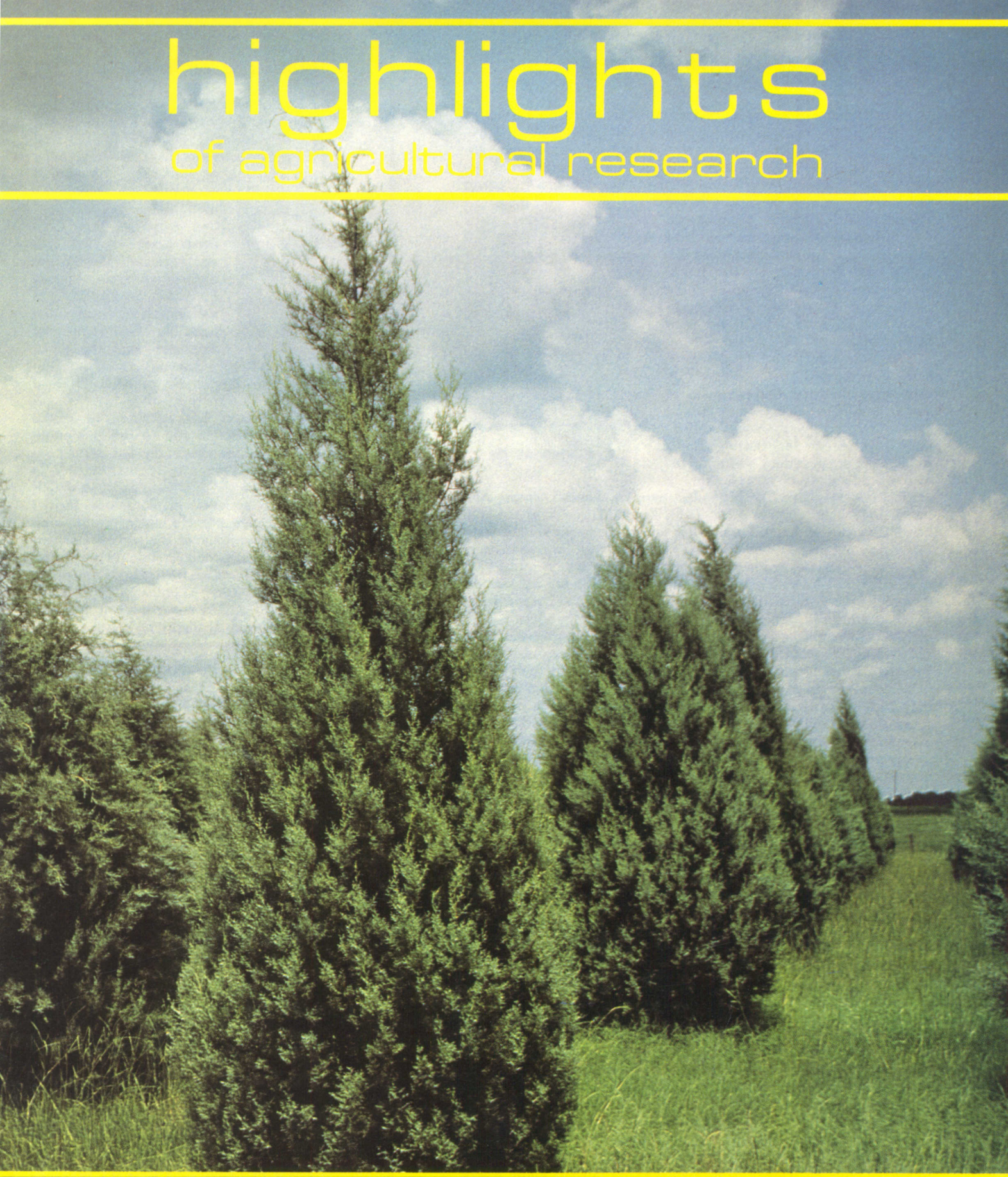
highlights of agricultural research



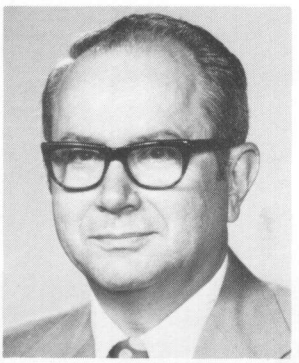
Vol. 26 No. 3 Fall 1979

AGRICULTURAL EXPERIMENT STATION
R. DENNIS ROUSE, DIRECTOR

AUBURN UNIVERSITY
AUBURN, ALABAMA

DIRECTOR'S COMMENTS

THE STRUCTURE of American agriculture is receiving new attention by the Secretary of Agriculture, Congress, and a number of advocacy groups. On July 25 and 26, the Senate Committee on Agriculture, Nutrition, and Forestry Subcommittee on Agricultural Research and General Legislation chaired by Alabama's Senator Donald Stewart, and the Senate Select Committee on Small Business on which Senator Stewart serves, held oversight hearings on Agricultural Research and Extension by the Land-Grant Universities as they apply to the family farm. Most of the 2 days' testimony was on small farms rather than family farms.



R. DENNIS ROUSE

The American Farm Bureau Federation presented testimony highly supportive of agricultural programs of the Land-Grant Colleges and critical of the Executive Branch of the Federal Government for shifting funds from these organizations so important to the productivity of this Nation.

Dr. B. D. Mayberry, Tuskegee Institute, Dr. James Dawson, Alabama A&M University, and Dr. J. M. Sprott, Director of the Alabama Cooperative Extension Service, joined me in presenting testimony showing that 17% of Alabama's farmers, with farm gross sales in excess of $20,000, produced 85% of the farm products sold (1974 census data). The 95% of this Nation's people who are not farmers depend on these and similar producers throughout the United States for food and fiber. This Nation depends on these producers for a balance of trade from agricultural exports, which is projected to be about $35 billion in 1979. Certainly these producers deserve a program of teaching, research, and extension to meet their needs.

We also recognize a strong obligation to the 83% that produce only 15% of gross sales – these individuals and families need appropriate assistance. Land-Grant Universities are obligated to serve all interested farmers to the extent financial resources permit.

We pointed out that the Executive Branch of the Federal Government had not been very supportive of Land-Grant programs. This year is fairly typical. President Carter's budget recommended an increase for research in most areas except food and agriculture. At this time, the House had recommended a 5% increase and the Senate a 9% except for forestry research where none was recommended by the House and 7% by the Senate. Hopefully, the Senate Bill will prevail. The Alabama Legislature supported Governor James' zero increase budget for these programs.

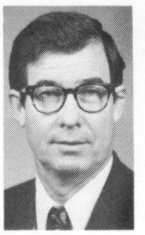
Last year, there was no increase in Federal funds but a good increase in State funds. Even with the best from Congress we have no alternative but again to further reduce our program. Thus, our ability to provide the teaching, research, and extension base required for farmers – large and small – to produce most efficiently, will be lessened.

I want to thank editors of farm publications for editorials pointing out that these programs have been and continue to be vital and their concern that the Land-Grant Universities programs in agriculture have not been assigned higher priority for funding. The Progressive Farmer, Farm Journal, Pecan Grower, Fruit Grower, and Agri-Fieldman and Consultant have recently had good editorials.

The August issue of The Progressive Farmer has an editorial by Emory Cunningham, President of the Company, entitled, "A Message for President Carter," that merits a special award. I join Emory in encouraging all readers to let their elected officials know where you stand.

may we introduce . . .

Dr. Lowell E. Wilson, professor, Department of Agricultural Economics and Rural Sociology. Dr. Wilson's area of major specialization is dairy marketing and he teaches marketing, agricultural economics, and research methods.



A native of New Concord, Kentucky, Dr. Wilson received his B.S. in agriculture from Murray State University, M.S. in agricultural economics from the University of Kentucky, and the Ph.D. in agricultural economics from the University of Illinois. He joined the staff of Auburn University in 1960.

Dr. Wilson has authored or co-authored more than 100 articles and publications in his area. He has served on numerous University committees, is a member of the graduate faculty, and is presently secretary of the general faculty of the University. He has served on numerous committees of the Auburn University Federal Credit Union and was president in 1977 and 1978. He is a member of Alpha Zeta, Gamma Sigma Delta, Sigma Xi, ODK, and has been active in the Alabama Academy of Science.

HIGHLIGHTS of Agricultural Research

FALL 1979 VOL. 26, NO. 3

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

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

ON THE COVER. This planting of experimental Christmas trees is at the Wiregrass Substation, Headland.

Christmas Tree Demand In Alabama

LOWELL WILSON and RONNIE DANIEL
Dept. of Agricultural Economics and Rural Sociology

In Alabama and throughout the South, demand for Christmas trees is substantial. The old practice of individuals going into the forest or grown up fields to cut a wild tree has been largely replaced by commercial Christmas tree industries that offer artificial and plantation grown trees to buyers. Many farmers and other landowners across Alabama are becoming keenly interested in the profitability of growing Christmas trees.

It is estimated that over three-fourths of the cut and live Christmas trees sold in southern markets are produced in the northern United States. With the advantage of a longer growing season in the South, as well as closer proximity to markets within the region, it is little wonder that keen interest in this new agricultural enterprise has developed. However, before committing substantial agricultural resources to this enterprise, knowledge of the nature of demand for the various types of trees would be valuable to educators and growers. As a contribution to a regional Christmas tree production and marketing research project, a survey of the household use of Christmas trees in Alabama was conducted by researchers at the Auburn University Agricultural Experiment Station during the 1978 holiday season. Use of Christmas trees in the business and the institutional markets was not included in the study.

A 1-page questionnaire was mailed to a sample of 1,069 Alabama residents during late December 1978. The sample was obtained from a statewide voter registration list. A followup questionnaire was sent to non-respondents in January 1979. Of the questionnaires mailed, 440 people in over 60 counties responded (41% response). Purpose of the questionnaire was to obtain information about the use of Christmas trees in the sample residents' households.

Christmas trees were used in 85% of the respondents homes during the 1978 holiday season, table 1. Artificial trees were reported in 228 households, which was almost 60% of the respondents reporting the use of Christmas trees. About one-fourth of the tree users purchased cut trees, while 14% still cut their own tree at no cost. Only 8 respondents reported purchasing a live tree to be planted after use as a Christmas tree.

Average age of artificial trees in use during 1978 was 5 years. Approximately one-third of the trees in use were purchased in the past 3 years. Average price paid for artificial trees was $24, however, artificial tree buyers in 1978 paid an average price of $29. Ninety percent of the artificial tree users expressed satisfaction with this type of tree and planned to continue its use.

Price paid for a live cut tree in 1978 was $14 for a tree averaging a height of 6.5 ft. For an increase of 1 ft. in tree height, retail price of the tree increased $1.81. However, influence of height on price of the more popular heights of trees (6 and 7 ft.) was about $2.20 per foot, table 2. About 80% of the cut trees were purchased during the last 2 weeks prior to Christmas. The most popular species of trees used including trees cut at no cost were eastern red cedar, spruce, and scotch pine.

The aggregate household use in Alabama of the various types of Christmas trees was estimated using the survey results which were adjusted by a recent Bureau of the Census analysis of household characteristics. It was estimated that 1,040,000 households, or 83% of the Alabama households, used some type of Christmas tree in 1978. Of these households, about 280,000 used a purchased cut tree, 135,000 cut a tree at no cost, 20,000 purchased live trees, and 605,000 used artificial trees.

Since approximately 9% of the artificial trees in use were purchased in 1978, total sales to households were about 355,000 trees of all types. Cut and live trees comprised about 85% of Christmas tree sales last year.

A statistical analysis was made of the factors influencing the probability of respondents' purchase of cut Christmas trees. Factors hypothesized to affect the likelihood of a cut tree purchase were: Tree price, tree height, population density of the respondents' county, days before Christmas when tree was purchased, household size, age of household head, and family income. Tree height, population density, days before Christmas when purchase was made, and family income were found to have significant relationships to the probability of cut tree purchases. Probability of using a cut tree is increased with increases in the tree height, population density, family income, and as days before Christmas decrease.

Overall, the demand for cut and live trees in 1978 amounted to about 85% of the commercial household market for Christmas trees. Artificial tree users were generally satisfied with their trees and continued to use them for several years. Opportunities for expansion in the commercial market for cut and live trees include the unsatisfied artificial tree users (10%) and people who are still cutting a tree at no cost. The latter group comprised about one-fourth of the people who secured a Christmas tree in 1978.

Table 1. Use of Christmas Trees During the 1978 Holiday Season, 440 Alabama Households

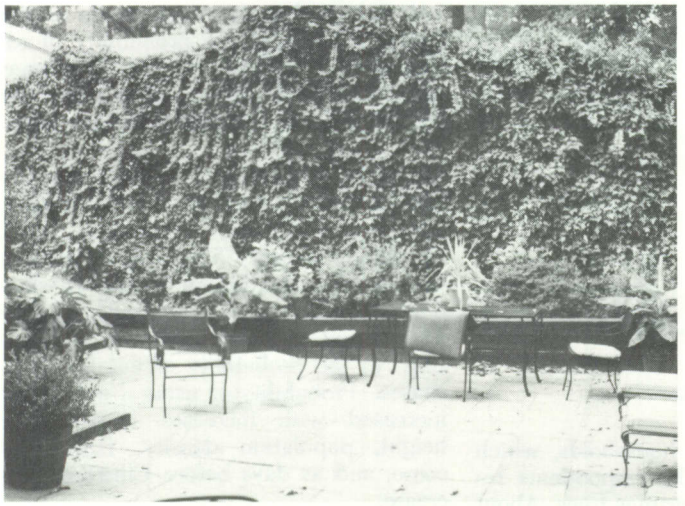
Response	Households	Percentage of households
	No.	*Pct.*
Used a Christmas tree	374	85.0
Did not use a Christmas tree	66	15.0
Total	440	100.0
Type of tree used[1]		
Cut tree Purchased	94	24.4
Cut own tree (no cost)	55	14.3
Live tree to be planted	8	2.1
Artificial tree	228	59.2
Total	385	100.0

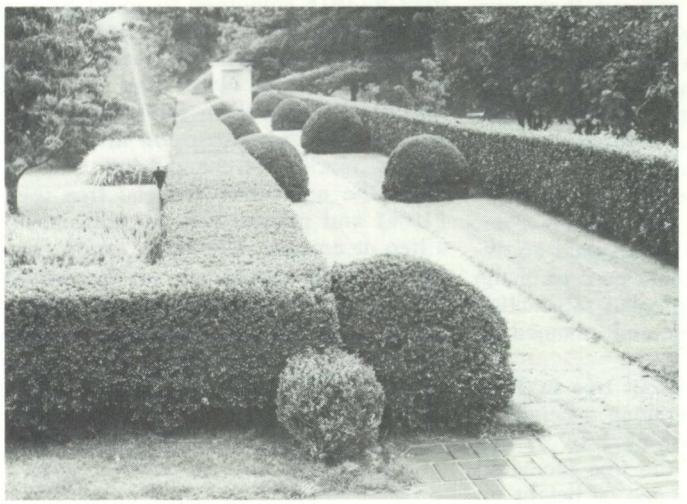
[1] A few households used more than one type of tree.

Table 2. Proportion of Purchases and Average Prices Paid for Cut Christmas Trees, by Tree Height, 1978

Tree height	Average retail price	Percentage of total purchases
Ft.	*Dol.*	*Pct.*
4 and under	4.40	4.4
5	11.20	14.3
6	13.40	39.5
7	15.60	27.5
8[a]	14.60	8.8
9 and over	19.40	5.5

[a] Exclusion of one eight-foot tree costing $3.00 would raise the average of this group to $16.28.





TOP: A screen of english ivy trained on wire provides privacy to this patio. BOTTOM: Hedges and topiary plants trimmed for the formal look. Burford chinese holly is the outer hedge, with the inner hedge being convexleaf japanese holly. The topiary plants are petit point japanese holly.

Hedges Provide Beauty, Privacy, Security

HENRY P. ORR, Department of Horticulture

A HEDGE CAN BE DESIRABLE for many reasons. It can be used as a windbreak or partial soundbreak, as a screen or barrier to give privacy and security, and most often to give added beauty.

Frequently hedges are used to define public, private, and service areas of the home landscape. In the private area, partial enclosure with hedges can result in the development of "outdoor rooms."

Hedges may be high or low, trimmed or untrimmed, deciduous or evergreen, planted in straight rows or curved to fit the contour of the landscape, and have small to large leaves. The smaller leafed species generally give a neater appearance after trimming, while larger leaves often will brown at the cut edge. Climbing vines can be trained on wire fences or trellises to produce space-saving substitutes for hedges.

A well-developed hedge will be in the landscape many years, so careful site preparation is needed to fit conditions to the plant species chosen. Generally, this requires a soil test, the adding of fertilizers and organic matter, and freeing the area of weeds.

Smaller plants are more easily established and less expensive than larger ones. A single row of plants usually is satisfactory. Small plants need to be spaced 9-12 in., while larger hedge plants are spaced 2-5 ft. apart.

Initially, the plants should be cut severely to produce low, dense branching. For a solid effect the hedge should be built up gradually to the desired height. Once the hedge is established, trimming will be needed 2-3 times per year depending on the species chosen and degree of neatness desired. The hedge may be kept neatly trimmed on one side for a formal appearance, and allowed to grow naturally on the other side. The base of the hedge should always be kept wider than the top to retain a better exposure of basal leaves to light and prevent legginess.

Spring flowering hedges should be trimmed immediately after flowering to allow next spring's flower buds to set, unless fruiting is desired. Summer flowering hedges are pruned in late summer after flowering or in early spring. All trimming should be done early enough to have hardening of new growth before freezes. The new growth will cover pruning or trimming scars.

How does the space for an effective hedge compare with other "separators"? Fences require 6 in. to 1 ft. (could be vine or espalier covered and serve as hedge); walls 1-2 ft.; clipped hedges 2-5 ft.; unclipped hedges 3-10 ft.; and well-developed borders 10-30 ft. You must be the judge of the space you can spare for beauty, privacy, and/or security.

The following is a list of plants that have performed well in tests at the Auburn University Agricultural Experiment Station:

Scientific name	*Common name*	*Easily controlled height, ft.*
Abelia x *grandiflora*	Glossy abelia	3-5
Berberis julianae	Wintergreen barberry*	3-5
Berberis x *mentoriensis*	Mentor barberry*	3-4
Berberis sargentiana	Sargent barberry*	3-5
Camellia japonica	Common camellia†	6-10
Camellia sasanqua	Sasanqua camellia†	5-9
Elaeagnus pungens 'Reflexa'	Bronze elaeagnus*	6-10
Ilex x *aquipernyi* 'Brilliant'		5-9
Ilex cornuta 'Burfordii Nana'	Dwarf burford chinese holly	5-9
Ilex vomitoria	Yaupon	10-15
Ilex vomitoria 'Nana'	Dwarf yaupon	4-6
Photinia glabra	Japanese photinia	10-15
Photinia x *fraseri*	Fraser photinia†	10-15
Pittosporum tobira	Japanese pittosporum†	6-10
Poncirus trifoliata	Trifoliate orange*	5-9

* Excellent barrier or security plant.
† Plants having larger leaves.

Ryegrass vs. Rye-Ryegrass-Clover for Stocker Grazing

R. R. HARRIS, Department of Animal and Dairy Sciences
N. R. McDANIEL and E. L. CARDEN, Gulf Coast Substation

PAST RESEARCH by the Auburn University Agricultural Experiment Station established that wheat or rye interplanted with ryegrass and clover provided excellent grazing for stocker beef calves. Under optimum conditions cattle have been slaughtered directly from such grazing and have produced Good-Choice carcasses. Even if cattle were not sufficiently finished for slaughter, they were ideal as feeder cattle for further finishing in a feedlot.

Farmer experience in southern Alabama indicates that ryegrass alone is an excellent quality forage crop and when seeded at heavy rates the sod will support cattle on heavy soils even in wet weather. Recent comparisons of grass alone with a rye-ryegrass-clover mixture confirm that ryegrass alone works well as pasture for beef steers.

Gulf Coast Substation Test

Ryegrass and rye-ryegrass-Yuchi arrowleaf clover were seeded on adjacent areas of fallowed land during each of 4 years (1975-78) at the Gulf Coast Substation, Fairhope. About 250 lb. per acre of 8-24-24 fertilizer was broadcast prior to planting. Seeding rates for the mixture were 90 lb. of rye, 15 lb. of ryegrass, and 10 lb. of clover. Ryegrass planted alone was seeded at 60 lb. per acre. Nitrogen was applied in the fall and early spring at a rate of about 75-80 lb. of N at each time.

Stocker beef steers were purchased annually for use as test animals. Pastures were stocked initially at a rate of one steer per acre, with cattle added or removed as forage supply and weather conditions dictated.

Typically the crops were planted in late September or early October and pastures were grazed initially in late November. During 3 of the 4 years, all pastures were stocked on the same date; however, during 1978-79 grazing of ryegrass alone was delayed 27 days because of dry weather. The small-seeded ryegrass did not germinate until after a general rain.

Steers on the rye-ryegrass-clover sward grazed continuously for the 173-day season (November 25-May 17) during 3 of the 4 years. For ryegrass alone, however, continuous grazing was possible only 1 year. For the other 3 years, cattle were off the ryegrass sward for periods from 34 to 51 days. This occurred during mid-January to February and was caused by insufficient forage.

Fast Steer Gain

The carrying capacity of these pastures was similar, see table. Rate of gain while on grazing was excellent for both swards: 2.0 lb. daily (164 days) for the mixture and 2.2 lb. daily (136 days) for ryegrass alone. Total grazing gain per acre of land reflects both stocking rate and rate of gain: 398 lb. for rye-ryegrass-clover and 408 for ryegrass alone. This is almost the same as the 400 lb. mean value obtained in a previous long-time evaluation of a small grain-ryegrass-clover mixture. Seasonal gain per animal favored the mixed sward by about 25 lb.

Results of the Fairhope test show that stocker beef calves gained faster from grazing ryegrass than for rye-ryegrass-clover pastures. However, cattle had to be removed from ryegrass pastures for about 40 days during January-February. In contrast, rye-ryegrass-clover pastures usually provided continuous grazing for the season (November-May). Total grazing gain for the season was about the same for both pastures, averaging about 400 lb. per acre.

ANIMAL PERFORMANCE ON COOL SEASON PASTURES, GULF COAST SUBSTATION, 1975-78

Item	Result, by pasture	
	Rye-ryegrass-clover	Ryegrass alone
Pasture size, acres	12	25
Stocking rate, steers/acre	1.24	1.38
Days grazed	164	136
ADG on grazing, lb.	1.99	2.20
Gain/acre from grazing, lb.	398	408
Initial wt. of calf, lb.	535	535
Seasonal gain/steer from grazing, lb.	330	306

Lime Slurry Works—But No Better Than Dry Lime

DALLAS HARTZOG, Wiregrass Substation—Cooperative Extension Service
FRED ADAMS, Dept. of Agronomy and Soils

A RECENT INNOVATION in liming acid soils is the use of "lime slurry," finely ground limestone suspended in water. The suspension usually consists of about 50% limestone, 48% water, and 2% clay (clay helps prevent settling out of the limestone particles). Other names for the suspension are fluid lime, liquid lime, and lime suspensions.

The appeal of a lime slurry rests on the premise that (1) it can be spread uniformly on the land with suspension-fertilizer equipment, (2) all the limestone particles are fine enough to react quickly with an acid soil, and (3) it can be used at a lower rate than agricultural grade limestone. (Commercial applicators generally use 1,000 lb. per acre of lime slurry – about 500 lb. per acre of actual limestone.)

Unfortunately, only the first premise appears reasonable. Results of 1978 research by the Auburn University Agricultural Experiment Station indicate no faster reaction time or greater neutralizing value for the suspension.

Lime slurry's effectiveness on Florunner peanuts was evaluated in a cooperative venture with the Ashford Gin Co. Four experiments were established in spring 1978 on farmers' fields in southeast Alabama. Lime slurry at 1,000 lb. per acre was compared with an equivalent rate of a finely ground, dry limestone and with the rate of lime recommended by Auburn's Soil Test Lab.

The lime was applied on turned land and disked into the top 3 in. of soil just before planting. Each farmer followed his usual cultural practices, from preplant use of herbicide and fertilizer through digging of peanuts. After digging, the soil of each test plot was sampled at three depths from the undisturbed area between digger swaths and analyzed for pH and available calcium (Ca).

All liming treatments increased the pH of the 0- to 3-in. soil layer, but data in the table show large differences among treatments. The 1,000-lb. rate of lime slurry increased soil pH about 0.2 unit, whereas the recommended lime rate increased it 0.6 to 1.5 units. The 500-lb. rate of dry lime was just as effective in raising soil pH as the 1,000-lb. rate of slurry (equivalent rates). Similarly, the recommended rate of dry, fine lime increased soil pH as much or more than the equivalent rate of lime slurry. The agricultural grade limestone increased soil pH as much as the lime slurry in two of the three comparisons.

The pH of the 3- to 6-in. soil layer was affected to a lesser extent than the surface soil, but the same relationship among lime sources was apparent. The 6- to 9-in. soil layer was barely affected by liming.

Lime affected available soil Ca in much the same way it did soil pH, with one major exception. The recommended rate of lime slurry increased available Ca more than any other liming treatment. This was because it was a calcitic liming material and contained more calcium than the dry limestones, which were dolomitic (39% vs. 21% calcium). The low rates of slurry and dry lime increased available soil Ca in the upper 3 in. of soil an average of 75 lb. per acre; increases were minor below the 3-in. level. The dolomitic limestones increased available soil magnesium, but the calcitic slurry did not.

Nothing in these data suggests that the lime slurry reacted with soil any faster or to a greater extent than dry lime. Furthermore, the soil pH and available Ca data show that the recommended rate of agricultural grade limestone was considerably superior to the 1,000-lb. rate of lime slurry.

The rate at which the different liming materials increased soil pH was not directly measured, but the yield and grade of peanuts gave an indirect measure. Instant reaction between soil and all lime particles would require thorough mixing of soil and lime particles, which does not occur with use of any liming material. However, all that is needed is sufficient contact between soil and lime particles to raise soil pH and available soil Ca above "critical" levels. In the case of peanuts, soil pH needs to be high enough to eliminate aluminum toxicity, and available Ca needs to be high enough to give maximum pod fill and seed yield. The Ca supply is not critical until peanut plants begin to flower and set fruit.

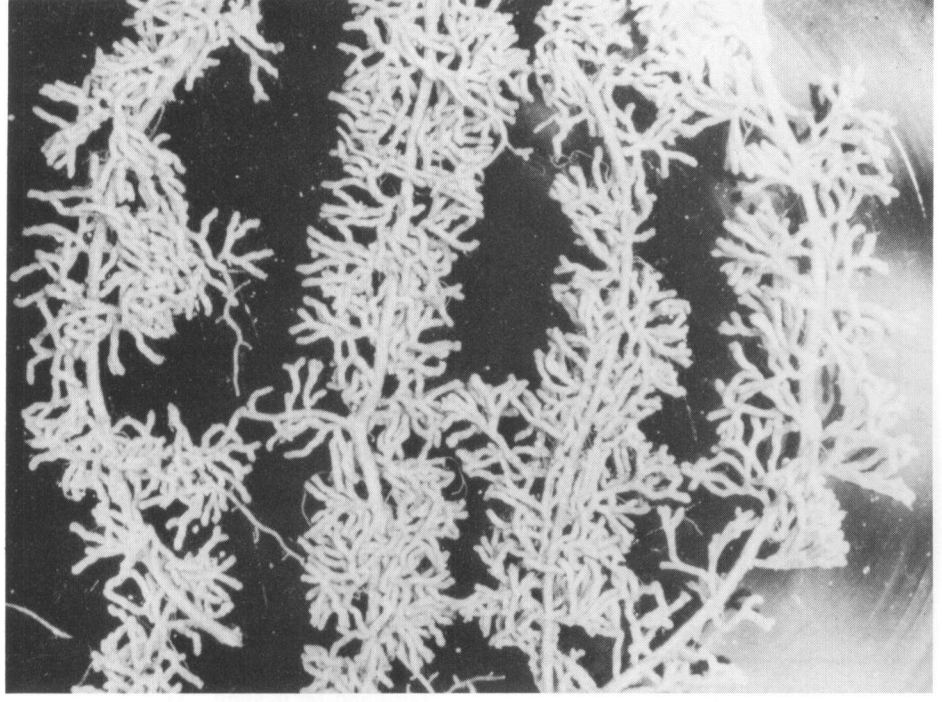
Using peanut yield and percent sound mature kernels (SMK) as further measures of lime reactivity, data in the table show significant responses to liming in only two experiments (Dothan and Faceville soils). In both cases, the 1,000-lb. rate of lime slurry increased yield and SMK some, but it failed to provide enough lime for maximum yield.

Although lime slurries probably can be applied more uniformly and more accurately than most dry, agricultural grade limestone with currently used equipment in Alabama, this does not suggest that a low rate of uniformly spread limestone will meet the crop's needs. In the experiments reported, it is clear that a low rate of lime slurry or dry lime raised soil pH, available Ca, peanut yield, and percent SMK only slightly. Where soil pH or available Ca was low enough to adversely affect peanut yields, 1,000 lb. per acre of a lime slurry was simply not enough to produce maximum yield.

EFFECT OF DIFFERENT RATES OF LIME SLURRY AND DRY LIME ON SOIL pH IN THE PEGGING ZONE AND ON YIELD AND PERCENT SOUND MATURE KERNELS OF FLORUNNER PEANUTS, ON FOUR FARMS IN SOUTHEAST ALABAMA, 1978

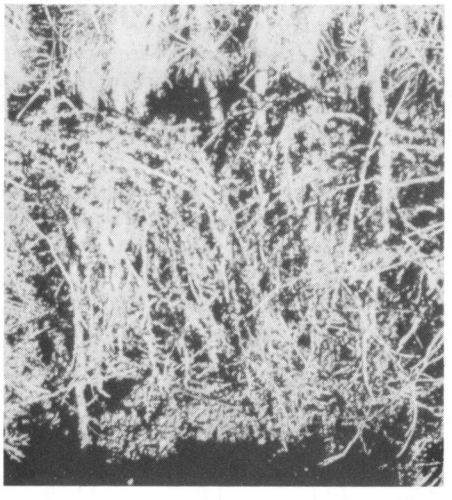
Lime source and rate	Dothan sl[1]			Faceville sl[1]			Esto ls[1]			Bonifay ls[1]		
	Soil pH	Yield/acre[2]	SMK[2]	Soil pH	Yield/acre[2]	SMK[2]	Soil pH	Yield/acre	SMK	Soil pH	Yield/acre	SMK
		Lb.	*Pct.*		*Lb.*	*Pct.*		*Lb.*	*Pct.*		*Lb.*	*Pct.*
None	5.2	3,270	71	5.2	2,150	67	5.3	3,190	69	5.4	3,240	74
Slurry, 1,000 lb.	5.4	3,920	77	5.4	2,310	71	5.5	3,100	70	5.7	3,610	76
Dry fine, 500 lb.	5.5	4,210	75	----	----------	----	5.7	3,530	67	5.7	3,540	75
Rec. rate[3]												
Slurry	5.8	4,440	76	----	----------	----	6.3	3,530	73	6.5	3,660	74
Dry fine	6.1	4,530	75	6.7	2,960	75	6.7	3,510	70	6.6	3,710	75
Ag grade	5.8	4,650	76	----	----------	----	6.4	3,470	67	6.0	3,830	75

[1] Soil abbreviations: sl = sandy loam; ls = loamy sand.
[2] Lime increased yield and SMK significantly.
[3] Rate recommended by Auburn's Soil Testing Lab: 1 ton/acre for Dothan sandy loam and Bonifay loamy sand; 1½ tons/acre for Faceville sandy loam and Esto loamy sand.



Tailored Mycorrhizae Improve Growth of Loblolly Pine

W. D. KELLEY
Department of Botany and Microbiology



THE TERM MYCORRHIZA means "fungus root." A mycorrhizal root is a symbiotic relationship between a fungus and a plant root. With the exception of cucurbits, all plants in their natural environment have mycorrhizae.

The importance of mycorrhizae to the survival and growth of southern pines has long been recognized. Mycorrhizal roots are much more efficient than non-mycorrhizal roots in nutrient uptake. The fungus mantle (sheath) of mycorrhizal roots provides a physical barrier to infection by soil-borne pathogenic fungi. At least one species of mycorrhizae has been shown to produce an antibiotic that inhibits infection by soilborne pathogens.

Several genera of fungi, all of which are Basidiomycetes, form mycorrhizae on roots of southern pines. A single pine seedling may have mycorrhizal roots representing several genera and/or species of fungi among its various roots. Differences exist among these fungi as to their efficiency in funneling nutrients to the seedling. The following study was conducted by the Auburn University Agricultural Experiment Station, to compare two mycorrhizal symbionts on growth of loblolly pine seedlings.

Two lots of pine seedlings were obtained from the USDA Forest Service Mycorrhizal Institute in Athens, Georgia. One lot of seedlings had been grown in nursery beds inoculated with the mycorrhizal fungus *Pisolithus tinctorius;* more than 65% of the roots of these seedlings were mycorrhizal with *P. tinctorius.* The second lot of seedlings came from standard (non-inoculated) nursery beds; more than 65% of the roots of these seedlings were mycorrhizal with the common symbiont *Thelephora terrestris.* Seedlings in each lot also had been graded for size before being packaged and shipped.

Seedlings were planted at a 3- × 3-ft. spacing at the E. V. Smith Research Center, Shorter, Alabama, on February 2, 1977. Twenty seedlings were planted in each of 4 replicate plots for each of the 2 lots of seedlings. In the springs of 1978 and 1979, percent survival of the seedlings was recorded as well as seedling height and stem diameter (at the soil line) of each surviving seedling.

The data, see table, show that after 1 year seedlings with mycorrhizal roots of *P. tinctorius* were 34% taller and 55% greater in diameter than seedlings mycorrhizal with *T. terrestris.* In addition, the percent survival of seedlings mycorrhizal with *P. tinctorius* was almost double that of the *T. terrestris* seedlings. Data after 2 years show that the same trend continued for growth in height and stem diameter.

The site where this study was conducted was primarily sand and river gravel and was extremely low in plant nutrients. The data indicate that *P. tinctorius* is much more efficient than *T. terrestris* in funneling nutrients to the host plant. Since pine seedlings are intolerant of shade, the more rapid growth exhibited by the seedlings mycorrhizal with *P. tinctorius* probably accounts for much of the observed difference in survival percent.

Seedlings tailored with *P. tinctorius* mycorrhizae are not yet available commercially; however, Abbott Laboratories, Long Grove, Illinois, is experimenting with the commercial production of *P. tinctorius* inoculum for use in forest nursery beds. The percent survival and fast growth of seedlings mycorrhizal with *P. tinctorius* in this study demonstrate the value of such seedlings for use in reforesting poor sites such as reclaimed strip mines and badly eroded agricultural lands.

AVERAGE PERCENT SURVIVAL, SEEDLING HEIGHT, AND STEM DIAMETER OF LOBLOLLY PINE SEEDLINGS MYCORRHIZAL WITH *Pisolithus tinctorius* OR *Thelephora terrestris* ONE AND TWO YEARS AFTER OUTPLANTING

Mycorrhizal symbiont	Percent survival		Seedling height		Stem diameter	
	1978	1979	1978	1979	1978	1979
	Pct.	*Pct.*	*cm*	*cm*	*cm*	*cm*
Pisolithus tinctorius	86	84	63	128	1.12	2.60
Thelephora terrestris	45	37	47	92	0.72	1.91

inflation causes and effects

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INFLATION is generally defined as a continuing rise in the general level of prices. A common definition is "too many dollars chasing a limited quantity of goods."

In formulating policy, a continuing rise in prices must be distinguished from a "one shot" increase in prices that might result from a severe drought, oil embargo, or some unusual situation. When the price level continues to rise at above normal rates, it becomes important for public policy to respond. However, it is not always easy to determine what the proper response should be since anti-inflationary policies may have costly side effects on other economic goals. An example is that of reduced employment as the result of some action to dampen inflation.

A rise in price level over a period of time may be measured in several ways. One of the most common methods is the consumer price index. The consumer price index (1967 = 100) has increased generally since 1950 but the most rapid increases have been in recent years, see table. In only 1 year, 1955, did the consumer price index decline slightly from the previous year. In 1974 the U.S. economy experienced double-digit inflation as indicated by a 11.0% increase in the consumer price index. The index stood at 214 in May 1979.

As indicated in the table, the purchasing power of the dollar has shrunk as consumer prices increased. The 1978 dollar was equivalent to 51 cents in purchasing power as compared to the 1967 dollar.

The erosion of purchasing power is most serious for persons on a fixed income or pension such as the case might be with a retired person. It has been estimated[1] that by 1984, a person retiring in 1979 with a pension of $10,000 will see the buying power of that pension decrease to $6,000 – if he is lucky.

Inflation not only hurts people on a fixed income but it is also detrimental to those who practice saving. Suppose an individual places $1,000 in a savings account that pays 5% annually or $50. If the inflation rate was 11% as indicated by the consumer price index in 1974, this person in effect lost in purchasing power his entire interest of $50 plus $60 of the principal amount.

Individuals and firms, depending on their situation, are affected differently by inflation. Persons who are in debt or go into debt to buy a house at the beginning of inflation, may pay off the debt in "cheap dollars" if their income rises. Also, at the end of the inflationary period the house may be worth more in terms of its market value.

Firms or individuals that have products to sell and can adjust their prices may benefit from inflation. Those who work under labor contracts or receive income that is adjusted for cost of living increases may keep up with inflation. Those who invest in items that go up with inflation also benefit.

Farming, just as other businesses, is affected by inflation. In recent years farmers have been squeezed as prices paid have increased faster than prices received. As a result, many farm families have supplemented their income by tapping nonfarm sources. Personal income of the U.S. farm population from nonfarm sources exceeded that from farm sources for the first time in 1975 and has continued since then.

Inflation has also been a factor in the increase of farm real estate values. Rising values have presented an almost insurmountable problem for those attempting to get into farming. However, high farm real estate values are a source of financial strength to those with substantial farm real estate and those in relatively high equity positions.

Causes of inflation fall broadly into two groups: "demand-pull" and "cost-push." Demand for goods and services is largely determined by income. New government expenditures may put additional money into the hands of consumers. Such expenditures are especially inflationary if financed through deficit financing and in periods of relatively full employment. Conditions of easy credit and a general speculative psychology in the minds of individuals and business firms may be demand-pull factors.

On the cost-push side, an example may be production cost increases that are passed on to consumers. This may result from rising wage rate pressure, scarcity of certain goods or materials, or even increased costs as the result of government or other regulations.

Because demand increases are frequently responsible for inflation, methods to take up excess demand are often used. Taxation and reductions in government spending are remedies taken. However, government spending is sometimes not adjusted quickly to meet changing economic conditions. This is further complicated by political considerations. Also, the effects of increased taxation may not be immediate because of the expectations of businesses about future income and profits.

Credit restraint measures of the Federal Reserve System are also used to help control demand and inflation. Increased interest rates help control demand but may put an undue hardship on residential housing. Also, segments of the economy using short-term financing may not be very sensitive to interest rate changes.

Inflation is a problem with many aspects and considerations. As a result, the controls are most frequently complex. What will work at one time may not be effective at another time. It is increasingly important that the public become more aware of the evils of inflation.

CONSUMER PRICE INDEX (ALL ITEMS), UNITED STATES, 1950-1978
(1967 = 100)

Year	Index	Percent change from preceding year	Purchasing power of dollar (1967 = $1.00)
1950	72.1	1.0	$1.39
1951	77.8	7.9	1.29
1952	79.5	2.2	1.26
1953	80.1	.8	1.25
1954	80.5	.5	1.24
1955	80.2	—.4	1.25
1956	81.4	1.5	1.23
1957	84.3	3.6	1.19
1958	86.6	2.7	1.15
1959	87.3	.8	1.15
1960	88.7	1.6	1.13
1961	89.6	1.0	1.12
1962	90.6	1.1	1.10
1963	91.7	1.2	1.09
1964	92.9	1.3	1.08
1965	94.5	1.7	1.06
1966	97.2	2.9	1.03
1967	100.0	2.9	1.00
1968	104.2	4.2	.96
1969	109.8	5.4	.91
1970	116.3	5.9	.86
1971	121.3	4.3	.82
1972	125.3	3.3	.80
1973	133.1	6.2	.75
1974	147.7	11.0	.68
1975	161.2	9.1	.62
1976	170.5	5.8	.59
1977	181.5	6.5	.55
1978	195.4	7.7	.51

[1] Campbell, Arlun. 1979. "Inflation: A Problem That Won't Just Go Away," Virginia Tech Spectrum, Vol. 1, No. 26.

Choice of Rootstock Affects Performance of Peach Trees

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Poor condition of the six trees in foreground, in comparison with surrounding trees in test planting, illustrates the effects of non-adapted rootstock.

A FEW DECADES AGO, peach trees lived about 20 years in the Southeast. Today the average life span is only about 10 years. This decreased longevity is a major reason that peach acreage has declined in Alabama and the Southeast.

Short life expectancy is usually not a problem with an ideal site where peaches have not been planted before. However, most of the optimum sites in peach growing areas have been planted to several generations of peach trees or are not available to growers. Therefore, another approach is needed to solve the problem.

Cold injury, diseases, nematodes, fertility, and toxins are interrelated problems that have been identified as causing peach tree short life. Cold injury appears to be the cause of death, but the other problems "set up" the trees to cold injury. The trees appear healthy in the fall but die during the winter.

Rootstock selection often is the most cost-effective method of dealing with peach short life, and this is an approach being tried by the Auburn University Agricultural Experiment Station. Several improved rootstock selections are being used in the United States, but no single selection has been suitable on a widespread basis. Thus, comparisons are needed to identify the best one for Alabama use.

A test planting of eight rootstocks was established at the Chilton Area Horticulture Substation in 1976. Emphasis of the project is on factors that contribute to peach tree longevity, survival, and productivity as influenced by rootstock.

The most promising rootstocks were chosen for the study: Rutgers Red Leaf, NC 152 Al-2, NA 8, Lovell, Halford, Siberian C, Harrow W 208, and Nemaguard. Loring and Red Haven varieties are being evaluated on each rootstock. Six trees of each variety/rootstock combination were planted in each of the four test blocks (replicates). The site was fumigated prior to planting with DBCP and has been fumigated each winter since planting.

The trees made vigorous growth during the three seasons. Loring trees were about the same size on all the rootstocks, and they were larger than Red Haven trees. Red Haven variety on Siberian C rootstock produced the smallest trees.

Suckers are a problem because of shading and competition. Removing the suckers damages the trunk, thus producing an entrance for disease and interfering with phloem transport. Many times when one sucker is removed, several will develop in the same trunk area. Suckering from the rootstock near the ground line was more severe on certain rootstocks with the Red Haven variety than with Loring. Siberian C and Nemaguard produced a greater number of suckers than the other rootstocks with both varieties. Trees on Halford, Lovell, and NC 152 Al-2 generally produced fewer suckers.

Accumulated yield for the 1978 and 1979 fruiting seasons did not vary greatly due to rootstock, see table. The trees produced good yields for their third and fourth growing seasons. Loring trees produced more fruit than Red Haven trees on the same rootstock.

Tree mortality was greater in the Red Haven variety than in the Loring, and greater on Siberian C than on other rootstocks. Fifty percent of the Red Haven and 12% of the Loring trees on Siberian C died. Cold injury was greater with trees on rootstocks that had a higher mortality rate and greater on the Red Haven trees than on the Loring trees.

Bacterial canker on trunks and major scaffold branches was more severe on trees with higher cold injury ratings and greater on Red Haven than Loring trees. All trees that died suffered from both cold injury and bacterial canker.

Rootstocks did not affect vegetative bud break, bloom date, fruit set, fruit size, fruit uniformity, or bacterial spot incidence of the Loring trees. However, Red Haven trees on Siberian C rootstock bloomed 2-3 days later, had less fruit set, lower bud density, and a higher incidence of bacterial spot than Red Haven trees on other rootstocks.

Early indications from the rootstock evaluation planting are that Halford, Lovell, and Nemaguard are the most promising from this series, and that Siberian C and NA 8 are the least promising. Also, the scion variety affects rootstock performance.

EFFECT OF ROOTSTOCK AND SCION VARIETY ON YIELD, TREE SURVIVAL, COLD INJURY, BACTERIAL CANKER INJURY, AND SUCKER PRODUCTION

Rootstock	Accumulated yield/tree, 1978, 1979		Survival, live trees July 1979		Cold injury[1] rating		Bacterial canker, trees with injury		Sucker production, sprouts/tree	
	Red Haven	Loring	Red Haven	Loring	Red Haven	Loring	Red Haven	Loring	Red Haven	Loring
	Lb.	*Lb.*	*Pct.*	*Pct.*			*No.*	*No.*	*No.*	*No.*
Halford	145	173	96	100	4.2	3.8	2	0	1.1	1.8
Harrow 208	----	182	----	96	----	3.4	----	0	----	2.8
Lovell	135	168	100	96	4.5	3.9	5	1	1.0	2.0
NA 8	132	167	71	96	7.0	4.5	6	9	3.3	1.8
Nemaguard	143	193	100	100	4.7	3.5	2	3	5.6	3.2
Siberian C	119	170	50	88	6.8	4.6	9	7	7.5	4.0
Red Leaf NRL 4	126	173	100	92	4.0	4.1	9	3	2.8	2.2
NC 152 Al-2	130	194	96	96	5.4	3.7	4	4	2.0	2.0

[1] Rating for cold injury in cambium: 1 = none; 2-3 = slight browning; 4-5 = moderate browning; 6-7 = severe browning; 8-9 = partial tree death to total tree death.

SICKLEPOD: tough competition for peanuts

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SICKLEPOD IS ONE of the most troublesome weeds in peanuts grown in the U.S. Coastal Plain. This weed is fast growing and highly competitive with peanuts. Since both sicklepod and peanuts are legumes, the botanical similarity makes chemical control of sicklepod difficult.

An understanding of the competition dynamics of sicklepod (*Cassia obtusifolia* L.) is especially important because development of the peanut foliage close to the soil surface precludes the use of directed postemergence herbicide applications and the most timely mechanical cultivation. Elimination of these two commonly used backup weed control procedures makes it essential that early season control does an effective job against this weed. Knowing when sicklepod emerges and competes most severely with the peanut crop would enable the grower to concentrate his control so as to be most effective.

The sicklepod studies reported here were cooperative between Auburn University's Agricultural Experiment Station and the Georgia Experiment Station. Conducted at the Wiregrass Substation, Headland, Alabama, and the Georgia Southwest Experiment Station, Plains, Georgia, the experiments considered three basic questions: (1) how long must peanuts be maintained free of sicklepod to produce maximum yield? (2) how long can this weed remain in peanuts and, if carefully removed, not reduce yields? and (3) how does the growth regulator Kylar (SADH) affect the weed-crop relationship?

The experimental area was treated with Balan (benefin), 1.5 lb. per acre, to control grasses and susceptible broadleaf weeds. This resulted in a sicklepod population of about 5 to 10 plants per sq. ft.

In the first series of tests, peanuts were maintained weed free for 0, 2, 4, 6, 8, and 10 weeks, and for the entire season. The peanuts were not weeded for the remainder of the growing season following the weed-free treatment period.

Table 1. Effect of Different Periods of Weed-Free Maintenance on Peanut Yield and Number and Weight of Sicklepod Surviving, Headland, Alabama, and Plains, Georgia

Weeks of weed-free maintenance	Sicklepod plants/10 sq. ft.		Sicklepod weight/acre		Peanut yield/acre	
	Headland	Plains	Headland	Plains	Headland	Plains
	No.	*No.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
0	56	20	11,798	14,899	1,148	1,269
2	17	7	6,710	3,523	1,862	2,652
4	13	1	1,935	259	2,616	3,084
6	2	0	515	0	2,950	2,973
8	2	0	83	0	3,021	2,991
10	2	0	78	0	3,021	3,098
All season	2	0	68	0	2,893	2,979

Results show that peanuts maintained free of sicklepod for 4 weeks or longer had fewer sicklepod than peanuts that were not weeded or those maintained free of sicklepod for only 2 weeks, table 1. Peanut yields were inversely related to amount of weed growth. In only one experiment over 3 years at the two locations did 4 or more weeks of weed-free maintenance result in a significant yield reduction. In all other trials, yields of peanuts were reduced only by 4 or fewer weeks of weed-free maintenance.

In the second series of experiments, sicklepod was allowed to compete with peanuts for 0 to 18 weeks and then carefully removed. In only two of six experiments over the 3 years at two locations did competition of 10 weeks or less result in reduction of yield of peanuts, table 2. In other experiments, 14 or more weeks of competition by sicklepod was required for yield reductions.

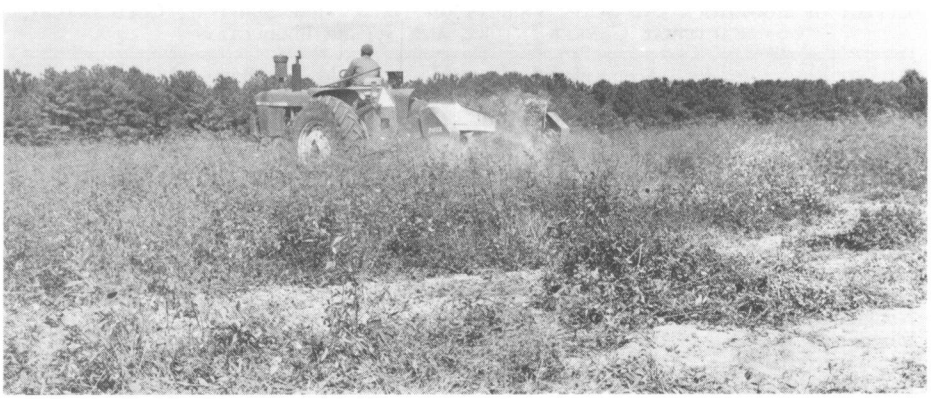
The evaluation of Kylar's effects on the competitive relationship of sicklepod with peanuts gave surprising results. Because of the increased compactness of the peanut canopy when treated with the growth regulator, it would be reasonable to expect such peanuts to be more competitive. However, results showed no increased competitiveness with Kylar treatments.

The results clearly indicate the necessity for controlling sicklepod during the first 4 weeks after peanut emergence to minimize the effect of these weeds on the crop. Otherwise, despite timely early cultivations, the weeds left in the row "pop up" above the crop about midseason.

One of the unexpected findings was the particularly strong competitive ability of the peanut canopy. Sicklepod control programs that judiciously utilize this competitive relationship of peanuts along with the best combinations of chemical, cultural, and mechanical procedures will be the most successful and produce the greatest profit for the grower.

Table 2. Effect of Different Periods of Weed Competition by Sicklepod on Yield of Peanuts at Headland, Alabama, and Plains, Georgia

Weeks of competition	Peanut yield/acre	
	Headland	Plains
	Lb.	*Lb.*
0	3,086	3,086
2	3,068	2,890
4	3,044	3,116
6	2,959	2,807
8	2,807	2,705
10	2,754	2,187
14	1,450	1,119
18	1,106	1,227



Unless sicklepod is controlled during the first 4 weeks after peanut emergence, weeds "pop up" above the crop about midseason and cause trouble at harvest.

Breeding Biology of Alabama's White-Tailed Deer

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THE WHITE-TAILED DEER is America's most important big game animal. Probably as much or more time and resources have been expended in studying and managing this species than any other game. Yet, much concerning the breeding biology of white-tails remains poorly understood. For the past several years researchers from Auburn University's Agricultural Experiment Station have studied white-tailed deer in their natural and undisturbed environs in southwest Alabama. The primary emphasis of this research was to study the various behavioral changes of both adult male and female deer attributable to peak breeding activity. Close attention was paid the home range sizes and daily activity patterns of bucks and does before, during, and after the rut (period of intense breeding activity). Observations also were made concerning interactions among and between the sexes during the above time periods.

The period of intensive breeding activity by white-tailed deer in Alabama is quite variable throughout the State. This activity occurs anywhere from late November to late February in Alabama, with most breeding peaks tending to occur toward the later end of the above time period. The reason for such an inconsistent pattern of breeding in Alabama and other Southern States remains unknown.

Auburn researchers captured and radio-tagged 9 adult male and 10 adult female deer and closely monitored their activities throughout the fall, winter, and early spring of 1975-76 on the Fred Stimpson Wildlife Sanctuary in Clarke County, Alabama. Nearly 5,000 individual visual and radio locations were recorded during the study. These data were used to construct the daily and seasonal movement and activity patterns of these animals and to compare these movements and activity patterns among the time periods.

Adult white-tailed bucks polished their antlers in September or early October. These males tended to associate with other adult males or remain solitary but seldom associated with females or yearlings. The average home range of the radio-tagged males during the fall was only 205 acres. During this period the bucks spent about 50% of the time moving and feeding and 50% bedded or moving very little. As time passed adult bucks spent some time engaging in pushing and shoving bouts with each other, presumably establishing some type of dominance hierarchy or "peck order" for the approaching rut.

The peak of the rut occurred between the last week in January and the second week in February in 1976. A few weeks before and for several weeks after this period the activity patterns and movements of adult males changed significantly. Bucks more than doubled their home range size and spent significantly more time moving about presumably in search of receptive females. This activity was even greater after the rutting peak. This might be attributable to a decreasing availability of receptive females. This was also a time of frequent and sometimes violent encounters between adult bucks.

By the end of February, the rut appeared to be almost over and by the first week in March pursuit of females was no longer observed. Adult bucks were once again observed travelling in all-male groups.

Adult does were also observed to undergo certain changes in their movement and activity patterns. Their home range size averaged 210 acres throughout the study and did not change significantly between pre-rut, rut, and post-rut periods. However, the rutting period was marked by a significant increase in activity among does while the amount of area covered decreased. Their movement changed from rather long linear patterns before the rut to crisscrossing movements of shorter magnitude within a restricted area during the rut. One can only speculate about the reason for these changes. Increased activity in a restricted area could tend to concentrate the sex attractants that would facilitate the sexually active female being located by a male.

Most does under observation had at least 1 day during the rut when they were active throughout the day and night. It is believed that this peak of activity coincided with the does' period of estrus. Female deer are receptive to mating for a period of at least 48 hours. Most does are apparently bred during their first receptive period. The rut seemed to come to a rather abrupt end after the second week of February.

Though much was learned during this study, much about the breeding behavior of white-tailed deer remains a mystery. No one has yet to adequately explain the purpose of the rubbed bushes and trees, the numerous scraped areas marked with urine and fecal material, or the possible function of antler display in mate selection. Study is continuing.

ADJUSTMENTS IN BEEF ENTERPRISE ORGANIZATION ON NORTH ALABAMA FARMS

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ALABAMA BEEF PRODUCERS have experienced problems of income variability associated with the cattle price cycle. They are now earning a respectable return to labor and investment. But memories of depressed cattle prices and soaring production cost during the period 1975-77 could make even the most optimistic producer apprehensive of what the future may bring. The relevant question facing each individual producer could easily be "How can I adjust to the extreme price variability brought about by the cattle cycle?"

A computer analysis study at the Auburn University Agricultural Experiment Station has an objective to determine the beef production strategies for a model producer to cope with the different phases of the cattle cycle. Data were obtained from a USDA study designed to estimate cost of production and resources representative of the average beef cattle operation in the major beef production regions of the United States. One production region includes areas of north Alabama known as the Limestone Valley, Sand Mountain, and Upper Coastal Plains. Using the resource base of the representative farm, several production alternatives were compared to determine the optimum beef farm organization during different cattle price cycle situations.

In the computer analysis several options were compared. The model producer could stay with cow-calf and sell all of the calves at weaning, or he could elect to carry weaned calves and/or purchased calves on pasture for 6 months and sell them as stockers or "backgrounded feeders." The producer could extend the operation one more step and keep the stockers for an additional 3 to 4 months using grazing with supplemental grain to achieve a fairly high rate of gain, and sell the animals for slaughter at weights of 950-1,100 lb.

Still another alternative for the producer would be to put his stock in a feedlot. Two feedlot options were compared. In the first option, weaned calves were placed directly in the feedlot for 8-10 months and then sold for slaughter at weights of 950 to 1,100 lb. The other option was to take stockers at weights of 700-800 lb. and put them in the feedlot for a short feeding period of 3 or 4 months and sell them for slaughter at 950-1,100 lb. All post weaning alternatives were compared for both spring and fall calving season and, also, using steers and/or heifers.

Two decision settings were considered. The first represents short-run planning; the model producer has fixed facilities and equipment in an ongoing operation and experiences prices at specific phases of the cattle cycle. The second represents long-run planning; the producer looks ahead 10 years or so, roughly the length of an entire price cycle. The major difference between the short- and long-run decision settings is that in the former the model producer has facilities and equipment, and is concerned only with costs associated with production and added facilities and equipment. He must recover cash outlays for livestock, feed, fertilizer, additions to facilities, and equipment and achieve an acceptable return to labor, capital, and management. In the long run, however, the producer is accountable for all costs, including the value of his own labor and fixed capital as he seeks the greatest return to management.

Forage alternatives considered for the model north Alabama beef farm were fescue-clover pasture, Coastal bermuda pasture, and native bermuda pasture. Stored forages included hay harvested from both the Coastal and fescue pastures and corn silage. Corn silage storage and handling was assumed to be accomplished by the use of a trench silo, front-end loader, and auger wagon. Concentrates assumed in the study were corn grain for energy and a 31-35% protein supplement.

For the representative beef farm, nitrogen is the critical input for forage production and corn is the major energy concentrate. Therefore, these inputs were compared at different price levels to determine their effect on the most profitable farm organization. The table presents optimum organizations for short- and long-run decision settings with four combinations of corn and nitrogen prices.

Results indicate that post weaning alternatives are more profitable than the beef cow-calf enterprise. A short-run planning strategy favors finishing animals on pasture rather than in the feedlot. However, the long-run situation favors finishing animals in the feedlot. Stockers are included in all planning strategies in the short run and also in the high corn price situation in the long run. Fescue-clover, Coastal bermuda, and native bermuda pastures are included in all cattle systems using pasture. Silage is in all short-run solutions, but is only used in the long run when corn prices are high relative to nitrogen. The "grain on grass" and feedlot programs favor using heifers rather than steers. Heifers finish at lighter weights, requiring less labor and feed, which offsets the price differential between heifers and steers.

Flexibility in beef enterprise selection and thorough planning can reduce variability of income caused by the beef cycle and fluctuations in prices for inputs.

OPTIMUM SHORT- AND LONG-RUN RESPONSE TO VARYING CORN AND NITROGEN PRICES FOR A NORTH ALABAMA BEEF FARM

Item	Unit	Short run				Long run			
		Base corn[1] base nit.	High corn base nit.	Base corn high nit.	High corn high nit.	Base corn base nit.	High corn base nit.	Base corn high nit.	High corn high nit.
Returns to:									
Land, labor, management	dol.	55,181	50,097	55,015	48,819	----	----	----	----
Management	dol.	----	----	----	----	20,004	15,221	19,951	14,537
Cattle system:									
Stockers	hd.	181(S)[2]	259(S)	151(S)	260(S)	0	197(S)	0	197(S)
Grain-on-grass	hd.	329(H)	136(H)	371(H)	130(H)	0	0	0	0
Feedlot	hd.	0	0	0	0	276(H)	0	276(H)	0
Pasture system:									
Fescue-clover	ac.	45	91	63	91	0	88	0	88
Coastal bermuda	ac.	103	57	85	57	0	60	0	60
Native bermuda	ac.	43	43	43	43	0	43	0	43
Hay:									
Fescue	ac.	17	22	20	28	23	0	23	0
Coastal bermuda	ac.	12	7	8	0	2	0	2	0
Silage	ac.	10	57	5	57	0	20	0	19
Corn	cwt.	5,137	770	5,585	753	4,521	244	4,520	250
Nitrogen	lb.	6,710	10,853	5,760	10,665	446	6,152	446	6,128
Total labor	hr.	2,706	2,985	2,618	2,965	786	1,516	786	1,514
Total capital	dol.	69,002	68,133	69,000	69,964	51,677	52,260	51,672	52,182

[1] Base nitrogen price, $0.170 per lb.; high nitrogen price, $0.275 per lb.; base corn price, $4.18 per cwt.; high corn price, $6.50 per cwt.

[2] S = steers; H = heifers.

sunshine available by climatic week

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ENERGY PERFORMS a very significant role in the production of agricultural products.

Heating of livestock structures, drying of grain and other crops, and irrigation of fields have been accomplished by use of a plentiful supply of low-cost petroleum based fuel. As petroleum supplies have become restricted and costs increased there has been a search for suitable alternative sources of energy. Such a source is solar energy. Solar energy is also a major requirement for plant growth through the process of photosynthesis.

In order for agricultural engineers to design systems which utilize solar energy, a knowledge of the magnitude as well as time and spatial distribution of solar radiation is required. Plant scientists also need this information as they develop new varieties or as they make recommendations for use of the various crop varieties. Unfortunately, reliable solar radiation data with comparative meteorological data have not been available.

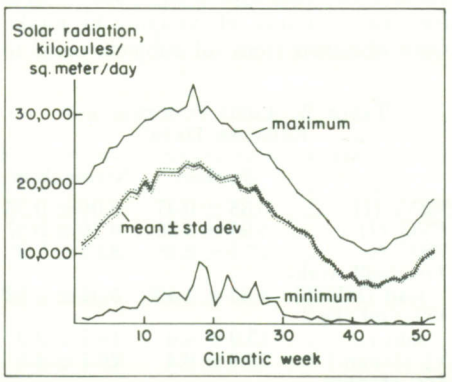
The National Climatic Center (NCC) has the responsibility for archiving all meteorological and solar radiation data. Historically, separate data files have been used to record hourly values of meteorological data and solar radiation data. The need for a common data base which includes both solar radiation and meteorological data led to the creation of the SOLMET data format by NCC.

SOLMET is a comprehensive data base which provides quality controlled hourly solar radiation and meteorological data for 27 stations previously archived in the Card Deck 280 and Tape Data Family-14 systems. All future solar and meteorological data will be recorded in the SOLMET format. There are 27 stations throughout the United States in the SOLMET data file. Data cover the period July 1, 1952, through December 31, 1975, for most stations.

SOLMET data are recorded in the International System of Units (SI). Hourly observations are listed by true solar and local standard time. Global solar radiation data are serially complete and have been corrected for all known scale, instrument, and calibration problems. Missing values have been estimated using sunshine, cloud, sky condition, or interpolation models. SOLMET provides the best currently available solar radiation and meteorological data file for the United States.

The SOLMET data tapes obtained for this study contained hourly observations for a period of approximately 23 years for each station. In this form, the data are useful primarily as input data for a computer simulation requiring hourly observations for a long period of time or for a particular year contained on the tapes. To be useful as design or planning data for engineering calculations, further analysis is necessary. Parameters selected for this analysis were maximum, minimum, and average daily solar radiation as well as standard deviation. The probability of receiving at least an indicated amount of solar radiation was also calculated at 10% increments from 10 to 90%.

Data were summarized by climatic week rather than calendar week or day. Climatic weeks were selected so that comparisons with other climatological studies (which are typically based on climatic weeks) would be possible. Also, short-term variation which could appear in daily averages would be smoothed out. Data at the beginning and end of the period of record for each station were not included if they were not within a complete climatic week. For the purpose of this study, February 28 and 29 (climatic week 53) were omitted. Climatic week 1 is March 1 through March 7. Data were analyzed for 26 of the 27 SOLMET stations.



An example of the results is shown in the accompanying figure which is typical of the Southeastern United States. The dark line in the center represents the average amount of solar radiation or sunshine received on a horizontal surface. The two lighter lines represent the average plus or minus the standard deviation. The small magnitude of the standard deviation, approximately 2 to 5% of the mean, shows that on the average the variation in solar radiation from year to year is not very large. There is a significant variation within the year, however. Radiation is highest during climatic weeks 10 through 26, May 5 through August 29, when the available radiation averages approximately 21,000 kilojoules per square meter per day. Much less radiation is available during weeks 39 through 49, November 22 through February 6, when the average is approximately 6,400 kilojoules per square meter per day. Over three times as much radiation is available per day on a horizontal surface during climatic weeks 10 through 26 as compared to weeks 39 through 49. This distribution favors plant production during warm summer months but is unfavorable for heating of livestock structures and other applications which require energy during winter months. The amount of radiation received by a surface can be increased by tilting it so that it is perpendicular to the sun's rays. This is the reason that solar collectors in North America are usually tilted at an angle with the horizontal of 45° or more.

Also of interest are the extreme curves representing the maximum radiation and minimum radiation received during each climatic week for the 23-year data collection period. The maximum available ranges from 1.4 to 1.9 times the average. Of more interest perhaps is the minimum radiation received. While the minimum received during the peak summer period is about 23% of the mean, the period from climatic weeks 39 to 49 had minimums of only about 5% of the mean. This emphasizes the need for adequate storage in a heating system which utilizes solar energy.

A complete report of the analysis is available as NOAA Technical Memorandum NWS SR-98 by R. R. Getz and M. M. Nicholas. The report may be obtained from the Environmental Studies Service Center at Auburn.

Effect of chronic cigarette smoking on vitamin C status, lung function, and resting and exercise metabolism in humans

ROBERT E. KEITH
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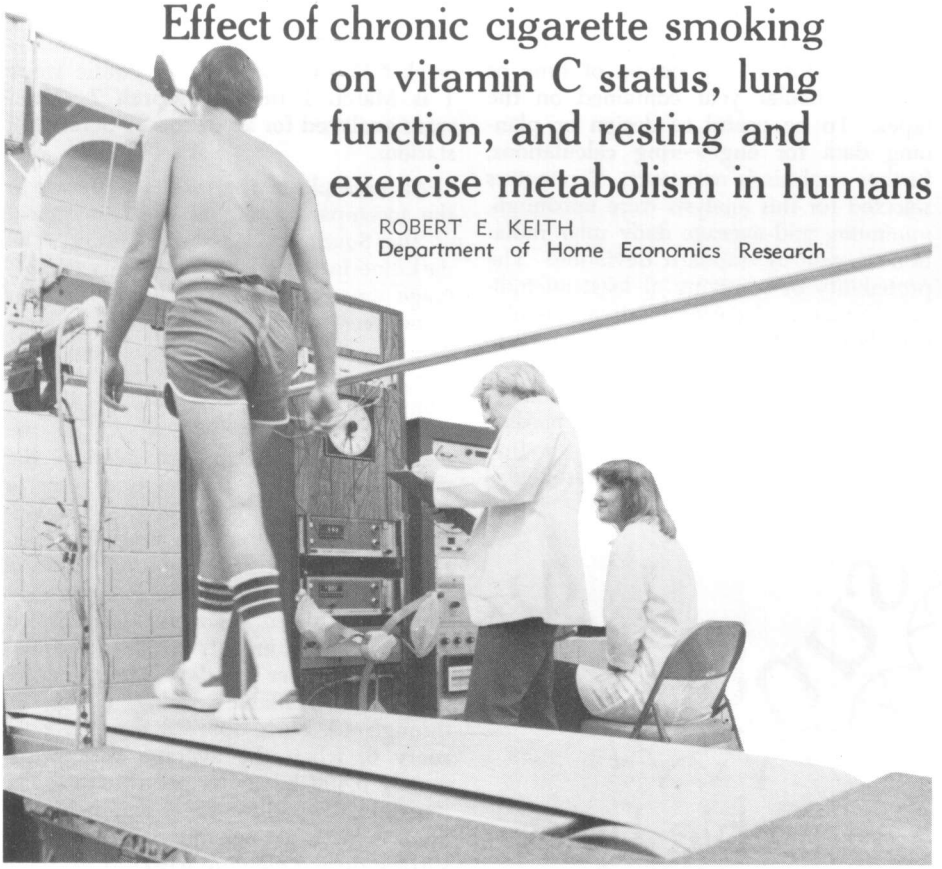

INVESTIGATORS have shown that cigarette smoking can cause temporary changes in cardiorespiratory performance. However, the chronic (long-term) effect of cigarette smoking on heart and lung function in healthy subjects is less clear. Furthermore, other research has indicated that plasma and leukocyte levels of vitamin C are lower in smokers, but these findings are not in total agreement. The present study was performed by the Department of Home Economics Research, Auburn University Agricultural Experiment Station, to assess the ascorbic acid status, lung function capabilities, and resting and exercise metabolism of apparently healthy male, untrained cigarette smokers and nonsmokers.

Twelve smokers and 10 nonsmokers, 25-38 years old, participated in the study. Both groups exhibited comparable physical activity profiles as determined by an activity-medical questionnaire. Informed consents and 3-day food records for determination of vitamin C intake were obtained from all subjects prior to testing. Plasma vitamin C levels were also determined from venous blood taken from the subjects prior to testing. All volunteers were initially weighed and heights recorded.

Spirometric (lung function) tests were performed with a 6-liter spirometer and consisted of two forced vital capacity (FVC) and 1-second forced expiratory volume (FEV_1) measurements with the highest values being recorded. The FEV_1/FVC ratio (FEV percentage) was calculated. Volunteers were prepared for electrocardiographic monitoring, and resting heart rates (HR) and blood pressures (BP) of the subjects were determined. Volunteers next mounted a motor-driven treadmill and worked at 50% of their maximal capacity as estimated by heart rate for a period of 5 minutes. During the last 2 minutes of the exercise, subjects were required to breathe through various gas collecting and recording instruments. Treadmill workloads, oxygen consumption (VO_2), and inspired ventilations (V_I) were recorded at this point. Blood pressure readings were again taken at 3 minutes post exercise and a fingerprick blood sample was obtained for the determination of blood lactic acid levels.

Anthropometric and pre-exercise data on the subjects are shown in table 1. No significant differences were seen for height, weight, or age between the groups. Smokers exhibited a smoking habit of approximately 16 pack-years (number of packs/day × number of years subject had been smoking). Plasma vitamin C levels were significantly lower in the smoking group even though daily ascorbic acid intakes of the two groups were not statistically different. Smokers also exhibited somewhat higher resting heart rates, but no differences were seen for blood pressure values.

Spirometric and exercise data are shown in table 2. Lung function test results indicated that smokers had somewhat lower FEV_1 and higher FVC values and a significantly lower FEV percentage than nonsmokers, possibly indicating some impairment of lung function in the smoking group. Treadmill workloads were significantly greater for nonsmokers although no differences were seen for VO_2, V_I, post-exercise blood pressures, or blood lactic acid levels.

In summary, the data presented in the current study give some indication of decreased vitamin C status as well as decreased lung function and cardiovascular-exercise performance in an otherwise healthy group of smokers when compared with a similar group of nonsmokers.

TABLE 1. ANTHROPOMETRIC AND PRE-EXERCISE DATA[1]

	Smokers	Nonsmokers
Height (in.)	70.4 ± 2.8	70.5 ± 2.4
Weight (lb.)	172.0 ± 22.4	167.9 ± 29.9
Age (yr.)	29.8 ± 4.6	28.4 ± 3.7
Vit. C intake (mg./day)	81.4 ± 54.1	106.0 ± 60.2
Plasma vit. C. (mg./dl.)	0.69 ± 0.26[2]	0.88 ± 0.27[2]
Resting HR (b/min.)	71.9 ± 13.1	64.1 ± 9.1
Resting systolic BP (mm. Hg)	126.8 ± 8.8	125.5 ± 9.6
Resting diastolic BP (mm. Hg)	74.0 ± 7.5	75.8 ± 6.0

[1] Values are mean ± SD.
[2] Values significantly different at $P = 0.05$.

TABLE 2. LUNG FUNCTION AND EXERCISE DATA[1]

	Smokers	Nonsmokers
FEV_1 (l)	3.85 ± 0.47	3.96 ± 0.35
FVC (l)	4.98 ± 0.59	4.76 ± 0.37
FEV %	77.3 ± 6.3[2]	83.2 ± 7.2[2]
Treadmill workload (METS)	4.35 ± 1.49[2]	5.32 ± 1.02[2]
VO_2 (ml./kg./min.)	15.9 ± 4.8	16.7 ± 2.0
V_I (l/min.)	22.9 ± 6.4	26.1 ± 4.5
Post-exercise systolic BP (mm. Hg)	131.9 ± 9.0	135.0 ± 9.0
Post-exercise diastolic BP (mm. Hg)	69.8 ± 7.2	73.4 ± 8.6
Post-exercise lactic acid (mg./dl.)	21.4 ± 6.5	17.8 ± 4.8

[1] Values are mean ± SD.
[2] Values significantly different at $P < 0.05$.

Oystershell or Limestone? Both Good Calcium Sources for Hens

DAVID A. ROLAND, Department of Poultry Science

A MAJOR GOAL of the commercial egg producer is to maintain acceptable egg shell quality throughout the life of the hen. However, the hen often fails as she ages, and the decline in egg shell quality results in a large economic loss. The problem is complex and confusing, as evidenced by the different, and often conflicting, suggestions the producer receives from other producers and from commercial and government "experts."

One concern to the producer is whether to substitute part of the fine granular limestone (calcium) in the diet with hen or pullet size particles and, if so, whether to use limestone or oystershell. The producers' dilemma arises primarily for three reasons: (1) since calcium is probably the major nutrient involved in shell calcification, he wants to use calcium from the best sources; (2) there are several calcium sources available; and (3) these sources vary widely in price. Economic considerations dictate that producers buy the cheapest source that will do the job.

This report reviews available information[1] comparing oystershell and limestone, which should provide a basis on which to make a decision.

Early History

In 1892 it was already a common practice to add calcium in some concentrated form to the feed of laying hens to maintain optimal shell quality. From 1923 to 1935, comparisons of Atlantic oystershell, Pacific oystershell, and various limestones found no appreciable difference in egg production or shell quality. However, there were conflicting conclusions from these early studies. Some reports indicated that oystershell was more beneficial than limestone for shell quality, while others concluded that limestone was more beneficial than oystershell.

Part of the inconsistency of results is because of wide variation in physical and chemical characteristics of the different calcium sources tested. Several researchers reported that dolomitic limestone reduced egg shell strength due to its high magnesium content. Others found that white, shiny limestone was more attractive to hens than dull gray limestone, but both were adequate sources of calcium for egg shell formation.

A 1960 report noted that the form in which calcium was consumed did not influence shell quality. There was no difference in egg shell quality when hen size oystershell (52 lb. per ton of feed) was substituted for an equal amount of fine granular calcium carbonate. Between 1921 and 1963, at least 12 papers were published in which oystershell and limestone were compared. Of these, 10 reported that limestone was equal to or better than oystershell for egg shell quality. The other two concluded that feeding oystershell gave better egg shells.

Controversy Picks Up

The controversy of oystershell versus limestone began gaining momentum in 1970 with at least 19 papers published during 1970-77 comparing the response of laying hens fed various sizes of oystershell and limestone.

A paper published in 1970 reported improved egg shell quality by hens fed diets in which oystershell supplied two-thirds of the added limestone. The explanation given was that the hen size particles of oystershell were retained in the gizzard during the day, with the calcium then metered out at night. This prevented hens from becoming calcium deficient during nighttime hours.

The next 7 years saw at least nine other researchers conducting similar experiments. Five reported that the inclusion of oystershell in the diet at the expense of limestone was not beneficial, whereas four said including oystershell improved shell quality. One researcher reported that the effect of oystershell on shell quality was more evident when the diet contained 3.00% calcium than when it contained 3.75%.

Most of the studies were not true comparisons of oystershell and limestone because hen size oystershell was compared with a fine, granular limestone. However, eight comparisons of hen or pullet size oystershell with hen or pullet size limestone were published during 1972-77. Seven of these reported equal responses and one stated that oystershell gave better results than limestone.

While there may be several reasons for the variation in response of hens fed various sources and sizes of good quality calcium carbonate, probably the most important were: (1) researchers were not comparing the same particle size, and (2) the hens in which oystershell was substituted for a portion of the fine granular limestone were not always consuming adequate calcium. In several studies, for example, the inclusion of large particles of calcium carbonate gave no response in diets containing adequate levels of calcium. However, other researchers reported a response with hens that were consuming inadequate amounts of calcium.

Adequate calcium is hard to define because the calcium requirement can be influenced by several factors. In the 1970 report cited earlier, hens fed diets containing 3.5% calcium were probably calcium deficient because they were consuming only 3.2 to 3.3 grams of calcium per day – below the NRC requirement of 3.6 grams.

Conclusions

1. The vast majority of research showed no difference between good quality (38-39% calcium) limestones and oystershells in promoting egg shell quality.
2. The inclusion of hen or pullet size particles of oystershell or limestone in diets will improve shell quality if hens are consuming inadequate calcium.
3. Hens need to consume a minimum of 3.75 grams of calcium per day to ensure maximum shell quality; older hens or hens with shell quality problems need up to 1.00 gram more, depending on the severity and type of problem. If hens consume these levels of calcium, the inclusion of hen size particles of oystershell or limestone in the diet would not give beneficial response. If for some reason (feeder design, feed separation, temperature, dietary calcium level) hens do not consume adequate calcium and shell quality is poor, hen or pullet size limestone or oystershell should be included in the diet. Because of the cost differential between sources of calcium and particle size, only one-third to one-half of the added fine granular calcium should be substituted with large particles.
4. Since the majority of studies indicate no difference in good quality limestone and oystershell, the source used should be least-cost formulated, just as for most other nutrients.

[1] A complete list of references can be supplied upon request to the author.

IRRIGATING PECANS Speeds Growth Boosts Production Increases Nut Size

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SUPPLEMENTARY IRRIGATION of pecans is a relatively new and accepted cultural practice, particularly in newly established plantings. With irrigation, precocious and prolific varieties grown in high density plantings can bear large commercial crops as early as the sixth season after planting. The result of irrigating such plantings, particularly with drip irrigation, can be yields of high quality nuts previously unattainable.

Pecan irrigation studies were begun by Auburn University Agricultural Experiment Station in 1971 at the Gulf Coast Substation. The project was designed to evaluate the response of precocious and prolific trees to supplementary irrigation as measured by vegetative growth, yield, and nut quality. Different drip irrigation scheduling procedures were used to ascertain if such an approach could fulfill the water requirements of pecan trees comparable to sprinkler irrigation.

Drip irrigation employs emitters (water outlets) inserted into buried or above-ground polyethylene lines laid out under the tree canopy. Emitters release a point source of water slowly (1 gal. per hour or more) under low pressure (generally 15 p.s.i.).

Lateral surface spread of drip irrigation water is usually confined to 2-4 ft. from the point source, depending on slope of the land and soil texture. Permanent location of the emitter permits maximum absorption by the tree because of a more extensive root system that develops under the area receiving emitted water. In contrast, sprinkler irrigation usually supplies water to the entire root system plus that area between rows where fewer roots exist.

Drip irrigation is successful in tree crops because only a fraction (perhaps 10-25%) of the entire root system can supply the tree's water needs if that fraction is in soil close to field capacity. Drip irrigation works on the principle of preventing moisture stress rather than correcting stress, as is often the case with sprinkler irrigation.

Drip treatments consisted of (1) 1-, 4-, and 8-hour per day watering programs (controlled by time clock); and (2) adding of water based on soil moisture availability monitored by soil tensiometers equipped with microswitches set at 15, 30, and 50 centibars. One emitter was used per tree.

The sprinkler treatment compared consisted of applying 1 in. of water per week, except that no water was applied if the soil tensiometer equipped with an override switch registered less than 30 centibars. A no-irrigation treatment (check) was included for comparison.

* Former Research Associate.

All trees scheduled for supplementary irrigation were drip irrigated the first year and check trees were mulched and periodically supplied water from a tank. Treatments were begun the second year after planting.

The first noticeable effect of supplementary irrigation was the high survival of newly planted trees. Few replants were required.

By the fourth growing season, sprinkler irrigated trees were consistently larger than those under drip treatments and 39% larger than non-irrigated trees. This effect has continued throughout the experiment. By the end of the seventh growing season, sprinkler irrigated trees were 55% larger than non-irrigated trees. Canopy volume showed large differences due to irrigation treatment, table 1.

Although sprinkler irrigation promoted the greatest degree of vegetativeness and resulted in the largest trees, it delayed the onset of pistillate flower formation. This delay showed up in reduced yields the sixth growing season, the first good crop, table 1. Sprinkler irrigation resulted in 589 lb. less nuts per acre than the highest yielding drip treatment (tensiometer at 30 centibars). Trees getting no irrigation yielded 933 lb. less nuts per acre than this drip treatment.

In the sixth growing season a period of drought stress occurred during the time when nut size was determined. No such stress was encountered during the filling period. Consequently, irrigation greatly influenced nut size and kernel weight, but had little effect on percent shellout for Shoshoni and Cheyenne pecans, table 2.

TABLE 1. EFFECT OF IRRIGATION ON CANOPY VOLUME AND YIELD OF PECAN, CAPE FEAR VARIETY

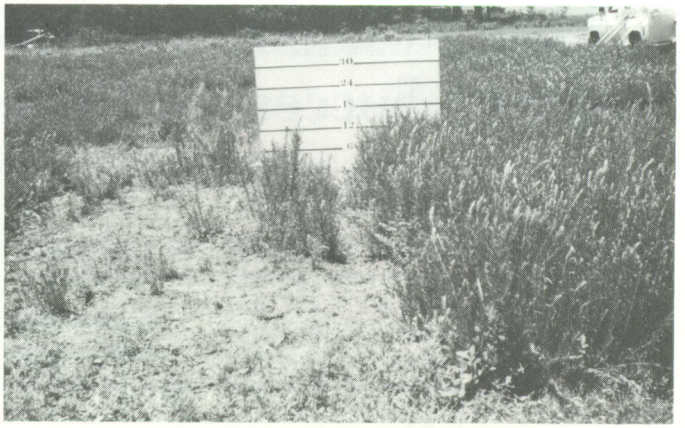
Irrigation treatment	Yield per tree[1]	Yield per acre[2]	Canopy volume[3]
	Lb.	*Lb.*	*Ft.*
Tensiometer @ 30 centibars	32.8	1,361	340
4 gal. drip per day	31.9	1,324	316
Tensiometer @ 50 centibars	28.4	1,179	299
1 gal. drip per day	23.6	979	224
Tensiometer @ 15 centibars	19.2	797	219
8 gal. drip per day	19.2	797	293
Sprinkler with tensiometer override @ 30 centibars	18.6	772	360
No irrigation	10.3	428	204

[1] After 5 years of differential treatment.
[2] Spacing, 30 × 35 ft.—41.5 trees per acre.
[3] After 6 years of differential treatment.

TABLE 2. EFFECT OF IRRIGATION METHODS ON NUTS PER POUND, KERNEL WEIGHT, AND PERCENT SHELLOUT, SIXTH GROWING SEASON, SHOSHONI AND CHEYENNE VARIETIES

Irrigation treatment	Nuts/lb.		Kernel wt.		Shellout	
	S[1]	C	S	C	S	C
	No.	*No.*	*G*	*G*	*Pct.*	*Pct.*
Sprinkler with tensiometer override @ 30 centibars	48	60	5.0	4.3	52.8	56.5
8 gal. drip per day	49	60	4.8	4.2	51.6	55.8
4 gal. drip per day	53	63	4.5	4.2	52.4	51.6
1 gal. drip per day	58	65	4.0	4.1	50.1	55.8
Tensiometer @ 15 centibars	48	62	4.8	4.1	52.3	56.2
Tensiometer @ 30 centibars	52	63	4.5	4.1	52.1	56.7
Tensiometer @ 50 centibars	57	71	4.2	3.7	52.3	56.9
No irrigation	65	67	3.7	4.0	52.7	58.5

[1] Variety: S = Shoshoni, C = Cheyenne.



Serala 76 (right) made good growth on nematode-infested test plot, while susceptible check (left) failed to survive.

Serala 76 and Interstate 76, New Auburn Sericea Varieties

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TWO VARIETIES OF SERICEA that are resistant to root-knot nematodes – Serala 76 and Interstate 76 – have been released by the Auburn University Agricultural Experiment Station. The two were developed from several resistant inbred lines developed cooperatively with the Georgia Agricultural Experiment Station and USDA-SEA.

Need for resistant varieties has been shown by stand failures after the first harvest year when varieties susceptible to root-knot nematodes were planted on infested soils. Higher forage yields and more persistent stands have been obtained with resistant varieties under the same conditions.

Variety Development

Serala 76 is a synthetic composed of 10 elite inbred lines that breed true for resistance to the root-knot nematodes *Meloidogyne incognita* and *M. incognita acrita*. Four of the 10 lines also are resistant to *M. hapla*. Six of the 10 lines originated from common sericea and four from the Arlington variety.

Interstate 76 was derived from two F_4 (fourth generation) lines from Interstate × Ala. L 11. This new variety breeds true for resistance to all three of the root-knot nematode species listed. The Interstate parent variety is resistant to *M. incognita* and *M. incognita acrita* species of nematodes. The other parent, Ala. L 11, is a tall growing inbred line that is resistant to all three of the species of root-knot nematodes listed.

TABLE 1. REACTION OF SERICEA VARIETIES AND LINES TO ROOT-KNOT NEMATODES IN A FIELD TEST PLANTED MAY 18, 1975, AT TIFTON, GEORGIA

Entry	Larvae/150 cc of soil, by date			
	11/19/75	12/6/76	2/22/77	7/6/77
	No.	*No.*	*No.*	*No.*
Serala	236	694	326	126
Serala 76	38	248	4	18
Ala. L 10, resistant check	22	42	10	6
Ala. L 100, susceptible check	1,094	2,352	824	388[1]
Interstate 76	28	46	6	18
Interstate	72	48	46	18

[1] Soil samples taken from root zone of surviving plants; stand mostly depleted.

TABLE 2. DRY HERBAGE YIELD PER ACRE PRODUCED BY SERICEA VARIETIES AND LINES, AT TWO LOCATIONS

Entry	Yield/acre, by location and year[1]			
	Tifton, Georgia			Auburn,
	1976	1977	1978	1978
	Lb.	*Lb.*	*Lb.*	*Lb.*
Serala	6,745	5,150	7,693	10,886
Serala 76	7,429	5,768	7,258	10,980
Ala. L 10, resistant check	7,739	6,157	7,659	——[2]
Ala. L 100, susceptible check	5,987	0	0	——[2]
Interstate 76	8,194	6,623	8,251	11,298
Interstate	7,511	6,242	8,248	9,936

[1] Soil type was sandy coastal plain at Tifton and Piedmont clay at North Auburn Agricultural Engineering Farm.
[2] Not included in this test.

Variety Description and Performance

Serala 76 is a fine-stemmed, tall-growing variety similar to Serala in stem type and height. It is more resistant to the cotton root-knot nematode (*M. incognita acrita*) than Serala, table 1. However, Serala produces some resistant and some susceptible plants and is much more resistant than Ala. L 100, the susceptible control.

Yields and stands of Serala 76 and Serala are similar (1) on soils that are not infested with these nematodes, and (2) on infested soils when Serala is seeded at high rates, table 2. The high seeding rate of Serala is required on nematode-infested soils to compensate for the portion of plants that are susceptible.

Interstate 76 is intermediate between Serala and Interstate in height and has a more open growth habit than Interstate. Both Interstate 76 and Interstate have a high level of resistance to the cotton root-knot nematode, table 1, and are more resistant than Serala and the susceptible Ala. L 100.

Forage yields of Serala 76 and Interstate 76 were similar to Serala and Interstate production at Tifton, Georgia, during each of 3 test years, table 2. Both of the new varieties yielded higher than the susceptible check, Ala. L 11, plants of which were killed before the second harvest year. On the heavy clay soil at north Auburn, forage yields of Serala 76, Interstate 76, and Serala were similar. All three made more forage than Interstate at that location.

Generally, both Interstate and Interstate 76 produced more early herbage (April) than Serala 76 or Serala. This is important because forage usually is in short supply at that time of year. Also, when used for conservation purposes (highway vegetation), an early variety is more competitive with weeds and presents a more attractive appearance than a later variety.

Seed of Serala 76 and Interstate 76 will be available after the 1980 seed crop is harvested.

How Residents Perceive Area Affects Success of Development

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DEVELOPMENT IS A TERM that has different meanings for different people. Even professionals who work in this area have not reached a consensus. Therefore, development in any geographical area is greatly dependent on how local people define it and what they perceive as being strengths and weaknesses within their geographical domains.

Varying views of development by local leaders are being gathered in Southern Regional Project S-120, which was planned to determine relationships between social organization at the county level and degree of development in the county.

The Auburn University Agricultural Experiment Station portion of the study began in spring 1978. Leaders in Clarke and Tallapoosa counties were interviewed to obtain information concerning their perceptions, assessments, and definitions of development.

The procedure for selecting leaders involved several steps. First, a list of positional leaders was compiled. This list was then shown to each individual whose name was on the list, and he or she was asked whether the people listed were indeed leaders. Each individual could add names to the list. After obtaining the final list, the individuals whose names appeared were to be interviewed. Information was obtained from 26 leaders in Clarke and 29 in Tallapoosa.

Definitions Obtained

As expected, the county leaders interviewed defined development in a variety of ways. Such responses as a terse "progress" to longer definitions including industry, government services, and human resources were given. Categorization is difficult, but there appears to be some agreement among the leaders. Definitions given by more than two leaders are listed in the table.

For Tallapoosa County, development means job opportunities, economic development and growth, and more services. Definitions given by Clarke County leaders included growth in industry, natural resource development, and human resource development. Clarke County leaders tend to emphasize improving county resources, while Tallapoosa County leaders emphasize the more traditional economic factors.

Perceived Strengths and Weaknesses

Clarke County leaders appeared to agree on the strengths of their county. The response with the most mentions (20) was people. This is rather vague, but more specific responses were morality of the people and their commitment to the county. It is difficult to argue that people are not a strength, but it also is difficult to determine exactly how this strength can be practically utilized.

Rurality was the next most often mentioned strength. Since rural areas have become an attractive place to live, this may well be an important asset. However, increasing cost of energy may greatly affect where people live and work.

Three other perceived strengths with six mentions each were potential for growth, recreation (hunting and fishing), and natural resources. Climate could have been included in natural resources, but because it was singled out by five leaders, it was left as a separate category.

Of the five major categories in which weaknesses were listed, need for employment opportunities was one of the most mentioned, along with health care and roads-transportation.

Tallapoosa County leaders agreed that their main strength was recreation. Recreational facilities are important in any area's development, of course, but especially so in Tallapoosa County because Lake Martin is partially in that county. The second most often mentioned strength was people, whose significance has already been discussed.

There was far less consensus among Tallapoosa County leaders on what their weaknesses were. Mentioned most often was roads-transportation, but only 11 leaders perceived this as a weakness. Lack of employment diversity, housing, and health care were other perceived weaknesses. Tallapoosa County employment is centered around the textile industry and is less diversified than many Alabama counties. Even so, only nine leaders mentioned this as a weakness.

Conclusions

Comparing the two counties, one can conclude that there is more consensus on strengths than on weaknesses in each county, and Clarke County leaders are more in agreement on their weaknesses than are Tallapoosa County leaders. Another conclusion is that Clarke County should be able to more easily attack its weaknesses since leaders are more united in their perceptions.

A third conclusion is that the two counties are similar in what leaders perceive as being weaknesses, but there is a great deal more diversity in Tallapoosa. Tallapoosa County leaders mentioned about twice as many weaknesses as Clarke County leaders.

Clarke County leaders emphasized their county's natural and human resources as being strengths, while Tallapoosa County leaders emphasized previous accomplishments, such as recreation (Lake Martin), low unemployment, and good schools.

LEADERS' PERCEPTIONS OF STRENGTHS AND WEAKNESSES IN DEVELOPMENT, CLARKE AND TALLAPOOSA COUNTIES

Strengths		Weaknesses	
Responses*	Times mentioned	Responses	Times mentioned
Clarke County			
People	20	Employment opportunities	16
Rural location	11	Health care	16
Potential for growth	6	Roads and transportation	16
Recreation (hunting and fishing)	6	Education	8
Natural resources	6	Housing	6
Climate	5		
Tallapoosa County			
Recreation	21	Roads and transportation	11
People	11	Diversity of employment	9
Geographical location	7	Health care	5
Low unemployment	7		
Rural county	5		
Schools	5		

* Only responses that were mentioned at least five times are included.

Cloudy Weather and Dissolved Oxygen in Catfish Ponds

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Low concentrations of dissolved oxygen (DO) and problems associated with heavy "blooms" of phytoplankton (dense growth of microscopic plants) are commonplace in channel catfish ponds during late summer and early fall.

Fish farmers widely recognize that DO concentrations are lower throughout the day during prolonged periods of cloudy weather than for fair days because of the unfavorable influence of low light intensity on oxygen production by the phytoplankton. Therefore, less DO is available for use by organisms during the night and DO can drop to dangerously low levels after a few days of cloudy weather. Unfortunately, little is known regarding the number of consecutive days of cloudy weather that may be tolerated before DO in channel catfish ponds is depleted to unacceptable levels.

In order to accurately predict the relationships between cloudy weather and DO dynamics in catfish ponds, a computer simulation model was developed by fishery researchers at the Auburn University Agricultural Experiment Station to determine DO in ponds for varying degrees of cloudy weather and plankton densities. The computer model solves two basic equations which give the concentration of DO in ponds. First, the amount of DO in pond water at dawn may be defined by the nighttime equation,

DO at dawn = DO at dusk ± DO exchanged with air above the pond − DO used by fish − DO used by bottom organisms − DO used by the plankton.

Secondly, the DO concentrations of pond water at dusk may be predicted by the daytime equation,

DO at dusk = DO at dawn ± daytime change in DO.

All terms in the two equations are obtained for ponds which do not have "muddy" water by recording the following information: pounds per acre of catfish, Secchi disk visibility[1] of pond water, daytime solar radiation, and water temperature at dusk. The Secchi disk visibility is the most important term in the nighttime equation because it is used to estimate DO consumption by plankton, the major user of DO. Likewise, solar radiation and Secchi disk visibility are the most important components in the daytime equation because they jointly regulate the daytime increase in DO.

Results of the computer analysis demonstrated, as expected, that the combination of dense plankton blooms and cloudy days was closely associated with low DO concentrations. Dense plankton blooms (Secchi disk visibilities less than 8 in.) would result in DO depletion (0 p.p.m.) after 1 day, table 1. Moderate plankton blooms (Secchi disk visibilities of 16 to 24 in.) and moderately overcast and partly cloudy weather results in DO depletion after 2 to 7 consecutive days. Little chance exists of a pond becoming completely depleted of DO during the night following slightly cloudy or clear days.

Channel catfish culturists frequently initiate emergency aeration in ponds when DO concentrations decline to 2 p.p.m. or less. Dissolved oxygen levels of 2 p.p.m. are likely to occur in ponds with moderate to high Secchi disk visibilities, 16 to 24 in., after 1 or 2 days of moderate to heavily overcast weather, table 1. Secchi disk visibilities of 8 in. or less are likely to result in DO concentrations declining below 2 p.p.m. during any given night regardless of the magnitude of solar radiation.

DO concentrations at dawn are generally lowest during July, August, and early September because plankton and fish densities, the major components of respiration, are greater at this time than earlier in the growing season. Furthermore, water temperatures are still high enough to favor rapid rates of respiration. One would therefore expect cloudy weather to have its greatest impact during this period. Knowledge of the probabilities of consecutive days of cloudy weather and of the number of consecutive days required for DO depletion, table 1, will be useful to catfish pond managers for predicting DO depletion. For example, the probabilities of incurring consecutive days of moderate to heavily overcast weather were calculated from 14 years of data obtained by the National Weather Service at Auburn, table 2. It is apparent that the probability of having 2 to 4 consecutive days of moderately overcast weather at Auburn is low during July and August but increases sharply during September and October. However, from mid-September through October reduced water temperatures result in lower respiration rates of the pond community and usually prevent DO depletion.

Table 1. Number of Consecutive Days of Cloudy Weather to Deplete Dissolved Oxygen in Catfish Ponds, for Specified Plankton Densities

Secchi disk[1] visibility (inches)	Cloudiness			
	Heavily overcast	Moderately overcast	Partly cloudy	Clear
Depletion to 0 parts per million				
Below 8	1	1	2	S[2]
16	1	2	6	S
24	2	3	6	S
32	2	3	7	S
Depletion to 2 parts per million				
Below 8	0	0	0	0
16	1	1	1	1
24	1	1	2	4
32	1	2	3	6

[1] Measures plankton density. Higher numbers indicate less plankton.
[2] S denotes that pond is safe from oxygen depletion.

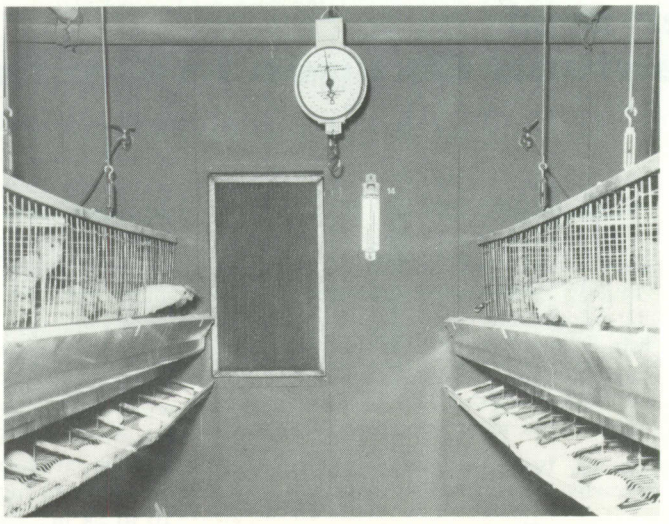
[1] A Secchi disk is a disk which is 8 in. in diameter and painted with alternate black and white quadrants. The depth at which it disappears from view is the Secchi disk visibility. The Secchi disk visibility gives an estimate of plankton density in ponds not contaminated with mud turbidity.

Table 2. Probabilities of Consecutive Days (Number Per 100) of Moderate to Heavily Overcast Weather at Auburn, Alabama

Number of consecutive overcast days	July	August	September	October
1	11/100	13/100	26/100	39/100
2	6/100	7/100	24/100	39/100
3	2/100	1/100	22/100	37/100
4	0/100	0/100	17/100	31/100

Facility Expands Poultry Research Capabilities

JOHN BRAKE, Department of Poultry Science
C. A. FLOOD, JR. and J. L. KOON, Department of Agricultural Engineering



THE AVIAN ENVIRONMENTAL PHYSIOLOGY LABORATORY of the Department of Poultry Science, Agricultural Experiment Station, has recently been through an extensive renovation to improve the capabilities of this unique research facility.

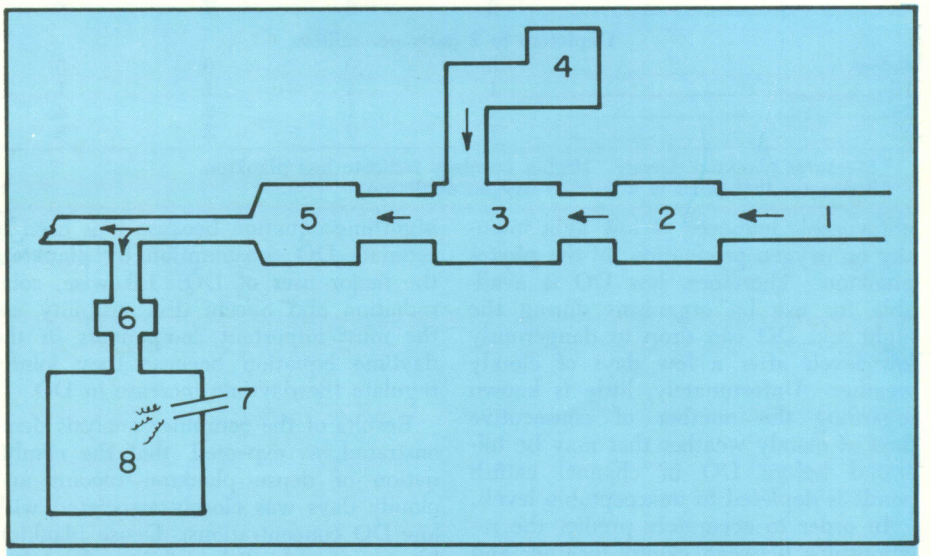
The facility houses 16 environmentally controlled chambers, necessary mechanical equipment, a workshop, and monitoring room. Each chamber has 100 sq. ft. of floor space and can house all types of poultry. Presently each chamber is equipped with 20 cages to be used for research with broiler breeder and caged layers.

All chambers are supplied with air by a common dehumidifier-conditioning system capable of supplying 100 cu. ft. of air per minute to each chamber. The supply air from this system can be varied in temperature as needed and possesses less than 10% relative humidity. The supply air is then reheated and rehumidified by hot water and steam, respectively, as it enters each chamber to achieve individual temperature and humidity control. Air quality is maintained by changing the air in the chamber every 6 minutes with this system. Additionally, individual photoperiod control is maintained by time clocks on each chamber. Ten chambers maintain constant temperature and humidity as selected. Six chambers have programmable controls which allow the researchers to select specific temperature and humidity cycles. Each chamber and the common air supply system are equipped with recorders and monitoring equipment to ensure proper control as well as a record of the environmental conditions during an experiment. These environmental chambers will allow experimentation with a number of environmental situations simultaneously, such that more information can be derived faster and more economically than in field conditions.

The major thrust of the research program will be to better define and quantitate how a bird interacts with its environment. Planned research for the facility includes investigations dealing with environmental factors and thyroid metabolism, forced molting, immunological studies, and the relationship of photoperiod to reproductive performance.

Results of these studies will allow adaptation of housing and equipment designs and management practices to better meet the physiological and nutritional requirements of the birds. This will result in better quality eggs and meat at a lower cost to both the producer and consumer.

General design of air handling system: air enters (1) and is partially dehumidified by refrigeration units (2); further drying occurs in dryer (3) where hot air is supplied by gas burners (4); cooling of heated, dry air is accomplished by refrigeration units (5) before entering chambers; individual hot water coils heat (6), and steam humidifies (7) each chamber (8).



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