisfied with their farm incomes. In contrast, half of the women said they were satisfied or very satisfied with their standard of living.

Among the wives employed off the farm, 83% reported that their employment increased the money available for family activities. Half of the employed farm wives also reported their off-the-farm employment decreased the time their family spent together, while 37% said their family time together was unaffected by their employment.

The preliminary analysis of data from this study shows that Alabama farm wives working off the farm have been making an important contribution to the economic welfare of their families. If these women were representative of Alabama's farm wife population in early 1985, the need for the economic contribution of the farm wife is even more critical today with the depressed farm economy. Since unemployment levels in many of Alabama's rural counties are much higher than the national average, farm wives may be facing bleak opportunities for employment in the future.

Warfield is Associate Professor of Consumer Affairs.

WIVES' OFF-THE-FARM AND TOTAL HOUSEHOLD (FARM AND NONFARM) INCOME FOR 1984

Income level	Percent of wives reporting each	
	Off-the-farm income ^{1,2}	Total household income ³
Less than \$5,000	26	12
\$5,000 - \$9,999	20	8
\$10,000 - \$14,999	20	16
\$15,000 - \$19,999	13	12
\$20,000 - \$24,999	7	6
\$25,000 - \$34,999	10	12
More than \$35,000	5	34

¹Does not add up to 100% because of rounding.

²Off-the-farm income could include other forms of income beside wages and salary, for example, interest or Social Security payments.

³Thirty-five women failed to report total household income.

HIGH WINTER productivity of AU Triumph tall fescue—80% more forage than the commonly grown Kentucky 31 variety—is a major advantage of the Auburn-developed variety. Now there is research evidence that AU Triumph also makes efficient use of fertilizer nitrogen during winter months when Kentucky 31 is largely dormant.

Nitrogen application recommendations from Auburn University's Soil Testing Laboratory call for 60 lb. per acre of N for tall fescue pastures September 1 and an additional 60 lb. per acre in February. This recommendation was based on results of long-term field tests and grazing trials at several Alabama Agricultural Experiment Station locations in Alabama. Now that the winter-productive AU Triumph is available, further research was begun to determine if additional N fertilizer should be applied during the winter to the new variety.

The test on Norfolk sandy loam soil at the E. V. Smith Research Center, Shorter, also included Kentucky 31 fescue for comparison with AU Triumph. Soil in the experimental field tested very high in phosphorus and low in potassium, and had an initial pH of 5.8. Therefore, 2 tons per acre of lime, 150 lb. per acre muriate of potash, and 50 lb. per acre of gypsum (sulfur source) were applied and incorporated before planting. The potash and gypsum treatments were repeated each fall during the test.

All plots received 27 lb. per acre of N at establishment. This was followed by November 15 and February 1 applications that brought the total to 90 lb., table 1. In subsequent years, total applications of 90, 120, and 150 lb. N per acre (applied September 1, November 15, and February 1) were compared, table 1. All N was applied as ammonium nitrate.

Both varieties died during the summer of the first year and were replanted that fall. Therefore, table 1 lists results of 2 establishment years.

In the establishment year, AU Triumph made better use of the 90 lb. of applied N than did Kentucky 31. As noted in table 1, applying 27 lb. N at planting and 63 lb. February 1 resulted



in yields just as high as when the 90 lb. of N was split into three applications (planting, November 15, and February 1).

After the stand was established, AU Triumph consistently made better use of the applied N than did Kentucky 31, table 1. Established Kentucky 31 did not effectively utilize N applied in mid-November.

At the two highest N rates (120 and 150 lb. per acre total), established AU Triumph was able to effectively utilize some N applied in mid-November. This difference in the ability of the two varieties to utilize N applied in mid-November is probably due to the greater growth of AU Triumph during the winter months. At the recommended rate of 120 lb. per acre total N, it is unlikely that the small yield increase noted for AU Triumph would justify the cost of a third (mid-November) N application.

The stand of the two varieties was evaluated following the fourth growing season, table 2. Neither variety survived well at low rates of total applied N. In the marginal growing areas of central Alabama, tall fescue is not as tolerant of poor management practices as it is further north.

Odom and Pedersen are Associate and Assistant Professors, respectively, of Agronomy and Soils.

AU TRIUMPH makes efficient use of nitrogen

J.W. ODOM and J.F. PEDERSEN

TABLE 1. TOTAL FORAGE PRODUCTION OF KENTUCKY 31 AND AU TRIUMPH, DIFFERENT NITROGEN TREATMENTS, E.V. SMITH RESEARCH CENTER

N fertilizer/acre			Dry forage yield/acre	
Sept. 1	Nov. 15	Feb. 1	Kentucky 31	AU Triumph
Lb.	Lb.	Lb.	Lb.	Lb.
Establishment year¹ (90 lb./acre total N)				
27	0	63	840	1,240
27	10	54	790	1,230
27	37	27	710	1,030
27	63	0	480	840
Established² (90 lb./acre total N)				
45	0	45	1,150	1,960
27	36	27	1,080	1,810
Established² (120 lb./acre total N)				
60	0	60	1,500	2,170
54	13	54	1,460	2,250
27	66	27	1,260	2,000
Established² (150 lb./acre total N)				
75	0	75	1,850	2,290
54	43	54	1,740	2,460

¹Both varieties died the first summer and were replanted that fall; therefore, data are for 2 years.

²Three years.

TABLE 2. STAND OF KENTUCKY 31 AND AU TRIUMPH TALL FESCUE AFTER FOUR GROWING SEASONS, BY NITROGEN TREATMENTS, E.V. SMITH RESEARCH CENTER

Total applied N/acre, lb.	Stand visual rating	
	Kentucky 31	AU Triumph
	Pct.	Pct.
0	12	4
27	38	13
54	22	28
80	50	40
107	53	25
134	41	31
161	63	23
188	48	33
214	63	30
241	73	30



Kidney-pelvic fat removal OK if carcasses are electrically stimulated

W.R. JONES and E.C. GRIMES

A PROPOSED CHANGE in USDA meat slaughter and processing regulations would permit removal of kidney, pelvic, and heart fat (KPH) from beef carcasses before chilling. This would eliminate KPH fat content as a factor in beef yield grading, and possibly provide an efficiency advantage in boxed beef merchandising by large packers. Conversely, small independent packers, processors, and renderers might consider KPH fat removal to be inefficient for their operations.

Aside from efficiency considerations, a major concern is how removal of kidney-pelvic fat prior to chilling would affect high value, unprotected beef tenderloins. Removal of kidney-pelvic fat prior to chilling leaves tenderloins exposed to many detrimental factors during chilling and processing. This offers the potential for surface drying of the tenderloins, leading to a darkened appearance that is unacceptable to consumers. Other possible problems are (1) a chance for surface contamination during handling of tenderloins, and (2) loss of tenderness from severe muscle contraction caused by low temperatures (called "cold-shortening") without fat insulation.

Application of electrical current to carcasses appears to prevent deterioration that could result from kidney-pelvic fat removal. This was learned in an Alabama Agricultural Experiment Station study done to (1) determine if kidney-pelvic fat removal prior to chilling affects color, causes decreased tenderness, or increases surface microbial contamination of beef tenderloins, and (2) determine how electrical stimulation affects the psoas major (the major muscle of wholesale tenderloins) with fat removed prior to chilling or left intact.

Carcasses were stripped of kidney-pelvic fat on alternating left and right sides and chilled at 36-39°F. The fat was aseptically removed from intact sides, tenderloins were swabbed at two locations (third and fifth lumbar vertebrae), and microbial load was determined by

total plate count. A 12-in. center section of the psoas major muscle was sliced into 1-in.-thick steaks for testing. Tests included a visual color evaluation, Hunter colorimeter rating, sarcomere (transverse muscle segment) length, cook loss, toughness (Instron shear force), percent moisture, and percent fat.

Removal of kidney-pelvic fat prior to chilling increased bacteria numbers on the surface of exposed tenderloins. This higher bacterial count could have resulted from added exposure of the lean surface to atmospheric and environmental contamination. Wholesale tenderloins from carcasses with kidney-pelvic fat removed prior to chilling and processed after a 24-hour chill would have a higher initial bacterial count than tenderloins from those with the fat left intact during chilling. Low initial bacterial counts are essential on retail cuts to assure good muscle color, acceptable shelf life, and consumer acceptability. Tenderloins from electrically stimulated carcasses also had lower bacterial counts than non-stimulated tenderloins.

Steaks from carcasses with kidney-pelvic fat intact received better color scores than those from the carcasses with fat removed. Electrically stimulated steaks also had higher Hunter colorimetric values for both fat treatments, as noted in the table.

Steaks from carcasses that had kidney-pelvic fat removed were tougher (had

Comparisons of electrically stimulated (right photo) and non-electrically stimulated (left photo) tenderloins on chill day 1. In each photo, tenderloin on left had kidney-pelvic fat removed; one on right had fat intact.

higher shear values) and had shorter sarcomeres than steaks from carcasses with the fat intact. Electrical stimulation also resulted in higher shear force values for steaks, but the differences were too small to be meaningful.

Three major findings came from the study:

1. Bacterial counts were greater on tenderloin surfaces with kidney-pelvic fat removed prior to chilling, but these bacterial levels would not cause serious contamination problems. Electrical stimulation also appeared to slow growth of bacteria.

2. Visual and colorimetry data indicate that kidney-pelvic fat removal resulted in darkened lean color; however, this color change could be negated through electrically stimulating the beef carcass prior to fat removal.

3. Removal of kidney-pelvic fat resulted in shorter sarcomeres and tougher meat (higher shear values). Electrical stimulation also reduced tenderness of the psoas major muscle, but differences were small and would not be likely to change the overall palatability of the most tender muscle in the beef carcass.

Jones is Assistant Professor and Grimes is a former Graduate Student of Animal and Dairy Sciences.

EFFECT OF KIDNEY-PELVIC FAT REMOVAL AND ELECTRICAL STIMULATION ON MICROBIAL, TENDERNESS, AND COLOR PROPERTIES OF BEEF TENDERLOIN

Measure	Electrically stimulated		Non-stimulated	
	Fat intact	Fat removed	Fat intact	Fat removed
Bacterial count, organisms per sq. cm	7	9	11	13
Visual color score ¹	5.93	4.80	5.58	3.53
Hunter colorimetric values ²				
L value	33.0	31.2	32.6	28.2
a value	18.1	17.3	16.8	16.1
b value	11.0	10.2	10.0	8.8
Sarcomere length, mm	3.34	3.22	3.44	3.42
Shear force ³ (tenderness rating), kg	3.59	3.62	3.12	3.26

¹Rating scale: 5 = bright cherry red; 1 = extremely dark red.

²L = lightness: 100 = white, 0 = black; a = color: 30 = extremely bright red, 0 = gray; b = color: 15 = light yellow, 0 = gray.

³Higher numbers mean tougher meat.

Quick Test for Biochemical Characters Speeds Development of Insect Resistant Tomatoes

K.S. RYMAL, S. TANTICHAROENKIAT, and A.G. HUNTER

INSECT RESISTANT TOMATOES have long been a goal of vegetable breeders, but progress has been slow. Now there is hope for speeding up the process by using a new testing process developed at the Alabama Agricultural Experiment Station. The testing process provides a rapid and reliable method of pinpointing biochemical characters that are responsible for insect resistance in tomato plants.

In the Auburn-developed method, a scanning electron microscope is used to identify small glands on the surface of leaves of resistant species, such as those shown in figure 1. The next step is the use of a technique known as capillary gas chromatography to produce profiles of the chemicals exuded from the glands. These are chemicals which may act as the first line of defense against insects.

The chemical profiles, such as the two shown in figure 2, exhibit a visual difference between resistant and susceptible species. Although the profiles shown may be meaningless to the untrained person, they provide valuable information to biochemists and plant breeders.

Differences are obvious, however, between cultivated tomato species (labeled A) and the wild, resistant species (labeled B). Thus, researchers can quickly identify a resistant plant.

Most cultivated tomatoes are susceptible to many insect pests, a problem that is obvious to gardeners. However, there are wild species of tomatoes that are resistant to many pests. These wild species cross readily with cultivated tomatoes, offering a method of incorporating resistance into hybrids that may also possess desirable quality traits.

Evaluating hybrids produced by crossing wild and domestic plants has been a slow process in the past. Plant breeders had to grow plants to maturity and conduct lengthy field studies to determine which of the progeny had inherited in-

sect resistance. With the new method, breeders can examine leaves of young hybrids with scanning electron microscopy and capillary gas chromatography to follow the physical and chemical changes that have been produced.

The method involves collecting chemicals from the leaf trichomes by rubbing the leaves with a dry cotton swab and analyzing the chemicals directly by gas chromatography. Total time involved is less than 1 hour.

In the Experiment Station study to date, all major components of 19 species and forms of tomatoes have been identified. The next step is to use the profiles as pattern comparisons for screening young hybrids. Changes that occur in the unique physical structure of leaf trichomes are also valuable in following inheritance of the resistant parent's characters.

Developments in this biochemical study provide good evidence of how complicated scientific procedures can lead to practical advances for agriculture.

Rymal is Professor, Tanticharoenkiat is a Graduate Student, and Hunter is a Research Associate of Horticulture.

FIG. 2. Chemical profile of the non-resistant tomato (top) is obviously different from profile of the wild tomato that has resistance (bottom).

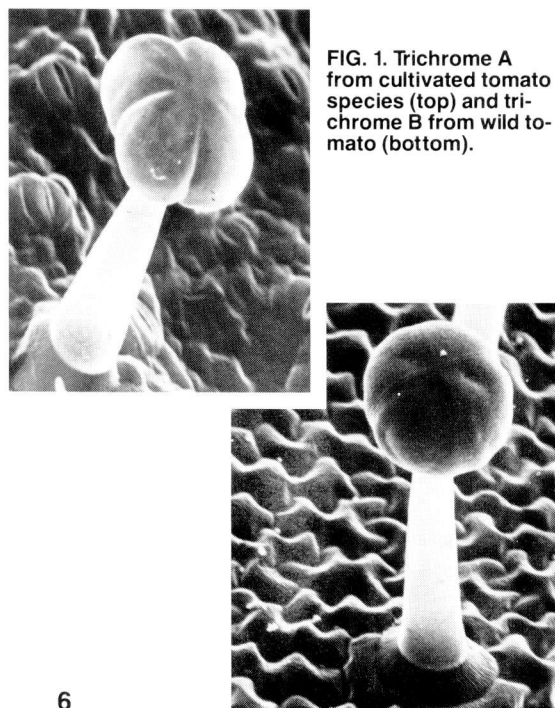
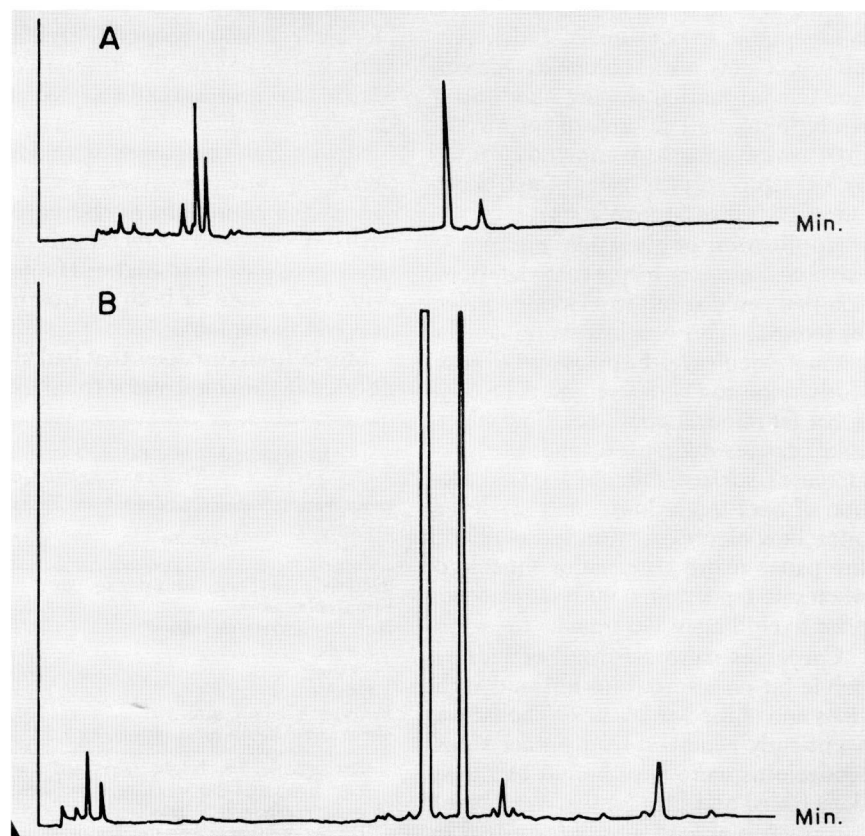


FIG. 1. Trichome A from cultivated tomato species (top) and trichome B from wild tomato (bottom).

MORE THAN A FOURTH of all U.S. households were the victim of some sort of crime in 1984. This was about 22.8 million households. That's the bad news. The "good" news is that the number of victimized households was down for the second consecutive year from the high in 1982. This decrease amounted to almost 2 million fewer victimized households.

Not all households are equally subject to victimization. National figures reveal that households with high incomes (\$25,000 or more), those in central cities of metropolitan areas, and those of blacks are most vulnerable to crime. Household larceny, the theft of household property without forceful entry, struck 8.5% of U.S. households in 1984; burglary, the breaking into a building with the intent to steal property, struck another 5.5%.

How well protected are homes in Alabama? Not too well, according to information supplied by 1,600 households in a 1985 Alabama Agricultural Experiment Station survey. The survey provided information on the types of security devices households have available to protect the home from theft and the extent to which households use different prevention behaviors or practices. Results are reported according to rural, urban, or metropolitan counties and by location of residence within these counties.

Many rural Alabama households can be characterized as "waiting to be victimized." As shown by data in the table, households located in predominantly rural counties are less likely to be protected by security devices than in counties containing large cities. Lighting for night-time protection, such as automatic timers and outside spot or flood lights, are not as common for rural homes. This is compensated in some cases by having outside area lights on separate poles. Area lights are used by more than 40% of rural households, except in metropolitan counties where only 30% use them.

Home security devices, such as dead-bolt locks and security chains on house doors, are installed much less often by rural residents. Little difference was found among rural, urban, and metro households for having window latches and locks and peephole doors. Burglar alarm systems are relatively expensive devices for protecting the home and only 6% of the households surveyed were equipped with such a device.

Rural residents are lax in protecting homes against crime

J.E. DUNKELBERGER, C.R. GRAHAM and J.O. BEAMISH

A variety of crime prevention practices is recommended for protection of home and property, but Alabama households do not use these practices regularly. Marking or engraving valuable household items with an identification number is strongly encouraged. National statistics indicate about 25% of American households use this practice. In Alabama, only 7% of survey households marked their more valuable property.

Another obvious protection method is to lock doors and windows. Rural families are much less likely to regularly lock their doors either at day or night and whether at home or away than are people living in towns and cities. Also, rural residents are less likely to leave lights on when away from home, to use automatic timers for lights and radio, to arrange for mail and newspapers to be stopped or picked up when away, and to have someone care for their yard when away for an extended time. Only metro residents are less likely than rural residents to follow

this latter practice and this difference may be due to apartment living.

Rural residents are also less likely to notify other persons when away from home for several days. The same is true of notifying the police.

One reason rural households do not install protection devices and use victimization prevention practices is that traditionally fewer crimes occur in rural areas. A second reason is that rural households have less fear of being victimized. Only about 20% of residents living in rural counties noted serious concern. The percentage is 25% for rural residents of counties containing large urban areas and 34% for those in metropolitan counties. At the same time, rural residents were more likely to believe that crime was on the increase in their community compared to either urban or metropolitan residents.

Dunkelberger is Professor and Graham is a Graduate Research Assistant of Agricultural Economics and Rural Sociology and Beamish is Assistant Professor of Consumer Affairs.

CRIME PROTECTION DEVICES AND PREVENTION BEHAVIORS BY COUNTY POPULATION AND HOUSEHOLD RESIDENCE TYPES^{1,2}

Preventive devices and practices	Percentages, by county and residence type							
	Rural		Urban		Metropolitan			State totals
	Rural	Urban	Rural	Urban	Rural	Urban	Metro	
Devices								
Automatic timers	11.6	11.4	11.5	28.9	15.6	21.3	30.3	16.3
Outside lights on buildings	80.3	85.1	80.6	86.0	86.4	87.5	88.8	83.2
Security light not on bldgs	41.7	28.3	43.5	20.4	29.6	21.5	15.5	33.8
Dead-bolt locks on home doors	37.5	44.7	39.9	53.0	43.1	58.7	65.2	44.8
Security chains on home doors	32.6	51.8	32.1	38.0	31.6	47.5	53.4	37.8
Peephole on home doors	49.6	60.5	53.4	54.7	56.2	46.2	51.4	52.2
Window latches or locks	88.2	94.7	89.2	92.7	90.3	90.0	92.1	90.3
Burglar alarm system	5.2	7.9	5.2	6.8	8.6	3.8	8.0	6.0
Preventive practices								
Mark valuable household items	8.2	7.8	8.1	4.7	8.5	7.5	7.4	7.1
Lock door at night when someone is home	78.5	90.4	80.4	88.0	81.9	93.8	89.9	83.4
Lock windows at night when no one is home	61.6	71.4	65.9	77.2	73.9	87.5	82.0	69.9
Leave light on when no one is home	45.7	52.6	54.3	60.0	52.3	61.2	55.6	51.8
Automatic timer for light and radio	7.3	5.4	6.5	17.9	11.8	21.0	19.3	10.5
Arrange for mail and newspaper when away	44.5	52.3	50.7	59.6	55.6	60.5	66.7	52.3
Arrange for yard maintenance when away	28.7	39.3	31.1	45.0	41.6	42.9	19.1	36.2
Have neighbor watch home when out of town	54.8	51.8	53.6	60.0	59.4	71.2	60.3	57.1
Notify police when family is away	6.6	15.8	5.1	8.0	10.3	10.0	6.7	8.0

¹Classification of county based on 1980 U.S. Census of Population. Rural indicates fewer than 50% of people living in places of 2,500 or larger; urban more than 50% living in places of 2,500 but not in a metropolitan area; and metropolitan counties as determined by the U.S. Census.

²Respondents' identification of their household residence.



Drought Induced Nitrate Toxicity in Pearlmillet is Self Limiting

K.S. RYMAL, C.E. EVANS and B.G. RUFFIN

IN PAST YEARS, there have been numerous reports of nitrate poisoning in cattle fed free-choice hay or forage containing high (usually over 2,000 p.p.m.) levels of nitrate. However, last year Alabama cattlemen saw for the first time nitrate-related abnormalities in forage severe enough that cattle refused to eat forage crops that are normally highly palatable. Lush dark green forage was almost totally rejected by hungry cattle, while weeds, wild

grasses, and even brush in fence rows were consumed.

Last year in many areas of Alabama, plantings of summer forage were followed by the worst drought of the century. In some counties, seed received enough moisture to germinate, but the plants made little growth for an extended period because of lack of water. Such conditions as low soil moisture, high temperature, low humidity, and slow growth favor the accumulation of nitrates in some forage crops, especially when they have been heavily fertilized.

Results of forage samples sent to the Auburn University Soil Testing Laboratory for nitrate nitrogen analysis are given in table 1. About 54% of the sorghum-sudan or millet samples had potentially toxic levels of nitrate nitrogen, with values ranging up to 10,000 p.p.m.

In Lee County, cattle turned into a drought stressed field of pearlmillet were observed to feed only on small portions of the field which, judging by the lighter green color, had received little or no fertilizer because of uneven distribution. Replicated samples from both portions of the field revealed there were high levels of nitrates in the dark green plants (fertilized with 60 lb. N per acre) and normal levels in the light green plants, table 2. The analyses also indicated that most of the nitrate was accumulated in the stem of the pearlmillet, with highest concentrations in the portions of the stem nearest the ground. It was apparent that the cattle were not feeding on the forage that contained the high levels of nitrates. However, nitrate itself is not normally unpalatable to cattle since cows have been observed eating nitrate fertilizer spilled in pastures.

Tests were conducted in the Alabama Agricultural Experiment Station to determine if other chemicals had accumulated along with the nitrates, making the forage unpalatable to the cows. Analysis of extracts of the millet leaves revealed the presence of a strongly bitter substance in the high nitrate leaves. Chemical analyses using two different reagent systems indicated that there was an alkaloid in the millet leaves in greater amounts in the high nitrate leaves. Many alkaloids are among the most bitter compounds known to man, leading researchers to believe it may have been the substance in the drought stressed millet leaves that made them unpalatable to cattle.

When rains finally came to Lee County and the millet resumed rapid growth, it was cut and baled. The nitrate concentration in the baled hay was found to be normal at 872 p.p.m.

When cattle refuse to graze on summer forage plants after a dry season, both accumulated toxic levels of nitrates and a bitter substance may be limiting their feeding. Rejection of the forage indicates that whole-plant samples should be analyzed for nitrates. After a period of increased growth, the added dry matter may dilute the total nitrate concentration so that the crop can be utilized for hay, following nitrate nitrogen analysis. It has not been determined at this time if hay that contains toxic levels of nitrate will also be unpalatable to cattle as was the green forage.

Rymal is Professor of Horticulture, Evans is Professor of Agronomy and Soils, and Ruffin is Extension Animal Scientist-Beef Nutritionist.

TABLE 1. NITRATE ANALYSIS OF SUMMER FORAGES 1986

Type forage	Number samples	Nitrate concentrations
Sorghum-sudan, millet		
High ¹ NO ₃ -N	7	3,404 to 10,868
Normal	6	464 to 1,274
Coastal bermuda		
High NO ₃ -N	1	2,293
Normal	6	192 to 1,346
Other forages		
High NO ₃ -N	0	
Normal	5	303 to 917

¹Above 1,500 p.p.m. is considered high and below 1,500 is considered normal.

TABLE 2. EFFECT OF FERTILIZATION ON DROUGHT INDUCED NITRATES IN DIFFERENT SECTIONS OF PEARLMILLET PLANTS

Plant section	Nitrate concentration ¹	
	Fertilized ²	Unfertilized
Whole leaf	p.p.m. 3,689	p.p.m. 398
Top ¼ of stem	8,750	391
Second ¼ of stem	9,762	501
Third ¼ of stem	11,173	555
Bottom ¼ of stem	10,292	597

¹Values are means of 4 replications.

²Fertilization according to soil test: 60-80-80.



Lesser Cornstalk Borer Damage to Peanuts

T.P. MACK, J.R. WEEKS, and C.B. BACKMAN

THE LESSER cornstalk borer (LCB) is a key pest of peanuts grown on sandy soils in the Southeastern United States, with damaging populations occurring during hot and dry years. Yield losses exceeding 70% have been reported in fields where damaging lesser cornstalk borer populations have developed. Lesser cornstalk borer populations were particularly high throughout the Southeast in 1986, resulting in heavy yield losses in Florunner peanut fields in Alabama. It is essential that lesser cornstalk borer damage to leaf, flower, peg, pod, and seed production be quantified so that growers know when this insect is causing economic damage, but until recently this had not been done.

To quantify LCB damage, a 2-year greenhouse study was conducted at the Alabama Agricultural Experiment Station. Florunner peanut plants potted in Dothan sandy loam soil were infested with five densities of lesser cornstalk borer larvae. Each plant had from 0 to 8 larvae feeding on it for approximately one month. Five different plant ages were studied to see if peanut plants were more susceptible to lesser cornstalk borer feeding at: (1) just prior to flowering, (2) flowering, (3) early pegging, (4) early pod fill, or (5) late pod fill.

The dry weight of peanut roots decreased by an average of 22% for each larva feeding throughout its larval life on the plant. This effect did not change with plant age. A reduction in a peanut plant's root system decreases its ability to obtain nutrients from the soil and with-

stand environmental stresses. This is critical because damaging populations of LCB often develop during a drought. When this happens, water stress from both lesser cornstalk borer damage and the drought could greatly reduce peanut yield.

In the same study, the peanut seed dry weight decreased by more than one-third for each LCB larva completing development on the plant. This was true even for plants infested with lesser cornstalk borers prior to flowering, when no seeds were present. This was probably a result of the reduction in size of the plant's root system.

Based on the results of these studies, it appears that in order for lesser cornstalk borer management to be successful, control tactics must be employed before many large-sized larvae are found in a field. Insecticides applied after peg, pod, and root crown damage has been done will probably reduce the lesser cornstalk borer larval population, but economic damage will have already oc-



Above left: Characteristic silken tube produced by a lesser cornstalk borer larva on the stem of this peanut. Above: Older pods damaged by lesser cornstalk borer.

curred. Recommended granular insecticides applied when most larvae are small to medium-sized will reduce the larval population and prevent economic losses. Rainfall should improve insecticide performance but is not needed to "activate" some of the recommended granular insecticides, since lesser cornstalk borers regularly crawl on the soil surface.

Mack is Associate Professor of Entomology, Weeks is an Area Extension Entomologist, and Backman is Lab Technician II.

Left: A peanut stem damaged by lesser cornstalk borer. Right: A peanut plant severely damaged by lesser cornstalk borer feeding. Note the large number of feeding sites.



INACTIVATED OIL-EMULSION VACCINE EFFECTS ON THE REPRODUCTIVE CAPABILITY OF BROILER BREEDER MALES

J.S. CRUZ-COY and G.R. McDANIEL

INACTIVATED oil-emulsion vaccines provide an immune response for several months and are commonly used for the prevention of bacterial and viral diseases in commercial flocks of layers and breeders. In breeder flocks, these vaccines applied to females may protect baby chicks from early exposures to infectious agents by supplying maternal antibodies through the yolk to their unhatched progeny.

The mineral oil protects against the breakdown of these bacterial and viral antigens in young chicks. The oil slowly releases antigens from the vaccine which remain at the site of inoculation for some period. This slow release of antigen provides continual stimulation of the immune system over an extended time period, creating a lasting immunity.

On the other hand, inactivated oil-emulsion vaccines have been incriminated in producing undesirable local and systemic lesions, such as granulomas and abscesses at the site of inoculation. In several species including birds, granulomatous lesions have formed in lymph nodes, lungs, liver, and kidneys. In rats, these lesions caused autoimmune disorders in articular and periarticular tissues.

In order to determine if the recent increase in the use of inactivated oil-emulsion vaccines in poultry breeders could be associated with a reduction in their reproductive performance, research in the Alabama Agricultural Experiment Station examined the effect of a commercial, bivalent, inactivated virus, oil-emulsion vaccine on the reproductive capability of broiler breeder males.

Seventy-two broiler breeder males were placed in individual cages and males assigned to three different treatments of 24 birds each. Group 1 was given a commercially available, bivalent, inactivated virus, oil-emulsion vaccine against Newcastle disease and infectious bursal disease (NDV-IBDV); group 2 received the oil-emulsion without viral antigens (OA); and group 3 was maintained as uninoculated controls. The commercial vaccine and the oil-emulsion without antigens were injected at the dorsum of the neck.

The experiment was conducted for 27 weeks (24th to 50th week of age of the

males), and blood samples were taken from all the birds at 3, 5, 7, 11, 15, 19, 23, and 27 weeks after vaccination to measure antibody titers against Newcastle disease (ND) and infectious bursal disease (IBD). Semen samples were collected from all males weekly for the first 16 weeks and biweekly thereafter to evaluate the concentration of sperm cells, semen volume per ejaculate, total sperm cells per ejaculation, and percentage of males producing semen. Body weight was recorded every month.

The males that received the inactivated oil-emulsion vaccine (group 1) had the highest level of immunity against ND and IBD during the trial. Results showed longer lasting antibody response

The vaccine provides immunity without compromising reproductive capability.

of these birds to the vaccination than in the other two groups, confirming the efficacy of the vaccine.

No differences occurred among the groups in sperm cell concentration, semen volume per ejaculate, total sperm cells per ejaculation, percentage of males producing semen, or body weight during the 27-week trial. Results did not show any detrimental effect in the reproductive parameters of the broiler breeders by the inactivated, bivalent, oil-emulsion vaccine, or the oil emulsion without the antigen, see table.

The implications of these results are of particular importance to the poultry industry, because of the use of inactivated oil-emulsion vaccines for preventing diseases in layers, breeders, and their progeny. On the basis of this trial, the commercial vaccine used did not compromise the reproductive capability of the breeder males. However, further research of this nature is needed with other commercial vaccines that contain multivalent antigens including those of bacterial origin.

Cruz-Coy is a graduate student and McDaniel is Professor of Poultry Science.

THE EFFECT OF THE BIVALENT, INACTIVATED VIRUS, OIL-EMULSION VACCINE (NDV-IBDV) AND THE OIL-ADJUVANT WITHOUT ANTIGEN (OA) ON THE REPRODUCTIVE CAPABILITY OF BROILER BREEDER MALES DURING TWO AGE PERIODS

Group	Reproductive capability of males at different ages									
	24-39 weeks of age					42-50 weeks of age				
	SC ¹	SV	TC	MP	BW	SC	SV	TC	MP	BW
	Bil./ml	ml	Bil./ml	Pct.	kg	Bil./ml	ml	ml	Pct.	kg
NDV-IBDV	3.8	0.6	2.4	81.9	4.4	4.1	0.6	2.5	88.0	4.8
OA	4.9	.6	2.4	93.8	4.5	4.8	.6	2.8	96.5	5.0
Uninoculated control	4.3	.6	2.5	92.7	4.4	4.5	.5	2.3	91.3	4.8

¹SC = sperm cell concentration; SV = semen volume per ejaculate; TC = total sperm cells per ejaculate; MP = percentage of males in semen production; and BW = body weight.

Maintenance and development of bovine embryos *in vitro*

D.A. STRINGFELLOW and M.S. THOMSON

THE NEED to maintain mammalian embryos in an artificial environment is at least as old as the idea of transferring embryos from donor to foster mothers. Such transfers in rabbits were first reported from Cambridge University in 1890. Successes were reported in sheep and goats in 1932, and in cattle and pigs in 1951. During the 1970's, techniques in the bovine were refined to such an extent that commercial embryo transfer is now readily available to cattlemen in this country and to a limited extent around the world.

To achieve successful transfers, embryos must be maintained *in vitro* (in an artificial environment) for the length of time required to move them between donors and foster mothers. With experience gained through the transfer of thousands of embryos and with the development of desirable culture media (fluids), it became obvious that embryos would continue to develop *in vitro*. Artificial

systems which allow for the maintenance and development of embryos provide useful models for the study of embryonic development and metabolism and for the study of the effects of noxious or infectious agents on early embryos. Such systems not only allow for a better observation of masses of embryonic cells than would be possible *in vivo* (in the live animal), but they also reduce the number of animals which need to undergo experimental treatments. This latter fact has not only economical, but in some cases, humane implications.

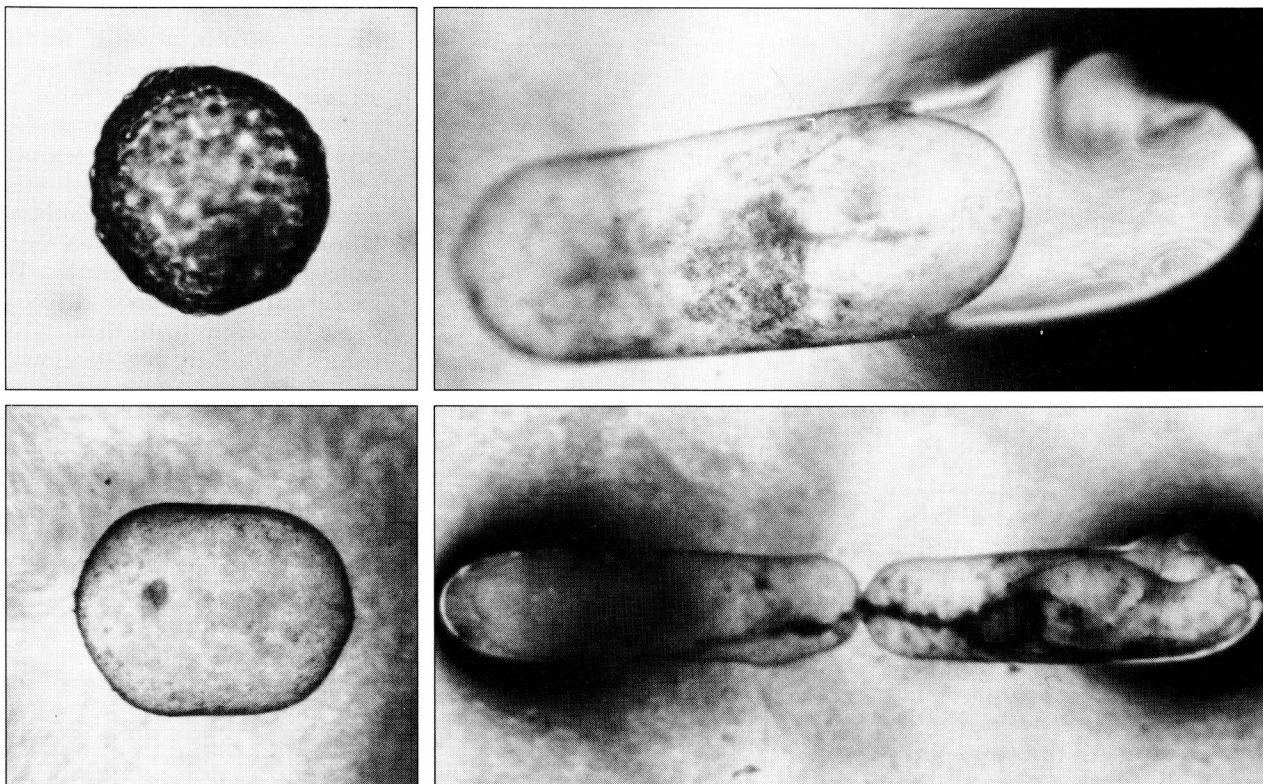
One current topic of research in the Alabama Agricultural Experiment Station is the interaction of preattachment stage bovine embryos with various infectious agents known to cause disease in cattle. This research has been important to the establishment of guidelines for the transfer of bovine embryos which are free of disease producing agents. In addition, it may be important to a more

complete understanding of the causes of early embryonic death which is a significant phenomenon in repeat breeder cows.

The need in the Auburn research to more closely monitor conditions in and around early stage embryos led to development of a system for long-term maintenance and development of bovine embryos *in vitro*. Researchers have been able to provide the culture conditions and media to allow the expansion and development for more than 7 days of embryos collected 9 to 11 days after fertilization, as illustrated in the photograph. As these techniques are refined, they should become a cost-efficient and useful component of efforts to describe the value of embryo transfer in preventing the spread of disease and to define the effects of many cattle pathogens on the early development of embryos.

Stringfellow is Assistant Professor and Thomson is a Graduate Research Assistant of Microbiology.

Embryo 9 days after fertilization (top left), after 2 days *in vitro* (bottom left), after 3 days *in vitro* (top right), and 7 days *in vitro* (bottom right).





Mechanical properties of southern pine not damaged by CCA treatment

J.G. OSTMEYER and T.J. ELDER

TREATING SOUTHERN PINE lumber with chromated copper arsenate (CCA) preservatives offers a six-fold or greater increase in performance life. Untreated lumber in water or ground contact lasts less than 5 years, while CCA-treated lumber can be expected to last 30 years.

In CCA treatment, the preservative solution of chromium, copper, and arsenic is forced into the lumber using pressure. Upon drying, the chromium, copper, and arsenic chemically bond with or become "fixed" in the wood, making it highly resistant to leaching. Thus, treatment prevents the wood from being attacked or destroyed by decay organisms such as fungi and termites. This resistance to leaching also makes CCA-treated lumber safe to use except in areas where treated wood comes in contact with food or portions of beehives which may come in contact with honey.

Along with being safe and decay resistant, CCA-treated lumber can also be finished using paint, stain, or varnish. These desirable properties have resulted in an increasing demand for CCA-treated wood for various construction applications. About one-third of all the southern pine lumber produced is treated with CCA preservatives. This has significant economic implications for Alabama, which has about 30 commercial treating plants.

In spite of the amount of southern pine lumber that is treated with CCA preservatives, there is relatively little information available concerning chemical and mechanical properties of CCA-treated wood. Some reports have indicated CCA treatment actually decreased mechanical properties of southern pine lumber in comparison with untreated lumber. Other studies have shown no reduction in strength following CCA treatment. None of the studies that in-

vestigated the mechanical properties of CCA-treated lumber also evaluated the chemical properties. Therefore, research was done at the Alabama Agricultural Experiment Station on both chemical and mechanical properties of CCA-treated lumber. Results to date indicate that CCA treatment extends lumber life without reducing its strength.

To better understand the interactions between the preservative chemicals and the wood substrate, southern pine lumber was treated with several different formulations of CCA preservatives, as well as single and double component solutions. In this way the interaction of the chromium, copper, and arsenic could also be investigated. Lumber treated using each of the formulations was air-dried following treatment, then analyzed chemically and mechanically.

EFFECT OF PRESERVATIVES ON STRENGTH OF SOUTHERN PINE LUMBER

Treatment	Reten- tion	Static bending	
		Modulus of rupture ²	Modulus of elasticity ³
		<i>p. c. f.</i> ¹	<i>p. s. i.</i>
CCA-type A	0.4	14,382	1,997
CCA-type A	2.6	17,309	2,304
CCA-type B	.3	14,627	2,039
CCA-type B	1.8	16,561	2,297
CCA-type C	.4	14,687	2,162
CCA-type C	2.4	16,268	2,250
Chromium	.2	14,960	2,223
Chromium	1.5	16,129	2,420
Chromium + copper	.3	14,591	1,971
Chromium + copper	1.6	17,079	2,401
Chromium + arsenic	.3	14,147	2,035
Chromium + arsenic	2.4	15,039	2,221
Water	—	13,813	1,994
Untreated	—	16,104	2,280

¹Pounds of chemical per cubic foot of wood.
²Determines the load a beam will carry—higher values indicate greater strength.

³A measure of the beam's resistance to bending—higher values indicate greater resistance.

Both appearance and performance varied among treatments of southern pine lumber.

Results from chemical analyses indicated that lignin, an important chemical component in wood, reacts with the preservative chemicals. The degree of interaction between lignin and the preservative chemicals increased with increasing severity of the treating solution. It was also found that the reaction of lignin with CCA preservatives requires the presence of all three components of the CCA preservative. The formulation showing the greatest interaction between lignin and CCA was the formulation most commonly used in treating southern pine (CCA type C).

Since lignin acts as a "cement" to hold the wood fibers together, the interaction of lignin with CCA preservatives is expected to influence the mechanical properties of the wood. In this study, however, results of mechanical testing of samples given in the table do not indicate any strength reductions in southern pine lumber as a result of treatment with CCA preservatives.

The results suggest that the chemical elements in CCA preservatives react with the wood, primarily the lignin, but these reactions do not reduce the mechanical integrity of the southern pine lumber. While additional mechanical testing is under way, the results obtained to date agree well with several other studies currently investigating the influence of CCA treatment on the mechanical properties of southern pine.

Findings of the Auburn studies suggest that while the CCA treatment followed by air-drying does not reduce the mechanical properties of southern pine, kiln-drying following treatment may damage mechanical properties. The next logical extension of this work would be to apply the same chemical analysis techniques to CCA-treated wood which has been kiln dried following treatment. This would determine if the kiln-drying process induces chemical and subsequent mechanical changes in southern pine lumber.

Based on the Auburn study, it is concluded that wood chemically reacts with the elements in CCA preservatives, so the chromium, copper, and arsenic become fixed in the wood without reducing the mechanical properties of southern pine lumber.

Ostmeier is a Graduate Research Assistant and Elder is Associate Professor of Forestry.

YELLOW NUTSEDGE ranks as one of the primary weed problems in the United States and has been reported in all but one of the 48 contiguous states. Under noncompetitive conditions of adequate light and moisture, a single plant is capable of forming several thousand tubers in a season.

Field cultivation and hoeing are common weed control methods in field nurseries. Both are time consuming, expensive, and only marginally effective in controlling yellow nutsedge and may contribute to its spreading throughout the field. Currently, no labelled herbicides are available that adequately control yellow nutsedge without causing injury to ornamental species. Consequently, when nutsedge appears in a field or around a container area it rapidly becomes a major problem.

Research at the Alabama Agricultural Experiment Station evaluated selected herbicides that were applied preplant incorporated (PPI), preemergence (PRE), and postemergence (POST) for control of yellow nutsedge and for phytotoxicity to four ornamental species.

On March 21, herbicides were applied PPI and PRE to Dothan sandy loam soil in 1-qt. plastic containers. Ten yellow nutsedge tubers were planted to a depth of 1 in. below the surface of the treated soil. Herbicides were applied at 1/2, 1, 1 1/2, and 2X rates as recommended by the manufacturer. For phytotoxicity evaluation, liners of Big Blue lirioppe, Copperman azalea, common boxwood, and Natchez crape-myrtle received over-the-top applications of all herbicide treatments. On April 11, 4-in.-tall yellow nutsedge plants were treated with four herbicides (POST) at three rates each. Six single-pot replications were used in a randomized block design.

Classic® at 0.75 and 1.0 oz. active ingredient (ai) per acre and Scepter® at 1.0 lb. ai PPI resulted in excellent control of yellow nutsedge at 8 weeks as reported in the table. Classic at 0.5 oz. ai per acre, Scepter at 0.75 lb. ai, and Dual at 2 lb. ai applied PPI showed initial control, but by week 8, healthy nutsedge began emerging. Reflex® applied PPI, PRE, and POST at 0.75 and 1.0 lb. ai per acre showed limited nut-

Herbicides evaluated for yellow nutsedge control and ornamental phytotoxicity

D.L. BERCHIELLI, C.H. GILLIAM,
G.R. WEHTJE, D.C. FARE,
and T.V. HICKS

sedge activity (8 weeks). In tests the previous year, Reflex had shown good yellow nutsedge control. While all preemergence applied herbicides initially delayed emergence of yellow nutsedge, only Classic and Scepter at the high rates continued to inhibit emergence beyond 8 weeks with PRE treatments.

Classic applied postemergence at 0.75, and 1.0 oz. ai per acre resulted in good control of yellow nutsedge at 8 weeks, see table. Although Classic, Scepter, Reflex, and Roundup applied POST at all other rates initially caused chlorosis to the nutsedge, by 8 weeks the nutsedge outgrew any previous injuries and healthy growth emerged.

With respect to phytotoxicity, neither Big Blue lirioppe nor common boxwood exhibited any injury symptoms from any of the herbicides at 8 weeks. Scepter at all rates suppressed growth of Natchez crape-myrtle and Copperman azalea. Phytotoxicity symptoms were character-

EFFECTS OF SELECTED HERBICIDES ON YELLOW NUTSEDGE CONTROL 8 WEEKS AFTER APPLICATION

Herbicide and rate of active ingredient/acre	Control rating by type of application		
	PPI ¹	Pre ¹	Post ²
Reflex			
0.25 lb.	1.4 ³	1.4	1.0
0.50 lb.	1.7	1.4	1.0
0.75 lb.	2.1	1.8	1.0
1.00 lb.	1.4	2.1	1.0
Classic			
0.50 oz.	3.5	3.3	2.8
0.75 oz.	4.4	4.0	3.3
1.00 oz.	5.2	4.9	3.5
Scepter			
0.25 lb.	1.0	1.0	1.0
0.50 lb.	1.8	1.8	1.0
0.75 lb.	1.8	1.8	1.0
1.00 lb.	5.0	5.2	1.0
Dual, 2.00 lb.			
1.0	—	—	—
Roundup			
0.50 lb.	—	—	1.0
1.00 lb.	—	—	1.1
1.0	1.0	1.0	1.0

¹Scale used to evaluate amount of yellow nutsedge control was as follows: 1 = healthy vigorous growth, 2 = light chlorosis or necrosis, 3 = moderate chlorosis or necrosis, 4 = severe chlorosis or necrosis, 5 = dead nutsedge, 6 = no emergence.

²Scale used to evaluate amount of control was as follows: 1 = healthy vigorous growth, 2 = light chlorosis or necrosis, 3 = moderate chlorosis or necrosis, 4 = severe chlorosis or necrosis, 5 = dead nutsedge.

ized by stunted plants with lanceolated leaves arising in a fashion similar to a witches broom. Reflex at all rates initially showed some chlorotic spotting on all ornamental species; however, at 4 weeks all species grew past the injury. Classic at the 2X rate initially caused stunting of growth in Natchez crape-myrtle and Copperman azalea, but by 8 weeks these plants were similar to the control plants.

Classic at 0.25, 0.5, and 0.75 oz. ai per acre was safe on all four ornamental species tested, with the 0.75- and 1.0-oz. rates, both PPI and PRE, providing excellent yellow nutsedge control. Classic is currently not registered for use on woody nursery stock but appears to be a promising herbicide for yellow nutsedge control.

Herbicide damage from Scepter is shown on plant at right, compared to control plant.



Berchielli is a Graduate Research Assistant of Horticulture, Gilliam is Associate Professor of Horticulture, Wehtje is Assistant Professor of Agronomy and Soils, Fare is a Research Associate of Horticulture, and Hicks is a Research Associate of Agronomy and Soils.

Farm Program Spending Preferences: WHAT ALABAMIANS WANT TO DO

J.J. MOLNAR and S.M. MULLA

OUR NATION'S food and agricultural policy centers on provisions to stabilize and support farm prices, but efforts to help farmers are politically linked to assisting the rural and urban poor and people in less developed countries. The extent of public support for both farm and non-farm programs is not well understood. As part of a nationwide survey of public attitudes toward agriculture, a cross section of 328 Alabama residents returned completed questionnaires, approximately 46% of the random sample of households contacted in the State. The table shows their preferences for growth, stability, or cut-backs in the programs.

Although all programs received majority support for continuation or expansion, food stamps (item 1) generated the most interest in reduced spending or elimination. Food stamps have been a highly successful vehicle for increasing and stabilizing the demand for food, as

well as enhancing the nutritional status of poor families (poor is defined as a family of four with an income of \$10,000 per year or less). Respondents may have been reacting to the potential for misuse of benefits by some recipients.

Respondents were more willing to extend or expand the other domestic food distribution programs. About 45% of the respondents felt that spending should be kept the same for supplying free or low-cost milk for school children and 35% recommended an increase (item 2). Nearly 51% responded that spending for school lunches for poor children (item 3) should be kept the same, but 30% wanted to spend more. Over 47% of the respondents felt that spending should be increased for free distribution of surplus food to the poor in the United States (item 4). In each instance, more than 80% favored maintaining or increasing food distribution programs.

Even though most preferred stability or growth in spending on international food assistance, over 30% felt that spending on free or low-cost food for hungry people in the poor countries (item 5) should be reduced or eliminated.

Alabamians were most supportive of expanded low-cost loans for young farmers to buy land and get started in the business. Over 54% of the respondents felt that spending for such programs should be increased, the only item where a majority supported an increase. Over 33% of the respondents felt that spending for partial payment to farmers for the cost of reducing soil erosion should be increased.

The results suggest that most respondents prefer government spending to remain the same or increase for food and agricultural programs; few would like such spending to decrease or be eliminated. Even in the case of food stamps, over half felt the program should stay the same or be increased. In the case of programs to aid young farmers, a majority would like government spending to increase. It seems that the public is aware of the importance of food and farm programs and endorses the need for continuing government support for these efforts.

Molnar is Professor and Mulla is a Graduate Research Assistant of Agricultural Economics and Rural Sociology.

FOOD AND AGRICULTURAL PROGRAM SPENDING PREFERENCES, STATEWIDE SURVEY, 1986¹

Program	Spending should be:				Number responding
	Increased	Kept the same	Decreased/eliminated	Don't know	
	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	
Food stamps for poor people	19.9	38.5	34.1	7.5	322
Free or low-cost milk for school children	35.1	45.3	16.2	3.4	322
School lunches for poor children	30.4	50.9	15.6	3.1	322
Surplus food distributed free to poor people in the U.S.	47.2	37.6	11.5	3.7	322
Free or low-cost food for hungry people in poor countries	22.6	34.4	30.0	13.0	323
Low-cost loans for young farmers to buy land and get started in business	54.5	26.3	11.5	7.7	323
Partial payment to farmers for the cost of reducing soil erosion	33.5	31.7	17.7	17.1	322

¹Responses from Alabamians were not significantly different from respondents nationwide.

BEEF HEIFERS raised on fungus-infected tall fescue had reduced conception rates, lower milk production, and fewer became pregnant again following calving, when compared to heifers raised on tall fescue that was not infected with the fungus. These results were found in a study conducted at the Alabama Agricultural Experiment Station.

This study was conducted at two locations, the Black Belt Substation (BBS) where there were 38 head of Simmental x Angus heifers and the Tennessee Valley Substation (TVS) where there were 54 head of predominantly Limousin x Angus or Hereford heifers. The heifers were purchased during late summer and were assigned to the following fescue grazing treatments: (1) low infection (0-5% of the plants infected), (2) medium infection (25-60% of the plants infected), and (3) high infection (80-99% of the plants infected).

During both winters of the 2-year trial, the heifers received hay having low, medium, or high levels of infection. In addition to the hay offered free choice, the heifers also received concentrate daily at 0.7% of their body weight (approximately 5 lb. per head during the first winter). At the BBS, the heifers grazed dallisgrass-clover pastures during the summer when fescue was dormant. At the TVS, the heifers grazed fescue all summer.

The paddocks were stocked at one head per acre in early fall with heifers that weighed an average of 572 lb. Breeding was done during the spring grazing using bulls with a proven breeding record.

Daily gains by the grazing heifers decreased linearly as the percent endophyte in the fescue increased, table 1. The decrease was 0.09 lb. per day for each 10% increase in endophyte, very close to the "rule-of-thumb" of 0.10 lb. for each 10% increase in endophyte that was observed in other studies. Surprisingly, daily gains during the winters were just the reverse of what was observed by grazing animals, tables 1 and 2. Grain consumption was nearly constant during winter; however, at the BBS, heifers assigned to medium and high infection treatments ate more hay than those assigned to low infection. During the second winter, table 2, heifers at both locations ate nearly the same amount of hay

Fescue Fungus Suppresses Growth and Reproduction in Replacement Beef Heifers

S.P. SCHMIDT, D.A. DANILSON, J.A. HOLLIMAN, H.W. GRIMES, and W.B. WEBSTER

and the gains were still reversed. The negative gains (but not necessarily the reverse order) during the second winter can be largely attributed to calving and the initiation of lactation. In two previous studies at the BBS, steers that had not previously grazed infected fescue gained more slowly when fed infected hay than steers fed hay containing only 0-5% fungus.

The number of heifers pregnant in each treatment decreased as the percent infection increased. Only slightly over half of the heifers in the high-fungus treatment group became pregnant.

For the second year, beginning with fall grazing, only heifers that were pregnant were included in the test. Grazing gains the second year continued to reflect the level of fungus infection in the fescue, table 2. Gains were slower the second year because the cattle were heavier and they were also nursing calves during the spring grazing season. Only heifers grazing the low-infection fescue continued to gain weight while nursing a calf during the spring grazing. Presence of the fungus had a tremendous impact on conception rates when the first-calf

heifers were rebred. Only one-third of the cows grazing the highly infected pastures became pregnant a second time.

Milk production by the cows was measured 100 days after calving, following a 12-hour calf removal period. Milk production was reduced due to presence of the fungus, being 50% lower for cows on the high-infection treatment. Birth weight of the calves (average = 74.5 lb.) was not different among the three groups. By 100 days of age, weights of the nursing calves were beginning to reflect the level of fungus in the fescue. In a previous cow-calf study at the BBS, it was found that calf gains were reduced nearly 50% due to presence of the fungus.

Presence of *Acremonium coenophialum* fungus in fescue pastures can have a large economic impact on cattle production. For each 10% increase in fungus infection, conception rates dropped 3.5% and daily milk production decreased by 2.3 lb.

Schmidt and Danilson are Associate and Assistant Professors, respectively, of Animal and Dairy Sciences, Holliman and Grimes are Associate Superintendent and Superintendent, respectively, of the Black Belt Substation, and Webster is Superintendent of the Tennessee Valley Substation.

TABLE 1. EFFECT OF FUNGUS-INFECTED TALL FESCUE PASTURES ON GROWTH AND REPRODUCTION OF REPLACEMENT BEEF HEIFERS

Treatment	Infection Pct.	Initial wt. Lb.	Av. daily gains ¹			Breeding wt. Lb.	Pregnant Pct.
			Grazing Lb.	Winter Lb.	Total Lb.		
Low	0-5	563	1.65	0.17	1.20	805	96
Medium	25-60	561	1.26	.35	.96	787	82
High	80-99	592	.76	1.19	.87	748	55

¹Grazing refers to gains during the combined fall and spring grazing periods; winter refers to the winter period; total refers to the combined gains.

TABLE 2. EFFECT OF FUNGUS-INFECTED TALL FESCUE PASTURES ON THE PERFORMANCE OF FIRST-CALF BEEF HEIFERS

Treatment	Av. daily gains		Wt. at rebreeding Lb.	Pregnant Pct.	12-hour milk production Lb.	100-day calf wt. Lb.
	Winter Lb.	Grazing Lb.				
Low	-1.65	1.25	1,028	93	8.1	294
Medium	-.90	.88	952	45	7.1	266
High	-.52	-.01	884	33	4.0	274



Plants in rear received molybdenum and lime, whereas those in front did not. Varieties are (left to right) Eckespoint C-1 Red, Gutbier V-14 Glory, and Annette Hegg Brilliant Diamond.

Applying lime and molybdenum solution prevents deficiency on poinsettias

D. COX

UNSIGHTLY YELLOWING and marginal browning of poinsettia leaves just prior to the Christmas sales season is a common occurrence for many poinsettia growers. These symptoms are caused by a deficiency of the trace element molybdenum (Mo). This injury can significantly reduce the economic value of the crop.

Research by the Alabama Agricultural Experiment Station found that a combination of low pH of growing medium, low Mo supply, and poinsettia cultivar influence the occurrence of Mo deficiency. The results also show that raising the pH level with lime and application of Mo prevent development of symptoms on the cultivars tested.

Poinsettia cultivars Annette Hegg Brilliant Diamond, Gutbier V-14 Glory, and Eckespoint C-1 Red were used in the test. Rooted cuttings of each were planted in 6-in. pots of amended sphagnum peat moss and perlite (1:1) medium. To study the effects of growing medium pH, comparisons were made of using growing medium with no limestone or 5 lb. dolomitic lime per cu. yd. incorporated. The resulting pH values were 4.7 and 5.8, respectively.

Trace element fertilizer was not incorporated in the medium, but was applied in solution two or three times per week with the routine application of water-soluble nitrogen and potassium fertilizer. One trace element solution supplied all trace elements but Mo, while Mo was added to the other at 0.1 p.p.m. To evaluate treatment effects on Mo status of plants, upper leaves were analyzed for

Mo content (results given in table). These analytical results were compared to the tissue analysis standard of 0.5 p.p.m. established for poinsettia.

The combination of low pH and no supplemental Mo caused the severe Mo deficiency symptoms in Gutbier V-14 Glory and Annette Hegg Brilliant Diamond shown in the photo. Symptoms were absent from Eckespoint C-1 Red.

Increasing growing medium pH and/or application of Mo-containing solution prevented the occurrence of Mo deficiency symptoms. Plant growth was the same in all treatments. Leaf analysis revealed that Mo in tissue was at or below the standard value (0.5 p.p.m.) with the combination of low pH and no supplemental Mo in the growing medium. It is not known why Eckespoint C-1 Red did not show symptoms even though tissue Mo was below the standard. Raising the pH and/or applying Mo raised the tissue Mo content to levels exceeding the standard.

From this study it appears that the most practical and reliable way of preventing Mo deficiency is the incorporation of enough limestone in the medium to achieve a pH of about 5.8 and frequent application of a dilute Mo solution. In all cultivars tested, the combination of pH 5.8 and supplemental Mo resulted in tissue Mo levels at least three times greater than the established critical level.

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EFFECT OF GROWING MEDIUM pH AND MOLYBDENUM APPLICATION ON MOLYBDENUM CONTENT OF POINSETTIA LEAVES

Treatment	Mo tissue analysis ¹		
	Eckespoint C-1 Red	Gutbier V-14 Glory	Annette Hegg Brilliant Diamond
	<i>p.p.m.</i>	<i>p.p.m.</i>	<i>p.p.m.</i>
pH 4.7, - Mo	0.3	0.5	0.3
pH 4.7, + Mo7	.8	.7
pH 5.8, - Mo4	.7	.6
pH 5.8, + Mo	1.7	1.8	1.4

¹Acceptable standard is 0.5 p.p.m.

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