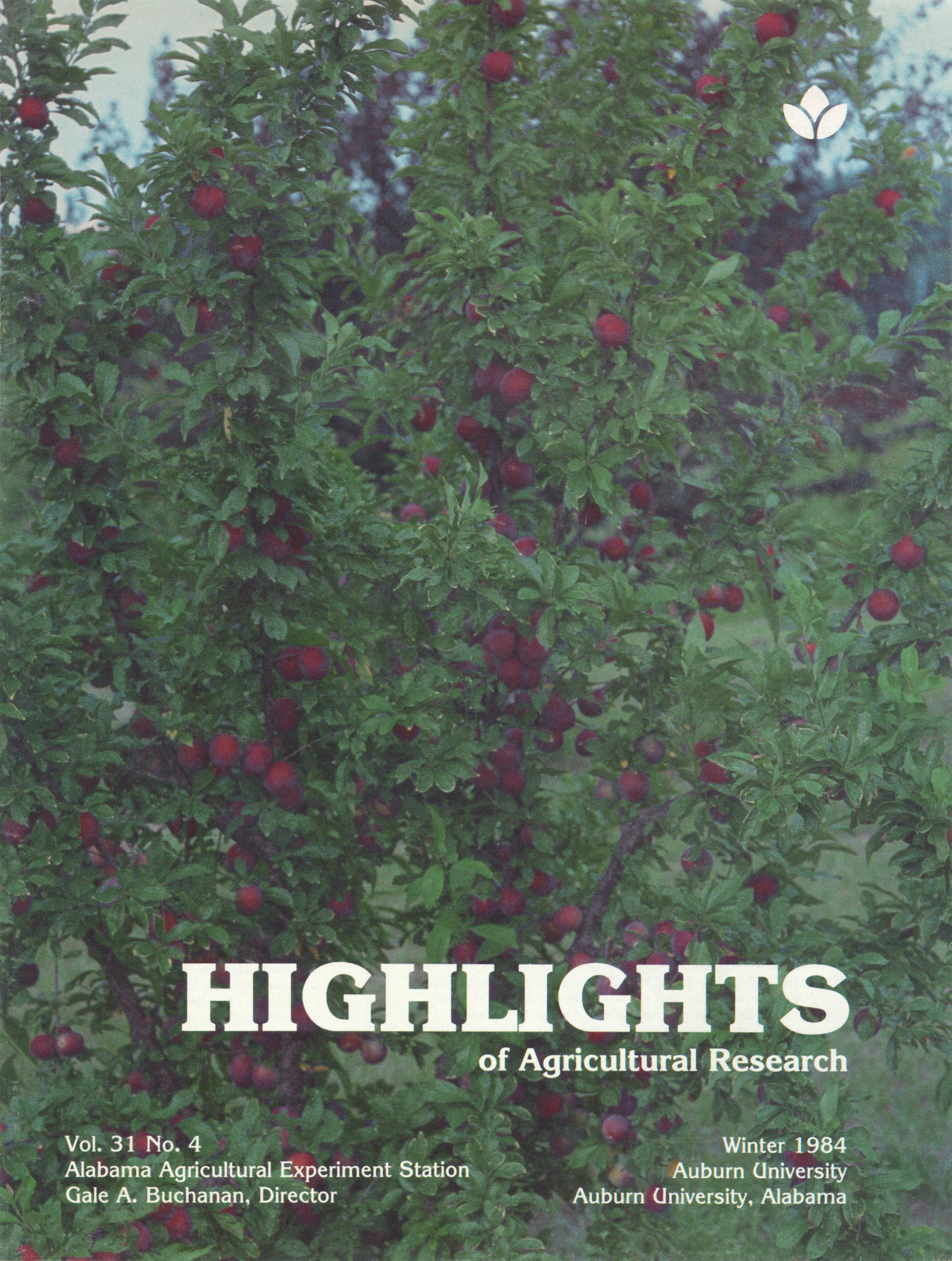


HIGHLIGHTS

of Agricultural Research

Vol. 31 No. 4
Alabama Agricultural Experiment Station
Gale A. Buchanan, Director

Winter 1984
Auburn University
Auburn University, Alabama

DIRECTOR'S COMMENTS

MOLECULAR GENETICS and biotechnology represent an emerging field of science that is creating great excitement among agricultural researchers and other scientists. In agriculture, such technology offers the possibility of tremendous advancements through rapid development of plants and animals tailored to precisely fit specific situations.

Although this promising area of basic research isn't likely to revolutionize agriculture and cannot be expected to solve all of mankind's problems, it does have the potential to make significant improvements in agriculture. There have already been enough successes to lend credence to the excitement shared by many regarding the potential of this emerging field of science.

Unfortunately, there is considerable opposition to some research in this field of science by people who perceive hidden dangers in genetic manipulation. This reaction is not new, however, since the unknown is often a source of concern or fear. We have been "messing with nature" in traditional livestock and plant breeding programs for years, and I suspect we can better predict the results from this new genetic manipulation than we could when using radiation breeding.

GALE A. BUCHANAN

Even the great Italian scientist Galileo had his research silenced during the latter portion of his career, because of skepticism of Aristotelian professors supported by powerful Dominican clergy. Fortunately, Galileo did not waste these years but used them to write and clarify his earlier research findings.

In more recent times there have been similar challenges to certain research efforts and the implementation of these findings. The introduction of the steel plow in the early 1800's caused quite a stir, with charges that the land would forever be poisoned by using such tillage contraptions. Since World War II, the use of pesticides has been embroiled in what appears to be a never-ending controversy. Although most of the dire predictions about pesticide use failed to materialize and most questions about the use of such chemicals have been satisfactorily answered, controversy continues. Similarly, molecular genetics and associated biotechnology have ushered in still different questions that must be answered.

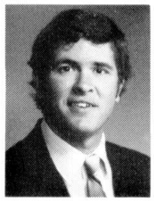
There is no denying that there are relevant and important questions about molecular genetics research that should be asked. The lay public, the legal profession, and special interest groups all have a right and responsibility to raise such questions and concerns. Scientists themselves have voiced concerns and have helped set stringent guidelines for laboratory experiments.

If this area of science is to make its maximum contribution in improving agriculture, it is imperative that we get on with the business of further establishing reasonable, sound, and workable guidelines for conducting research. It is just as important that we go one step further and develop effective and workable standards and criteria for the introduction of resulting concepts and discoveries into the marketplace. The time to do these things is now.

I remain firmly convinced that these things can be accomplished most effectively with scientists playing an integral role in working with various regulatory agencies and organizations. If we are to maintain our momentum in this exciting new field of science, we must create a favorable climate for research and an effective mechanism for the utilization of research findings which are sure to come.

may we introduce . . .

Dr. Jeff Pedersen, assistant professor of agronomy and soils. A native of Nebraska, Dr. Pedersen is a 1980 addition to the Alabama Agricultural Experiment Station staff.



Dr. Pedersen earned a B.S. degree in biology from Nebraska Wesleyan University. He also holds an M.S. degree and the Ph.D. from the University of Nebraska-Lincoln, specializing in plant breeding and genetics. While at Nebraska Wesleyan, Dr. Pedersen served as a teaching assistant in biology. He worked as a graduate research associate in plant breeding and genetics during his studies at the University of Nebraska-Lincoln. He is a member of Gamma Sigma Delta, Beta Beta Beta, and Sigma Xi professional honoraries.

At Auburn, Dr. Pedersen is working extensively on fescue breeding, and he also does research with other grasses. His report on comparison of three levels of fungus-infected Kentucky 31 tall fescue versus newly developed AU Triumph in this issue of Highlights indicates the new fungus-free variety will be a good forage source for area livestock producers.

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ON THE COVER. Performance of AU-Roadside plum, newly released variety from the Alabama Agricultural Experiment Station, is reported in the story on page 20.

Junior College Degree Benefits Rural Youth

J.E. DUNKELBERGER and N.C. WAKEFIELD, Agricultural Economics and Rural Sociology Research

ASSURANCE of a well-paying, satisfying job has typically been the motivation for many young people to seek high levels of formal education. Rural youth consider education to be a means by which they can obtain employment that offers good pay, responsibility, and a sense of personal control over work conditions. However, in the past, many youth have been at a disadvantage in competing for these kinds of jobs because the appropriate educational opportunities were not accessible to them in rural communities.

One response to the need for better rural secondary education was the creation of a network of junior and community colleges. These schools, offering two-year associate degrees, increased the availability of college training for rural youth and improved their possibilities for achieving a broader variety of psychologically and economically rewarding occupations.

A survey by Alabama Agricultural Experiment Station sociologists reveals a consistent payoff to young, rural adults who achieve junior college associate degrees. These benefits are realized by both males and females, blacks and whites, and nonmigrants and migrants.

The sample of rural youth described in this study included 964 survey respondents representing six Southern States: Alabama, Georgia, Louisiana, Mississippi, South Carolina, and Texas. These young adults were approximately 29 years of age in 1979, when the data were collected. Study participants were residents of rural and economically disadvantaged counties when in high school. Respondents completed questionnaires that focused on their educational and occupational experiences after high school. College graduates completing professional or graduate degree programs were excluded from this analysis.

The concept of job quality includes a variety of employment characteristics that make some work situations more satisfying than others. The five job quality dimensions studied include average monthly income, supervisory responsibility, and the perceived control that workers have over speed at which they work, timing of their work breaks, and the number of hours they work.

Junior or community college graduates attain better employment than do those with less education who complete either high school or vocational-technical programs. This overall relationship holds true regardless of race, sex, or migration status. However, the better employment situation of junior college graduates is only slightly better than that of young adults with less education.

Of the five job quality indicators considered, only the perceptions of having some control over work speed and timing of work breaks were better for junior college graduates than for high school graduates. None of the indicators was better for junior college graduates than for vocational school graduates.

On the other hand, college graduates had better quality employment on the five job quality indicators than did junior college graduates. However, the differences were minor except for monthly income, which was $217 higher for college graduates than for junior college graduates.

These results indicate that a junior college degree is an intermediate level of education with its own level of employment rewards. In other words, completion of a 2-year junior college program is a transitional attainment level between high school and college that results in identifiable and real job quality benefits to its graduates.

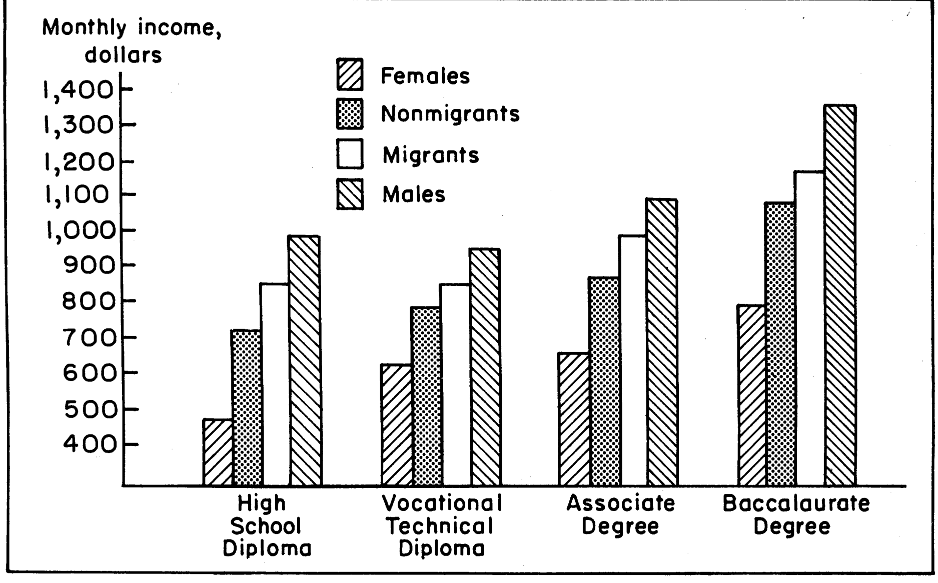
Further analysis indicated that males, at all levels of completed education, achieved better monthly incomes than did females, see graph. Similar differences existed for all indicators of job quality. Most likely, males achieve greater benefit from their education because of inherent societal values and norms than as a result of actual differences in work performance.

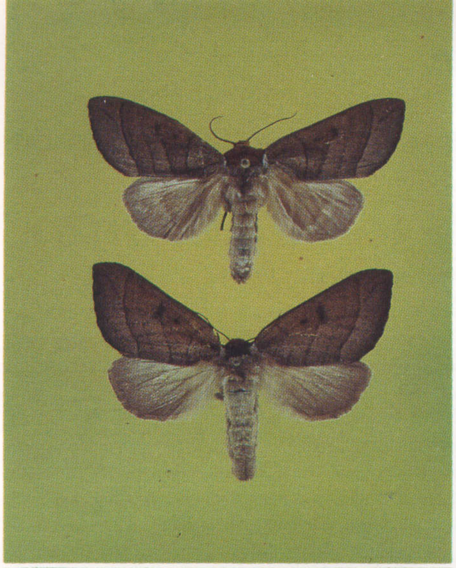
Race differences in job quality associated with different educational levels were not as marked as were those for males and females. Both blacks and whites experienced direct job quality benefits from their junior college degrees that were better than those of high school and vocational school graduates, but not as good as those of college graduates.

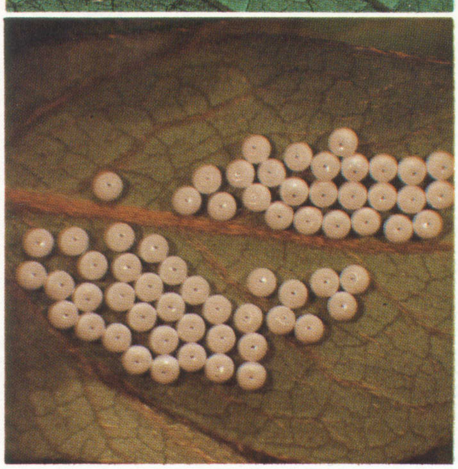
Migrant status refers to whether a young person raised in a rural area remains in the same rural environment or moves away as an adult, often to a city. The graph shows that out-migration does tend to produce some modest benefit to monthly income at all levels of education. Similar benefits were realized for the other job quality dimensions as well. When looking at junior college graduates specifically, there is a consistent pattern of positive benefits that accrue to these young adults regardless of whether they stay in their home area or migrate. Most important, however, is the fact that the local job market does recognize and reward local youth who complete this type of educational program.

Junior colleges provide a necessary and valuable service to youth living in rural areas by providing an opportunity to upgrade the quality of their adult employment beyond that achieved by those who attain less education. Junior and community colleges are accomplishing the important goal of improving the quality of the rural labor force, which in turn increases the opportunities for rural-reared youth to obtain better quality employment as adults.

Monthly income of young adults from rural areas with different educational attainments, by sex and migrant status, 1979.







AZALEA CATERPILLARS DAMAGE AZALEA FOLIAGE

M.L. WILLIAMS, G.L. MILLER, and B.J. SHEFFER
Zoology-Entomology Research

AZALEAS are among the most colorful of all flowering shrubs. Their showy blossoms and luscious dark-green foliage make them popular landscape plants in the South. Azaleas are plagued with a number of diseases and insect pests, but none is more obvious and alarming to the homeowner or nurseryman than the azalea caterpillar, *Datana major* (Grote and Robinson). This insect pest is such a ravenous foliage feeder that as few as 10 late-stage caterpillars may defoliate an entire plant.

In addition to feeding on azalea, its primary host, the azalea caterpillar has also been known to damage andromeda, apple, blueberry, and red oak. The azalea caterpillar is primarily a pest in the Southeastern States and occurs throughout Alabama. However, it has been recorded as far north as Maine and as far west as Arkansas.

Azalea caterpillars are not difficult to control if insecticides are applied at the right time. Yet there is controversy about the life cycle of the insect, a factor considered when determining the best time to spray. Therefore, basic biological studies are being conducted at the Alabama Agricultural Experiment Station in environmental chambers and in the field to follow the azalea caterpillar's life history. This will help determine the optimum time to apply sprays.

Adults of the azalea caterpillar are stout-bodied moths belonging to the family Notodontidae, commonly called prominents. They are dull grey to brown, medium-sized moths with inconspicuous lines on the forewings, figure 1. Their wingspan is about 1¾ in. The body and legs are very hairy, and this hair almost conceals the head. Adults, which do not damage plants, are nocturnal and are not often seen.

The larvae or caterpillars are the damaging stage of this pest, figure 2. Newly hatched larvae skeletonize the leaf; older larvae devour all except the leaf stalk. Complete branches or even an entire plant may be defoliated during summer and early fall.

Top to bottom: FIG. 1—*Datana major* adults, male (top) and female; FIG. 2—azalea caterpillars and damage to azaleas; FIG. 3—defensive posture; FIG. 4—eggs of *D. Major.*

Azalea caterpillars are gregarious feeders, and when disturbed, the entire group will arch their heads and tails and assume a U-shaped defensive posture, figure 3. First and second stage caterpillars will also sway back and forth in unison. Early stage caterpillars are red to brown with yellow or white stripes. The last stage caterpillar has a red head, legs, and tail, and a black body offset with longitudinal rows of yellow or white spots and sparse white hairs.

Researchers of the Alabama Experiment Station have concluded that the life history and habits of azalea caterpillar are similar to other *Datana* caterpillars. The female moth lays its eggs in clusters of up to 100, usually on the underside of a leaf. The eggs are spherical with a central dark spot, figure 4. Occasionally the female will deposit single eggs on the foliage or stem. Eggs hatch in about 5 days.

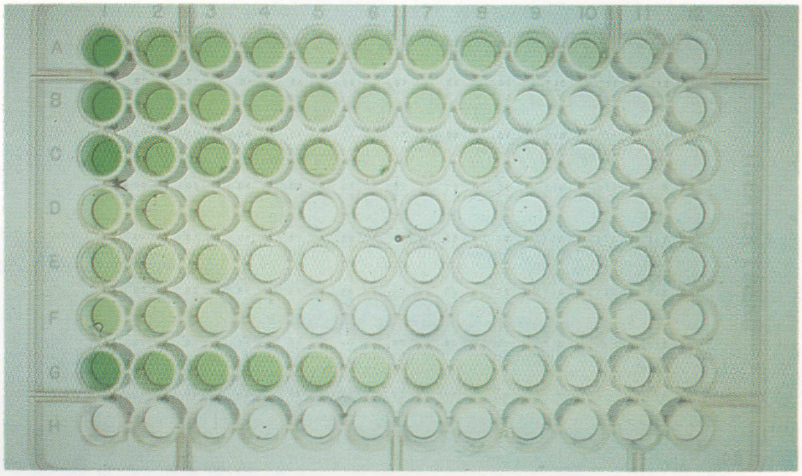
The caterpillars go through 5 stages before pupation, each stage lasting 5-10 days. The fully-fed, last-stage caterpillar will migrate from the host plant to the soil and form a pupal cell near the base of the plant. The caterpillar changes into a pupa within this cell. The insect overwinters as a pupa in the soil and emerges as an adult moth the following summer.

In south Alabama, adults will begin depositing eggs in late June and early July. Biological studies in the laboratory at controlled temperatures and field observations indicate that two generations may occur in Alabama. Lab cultured azalea caterpillars complete a generation in about 50 days.

Azalea caterpillar infestations tend to occur in the same locality year after year. Undoubtedly, this is because the insect tends to spend its entire life on or around the host plant upon which it became established. Registered insecticides such as Diazinon®, Orthene®, and Sevin® will provide effective control of azalea caterpillars. They may also be hand picked or, if still in the gregarious stages, the infested branch may be removed and destroyed along with the cluster of caterpillars.

Potential of the ELISA in Detecting Carriers of Swine Dysentery

G.R. WILT, R.B. REED, V. PANANGALA, and T.A. POWE, JR.
Animal Health Research and School of Veterinary Medicine



Color reaction in clear serum portion of blood identifies positive pigs in ELISA test; rows with low color reaction are pigs negative for the causative agent.

SWINE DYSENTERY is a severe disease of pigs which is characterized by a bloody diarrhea. Caused by a spirochete (*Treponema hyodysenteriae*), the disease is most frequently seen in 7- to 14-week-old pigs, but pigs of any age can be afflicted.

Pigs recovering from the disease become asymptomatic carriers (those that show no symptoms). Perhaps the most common way swine dysentery is introduced to a farm is through the unknowing purchase and stocking of asymptomatic carrier pigs.

Detection of asymptomatic carriers is difficult and at present cannot be reliably done. Studies at the Alabama Agricultural Experiment Station have shown that infected pigs can shed potentially infectious material up to 18 weeks beyond the time that clinical signs disappear. However, bacterial examination of these pigs resulted in recovery of the spirochete only 46% of the time. There are no serological agglutination or precipitation tests which can detect individual carrier pigs. The fluorescent antibody test available will work only on pigs actively shedding the *T. hyodysenteriae* spirochete in abnormally loose feces.

Now there is encouragement from Experiment Station results with a laboratory test that shows promise of being able to successfully identify carriers of the disease. The promising test is the enzyme-linked immunosorbent assay (ELISA), which is currently being used in diagnosis of both human and animal disease.

The ELISA owes its sensitivity to an enzyme (in these studies, a peroxidase) that is linked to an antibody (Ab) which is highly specific to what it attaches to. The Ab-peroxidase being used at Auburn binds to the antibody of the spirochete which pigs with a history of swine dysentery possess.

In testing, blood is collected from the pig's neck vein and the ELISA performed using the clear serum portion of the blood. Presence of the antibody to the disease-causing agent is determined by a positive color reaction.

In the Auburn trials, ELISA's were performed on sera collected from both experimentally and naturally infected pigs and noninfected controls. Results showed at least a 4-fold average difference in antibody presence between the infected and noninfected pigs.

A statistical procedure (discriminate analysis) was used to determine the percentage correctness of the classification of pigs as infected or noninfected, based on a single ELISA result determined any time from 2 weeks to 10 weeks after infection. In 314 observations to date, the ELISA gave a 78% correct classification of infected pigs and a 79% correct classification of noninfected pigs.

In the latest trial involving pigs from a naturally infected herd near Phenix City and noninfected control pigs, the ELISA correctly classified 94% of the infected pigs and 93% of the noninfected pigs.

Based on findings to date, the ELISA, with further refinement, has excellent potential for detecting asymptomatic carriers of swine dysentery.

SUCCESS OF IDENTIFYING PIGS AS INFECTED OR NONINFECTED BY ELISA

Pigs tested	Pct. classified correctly	
	Infected class	Uninfected class
	Pct.	*Pct.*
All pigs tested		
Infected	78	21
Noninfected ...	22	79
Phenix City herd		
Infected	94	7
Noninfected ...	6	93

Carriers of swine dysentery may not show symptoms of the disease, as exhibited by this affected animal.

COMPUTER MODEL IMPROVES EFFICIENCY AND PRODUCTIVITY OF SAWMILLS

H.F. CARINO
Forestry Research

A COMPUTER PROCEDURE developed at the Alabama Agricultural Experiment Station offers needed help for sawmill operations. The model evaluates profitability of a sawmill under current operations and offers guides for improvement in resource allocation, efficiency of converting log input to lumber yield, economic analysis, design and materials flow, and return on investment.

The computer model was developed in response to a need for enhancing the analytical procedure being used in sawmill improvement studies under the Sawmill Improvement Program (SIP). This program, a service project of the USDA Forest Service since 1973, is designed to extend the nation's timber supply by improving conversion efficiency in sawmills.

Scores of SIP projects have been done in Alabama in close coordination with the Alabama Forestry Commission. Current SIP studies are focusing on (1) current level of mill conversion efficiency, (2) potential increase in lumber recovery by improving log bucking practices, (3) potential increase in lumber recovery by reducing the green target size on the lumber, and (4) potential increase in lumber recovery by computer control of the sawing process.

Improvements in sawmill conversion efficiency from past SIP projects have led to either reduced log volume input for the same lumber production level or increased lumber output from the same amount of log input. The former results in reduced log costs per unit of output and hence more profit for the mill.

Boosting lumber output without increasing log input would logically be expected to ultimately lead to more profit from the mill. But this is not always true, primarily because of limiting factors in mill design and layout which restrict production. For instance, improvements in the head-sawing process may not result in increased volume production as expected because a processing station downstream may already be operating at capacity or the intervening surge deck may be too short to cope with a higher level of volume productivity.

Evidently an analysis of mill design and materials flow should also be considered in trying to determine attainable conversion efficiency or potential improvement that relates to increased lumber output from the same amount of log input. Furthermore, the economic desirability of implementing any process and facility design changes necessary for improving conversion efficiency should be considered, since this affects profitability.

From a sawmill owner's standpoint, maximization of profit or return on investment is the final criterion of operating efficiency, not simply maximization of conversion efficiency or lumber recovery, which current SIP analysis emphasizes. Maximum product yield and minimum operational delays are often consistent with minimum costs and maximum net returns, of course, but this cannot be assumed without evaluation of each specific case. This is where the Auburn computer model can provide a valuable service by enabling the SIP analyst to evaluate these four factors:

(1) Current mill conversion efficiency.

(2) Allocation of mill resources for maximizing net revenues.

(3) Improving conversion efficiency by dropping unprofitable size classes of sawlogs, improving log bucking practices, reducing sawing variations, reducing planing allowance, reducing oversizing, improving mill design or layout, or using computer control of the sawing process.

(4) Economic desirability of investment opportunities in relation to changes deemed necessary for attaining a higher level of conversion efficiency.

A case study of one mill where the computer model has been used provides evidence of how the system works. This sawmill currently processes logs with small-end diameter of 6 in. and up. However, it was determined that the mill would be economically better off by not processing logs with small-end diameter of less than 9 in., as shown in the table. Moreover, it was found that the mill could attain higher lumber recovery and thus realize higher net revenues if log overlength was eliminated through better bucking practices and if the overall milling conditions were modified to conform to industry norms.

Use of the computer model can make current SIP program efforts consistent with sawmill operators' primary objective of maximizing profitability.

POTENTIAL INCREASES IN REVENUE DUE TO IMPROVEMENT IN ATTAINABLE LUMBER RECOVERY FACTOR

Log input	Lumber recovery factor: Current milling conditions	Modified milling conditions	Percent improvement	Net revenue/ hour
6 in. minimum diameter				
With overlength	7.21			$1,385
Without overlength	7.39		2.6	1,409
With overlength		7.70	6.9	1,458
Without overlength		7.90	9.6	1,482
9 in. minimum diameter				
With overlength	9.14			1,819
Without overlength	9.35		2.3	1,841
With overlength		9.78	7.0	1,944
Without overlength		10.00	9.4	1,966

Composted Municipal Sewage Useful in Surface Mine Reclamation

E.S. LYLE, Forestry Research

DISPOSING OF CITY SEWAGE and reclaiming surface mines are unrelated problems that are of importance in Alabama. But results of Alabama Agricultural Experiment Station research indicate the possibility of a mutually advantageous connection between the two problems.

Research findings indicate that composted municipal sewage can be a satisfactory soil amendment for use in revegetating soils following surface mining operations. The sewage compost supplied needed plant nutrients so mineral fertilizer was not needed, and its organic matter content probably improved soil physical condition.

The Experiment Station project was begun because of the success that organizations, such as the City of Milwaukee, Wisconsin, have had with composting sewage and selling it as an organic fertilizer and because of the many surface mines near Birmingham that require reclamation. An experimental composting system was installed at one of Birmingham's sewage plants, and an acceptable compost was produced from sewage sludge and wood chips. The compost was trucked to a coal surface mine that had been regraded to an acceptable topography for revegetation.

Chemical analysis revealed that the compost contained 1.81% nitrogen, 0.01% phosphorus, and 0.079% potassium. The experiment compared different rates of the compost with the amounts of mineral fertilizer that would ordinarily be used for revegetation. Both vegetative growth and costs were compared for compost and fertilizer treatments.

Another factor considered in the study is whether topsoil will be placed on the mixture of rock and soil (called overburden) left over from the mining operation. Both compost and mineral fertilizer were applied to overburden and overburden plus topsoil (6 in. of A and/or B soil horizons placed on top of overburden).

Three tons of limestone per acre were applied to both overburden and topsoiled plots to reduce soil acidity. Three treatments were then applied to the overburden and topsoiled plots:

1. 400 lb. of 13-13-13 per acre
2. 30 tons of compost per acre
3. 70 tons of compost per acre

The soil additions were disked into the plots and a mixture of annual ryegrass, Kentucky 31 tall fescue, and crimson clover was seeded to all plots. Plots were then covered with a straw mulch.

No further soil amendments were applied, in accordance with Federal and State regulations that prohibit such additions until vegetative cover is evaluated after approximately five growing seasons. Because of these regulations, it is necessary to assure that an adequate vegetative stand is established quickly and maintains itself for the 5-year period.

As shown by data in the table, the compost treatments resulted in twice as much forage production as the fertilizer treatment (5.7 tons vs. 2.8 tons per acre). And the 30-ton compost rate was equal to the 70-ton rate.

The regulatory agencies are not especially concerned with forage production, but with the amount of soil covered by vegetation. In Alabama, the surface mine reclamation regulations state that 80% of the soil surface must be covered by vegetation. All plots receiving compost had enough soil cover to comply with reclamation regulations. Three of the six plots receiving mineral fertilizer did not have enough cover to comply. If all plots receiving mineral fertilizer had been evaluated for soil cover as a single unit, the result would have been a 72% cover.

The total cost of transporting and applying the compost at the rate of 30 tons per acre was approximately $270 per acre. This cost assumes that the compost itself is free. The total cost of purchasing, transporting, and applying 400 lb. of 13-13-13 was approximately $197 per acre. Thus, using the fertilizer would be $73 per acre cheaper than the use of compost. However, the plant nutrient value of the compost was about $90 greater than that of the fertilizer, and the compost plots produced an acceptable soil cover and the fertilizer plots did not.

Additional fertilizer could be added to the fertilizer plots during the second growing season to increase soil cover and forage yield, but this would mean that the regulatory agency would add another year to the time required to release the reclamation bond. The interest lost on the bond money by the mining company would more than compensate for any increased cost of using compost.

In addition to the plant growth benefits noted, use of the composted sewage will improve the physical and chemical properties of the soil by adding organic matter and reducing soil erosion from rainfall while utilizing a waste product in a beneficial manner instead of it being a disposal problem.

The negative aspects of using compost are costs associated with transporting the bulky material, equipment required to handle and spread the compost, extra time to apply compost in comparison with commercial fertilizer, and the possibility of toxic elements in the compost.

Results indicate that composted sewage can be used instead of mineral fertilizer to successfully establish a forage stand on coal surface mines and maintain it at least 2 years. Present information also indicates that the use of compost is economically feasible, but further investigation is needed to confirm this.

FORAGE YIELD AND GROUND COVER OBTAINED FROM MINERAL FERTILIZER AND COMPOSTED SEWAGE AFTER TWO GROWING SEASONS ON AN ALABAMA COAL SURFACE MINE

Soil material	Results, by treatment					
	400 lb. 13-13-13/acre		30 tons compost/acre		70 tons compost/acre	
	Yield/ acre	Ground cover	Yield/ acre	Ground cover	Yield/ acre	Ground cover
	Tons	*Pct.*	*Tons*	*Pct.*	*Tons*	*Pct.*
Topsoil	6.17	96	4.29	90	6.71	98
Topsoil	4.07	94	5.72	90	6.30	82
Topsoil	1.60	62	7.82	90	8.48	100
Overburden	.76	74	7.63	94	5.54	98
Overburden	3.30	80	5.53	92	5.68	100
Overburden	.72	28	3.19	92	1.85	94
Average	2.77	72	5.70	91	5.76	95

Planting Dates and Plant Populations Affect Grain Sorghum Production

W.C. JOHNSON, E.D. WILLIAMS, and J.T. TOUCHTON
Agronomy and Soils Research
J.T. EASON and M.E. RUF, Sand Mountain Substation

GRAIN SORGHUM has a lot of potential as an alternate grain crop for growing in Alabama. It fits well into diversified farming operations, including double-cropping systems, and has more tolerance to drought than other grain crops.

But grain sorghum does not have the latitude for a long planting season that many have attributed to it. Thus, farmers can expect to lose yield if planting is delayed past the optimum season.

Importance of planting at the correct time showed up in Alabama Agricultural Experiment Station research. The experiment was done at the Sand Mountain Substation, Crossville, during 1982 and 1983 to identify the planting periods and plant populations that give highest production.

The variety planted was Savanna 5, a full-season sorghum. Lime, phosphorus, and potassium applications were based on soil test recommendations. Split nitrogen applications—20 lb. N per acre at planting and 100 lb. per acre approximately 4 weeks after planting—were made.

Weeds were controlled with mechanical cultivation and a postemergence application of atrazine (1 qt. per acre). Insecticides used were Furadan® (1.5 lb. per acre) at planting and two applications of Lannate® (1 pt. per acre) during mid-bloom.

Optimum planting date for any crop varies with rainfall patterns during the growing season. Nevertheless, the yield data in table 1 strongly indicate that late April to early May is the best time to plant grain sorghum in the Sand Mountain area. Delaying planting to late May and early June resulted in yields of 10 and 46 bu. per acre less than from early plantings in 1982 and 1983, respectively. It is doubtful that yields obtained from the early July planting were economical in either year.

The 36-in. row widths used would probably favor the early planting. Row width research with soybeans has shown that narrow rows are not necessarily advantageous for early plantings, but boost yields of late plantings.

The April plantings had yields comparable to May plantings, but the April plantings did have poor germination and low seedling survival. Poor stands from April plantings were probably related to emergence. Days to emergence averaged 14, 8, 6, and 5 days, respectively, for the April, May, June, and July plantings. As the time span between planting and emergence decreases, the probability of obtaining adequate stands increases.

Yields did not vary as much among populations as expected in the comparisons among 30, 60, 90, and 120 thousand plants per acre. Although results varied among planting dates, data indicate that a population ranging between 60,000 and 90,000 plants per acre will be adequate regardless of planting date.

Stand establishment often ranges between 70% and 80% of the seeding rate. Therefore, use of 100,000 seed per acre for plantings made before early May or 80,000 seed per acre for later plantings will probably be adequate. Since size of sorghum seed varies widely among and within varieties, seeding rates should be based on actual seed drop and not pounds of seed per acre. Seeding rate guides for various row spacings are listed in table 2.

Based on the results reported, it can be said that (1) late April and early May are optimum planting dates for grain sorghum, and (2) plant populations of 60,000 to 90,000 plants per acre (80,000 to 100,000 seed per acre) are adequate for top yields.

TABLE 1. GRAIN SORGHUM YIELDS AS AFFECTED BY PLANTING DATE AND PLANT POPULATION, 1982 AND 1983

Plants per acre	Yield per acre by planting date			
	April 1	May 1	June 1	July 2
	Bu.	*Bu.*	*Bu.*	*Bu.*
1982				
30,000	93	91	92	45
60,000	96	103	98	56
90,000	91	103	85	48
120,000	--	104	84	49
	April 13	May 2	May 31	July 6
1983				
30,000	113	113	60	26
60,000	117	116	80	30
90,000	---	115	74	20
120,000	---	113	70	28

TABLE 2. INCHES BETWEEN SEED AND SEEDS PER FOOT OF ROW IN VARIOUS ROW SPACINGS FOR VARIOUS PLANT POPULATIONS

Seed/acre	Distance between seed, by row width				
	12 in.	18 in.	24 in.	30 in.	36 in.
	In.	*In.*	*In.*	*In.*	*In.*
60,000	8.7	5.8	4.4	3.5	2.9
80,000	6.5	4.4	3.3	2.6	2.2
100,000	5.2	3.5	2.6	2.1	1.7
120,000	4.4	2.9	2.2	1.7	1.5
	Seed/foot, by row width				
	12 in.	18 in.	24 in.	30 in.	36 in.
	No.	*No.*	*No.*	*No.*	*No.*
60,000	1.4	2.1	2.7	3.4	4.1
80,000	1.8	2.8	3.7	4.6	5.5
100,000	2.3	3.4	4.6	5.7	7.0
120,000	2.8	4.1	5.5	6.9	8.3

Protein Level Offers Savings in Broiler Breeder Development

W. ROBEY and G.R. McDANIEL, Poultry Science Research
C.D. SUTTON, Cooperative Extension Service

CAN FEED COST to the poultry industry be reduced without loss of performance? Yes, by reducing the level of dietary protein during the growing period, according to research at the Alabama Agricultural Experiment Station.

Feed accounts for approximately 60% of the total cost of poultry production, and protein is the most expensive nutrient. Therefore, reducing the level of dietary protein could mean substantial savings to the poultry industry, particularly to the broiler breeder industry.

Dwarf strains of broiler breeders are becoming more popular because of their size and feed and space efficiency. Because of this interest, a study was conducted at the Experiment Station to evaluate the protein requirement of dwarf broiler breeder females during the developmental phase (6-21 weeks), with emphasis on potential feed cost savings. Extensive research has been conducted to determine the nutrient requirements of commercial laying pullets during the developmental stage, but there have been only limited studies with broiler breeder pullets and even less research with dwarf breeder pullets.

The protein level of developer rations for normal breeder females in the poultry industry is approximately 14.0-15.4%. Breeders of dwarf lines recommend a protein level of 19% in their starter rations (0-8 weeks) and 16.5% in their developer rations (9-22 weeks).

For the study, day-old female ISA Vedette dwarf broiler breeder chicks were placed in 12 floor pens (86 chicks per pen, 0.99 sq. ft. per chick) in an environmentally controlled house. The chicks were full fed a standard starter ration (22.6% protein, 3,146 kcal/kg) for 3 weeks.

TABLE 1. PULLET BODY WEIGHT DURING THE DEVELOPMENT PERIOD, 6-21 WEEKS OF AGE

Protein level, pct.	Body weight, grams[1]		
	6 weeks	12 weeks	17 weeks
12	620	1,154	1,437
14	624	1,175	1,444
16	625	1,202	1,453
18	622	1,204	1,481

[1]454 grams = 1 lb.

At 3 weeks of age, one of four isocaloric developer rations (12, 14, 16, or 18% protein) was randomly assigned to each pen, resulting in three pens (258 birds) per treatment. Ration manipulations were done with corn, soybean meal, and rice mill feed to obtain the varying protein levels.

A representative sample of birds receiving the 16% protein ration on a restricted feeding program was weighed weekly. These weights were used to adjust feed to maintain pullet weights as suggested in the ISA breeder manual. The remaining groups (12, 14, and 18% protein feed) received the same quantity of feed as the 16% protein group. Individual body weights of all pullets were recorded at 6, 12, and 17 weeks of age.

Pullet body weights showed no differences among treatments at 6 weeks, table 1. Weights ranged from 1.37 lb. (12% protein ration) to 1.38 lb. (16% protein ration).

At 12 weeks of age, significant treatment differences were observed, with a positive relationship being exhibited between pullet body weight and level of dietary protein. Weights ranged from 2.54 lb. (12% protein) to 2.65 lb. (18% protein).

This same trend continued through 17 weeks of age, with body weights of 3.26 lb. for 18% protein, 3.18 lb. for 14% and 16% protein feed, and 3.16 lb. for 12% protein.

These results are similar to data obtained by other workers in which low levels of dietary protein during the developmental phase produced lighter weight pullets. It is important, however, that by week 17 these differences had largely disappeared. In fact, the difference in body weight between the 12% and 18% protein fed pullets was only 0.09 lb., or 3%, at 17 weeks of age. However, the difference in protein intake between these groups was 30% (0.01 lb. per day), tables 1 and 2.

Results of this test show that protein levels as low as 12% do not have a marked adverse effect on the developing pullet's body weight or on mortality rate. Therefore, feeding a low protein feed offers the opportunity for reducing the costs of growing pullets through the developmental stage.

TABLE 2. PROTEIN AND ENERGY CONSUMED FROM 1 TO 21 WEEKS OF AGE

Weeks of age[1]	Protein consumed/ bird/day, grams[2]				Energy consumed/ bird/day, kcal
	12%	14%	16%	18%	
3-7	5.2	6.0	6.9	7.8	122.0
8-13	7.1	8.3	9.5	10.7	166.8
14	9.5	11.0	12.6	14.2	222.3
15-17	9.8	11.4	13.1	14.7	230.2
18-21	10.9	12.7	14.5	16.3	255.9

[1]First and second weeks fed 23% protein starter (3,146 kcal/kg); weeks 3-21 fed developer ration.
[2]28 grams = 1 oz.

WILDFIRE IN FORESTS MAY HAVE SMALL ECONOMIC IMPACT

R.S. MELDAHL, S.D. SHNITZLER, and W.L. MILLS, Forestry Research

WILDFIRE in forest stands may cause less economic loss than is generally believed. While short-term effects of such fires may be negative, the long-term effect may actually be beneficial.

That was the finding in a recent Alabama Agricultural Experiment Station study of 17 highland loblolly pine plantations (16 in Alabama and 1 in Georgia). The study evaluated changes in both present and future volume production. No attempt was made to assess the impact of fire on nontimber resources, such as recreation, watershed, or wildlife.

The stands sampled ranged from 3 to 26 years of age on land that had site index values[1] of 40 to 50 and ranged in size from 3 to 88 acres. The areas had experienced one wildfire in the last 3 years and had not been replanted after the fire. There was no evidence of prescribed fires within the last 5 years.

The stands in the study covered a fairly wide range of conditions: DBH (diameter breast height), 1.67 to 9.48 in.; total stems per acre, 124 to 468; and basal area per acre, 4.2 to 141.6 sq. ft.

Randomly selected 1/20-acre plots were sampled at each location to determine (1) number of surviving trees, (2) number of trees killed by the fire, (3) DBH, (4) radial growth estimates, (5) total age of two dominant/codominant trees for site index calculation, (6) assessment of fire intensity, (7) estimate of initial tree spacing, and (8) number of competing stems.

The appraisal of fire damage was estimated for immediate (short-run) and long-term impact. The short-run was included to determine how much of the inventory was destroyed by the fire, while the long-run impact is important in making management decisions and assigning accurate dollar impacts.

Short-run economic impact is defined as any immediate loss that could be attributed to the fire. This represents the value of trees killed by the fire plus the value of any growth that was lost minus the value of any timber that could be salvaged.

The long-run economic impact was computed by taking the difference between the future value of an unburned plantation and the future value of the same plantation if it had been burned. This difference in value was then converted to present dollars (present net worth). The long-run for this study was assumed to be a final harvest at age 35.

The prediction of future volumes for burned and unburned plantations required the use of a loblolly pine plantation simulation model. The model selected allowed the direct input of a stand table as well as total basal area and number of trees. Thus, a wildfire's selective impact on a stand's structure could be specifically incorporated in the yield projection. All costs, such as taxes and management fees, were assumed to be constant between burned and unburned stands and were not included in the present value calculations.

Short-run economic impacts due to mortality and growth loss for pulpwood, sawtimber, and total stand are given in the table. In the short run, the majority of the impacts were negative (14 of the 17 sampled stands). Pulpwood class mortality, as expected, caused the largest negative dollar impact. In all but one stand, pulpwood growth impact was negligible. No sawtimber mortality was observed in any of the 17 stands surveyed. Sawtimber growth impact was positive in some cases and negative in others, but generally had little effect on the total short-run economic impact.

Long-run economic impacts were calculated using yield information from the simulation model and assuming stumpage prices of $14 per cord and $143 per thousand board feet (Scribner), with a 2% real annual rate of price increase. In general, most wildfires in this study increased sawtimber production and decreased pulpwood production, resulting in a positive economic impact in 11 of the 17 fires, see table. Three fires resulted in no impact and three fires yielded negative long-run economic impacts.

A close examination of the short- and long-run economic impacts of the 17 wildfire sites indicates an interesting trend. Only 3 of the stands have negative long-run impacts, while 12 stands have significant negative short-run impacts. In 8 of the 12 cases, the negative short-run impact is associated with a positive long-run impact. Therefore, management decisions concerning the future management of burned stands should not necessarily be based on short-run impacts. Wildfires which are not totally destructive appear to act as prescribed burns and thinnings from below, and their true impact may be positive.

The results of this study should be interpreted carefully. The wildfires included in the analysis were not selected randomly from all possible fires in loblolly pine plantations. Thus, the results should not be applied to all acres of loblolly pine plantations in all conditions. Also, wildfires on the sampled area occurred under current fire prevention and suppression levels. The impact of wildfire without this fire prevention and suppression activity might be much different. In similar stands, however, the analysis suggests that the present level of fire control may be sufficient to reduce most losses to acceptable levels.

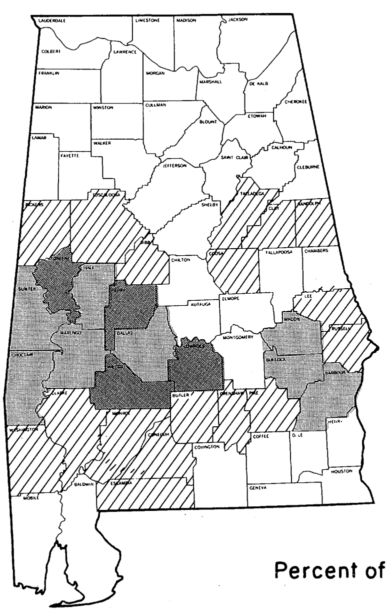
SHORT- AND LONG-RUN ECONOMIC IMPACT OF WILDFIRES IN SEVENTEEN LOBLOLLY PINE PLANTATIONS

Location of fire, county	Short-run effect/acre			Long-run effect/acre		
	Pulpwood	Sawtimber	Total stand	Pulpwood	Sawtimber	Total stand
	Dol.	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
Cherokee	-20.80	0.32	-20.48	- 8.51	13.40	4.89
Cherokee	- 3.52	0	- 3.52	-22.63	94.69	72.06
Cleburne	- 4.96	0	- 4.96	-14.78	- 6.05	- 20.83
Cleburne	- 8.87	- .22	- 9.09	- 9.99	49.28	39.29
Haralson[1]	- 9.84	- .25	-10.09	- 4.43	17.02	12.59
Cleburne	- .12	0	- .12	- 7.42	32.21	24.79
Cleburne	- .06	0	- .06	- 1.02	2.73	1.69
Shelby	-12.97	- .33	-12.97	- 9.80	22.92	13.22
Fayette	- .005	- .13	- .14	0	0	0
Fayette	1.30	0	1.30	- 4.49	17.30	12.81
Tuscaloosa	0	0	- .02	0	0	0
Tuscaloosa	-68.92	.03	-68.89	-52.80	178.92	126.12
Shelby	- 2.19	.09	- 2.10	- 9.30	- 19.10	- 28.41
Cleburne	- .08	.22	.14	- 1.88	3.75	1.87
Cleburne	2.56	8.94	11.50	- 3.03	20.69	17.66
Calhoun	0	- .70	- .70	8.20	- 49.98	- 41.78
Cleburne	- .006	0	- .01	0	0	0

[1]Georgia; all others Alabama.

[1]Site index values are the estimated average heights of dominant or dominant and codominant trees in a stand at age 25.

POVERTY in Alabama



Percent of 1980 population below poverty line

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JOBS and economic development continue to be widely shared objectives for most Alabama leaders and residents. The high levels of poverty found in certain parts of the State and our standing relative to the nation are evidence of the significant need for employment growth.

The U.S. poverty rate was 11.3% in 1979, compared to 18.9% for Alabama. Nationwide, 30.6% of the black population and 8.7% of the white population are below the poverty level. Data from the U.S. Bureau of Census show that in Alabama, 38.5% of the black population and 12.1% of the white population are below poverty level.

Researchers with the Alabama Agricultural Experiment Station found that people in north Alabama are better off than others in the State, partially because of the long-term TVA assistance that area has received and the large number of industries.

In contrast, the Black Belt counties Greene, Perry, Lowndes, and Wilcox have the highest poverty rates. Much of the rural black population is concentrated in this region, which offers little economic opportunity outside of agriculture and forestry, particularly for minorities.

Although black residents comprise only 24% of the State's population, there are more poor blacks than poor whites. The black poor outnumber the white poor in urban areas by nearly 84,000. In rural areas, however, the white poor outnumber the black poor by more than 50,000. In particular, the white farm population living below the poverty level is five times greater than the black rural farm poor.

The Alabama Experiment Station study shows that women are highly overrepresented among the poor in the State, outnumbering males by 106,000. Poor black females outnumber poor black males by 56,000, whereas poor white females outnumber poor white males by almost 50,000. Women with dependent children tend to have greater difficulty being employed. Women also outnumber men among the elderly, an age group where poverty rates tend to be higher.

In the working age population (16-64 years), whites below the poverty line slightly outnumber blacks. Among the elderly, poor whites outnumber poor blacks by nearly 26,000. Some of these differences can be attributed to the large number of now middle-aged and older blacks who left the State during the last several decades, as well as a longer life expectancy for whites.

The largest numerical difference between the black and white population below poverty level in the State is among youth under 16 years of age. Data from the U.S. Bureau of Census show that 46.9% of black youth are below poverty level, but only 13.3% of white youth fall into this category. This suggests that the over-representation of blacks below the poverty level may continue unless opportunities improve in the central city and rural locales where most of these individuals live.

Black poverty rates are generally three times those of the white population. When comparing black versus white poverty levels by place of residence, the smallest difference was among rural farm residents, followed by urban dwellers, then rural residents. Also worthy of attention are the high rates among black elderly and black youth, only a small portion of which participate in the labor force.

Alabama's poor are somewhat protected by a safety net of food stamps, minimal welfare payments, and social security benefits. Although these programs ensure some security for the poor, their level of living is far from that of the average working Alabamian. The poor include children, elderly, and handicapped, as well as a minority of able-bodied people. The latter may lack motivation, work habits, or skills, but a fundamental shortage of job opportunities that build experience and an achievement orientation is an obstacle to overcome in the long-term for the benefit of all Alabamians. Some of the future pain, misery, and lowered self-worth associated with poverty can be avoided by today's prudent efforts to improve education and increase employment opportunities for all.

TABLE 1. NUMBER AND PERCENT OF ALABAMA RESIDENTS BELOW OFFICIALLY DEFINED POVERTY LEVEL, BY RESIDENCE, GENDER, AGE, AND RACE, 1979[1]

Number in category	Number below poverty[2]	Percent below poverty
State total, 3,813,014	719,905	18.9
Black, 971,436	374,145	38.5
White, 2,818,578	341,060	12.1
Urban		
Black, 674,207	244,063	36.2
White, 1,570,803	160,222	10.2
Rural		
Black, 297,670	130,082	43.7
White, 1,238,616	180,838	14.6
Rural farm		
Black, 4,893	1,566	32.0
White, 82,060	8,871	10.7
Male		
Black, 448,500	158,913	35.4
White, 1,370,299	145,736	10.6
Female		
Black, 522,936	215,232	41.2
White, 1,448,279	195,324	13.5
Under 16		
Black, 318,758	149,397	46.9
White, 679,582	90,644	13.3
16-64		
Black, 631,229	201,741	32.0
White, 2,163,408	203,489	9.4
65 and over		
Black, 103,010	46,740	45.4
White, 317,607	72,592	22.9

[1]Source: United States Bureau of Census, Census of the Population: 1980. *General Social and Economic Characteristics, Alabama.*

[2]Poverty level, an economic threshold, is defined by a complex cost-of-living calculation ($7,412 for a family of four in 1979). The number of persons below the poverty level is the sum of the number of persons in families with incomes below the poverty level and the number of unrelated individuals with incomes below the poverty level.

Proper Processing of Animal Waste For Use in Livestock Feed

T.A. McCASKEY and C.M. HOWARD
Animal and Dairy Sciences Research

ANIMAL WASTE is a major renewable resource in Alabama. Traditionally it has been applied to land as a fertilizer, or sometimes merely to dispose of the waste. Another way to utilize this resource is to use the nutrients of waste as a feed ingredient for ruminant animals. Waste has nutritive value for ruminants because these animals are capable of utilizing non-protein nitrogen and fiber.

Broiler litter has been successfully used as a feed ingredient for cattle in Alabama for about 30 years. This practice has been widely adopted on beef cattle farms that are close to broiler farms. The broiler litter is generally deep-stacked for several weeks after its removal from the broiler house. This temporary storage permits the litter to generate temperatures of 160°F or higher, which render the litter free from potentially pathogenic microorganisms that might be present. Therefore, there have been no documented health problems associated with feeding broiler litter.

Another method of processing animal waste to ensure its safety from pathogenic microorganisms is fermentation. This can be accomplished by blending the waste with other feed ingredients to increase the level of fermentable carbohydrates and by adjusting the moisture content to about 40%. The blended mixture can then be ensiled, fermenting the carbohydrates to primarily lactic and acetic acids. The process both preserves the mixture and destroys any pathogenic organisms that might be present.

Since fermentation offers advantages, such as improved palatability and nutrient composition, the system has been tested in Alabama Agricultural Experiment Station research. The tests were done to determine fermentation effectiveness in rendering broiler litter safe from such pathogens as tubercule bacteria. Although there have been no problems from these mycobacteria in broiler litter and the disease has been reported less in recent years, this pathogen was used in the research because some species can cause tuberculosis in susceptible animal and human hosts. Therefore, there was interest in knowing if fermentation could effectively destroy such pathogens.

Earlier research at the Alabama Experiment Station had demonstrated that *Salmonella* and fecal coliform bacteria added to waste-blended rations at high levels are killed during the fermentation process. To further evaluate the effect of fermentation, the current studies used waste-blended rations that had been inoculated with mycobacteria. Nine cultures of mycobacteria were inoculated at varying levels into three rations formulated with either cow manure, poultry litter, or corn forage. All nine cultures were eliminated from the cow manure and corn forage silages after 5 days of ensiling, but all were still alive in the poultry litter silage after 15 days, see table.

EFFECT OF FERMENTATION ON SURVIVAL OF MYCOBACTERIA IN SILAGES

Days ensiled	pH	Mycobacteria recovered[1]	Lactic acid (dry matter)
		No.	*Pct.*
Corn silage (71% moisture)			
0	5.0	9	1.87
1	4.2	9	7.60
2	4.0	9	7.68
4	3.9	6	10.61
5	3.8	0	10.77
60% cow manure[2] (41% moisture)			
0	6.3	9	.79
1	4.7	9	2.26
2	4.5	9	2.42
4	4.1	4	2.98
5	4.1	0	3.33
55% poultry litter[3] (41% moisture)			
0	8.2	9	0
1	6.3	9	1.39
2	5.8	9	1.62
4	5.7	9	1.76
5	5.5	9	2.04
8	5.7	9	2.53
9	5.5	9	3.11
10	5.5	9	2.51
15	5.7	9	2.89

[1]Nine cultures inoculated into the feed mixtures.
[2]Silage contained in addition to cow manure 29% ground Coastal bermudagrass hay, 19% ground corn grain, and 1% limestone.
[3]The litter silage also contained 20% ground corn grain, 5% ground Coastal bermudagrass hay, and 5% cane molasses. Water was added to obtain 40% moisture in the mixture.

The acidity of the mixtures, as determined by pH measurements, increased with ensiling time and reached maximum acidity at 4 to 5 days. The cow manure and corn forage silages achieved acceptable pH values and lactic acid levels over 3.03% (dry basis), but the broiler litter silage failed to produce adequate acid characteristic of good quality silages. The apparent reason why broiler litter silage failed to produce adequate acid is its higher initial pH and its higher buffer capacity which resists pH change. The broiler litter ration prior to fermentation had a pH of 8.2 and required 7.5 times more lactic acid to lower the pH to 4 than the corn forage.

Although mycobacteria inoculated into the broiler litter silage were not killed, this does not mean that ensiled broiler litter is unsafe from mycobacteria. Broiler litter has a high pH and the ammonia evolved from litter under this condition is toxic to most microorganisms. However, the results do indicate that the practice of deep-stacking poultry litter for a period after it is removed from the poultry house is desirable even if the waste ration is to be ensiled.

Deep-stacked litter undergoes a spontaneous heating process reaching temperatures over 160°F. Pathogenic mycobacteria do not grow at temperatures over 80°F and they are killed at 145°F in a matter of minutes. Therefore, broiler litter that has been deep-stacked prior to ensiling should be safe from mycobacteria. Further processing of the deep-stacked litter by fermentation increases the acidity of the litter and aids its preservation.

Atrazine Resistance Investigated

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SELECTIVE HERBICIDES which eliminate weeds from crops have been a part of agricultural practice for more than 30 years. Atrazine, a triazine herbicide, is one of the most widely used of these selective herbicides for controlling broadleaf weeds in corn, sorghum, and other crops.

The first report of weed resistance to atrazine was in 1970, when common groundsel was not killed by atrazine even when it was applied at about 10 times the normally lethal concentration. Since that first report, atrazine resistance has been found in stands of a wide variety of other economically damaging weeds, including species of pigweed and foxtail, common lambsquarters, horseweed, and downy brome, in many different parts of the world. In North America, atrazine-resistant weeds are most common in the northern parts of the United States and Canada.

These resistant weeds have appeared only in areas which have been repeatedly treated with atrazine or one of the other triazine herbicides over a long period of time. To understand how plant populations have acquired atrazine resistance, and why scientists are currently excited about the information being gained from studying these resistant plants, we must first see why atrazine kills plants.

Plants grow by converting the radiant energy of light into the chemical energy of carbohydrates through the process of photosynthesis. This process takes place in small, green, oval-shaped bodies called chloroplasts, which are found in large numbers in cells of the leaf. During photosynthesis, light energy is absorbed by chlorophyll, the green pigment of chloroplasts. This sets in motion a series of events involving the movement of electrons along a chain of electron carrier molecules which are bound to special proteins built into the membranes of the chloroplast. One of the electron-accepting molecules which takes part in this chain reaction is a compound called a quinone which recognizes and binds to its own specific protein in the chloroplast membrane in much the same way that a key fits the shape and configuration of a lock. Atrazine, however, is also able to bind to this same protein and, when it does, it fills the space which would normally be occupied by the quinone molecule, the electron carrier chain is then broken, photosynthesis is halted, and the plant ultimately dies. In crop plants or other species that are not normally injured by atrazine, either the atrazine is not taken up by the plant or, if it is absorbed, it is broken down within the plant to a non-toxic compound before it has time to reach the chloroplasts and bind to the protein.

In atrazine-resistant plants, however, the explanation of resistance is different and much more interesting. In these plants, the chemical composition of the quinone-binding protein is slightly different. This slight change in chemical composition alters the protein structure such that the atrazine molecule no longer binds to the protein. However, the quinone is still able to bind to this changed protein and, hence, the electron transport chain continues to operate in these plants even in the presence of atrazine.

There is a biological price to pay for this modification. In these resistant plants, photosynthesis does not proceed quite as rapidly as it does in atrazine-sensitive plants and their growth rate is reduced. Plants with the modified protein occur at a low frequency in natural populations of the species, but, because they do not grow as rapidly as the plants with the susceptible protein, they tend to be outgrown by their neighbors and therefore lost due to competition. If atrazine is repeatedly applied to weed stands, however, the sensitive plants are killed. This allows the resistant plants a greater opportunity to grow, survive, and multiply until eventually a stand of atrazine-resistant plants is produced.

Photosynthesis is not limited to green plants, but is also carried out by certain bacteria. These photosynthetic bacteria are usually not obvious to the observer mainly due to their small size, but they are present in large numbers in both water and soil.

Work at the Alabama Agricultural Experiment Station has recently shown that photosynthesis in these organisms also is inhibited by atrazine. Furthermore, in these populations there are always a few individuals which apparently have a protein modification corresponding to the protein change found in green plant chloroplasts, making them resistant to atrazine. When grown in the presence of atrazine, the bacteria with the modified protein continue to divide while the others are killed, and cultures of these bacteria can be produced which show a high level of atrazine resistance.

The Auburn research also shows that photosynthetic bacteria isolated from areas which have received long-term and repeated applications of atrazine show a higher level of resistance to atrazine than is found for the same photosynthetic bacteria isolated from areas that have not been exposed to atrazine. This discovery indicates that precisely the same selection mechanisms that led to the establishment of stands of triazine-resistant weeds are operative at the microbial level.

This work is important because of the future possibilities opened up by these discoveries.

First, because of their rapid growth rates and the ease with which they can be handled, atrazine-resistant bacteria are an ideal model system for studying the basic chemistry of photosynthesis and hence plant growth.

Second, a clearer understanding of the relationship between the membrane receptor protein and the electron-carrying quinone could lead to information valuable in the design and production of more efficient herbicides.

Finally, the possibility exists that the genetic information in the bacterium which produced the protein change may be transferable by genetic-engineering techniques to the genetic information bank of a crop plant. If this should turn out to be possible, then with time we may see the production of crop species such as soybeans which contain this gene, and which could become atrazine resistant upon expression of the gene. Because of its potential benefits to agriculture, genetic information transfer will be a focus of continued research by the Alabama Agricultural Experiment Station.

In the photo at top of page, atrazine resistant weeds overgrew the corn at right where atrazine was the herbicide used; contrast with plot at left where a combination of herbicides controlled weeds.

Tall, Slow Maturing Cattle Show Advantages in Comparison

T.B. PATTERSON and S.P. SCHMIDT, Animal and Dairy Sciences Research
R.A. MOORE, Upper Coastal Plain Substation

SIZE OF BEEF CATTLE has undergone some rather drastic changes over the past 60 years. Initially, the change was from large, slow growing, slow maturing cattle to smaller, slower growing, and faster maturing cattle. Next came a period when emphasis was on selection for rate and efficiency of gain, which resulted in cattle becoming larger, faster growing, and slower maturing.

More recently, cattle breeders have selected for taller cattle, using frame score as the principal selection factor. Cattle from such selection programs are generally later maturing than previously selected types. Based on initial Alabama Agricultural Experiment Station research, the fast growing, later maturing types currently desired are what the commercial producer needs. These cattle grew faster to weaning and through finishing, without any disadvantage associated with rate of maturity.

The Experiment Station study was done to determine how selection for maturity patterns affects size, performance, and economic returns. Slow maturing and fast maturing cattle were selected from purebred herds of Angus and Charolais at Auburn to provide two test herds.

In the first stage of the study, eight Angus bulls representing differences between the two test herds were mated to Hereford cows at the Upper Coastal Plain Substation, Winfield, which had also been divided on the basis of rate of maturing. Data collected from these cows and their crossbred calves were birth weight and reproductive rate, growth rate and feed efficiency, carcass characteristics, and gross returns.

The Substation cow herd was managed as a single unit to minimize environmental differences. During the winter, the brood herd was fed corn silage and Coastal bermudagrass hay, along with having limited grazing on winter annuals with a protein supplement when needed. Spring and summer pastures consisted of dallisgrass-white clover and Coastal bermuda. Calves were not creep fed.

After weaning, all calves went directly into the feedlot. They were placed in pens on the basis of rate of maturing, sex of calf, and sire. They were full-fed a diet of 51% corn silage, 42% ground shelled corn, 5% soybean meal, and 2% supplement (containing minerals, vitamins, and Rumensin). Calves were marketed when average backfat was 0.4 to 0.5 in. Carcass data were obtained at a packing house by a USDA grader. Carcass value was obtained and adjusted to year and seasonal variation.

There was no difference in percent calf crop born or weaned attributable to rate of maturing. The overall calf crop was low (about 83% born and 80% weaned) from the straight-bred Hereford cows that were managed with only a 90-day breeding season. There was a difference in birth weight (64 lb. for the fast maturing group, 72 lb. for the slow maturing ones), but no calving problems were attributed to this weight difference.

Slow maturing calves, both steers and heifers, were heavier at weaning, see table. These calves continued to grow faster in the feedlot than faster maturing calves, resulting in slaughter weights 76 and 67 lb. greater, respectively, for steers and heifers of the slow maturing group.

Despite the difference in rate of gain, the two maturity groups showed no difference in number of days to reach the same degree of finish (187 days for both). Neither was there a difference in feed required per unit of gain (11 lb. per pound of gain). The lack of difference in feed efficiency was probably due to the extra feed required for maintaining the heavier, slow maturing calves. This extra maintenance offset the expected increase in feed efficiency associated with faster gains.

There were no differences in quality or yield grade between the two rate-of-maturing groups since all calves were marketed at about the same degree of finish as determined by backfat probe. Surprisingly, dressing percent tended to favor the slow maturing calves. Higher dressing percentages are normally reported for fatter cattle, but since fatness of the two groups was equal, the higher dressing percent would reflect the higher nonfat carcass weight of the slow maturing cattle.

Slow maturing calves had higher frame scores, 0.8 and 0.5 larger for steers and heifers, respectively. This average difference of 0.65 is reasonable since there was a difference of approximately 1 in frame score between both bulls and cows that produced these calves and heritability for this trait is estimated at about 0.6.

Frame score is correlated with rate of maturing and mature size, which resulted in heavier carcasses that produced a greater gross return. The difference was $66 and $50 for steer and heifer carcasses, respectively, in favor of slow maturing calves. Most of the difference was related to carcass weight, but some of the difference resulted from a higher price per hundredweight for the heavier carcasses. Had these calves been marketed at a plant that markets boxed beef exclusively, the discount for small carcasses (smaller than 600 lb. for steer carcasses and below 550 lb. for heifer carcasses) would have been much greater. This type pricing structure could have doubled the difference in return between slow and fast maturing cattle.

Since this experiment is in its early stages, the difference in maturity rates for the crossbred offspring was small. Even so, 75% of the fast maturing calves did not reach minimum weight for boxed beef when finish grade was reached, as compared to only 35% of the slow maturing calves.

PRE-WEANING AND POST-WEANING TRAITS OF SLOW MATURING AND FAST MATURING STEERS AND HEIFERS

Item	Steers		Heifers	
	Slow maturing	Fast maturing	Slow maturing	Fast maturing
No. of calves	49	51	52	39
Weaned wt. (205 day adj.), lb.	422.2	387.5	421.5	395.6
Feedlot av. daily gain, lb.	2.62	2.40	2.40	2.28
Final slaughter wt., lb.	1,030.1	954.1	950.9	883.6
Hot carcass wt., lb.	612.8	561.6	572.5	524.4
Dressing pct.	60.2	59.5	59.4	58.8
Quality grade[1]	11.7	11.6	11.3	11.4
Yield grade[2]	2.7	2.5	2.9	2.8
Final frame score[3]	3.9	3.1	3.9	3.4
Gross return per calf, $[4]	652.87	587.16	585.37	534.78

[1] 11 = high Good; 12 = low Choice.
[2] 5 = fat; 1 = lean.
[3] A difference of 2 in. in height at hip is equal to one frame score difference in both sexes.
[4] The average price received for different weights and grades which were adjusted for year and season of year.

Changing Fat Content of Diets Could Help Adolescent Females

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AMERICAN DIETS have changed greatly in recent years as people have become concerned about the relationship between diet and health. One of these changes has been in the composition of fat in the diet. The proportion of vegetable fat has increased considerably with the widespread use of salad and cooking oils, margarines, and shortenings.

Much of the research aimed at learning how different fats affect health has been done with animals. Therefore, information about fat consumption by specific groups of people is needed to identify any potential risks for people in different dietary groups. Adolescent females are considered to be a problem group with respect to diet, so nutrition research by the Alabama Agricultural Experiment Station has focused on this segment of the population. One of these studies is designed to provide information about fat consumption by adolescent females.

The majority of vegetable fat consumed today is chemically modified by partial hydrogenation, which converts the original oils to products with a desirable spreading consistency and reduced tendency to become rancid. These hydrogenation procedures result in the conversion of some of the natural unsaturated fatty acids (called *cis*) into a form called *trans*.

Some investigators have proposed that increased amounts of *trans*-fatty acids may adversely affect the health of Americans. This concern is based mainly on results of dietary studies with animals fed diets containing *trans*-fatty acids in amounts higher than is thought to be present in the American diet. Properties of *trans*-fatty acids tend to resemble saturated fatty acids rather than unsaturated fatty acids. Some of the studies suggest that *trans*-fatty acids might be related to elevated serum lipid levels.

Approximately 8% of the total fat consumed by the American public is believed to be *trans*-fatty acids. This estimate is based on the amount of hydrogenated fat being sold in the national market. Little is known, however, about the amount of *trans*-fatty acids in diets eaten by various groups. Thus, the present Experiment Station study investigated the fat consumption pattern of a group of adolescent females.

The study group consisted of eight adolescent girls, 12 to 15 years of age, from Lee County, Alabama. The subjects ate self-selected diets, kept daily diet records, and weighed all food items consumed for a week.

Subjects were instructed to prepare or purchase an extra portion of all food eaten during the 1-week period. These "duplicate portions" were collected daily for laboratory analysis. Caloric consumption, total fat intake, linoleic acid content, and the ratio of polyunsaturated to saturated fatty acids were calculated from the dietary records using nutrient composition tables. The diet collections were chemically analyzed in duplicate for *trans*-fatty acid content.

Average caloric intake of the eight adolescents varied from 1,086 to 1,735 calories per day, and the average total fat intake ranged from 32.7% to 40.4% of total calories, see table. This fat intake level is typical of American diets in general, but is slightly higher than recommendations such as the United States Dietary Goals.

Linoleic acid (an essential fatty acid and the primary polyunsaturated fatty acid in the diet) made up 3.64 to 8.25% of dietary energy in the diets of the adolescent girls. Three percent of energy in the form of linoleic acid is considered satisfactory to meet the essential fatty acid requirement for groups with relatively low fat intakes (below 25% of calories).

According to the Committee on Dietary Allowances, a diet with a fat intake at the level currently found in the United States should contain 8 to 10% of the total calories as essential fatty acids. However, it is also important to consider the ratio of polyunsaturated to saturated fatty acids in the diet. The ratio recommended by the Committee on Dietary Allowances and the U.S. Dietary Goals should approach, but not exceed, a value of one. The ratio found in the diets of the girls ranged from 0.32 to 0.65. Thus, a moderate increase in polyunsaturated fat in the diet might be advisable.

Laboratory analysis of the 7-day diet collections of each girl indicated that the average amount of total *trans*-fatty acids in the diet varied from 4.34 to 9.61% of total fatty acids, with an overall mean of 6.53%. The mean value for the amount of dietary *trans*-fatty acids found in this study was lower than the estimated value of 8% of total fat.

The Experiment Station study of Alabama adolescent females can be summarized by stating that their fat consumption was typical of American diets, but higher than recommended by the U.S. Dietary Goals. The linoleic acid content was sufficient to prevent essential fatty acid deficiency, but it and the ratio of polyunsaturated to saturated fatty acids were lower than recommended values. The amount of *trans*-fatty acids was lower than previous estimates. The data on the amount of *trans*-fatty acids actually being consumed by a specific group of people provide a valuable framework for evaluating the animal studies on the physiological effects of *trans*-fatty acids.

Although diets of these girls were typical of American diets, some adjustments to conform with the recommendations made by the Committee on Dietary Allowances and the U.S. Dietary Goals might be beneficial, especially with respect to long-range health status.

CALORIC AND FAT INTAKE OF EIGHT ADOLESCENT FEMALES OVER A 7-DAY PERIOD[1]

Subject number	Energy	Total fat	Linoleic acid	P/S ratio	*Trans*-fatty acids
	Cal.	*Pct. cal.*	*Pct. cal.*		*Pct. f.a.*
1	1,571	36.8	5.01	0.37	4.34
2	1,327	32.7	4.70	.40	6.83
3	1,568	37.1	5.06	.39	5.78
4	1,587	36.8	4.29	.32	9.61
5	1,086	32.7	3.64	.37	6.63
6	1,462	40.4	8.25	.65	4.74
7	1,735	34.0	5.92	.55	6.13
8	1,602	35.9	6.06	.50	8.10
Overall mean . .	1,489	35.8	5.37	.45	6.53

[1]Abbreviations: Cal. = calories; P/S = ratio of polyunsaturated to saturated fatty acids (g linoleic acid/g saturated fat); pct f.a. = percentage of total fatty acids. Each number represents the average of 7 days, except for the overall mean which is the average of 56 daily diets.

Beef Gains Higher on AU Triumph Tall Fescue than on Kentucky 31

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NUMEROUS REPORTS of the superior performance of cattle grazing fungus-free tall fescue compared to those grazing fescue heavily infected with the fungus have been made by the Alabama Agricultural Experiment Station. However, little is known about cattle performance when grazing tall fescue with intermediate levels of fungus infection.

At the same time the relationship between fescue toxicity and *A. coenophialum* was being researched, several new varieties of tall fescue, including AU Triumph, were being developed. Although the AU Triumph used in grazing studies is fungus free, previous reports compared it with Kentucky 31 which was fungus infected. Under these conditions, AU Triumph was certainly the superior variety. However, since sources of noninfected Kentucky 31 are now available, an unbiased comparison of AU Triumph and Kentucky 31 is necessary.

To determine the relative effects of intermediate levels of infection in Kentucky 31 and to compare AU Triumph to fungus-free Kentucky 31, a 3-year grazing trial was conducted at the Black Belt Substation beginning in the fall of 1980 and ending in June 1983. Crossbred steers weighing 500 lb. were assigned to 90% infected Kentucky 31, 28% infected Kentucky 31, noninfected Kentucky 31, and noninfected AU Triumph paddocks on approximately October 1 each fall. Nitrogen fertilizer was applied at 100 lb. per acre each September and February. All other fertilizers were applied according to soil test recommendations. Stocking rate was adjusted during the study period to keep forage availability the same among paddocks during the grazing season. During January and February, when sufficient forage was not available, the steers were fed a diet of hay plus corn-cottonseed meal supplement. They were removed from the paddocks on approximately June 1 each year.

THREE-YEAR AVERAGES OF STEERS GRAZING AU TRIUMPH AND KENTUCKY 31 TALL FESCUE AT THREE LEVELS OF *ACREMONIUM COENOPHIALUM* INFECTION

Cultivar	Infection	Stocking rate	Average daily gain	Gain per acre
	Pct.		*Lb.*	*Lb.*
AU Triumph	0	1.54	2.09	518
Kentucky 31	0	1.32	2.16	461
Kentucky 31	28	1.40	1.76	397
Kentucky 31	90	1.77	1.41	369

Highly infected Kentucky 31 had a higher carrying capacity than Kentucky 31 with lower *A. coenophialum* levels, see table. This suggests that intake on a per animal basis was lower on highly infected fescue. AU Triumph had a carrying capacity nearly as high as the 90% infected Kentucky 31. This was probably due to the better early spring yields of AU Triumph.

Both AU Triumph and fungus-free Kentucky 31 gave excellent average daily gains of over 2 lb. per day. The large decrease in average daily gain for the 90% infected Kentucky 31 and the intermediate average daily gain shown for the 28% infected Kentucky 31 agree with earlier reports.

The most important statistic, however, is the total beef gain per acre of pasture. AU Triumph, having both high stocking rates and high average daily gains, produced 12% more beef than did fungus-free Kentucky 31. Surprisingly, the 28% infected Kentucky 31 exhibited total beef production per acre as low as the 90% infected Kentucky 31. This is due to the relationship of average daily gain and stocking rates which were both low in this case.

Two new and important conclusions can be drawn from this study. First, in terms of beef production per acre, *A. coenophialum* infection levels as low as 28% are quite damaging. Production losses in this test were similar to those on the 90% infected tall fescue. Second, AU Triumph is truly a superior new variety for this area. Without the biasing effect of *A. coenophialum* in Kentucky 31, AU Triumph still outperformed this tried and proven cultivar.

These steers at Black Belt Substation are on AU Triumph fescue pastures, which produced 12% more beef than fungus-free Kentucky 31 variety.

Problems from Pesticide-Induced Foliar Phytotoxicity Investigated in Peanuts

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FOLIAR INJURY is a concern when applying pesticides to crops such as peanuts. Phytotoxic chemicals cause leaf yellowing and blight (tissue darkening) followed by premature defoliation, which are similar to symptoms of damage from drought or extreme heat.

Foliar phytotoxicity problems from a flowable formulation of the fungicide SuperTin® and an emulsifiable concentrate formulation of the insecticide/fungicide Lorsban® have occurred in recent years, resulting in these products being removed from the recommended list for peanuts. Lorsban (WP) wettable powder has been restored to the recommended list for use as an insecticide or fungicide. Du-ter®, a flowable or powdered formulation with the same active ingredient as SuperTin, is still recommended as a fungicide. Symptoms associated with the two pesticides are similar, and have been described as leaf or foliar burn because of the characteristic discoloration of treated leaves illustrated in the photograph. First symptoms are circular to irregular, reddish-orange brown blotches with or without spreading yellow margins, changing to tan or dark brown with time. Symptoms of foliar burn may be similar to lesions caused by leafspot fungi.

Because of the effectiveness of SuperTin and Lorsban for peanut pest control, the Alabama Agricultural Experiment Station began investigating the problem of phytotoxicity from the chemicals. The studies dealt with occurrence and severity of phytotoxicity and effects of different formulations, application rates, and timing of applications.

Phytotoxicity attributed to SuperTin or Lorsban varied in severity and appeared to occur randomly in the peanut growing areas of Alabama and Georgia in 1981-83. Occurrence of foliar burn indicated that the active ingredients of the pesticides penetrated the waxy cuticle of the peanut leaves to cause damage. Since cuticle development is affected by environmental conditions and by the age of leaves, experiments were conducted to determine if conditions during cuticle development may be responsible for the incidence of foliar phytotoxicity associated with these pesticides.

In peanut plots where light intensity was regulated with screens that allowed various degrees of sunlight to penetrate, SuperTin treatment caused phytotoxicity only under medium and heavy shading. Another significant finding was the severe level of phytotoxicity occurring in plots treated with Bravo® (a flowable fungicide) followed by SuperTin. Subsequent experiments showed that SuperTin-Bravo tank-mixes were highly phytotoxic. Plants sprayed with Bravo also remained sensitive to SuperTin treatment for up to 7 days after Bravo was applied.

Leaf yellowing and blight, followed by premature defoliation, are symptoms of pesticide phytotoxicity.

In the initial series of field experiments with Lorsban, five formulations[1] of chlorpyrifos (the active ingredient of Lorsban) were applied at 1X, 1.5X, and 2X the recommended field rates. Because of the results with Bravo already described, tank-mixed applications of the fungicide and insecticide were included in the test. The results illustrated the inherent phytotoxicity of chlorpyrifos, with the degree of foliar burn increasing with increasing application rates. EC formulations were significantly more phytotoxic than WP, and foliar burn was substantially more severe with tank-mixed applications of the insecticide with Bravo. The tank-mix effect was significantly more pronounced using EC formulations of chlorpyrifos.

Subsequent field experiments dealt with the effects of repeated chlorpyrifos applications and spray dilution (or gallonage) on the incidence and severity of foliar burn. In peanut plants treated with Lorsban (up to four applications) beginning at preflowering (PRE), flowering (FLO), pegging (PEG), or pod-fill (POD), there were no differences in the average levels of foliar burn among plants receiving 1, 2, 3, or 4 applications. This trend was consistent among chlorpyrifos formulations and among tank-mixed treatments.

Greater levels of phytotoxicity were observed during the early part of the 1983 season (PRE and FLO), probably because of environmental conditions rather than plant age. The early portion of the season was much wetter (higher humidity with more frequent rain) than the latter portion. Plants grown under these conditions would be expected to be more susceptible to Lorsban-induced burn since the leaf cuticle may be more hydrated and thus more permeable.

These results are consistent with data obtained in two environmentally controlled experiments. In the first, plants receiving a single application of Lorsban (EC or WP, alone or tank-mixed with Bravo) showed severe foliar burn only after PEG. In the second experiment, where plant water status was controlled, plants subjected to increasing levels of water stress had lower levels of foliar burn. This effect may also explain the greater levels of phytotoxicity observed in the first experiment, which was conducted during a much wetter growing season than among tests conducted in the subsequent drier growing season.

Plants treated with several chlorpyrifos formulations and tank-mixes in the spray gallonage test also showed more severe phytotoxicity during wetter periods. There were no differences in foliar burn, however, when Lorsban was applied in 5, 15, or 25 gal. of spray per acre.

In other experiments, the degree of phytotoxicity was found to vary among peanut varieties. Florunner was significantly more sensitive to Lorsban than Pronto, Spantif, and Florigiant varieties.

Defoliation due to disease is a major limiting factor in peanut pod production, but differences in yield from the field tests involving SuperTin or Lorsban could not be attributed to phytotoxicity. That peanuts can tolerate a certain level of defoliation without yield loss was shown in studies using mechanical defoliation. Therefore, a certain low level of pesticide-induced defoliation may be acceptable if pest control provided by the pesticides is sufficient to avoid high pest-induced defoliation.

Although the flowable formulation of SuperTin and emulsifiable concentrate formulation of Lorsban are no longer recommended for use in peanuts, these results indicate that their judicious application could provide economic pest control without severe phytotoxicity. However, environmental conditions at application time must be considered, and use of excessive rates and tank-mixing with incompatible pesticides, particularly emulsifiable concentrate with wettable powder or flowable formulations, should be avoided.

[1]Included three commercial—two emulsifiable concentrates (EC) and one wettable powder (WP)—and two experimental EC formulations.

CRITICAL YEAR FOR FARMERS

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A NATIONWIDE financial problem exists in agriculture, and Alabama's farm situation is no exception. Financial stress and liquidations have been increasing in the 1980's.

A major part of the problem had its roots in the latter part of the 1970's when inflation moved ahead rapidly. This sent signals to the marketplace, especially through growing export markets, to expand production. As has been true in the past with an expansion in production, the increase in production costs did not occur as fast as the increase in prices received. To expand production, farmers added to their land holdings and farm real estate values increased.

Research conducted by Alabama Agricultural Experiment Station economists, based on USDA data, shows that the average value of farm real estate in Alabama more than doubled from 1976 to 1982. Believing that markets would remain strong and that farm real estate values would continue to increase, lenders provided borrowers with funds for expansion based on increased equity in the farm.

By 1981, however, a number of countries experienced periods of economic recession and the dollar became stronger in foreign exchange markets. This made U.S. exports of agricultural products less competitive. Prices received by farmers decreased at the same time that prices paid by farmers continued to increase.

Adding to these problems were droughts in 1980 and 1983. Instability in yields in the last 5 years has added to the farm income problem.

The average yield of soybeans in Alabama varied from 15 bu. per acre in 1980 to 25 bu. in 1982. Cotton yields varied from an average of 409 lb. per acre in 1983 to 748 lb. per acre in 1982, while peanut yields ranged from 1,325 lb. per acre in 1980 to 2,950 lb. in 1982.

While production costs went up as a result of higher prices paid for the items farmers buy, profit margins narrowed. From 1979 to 1982, Alabama farmers incurred a 59% increase in total expenditures for seed and a 33% increase in depreciation on capital items. However, the expenditure that showed the greatest increase was interest on the farm mortgage debt. This item of expense increased 75% in the 3 years.

With the financial squeeze on farmers and the decline in inflation, the dollar value of farm real estate began to fall. In 1982 and 1983, it was difficult to tell just what the value of farm real estate was because the market was so weak. USDA figures indicated a decline in value of Alabama farm real estate of 8% from 1981 to 1984. Declines in other Southern States, such as Georgia and Mississippi, and in the Corn Belt have been more severe.

The decline in farm real estate values and the squeeze in profits resulting from higher costs and unfavorable prices received, together with some bad crop years, have put a number of farmers in a bad financial situation. It is estimated that 8-10% of Alabama's farmers are in serious trouble.

Alabama's gross farm income in 1982 was 179% more than in 1970, table 1. Gross farm income includes cash receipts from farm marketings, government payments, and other farm income. However, farm production expenses in 1982 were 186% more than in 1970. As a result, net farm income little more than doubled from 1970 to 1982. The highest net farm incomes since 1975 were in 1978 and 1979. It is significant that in 1982 it took $5.32 in gross farm income to equal $1.00 in net farm income; yet in 1978, it took only $3.46.

Total assets of Alabama farmers increased 176% from 1970 to 1983, table 2. Farm real estate is the major component of assets. Also included is the value of machinery and equipment, livestock, and inventories of feed, seed, and supplies.

Total debt, real estate and non-real estate, increased 269% from 1970 to 1983. As an average, Alabama farmers had $6.99 in assets for each $1.00 in debt in 1970, compared to a ratio of $5.23 in assets to each $1.00 in debt in 1983. The ratio of total debt to net farm income increased from $2.79:$1.00 in 1970 to $4.66:$1.00 in 1982. Since 1975, Alabama's total farm debt has been increasing about 15% per year, with only a small increase from 1982 to 1983.

This year will be a critical one for Alabama farmers. Some farmers are not likely to be able to repay accumulated debt and will stop farming. The challenge exists for Alabama farmers to become more competitive with other areas. Better financial management will no doubt be the key to survival for many farmers.

TABLE 1. FARM INCOME AND PRODUCTION EXPENSES IN ALABAMA

Year	Gross farm income	Farm prod. exp.	Net farm income	GFI / NFI[1]
	Mil.	*Mil.*	*Mil.*	*Ratio*
1970	$ 944	$ 720	$226	$4.18
1975	1,508	1,144	400	3.77
1976	1,809	1,284	448	4.04
1977	1,751	1,325	365	4.80
1978	2,110	1,466	609	3.46
1979	2,328	1,735	619	3.76
1980	2,234	1,878	347	6.44
1981	2,598	2,076	559	4.65
1982	2,641	2,059	496	5.32

[1]Gross farm income per $1.00 of net farm income.

TABLE 2. FARM ASSET AND DEBT SITUATION IN ALABAMA

Year	Total farm assets	Total debt	Assets/ $1 of debt	Net farm income	Debt/ NFI[1]
	Mil.	*Mil.*	*Ratio*	*Mil.*	*Ratio*
1970	$ 4,404	$ 630	$6.99	$226	$2.79
1975	7,509	1,062	7.07	400	2.66
1976	8,322	1,150	7.24	448	2.57
1977	8,630	1,255	6.88	366	3.43
1978	9,120	1,475	6.18	609	2.42
1979	9.190	1,611	5.70	619	2.60
1980	11,313	1,861	6.08	347	5.36
1981	12,576	2,107	5.97	559	3.77
1982	12,516	2,312	5.41	496	4.66
1983	12,161	2,326	5.23	---	---

[1]Total debt per $1.00 net farm income.

Coffee Senna Joins List of Important Cotton Weeds

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COFFEE SENNA has been observed in Alabama since 1884, but it has been considered a problem weed in cotton only in recent years. It joined the list of Alabama's 10 most troublesome weeds in cotton in 1979, and its infestation in the State's cotton reached 153,000 acres in 1983. The increasing occurrence of this weed (also known as stinking coffeeweed) might be attributed to the continued use of a limited number of herbicides that provide only marginal control.

Just how bad is coffee senna in cotton? It's a serious enough pest to cause sizeable yield reductions if present in large numbers at the wrong time. Each individual coffee senna plant per 25 ft. of row reduced seed cotton yield 40 lb. per acre in Alabama Agricultural Experiment Station tests at two locations. Significant yield losses resulted if coffee senna was allowed to compete longer than 2 weeks after cotton emergence. The good news is that 6-8 weeks of weed-free maintenance prevented any yield loss.

The Experiment Station study on coffee senna competitiveness was done during 1982-83 at the Prattville Experiment Field and Tennessee Valley Substation. Cotton was planted under conventional tillage methods in four-row plots of 25-ft. length. Annual grasses and small-seeded broadleaf weeds were controlled by preplant incorporated application of Prowl®, 0.75 lb. active ingredient per acre. Plots were also hoed to remove unwanted weeds. Thus, specific aspects of coffee senna could be measured.

Three aspects of coffee senna competition were evaluated: stand densities, competition periods, and weed-free periods.

Densities were established by planting coffee senna seed adjacent to the two center cotton rows of each cotton plot immediately after planting cotton. The weeds were thinned to densities of 0, 1, 2, 4, 8, 16, and 32 plants per 25 ft. of row—at equal intervals along the row—within a 2-week period after planting. Each density was then allowed to compete with the cotton for the entire growing season.

Seed cotton yields were reduced both years, the amount being determined by coffee senna densities, see table. Two-year average yield reductions ranged from 1% to 35% at the Prattville Field and 2% to 75% at the Tennessee Valley Substation as densities increased from 1 to 32 coffee senna plants per 25 ft. of row. Seed cotton yield reductions averaged 4% for a density of 2 coffee senna plants per 25 ft. of row.

When averaged over both locations and years, each individual coffee senna plant per 25 ft. of row resulted in a 40-lb.-per-acre loss of seed cotton. Results indicate that infestations of coffee senna at a density of 2 or more plants per 25 ft. of cotton row will cause significant seed cotton yield losses.

SEED COTTON YIELD AS INFLUENCED BY COFFEE SENNA

Coffee senna treatment	Seed cotton yield/acre: Prattville 1982	Prattville 1983	Prattville Av. reduction	Tenn. Valley 1982	Tenn. Valley 1983	Tenn. Valley Av. reduction	Total av. reduction
	Lb.	*Lb.*	*Pct.*	*Lb.*	*Lb.*	*Pct.*	*Pct.*
Density, plants/ 25 ft. of row							
0	2,246	1,547	0	3,536	928	0	0
1	2,213	1,539	1	3,431	912	2	2
2	2,181	1,530	2	3,326	896	5	4
4	2,116	1,514	4	3,117	863	9	6
8	1,986	1,481	8	2,698	800	19	14
16	1,725	1,415	16	1,861	672	37	26
32	1,041	1,283	35	186	418	75	55
Competition, weeks							
0	2,667	1,579	0	4,004	1,107	0	0
2	2,436	1,504	7	3,614	995	10	8
4	2,204	1,429	13	3,225	886	20	16
6	1,972	1,354	20	2,836	777	29	24
8	1,741	1,279	27	2,446	667	39	33
10	1,509	1,204	34	2,056	557	49	42
All season	1,046	1,054	47	1,278	339	69	58
Weed-free, weeks							
0	1,220	1,082	38	1,344	317	64	51
2	1,703	1,274	19	2,320	555	38	28
4	2,077	1,457	5	3,368	833	12	8
6	2,342	1,577	1	3,615	883	3	2
8	2,498	1,634	0	3,931	972	0	0
10	2,546	1,628	0	4,028	1,012	0	0
All season	2,315	1,427	0	3,558	940	0	0

Competition periods were established in the same manner as the densities, except plots were not thinned to a certain weed density. Each plot had approximately 12 coffee senna plants per foot of row. These plants were allowed to compete with the cotton for a specified time period and were then removed for the remainder of the season. Competition periods evaluated were 0, 2, 4, 6, 8, and 10 weeks and all season.

Each additional week of competition reduced seed cotton yield 0 to 47% at Prattville and 0 to 69% at the Tennessee Valley for periods from no competition to all season competition, see table. Competition for 2 weeks after cotton emergence resulted in a yield loss of 8% when averaged over both locations and years. Therefore, competition for longer than 2 weeks after cotton emergence could result in significant yield losses.

Weed-free periods of 0, 2, 4, 6, 8, and 10 weeks and all season were established in a similar manner. Plots were kept weed free for a specified time and then coffee senna seed were planted and allowed to grow with the cotton for the remainder of the growing season.

Results showed that maintaining cotton free of coffee senna for 6 weeks after emergence resulted in optimum seed cotton yields. Yield losses ranged from 38% to 0 at Prattville and 64% to 0 at Teneseee Valley for weed-free periods ranging from no weed-free time to all-season freedom, see table. When averaged over locations and years, however, only a 2% yield reduction was observed when cotton was maintained free of coffee senna for 6 weeks after emergence.

AU-Roadside Plum

An Excellent Quality Plum for Home Use and Local Marketing

J.D. NORTON and R.D. COSPER, Horticulture Research

TABLE 1. DISEASE RESISTANCE OF PLUM VARIETIES IN EXPERIMENTAL PLANTINGS AT AUBURN, CAMP HILL, CLANTON, CULLMAN, FAIRHOPE, AND HEADLAND

Variety	Disease index[1]					
	Bacterial fruit spot	Bacterial leaf spot	Bacterial canker	Black knot	Brown rot	Plum Leaf scald
AU-Producer	0	0	0	1	2	1
AU-Roadside	0	0	0	0	2	1
Bruce	0	0	0	0	4	4
Crimson	0	0	0	0	1	3
Homeside	0	0	1	1	3	1
Methley	3	5	5	5	3	4
Morris	1	2	2	5	2	2
Ozark Premier	0	1	1	1	3	4
Santa Rosa	5	5	5	0	3	5

[1]Disease index: 0 = 0, 1 = 1-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61-80%, 5 = 81-100% of fruit, leaves, and trees infected.

AU-ROADSIDE is a new plum variety developed by the Alabama Agricultural Experiment Station for growing in areas that receive 700 hours of chilling temperature below 45°F. AU-Roadside has proven its ability to produce high yields of excellent quality fruit. This new variety is superior to the Ozark Premier in yield, fruit quality, tree vigor, disease resistance, and tree longevity. Therefore, AU-Roadside is being released as a replacement for the Ozark Premier variety.

The new Auburn variety was selected from a cross between Ozark Premier and Methley varieties. The cross was made in 1965 and the seedling was tested as Ozark Premier F-2.

Trees of AU-Roadside are vigorous and spreading, with dark green leaves. The plant is self fruitful, flowers profusely, and sets a heavy crop.

AU-Roadside has resistance or tolerance to black knot, bacterial canker, bacterial fruit spot, and plum leaf scald, prevalent diseases of plums, table 1. Such resistance is particularly important in the Southeast where prevalence of these diseases and susceptibility of commercial varieties have discouraged plum production. The new variety inherited its resistance to bacterial and fungal diseases from the Ozark Premier parent, and its excellent fruit quality from both parents.

Fruits of AU-Roadside have dark red (currant red) skin and flesh. Fruit quality is excellent for fresh market, which makes the variety adaptable for home, roadside, and local markets. Fruits were rated acceptable in canned fruit tests. Maturity date is about 1 week before Ozark Premier.

The new variety has been in trials as Ozark Premier F-2 at several locations of the Alabama Agricultural Experiment Station system and in grower trials. It compares favorably with other varieties in yield. Production was highest in central and southeast Alabama, table 2. Average yields of marketable fruit per tree were 107 lb. and 166 lb., respectively, from 4- and 5-year-old trees.

Tree vigor and tolerance to plum leaf scald are the primary advantages of AU-Roadside over Ozark Premier. AU-Roadside trees are vigorous and show only traces of plum leaf scald, whereas Ozark Premier trees grow much slower and are highly susceptible to plum leaf scald. Tree vigor is a primary selective criterion in the Southeast, and the relationship of plum leaf scald to phony peach makes resistance important.

Ripening date, growing season, and skin color at maturity may be taken collectively as another important advantage of AU-Roadside. AU-Roadside ripens 9 days earlier, has a shorter growing season by 7 days, and is more fully colored at any comparable stage of maturity than Ozark Premier.

AU-Roadside trees should be available from wholesale and retail nurseries for planting in the winter of 1984-85.

TABLE 2. YIELD OF FRUIT OF AU-ROADSIDE AT AUBURN, CAMP HILL, HEADLAND, AND THORSBY, 1976 TO 1982[1]

Year	Fruit yield per tree			
	Auburn	Camp Hill	Headland	Thorsby
	Lb.	*Lb.*	*Lb.*	*Lb.*
3	47	9	43	23
4	107	8	23	24
5	166	26	158	27
6	149	88	149	85
7	115	0	106	68

[1]Yield = pounds of fruit per tree, one tree per plot and six replications.

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