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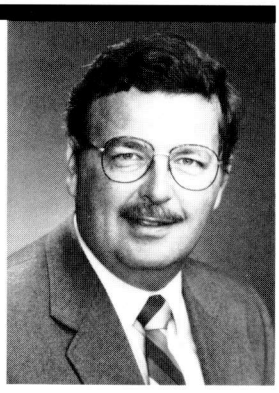
HIGHLIGHTS

OF AGRICULTURAL RESEARCH

Director's Comments

The forest industry is a billion dollar business in Alabama, placing it among the elite in the State. And, that's not the best news! The forest industry is still growing in the State and doing well, even in today's economic recession. Despite it's dynamic nature and contributions to the State economy, few really understand the makeup of Alabama's forest industry.

A recent survey cited on page 3 of this Highlights reveals some interesting insights into the forest industry. Perhaps the biggest myth is that large companies, such as paper companies, own most of the forest land in Alabama. In truth, the vast majority of forest land in the State is owned by private landowners, and most in small acreages.



LOWELL T. FROBISH

As part of the survey cited on page 3, there was a Forestry Knowledge Quiz. Like most people who read the survey, I took the quiz. And, like most, I didn't do nearly as well as I thought I would. See how much you know about the State's forest industry. The answers are at the bottom of this column, but don't cheat.

Forestry Questionnaire

(1) Pine pulpwood is currently worth between $15 and $25 per cord on the stump in Alabama (43% of those surveyed answered correctly).

(2) Most mixed pine and hardwood forests in Alabama will come back to pine naturally after harvesting (36% answered correctly).

(3) Special precautions are necessary during a timber harvest to prevent soil erosion (91% answered correctly).

(4) Forest industries spray their pine plantations with herbicides every year (48% answered correctly).

(5) In order to grow pine, it is necessary to control hardwood competition with fire, herbicides, or through some other method (53% answered correctly).

(6) Prescribed burning is more harmful to hardwoods than to pines (46% answered correctly).

(7) Most loggers are registered foresters in Alabama (71% answered correctly).

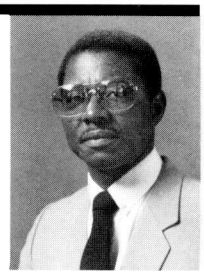
(8) Large forest industries own most of Alabama's timberland. (I've already answered this one for you, but only 33% of those surveyed answered correctly.)

(9) Timber is among the top three agricultural commodities in Alabama. (I've answered this one too, and 83% answered it correctly.)

(10) For tax year 1990, capital gains income from timber sales is taxed at a lower rate than the rate paid for ordinary income (34% answered correctly).

ANSWERS: 1 (TRUE), 2 (FALSE), 3 (TRUE), 4 (FALSE), 5 (TRUE), 6 (TRUE), 7 (FALSE), 8 (FALSE), 9 (TRUE), AND 10 (FALSE).

May We Introduce



Dr. James E. Brown, Vegetable Physiologist and Associate Professor of Horticulture. A native of Quitman, Georgia, Brown earned a bachelors degree in agronomy from Fort Valley State College, a masters in plant and soil science from Tuskegee University, and the Ph.D in horticulture from the University of Illinois.

After completing his Ph.D, Brown returned to Tuskegee University, where he served as Horticulture Specialist. He joined the Auburn University horticulture staff in 1985 as an Assistant Professor and was promoted to Associate Professor in 1990.

Brown has gained state, national, and international recognition for his work with plastic mulches for soil solarization in vegetable crops. An article on page 6 of this issue of *Highlights* involves the use of reflective mulches to reduce virus damage to summer squash.

ON THE COVER: Crimson clover can beseeded into Ally® treated bahiagrass. See related story on page 16.

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J. C. BLISS

Survey Yields Insight Into Alabama Forest Owners' Attitudes

PRIVATE individuals own most of Alabama's forestland, and hence greatly influence the economy and environmental quality of the State. In an Alabama Agricultural Experiment Station study, a detailed questionnaire was designed to determine forest owners' social and economic characteristics, past and planned forest management activities, and opinions about several currently "hot" issues in forestry.

Interviews were completed with 731 forest owners. They indicated that Alabama's non-industrial private forest owners are a diverse group of individuals not readily classified into neat categories. Still, some interesting patterns are discernible, see table. Most of the owners come from rural backgrounds. Approximately 40% are 65 years of age or older, while only about 2% are less than 35 years old. Since timber is often sold when land changes hands, the aging of Alabama's forest owners could mean an increase in land ownership changes in the future, and with it an increase in the amount of timber offered for sale.

Alabama's forest owners of today are also more highly educated than those surveyed in the past. While fewer than 10% of the study respondents have not completed high school, 40% have completed at least 16 years of formal education, the equivalent of a college degree. This trend should bode well for the future care of Alabama's forests.

Those surveyed own and use their forestlands for a variety of benefits from nature appreciation to timber production. One-third of the respondents said that "keeping land in the family" was the primary benefit they receive from owning forestland in Alabama. About 25% of the sample cited income from timber sales as the primary benefit of ownership, and an additional 14% said the primary benefit they receive is "beauty or land appreciation." In addition to these primary benefits, the owners said that personal recreational opportunities, hunting opportunities, and habitat for game and non-game wildlife were important benefits.

A majority of respondents have actively taken measures to utilize or increase the productivity of their forestlands through preparing sites for forest regeneration, planting trees, conducting prescribed fires, and harvesting timber. This suggests that they find timber production activities compatible with the other benefits they derive from their land.

Some of the most enlightening results concern forest owner attitudes toward current forestry issues. Of those responding, 74% agreed with the statement "Producing timber is the most important objective of forest management." However, they hold somewhat diverse opinions as to what constitutes acceptable forest management. While 74% agreed that "Prescribed burning is an acceptable forest management practice," 53% felt the same about clearcutting, while 48% of those expressing an opinion felt using herbicides is acceptable.

Regarding the economics of timber growing, 51% felt that prices received by landowners for their timber provide a fair return on investment (20% disagreed). About 64% felt that inheritance taxes have a negative effect on forest management, and over 78% felt that a reduced tax rate for capital gains income is essential to encourage management.

Given that 71% of survey respondents classified themselves as conservative on most issues, it is not surprising that 49% disagreed with the general statement "Forestry practices on private land should be regulated in order to protect the environment." When asked to respond to a more specific statement, "Timber harvesting should be strictly controlled in wetlands," 58% agreed, and only 24% disagreed.

While this result doesn't answer the question of who should do the controlling, it does indicate that forest owners recognize a need for protection of environmentally sensitive areas. This interpretation is strengthened by the finding that 64% of the respondents agreed with the statement "Timber harvesting practices should be regulated where necessary to protect habitat for endangered species." While some might argue that survey responses report what people say — not what they do — at least these results indicate that Alabama's private forest owners are concerned about protecting the environment.

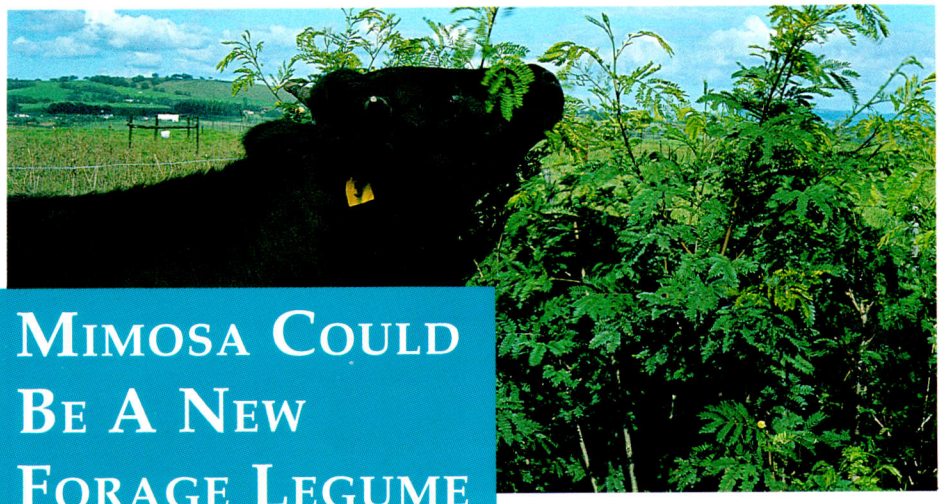
Characteristics of Survey Respondents[1]

Characteristics	Sample
	Pct.
Forest acres owned	
1-100	26.3
100-499	36.4
500-999	13.4
1,000-4,999	16.3
5,000+	4.3
Missing	3.3
Owner's background	
Farm	32.2
Rural non-farm	23.8
Town <10,000	20.3
City 10,000-100,000	14.0
City >100,000	8.5
Missing	1.2
Age, years	
<35	2.3
35 - 64	55.5
65+	40.2
Missing	2.0
Education, years	
<12	9.8
12 (High school graduate)	32.5
13-15 (Jr. college, tech school)	15.6
16 (college graduate)	23.3
17+ (advanced study)	16.7
Missing	2.3

Forest acres are indicated for all respondents (731), including corporate owners. Other characteristics are shown for non-corporate owners only (656).

Bliss is Assistant Professor of Forestry.

S.E. SLADDEN, D.I. BRANSBY, G.E. AIKEN, AND P.A. ROSE



MIMOSA COULD BE A NEW FORAGE LEGUME

MIMOSA was imported into the United States from Asia as an ornamental plant. However, preliminary research by the Alabama Agricultural Experiment Station at the E.V. Smith Research Center, Shorter, indicates that it could be a highly productive warm-season forage legume for the Southeast.

With increased emphasis on low-input, sustainable agriculture, legumes are receiving more attention because they fix their own nitrogen (N) and therefore do not require expensive N fertilization, and they provide high quality forage for livestock when compared to grasses. Several good cool-season forage legumes are widely used in the Southeast, but there is no warm-season legume that can be considered as successful.

Problems with the warm-season legumes evaluated to date include: poor persistence under grazing, low tolerance to short summer droughts, poor competitive ability with aggressive warm-season grasses such as bahiagrass and bermudagrass, slow establishment, low tolerance of acid soils, damage from insects and pests, low tolerance to severe cold in winter, low palatability, and presence of toxins. However, the search for a suitable warm-season forage legume for the Southeast has been confined almost entirely to herbaceous-type plants. Woody shrubs and trees have been largely overlooked even though they might not have many of the disadvantages listed above.

The concept of using woody plants for forage may be strange in this region but it is common practice in many other parts of the world. For example, trees and shrubs are an important source of forage for livestock in both Asia and Africa, and many species of African wildlife would not exist if it were not for this source of forage that makes up most of their diet.

Leucaena leucocephala is the most widely used, improved leguminous forage tree, but it is of tropical origin and will not survive the cold winters of the Southeast. In addition, if it exceeds 30% of the diet it can be toxic to animals. Mimosa has a similar appearance to Leucaena, but is more cold tolerant. It grows from the gulf coast to Kentucky, up to Washington, D.C., on the eastern seaboard, and as far west as Lubbock, Texas. It appears to be palatable to all livestock, since it is seldom observed growing in grazed pastures.

Steer browsing Leucaena (at top of page), and (above) mimosa plot regrowth 6 weeks after complete removal of leaves.

In 1989 mimosa and Leucaena were each planted in four 12 x 20-ft. plots with 3 ft. between rows and 1 ft. between plants in the row. A set of individual plants was planted with a 10 x 10-ft. spacing for a separate experiment. Leaf material was harvested by hand-plucking in the summer of 1991. Plots were harvested every 6 weeks, while the experiment with individual trees involved harvesting every 4, 6, 8, 10, or 12 weeks. Seeds were not inoculated with rhizobium before planting and no N, phosphorous, or potassium fertilizer was applied. Forage samples were analyzed for crude protein and digestibility in the laboratory. In addition, fresh mimosa was harvested daily and fed to two sheep for 3 weeks in a digestibility trial.

Leucaena plants were killed by cold weather in the winter of 1989-90. Plots of mimosa provided a total of 4.5 tons of dry matter per acre from four harvests. Average protein content of leaves was 17% and digestibility estimated from laboratory analyses was 66%. Based on the yield and protein content, mimosa fixed 245 lb. of N per acre during the summer growing season.

The harvest frequency experiment showed that maximum yield was obtained when 6 to 8 weeks were allowed for regrowth between defoliations. This suggests that under production conditions, a four-pasture scheme with animals moved every 2 to 3 weeks should be feasible. The sheep digestibility trial indicated that mimosa was readily consumed, there were no signs of toxicity, and apparent digestibility was 61%, which is good.

In summary, preliminary data show that mimosa could be an extremely high producing new forage legume for the Southeast. It could be planted in solid stands, or strips could be established in existing bahiagrass or bermudagrass pastures to increase forage quality. This strategy would allow hay to be harvested from the grass strips until mimosa plants were large enough (4 to 6 feet) to be utilized by animals.

Danger of mimosa becoming a serious weed problem should not be overlooked. However, low germination caused by a hard seed coat (which is overcome by treating seed with hot water) and prevention of seeding by repeated defoliation with animals should reduce this hazard.

Sladden is Research Specialist, Bransby is Professor, Aiken is former Postdoctoral Research Fellow, and Rose is former Research Associate of Agronomy and Soils.

M.R. BRADBARD, E.G. BROWN, AND R.J. BISCHOFF

PATTERNS OF DAY CARE SELECTION BY PARENTS OF SCHOOL-AGE CHILDREN

SCHOOL-AGE children currently make up one of the fastest growing segments of our society. With "baby boomers" now having their own children, the school-age child population is projected to continue to increase until 1995. Paralleling these changes is the increase in the number of mothers in the work force. Combining these two demographic trends, it is estimated that by 1995 over three-quarters of school-age children will have mothers who work outside the home. These figures translate into a greater need to determine how and why working parents of school-age children select day care.

To obtain day care selection information, questionnaires were developed by the Alabama Agricultural Experiment Station and sent to all parents whose 5- to 12-year-old children were enrolled in one of 10 profit-making day care centers in two east Alabama communities. Questionnaires were obtained from 77 parents (67 mothers, 10 fathers), representing a response rate of 37%. On average, the respondents had 1.8 children and 3 years of college education.

Initial results indicated that 94% of all parents who completed the questionnaire visited the center their child currently attended between one and three times (average = 1.4) prior to enrolling their child, and 77% visited or telephoned more than one center before enrolling their child in a center. More than half of the parents first learned about the center they selected from friends; few first learned about the center by consulting either child development specialists (4%) or day care licensers (1%). Other first sources of information came from driving by the center (13%), Yellow Pages (6%), newspaper ads (5%), and neighbors (3%). In more than half the sample, the decision to enroll the child in a particular center was made jointly by both parents.

Parents ranked the reasons they had for selecting a day care program for their school-age children in the following order from most important to least important: health and safety considerations; quality of the caregiver; the social, academic, and physical development of their children; the center's hours of operation, location, and cost.

Finally, six variables listed in order of importance contributed significantly to parents' ability to select better quality profit-making day care centers for their school-age children. Better quality centers were selected by parents who were better educated, visited the center they selected fewer times, were less likely to use information obtained by driving by the center as a first source of information, were more likely to obtain information from friends as a first source of information, were more likely to rank the quality of the caregiver as an important reason for selecting a center, and were more likely to rank cost as an important reason for selecting a center.

These results illustrate that Alabama parents appear to have an extensive repertoire of past experiences and information-seeking methods at their disposal to help them identify quality day care centers for their school-age children. Furthermore, their reasons for selecting day care centers corresponded closely to those recommended by child development experts. That is, child-related factors such as health and safety and quality of caregivers took precedence over convenience factors such as the center's hours of operation, location, or cost.

However, two important questions to consider in future research and practice also emerge from these findings. First, parents in this sample virtually never sought advice from child development professionals or day care licensers. Could seeking expert advice—for example, calling a day care licensing agency or an information and referral "hot line"—enhance parents' ability to select better quality day care? Second, would having consumer information in-hand on how to select quality day care centers contribute to parents' chances of making more optimal day care choices for their school-age children?

Selecting quality day care centers is important for all children.

Bradbard is Professor, Brown is Doctoral Student, and Bischoff is former Master's Student of Family and Child Development.

J.E. BROWN, R.T. GUDAUSKAS, R.P. YATES, B.C. EARLY, AND W.T. HOGUE

Reflective Plastic Mulch Boosts Yield, Reduces Aphid Populations and Mosaic Diseases in Squash

MOSAIC diseases caused by viruses, which often are transmitted by aphids, can be devastating to yields of yellow summer squash in Alabama, particularly late in the growing season. Recent Alabama Agricultural Experiment Station research indicates reflective mulches can aid in the control of mosaic diseases by discouraging aphid infestations, subsequently increasing squash yields.

An Experiment Station study focusing on the use of various reflective mulches in the production of summer squash was conducted on an Orangeburg sandy loam soil (pH 6. 2) at the E.V. Smith Research Center, Shorter. Treatments were: (1) black plastic mulch, (2) yellow painted plastic mulch, (3) white plastic mulch, (4) aluminum painted plastic mulch, (5) bare soil as a control, and (6) bare soil with Diazinon® insecticide.

On July 25, black plastic mulch (1.5 mil thick and 6 ft. wide) was applied to rows 20 ft. long, spaced 5 ft. apart. Methyl bromide was injected beneath the black plastic mulch at the same time the mulch was applied in a one-step operation. Aluminum and yellow colored paints were applied to some treatments using all purpose paints diluted (2:1) with a mineral spirit paint thinner. Black plastic mulch was laid on all bare soil plots with a plastic layer applicator to permit adequate fumigation, then removed for bare soil treatments.

On August 3, Dixie hybrid yellow crookneck summer squash was direct seeded through 18-in. interval punched holes in rows of the different plastic mulch treatments. The Diazinon insecticide treatment was applied to the plants every 7 days from the time seedlings appeared above ground to the end of the harvest period.

A 4.5 x 10.5-in. yellow pan partially filled with a 1:1 mixture of anti-freeze and water was placed in each treatment plot to serve as an aphid trap. Beginning on August 24, aphids were collected four times during the study period. Plots were harvested a total of nine times beginning October 10. Plants from the different treatments were rated for mosaic symptoms, and viruses associated with the disease were identified by the enzyme-linked immunosorbent assays (ELISA) of foliage and fruit.

Based on ELISA results, zucchini yellow mosaic and cucumber mosaic viruses were the predominant viruses infecting the squash. Effects of the viruses on the plants were most severe during the latter part of the growing season.

Aluminum painted mulch was the most effective treatment in delaying development of mosaic diseases in the crop, table 1. White and yellow plastic produced similar effects and were the next most effective in delaying the diseases. Black plastic, loose soil, and bare soil plus insecticide were the least effective.

Aluminum painted mulch was most effective in reducing incidence of mosaic diseases during the first 3 weeks of harvest. As the plants' foliage covered the mulch, light reflectance into the plant canopy was reduced, and presumably this allowed aphid populations to increase as the growing season progressed. Aluminum white and yellow plastic treatments produced the highest squash yields as compared to other treatments. Bare soil produced the lowest yields, table 2.

Results of this study showed that aluminum plastic mulch reduced the incidence of aphids and thereby delayed development of mosaic diseases for approximately 3 weeks, thus extending the harvest period for marketable squash. Total yields were higher and fewer squash fruits with mosaic symptoms were harvested from aluminum plastic mulch than from black plastic, bare soil:insecticide, and bare soil treatments. Alumium plastic mulch clearly has the potential to be an effective cultural practice in Alabama.

Table 1. Effect of Reflective Mulch Treatments on Mosaic Disease Index of Yellow Crookneck Summer Squash Foliage

Mulch treatment	Date of rating[1]			
	Oct. 10	Oct. 18	Oct. 24	Nov.1
Black	1.37	2.43	2.60	3.23
Yellow	.79	2.04	1.94	2.43
White	.57	2.19	2.49	2.76
Bare soil	1.37	2.28	2.66	3.08
Aluminum	.03	.40	.74	1.41
Bare soil (Diazinon)	1.42	2.36	2.52	2.78

[1] Based on a rating of 0 = no disease symptom, 5 = 100% of plant killed.

Table 2. Effect of Reflective Mulches on the Production of Summer Yellow Crookneck Squash

Mulch treatment	Total yield/acre	Marketable	Nonmarketable	
			Mosaic	Cull
	Ton	*Pct.*	*Pct.*	*Pct.*
Aluminum	11.1	57	39	4
White	11.3	42	57	1
Yellow	10.0	42	57	1
Black	7.9	26	72	2
Bare soil (Diazinon)	6.9	32	68	0.4
Bare soil	5.7	40	59	1

Brown is Associate Professor of Horticulture; Gudauskas is Professor of Plant Pathology; Yates is Research Assistant; and Early is Laboratory Technician VI of Horticulture; Hogue is Superintendent of the Horticulture Unit, E.V. Smith Research Center.

J.H. EDWARDS, E.C. BURT, R.L. RAPER, AND D.T. HILL

Recycling Paper and Poultry Byproducts in Agriculture

PAPER and poultry are leading industries in the Southeast, but paper products currently constitute 30-40% of landfill volume and more than 1.7 million tons of litter are produced annually in Alabama, creating a potential environmental hazard. Recent Alabama Agricultural Experiment Station tests indicate that, if applied properly, these waste products can have positive effects on some of the physical properties of agricultural soils.

AAES research at the E. V. Smith Research Center, Shorter, studied the effects of ground-up paper mixture and broiler litter additions to the soil on cotton yield and cotton rooting depth. Treatments included a check; ground newsprint surface applied 1 lb. per square ft.; 50:50:0 (volume of soil removed from trench 4 in. wide x 24 in. deep x 60 ft. long mixed with ground newsprint); 50:40:10 (volume of soil removed from trench 4 in. x 24 in. x 60 ft. mixed with 40% ground newsprint and 10% broiler litter); backfill (volume of soil removed from trench 4 in. x 48 in. x 60 ft. and backfilled into the trench, fertilizer and lime were added according to Auburn University soil test recommendations); 50:50:0 (volume of soil removed from trench 4 in. x 48 in. x 60 ft. mixed with ground newsprint and calcium supplied from dolomitic limestone); 50:50:0 (volume of soil removed from trench 4 in. x 48 in. x 60 ft. mixed with ground newsprint and calcium supplied from agricultural gypsum); 50:40:10 (volume of soil removed from trench 4 in. x 48 in. x 60 ft. mixed with ground newsprint and 10% broiler litter). Trenches were dug in the center of the plot between rows three and four. The soil:newsprint:litter mixture was put back into the same trench and excess volume of material was mounded over the trench.

Effects of Trenching, Newsprint, and Broiler Litter Application on the Lint Yield of Cotton

Treatments	Trench	Cotton lint, yield/acre
	In.	*Lb.*
Check[1]	No	682
Surface[2]	No	422
50:50:0[3]	24	783
50:40:10[4]	24	1,021
100:0:0[5]	48	879
50:50:0[3]	48	781
50:50:0[3]	48	710
50:40:10[4]	48	1,103

[1] Fertilizer according to Auburn University soil test.
[2] Ground newsprint applied to soil surface at the rate of 1 lb./ft.
[3] Volume of soil:newsprint:broiler litter (fertilizer according to Auburn University soil test).
[4] Volume of soil:newsprint:broiler litter.
[5] Volume of soil removed from trench, fertilizer and lime was added according to Auburn University soil test.

(Above) Digging trench in center of research plots. (Below) Mixing and backfilling mixture of paper, litter, and soil (50:40:10) into trench.

The highest yielding treatments were the two that had mixed newsprint and broiler litter (50:40:10) with the excavated soil. The 24-in. trench had a lint yield of 1,021 lb. lint per acre and the 48-in. trench had 1,103 lb. lint per acre. Cotton grown on the 24-in. trench yielded 81% of the lint produced at the first harvest, while the 48-in. trench yielded only 72% of the total amount of lint produced at the first harvest.

When ground newsprint was placed on the surface and incorporated into the top 6 in. of soil, it severely stunted cotton seedlings for the first 6 weeks after germination. Total lint yield was 422 lb. per acre with 94% of yield harvested at the second harvest date (October 21). On the average, less than 30% of the cotton yield was harvested at the second harvest date in the other treatments. These observations suggest that surface-applied ground newsprint must have an incubation interval before any crops are planted in the area.

Cotton roots in the check and surface applied ground newsprint were confined to the top 6 in. of soil. The restriction in rooting depth in these treatments was related to high soil bulk density (1.55 g cm^{-3}) that occurred at the 6-12-in. soil depth. Cotton roots in the backfilled and the 50:40:10 (soil:newsprint:broiler litter) treatments were observed growing to the bottom of the 48-in. trenches. In the undistributed soil in these plots, rooting depth was confined to the top 6 in. of soil similar to the check treatment. The proliferation of roots in the trench was due to the differences observed in the soil bulk density between the disturbed soil and undisturbed soil.

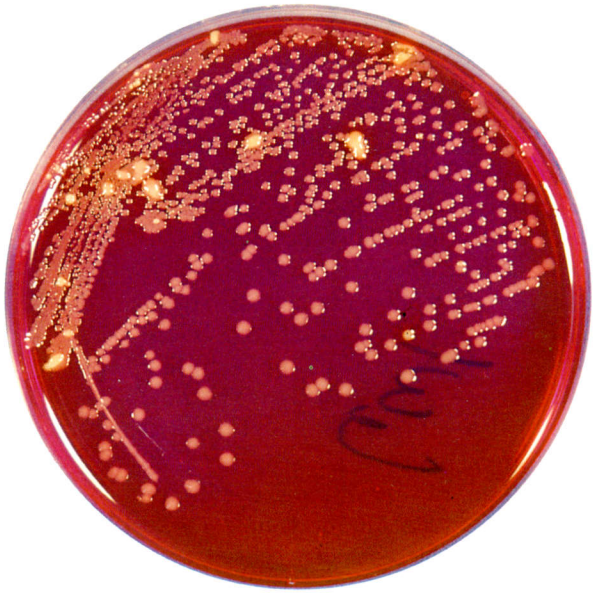
In summary, trenching in combination with newsprint and broiler litter addition has a positive effect on cotton yield. However, it does not appear that trenching beyond 24 in. had any beneficial effect on cotton yield. The effective soil volume was limited to the trench with no beneficial effects to the cotton rows 60 in. from the trench. Increasing the soil compaction above the critical level of 1.55 g cm^{-3} was the most important factor controlling rooting depth of the cotton.

Edwards is USDA-ARS Adjunct Associate Professor of Agronomy and Soils; Burt is Adjunct Associate Professor, Raper is Adjunct Assistant Professor, and Hill is Professor of Agricultural Engineering.

M.A. REIBER AND D.E. CONNER

CONTROL OF *SALMONELLA* IN BREEDER CHICKENS

SALMONELLA is one of the leading causes of foodborne gastroenteritis in the United States, with an estimated 3,000,000 cases per year. Many domesticated animals often carry *Salmonella* as part of their intestinal microflora, and products of animal origin, particularly beef, pork, milk, poultry, and eggs, are most often implicated as sources of human salmonellosis. Thus, there is a need to know and control potential sources of these bacteria to reduce the risk of contamination of final food products. Intervention at certain live production phases may be useful for meeting this need and ultimately improving the microbiological safety of poultry and meat products.



Laboratory culture of *Salmonella enteritidis*.

Previous research has found that chicks in the hatchery may be infected with *Salmonella*, indicating salmonella infection may occur prior to hatch, at the time of hatch, and/or shortly after hatch. Management practices and conditions before hatching of broilers, particularly at the breeder flock level, may influence the extent of salmonella contamination. It has been recently shown that hens with infected ovaries may pass *Salmonella* to the interior components of the egg through a phenomenon referred to as transovarian or vertical transmission. Reportedly, such routes of transmission occur at low rates and tend to be sporadic.

Although hens have been established as a potential harbor for *Salmonella*, the role of the breeder male has not been investigated prior to a recent Alabama Agricultural Experiment Station test.

Experiments were conducted with caged leghorns and with floor pen mated broiler breeders. In both experiments, semen was collected from donor males and divided into three equal amounts. One served as uninoculated (control) semen. The other two were inoculated with a virulent strain of either *Salmonella typhimurium* or *Salmonella enteritidis* such that each hen was challenged with 1,000 cells of the appropriate challenge *Salmonella* upon insemination with 0.05 ml of the semen.

In the first experiment (leghorns), 5.3% of eggs from *S. enteritidis*-challenged hens and 4.0% of those from *S. typhimurium*-challenged hens harbored the respective challenge *Salmonella*. Interestingly, only eggshells were found to be positive and challenge strains could not be recovered from any other egg components. This was particularly interesting because for the hens producing these eggs, the *S. enteritidis* and *S. typhimurium* persisted for at least 14 days in 40 and 30% of the reproductive tracts, respectively. Moreover, 20% of the ovaries in both treatment groups were colonized with the challenge *Salmonella*.

These data indicate that transovarian transmission was not observed in this experiment and concur with other reports that transovarian transmission occurs sporadically. However, results do show that the persistence of *Salmonella* in ovaries and/or oviducts can contribute to eggshell contamination, which in turn can serve as a source of *Salmonella* in the hatchery environment.

In the second experiment (active broiler breeders), contrasting results were obtained. Hens inseminated with semen inoculated with *S. typhimurium* did not produce any *Salmonella*-containing eggs during the 14-day post insemination collection period. Similarly, the *S. enteritidis*-challenged hens produced only two eggs with *S. enteritidis*. One of these was an egg shell sample, while the other was a yolk sample. In both experiments this was the only evidence of transovarian transmission. However, at 14 days post insemination, no reproductive tract component yielded either test *Salmonella* strain, indicating neither bacterial strain persisted during the collection period.

Under certain conditions, *Salmonella* originating from the semen can persist in the ovary and/or oviduct for an extended period. However, eggs from hens with infected ovaries and/or oviducts do not consistently produce contaminated eggs. This illustrates the complex nature of salmonella transmission in live poultry. Nevertheless, these findings indicate transmission of *Salmonella* can occur through male birds or other related breeding activities. Intervention to control *Salmonella* at this stage in live poultry producing could help control contamination of final food products because eggs that are surface contaminated with *Salmonella* at oviposition (or postoviposition) lead to hatchery contamination once eggs are collected and transferred.

Newly-hatched chicks are particularly susceptible to cecal colonization with *Salmonella*. Such cecal colonization can lead to a greater level of the pathogen in the grow out environment (via cecal shedding and caprophogy) which in turn can contribute to higher levels of *Salmonella* in the processing plant. Thus, any reduction in *Salmonella* numbers at the breeder and hatchery levels that results from use of salmonella-free breeders, additional sanitation, egg disinfection, etc., tend to be effective for improving the microbiological safety of poultry products at the retail level.

Reiber is a Graduate Research Assistant and Conner is Assistant Professor of Poultry Science.

L.J. KUTZ AND J.B. CRAVEN

ROBOTIC TRANSPLANTING OF BEDDING PLANTS

A ROBOT ARM coupled with infrared sensors may help nursery operators overcome seasonal labor shortages associated with transplanting of bedding plants. The robot and sensors are part of a system under development in Alabama Agricultural Experiment Station research to automate the labor-intensive task of transplanting seedlings from plug flats to grow flats. Although not currently cost-effective, the robot system is being used to evaluate sensors and handling strategies that might be used in a commercial transplanting machineof the future. Preliminary results show the robot can transplant one seedling every 6 seconds, compared to humans who can transplant about 3 seedlings every 6 seconds.

Most bedding plants are seeded and germinated in plug flats, which are transplanted into grow flats primarily in January through April. This task requires a sizable labor force for a brief period of time. Greenhouse operators often have difficulty hiring people for this temporary, tedious, and low-paying job.

To simulate the gentle touch, vision, and decision-making capability of a human, an IBM 7535 robot in the Industrial Engineering Department at Auburn was adapted to selectively fill a grow flat with transplanted seedlings, figure 1. In industrial applications, this robot is often used in assembling electronic components on circuit boards used in personal computers. Such a pick-and-place operation uses the robot gripper to grasp a part at one location and move it to another location. Transplanting bedding plants is a similar pick-and-place operation, but requires additional considerations to prevent damaging or mishandling the seedlings.

The plug flat is a shallow plastic tray containing about 200 to 500 cells. The cells often are filled with a media containing primarily peat moss, and one seed is sown into each cell. Because germination is rarely 100%, each cell may not contain a seedling. Consequently, the robot must be able to "see" seedlings in the plug flat so that it transplants a seedling into every cell in the grow flat.

Grasping and removing a seedling from the plug flat required special modifications to the robot gripper. Several gripper "finger" designs were tried, and the one shown in figure 2 was the most successful. The fingers are made of spring steel to be flexible when grasping the soil plug attached to the seedling.

Four infrared sensors were mounted just above the robot gripper to sense the presence of seedlings after having been grasped by the fingers. Two such sensors are visible in figure 2. The infrared part of the spectrum is especially useful in distinguishing green foliage from background objects such as the soil. The sensors provide feedback to the robot controller as to whether a seedling has been successfully removed from the plug flat.

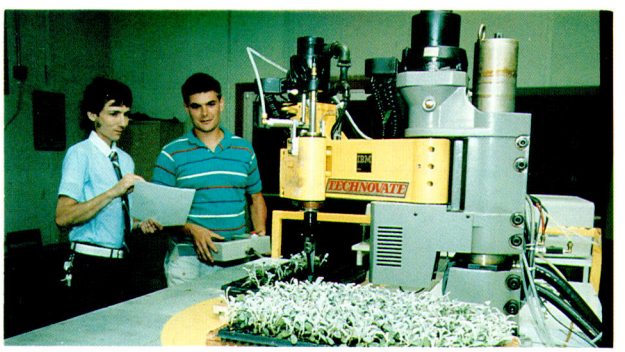


Fig. 1. IBM 7535 robot used to transplant seedlings.

Transplanting tests were conducted with 10 species of bedding plants, including vinca, geranium, impatiens, tomato, begonia, marigold, dahlia, salvia, dusty miller, and petunia. Three types of plug flats (390, 392, and 512 cell) and six types of grow flats (32, 36, 48, 50, 54, and 72 cell) were used in the transplanting tests.

The robot and sensor system was able to successfully transplant all 10 varieties. Grow flats were completely filled with transplanted seedlings, however sometimes at the expense of discarding a significant number of undetected seedlings.

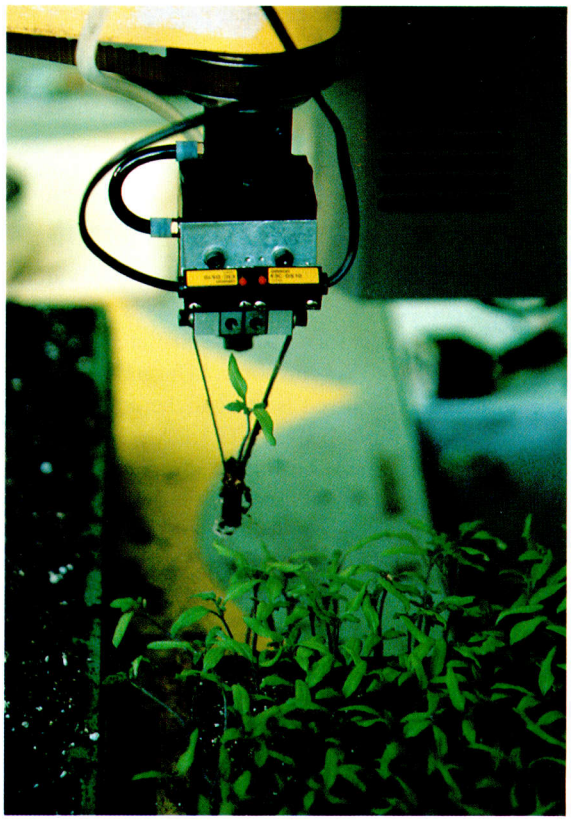


Fig. 2. Grippers used to transplant seedlings.

The sensors worked well in detecting tall, leafy varieties, such as marigold, vinca, and geranium. Undetected seedlings of these varieties were usually the poorer quality seedlings, such as stunted or malformed seedlings, which were discarded by the robot.

Tomato and salvia varieties, both tall seedlings, were not always detected by the sensors because their growth patterns sometimes caused them to fall out of the detection zone.

Future work is planned to examine other sensors to make the system useful with more varieties. The goal is to develop an intelligent robotic transplanting system capable of grading plants while transplanting so that uniform, high quality seedlings are transplanted quickly and automatically.

Kutz is Assistant Professor and Craven is former Graduate Research Assistant of Agricultural Engineering.

W. R. EGBERT, D. L. HUFFMAN, AND D. D. BRADFORD

STABILITY OF AU LEAN® GROUND BEEF DURING REFRIGERATED STORAGE

AS CONSUMERS reduce the fat and caloric content of their diets, they select food products that are perceived as being lower in fat and eliminate those perceived as being higher in fat, such as ground beef. AU LEAN® ground beef has made an impact on meat buying consumers, many of whom are concerned with reducing dietary intake of fat and calories. These products are rapidly expanding into retail markets; therefore, research efforts were initiated by the Alabama Agricultural Experiment Station to determine the refrigerated storage stability of these products during simulated retail distribution.

For each of three replications, low-fat (8% fat) ground beef and AU Lean carrageenan-based beef product (8% fat) were manufactured and packaged at a commercial grinding operation. AU Lean ground beef was formulated to contain 10% added water, 0.5% carrageenan, 0.4% encapsulated salt, and 0.2% hydrolyzed vegetable protein. After shipment to Auburn University, the ground beef products were held under conditions that would normally be encountered during retail distribution and display.

After the simulated retail display, the ground beef products were evaluated for microbial populations and color stability (total and surface color). Aerobic, psychrotrophic, coliform, and mold and yeast populations were determined for each product. Color stability was evaluated using both objective (Hunter color 'a' values and metmyoglobin content) and subjective (visual appraisal panel: overall color scores and discoloration) measurements.

Few differences were found in microbial populations in the present study. No differences were found between the low-fat, all-beef product and AU Lean ground beef for aerobic plate counts, populations of psychrotrophs, or mold and yeast populations, figure 1. A small difference was found between the products for coliform populations with the AU Lean product having slightly higher numbers, figure 1. However, this difference has little practical significance.

Visual appraisal color scores for both surface and total color indicate that AU Lean ground beef possessed greater redness than the low-fat control product, figure 2. No differences were found between the two low-fat products for total color.

Overall, few differences were found in the microbial populations or color stability of the low-fat, carrageenan-based ground beef product in comparison to the low-fat, all beef control product.

Egbert is former Research Associate, Huffman is Professor, and Bradford is Research Associate of Animal and Dairy Sciences

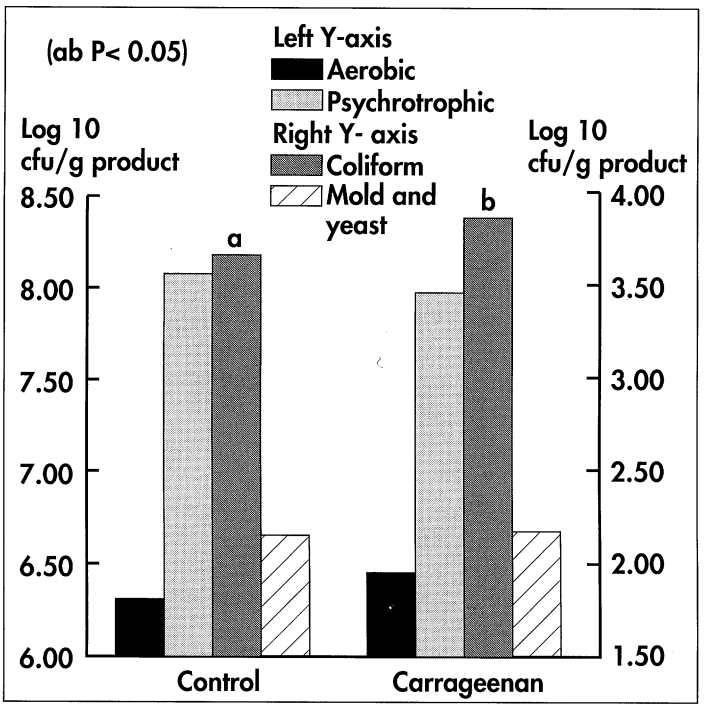


FIG. 1. Microbial population of ground beef products during simulated retail distribution. Standard error of the mean values for aerobic, psychrotrophic, coliform, and mold and yeast population are 0.03, 0.02, and 0.06, respectively.

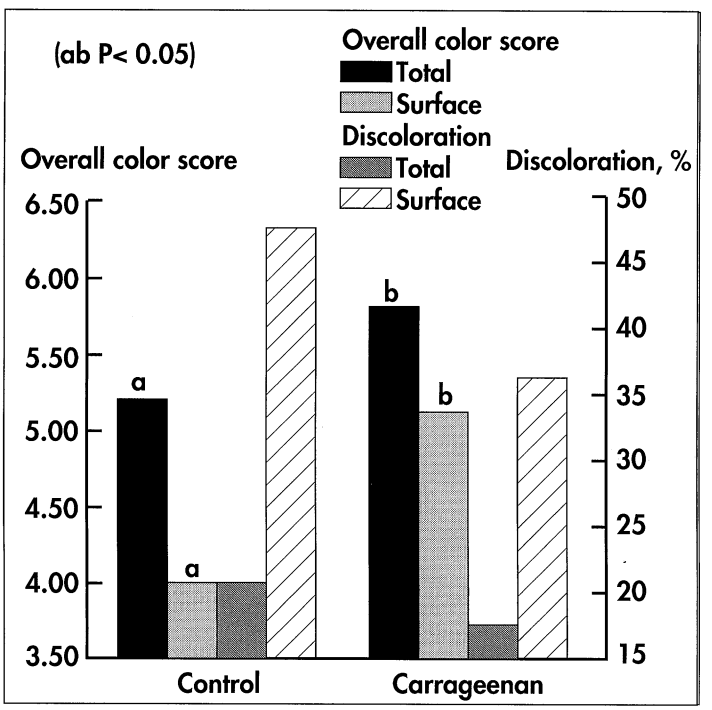


FIG. 2. Effect of retail distribution and display on the color stability of ground beef products measured subjectively. Standard error of the mean values for overall color score (total and surface and percent discoloration (total and surface) are 0.05, 0.28, and 4.35, respectively.

R.J. LIEN, T. YUAN, AND G.R. MCDANIEL

FEEDING AND LIGHTING PROGRAMS AFFECT BROILER BREEDER EGG PRODUCTION

CHICKENS are capable of initiating reproduction prior to 20 weeks of age. Therefore, it may be possible to reduce rearing costs by stimulating egg laying by breeder pullets at an earlier age. A recent Alabama Agricultural Experiment Station study investigated whether it is possible to stimulate earlier production of adequately sized eggs by allowing greater body weights during rearing and initiating photo (light) stimulation at earlier than normal ages.

Female broiler breeder chicks were provided constant light and starter feed free choice to 3 weeks of age. The pullets were then subjected to feeding programs providing different amounts of feed during the remainder of the rearing period and exposure to long daylengths, or photo stimulation (PS), at different ages. From 3 weeks until PS they were subjected to 8 hr. of light per day and provided grower feed either free choice (heavy treatment) or to result in projected growth to weights of 6.2 (medium treatment) or 5.3 lbs. (light treatment) at 20 weeks. A total of 72 pullets from each of the three feeding treatments were subjected to PS by 15 hr. of light per day from either 14, 17, or 20 through 64 weeks.

Breeder feed was provided daily at levels of 22, 24, 26.5, and 30 lb. per 100 birds during weeks 1, 2, 3, and 4 after PS, and 33, 32, and 31 lb. per 100 birds during the following 10, 9, and 9 week periods, respectively. During the remainder of the study, 30 lb. per 100 birds was provided daily. Body weight, age at first egg, egg production, and egg weights were determined for the 72 birds in each of the nine treatments.

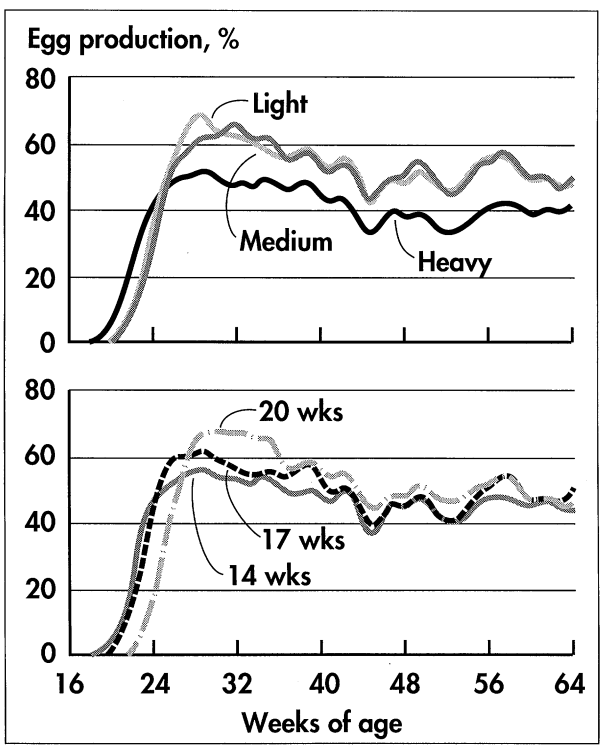
Heavy pullets weighed 6.6, 7.4, and 8.3 lb. when subjected to PS at 14, 17, or 20 weeks of age, respectively. Peak egg production levels ranged from 50 to 70%, see figures. Although heavy hens began laying eggs at an earlier age, total egg production of medium and light hens was greater than that of heavy hens, see table. This was due to increased peak and post-peak production levels in hens subjected to feed restriction during rearing (medium and light treatments). Similarly, age at first egg was decreased in hens subjected to PS at both 14 and 17 weeks. But, since peak egg production levels were greater in hens subjected to PS at 17 and 20 weeks, total production was not affected by age at PS.

EFFECT OF REARING PERIOD FEEDING TREATMENT AND AGE AT PHOTO STIMULATION ON BROILER BREEDER EGG PRODUCTION AND WEIGHT

Treatment	Age at first egg, weeks	Total egg/hen	Total greater than 21 oz./doz. eggs/hen	Av. egg weight, oz./dox.
Rearing period feeding				
Heavy	23.2	124	79	23.2
Medium	24.4	152	119	25.4
Light	24.1	156	119	25.4
Age at initiation of photo stimulation				
14 weeks	23.1	140	101	24.4
17 weeks	23.4	145	108	24.4
20 weeks	25.2	148	109	25.2

Average egg weights for the production period were increased by medium and light treatments and PS at 20 weeks of age. Similarly, production of eggs weighing more than 21 oz. per dozen was increased by rearing period feed restriction and decreased by PS at 14 or 17 weeks. In all treatments, weekly egg weights increased similarly from an average of about 19 oz. per dozen at 25 weeks to 25 oz.per doz. at 39 weeks. Egg weights were primarily dependent on age and there were only slight differences among treatments at the same age. So, differences in average egg weights and the production of eggs weighing more than 21 oz. per dozen were due to the greater percentage of total eggs laid by hens of the heavy and 14 week PS treatments early in the laying period.

Within the ranges of the feeding and age at PS treatments tested, it appears that it may not be practical to stimulate early egg production by breeder hens since egg size is primarily influenced by age and does not respond to increases in body weight during the rearing period.



Effect of rearing period feeding treatment and age at photo stimulation on broiler breeder egg production.

Lien is Assistant Professor, Yuan is a Graduate Student, and McDaniel is Professor of Poultry Science.

D.L. RANKINS, JR., D.I. BRANSBY, AND W.H. GREGORY

JOHNSONGRASS - WEED OR FEED?

Steers fitted with fistulas that allow scientists to sample stomach contents for analysis.

THOUGH johnsongrass is considered a noxious weed in row crops, it has been a good emergency forage for several years. While it is known to make excellent hay, johnsongrass is generally considered to be intolerant to grazing, resulting in decreased stand persistence. However, in a recent Alabama Agricultural Experiment Station study at the E.V. Smith Research Center, Shorter, johnsongrass was continuously grazed at stocking rates up to 4.2 steers per acre for two summer grazing seasons without any visible loss of stand.

In May 1990, johnsongrass was seeded in six pastures (two 2-acre, two 2.5-acre, and two 3.3-acre pastures) at a seeding rate of 25 lb. per acre. The pastures were irrigated from a waste lagoon just prior to planting and 30 days after planting. This resulted in high fertility and increased soil organic matter in the first year. In April 1991, 60 lb. of nitrogen (N) were applied per acre. Soil tests indicated that potassium and phosphorus were not needed.

In June 1990, when average forage height was approximately 18 in., five medium-framed, crossbred steers averaging 490 lb. were assigned to each pasture. After 42 days, 10 additional cattle were added to each pasture to control excessive forage growth, and then removed after 14 days. After 70 days, grazing was terminated resulting in average stocking rates of 2.1, 2.8, and 3.5 steers per acre. Because the johnsongrass had been planted the previous year, grazing began earlier in 1991. In May, when average forage height was approximately 18 in., eight medium-framed, crossbred steers (average weight 491 lb.) were assigned to each pasture. After 7 days, additional cattle were added to control excessive forage growth, and then removed after 18 days. Grazing was terminated after 87 days, resulting in average stocking rates of 2.6, 3.4, and 4.2 steers per acre.

Results are shown by stocking rate and year in the table. Average daily gain (ADG) was not different among the three stocking rates in 1990 and at 0.9 lb. per day was comparable to that frequently achieved on other warm-season perennial forages.

However, in 1990, total gain per acre was lower and the grazing season shorter than for other warm-season perennials. The short grazing period can be attributed to the late starting date (June) as a result of stand establishment and early termination of grazing due to low rainfall (June, July, and August 1990 precipitation was approximately one-half the 30-year average). The slow gains can be attributed to poor forage quality during the last 3 to 4 weeks of the grazing period. The residual forage was quite fibrous (65% acid detergent fiber) resulting in animals having mainly stems to consume with very little regrowth, hence zero to negative weight gains during the last part of the season.

AVERAGE DAILY GAIN AND GAIN PER ACRE FOR STEERS CONTINUOUSLY GRAZING JOHNSONGRASS AT VARYING STOCKING RATES

Treatment	Results, by steers/acre		
Stocking rate			
1990	2.1	2.8	3.5
1991	2.6	3.4	4.2
Average daily gain, lb.			
1990	0.9	0.9	0.9
1991	1.2	0.8	0.3
Total gain, lb.			
1990	116	149	159
1991	271	235	110

In 1991, the best ADG and gains per acre were observed at the low stocking rate (2.6 steers per acre). The ADG was 1.2 lb. and total gain per acre was 271 lb. A decrease in ADG and gain per acre was observed at a stocking rate of 3.4 steers per acre and gains were severely decreased at a stocking rate of 4.2 steers per acre.

Forage quality decreased with time in both years. Crude protein decreased from 22 to 11% while acid detergent fiber increased from 35% to 65% throughout the summer, indicating a decrease in digestibility over time.

In addition to the perceived low resistance of johnsongrass to grazing, occasional reportings of prussic acid and/or nitrate poisoning represent another disadvantage. However, neither problem was evident during the 2-year study.

The two pastures that supported the high stocking rates in 1990 (3.5 steers per acre) and 1991 (4.2 steers per acre) showed a vigorous stand in late 1991 after the animals were removed and a September rain stimulated regrowth. This persistence under heavy grazing may have resulted partly from the high fertility and increased soil organic matter created by irrigation with lagoon wastewater in the first year. In addition, no animals showed any signs of toxicosis throughout the study.

Rankins is Assistant Professor of Animal and Dairy Sciences; Bransby is Professor of Agronomy and Soils; Gregory is Superintendent of the Beef Cattle Unit, E.V. Smith Research Center.

W.L. KINGERY, C.W. WOOD, AND D.P. DELANEY

Potential Environmental Effects of Long-Term Land Application of Broiler Litter

ALABAMA is among the nation's top poultry producing states, and the industry is heavily concentrated in the Sand Mountain area of the State. More than 40% of the State's broiler production is in this relatively small geographic region, and recent Alabama Agricultural Experiment Station research identified some potential problems with soil contamination from disposal of nearly the 2 million tons of broiler litter annually in the area.

This litter typically is disposed of in large amounts on relatively small areas of fescue pastures. Environmental characteristics of the region include a mild climate, high annual rainfall, and sandy textured soils that are sloping and shallow to bedrock. These conditions promote biological breakdown and release of nutrients and other elements from land-applied litter, which can be leached through the soil to groundwater or transported in runoff water to lakes and streams.

Auburn researchers investigated current environmentally related conditions resulting from long-term land application of broiler litter in the major broiler producing counties (Blount, Cullman, Dekalb, and Marshall) in the Sand Mountain region. In each of the four counties, three pairs of littered and nonlittered pastures on matching soil types were sampled, for a total of 12 sites in the region. Soil cores, taken down to bedrock, were collected from each pasture. The cores were sectioned to give soil samples in 12-in. depth increments down to bedrock. Samples were then analyzed for nitrates (NO_3-N), phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), manganese (Mn), copper (Cu), and zinc (Zn).

Landowners in the study were surveyed to determine litter application practices. Littered pastures had received annual applications for 15 to 28 years. Application rates ranged from 2.5 to 10 tons per acre normally applied in early spring. These practices are considered representative of the region as a whole.

Soil cores were taken to bedrock.

Long-term land application of broiler litter had an impact on NO_3-N, P, and K concentrations in soil profiles, see figure. Concentration of NO_3-N in littered pastures at shallower depths was nearly equal to nonlittered pastures, but at lower soil depths NO_3-N accumulations were much higher with than without litter application. In some soils, significant amounts of NO_3-N leached to or near bedrock.

Litter application dramatically increased P levels in littered pastures as compared to no litter to a depth of 18 in. The average increase in P, due to litter applications, throughout this depth increment was approximately 530% which is considered to be excessive.

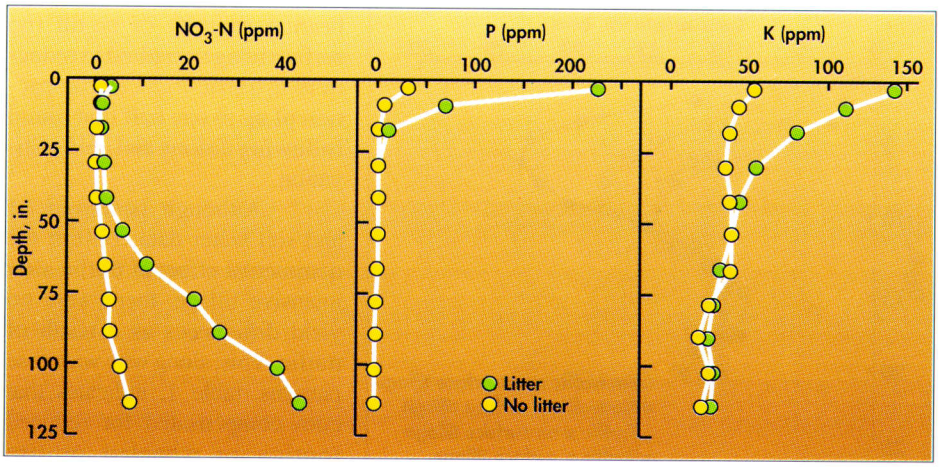
Potassium was found in higher levels on pastures with than without litter at depths to 36 in. Mg and Ca were present in higher concentrations in litter compared to no litter at 6 and 48 in., respectively. The K, Mg, and Ca concentrations that were measured under littered pastures are more than adequate to meet crop requirements.

Copper levels under litter pastures gave evidence of soil accumulation to a depth of 12-in. Zn and Mn were not noticeably higher in litter soils.

These findings indicate that long-term land application of broiler litter at disposal rates may be creating a potential for harmful environmental effects in the Sand Mountain region. However, experience with land-applied broiler litter, at rates prescribed for fertility programs, shows that proper land application offers the best option for poultry waste management.

Proper disposal of large amounts of poultry wastes is essential to the vitality of Alabama's poultry industry. Recently initiated research with poultry wastes is designed to provide proper disposal guidelines. For the present, producers are encouraged to use available guidelines from various agencies and the Cooperative Extension Service.

Kingery is a Graduate Research Assistant and Wood is Assistant Professor of Agronomy and Soils; Delaney is Extension Resource Conservation Associate.



Soil concentrations (ppm) of NO_3-N, P, and K with depth from litter and no-litter fescue pastures in the Sand Mountain region.

D.W. REEVES, H.A. TORBERT, H.H. ROGERS, AND S.A. PRIOR

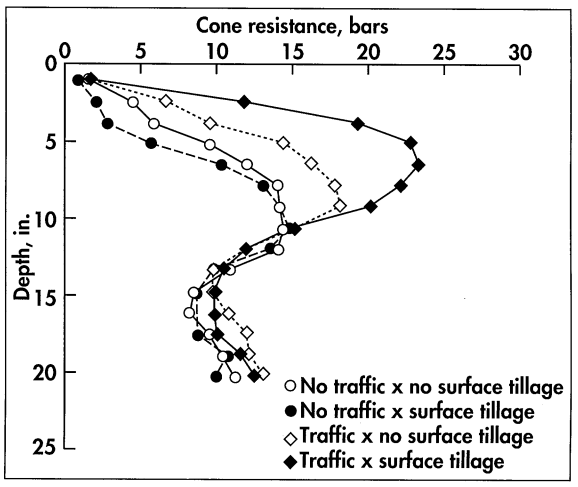
TRAFFIC AND TILLAGE: MANAGING SOIL COMPACTION FOR CORN

EQUIPMENT traffic after intensive tillage severely compacts soil, but corn plants have the ability to compensate for reduced rooting in compacted soil zones, according to findings in a cooperative project by the Alabama Agricultural Experiment Station and the USDA-Agricultural Research Service (ARS).

This ongoing study, which is being conducted at the E.V. Smith Research Center, Shorter, was initiated in 1988 on a Norfolk loamy sand with a well developed hardpan 6 to 10 in. below the surface. A winter cover crop of Cahaba White vetch was planted in the fall of 1987 and 1988. The cover crop was killed with Gramoxone® 4 to 7 days prior to planting DeKalb 689 corn in 30 in. rows each spring.

All possible combinations of three factors were included in the study. The three factors were:

- Deep Tillage: (1) no subsoiling, (2) annual in-row subsoiling, or (3) complete disruption of the hardpan, subsoiling on 10-in. centers,
- Surface Tillage: (1) incorporating the cover crop residue by disking and field cultivating, or (2) leaving the cover crop residue in place on the soil surface,
- Equipment Traffic: (1) normal traffic with the use of 4-row equipment, or (2) no traffic using a wide-frame research vehicle.



Soil strength as affected by traffic and tillage within a wheeled or tire middle.

In 1989, soil moisture was monitored from tasseling until black layer in three positions; in the row, and in the middles on either side of the row. In plots that received traffic, with the four-row pattern, every other row middle would have been compacted by tractor tires.

Soil water was highest in the traffic or tire middles, especially with surface tillage, table 1. This shows that soil compaction in the wheel tracks, especially following surface tillage, reduced root growth and subsequent soil water extraction.

Without traffic, surface tillage increased soil water extraction, resulting in lower soil water contents, however, there were no differences due to row middle position since in these plots neither middle was compacted by equipment tires. In trafficked plots, soil water content was much less in the no-tire middles than the tire middles, indicating greater root growth and water extraction in the no-tire middles of these plots.

Soil strength measurements with a penetrometer show that traffic after surface tillage severely recompacts the soil, see figure. In contrast, the increased bearing capacity of no-till (no surface tillage) resulted in reductions in traffic-induced compaction of up to one half that found following disking and field cultivation.

Although penetrometer and soil water data confirm the detrimental effect of traffic after intensive tillage, there were no yield differences as a result of traffic. This, along with water use patterns, table 1, indicates that corn compensated for reduced rooting in wheeled or tire middles by increased rooting in nonwheeled or no-tire middles.

TABLE 1. VOLUMETRIC SOIL WATER CONTENT IN 0-8 IN. DEPTH AS INFLUENCED BY TRAFFIC, TILLAGE, AND ROW POSITION

Traffic	Tire middle		No-tire middle	
	Surface tillage	No-surface tillage	Surface tillage	No-surface tillage
	Pct.	*Pct.*	*Pct.*	*Pct.*
No-traffic	10.95	11.98	11.01	11.55
Traffic	15.01	13.97	10.23	12.48

TABLE 2. INFLUENCE OF DEEP AND SURFACE TILLAGE ON CORN GRAIN YIELD

Deep tillage	Surface tillage, 1988, bu./acre		Surface tillage, 1989, bu./acre	
	Yes	No	Yes	No
No subsoiling	23	18	103	75
Annual subsoiling	44	50	113	110
Complete disruption	56	61	124	118

In both the drought year of 1988 and the abundant rainfall year of 1989, surface tillage interacted with deep tillage to affect grain yields, table 2.

In the drought year of 1988, with both complete disruption and in-row subsoiling, yields were greatest when vetch residue was not incorporated by surface tillage. Without deep tillage, however, surface tillage increased yields. With favorable rainfall in 1989, there was no benefit from leaving residues on the surface, as in 1988. However, yields again increased with the intensity of deep tillage while surface tillage increased yields when no deep tillage was performed.

Results suggest that the conservation tillage practice of in-row subsoiling without incorporating residues is an appropriate practice for sustaining crop yields on Coastal Plain soils, especially if traffic patterns can be maintained so that at least one row middle adjacent to each row receives no traffic during the growing season.

Reeves is Research Agronomist, USDA-Agricultural Research Service (ARS) National Soil Dynamics Laboratory (NSDL), and Adjunct Professor, Torbert is Soil Scientist, USDA-ARS-NSDL, and Adjunct Assistant Professor, Rogers is Plant Physiologist, USDA-ARS-NSDL, and Adjunct Professor, and Prior is Research Associate, USDA-ARS-NSDL, Department of Agronomy and Soils.

M.G. PATTERSON, D.P. MOORE, B.E. NORRIS, AND W.B. WEBSTER

EVALUATING NARROW ROW COTTON IN ALABAMA

INTEREST in narrow-row cotton has increased recently with the availability of pickers designed for reduced row widths. Research, which was initiated to evaluate the potential for narrow-row cotton in Alabama, shows a solid 30-in. row pattern produced more seed cotton than a solid 40-in. pattern.

Cotton planted in four row patterns was grown at the Prattville Experiment Field, Prattville, and Tennessee Valley Substation, Belle Mina, using low and high weed control inputs, both with and without Pix® plant growth regulator. In addition to the solid-row patterns, skip-40 (62-in. skip between pairs of 40-in. rows) and skip-30 (40-in. skip between pairs of 30-in. rows) patterns also were used, see table.

Deltapine 50 and Deltapine 90 varieties were grown at Belle Mina and Prattville, respectively. Seeding rate in the row (6 seed per foot) was not changed between row patterns, therefore seeding rate per acre varied from 104,000 seed per acre (solid-30) to 61,000 seed per acre (skip-40).

Low weed control input consisted of Treflan 4EC® at 1 pt. per acre preplant incorporated (PPI) and Cotoran 4L® at 3 pt. per acre preemergence (PRE). High weed control input consisted of Treflan at 1 pt. tank-mixed with Zorial® 80DF at 1 lb. per acre (PPI) plus Cotoran at 4 pt. tank-mixed with Zorial at 0.75 lb. per acre (PRE). Pix was applied at both pinhead square and early bloom at the rate of 4 oz. per acre each time.

Cotton grown in a solid 30-in. row pattern produced an average of 7% higher yield than the solid-40 pattern at both Belle Mina and Prattville, see table. The skip-40 pattern produced the lowest yields at both locations. The skip-30 pattern produced yields equal to the solid-30 pattern at Prattville, but did not provide any benefit at Belle Mina.

Cotton yields at Belle Mina were adversely affected by the high weed control input, which appears to be related to crop injury. Spotted spurge control at Belle Mina was better with the high weed control input; however, control was not influenced by row pattern. Yields at Prattville were greater with the high weed control input due to better control of sicklepod. Weed control at Prattville was not affected by row pattern.

Pix plant growth regulator provided a slight overall yield increase at Belle Mina, but did not influence yield at Prattville. Excessive plant growth did not occur at either location during the 3-year study.

Row pattern was the only variable that affected boll counts. Cotton grown in wider row patterns produced more bolls per plant than the solid 30-in. pattern.

Results from this study indicate narrow-row cotton can consistently provide a significant yield increase compared to traditional row spacings for growers in the Tennessee Valley and Prattville areas.

Patterson is Associate Professor of Agronomy and Soils; Moore is Superintendent of the Prattville Experiment Field; Norris is Assistant Superintendent and Webster is Superintendent of the Tennessee Valley Substation.

INFLUENCE OF ROW PATTERN, WEED CONTROL LEVEL, AND PLANT GROWTH REGULATOR ON COTTON YIELD AND BOLL COUNTS

Treatment	Belle Mina, 3-year av.		Prattville, 3-year av.	
	Seed cotton	Boll counts/ plant	Seed cotton	Boll counts/ plant
	Lb.	*No.*	*Lb.*	*No.*
Row pattern[1]				
Solid-30	1,788	24	2,075	23
Solid-40	1,671	29	1,933	27
Skip-30	1,614	26	2,115	27
Skip-40	1,471	33	1,728	30
Weed control[2]				
Low	1,696	26	1,892	26
High	1,576	29	2,034	27
PGR[3]				
Pix	1,661	29	1,940	27
No Pix	1,611	27	1,986	26

[1] Averaged over weed control and PGR treatments.
[2] Averaged over row pattern and PGR treatments.
[3] Averaged over row pattern and weed control treatments.

J.S. RICHBURG, III, AND R.H. WALKER

New Herbicide Doesn't Restrict Overseeding of Winter Forages into Bermudagrass Hay Fields

WINTER annual forages are overseeded into bermudagrass sod to improve forage quality, to extend the grazing period, and in the case of legumes, to add nitrogen to the soil. Ally®, a new herbicide, is being used for Pensacola bahiagrass control in bermudagrass hayfields; however, it has the potential to persist in the soil long enough to cause recropping problems to sensitive plant species.

Experiments were conducted by the Alabama Agricultural Experiment Station at the Plant Breeding Unit, Tallassee, Tennessee Valley Substation, Belle Mina, and Black Belt Substation, Marion Junction, to determine if selected winter annual forages could be safely overseeded into forage bermudagrass sod that had received a prior application of Ally. Variables included four dates of application (April through August), three rates of Ally (none, 0.42, and 0.85 oz. of product per acre), and three forage species. The experiments were conducted for 2 years in the same plots. Data presented in the table are a 2-year average of total dry matter yields from the July application date.

Winter forage species overseeded during 1989-90 and 1990-91 at Tallassee were annual ryegrass, crimson clover, and arrowleaf clover. Dates of application were April, May, June, and July. Results showed that seedling stand counts and winter forage yields for annual ryegrass and crimson and arrowleaf clover were not adversely affected by date of application or rate of Ally. However, there was a downward trend for crimson clover yield with the higher Ally rate applied in July.

Winter forage species overseeded during 1989-90 and 1990-91 at Belle Mina included annual ryegrass, red clover, and white clover. Dates of application were May, June, July, and August. Seedling stand counts and yields were not adversely affected by the experimental variables, with the exception of a downward trend for white clover yield with the higher Ally rate applied in July.

The experiment at Marion Junction was conducted both years, but the 1989-90 experiment was abandoned due to poor stands caused by dry weather. Dates of application were April, May, June, and July. Seedling stand counts of white clover were reduced when Ally was applied later than May. There was a downward trend for lower white clover yield with the higher Ally rate applied in July. Annual ryegrass and red clover were unaffected by date of application or Ally rate.

Ally is registered for use on bermudagrass at 0.30 oz. product per acre, which provides good control of Pensacola bahiagrass. Rates used in these studies were approximately 1.5 and 3 times this rate. Few problems were encountered when overseeding these winter forage species even after application of Ally at 0.85 oz. product per acre as late as July 15, and for 2 consecutive years.

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WINTER FORAGE YIELD (DRY WEIGHT) PER ACRE AS AFFECTED BY THE JULY APPLICATION OF ALLY

Oz. per acre of Ally[1]	Tallassee, 2-year av.			Belle Mina, 2-year av.			Marion Junction, 1990-91 yield		
	Annual ryegrass	Crimson clover	Arrow-leaf clover	Annual ryegrass	Red-clover	White clover	Annual ryegrass	Red clover	White clover
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
None	3,335	3,928	1,867	4,639	1,129	645	7,655	958	318
0.42	3,161	4,199	2,510	5,338	1,251	680	6,733	934	266
0.85	3,516	2,961	1,881	5,272	1,012	403	6,872	815	185

[1] Ally at 0.42 oz. product/acre = 0.016 lb. active/acre; 0.85 oz. product/acre = 0.032 lb. active/acre.

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