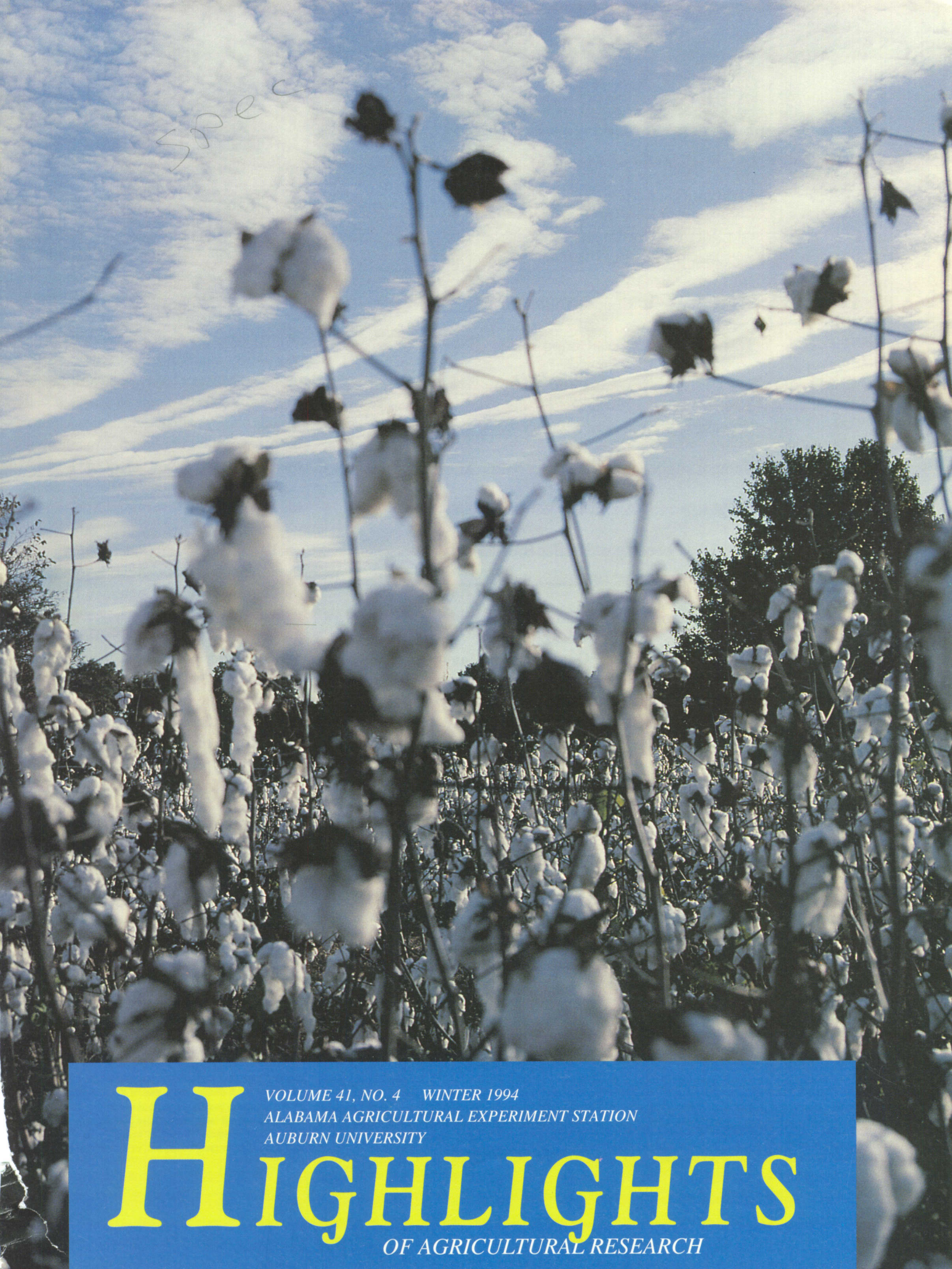

VOLUME 41, NO. 4 WINTER 1994
ALABAMA AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY

HIGHLIGHTS

OF AGRICULTURAL RESEARCH

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ON THE COVER. Auburn University's "Old Rotation" is America's oldest continuous cotton experiment. It has provided valuable information on sustainable agriculture; see story on page 4.

Guest Column

Agricultural research calls for teamwork and increased attention to downstream concerns of the world's market economy. The role of the consumer in the food and fiber system has taken on greater importance as expanding product choices lead to fierce competition in the marketplace.

Food safety and nutrition have been catapulted to the top of the national agenda. In preparation for the 1995 Farm Bill reauthorization, the human sciences community will sponsor a food chain workshop in Washington, D.C. Some key topics will include dietary patterns and consumer food behavior, improving health through optimal nutrition, and food safety and quality.

In partnership with Textile Engineering researchers, Consumer Affairs faculty tackle issues of product safety and quality, markets, and trade. Auburn and three other universities work jointly in the National Textile Center, perhaps the ultimate university, industry, government partnership. The NTC is funded by a $9 million appropriation from the U.S. Department of Commerce and is guided by national textile industry leaders.

Through these experiences, we have learned that partnerships gain strength through commitment to common purposes and diversity of expertise. Our outreach beyond the traditional boundaries of agriculture will establish new systems and encompass new talent to generate creative solutions for today's complex problems.

June Henton, Dean
School of Human Sciences

Winter 1994 Volume 41 Number 4

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.

FIGHTING Fescue Toxicity

by David Bransby, David Kee, Susan Sladden, John Eason, and John Owen

Cattle producers could have a new tactic for combatting the effects of tall fescue pastures infected with a toxic fungus on grazing livestock. Toxic fescue slows the rate of weight gain in beef cattle, but AAES researchers discovered that using a deworming medication in combination with growth hormone implants had a dramatic effect in countering this problem.

Nontreated steers (left) show signs of fescue toxicosis on high-fungus pastures, while those treated with Ivomec and Synovex are healthy.

Beef steers grazing toxic fescue showed more than an additive increase in weight gain when dewormed with Ivomec and implanted with Synovex, compared to when they received either product alone. This apparent synergistic effect of the two products was not evident among steers grazing fescue with low levels of toxicity.

It is well known that growth implants, infection of animals with worms, and tall fescue infected with the toxic endophytic fungus, *Acremonium coenophialum*, all affect the hormonal system of beef cattle. In addition, several experiments have shown unusually large weight gain responses to deworming cattle with Ivomec on toxic fescue. However, no previous research examined the interaction among all three of these factors on beef animals.

Steers grazed high- and low-fungus fescue at Sand Mountain Substation in Crossville in spring and summer 1994 with (1) no deworming or implant (nontreated controls), (2) deworming with Ivomec only, but no implant, (3) Synovex S implant only, but no dewormer, or (4) both deworming with Ivomec and implanting with Synovex. Sixty-four steers were placed on 16 two-acre pastures at a stocking rate of two 600-pound steers per acre. All treatments except 2 and 4 on low-fungus pastures also were evaluated at the Piedmont Substation in Camp Hill in the spring only. High-fungus

Continued on page 4

Average Daily Weight Gain for Steers Grazing High- and Low-Fungus Fescue With or Without Treatment with Ivomec and Synovex

Treatment	Sand Mountain		Piedmont	
	High-fungus *Lb./day*	Low-fungus *Lb./day*	High-fungus *Lb./day*	Low-fungus *Lb./day*
Nontreated controls	1.27	1.48	0.38	1.06
Ivomec only	1.54	1.89	0.53	—
Synovex only	1.28	1.71	0.63	1.59
Ivomec & Synovex	1.75	1.71	1.42	—

Combatting Effects of Toxic Fescue on Steers, continued

pastures averaged about 70% infection and low-fungus pastures about 15%. Grazing continued for 203 days at Sand Mountain and 84 days at Piedmont.

Nontreated animals on high-fungus pastures showed typical signs of fescue toxicosis, including rough, muddy hair coats and poor condition (see photo on page 3). At Sand Mountain there was relatively little weight gain response to either product when administered alone on high-fungus fescue, but the response was large when the products were applied together (see table). In fact, when both products were used on animals grazing high-fungus pastures, weight gain was similar to the highest gains recorded for animals grazing low-fungus pastures. Weight gain per acre was 710 pounds, which is exceptionally high for stockers grazing toxic fescue without supplement. Furthermore, these steers showed little sign of fescue toxicosis . Although weight gain was lower at the Piedmont Substation, the pattern among the treatments tested was very similar and actually more pronounced on high-fungus pastures. However, these patterns were not evident among animals grazing low-fungus fescue at either location.

The strong similarity in results from the two locations suggests that the response observed in this study might be consistent. However, 1994 was a year of unusually high rainfall and results could be weather-dependent. Furthermore, the physiological mechanism that caused the weight gain response is not understood. Consequently, further research is needed to examine these issues.

Bransby is a Professor, Kee is a Research Associate, and Sladden is a Research Specialist in Agronomy and Soils. Eason is Superintendent of the Sand Mountain Substation and Owen is Superintendent of the Piedmont Substation.

Old Rotation Documents Sustainable Cotton Production

Farmers are concerned about the world's ability to sustain profitable agricultural production. Consumers demand high-quality, dependable, and low-cost products. And both groups support farming practices that protect the environment and preserve natural resources. A simple way to measure sustainability, taking into account all these attributes, has not yet been developed.

However, AAES researchers with Rockefeller Foundation support have measured sustainability of continuous cotton production using the concept of "total factor productivity" (TFP) at Auburn University's "Old Rotation." The Rockefeller Foundation selected the Old Rotation, America's oldest continuous cotton experiment, to document the sustainability of cotton production. In the study, researchers utilized Old Rotation records that date back to the experiment's inception in 1896. Trends can be observed over almost a century of continuous production and an era of tremendous change in technology and markets.

TFP reveals how productive a system is by comparing all production inputs and outputs. TFP uses an index that allows comparisons from one year to the next even when input and output prices change. The index considers all inputs of the cropping system, the costs of those inputs, all outputs, and the value of those outputs. If the index is greater than 1.0, the amount of output produced per unit of input is increasing over time, and the system can be considered sustainable.

The Old Rotation experiment includes different rotations of cotton with corn, soybeans, small grains, and winter legumes (crimson clover and vetch). Three of the continuous cotton systems were analyzed

by Charles Mitchell, Gregory Traxler, and James Novak

Taking records in the "Old Rotation" in 1923. Established in 1896 to test advantages of rotating cotton and legumes, the Old Rotation is still active on the same plots.

in this study: (1) no legumes and no fertilizer nitrogen; (2) winter legume nitrogen only; and (3) fertilizer nitrogen only (120 pounds of N per acre per year as ammonium nitrate).

The output index is the yield of cotton lint and seed and the price received for each product. Input measurements are not as simple to calculate. They include costs for seed, fertilizer, pesticides, harvest, ginning, machinery, fuel, and labor (see table). Also considered in the sustainability measurements were inputs with indirect costs, such as soil erosion associated with each cropping system and potential environmental or health threats posed by pesticide use. Such "externalities" are difficult to quantify. Values based on previous research were used as references in these calculations.

Using 1990 as a reference point, the figure illustrates no constant trend in TFP or sustainability. The treatment using fertilizer N did not begin until 1956. There have been periods (1900-1925 and 1965-1980) when productivity was declining in all systems. From the late 1940s until the 1970s, productivity increased. A dramatic increase occurred around 1960 when a single technological advancement overwhelmed all other input factors — the adoption of the mechanical cotton picker. The large increase in TFP associated with this one advancement points out the tremendous influence technology can have on agricultural sustainability.

Output and Input Shares on the Old Rotation, 1896 and 1992

	1896 Pct.	1991 Pct.
Output		
Seed	7	11
Lint	93	89
Input		
Seed	8	6
Fertilizer	11	4
Herbicide	0	5
Insecticide	2	9
Drying/ginning	28	39
Defoliant	0	1
Labor	34	7
Machinery	17	29

All three Old Rotation treatments fulfill at least one criteria required for a system to be sustainable — output per unit input is higher in 1991 than in 1896, even when externalities are valued. The external effects of soil erosion and pesticide use have only a modest effect on measured productivity. However, the "low input" system with neither chemical or organic nitrogen is less productive than the other two systems. The organic and chemical sources of nitrogen have similar productivity impacts.

Continued on page 6

by Beth Guertal, Edzard van Santen, Kathy Glass, Paul Mask, and David Bransby

A Better Way to Choose Your

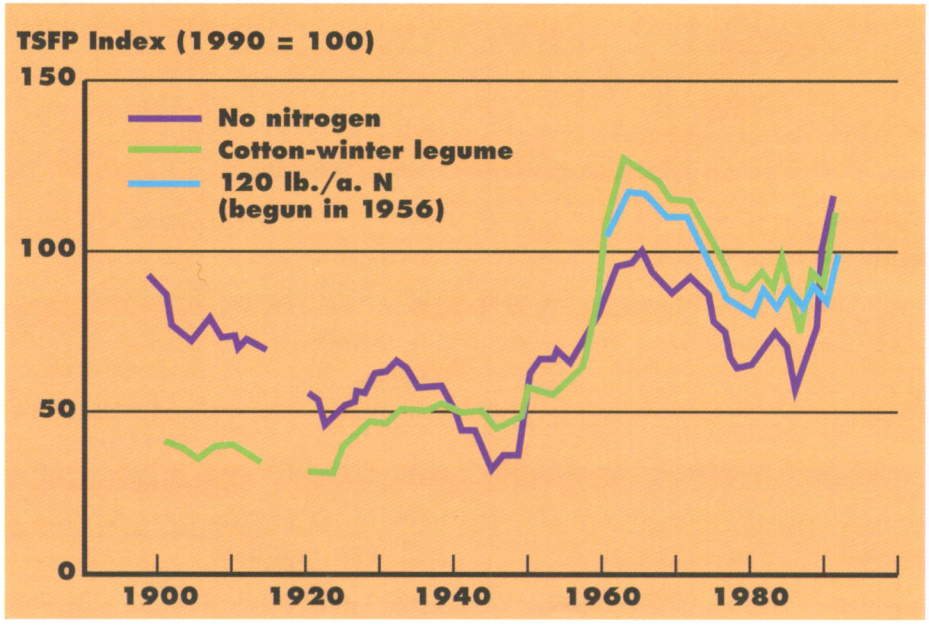
Each year, farmers are faced with the challenge of selecting wheat varieties that are high yielding, disease resistant, and adapted for their growing area. Variety information available through the AAES helps farmers make those selections, and now research is providing additional information that can enable farmers to make even more educated decisions.

Variety information often is gleaned by farmers from the *AAES Alabama Performance Comparison of Small Grain Varieties* report. This publication, available through the AAES and at each county Extension office, provides yield rankings from variety trials conducted at 11 loca-

Old Rotation Documents Sustainable Cotton Production, continued

So, what does all this mean to Alabama cotton farmers who are interested in sustainable cotton production? These data prove that continuous cotton production can be sustainable. However, the effect of weather, management, pests, technological advancements, and other factors can create productivity cycles that may last for several decades. Because major technological breakthroughs cannot be predicted, future sustainability cannot be predicted. Farmers can only use those practices that appear to give them the highest TFP in today's systems.

Mitchell is an Associate Professor of Agronomy and Soils; Traxler is an Assistant Professor and Novak is an Associate Professor of Agricultural Economics and Rural Sociology.



Total factor productivity index (five-year averages) with externalities of erosion costs and off-site pesticide costs. TFP = (output index) / (input index).

WHEAT

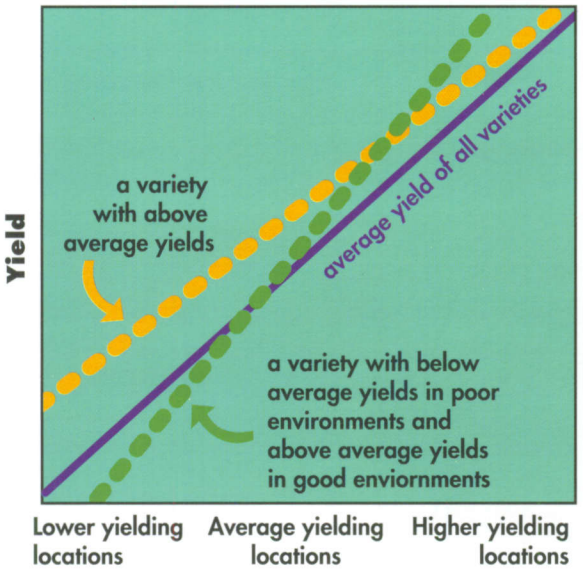


Figure 1. Stability analysis.

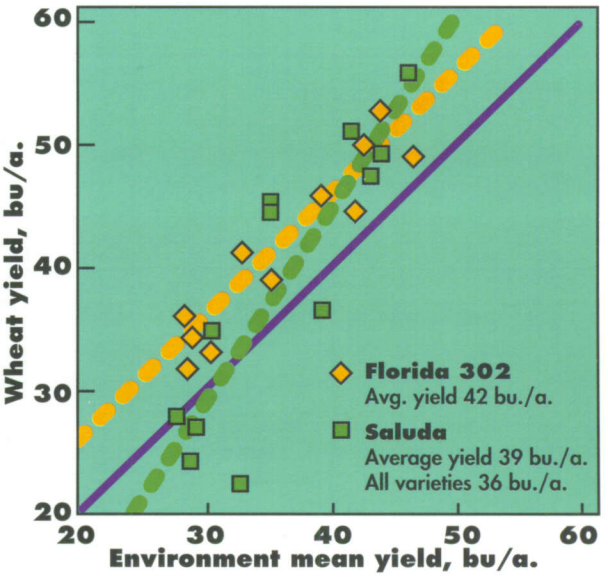


Figure 2. Example stability analysis.

tions throughout Alabama, along with disease ratings for northern, southern, and central Alabama. Wheat grain yields from the current year are published, along with two- and three-year station and regional averages.

Researchers in the Department of Agronomy and Soils have been exploring the use of a technique called "stability analysis" to provide growers with additional information about the relative yields of wheat varieties across Alabama. Stability analysis is a comparison method where the performance of a selected wheat variety is compared to all the other varieties in the trial. Stability analysis is different from methods currently used because yield differences due to location are not just averaged into a final average number, but are considered an important part of the variety selection process. Stability analysis is often presented as a graph, so the response of the variety to different locations (changes in environment) can be examined visually.

Using Figure 1 as an example, the average yields of all varieties is represented as a diagonal line that divides the figure into two equal triangles. This is the reference line against which specific varieties are compared. Yields of a specific wheat variety are plotted against the average yield of *all* varieties at each location.

The average yield of a given location is an indicator of the quality of that environment — if the location is high yielding then it will appear on the right hand bottom side of Figure 1. If the location is low yielding, it will appear on the left-hand side. When all the individual locations have been plotted, a line describing the relationship between the selected variety and all the other varieties is calculated. These are the lines that are illustrated in Figure 1.

If the line lies above the diagonal line then it is a *stable* variety, and it has outyielded the average of all the varieties, no matter how poor or good the environment (the orange line in Figure 1). The green line illustrates a variety that performed worse than the average in poor environments, but yields better than the average in good environments, a typical situation with many wheat varieties.

Ten years of wheat variety trials conducted at 12 locations with a total of 82 varieties were used in the stability analysis. As an example, two wheat varieties popular in Alabama are used in the stability analysis illustrated in Figure 2. Florida 302 consistently outyielded the average of all the varieties, regardless of the quality of the environment. In contrast, Saluda performed poorly in lower yielding environments, but outyielded the average and Florida 302 in the best environments.

Some states already include stability analysis in yearly variety test publications. The use of stability analysis for selection of wheat varieties shows promise, and it may become a regular part of the *Alabama Performance Comparison of Small Grain Varieties*. A combination of stability analysis and conventional variety test results can help growers to select wheat varieties well adapted to their specific location.

Guertal is an Assistant Professor, van Santen is an Associate Professor, Glass is a Research Associate, Mask is an Associate Professor, and Bransby is a Professor of Agronomy and Soils.

Textile Sludge Boosts Cotton Yields

Sludge-treated plots (left foreground) had increased growth of seedling cotton and higher yields than conventionally fertilized plots (right foreground) in 1993.

In an effort to recycle and keep potentially valuable materials out of landfills, more and more materials are being evaluated as soil amendments. One such material is textile mill wastewater treatment sludge, which resulted in impressive yield increases when applied to cotton at the E.V. Smith Research Center in Shorter.[1]

Textile sludge contains decomposed waste fibers and dyes that collect in a wastewater lagoon. According to Environmental Protection Agency guidelines, the sludge used in this study could be applied with no restrictions.

Sludge was collected from a local textile mill and drained of water. It was applied and incorporated just before cotton was planted in late April of 1993 and 1994. Preliminary tests had indicated that the sludge contained 10 pounds of nitrogen (N) per wet ton, but tests after application revealed that it actually contained approximately 18 pounds. Only half that amount was available for plant uptake. Therefore, each ton of sludge provided nine pounds of available N, instead of the five pounds for which researchers had originally planned. The sludge was low in other primary and secondary nutrients.

Three application rates were used: 20,

[1]This research was supported by the West Point-Stevens mill in Opelika.

by Charles Mitchell and John Odom

40, and 80 tons per acre. These rates provided 180, 260, and 720 pounds of available N per acre, respectively. The unexpectedly high rates were enough to create excessive vegetative growth under the right conditions. Sludge was applied to fallow land each year. In addition, the 1993 treatments were evaluated for their residual effects in 1994. Both years, researchers included treatments that received 100 pounds of N as ammonium nitrate and others that received no N.

In the relatively dry growing season of 1993, sludge-treated plots produced 50% to 73% more cotton than the conventionally fertilized treatments. However, 1994 was relatively wet, and yields in the sludge-treated plots were 4% to 22% lower than plots treated with 100 pounds of N as ammounium nitrate. The high-N rate caused excessive vegetative growth and rank cotton. There were no significant differences in yield between the 20-ton and 80-ton rates.

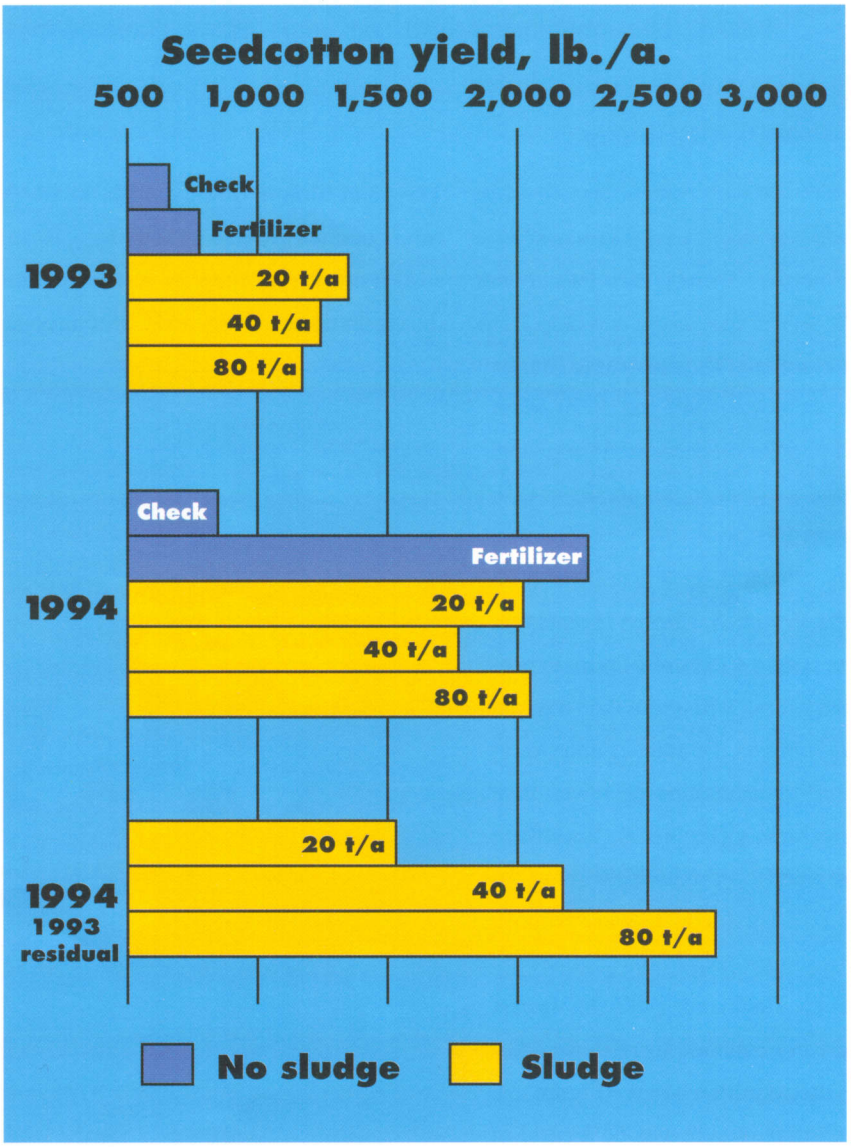
The high rate of sludge application in 1993 had no negative effects. Instead, sludge improved the physical condition of the soil by providing organic material, and it increased water-holding capacity of the soil. These factors may have contributed to the dramatic yield increase from the sludge during the dry growing season.

Soil profile analysis after harvest indicated that nitrate-N was leaching below the effective rooting zone where excessive sludge was applied. Where 80 tons of sludge per acre was applied in the spring, soil samples contained as much as 60 parts per million (ppm) of nitrate-N in the 16- to 24-inch depth, compared to five ppm where 100 pounds of fertilizer N was applied.

There also was significant N carryover from 1993 to 1994 where 80 tons of sludge were applied. The residual effects of the 1993 application produced significantly higher yields in 1994 than any of the other treatments.

When used at appropriate rates based upon total N, the textile mill sludge could have positive agronomic benefits for some cotton producers.

Mitchell and Odom are Associate Professors of Agronomy and Soils.



Seedcotton yields from the application of 100 pounds N per acre as fertilizer and 20, 40, and 80 tons per acre of wastewater sludge. Considerable N carryover is evident in 1994 yield from residual sludge applied in 1993.

The Changing Face of Rura

The change that has occurred in rural Alabama during this century is astounding. In a period not much longer than the 75-year average life expectancy of today's Alabamians, the state has shifted from rural, farm-based to urban, industry/service-based. This population shift translates into a changed economic and political reality and a need for new policies to serve all Alabamians.

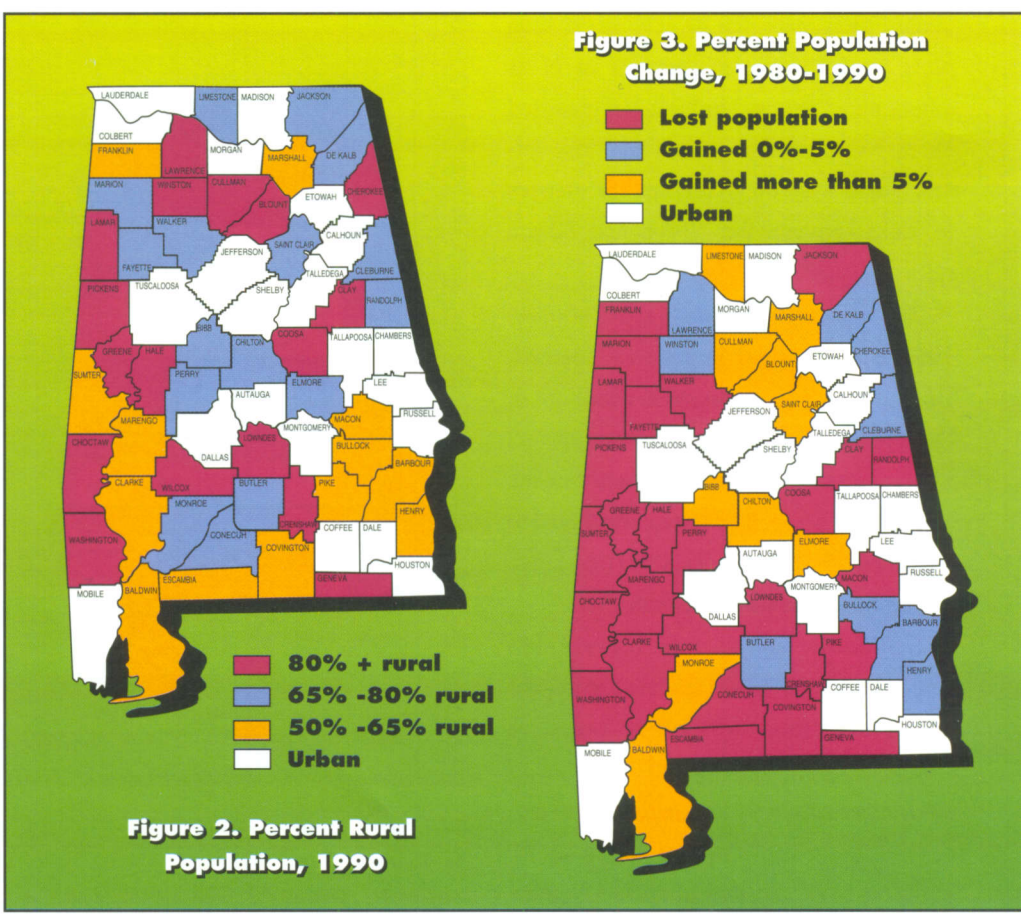
In 1900, 88% of Alabamians lived in rural areas and 65% lived and worked on farms (Figure 1). Ninety years later, fewer than 40% live in rural areas and only 1.5% are farm residents. The most rapid change occurred between 1940 and 1970 when the rural population decreased from 70% to 42% and the farm population from 47% to less than 5%.

While Alabama as a whole is 60% urban, the 1990 U.S. Census reveals that 46 of the state's 67 counties remain predominantly rural, with more than half the residents living in the open-country or in towns and communities of fewer than 2,500 inhabitants (Figure 2). Seventeen counties were more than 80% rural; 16 were 65-80% rural; and 13 were 50-65% rural.

Between 1980 and 1990 the fastest growing rural counties were those adjacent to metropolitan areas (Figure 3). Shelby County, which was 65% rural in 1980, grew 70% during the decade to 61% urban. Baldwin County increased 25%; St. Clair County, 21%; Limestone County, 18%; and Elmore County, 13%. In all, 20 rural counties grew in the 1980s.

But most rural counties lost population during the decade. Perry and Conecuh counties each declined more than 10%. This loss of people from Alabama's rural counties was the result of more residents moving out of these counties than there were babies born or new residents moving in. The largest out-migration occurred from counties located across the rural, Black Belt area of the state, particularly, Perry (-21%), Dallas (-19%), Wilcox (-17%), and Lowndes (-16%) counties (Figure 4).

More than 89,100 persons — 2.3% of the population — left Alabama during the 1980s and were not replaced by natural



Alabama

by Glenn Howze, John Dunkelberger, and Noel Thompson

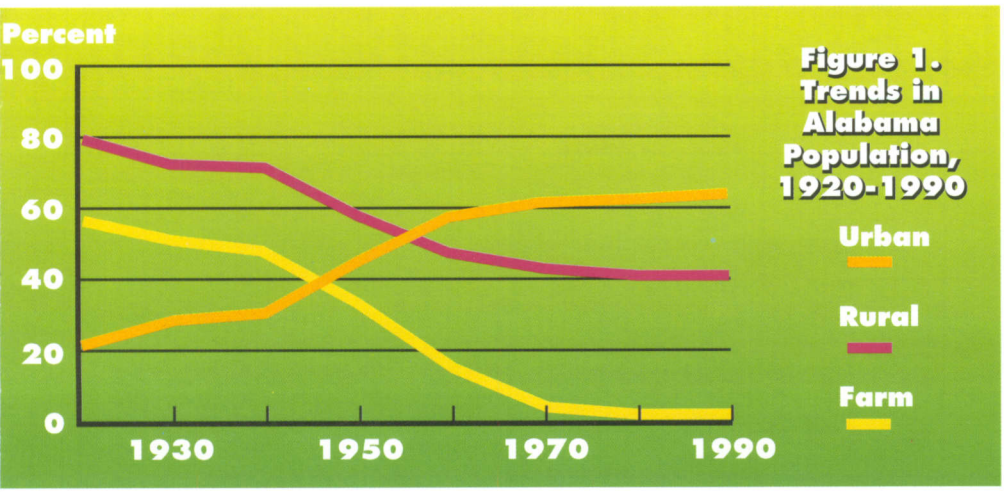


Figure 1. Trends in Alabama Population, 1920-1990

increase (more births than deaths) or in-migration. In 51 counties, both rural and urban, more people moved out than moved in. Urban counties with the greatest out-migration losses were Dallas (-19%), Calhoun and Jefferson (-9%), Etowah and Mobile (-6%), and Montgomery (-3%).

African-American residents, who comprise more than 95% of Alabama's nonwhite population, left at a higher rate than white residents (Figure 5). Only 16 counties showed a net increase of nonwhites, and all but three of these counties were in the northern half of the state where the nonwhite population has been small historically. The exceptions, located in the southern half of the state, were Lee, Elmore, and Bullock counties. Rural counties with the largest proportionate increases in nonwhite population were Dekalb (25%), Winston (21%), Lawrence (20%), Jackson (18%), and Marion (17%). Conversely, the largest declines in African-American residents among rural counties occurred in the Black Belt counties of Lowndes, Marengo, Perry, and Wilcox, where out-migration was in excess of 20% during the 1980s.

The transformation of Alabama from a rural to urban state has occurred at a rapid pace. It has left many rural counties and multi-county areas economically and politically weakened. It has widened differences in standards of living between rural and urban residents. It has raised anew questions about equity in rural and urban education, health care, and social services. Continued out-migration of rural residents, particularly older youth and young adults, jeopardizes efforts to promote and accomplish social and economic development in rural areas.

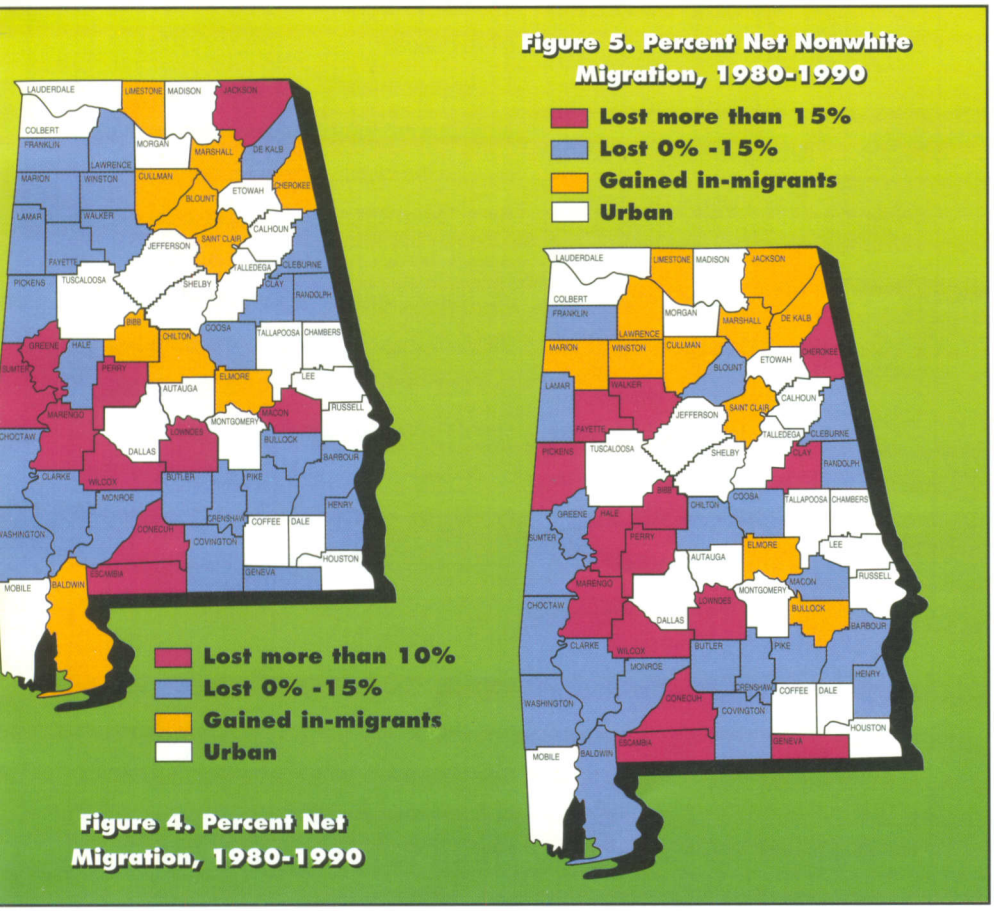


Figure 4. Percent Net Migration, 1980-1990

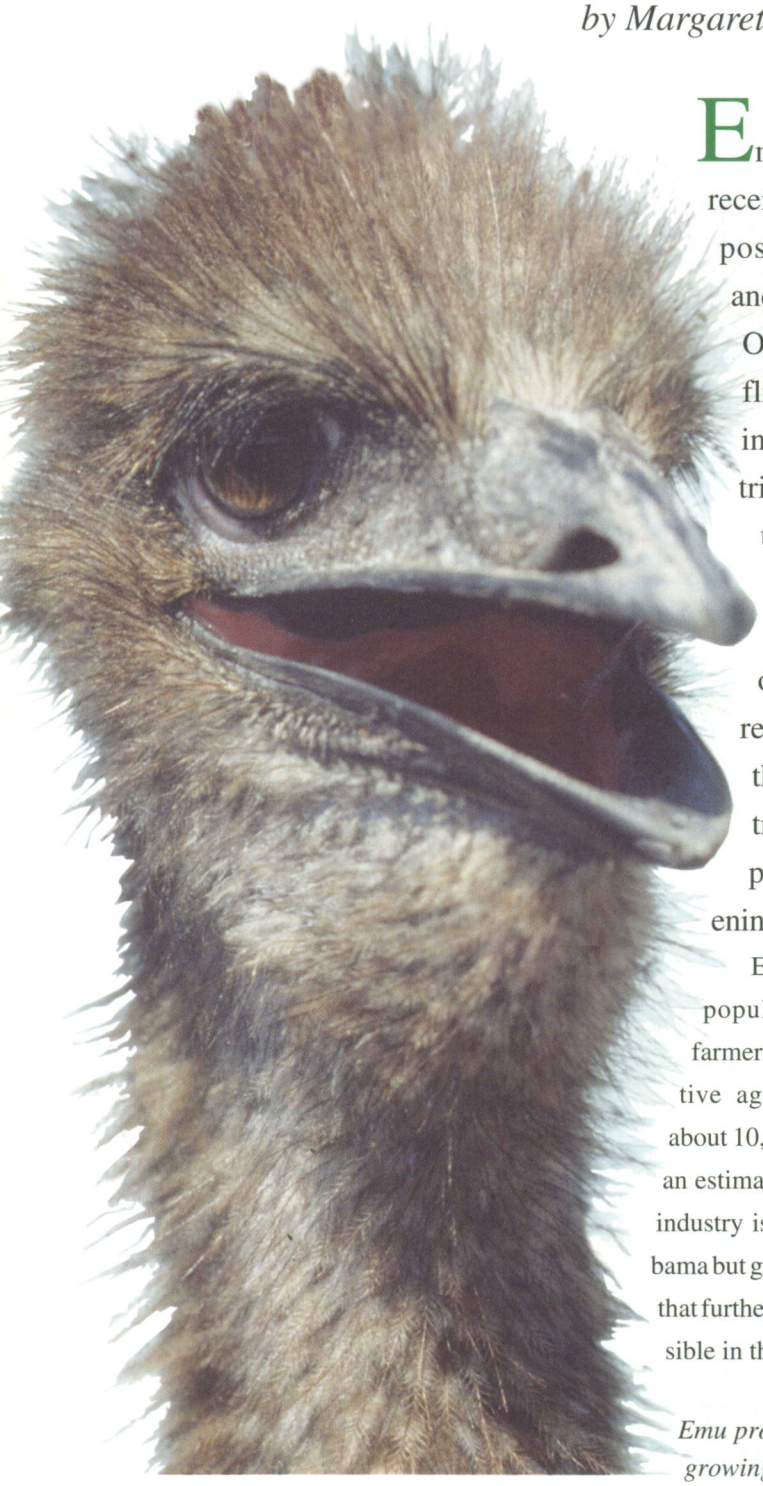
Figure 5. Percent Net Nonwhite Migration, 1980-1990

Howze and Dunkelberger are Professors of Agricultural Economics and Rural Sociology. Thompson is an ACES Data Analyst.

Unlocking the Emu Oil Myste

Findings Could Boost Alternative Agricul

by Margaret Craig-Schmidt, Amanda Brown, and Paul Smith



Emu production is a small but growing industry in Alabama.

Emu oil has recently received attention for its possible therapeutic and cosmetic benefits. Oil from the emu, a flightless bird second in size only to the ostrich, has long been used as a pain-relieving emollient by Australian Aborigines and is currently being used in the cosmetic industry for its reported protective and softening effects on the skin.

Emus are becoming popular livestock among farmers looking for alternative agriculture. Nationally, about 10,000 emu ranchers have an estimated 500,000 birds. The industry is in its infancy in Alabama but growing, and experts say that further emu production is feasible in the state. Greater understanding of the benefits of emu-related products could make the industry grow at an even faster rate.

It is not known exactly how emu oil exerts its beneficial effects. Because several fatty acids are known to have potent physiological effects, it is important to characterize the composition of emu oil. AAES researchers studied the fatty acid composition of emu oil and found information that helps explain the oil's properties and possible benefits.

Approximately 70% of the fatty acids in emu fat were found to be unsaturated, which is consistent with current recommendations for a "heart healthy" diet. The emu's meat, which tastes much like beef, is low in cholesterol and 97% fat-free. In addition, the Auburn study found emu oil to be high in a fatty acid that is known to help topical agents penetrate the skin.

Natural fat contains a mixture of three types of fatty acids — saturated, monounsaturated, and polyunsaturated. Saturated fat in the diet raises blood cholesterol. Unsaturated fats lower blood cholesterol levels, thus reducing one's risk for cardiovascular disease. Some polyunsaturated types are called "essential fatty acids" because they are necessary for good health but can only be obtained from dietary sources.

ry:
ure Industry

Oleic acid was found to be the major monounsaturated fatty acid in emu oil, comprising over 40% of total fatty acids. Oleic acid is known to enhance the transport of bioactive compounds into the skin, possibly explaining why emu oil is very penetrating. In a followup investigation, Auburn researchers are studying emu oil's ability to transport anti-inflammation drugs through the skin.

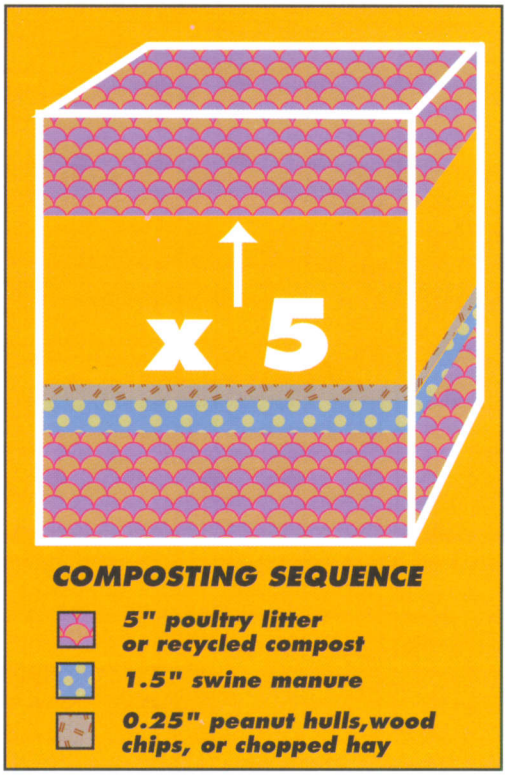
Linoleic acid, an essential fatty acid involved in the production of powerful hormone-like compounds required for normal body function, was found to be the primary polyunsaturated fatty acid in emu oil. Linoleic acid comprised 20% of total fatty acids.

Other unsaturated fats found were palmitoleic acid (less than 5%), linolenic acid (1-2%), and arachidonic acid (trace amounts). Major saturated fatty acids in emu oil were palmitic acid (20%) and stearic acid (8%). Ten samples from birds across the Southeast were analyzed by gas chromatography: eight of the samples were non-rendered, and two were rendered.

Craig-Schmidt is an Associate Professor and Brown is a Graduate Research Assistant in Nutrition and Food Science. Smith is a Professor of Pathobiology.

Composting Sweetens Smell of Swine Manure

by Tom McCaskey and Joe Little



A five-inch layer of poultry litter or recycled compost was used as the base, followed by a 1.5-inch layer of swine manure and a 0.25 inch layer of bulking agent. The sequence was repeated five times, and a five-inch layer of litter or compost was added to the top.

Swine manure can be put to valuable use as a fertilizer, but it can create noxious odors during land application and can contaminate water supplies if applied improperly. AAES research has shown that composting may help reduce these problems and enhance the usefulness of this byproduct.

Composting has been advocated to create a marketable resource, while minimizing landfill disposal of biodegradable wastes. This method is commonly used by poultry producers and others to turn organic wastes into relatively odorless, stable fertilizers that can be land applied with less impact on the environment or marketed to the public.

Composting degrades organic compounds and eliminates noxious odors. The humus material produced by the process is relatively inert and stable from further decomposition. Components of the compost, such as nitrogen, phosphorus, potassium, micronutrients, and fiber, make good fertilizer and soil amendments.

The swine manure composting study was conducted at the Lower Coastal Plain Substation in Camden. Four experimental compost bins, each with a 16.6-square-foot base, were constructed for composting 1,500 pounds of material. The compost recipes contained swine manure mixed with either poultry litter or recycled compost, along with peanut hulls, wood chips, or hay (Table 1, page 14). These ingredients provide a source of carbon to facilitate composting. The swine manure (19% dry matter) was collected from swine fed a finishing ration and reared on concrete.

A five-inch-thick layer of poultry litter or recycled compost was used as the base for

Continued on page 14

Table 1. Swine Manure Composted with Poultry Manure or Recycled Compost

Recipes	Initial mix			After two-stage composting			
	Ingredients SM/PL/CS[1]	C/N ratio	Moisture	Mass reduction	Volume reduction	Compost temperature	
						Max.	Days >122°F
			Pct.	*Pct.*	*Pct.*	*°F*	*°F*
With poultry manure							
A	1/1.4/0	9.3:1	46.6	20.4	15.6	128	13
B	1/1.6/0	8.6:1	43.6	18.5	14.0	137	14
C	1/1.5/.033[2]	9.1:1	43.4	16.9	17.5	134	17
D	1/1.6/.046[3]	8.2:1	43.1	15.2	17.7	134	9
With recycled compost							
	SM/RC/HA[4]						
E	1/1.6/.05	15.3:1	58.7	30.9	31.0	144	11
F	1/3.0/.10	12.1:1	52.4	28.1	23.9	145	21
G	1/4.5/.15	12.1:1	52.5	27.6	22.8	148	22
H	1/5.8/.20	13.8:1	50.3	24.6	21.9	149	22

[1]SM/PL/CS = swine manure/poultry litter/carbon source.
[2]Peanut hulls.
[3]Wood chips.
[4]SM/RC/HA = swine manure/recycled compost/hay.

each compost bin, followed by a 1.5-inch layer of swine manure, and about a 0.25-inch layer of bulking agent (peanut hulls, wood chips, or chopped hay). The sequence of layering ingredients was repeated five times, and a five-inch layer of poultry litter or recycled compost was added to the top. The temperature of the compost was monitored daily to ensure that it reached 122°F and remained there for at least five days. This heating is necessary to eliminate any enteric pathogenic bacteria.

After approximately 30 days, the bins were monitored for mass and volume reductions of the compost. Compost was removed from the bins, mixed to aerate the material, and returned to the bins to undergo a second 30-day composting process.

Compost recipes A-D used poultry litter as the principle bulking agent. Recipes E-H used recycled compost that was created after recipes A-D had undergone two-stage composting. Moisture levels of the mixtures before composting were near the ideal range of 45-55%.

Recipes with recycled compost had higher carbon to nitrogen (C/N) ratios which allowed recipes E-H to achieve higher temperatures. All recipes were adequate to achieve needed composting temperatures.

Recipes E-H also achieved greater mass and volume reductions, indicating better composting conditions. Composting is a degradation process, the success of which is indicated by reductions in mass and volume. However, the fertilizer value of the compost is reduced due to losses of nitrogen and other components. The value of compost for recipes E-H was about $8 per wet ton lower than the compost from recipes A-D.

Economic analysis indicates that swine manure compost is worth about $25-35 per wet ton based on its N-P-K content (Table 2). This compares favorably with composted dead chickens and poultry litter.

These results indicate that composting swine manure has potential in on-farm settings and may help pork producers reduce costs and quandaries associated with waste disposal.

McCaskey is a Professor of Animal and Dairy Sciences and Little is Superintendent of the Lower Coastal Plain Substation.

Table 2. Fertilizer Value of Swine Manure Compost and Other Agricultural By-products

Recipes	N[1] *Lb./ton*	P_2O_5[1] *Lb./ton*	K_2O[1] *Lb./ton*	Total N-P-K value[2]
Manure with poultry litter				
A	51.0	55.7	34.2	$32.73
B	53.0	61.9	38.3	35.35
C	56.1	62.5	35.8	36.02
D	55.3	59.2	36.5	35.14
Manure with recycled compost				
E	9.6	64.7	37.9	$23.35
F	14.2	68.0	41.2	25.94
G	17.3	68.5	41.8	27.05
H	24.3	73.6	43.9	30.57
Other byproducts				
Swine manure (19% dry matter)	8.8	15.6	7.0	$7.19
Poultry mortality compost (64% dry matter)	48.4	52.6	32.2	30.97
Poultry litter (81% dry matter)	64.4	57.8	44.8	38.64

[1]Pounds of the nutrient per wet ton.
[2]Values were calculated on a per-pound basis: N = 29 cents, P_2O_5 = 23 cents, and K_2O = 15 cents.

Fungi Affecting Alabama's Winter Wheat

by Chunguan Chen, Dan Collins, and Gareth Morgan-Jones

Root and crown diseases can be a major constraint to winter wheat production in Alabama, causing thin stands, reduced grain yields, and other problems. However, before farmers can protect their crops, they must first know exactly what organisms cause these diseases.

AAES researchers have conducted the first detailed survey of the distribution and prevalence of the pathogens that cause root and crown diseases in Alabama's winter wheat. Results from this survey will be used to plan future research on cultural and biological control of these diseases.

Root diseases can affect wheat at virtually any stage of plant growth and development. Root and crown diseases of wheat are caused by at least five different fungi, all of which live in the top four to six inches of soil. Diseases caused by these fungi typically cause death of roots, crowns, and other plant structures.

Plant samples were taken from 61 wheat fields in 19 Alabama counties during the spring and fall of 1993. Samples were taken from the seedling to the soft dough stages of growth. Roots and crowns were examined for disease.

Diseased tissue was cultured, and the fungal colonies growing from the diseased tissue were isolated and identified. All isolated fungi were tested to see if they caused disease in seedlings of Coker 9766 soft red winter wheat, a variety representative of the types of wheat

A total of 218 fungi were isolated and identified from diseased roots and crowns.

Continued on page 16

Fungi Affecting Alabama's Winter Wheat, continued

commonly grown in Alabama. A total of 218 fungi were isolated and identified from diseased roots and crowns; 196 (89%) caused disease in Coker 9766 seedlings.

Of the fungi identified, the most prevalent was *Gaeumannomyces graminis* var. *tritici (59 fungi, 27% of total)*, which causes take-all root rot. Wet soils during winter wheat production many have favored *G. graminis* var. *tritici*. Also, wheat is often double-cropped with soybeans, a cropping system that may maintain spores of the take-all fungus. However, rotation with oats or a winter legume can reduce the disease to minor status when wheat is grown again.

Forty-six fungi (21%) were *Cochliobolus sativus,* which causes common root rot. Sixty-one (28%) were *Fusarium* species, of which 43 (20%) were *Fusarium oxysporum.* Various Fusarium species are involved in the root rot complex of wheat. Although *F. oxysporum* was frequently isolated, it was not as virulent as *G. graminis* var. *tritici* or *C. sativus* and probably is not a major component of the root and crown rot complex of winter wheat in Alabama. The remaining 24% of the fungi were *Rhizoctonia solani, Sclerotium rolfsii,* and *Pythium* species.

The prevalence of fungi isolated from diseased root and crown tissue of wheat differed according to geographic locations in the state. In north Alabama *G. graminis* var. *tritici* was frequently associated with diseased tissue. *R. solani* was frequently found in north and central areas of the state. *Fusarium* spp. and *C. sativus* generally were found throughout the state.

Chen is a Graduate Research Assistant, Collins is an Assistant Professor and Morgan-Jones is a University Professor in Plant Pathology.

Two-Stage Feeding of Broiler Breeders: Good Egg or Bad Egg?

by Joe Hess and Roger Lien

Eggshell quality is vital in broiler breeder production because it maintains optimum hatchability, minimizes contamination of eggs during incubation, and ensures higher quality chicks. Shell quality generally declines as breeders age and temperatures increase, and poor shell quality causes excessive moisture loss during incubation.

In an effort to minimize this decline in shell quality in older hens, many breeder producers are adopting a two-stage feeding program

A researcher "candles" eggs at the Auburn University Poultry Research Center. Candling is a test of eggshell quality and chicken embryo viability, in which a light source is used to illuminate an egg's interior. AAES researchers found that two-stage feeding may not improve eggshell quality.

in which the second phase feed provides different levels of nutrients than the first. The problem is that these feeding programs are based on research conducted on Leghorn hens, which lay eggs for human consumption (table eggs). In table-egg layers, alterations in dietary nutrient levels have been shown to significantly increase eggshell thickness and control the normal increase in egg size that occurs as hens age, thus reducing the number of cracked eggs. No previous research had documented the effects of two-stage feeding on breeder hens. AAES researchers found that even at moderately high temperatures, such programs do not appreciably affect breeder egg size or eggshell quality.

Hens at the Auburn University poultry research farm were provided one of two feeding programs: (1) a standard breeder feed from 20 weeks of age until the end of the 65-week production cycle; and (2) the standard feed from 20-45 weeks and a specially formulated second feed from 45-65 weeks. The second feed contained more calcium (3.80 vs. 3.20%) but less protein (14.5 vs. 15.5%), methionine (.33 vs. .37%), and available phosphorus (.35 vs. .40%). Egg weight, shell quality, egg production, and body weight were monitored at five-week intervals from 45-65 weeks.

Unlike research with table-egg layers, few measurable differences in production were found in broiler breeders provided the two-stage program. Eggshell quality remained good in both treatments, and there were no differences in egg size (see table). Egg production declined with age, but neither feeding treatment affected production significantly from 45-65 weeks. However, body weights of hens fed the second feed increased at a faster rate from 50-65 weeks, perhaps because the lower protein and methionine levels allowed them to produce more fat. Egg production in this group also showed a slightly greater decreasing trend from 60-65 weeks.

Although temperatures were moderately high during the latter part of the trial, they were not extreme. It is possible that any positive effects of a second breeder feed may be manifested only during severe heat stress.

A lack of benefit from the two-stage programs may be explained by the fact that breeder hens exert less pressure on the systems that provide nutrients for egg production than do table-egg layers. Leghorns weigh 3.5-4 pounds, eat 100 grams of feed daily, and lay an average of 5.5 60-gram eggs weekly. Broiler breeders weigh 7-8 pounds, eat 150 grams of feed daily, and produce about four 65-gram eggs weekly. Leghorns can produce at this level for over a year, while breeders only produce for nine months. Therefore, breeders have greater body stores to meet nutrient needs, less time to deplete body stores, and greater feed intakes to provide nutrients.

One benefit that was realized during the trial was the cost savings of feeding a less expensive feed with no marked negative effects. It cost $3 per ton less for the 20-week period when the second feed was provided. However, these savings would be lost if total egg production dropped by more than one or two eggs per hen.

Eggshell Quality of Broiler Breeders Provided a One or Two-stage Feeding Program

Age, weeks	Specific gravity		Pct. shell		Egg wt. (Grams)		Body wt. (Lb.)		Egg production (Pct.)	
	one[1]	two[1]	one	two	one	two	one	two	one	two
45	1.0870	1.0876	9.08	9.26	65.0	64.4	8.06	8.10	62.4	62.7
50	1.0857	1.0860	9.02	8.84	66.3	66.0	8.77	8.87	53.5	51.8
55	1.0843	1.0854	9.07	9.39	66.6	67.2	8.86	9.19	44.2	44.4
60	1.0822	1.0832	8.50	8.87	67.7	67.0	9.20	9.54	47.8	46.7
65	1.0828	1.0827	8.73	8.75	67.0	66.3	9.30	9.76	47.8	41.8

[1]Numbers refer to one-stage or two-stage feeding programs. See descriptions in text.

Hess and Lien are Assistant Professors in Poultry Science.

Clean Orchard Floors Yield More

Keeping the floor of pecan orchards clean of weeds can increase the growth of young trees and result in higher yields, according to results of six years of AAES research.

South Alabama pecan grove with grassy floor.

The project, initiated in 1986 at the Gulf Coast Substation in Fairhope, was designed to determine the effects of weeds on growth and production of young pecan trees. Earlier research showed that controlling weeds increased the growth of newly planted pecans. That same trend can be seen in yields now that the trees are beginning to produce nuts.

Trees in this ongoing experiment were subjected to the following orchard floor management systems: (1) total chemical control of weeds and grasses; (2) mowing every two weeks; (3) monthly tillage by disking; (4) grass-only control using selective herbicides; and (5) no control. These systems were applied to drip irrigated and nonirrigated trees until irrigation was discontinued in 1993. All production inputs, including fertilization, disease, and insect control, were maintained for optimum growth and production.

Herbicides used for the total treatments included oryzalin (Surflan), norflurazon (Solicam), simazine (Princep), diuron (Direx), and glyphosate (Roundup). Oryzalin and sethoxydim (Poast) were used to maintain the grass-only treatments. These herbicides are registered for use in pecans and were used at labeled rates.

Weeds infesting the orchard included nutsedge, common bermudagrass, prickly sida, large crabgrass, horseweed, and cutleaf eveningprimrose. Trees in the study began to bear pecans in 1990 and have produced a crop each year since.

Pecan growth differences established in the early years of the study have been maintained up to 1993 (Table 1). Trees receiving the total treatment were larger than trees in three of the other four treatments. Disking produced growth equivalent to the total treatment but is not endorsed because of the possibility of causing erosion or the spread of crown gall disease. Irrigation increased overall growth slightly in all treatments. Fairhope averages about 65 inches of rainfall per year.

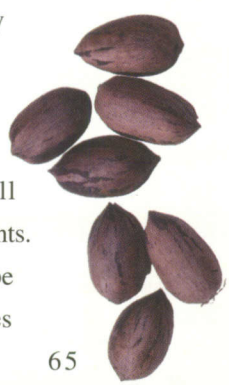


Table 1. Pecan Stem Diameter as Influenced by Weed Control and Irrigation in Bearing Trees[1]

Treatment	Year		
	1991	1992	1993
	In.	*In.*	*In.*
Irrigated			
Total	4.7	5.7	6.5
Disking	4.3	5.0	6.0
Mowing	3.4	4.4	5.3
Grass only	3.7	4.7	5.4
None	3.3	4.5	5.2
Avg. of irrigated	3.9	4.8	5.6
Nonirrigated			
Total	4.4	5.5	6.3
Disking	3.8	4.8	5.7
Mowing	3.1	3.8	4.9
Grass only	3.2	4.2	5.1
None	2.7	3.5	4.2
Avg. of nonirrigated	3.4	4.4	5.2

[1]Tree stem diameter measured in February each year from 1990-93.

Pecans

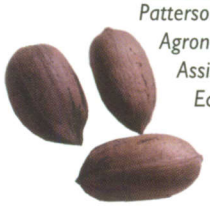
by Mike Patterson, Bob Goodman, Bill Goff, and Ronnie McDaniel

Trees in dryer areas may respond differently to irrigation and weed control.

Yields followed the same trend as tree growth. Trees receiving the total treatment produced more nuts than most other treatments (Table 2). Trees receiving the disking treatment produced yields equal to the total treatment but only when the trees were irrigated. Disking dries the soil, and if moisture is not replaced by irrigation or rainfall then yield is affected.

Yields from trees in the mowing and grass-only treatments were no better than trees in the no-control treatment. Cumulative yields over the four-year period show trees receiving the total orchard floor management system produced approximately four times as many nuts as trees receiving no control.

Assuming an average price of $1 per pound of pecans to the grower and a cost of $45 per acre annually for the total system, this management strategy would provide a return of approximately $7 per acre for each dollar spent on weed control.



Patterson is an Associate Professor of Agronomy and Soils; Goodman is an Assistant Professor of Agricultural Economics and Rural Sociology; Goff is a Professor of Horticulture; and McDaniel is Associate Superintendent of the Gulf Coast Substation.

Table 2. Pecan Yields As Influenced by Weed Control and Irrigation[1]

Treatment	Year				Cumulative[3]
	1990	1991	1992	1993[2]	
	Lb./a.	*Lb./a.*	*Lb./a.*	*Lb./a.*	*Lb./a.*
Irrigated					
Total	227	389	1,452	1,849	3,917
Disking	234	405	1,174	1,563	3,376
Mowing	10	51	384	906	1,350
Grass only	44	119	486	953	1,602
None	24	77	275	659	1,035
Avg. of irrigated	108	208	755	—	
Nonirrigated					
Total	281	255	1,329	1,790	3,655
Disking	84	144	680	1,102	2,010
Mowing	47	81	521	761	1,411
Grass only	103	67	355	975	1,498
None	44	37	247	575	902
Avg. of nonirrigated	111	117	625	—	

[1]Yields obtained in November each year.
[2]Irrigation treatments discontinued in 1993.
[3]Total of 1990 through 1993.

LOW-FAT GROUND BEEF: Good Food in Many Ways

by Jean Olds-Weese

Consumers demand foods lower in fat, salt, and sugar, and the food processing industry has responded with many new products, including low-fat ground beef. AAES research indicates that new low-fat ground beef products not only offer less fat, but also provide additional nutritional benefits.

Traditional ground beef may contain up to 27% fat, which translates to 313 calories in a four-ounce uncooked beef patty. Ground chuck, which must be no more than 20% fat, and ground round, with approximately 15% fat, were once the only leaner options for consumers. Now several new low-fat options exist, including AAES-developed AU Lean, which has 6-7% fat. A product similar to AU Lean — Ultra Lean — is being marketed by an Alabama grocery store chain. Ultra Lean contains approximately 10% fat.

AAES researchers have been evaluating the effect that lowering fat in ground beef products has on other nutritional elements, such as vitamins. One such study evaluated

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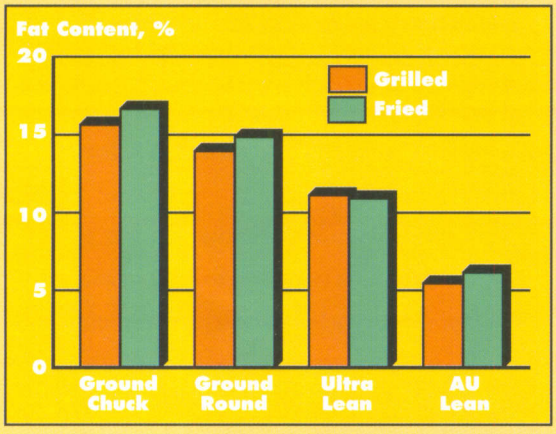
the vitamin B_6 content in traditional and lean ground beef.

Vitamin B_6 is essential in building tissue and utilizing energy in the body. The Recommended Dietary Allowance (RDA) for vitamin B_6 is two milligrams (mg) for men and 1.6 mg for women. The requirement for vitamin B_6 is linked to protein intake because the vitamin is required for the utilization of protein. On average, women's vitamin B_6 intake is typically less than the RDA, probably because they have lower protein intakes than men. Lean meats are the best dietary sources of vitamin B_6.

The study looked at B_6 content in ground chuck, ground round, AU Lean, and Ultra Lean. Three pounds of meat were divided into 10 four-ounce patties. Four of the patties were grilled on a charcoal grill, four were fried in an electric skillet, and two were left raw. Cooked patties were grilled or fried to an internal temperature of 165° F.

All samples were analyzed to determine their moisture, fat, protein, and ash contents. The results of the fat analysis are shown in Figure 1.

As expected, both AU Lean and Ultra Lean were lower in fat than the other ground beef samples. Ground chuck (15-16% fat) had the greatest fat content, while AU Lean had the least. Whether the patty was grilled or fried made little difference in fat content.



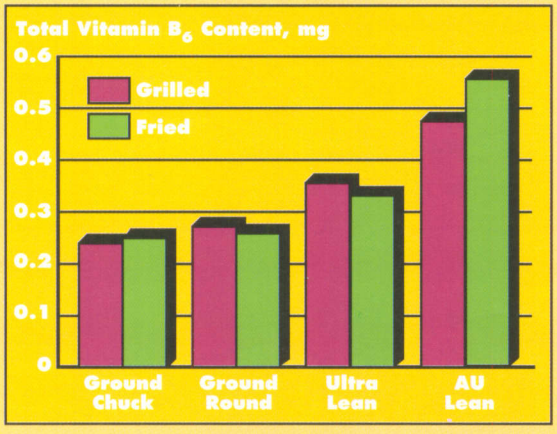


Figure 1. (top). Fat content of grilled and fried ground beef samples. Figure 2. Total vitamin B_6 content in grilled and fried meat samples.

In addition to having the lowest fat content, AU Lean was found to contain the greatest amount of vitamin B_6 — 0.56 mg per 100 grams (Figure 2). Theoretically, three AU Lean burgers would provide a woman with her RDA for vitamin B_6 and simultaneously allow for a significant reduction in fat intake.

Ground chuck (0.25 mg per 100 grams) contained less than half the vitamin B_6 of the AU Lean. Vitamin B_6 content of all four products was unaffected by cooking method.

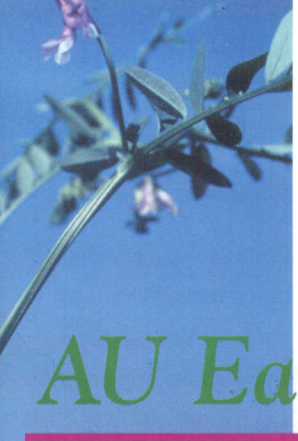
These results show that the availability of low-fat ground-beef products provides a twofold advantage for consumers — reduced fat intake and increased vitamin B_6 intake. Ongoing research is aimed at determining the amounts of other nutrients in these products.

Olds-Weese is an Assistant Professor of Nutrition and Food Science.

Hairy vetch, a winter annual legume, provides numerous soil and conservation benefits when used as a cover crop. Now, thanks to a new cultivar developed by the AAES and the USDA Soil Conservation Service (SCS), those benefits may be increased for Southern farmers.

Many farmers use hairy vetch to help conserve soil and water resources and also as an inexpensive source of nitrogen in conservation tillage systems. Unfortunately, most commercially available cultivars do not flower until late spring after many Southern farmers have had to turn or kill a cover crop in preparation for spring crops. Since vetch does not reach maximum dry matter yield until it is in full bloom, these farmers cannot reap full benefits from the legume.

The AAES and SCS have jointly developed AU EarlyCover, an early-flowering cultivar that could maximize the potential of hairy vetch in the South. AU EarlyCover was bred from hairy vetch plants collected in Henry County. Thirty-three plants were initially selected. The main selection criterion during the three cycles of selection was early flowering date. Other important criteria were vigor, pest resistance, and uniform morphological traits. Three lines, selected after progeny testing, were used to breed AU EarlyCover.



by Jorge Mosjidis, Charles Owsley, Malcolm Kirkland, Don Ball, and Kenneth Rogers

AU EarlyCover

A Full Benefit Cover Crop

Extensive testing for forage yield, maturity, canopy height, composition, and diseases of selected hairy vetch lines was conducted throughout Alabama (Winfield, Belle Mina, Marion Junction, Monroeville, and Tallassee) and in Americus, Ga. The three lines performed well in clipping trials at each of these locations.

AU EarlyCover appears to be an excellent cover crop because of its early growth (see Table 1). When this cultivar is harvested or incorporated into the soil as a green manure on or around April 1 (about the time when many Alabama farmers get ready to plant corn), it has a dry matter yield comparable or superior to the commercial- type hairy vetch (Table 2). By mid-February, when commercial hairy vetch has little accumulated growth, AU EarlyCover can have 150 to 200 pounds per acre of dry matter, therefore, it can be turned earlier than commercial hairy vetch.

Table 1. Canopy Height and Forage Yield (Dry Matter) of Vetches Harvested at Tallassee and Americus on Feb. 15, 1993

Cultivar	Tallassee		Americus	
	Canopy height	Yield	Canopy height	Yield
	In.	*Lb./a.*	*In.*	*Lb./a.*
AU EarlyCover	10.6	206.3	13.3	153.6
Commercial	5.5	11.6	3.9	48.2

AU EarlyCover is well adapted to the central and southern parts of Alabama and Georgia. The plants flower 23-36 days earlier than commercial hairy vetch (Table 3). Crude protein content of AU EarlyCover is about 27% (dry matter basis) on or near April 1.

AU EarlyCover also may be a better choice for forage purposes if farmers want to provide early grazing. It also can be a superior legume companion with small grain that is to be cut for silage or hay because its maturity (and thus the optimum harvest date) better matches that of the small grains.

Seed of AU EarlyCover should be available in limited quantities for the 1995 autumn planting season.

Table 3. Number of Days to 75% Bloom at Tallassee and Americus in 1992 and 1993[1]

Cultivar	Tallassee	Americus	Average
1992			
AU EarlyCover	46.4	32.3	39.0
Commercial	69.5	68.8	69.1
1993			
AU EarlyCover	42.3	32.5	36.7
Commercial	74.0	—[2]	74.0

[1]March 1 was the first day.
[2]Plots were lost.

Table 2. Forage Yield (Dry Matter) of AU EarlyCover and Commercial Hairy Vetch Harvested in Early April of 1992 and 1993

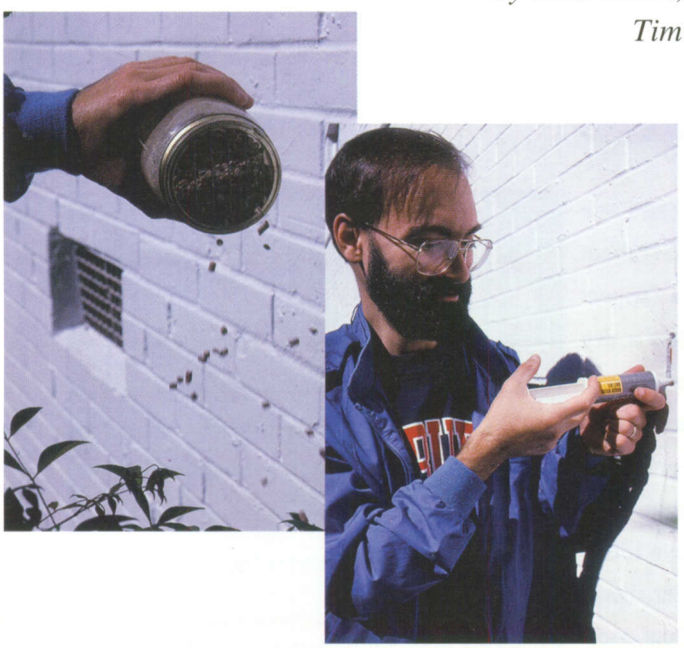
Cultivar	Tallassee	Americus	Winfield	Belle Mina	Marion Junction	Monroeville	Average
	Lb./a.	*Lb./a.*	*Lb./a.*	*Lb./a.*	*Lb./a.*	*Lb./a.*	*Lb./a.*
1992							
AU EarlyCover	808.2	1,288.0	581.9	1,560.4	1,338.6	3,071.1	1,455.6
Commercial	762.6	1,089.5	431.3	2,570.9	805.5	1,964.6	1,270.7
1993							
AU EarlyCover	910.0	1,118.0	—[1]	2,705.8	1,234.1	2,084.3	1,611.0
Commercial	604.6	721.5	—[1]	2,653.1	834.1	2,739.7	1,445.8

[1]Plants were killed by frost, except for the commercial type that was not killed, but was damaged.

Mosjidis is an Associate Professor of Agronomy and Soils; Owsley is Manager and Kirkland is Assistant Manager of the Americus Plant Materials Center, Soil Conservation Service, Americus, Ga.; Ball is a Professor of Agronomy and Soils; and Rogers is an Agronomist with the Soil Conservation Service, Auburn.

Controlling Cockroaches with Less Insecticide

by Lane Smith, Eric Benson, Art Appel, Tim Mack, and Gary Keever



Researcher applies insecticide and gel in an IPM treatment.

Smokybrown cockroaches are the most common cockroaches found around Alabama homes. Since this pest rarely breeds indoors, controlling them outdoors also reduces the number seen in the home.

AAES researchers have shown that an integrated pest management (IPM) program, which involves a series of outdoor tactics, can reduce pesticide use in cockroach control. In addition, newer, outdoor-applied insecticides, effective at lower application rates, may help reduce insecticide use even further.

In 1993, researchers examined smokybrown cockroach control with three insecticides applied at recommended rates in a 10-foot perimeter around homes. These included DURSBAN wettable powder (chlorpyrifos), SAGA wettable powder (tralomethrin), and K-OTHRIN suspension concentrate (deltamethrin). DURSBAN was the old standard, while SAGA and K-OTHRIN are new insecticides for cockroach control.

The effectiveness of these insecticides was compared to a no-management treatment and an IPM treatment. The IPM treatment combined two tactics. One was the application of a pelletized bait (GOLDSTAR ant-and-cockroach bait) containing 0.5% DURSBAN to pine straw, fallen leaves, or ivy within three feet of a home, and next to other suspected habitats, such as garden borders, large rocks, or aluminum sheds. The second tactic was a gel bait (MAXFORCE) containing 2% hydramethylnon, which was applied in sheltered crevices, such as porch corners, under ledges, cracks in bricks, in crawl space gratings, and under garage doors.

Cockroach population was measured weekly, before and after insecticide treatment, using 12 baited traps at each home. Researchers measured reduction in cockroach abundance, duration of reduction, and amount of insecticide applied at 24 homes.

All tested insecticides were effective, but K-OTHRIN (the least toxic, Table 1) reduced cockroach abundance 85%, and control lasted more than 40 days. SAGA and DURSBAN reduced abundance only 55%. SAGA lasted about 40 days. DURSBAN (the most toxic and highest rate) lasted only 20 days. The IPM treatment reduced cockroach abundance 90%, and the reduction lasted more than 40 days.

In 1994, AAES researchers tested SAGA as an IPM tactic. The insecticide was applied on the exterior of homes to cracks and crevices suspected of harboring cockroaches. Two doses of SAGA were tested: 0.04 or 0.013 ounce per gallon of water at each home.

These treatments were compared to a no-management treatment and two IPM treatments. The standard IPM treatment included, as in the previous year, pellet and gel baits. The second IPM treatment was

Table 1. Comparison of Labelled Application Rates Per House and Toxicities of Three Insecticides

Insecticide	Rate	Acute mammalian toxicity[1]
	Oz./house	*Oz.*
DURSBAN	3.1	0.35
SAGA	0.4	0.82
K-OTHRIN	0.2	>10.00

[1]Average lethal dose for a 150-pound person.

Table 2. Amount of Active Ingredient Used In Different Control Treatments, 1994

Treatment	SAGA	MAXFORCE	DURSBAN
	Oz.	*Oz.*	*Oz.*
SAGA	0.04	—	—
1/3 SAGA	0.013	—	—
Standard IPM	—	0.11	0.6
1/3 IPM	—	0.03	0.2

similar but used only one third of the insecticide (Table 2). By using two levels of insecticide for both SAGA and IPM, researchers tested whether current recommended insecticide treatments are excessive. Reduction in cockroach abundance, duration of reduction, and amount of insecticide applied at 32 homes were measured.

SAGA (0.04 ounce) reduced abundance approximately 90% for both concentrations, while reduction lasted longer than 47 days. The one-third SAGA treatment (0.013 ounce) reduced cockroaches only 75%, and the reduction lasted only 20 days. Both IPM treatments reduced abundance 90%, and reduction lasted longer than 47 days.

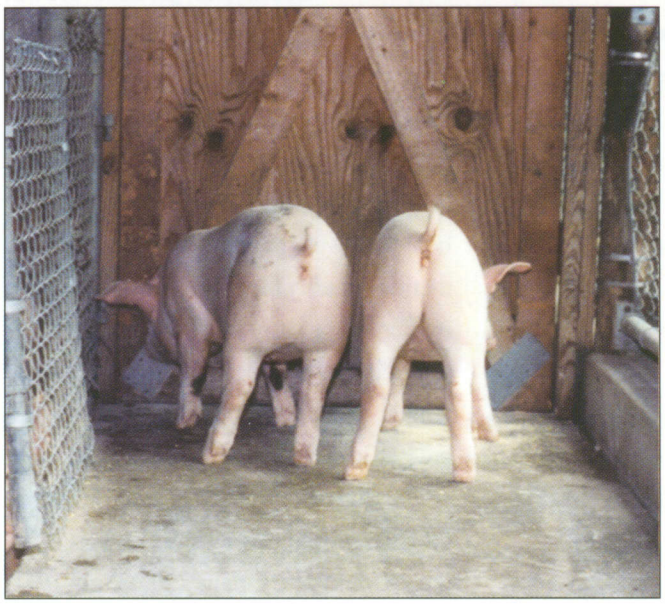
These results indicate that use of insecticides following IPM guidelines can reduce insecticide use 90% from recommended perimeter sprays. Reducing the amount of active ingredient of SAGA in a perimeter spray, 0.4 ounce to 0.04 ounce per house in accordance with IPM guidelines, does not decrease control. In fact, greater reductions were attained with SAGA in 1994 through IPM guidelines. The use of an insecticide like SAGA as an additional tactic in an IPM strategy decreases cockroach abundance and possibly lengthens the period of control. The additional amount of insecticide required for this additional tactic is extremely small, only 0.04 ounce per house (Table 2).

In addition, the amount of active ingredient of DURSBAN and MAXFORCE required for an IPM treatment, currently recommended as 0.71 ounce, can also be reduced to 0.23 ounce. The key to the success of the IPM strategy is in placement of insecticide where the cockroaches hide and feed, not in the amount of pesticide used.

Smith is a Post-Doctoral Fellow, Benson is former Assistant Professor, Appel is an Associate Professor, and Mack is a former Professor in Entomology. Keever is a Professor in Horticulture.

Hormonal Treatments May Muscle Up Swine Industry

by Don Mulvaney, Russ Kelley, Frank Owsley, Steve Jungst, Dwight Wolfe, Tom Powe, Benjy Mikel, and Hardin Rahe



The pig on the left represents progeny from pST-treated gilts, while the pig on the right represents progeny from gilts not treated with pST during gestation.

To meet consumer demand for lean pork products and compete with other lean meat options, the swine industry is continuously seeking new strategies for enhancing performance and carcass characteristics of hogs. AAES research indicates hormonal treatments may help meet that need and allow producers to generate leaner, more muscular pigs.

Since muscle is the largest component of meat, increasing muscle mass and reducing fat in pigs allows producers to offer a product that meets consumer demand. Researchers have found that these performance and carcass composition benefits can be gained when the growth hormone porcine somatotropin (pST) is administered to pregnant sows. In addition to improving efficiency of the pigs, this management strategy also enhanced productivity of the sows. This project was the first time pST was used in management scheme for early-gestating gilts.

Crossbred gilts were bred naturally to boars, and pregnancy was confirmed between

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Treatment-affected Traits at Three Stages: Embryonic, Feeder, and Market Weight[1]

INCREASED	DECREASED
Birth length (CRL)[2]	Embryo mortality[2]
Feeder loin eye area[3]	Feeder 10th rib fat[3]
Feeder length[3]	Market average backfat[4]
Market loin eye area[2]	Market 10th rib backfat[4]
Market loin weight[4]	
Market ham weights4	

[1]Feeder weight was 45 pounds. Market weight was 220 pounds.
[2]Observed in both studies.
[3]Observed in Year 1 study (0 or 6.8 µg/lb).
[4]Observed in Year 2 study (0, 6.8 µg/lb, or 13.6 µg/lb).

day 21 and 24 of gestation using ultrasound. All animals were allowed free choice consumption of a 16% crude protein gestation diet through day 21 of gestation and 6.6 pounds per day for the remainder of the trial. Gilts were injected twice daily with zero or 6.8 micrograms (µg) of pituitary-derived pST per pound of body weight during days 28-39 of gestation. In the study's second year, 13.6 µg of pST was injected, along with the original treatments. Data were collected during embryonic, feeder, and market weight phases.

Muscle growth and development is determined during embryonic growth by the number and size of cells dedicated to becoming muscle cells. Administering pST to gestating gilts altered the activity of specific genes involved in determining the number of muscle cells the pigs ultimately developed. Genes that produce growth factors within the uterus also were changed.

Examination at day 41 of gestation revealed pST treatment increased embryonic survival (87.9 vs. 77%). Higher embryo survival, possibly due to increased uterine capacity in the sow and/or enhanced immunological status of the progeny, resulted in larger litters of pigs. Crown rump length, a measure of growth, also was increased in the embryos of pST-treated sows.

Pigs from pST-treated gilts had increased crown rump lengths at birth (12.4 vs. 11.96 inches) and at 21 days (20.03 vs. 19.05 inches). No significant differences were observed in birth or 21-day weight as a result of pST treatment. However, there was a decreased incidence of birth weights less than 2.2 pounds. Carcasses of feeder (45-pound) and market-weight (220-pound) offspring from pST-treated gilts had longer sides and improved muscle traits (see table).

This research could lead to practical strategies for enhanced productivity in the swine industry. As the industry moves toward payment incentives for lean pigs, improved carcass composition could provide benefits of $3-5 per head. In addition, the use of pST on gestating sows is less labor-intensive than injecting or implanting each of the offspring. Another advantage is that meat values would be increased by decreasing the amount of fatty wastes in pigs. If approved by the Food and Drug Administration, the use of pST in swine production should benefit both producers and packers.

Mulvaney, Mikel, Owsley, and Rahe are Associate Professors; Kelley is a Research Specialist; and Jungst is a Research Associate in Animal and Dairy Sciences. Wolfe and Powe are Associate Professors in Large Animal Surgery and Medicine.

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