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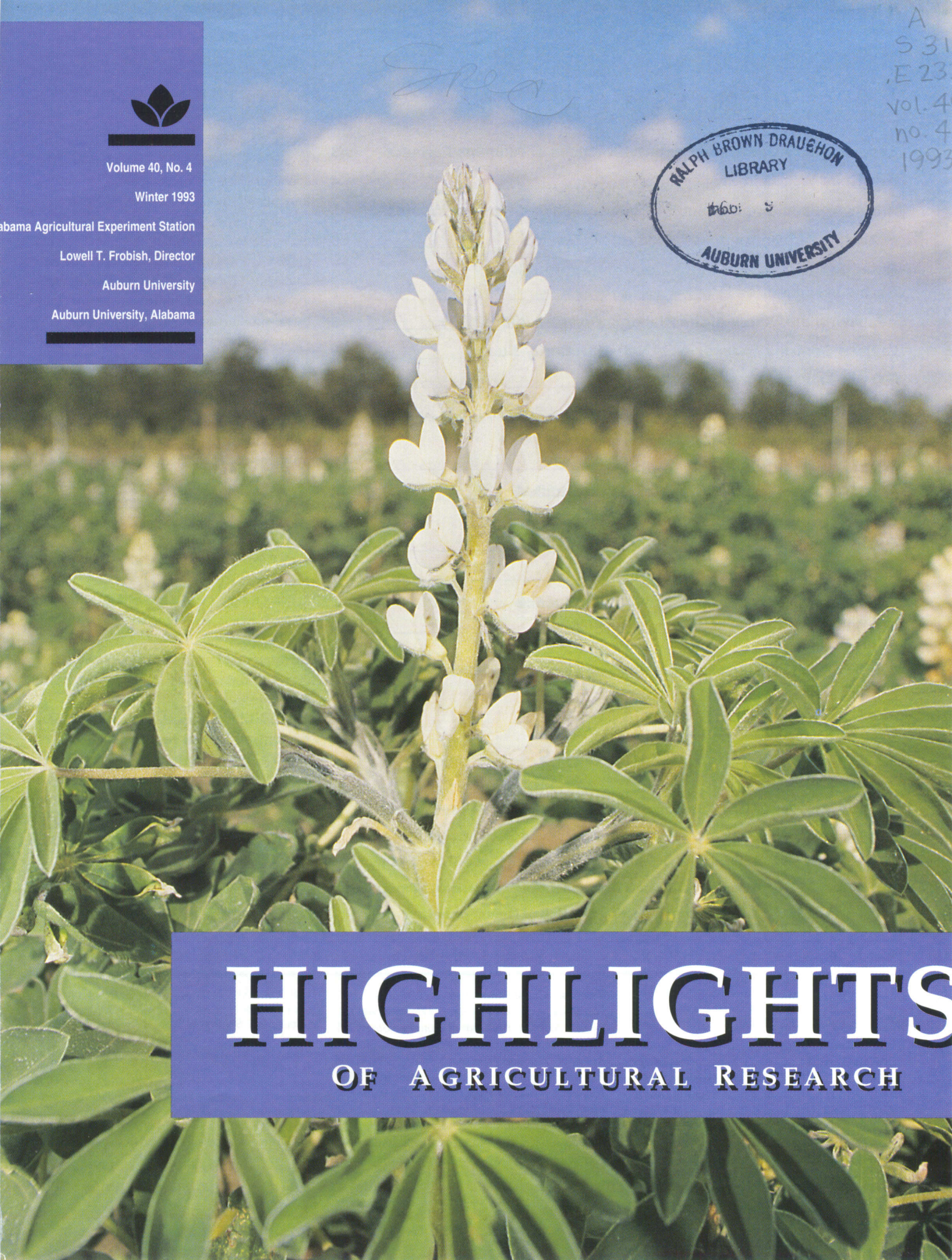

HIGHLIGHTS

OF AGRICULTURAL RESEARCH

In This Issue

ON THE COVER. White lupins are a promising winter crop for Alabama growers, see story on page 15.

Upcoming Events

January 25-26	Alabama Fertilizer and Pesticide Conference, Montgomery
February 5-9	Southern Association of Agricultural Scientists, Nashville
February 8-9	Alabama Fish Farming Conference and Trade Show, Montgomery
February 25-26	Alabama Cattlemans Association Annual Meeting, Montgomery
March 1	AU Ag Alumni Meeting and Hall of Honor, Auburn

Director's Comments

As we approach the Christmas season, it is a good time to reflect back on the accomplishments of the past year and to look ahead to the challenges of 1994.

For many Alabama farmers 1993 was not a good year. Drought, heat, and insects played havoc with peanuts, cotton, corn, and soybeans. Though not as directly affected, the state's livestock industry was also hurt by the drought and higher than average temperatures that extended in many parts of the state from early June to mid-August.

The drought provided researchers in the Agricultural Experiment Station an opportunity to investigate production practices under these extreme conditions. Hopefully, the next time heat and drought come in such strong doses, producers will have some management practices available to soften the blow.

The North American Free Trade Agreement (NAFTA), the General Agreement on Tariffs and Trade (GATT), and the opening debates on the 1995 Farm Bill all will have direct impacts on Alabama agriculture in 1994 and beyond. If NAFTA and/or GATT are approved by Congress, they will affect the way farmers produce their crops and raise their livestock.

Those of us in the Alabama Agricultural Experiment Station face the challenge of keeping agricultural technology current and helping our producers stay competitive on a global basis. We likewise have to face the real challenge of doing this within a framework that will not further degrade our environment.

We will be up to the challenge!

Merry Christmas and the most prosperous New Year yet!

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

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

J.E. Dunkelberger, R.D. Lawler, and G.J. Lyles

Farm Property Crime and Security Practices of Alabama Farmers

Reported rural crimes in the U.S. increased from 423 to almost 2,000 per 100,000 people from 1960-90. However, the actual amount of crime in rural areas is believed to be even higher since many of the offenses against farm property are not considered in the computation of rural crime rates.

For this reason, a statewide AAES survey was conducted to gather information about the crime experiences of Alabama farmers. More than 400 participating farmers were asked to report any violations during a single 12-month period and during all their years of farming.

In one year alone, 19% of farms had been victimized, with vandalism most often experienced, followed by theft of farm property, and burglary of farm buildings. Over their years in farming, almost 60% had been victimized at least once. Theft and vandalism were the most common offenses. Large farms were much more likely to be victims of all types of property crimes, both recently and in the long term (Table 1).

Theft of farm materials, such as gasoline, chemicals, seeds, and fertilizers, was reported by 32% of farmers, while theft of farm machines, equipment, and tools was reported by 31%. Almost half the large farms experienced material or equipment theft, compared to 20% of small and medium farms. Theft of harvested and unharvested crops was reported for 14% of all farms and 25% of large farms. Similarly, 12% of all farms and 28% of large farms experienced the theft of cattle.

Attempted or actual burglary of barns or other buildings was reported for 21% of all farms and 34% of large farms. Vandalism to machines, equipment, tools, livestock, crops, or timber was reported for 25% of all farms and 42% of large farms. Although 15% of all farmers experienced vandalism of their farm buildings, large farmers were more likely to report such incidents.

Farmers were asked how often they used each of 12 common security measures to protect their farm property. After taking into account farm operations in which there was no need for a particular precaution, widespread failure to use many of these security practices was observed (Table 2). The survey found that the most widely practiced security measure was to have a neighbor watch the farm during periods of extended absence. Farm machinery insurance and livestock identification were used with varying frequency by about two-thirds of applicable farmers. Large farmers more frequently used most of the security precautions, but they were much more apt to leave farm machinery unprotected overnight in fields where it was more vulnerable to crime.

Clearly, many Alabama farms are being and have been victims of property crime. Yet, most of the state's farmers are not doing all they can do to protect their property.

Dunkelberger is Professor of Rural Sociology; Lawler is a Graduate Research Assistant in Community Resource Development with the Alabama Cooperative Extension Service; and Lyles is Professor of Sociology, Tuskegee University.

Table 1. Experience of Alabama Farmers with Farm Property Crime[1]

	Size of farm[2]		
	Small	Medium	Large
	pct.	*pct.*	*pct.*
In a Single Year:			
Any property crime	13.2	16.0	30.1
Vandalism	9.6	10.4	25.5
Burglary	4.8	9.4	11.8
Theft	5.6	8.8	17.5
Ever experienced:			
Any property crime	50.0	55.7	75.7
Vandalism	31.9	42.3	59.4
Burglary	23.9	31.6	44.2
Theft	32.8	45.8	65.6
Number of farmers[3]	(148)	(129)	(104)

[1]Some farmers experienced multiple crimes.
[2]Each farm was classified as small, medium, or large based on gross farm income and acres farmed.
[3]Number of farms adjusted for farm size variance from U.S. Agricultural Census Profile for Alabama (1988).

Table 2. Farm Security Measures Used at Different-Sized Farms[1]

Security practices	Size of Farm		
	Small	Medium	Large
	pct.	*pct.*	*pct.*
Brands, ear tags or notches, or other means to identify livestock	41.7	65.2	85.9
Put name or identification number on farm machinery	22.9	29.4	36.4
Put name or identification numbers on farm tools and equipment	33.7	31.4	41.8
Keep records of all farm machinery and equipment serial numbers	52.3	43.1	66.7
Keep doors on farm buildings locked	59.1	48.1	67.5
Keep windows on farm buildings locked	40.8	31.2	33.8
Keep farm gates locked	42.3	43.4	70.1
Have insurance on farm machinery	58.5	61.9	85.4
Have theft insurance on livestock	12.0	18.9	19.2
Have a neighbor watch farm when out of town	85.1	79.6	86.7
Inform sheriff when away from farm for several days	12.6	7.5	14.3
Leave farm machinery overnight in fields out of sight from your house[2]	34.5	56.0	70.0

[1]Percent of responses "sometimes," "often," and "always."
[2]The desired practice is not to leave machinery unprotected.

C.C. Mitchell, R.H. Walker and P.P. Shaw

Are There Weeds in Broiler Litter?

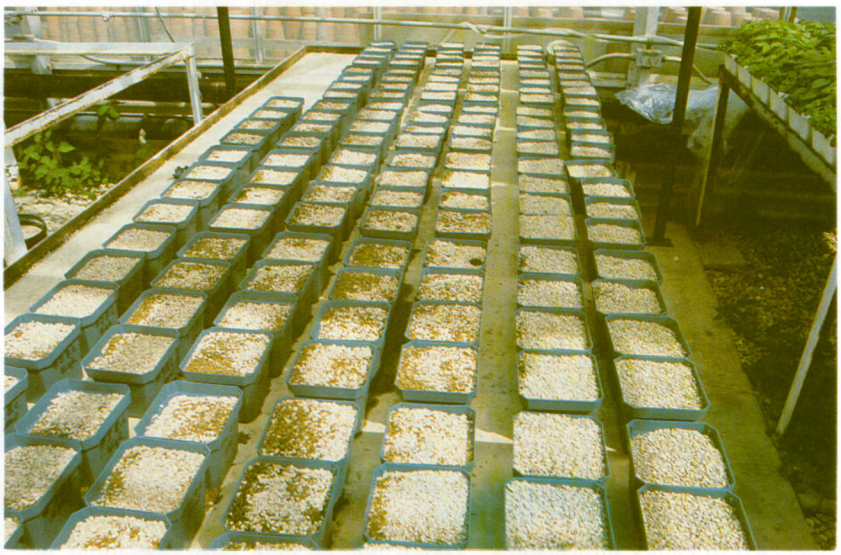


Figure 1 (above). No weeds grew in any of the broiler-litter treated pots after 6 weeks. Figure 2 (below). Large-seeded weeds such as morningglory and sicklepod thrived when planted into broiler litter treated soil. Crabgrass and spiny amaranth growth were inhibited by some litter sources and enhanced by others.

Alabama farmers and cattlemen who have used broiler litter as a soil amendment are concerned that they may be introducing weed seeds into their cropland or pastures. Because they see a flurry of weed growth soon after broiler litter application, growers often reason that the weeds are coming from the litter.

However, seeds in raw feed grain are not likely to survive processing into poultry feed, and consumed seeds are not likely to survive digestion. But few studies have tested these beliefs. An AAES greenhouse study was conducted to determine if broiler litter contains weed seeds, if the source of litter affects the presence of weeds, and how litter and plant nutrients affect germination and growth of weeds commonly found in the soil.

Samples of fresh litter, which included peanut hulls and pine shavings, were collected from 18 broiler houses throughout Alabama. Each sample was analyzed to determine nutrient content. Samples were mixed with a sterile potting medium (fritted clay) to approximate application rates of 16 and 32 tons of litter per acre. Additional treatments included a non-amended control, urea, and urea plus diammonium phosphate at rates equivalent to the average N and P applied in the two broiler-litter treatments. The treated medium was placed in trays, half of which were planted with seed of spiny pigweed, pitted morningglory, sicklepod, and large crabgrass. Soil was kept moist for six weeks. Weed seed germination and dry weight yield after six weeks were measured.

After a six-week incubation period, weeds were found only in trays where seeds had been planted. This fact, alone, is conclusive evidence that broiler litter does not introduce weed seed into pastures or cropland.

Litter source and rate had varying effects on weed germination and performance. The large-seeded weeds, morningglory and sicklepod, appeared to be more tolerant to high rates of broiler litter. Crabgrass and spiny pigweed germination and growth were inhibited by some sources and enhanced by others compared to fertilized controls. Some litter actually killed or prevented germination of crabgrass and spiny pigweed, probably due to high ammonia levels in the sterile soil medium.

Where broiler litter is applied to the land, weed infestations are likely to occur because of indigenous seeds already present in the soil, not seed found in litter. The high level of fertility, particularly ammonium concentrations, may induce germination of some species but could inhibit germination and growth of others.

Mitchell is Associate Professor, Walker is Professor, and Shaw is Student Assistant in Agronomy and Soils.

M.P. Masser, B.A Hawcroft, and K.H. Yoo

A New Aquaculture System to Produce Fish and Remove Wastes

Embankment and watershed ponds are commonly used for fish farming in Alabama, but can be difficult to harvest. AAES research is finding that a new system, called In-Pond Raceways (IPR), may put producers on a faster track for harvesting.

Embankment and watershed ponds are usually deep and may contain bottom irregularities that require them to be completely drained during harvest. Draining not only is a poor water conservation practice, but may be restricted by discharge regulations in the near future. A few farmers with this type pond have tried cages or, in rare cases, earthen or concrete raceways, but these systems have not been widely accepted because of associated problems. Cages, for example, require a much lower density of fish per acre (compared to open-ponds) and commonly have disease and localized water quality problems. Raceways are not economically feasible because of the construction and pumping costs. The IPR system was developed to address these problems.

The IPR is a hybridized culture system that combines desirable characteristics of both cages and raceways. The IPR has the potential to be adaptable to any type of pond and confines fish for easy feeding, observation, and harvest. The system also aerates, improves overall water quality, simplifies and/or reduces costs of disease treatments, and removes a portion of the fish waste before it enters the pond.

Experimentation with the IPR began in 1991 with one raceway, was expanded to four in 1992, and to six in 1993. Experimental IPRs at the North Auburn Fisheries Experiment Station are 16x4x4-foot boxes (raceways) suspended between floating piers.

Pond water is pumped into the IPR by means of air-lift pumps and exits through an opening at the tail of the raceway. Before being released back into the pond, however, the water passes through a cone-shaped settling basin. Solids that settle to the apex of the cone are removed by pumping. Water flow rates in the IPR can be controlled from 100 to 500 gallons per minute with two IPRs supplied by a one-horsepower blower. At the higher flow rates water is completely exchanged within the IPR in four to six minutes.

The IPR has a backup system, similar to systems in fish hauling tanks, that delivers supplemental pure oxygen to each raceway and keeps the fish alive in case of a power failure. This backup system also is used during therapeutic bath treatments for certain disease outbreaks. This greatly increases the effectiveness of most bath treatments and considerably reduces costs compared to whole-pond or cage treatments.

In three years of research, fingerling channel catfish have been stocked into the IPRs at approximately 12 fish per cubic foot. This is more than twice the common stocking density for cages and makes two IPRs the equivalent of one acre of intensive open-pond culture. Growth, survival, and feed conversion of the IPR have been comparable to that in floating cages in spite of the higher stocking densities.

Research on the IPRs has not been without problems, however. Difficulties have occurred with predators, the waste collection system, water flow rates, and disease.

Potentially the greatest benefit of the IPR could be its waste removal system. Removing wastes before they enter the pond could increase overall production in the pond to levels above those common with cages. Also, removing the wastes would enhance the quality of water leaving the pond during rain events and draining, thus enhancing overall water quality in receiving streams. Wastes of particular interest are nitrogen and phosphorus. Based on biweekly analyses in 1992, this system removed only 1.8% of the nitrogen and 1.6% of the phosphorous that were in the wastes. However, in 1993 the redesigned system removed an estimated 3.4% of the phosphorous from the wastes.

In-Pond Raceway during harvest.

As a new type of fish culture system, much research still needs to be done on the IPR. In the next few years research on the IPR will continue to concentrate on improving fish performance and increasing the efficiency of the waste removal system.

Stocking Rates, Length of Grow-out, Survival, Feed Conversion, and Harvest Weights for the In-Pond Raceways, 1991 - 93

	1991	1992	1993
Number of dish stocked/IPR	2,324	2,078	2,000
Length of grow-out (days)	137	124	146
Survival (%)	71.8	83.6	53.9
Feed conversion (FCR)	2.7	1.9	1.5
Harvest weight (lb)	.45	.38	.88

Masser is Associate Professor and Hawcroft is Graduate Research Assistant of Fisheries and Allied Aquacultures; Yoo is Associate Professor of Agricultural Engineering.

S. M. Forsythe

Marketing Alabama Apparel Products in Mexico: Opportunities for Alabama Apparel Manufacturers

Mexico is already a major consumer of Alabama-produced textile products. An AAES study indicates the best way to continue growth in apparel exports is for U.S. producers to understand and meet the needs of Mexican consumers.

Mexican apparel imports from Alabama accounted for $23 million in 1992. Continued growth in apparel exports to Mexico is promising. In the next decade, the Mexican population, age 20 - 49 is projected to increase by 42% vs. 4% in the U.S. The total Mexican apparel market is expected to increase at an average annual rate of about 15%.

The success of Alabama apparel manufacturers in Mexican markets will depend on how well they meet the needs of Mexican consumers. Preliminary survey results indicate that what sells in Alabama and the U.S. may not sell in Mexico, and what sells in Mexico City may not sell in Monterrey or other Mexican cities. Likewise, product and marketing strategies that are successful in the U.S. may not be successful in Mexico City.

A case study approach which included surveys of retail store buyers from Mexico, a survey of vendors who sell apparel products to buyers in Mexico, and interviews with Mexican buyers and retail executives was used to collect data on the apparel purchase attitudes and behaviors of Mexican consumers.

Surveys of buyers in Mexico found that Mexican consumers have very positive attitudes toward U.S. apparel brands and typically seek high quality products. Brand name is used as an indicator of product quality by Mexican consumers. Most middle and upper income Mexican consumers are extremely brand and fashion conscious and display purchase patterns similar to U.S. consumers. However, middle and upper income Mexican consumers are not as price conscious for U.S. brands as they are for Mexican brands. Aesthetic reasons are most important in the decision to purchase apparel. Although price is important, it generally follows style and quality.

Mexican buyers rated the importance of selected apparel attributes. Although all attributes were important to the buyers, quality was considered most important, followed closely by price and style. Ratings of U.S. brands by Mexican buyers were very favorable. On a ten point scale (where 0 = poor and 10 = excellent), U.S. apparel products were rated highly (8 or above) on each of the following attributes — price, quality, style, color, size, fiber, care required, brand name (see figure). They believed U.S. brands were better made and would last longer than Mexican brands. Results of an additional survey of selected retail buyers representing department and specialty stores in Mexico were generally consistent with the results of the initial survey. In both surveys of Mexican buyers, the U.S. was the most favored country for apparel products.

There are significant market opportunities for Alabama apparel producers who are interested in exporting to Mexico. However, Mexican consumers have different tastes and needs than U.S. consumers. Accurate and current market information will be required to make effective product and marketing decisions about selling U.S. products in Mexico. Because of Mexico's expanding demand for apparel products and the favorable images that U.S. apparel brands enjoy in Mexico, the prospects for Alabama's apparel manufacturing firms to export more product to our southern neighbors appear very good.

Forsythe is Wrangler Professor of Consumer Affairs.

D.E. Conner and M.K. Eckman

Rotating Disinfectants Helps Control Hard-to-Kill Germs in Hatcheries

Alabama is home to 35 poultry hatcheries which produce more than 900 million chicks annually. This high-intensity industry depends on the regular use of chemical disinfectants to control disease and maintain chick quality, but problems arise when bacteria develop resistance to a frequently used germicide.

Bacteria adhere to floors, walls, incubators, hatchers, and other surface areas, increasing the microorganisms' ability to resist the killing effects of disinfectants. The development of "biofilms" — resistant, adhered populations of bacteria — is a significant obstacle to any hatchery sanitation program. These layers of resistant bacteria are persistent sources of contamination.

Previous AAES research showed that rotating compatible phenolic disinfectants slowed the development of resistant bacteria in culture dishes. Follow-up research was conducted to determine if this procedure affected bacteria adhered to stainless steel. This is important because biofilms adhered to hard, nonporous surfaces are typically more germicide-resistant than bacteria grown in laboratory media.

As in the first study, an alkaline phenolic detergent (pH 10.4) and an acidic phenolic detergent (pH 2.6) were used to control the bacterium *Pseudomonas aeruginosa*. Researchers used cotton swabs to coat sterilized stainless steel coupons (10-centimeter squares) with *P. aeruginosa* until biofilms of the bacteria were established. Four disinfectant treatments were tested: a distilled water control; repeated applications of the alkaline disinfectant; repeated applications of the acidic disinfectant; and rotating applications of both disinfectants.

Two, six-coupon support frames were dipped into 0.4% diluted solutions of each treatment. Each test apparatus was then drained, dipped into sterile water, and drained again. Coupons were sampled 24 hours later to count surviving biofilm bacteria and were immediately reinoculated. Disinfectant treatments were repeated after another 24 hours, with the rotation treatment alternating between the alkaline and acidic phenols. This procedure was repeated 24 consecutive times.

Resulting data verified that the rotation of the two phenolic disinfectants significantly increased the ability of both disinfectants to kill biofilm bacteria (Figures 1, 2). This effect was more pronounced with the alkaline detergent. When applied alone, the alkaline phenol had a limited effect on attached *P. aeruginosa,* but it was fully active for six consecutive applications when used in rotation with the acidic disinfectant (Figure 1). The effect of rotational application was less pronounced with the acidic disinfectant, primarily because it was already more active than the alkaline phenol when used alone on a repeated basis (Figure 2).

Rotational applications may therefore be of value in reducing the development of adhered, resistant bacterial populations in high-intensity hatchery operations. Furthermore, rotational application of compatible disinfectants may be a more effective means of eliminating established biofilms.

Conner is Assistant Professor and Eckman is Professor of Poultry Science.

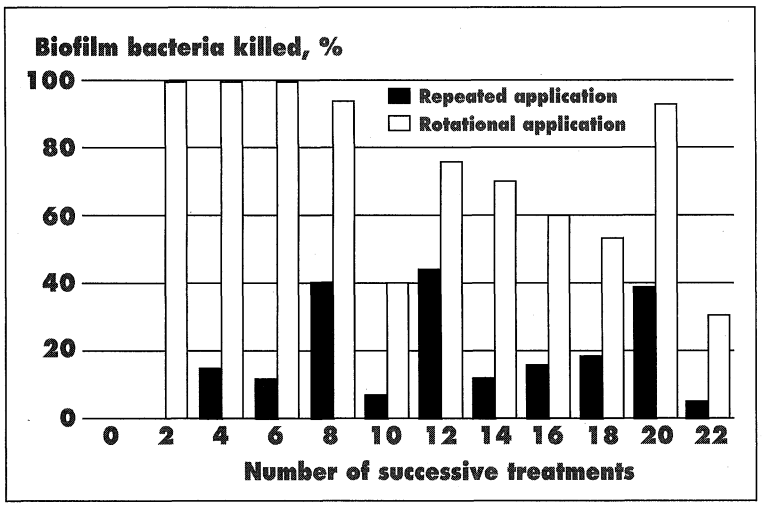


Fig. 1. Germicidal effect of the alkaline phenolic disinfectant against biofilm bacteria when the disinfectant was applied on a rotation *vs.* repeated basis.

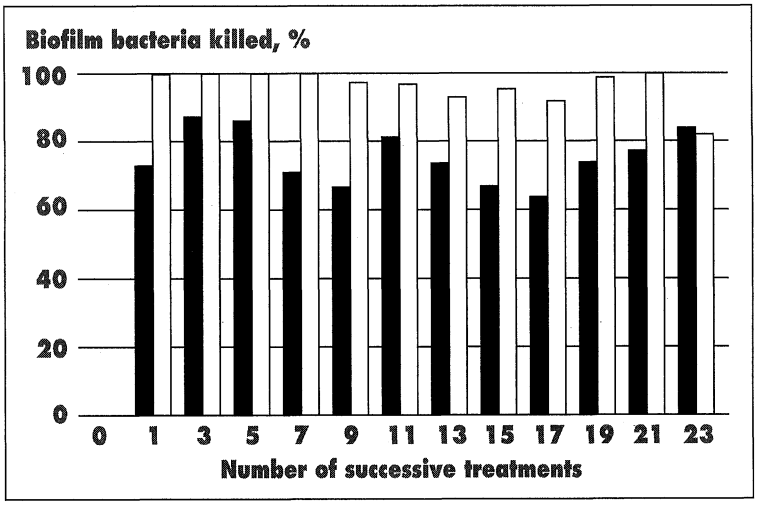
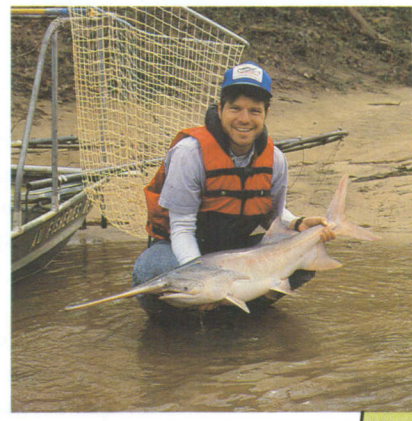


Fig. 2. Germicidal effect of the acidic phenolic disinfectant against biofilm bacteria when the disinfectant was applied on a rotation vs. repeated basis.

G.M. Lein, D.R. DeVries, and J.G. Knight

Assessing the Status of the Alabama River Paddlefish



The North American paddlefish is a living representative of an ancient lineage of fishes that have become specialized inhabitants of fresh waters. Paddlefish inhabit large rivers and often reach lengths of seven feet. Though paddlefish once were abundant throughout the Mississippi and Mobile rivers, their range has decreased dramatically in the last 50 years, due primarily to habitat alteration, such as impoundment of rivers, dredging of gravel spawning sites, and overharvest.

Little is known about this species in the Mobile drainage, where it is found predominantly in the Alabama River and its major tributaries. Studies in the 1980s revealed that Alabama River paddlefish populations had declined to extremely low levels, prompting placement of a moratorium on its possession and harvest. Because this species is so widely distributed, and little is known about its biology in Alabama, more information is needed on the Alabama paddlefish population to ensure they are effectively managed in the state.

An AAES project, with support from the Alabama Department of Conservation's Game and Fish Division, is helping to assess the status of the currently-protected paddlefish population in Alabama.

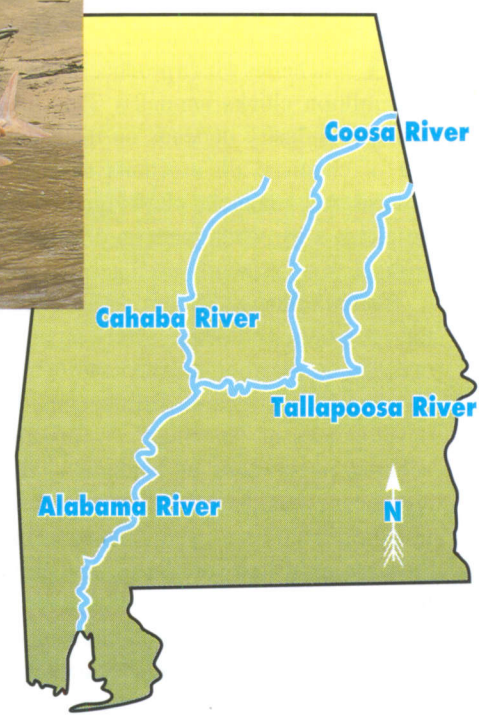
This research was conducted in two upper tributaries of the Alabama River, the Tallapoosa and Cahaba rivers. The Tallapoosa River, located in east-central Alabama, is impounded by four dams and sampling for this project was conducted below the lowermost dam (Thurlow Dam). The Cahaba River is the largest free-flowing river in Alabama, and is located in west-central Alabama.

Sampling began in January 1992, as paddlefish began to move upstream to spawn, and continued into June 1992, after fish had moved back downstream. Sampling was resumed in December 1992 and continued through May 1993. The rivers were sampled weekly using both gill nets and electrofishing gear. All collected fish were tagged for identification in future collections.

A total of 906 fish was collected from these rivers (404 in 1992, 502 in 1993), most of which came from the Tallapoosa River. Paddlefish spawning activity was documented in both rivers, and fish were found in the Cahaba River as far upstream as 32 river miles below Centerville, adjacent to the Marion fish hatchery (or 52 river miles upstream from the confluence with the Alabama River). During the study, 55 fish were recaptured. The longest period of time between capture and recapture was 507 days for a male and 454 days for a female, and no fish moved between rivers.

Of the fish that were collected, 442 were identified as male and 261 as female. Males were generally both smaller and lighter than females. During 1992 males averaged 35 inches in length and 22 pounds in weight, while females averaged 38 inches and 32 pounds.

Though the field work for this project is complete, two aspects continue. First, ages of a subsample (113 fish) of the collected paddlefish are being determined by counting annual rings on the fish's lower jaw bone. This approach is similar to using rings in a tree trunk as yearly marks, and will allow researchers to quantify paddlefish age structure and annual mortality rates. Second, using tissue samples from a subsample (16 fish) of collected paddlefish, scientists are quantifying the genetic composition of the Alabama River paddlefish. Because the Alabama River paddlefish is thought to represent a stock that may be distinct from the better-studied Mississippi River stock, both of these ongoing aspects of this research will allow a definitive comparison of these populations.



Map of Alabama, indicating the two tributaries of the Alabama River (the Tallapoosa and Cahaba Rivers) in which this research was conducted.

All of the results from this work, combined with previous research on movements of the Alabama River paddlefish, will help determine the current status of these fish. In addition, the results will help the Alabama Game and Fish Division to continue to re-evaluate the moratorium on possession and harvest of paddlefish.

Lein is Research Technician, DeVries is Assistant Professor, and Knight is Research Associate of Fisheries and Allied Aquacultures

G.J. Keever and C.H. Gilliam

Cutless Controls Excessive Growth of Butterfly-Bush

Vigorous shoot growth during container production of butterfly-bush, a large, fast-growing shrub, requires many prunings to develop a well-branched, marketable plant. AAES research has identified a chemical growth retardant that reduces the need for time-consuming labor and improves the quality of this popular landscape shrub.

Cutless, a growth retardant labeled for turfgrass use, was shown to effectively control shoot elongation of butterfly-bush, making the plant more compact and uniform. Cutless treatments enhanced plant appearance even more by promoting darker green foliage. Flowering of treated plants was minimally affected.

In two related experiments, Royal Red butterfly-bush liners (young plants) were transplanted into three-gallon pots of an amended pine bark:sand growth medium, placed in full sun with overhead irrigation, and later pruned to a uniform height of six inches. In the second experiment, the shrub also was tip-pruned for uniformity. Foliar spray Cutless treatments of 0-2,500 parts per million (ppm) were applied in Experiment 1; 62.5-2,000 ppm in Experiment 2.

Foliar color of Cutless-treated plants was noticeably darker at 30 days after treatment. Darker green foliage of treated plants was apparent throughout the season. This response is most likely caused by an increased chlorophyll content in the foliage.

The tables summarize Cutless' effects on plant growth suppression. Because of similar size and foliar color of Cutless-treated plants in Experiment 1, there appeared to be little reason to use rates above 500 ppm. The lower rates (62.5, 125, and 250 ppm) tested in Experiment 2 provided shorter periods of growth inhibition and less growth retardation over time. Data from both studies show that rates of 500 ppm or less have minimal effects on plant size the following growing season.

The butterfly-bush on the right shows signs of growth suppression caused by treatment with Cutless 90 days after application. The plant at left was not treated with growth retardant.

Shoots of treated plants — measured after the 1993 spring growth flush — tended to be as long or longer than those of control plants, suggesting similar or greater vigor. Much of the new growth that developed in 1993 was upright, rank shoots formed near the base of the plant.

In both experiments, flower cluster number and size decreased with increasing Cutless rate, but rates of 250 ppm or less minimally affected these characteristics. In Experiment 1, flower cluster numbers decreased 16-43%, and the clusters of treated plants were noticeably shorter, narrower at the base, and more rounded at the apex. In Experiment 2, most of the decreases in flower cluster growth and number occurred with plants treated with 500-2,000 ppm Cutless. Stage of development — a measurement of the number of flowers unopened, opened, or faded 30 days after Cutless application — was not affected in either experiment.

These data show the potential for using Cutless in container production and landscape plantings where vigorous growth requires extensive hand pruning to maintain plant size. Magnitude and duration of growth suppression was rate dependent, with rates of 500 ppm or higher considered excessive for container production. Researchers are now testing Cutless in landscape plantings.

Keever and Gilliam are Professors of Horticulture.

Table 1. Percentage Reduction in Growth Index for Cutless-Treated Butterfly-Bush at 30-360 Days After Treatment, Experiment 1

Cutless Rate	30 DAT[2]	60 DAT	90 DAT	120 DAT	360 DAT
ppm	*pct.*	*pct.*	*pct.*	*pct.*	*pct.*
0	-	-	-	-	-
500	28	20	17	15	3
1,000	27	28	29	30	7
1,500	29	33	33	28	8
2,000	27	29	25	27	12
2,500	26	31	27	28	8

Table 2. Percentage Reduction in Growth Index for Cutless-Treated Butterfly-Bush at 45-286 Days After Treatment, Experiment 2[1]

Cutless Rate	45 DAT[2]	120 DAT	286 DAT
ppm	*pct.*	*pct.*	*pct.*
0	-	-	-
62.5	9	2	3
125	20	11	6
250	19	16	9
500	24	25	9
1,000	43	39	10
2,000	46	46	20

[1]Experiment 1 was initiated on April 28, 1992; Experiment 2 on June 30. Both ended after the 1993 spring growth flush — 360 days after treatment in Experiment 1, and 286 days after treatment in Experiment 2. Growth index is defined as (height + $width_1$ + $width_2$)/3, where $width_1$ was measured at the widest point of the plant and $width_2$ was perpendicular to $width_1$.
[2]Days After Treatment.

D.R. Mulvaney, J.D. Hough, W.H. McElhenney, and J.L. Holliman

Growth Implants Pay Big Dividends

Profitability and sustainability of beef production is highly related to cutting costs. A recent Auburn University study demonstrated the relationship between maturity patterns of cattle and use of commercially available growth promotants, both of which can have a direct impact on profitability.

Commercially-available growth implants contain naturally occurring hormones which improve growth rate prior to weaning and from weaning to slaughter. A developing trend in breeding decisions of beef cattle has been toward earlier maturing, smaller mature size biological types of cattle to capitalize on potentially lower per unit input costs.

To examine the influence of implant and maturity pattern on traits important to beef production, a series of Alabama Agricultural Experiment Station studies were conducted at the Black Belt Substation (BBSS) in Marion Junction. Cattle used in one of the studies were early and late maturing lines of Angus and Charolais. Both steer and heifer calves were implanted with Synovex-C® during the pre-weaning and post-weaning growth periods. Calves were weaned at 240 days and immediately programmed into a confinement feedlot. Cattle were slaughtered when ultrasound backfat measurements indicated .45 inch of backfat.

The two-year study showed that late maturing cattle were 30 pounds heavier at weaning and 37 pounds heavier as well as 2.4 inches taller at one year of age compared to the early maturing cattle. Charolais gained 0.5 pound per day faster in the feedlot, were 54 pounds heavier at weaning, 2.9 inches taller at weaning, and 125 pounds heavier and 3.7 inches taller at one year than Angus. While Charolais had 2.9 square inch larger ribeye areas and 0.8 lower numerical Yield Grades than Angus, the ribeye area per hundred pounds (cwt) of carcass weight was slightly higher and marbling was one full degree higher in the Angus.

Implanting calves prior to weaning resulted in 16 to 46 pounds of additional calf at weaning, depending on breed or maturity line, with an overall average of 24 pounds. If producers receive $85 per cwt for weaned calves, the preweaning implant would have increased returns by $13-39 per calf. The benefit was more noticeable for cattle having an earlier maturity pattern of growth, but was not dependent on breed. Implanting prior to weaning increased yearling weight by 26 pounds and actual carcass ribeye area, but had no effect on degree of marbling.

Implanting after weaning increased average daily gain by 0.27 pound per day, yearling weight by 37 pounds and actual ribeye size by 6%. Although the marbling score was slightly reduced, the average marbling scores of both implanted and non-implanted cattle qualified them for USDA Choice.

In another implant study at the BBSS, 34 crossbred steers weighing 748 pounds were placed in the feedlot after weaning and either implanted with Finaplix® plus Synovex-S® in opposite ears or not implanted with any promotant. All sires of calves were represented in both groups to avoid confounding sire and treatment effects. Calves were fed for approximately 150 days before slaughter and reimplanted once with Finaplix®. Calves receiving the implants weighed more at slaughter (1,203 versus 1,120 pounds), and had 28% larger average daily gains (3.85 versus 3.03) compared to the non-implanted steers. Implanted steers gained 462.1 pounds and non-implanted steers gained 363.7 pounds for a difference of over 98 pounds. There were no effects of implant on maturity, marbling, color, texture, or firmness of lean. This indicates that implanting can have significant impact on feedlot performance and profit. Based on this study, at $85 per cwt live for cattle at slaughter, a producer would receive an additional $83 per head.

Results of these studies reinforce the need for caution in selecting cattle for earlier maturity patterns as pre- and post-weaning performance may be negatively affected. The series of studies also indicate that the benefits in calf performance pre-weaning and in the feedlot favor implanting regardless of breed or maturity pattern. Response to implanting cattle both pre-and postweaning with Synovex® was more evident in the lines which were genetically slower growing. Implant program strategies should be an important part of programs designed for production of lean beef.

Mulvaney is Associate Professor and McElhenney is Research Fellow in the Department of Animal and Dairy Sciences, Holliman is Superintendent of the Black Belt Substation, and Hough is a former faculty member.

Effects of Line, Breed and Implant Treatment on Measures of Growth and Carcass Characters

	Line		Breed		Preweaning		Postweaning	
	Late	Early	Charolais	Angus	Implanted	No implant	Implanted	No implant
Weaning								
Weight wt. lb.	537	507[1]	549	495[1]	509	535[1]		
Weaning ht. in.	44.2	41.9	44.5	41.6	43.1	43.0		
Yearling								
Postweaning ADG, lb.	2.7	2.7	2.9	2.5[1]	2.7	2.7	2.9	2.6[1]
Yearling wt. lb.	919	882[1]	963	838[1]	913	837[1]	918	882[1]
Yearling ht., lb.	48.8	46.4[1]	49.4	45.7[1]	47.6	47.6	47.9	47.1[1]
REA, in.[2]	12.7	12.6	14.1	11.2[1]	12.8	12.5[1]	12.9	12.3[1]
REA/cwt	1.15	1.2[1]	1.2	1.2[1]	1.2	1.2	1.2	1.2
Yield Grade	2.3	2.3	1.9	2.7[1]	2.2	2.4[1]	2.2	2.4[1]
Marbling	595	546	506	636[1]	575	567	558	584[1]

[1] Results in a row for paired columns differed significantly.

R.J. Travnichek, J.W. Prevatt, and N.R. Martin, Jr.

Marketing Choices of Alabama Cattle Producers

In the past, livestock auctions and direct selling to buyers were the only marketing choices available to producers. Transportation and handling costs at auctions, and time required for direct sales, make these options costly. Today, beef cattle marketing has become more innovative, as well as more efficient. However, the adoption of new alternatives has not been well studied.

A regional project, involving Land Grant universities in Alabama, Georgia, Kentucky, Mississippi, and Tennessee, is attempting to determine the marketing needs, and contribute to meeting these needs of Southeastern feeder cattle producers. Researchers compiled producer attitudes regarding, and reasons for adopting, five different marketing alternatives— weekly auctions, graded feeder sales, video board (often referred to as tele-auctions) sales, satellite sales, and direct to buyer sales.

Weekly auction market and the graded feeder sale alternatives are different from the video board sale, satellite sale, and direct to buyer alternatives in that cattle must be transported to a market site for the former but not for the latter. This difference has led to a general consensus that the weekly auction alternative may not be cost effective. However, the assembly cost for the graded feeder sale is generally considered to be offset by the buyer advantages of bidding on graded cattle. The direct to buyer option may suffer from limited access to competitive bidding on small groups of cattle. In place of live cattle at a market site, video board and satellite sales use recorded pictures and verbal descriptions of the cattle. Buyers assemble at one place for the video board sale, while buyers may be linked only by satellite and telecommunication for the satellite sale.

Descriptive indicators obtained from 228 Alabama cattle producers were quite diverse. Two-thirds of Alabama producers reported herds of less than 50 brood cows on less than 100 acres of owned and/or leased land. Respondents reported herd sizes ranging from 0 head (a stocker operation) to 700 head.

Age of producer ranged from 27 to 91, with an average age of 65. Most producers were nearing retirement or were already partially retired. More than 75% of producers were older than 50 and 23% were over 70 years of age. Amount of formal education averaged 12 years. There was no correlation between age and herd size. Age did not affect the herd size of responding producers.

Alabama cattle producers are dispersed throughout the state's 67 counties. The survey showed a 60/40% split in the number of survey respondents between the northern and southern regions of Alabama. Census data show that 63% of Alabama beef farms are located in the northern region and 37% in the southern region. Thus, the survey reflects a suitable representation of the state's producers according to locations.

The survey indicated that most Alabama producers marketed their livestock through weekly auction markets. Less than three percent of respondents indicated that they did not use weekly auctions for any of their cattle. More than 75% used this type of market for almost all of their cattle. There was a very small difference between farms with small (1-49 head), medium (50-99 head), and large (100+) beef herds concerning the use of weekly auctions. Producers with small and medium sized herds used weekly auctions more than farms with large herds. There was little regional difference in frequency of use of weekly auctions.

Reasons given by respondents for their choice of weekly auction markets included tradition, lower commissions, expected higher price, closeness to farm, good market management, open bidding, less effort, small lots, favorable weighing, and assurance of payment. Expected higher prices, closeness to farm, open bidding, selling in small lots, and assurance of payment were considered very important to responding producers.

Another market alternative used by Alabama cattle producers was direct to buyer selling. Twenty percent indicated using this marketing method, usually for less than one-fourth of their cattle. Only six percent of respondents marketed more than half of their cattle direct to buyer. Ability to sell at any time, building a reputation, and high price expectations were considered very important to producers who use direct selling.

The only other type of market alternative reported to be used by three percent of respondent cattle producers was graded feeder cattle sales. Additionally, one respondent reported use of the satellite marketing alternative.

Travnichek is Graduate Research Assistant, Prevatt is Associate Professor, and Martin is Professor of Agricultural Economics and Rural Sociology.

W.B. Mikel, D.R. Mulvaney, W.R. Jones, B.S. Smith and K.W. McMillin

Lean Beef Production from Cull Cows Treated with Bovine Somatotropin

Over 44% of today's beef is consumed in the form of ground beef products. In addition, a growing segment of the population is demanding the foods they eat be healthful and nutritious. Current technology exists in the meat processing industry to provide consumers with leaner processed meat products. However, due to an inadequate supply of lean raw beef, large quantities of fat must be removed and discarded from carcasses to produce leaner meat products.

Effects of rbST on carcess yield. Carcass 1 = control; carcass 2 = low dose rbST; carcass 3 = high dose rbST.

A large portion of the raw materials used for producing ground beef comes from cull cows (older cows removed from production herds). Usually, these animals contain excess fat which may have an undesirable yellow color due to the feedstuff they eat. In order to better utilize this source of raw materials for lean ground beef, researchers at the Alabama Agricultural Experiment Station conducted a study to determine the effects of recombinant bovine somatotropin (rbST) on the production of lean meat from cull cows.

The Food and Drug Administration announced approval of rbST for increasing milk production in dairy cows. The public can be confident that milk and meat from rbST-treated cows is safe to comsume. Recent studies have revealed that rbST improves growth rate and carcass composition of growing cattle. Studies with humans indicate that somatotropin may be useful as an "aging reversal agent" in elderly men and women. Therefore, the goal of this research was to determine if bovine somatotropin could act in such a way as to reverse the aging process in cull cows to improve carcass composition and its use as a raw material for lean meat products.

Forty-two cull beef cows were randomly assigned to receive either 0, 25, or 50 milligrams of rbST each day for 21 or 42 days before processing at the Auburn University Meat Laboratory. After a 24-hour chill period, carcasses were fabricated into subprimal cuts and yields determined. Chuck Roll and Inside Round primal cuts, common raw materials used in ground beef production, were vacuum packaged and stored at 40° F for two days until processing. Ground beef products were formulated from chucks and rounds of cows in each treatment group of rbST and time on treatment. Subprimal cuts were ground, formed into four ounce patties, frozen and vacuum packaged for storage. Patties were thawed later for chemical and physical analyses and cooked to determine cook loss and shear force as an indication of tenderness.

Administration of rbST at both levels decreased 13th rib backfat of carcasses by up to 25% while at the same time increasing ribeye muscle size by 12% compared to control cows. Yield of lean meat also increased by five percent in rbST treated cows versus nontreated cows. These data suggests that processors would benefit substantially from the additional yield of grindable and whole-muscle products.

Ground beef patties made from rounds and chucks from all bST-treated cows had 19% less fat and five percent more moisture than patties made from cows not receiving rbST. Also, patties made from chucks of cows that received rbST for 42 days had 31% less fat than those from cows which received rbST for 21 days.

Pattie color was positively affected by rbST and length of treatment. Patties made with raw materials from rbST-treated cows had a darker, less yellow color indicating that less fat was present. As time on treatment increased, patties also had a redder color indicative of a greater percentage of lean meat and less yellow fat. These color changes suggest that raw materials from cull cows treated with rbST for 42 days may be used in ground beef production without adversely affecting consumer appeal.

There were no differences between patties from rbST-treated and control cows for pattie cooking loss, shear force (as an indicator for tenderness), or percent change in patty thickness. Time on treatment had no adverse affects on pattie cooking loss, shear force, or pattie thickness.

In conclusion, bovine somatotropin administration to cull cows had no negative effects on the physical characteristics of ground beef patties. The use of rbST, which has been proven safe for use on animals and products for humans, in cull cows can improve their value to the processor while providing a safe and nutritious food product for the consumer.

Mikel is Associate Professor, Mulvaney is Associate Professor, and Jones is Professor of Animal and Dairy Sciences; Smith is Research Associate and McMillin is Associate Professor of Animal Science at LSU.

E.J. Sikora, R.T. Gudauskas, K.B. Burch, J.F. Murphy, G.W. Zehnder, and J.W. Everest

North Alabama Tomato Virus Epidemics Studied

During the summer of 1992, a severe viral epidemic reduced production throughout the major tomato growing region of the state. Estimates indicated that more than 25% of the 4,300 acres devoted to tomatoes in north Alabama were lost due to the epidemic. AAES research has helped to identify the causes of this epidemic and provide control measures for future crops.

The most common symptom of the epidemic was terminal stunting of the plant. Leaf symptoms were varied and included: typical mosaic patterns, severe interveinal chlorosis, leaf curling or crinkling, and marginal leaf roll (see figure). Plants infected at an early stage of development rarely produced fruit. Laboratory and greenhouse tests showed that cucumber mosaic virus (CMV) alone or in combination with potato virus Y (PVY) and/or tobacco etch virus (TEV), was responsible for the tomato crop failure (see table). Disease incidence ranged from a few plants up to 100% in some fields of 20 or more acres. Symptoms were reproduced in the greenhouse using virus-infected material collected from the field as a source of inoculum.

CMV, PVY, and TEV are vectored by aphids. Both the green peach aphid and the potato aphid were identified in tomato fields in the affected areas.

Mild winters in Alabama in 1990 and 1991 may have allowed the aphid vectors and weed hosts of the viruses to overwinter more readily, providing the area with a large source of vectors and virus inoculum. May and June of 1992 were relatively cool and dry for Alabama, favoring an early season build-up of aphid populations and subsequent movement to tomatoes. Also, tomatoes have been grown continuously in the region for more than 40 years in monocultural-type settings. This, along with standard practices of staggered plantings, provided field conditions favorable for an epidemic.

In response to this epidemic, early in 1993 the AAES and the Alabama Cooperative Extension Service launched a program of laboratory research, on-farm tests and demonstrations, and grower education to reduce the effects of similar outbreaks that appeared likely to occur in the future.

One objective was to determine potential overwintering hosts of the viruses. Samples from more than 20 different plant species collected throughout the tomato production area were tested in January and February. CMV, PVY, and/or TEV were detected in collards, turnip, mustard, broadleaf dock, white clover, honeysuckle, wild garlic, henbit, and wild geranium.

Tomato fields was monitored for virus incidence throughout the 1993 growing season. Fields were sampled weekly from the time of transplanting through harvest. A total of 23 fields were monitored for CMV, PVY, and TEV, as well as tobacco mosaic virus (TMV) and tomato spotted wilt virus (TSWV). As of September 1993, more than 6,000 plants had been tested for the five viruses.

Results indicate that the viruses were not introduced into the area on infected transplants. Virus incidence usually remained low until three weeks after transplanting in the earliest settings. Incidence increased rapidly thereafter and often exceeded 90% by harvest. However, symptoms were mild and often did not appear until late in crop development, and yields from these early settings were not adversely affected. All five viruses were detected at varying levels, with CMV being the most common.

All the viruses were detected earlier and incidence increased more rapidly in fields transplanted after June 1. The viruses were often detected within one to two weeks after transplanting and symptoms appeared earlier and were more severe than in earlier settings. In many cases the crop was not harvestable.

Aphid populations were low to moderate throughout the season and generally consisted of green peach and potato aphids.

Although the virus epidemic occurred again in north Alabama in 1993, overall losses were fewer than in 1992 because the tomato acreage was reduced and there was increased awareness of the problem.

Virus-infected tomato plant in North Alabama field.

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Viruses Detected in Diseased Tomato Plants in North Alabama in 1992

Virus	No. plants Tested	No. plants Positive	Infected
			Pct.
CMV alone	317	140	44.1
PVY alone	259	14	5.4
TEV alone	259	8	3.0
CMV+PVY	259	22	8.4
CMV+TEV	259	8	3.0
CMV+PVY+TEV	259	37	14.2
PVY+TEV	259	11	4.2

B.J. Rude and D.L. Rankins, Jr.

Ensiling Broiler Litter and Johnsongrass Forms Quality Feedstuff

Broiler litter and johnsongrass often are considered liabilities for Alabama agriculture. However AAES research has shown that the two can be combined to produce a palatable and nutritious feedstuff.

Approximately two million tons of broiler litter (a combination of feed, manure, and bedding material that collects on the floor of broiler houses) are produced annually in Alabama alone. Though there are several uses for litter, such as applying it to land as a fertilizer or using it as an inexpensive protein source for beef cattle, additional uses for this by-product are needed.

Johnsongrass, which can be a noxious weed in row crops, grows abundantly in the state and is sometimes used as a forage. However, some of the nutritional value of the forage can be lost when it is baled for hay under Alabama's humid weather conditions.

An AAES study looked at ensiling broiler litter with johnsongrass, a method that would optimize the nutritional quality of the grass and also eliminate pathogenic organisms in the broiler litter, making it safe as a livestock feed.

For the AAES study, johnsongrass-broiler litter silage was compared to corn-broiler litter silage. Johnsongrass was harvested in early June at 65% moisture and ensiled with 10 or 20% added broiler litter (wet basis). Corn was harvested in late July at 65% moisture and ensiled with broiler litter added at 10 or 20%. On a dry matter basis, these mixtures contained 18.5 and 37% litter. In mid-September, the silages were fed to growing lambs weighing an average of 64 pounds each.

The crude protein content and the mineral content of both corn and johnsongrass silages were enhanced by the addition of broiler litter (Table 1). Lignin and acid detergent fiber values were greater for the johnsongrass silages, as was the pH for these silages. This indicates that the johnsongrass mixes ensiled to a lesser extent than the corn mixes, probably because of the greater fiber content. However, the pH of all silages were less than or equal to 4.7, which indicates they were appropriately processed.

All four silages were readily consumed when offered to lambs. Average consumption was 2.25% of body weight. Digestibility values were acceptable for all silages (Table 2); however, johnsongrass silage with added broiler litter was less digestible than corn-broiler litter silage. Again, this was probably a result of johnsongrass being more fibrous than the corn forage. Stage of maturity at harvest influences the fiber content of forages. However, the johnsongrass was harvested at the boot stage, indicating that it would be difficult to obtain acceptable yields that would contain less fiber. Nonetheless, johnson-grass still produced acceptable digestibilities and was palatable. Addition of either 10 or 20% broiler litter had no effect on nutrient digestibilities. Addition of more than 20% litter would raise the pH above 4.7, which would be unacceptable.

By correlating the estimated nutrient requirement tables for beef cattle to these results with sheep, a few conclusions can be drawn. The johnsongrass silages were adequate in crude protein content for all types of cattle. However, the silages were lacking in energy content. Based on energy retention values in these sheep, a 600-pound steer would gain only 1 to 1.2 pounds per day. As a feedstuff for early-pregnant brood cows the johnsongrass silages would be nutritionally adequate.

Corn silage yields typically are 10 to 15 tons per acre in Alabama. At 65% moisture, this equates to 3.5 to 5.25 tons of dry matter per acre. Johnsongrass will typically yield 2 to 5 tons of dry matter per acre. Because planting corn would be more costly than utilizing existing stands of johnsongrass, the economic benefits of johnsongrass are clear. Johnsongrass silage, although not equal to the corn silage, was acceptable and when economic factors are considered, it offers a viable alternative for ensiling broiler litter.

Table 1. Nutritional Content of Silages

Variable	Corn silage 10	Corn silage 20	Johnsongrass silage 10	Johnsongrass silage 20
	Pct.	*Pct.*	*Pct.*	*Pct.*
Dry matter, pct.	43	46	40	44
pH, pct.	4.1	4.3	4.5	4.7
Ash, pct.	8.7	12.8	16.8	18.5
Crude protein, pct.	12.5	14.4	14.4	16.3
Gross energy, Mcal/lb.	2.0	1.9	1.8	1.8
NDF, pct.	58	55	60	57
ADF, pct.	24	24	42	42
Hemicellulose, pct.	34	31	19	16
Lignin, pct.	5.2	5.6	8.3	8.3

Table 2. Digestibility Values of Silages

Variable	Corn silage 10	Corn silage 20	Johnsongrass silage 10	Johnsongrass silage 20
	Pct.	*Pct.*	*Pct.*	*Pct.*
Digestibility				
Dry matter, pct.	69	65	56	56
Organic matter, pct.	72	68	60	60
Energy, pct.	71	67	59	60
Crude protein, pct.	62	60	59	60
Retention				
Nitrogen, g/day	13.8	11.1	5.6	7.3
Energy, Mcal/day	3.8	2.8	1.6	2.0

Rude is Graduate Research Assistant and Rankins is Assistant Professor of Animal and Dairy Sciences.

E. van Santen, D.W. Reeves, and G.L. Mullins

Lupin, a Potential New Crop for Alabama

The southern region of the United States is fortunate to have a climate that allows two cropping seasons per year. However, the choice of winter crops is rather limited at present. Wheat has been the traditional winter crop choice, but acreage of wheat grown for grain has decreased during the past decade because of increasing production costs and declining grain prices. One crop with a potential to fill this void is sweet white lupin, a winter-grown annual legume.

Sweet white lupin is naturally adapted to well-drained, low-fertility, coarse-textured, neutral to acidic soils, such as those in the southern Coastal Plain of the United States. Because it is a nitrogen (N) fixing legume, it does not require nitrogen fertilizer. Development of cropping systems utilizing winter-grown lupin would: (1) provide a rotation yield response to subsequent summer crops; (2) reduce or eliminate N fertilizer requirements; and (3) produce high protein feed grain or high quality silage. A cropping system involving sweet white lupin as a component would fit particularly well into a diversified crop/livestock system.

Lupin also offers other advantages. As a cover crop it would reduce erosion, improve soil tilth, and reduce the danger of ground and surface water pollution. It would have all the advantages of current legume cover crop systems in conserving soil and water resources, but could be more profitable than current systems due to the value of grain or silage produced. Sweet white lupin seed does not contain trypsin inhibitors or other antinutritive factors that require heat processing, such as soybeans. Lupin seed therefore can be used without special precautions and the crop does not require that a marketing or trading system be in place.

An AAES research project to evaluate lupin as a potential crop for Alabama was initiated in 1991. The project is a collaborative interdisciplinary research and extension effort and is funded in part by the Wheat and Feed Grain Committee of the Alabama Farmers Federation.

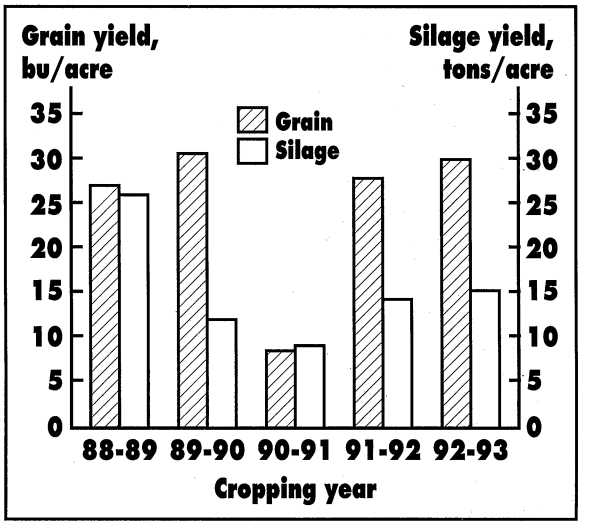
One of the requirements for commercialization of a new crop is that it can be grown reliably. Thus, research focused on basic agronomic practices, such as planting method, seed treatments, planting date, and seeding rate. Furthermore, most leguminous crops such as lupin become weak and are susceptible to soil-borne disease organisms if exposed to water-saturated soils. Therefore, other work has focused on planting lupin on raised beds, which is the most effective method of reducing attack by soil-borne disease organisms and improving stand percentage.

White lupin is a cold-hardy species that tolerates low temperatures during the vegetative stage. In December 1989, Tifwhite-78 white lupin in AAES plots was subjected to five consecutive days of freezing (temperatures), during which temperatures did not exceed 28°F and daily lows were 12, 8, 3, 3, and 24°F. Some plants were killed during this period, but damage was minimal in elevated and well-drained sites. However, lupin is cold-sensitive during flowering and seed set. The late-winter snow storm on March 13, 1993, severely damaged the French variety Lunoble that was flowering at the Plant Breeding Unit, Tallassee, but no harm was done to the same variety at the Tennessee Valley Substation, Belle Mina, because it was still vegetative.

These findings suggest that planting dates need to be adjusted to match varieties to local environmental conditions. Maximum grain yields have been obtained when lupin was planted in late-September in northern Alabama and late-October in southern Alabama. In 1988-1993 trials, average grain yields ranged from nine to 30 bushels per acre (see figure), with top yields exceeding 60 bushels per acre. The low yield during the 1990/91 cropping season was caused by severe disease brought on by excessive rainfalls during pod set in April and May 1991. Silage yields at 65% moisture during the same years ranged from nine to 26 tons of dry matter per acre.

Is there a future for lupin in Alabama's agriculture? Based on research conducted during the last five years, there definitely is. But don't look for thousands of acres of flowering lupins within the next three years. Developing a new crop is a long, arduous process. Many details need to be addressed before the crop can be grown commercially.

One important aspect is determination of the value of the resulting grain or silage in animal diets, including cattle, hogs, poultry, and fish. Studies to determine this have begun but will take three to four years to complete. Another need is the development of varieties that are better adapted to climatic conditions in Alabama. Promising parental lines have been obtained from collaborators abroad with which varietal development has started, but it will take five to seven years before a new variety can be released.



Average white lupin grain and silage (at 65% moisture) yields from trials conducted from 1988-1993.

van Santen is Associate Professor, Reeves is Affiliate Associate Professor (and Research Agronomist with USDA-ARS-NSDL), and Mullins is Associate Professor of Agronomy and Soils.

L.M. Smith, A.G. Appel, T.P. Mack, and G.J. Keever

Ground Cover Around Your Home Can Influence Abundance of Cockroaches

Smokybrown cockroaches can live in mulches such as pine straw and other ground cover near homes, but they often become unwanted houseguests. AAES research has found that changing the ground cover next to homes can help evict the pests.

A favorable cockroach habitat must provide year-round hiding places, because the insects require two years or more to complete their life cycle. Favorable ground cover also provides moisture, protects cockroaches from the summer heat, and keeps them from freezing in the winter. AAES researchers compared several common ground covers to learn which are less suitable for cockroaches.

Smokybrown cockroaches can thrive in many types of ground cover commonly found near homes. (Photo: Eric Benson)

At the E.V. Smith Research Center in Shorter, researchers placed various ground covers on each side of four simulated houses in contiguous 3x6-foot plots. Ground covers included pine straw, bare soil, centipede grass, dethatched centipede grass, white garden stones, periwinkle, and blue-rug juniper. Each ground cover was regularly maintained for weed control.

Light intensity, temperature, and soil moisture were recorded for each ground cover type with electronic sensors installed at the center of each plot at the soil surface. These measurements were taken every hour for two years by a computer.

Researchers then calculated the percentage of time each season when factors were favorable to cockroaches for each ground cover. Favorable limits include soil temperatures 41-95°F; moistures 75-95% of soil water-holding capacity; and light less than 100 lux (approximately equivalent to pre-dawn light).

Pine straw proved to be capable of supporting the greatest abundance of cockroaches throughout the year; it provided a favorable climate an average of 75% of the time. Pine straw was followed by thatched (70%) and dethatched (68%) grass, garden stones (65%), blue rug (61%), and bare soil (45%).

Pine straw is favorable because it maintains soil moisture and insulates the soil from summer heat, properties that also make it a good landscape mulch. Pine straw also provides cockroaches hiding places during the day. Similar ground covers, such as oak-leaf litter, holly litter, or ivy, can also provide similarly favorable habitats. Observations made by the researchers at Auburn homes support this assumption.

Thatched grass was a good habitat except when it became waterlogged in the fall. Dethatched grass was a less favorable ground cover due to wide temperature fluctuations. Garden stones and live plant cover were subject to extreme temperature fluctuations and lower soil moisture at times. Bare soil not only experienced the widest daily temperature fluctuations and extreme soil drying between rains, but also was exposed to sunlight when the nocturnally active cockroaches were in hiding.

Differential shading created by orientation of plots (north, south, east, and west), did not greatly affect these results. However, the monthly percentages of favorable conditions were higher on the eastern and southern exposures.

Ground cover that maximizes seasonal temperature fluctuations, such as dethatched grass or garden stones, should be used next to homes to reduce cockroach abundance. However, this alone will not control the insects, because many other factors contribute to cockroach abundance. Yet, reducing suitability of cockroach habitat is highly effective when used in integrated pest management with other control measures.

Smith is Post Doctoral Fellow, Appel is Associate Professor, and Mack is Professor of Entomology; Keever is Professor of Horticulture.

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