highlights
of agricultural research

Vol. 27 No. 3 Fall 1980

AGRICULTURAL EXPERIMENT STATION AUBURN UNIVERSITY

R. DENNIS ROUSE, DIRECTOR AUBURN UNIVERSITY, ALABAMA

DIRECTOR'S COMMENTS

THE FEDERAL LAWS providing for an Agricultural Experiment Station and for Forestry research in each state (the Hatch Act of 1887 and the McIntire-Stennis Act of 1964) require states to match federal dollars. We would not have much agricultural and forestry research if states only matched federal dollars. Thankfully states have placed a higher value on productivity than has the federal government.

R. DENNIS ROUSE

The productivity of American agriculture and forestry is the key to this nation's future. It is frustrating that a higher funding priority is not placed on agricultural research, extension, and teaching than has been for the past 25 years. Federal funding for all research recommended by President Carter for next year was 13%. Funding recommended for agricultural research in the USDA and State Agricultural Experiment Stations was less than one-half the average for all federal research, not nearly enough to offset inflation. The House Agriculture Committee recommended an increase equal to the average for federally funded research. The full House essentially supported the President's recommendation.

Congressman Foley (D) Washington State, Chairman of House Ag Committee, made an impressive speech in reference to this year's appropriation bill urging better support for next year. I quote from the Congressional Record of July 30, 1980 — ". . . there is one disquieting aspect of the bill which particularly bothers me. This is what I consider to be the inadequate funding of agricultural research, extension, and teaching proposed for fiscal year 1981.

"We are dealing here not with a current cash-flow type of expenditure which can be cut back in a belt-tightening year and compensated in a later year without lasting damage. We are talking about an investment-type expenditure which involves a cumulative building process essential to the long-range welfare of our food and fiber industry. We are talking about the technical lifeblood of our unparalleled U.S. food system.

"For a number of years we have been draining the blood from this system through a process of hold-the-line budgeting which has not kept pace with essential cost increases.

". . . Recently a group of independent scientists looked at all the studies conducted during the past 20 years on the benefits of public research and concluded that annual rates of return on agricultural research are on the order of 50%.

"The rate of growth in agricultural productivity in the United States began an alarming decline during the decade of the 1970's. With inflation an overriding concern, we must reverse this trend in the 1980's. We can sustain productivity growth in agriculture only if our research, extension, and teaching programs continue to feed new scientists and new knowledge into the system.

"Mr. Chairman, I realize we must make hard choices and set hard priorities in this most difficult of economic times for our Nation. I do not plan to offer any amendments to this bill. However, I am convinced that our basic research, extension, and teaching programs must receive higher priority than in recent years.

"We cannot allow a coasting in programs that increase our productivity and our ability to supply food for our fellow citizens and a hungry world.

"I would urge my colleagues on the Appropriations Committees for next year to give even more careful attention to this matter, and specifically to placing higher priority on this important area.

"And I would urge all of my colleagues in the House to join in this effort."

Congressman Foley has correctly stated the situation.

may we introduce . . .

Dr. Morris White, professor in the Department of Agricultural Economics and Rural Sociology. A native of Ashland, Alabama, Clay County, Dr. White joined the Auburn faculty in 1950. Dr. White received a B.S. degree in agriculture from Auburn in 1938, an M.S. from Purdue in 1947 and the Ph.D. from that institution in 1950. He worked three years as a graduate assistant while at Purdue. Dr. White worked three years as a county supervisor with the Farm Security Administration 1938-41, spent 49 months in the Army, and was discharged as Major.

Dr. White teaches both undergraduate and graduate courses in agricultural prices, marketing, and policy, and conducts research in commodity marketing and prices. He has authored numerous Station publications and professional journal articles and is a member of several professional and honorary societies.

HIGHLIGHTS of Agricultural Research

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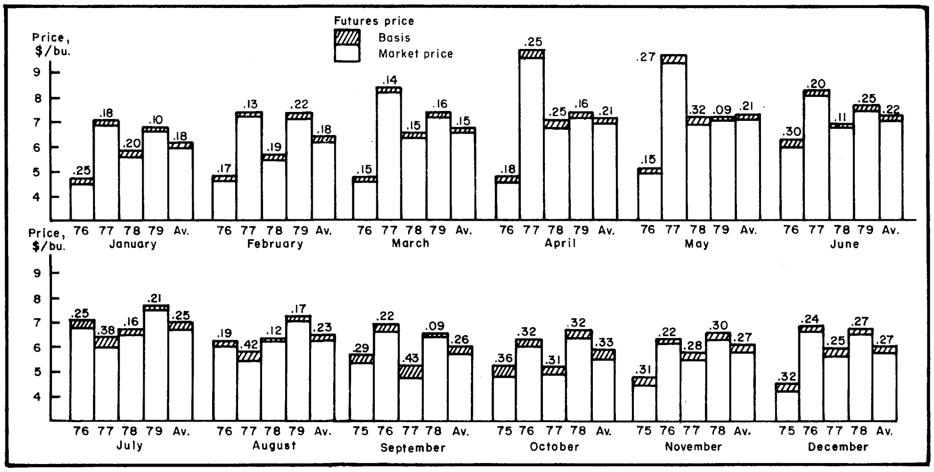
ON THE COVER: Marketing is important to soybean profits, see story page 3.

Differences in Cash Prices and Futures Quotations for Soybeans

MORRIS WHITE and EDDIE EASTERLING
Department of Agricultural Economics and Rural Sociology



ALABAMA SOYBEAN GROWERS harvested 56.2 million bushels of soybeans from 2,250,000 acres in 1979. This was almost four times the acreage of soybeans harvested in 1970, and it was 54% of the total acres of all crops harvested in the State in 1979. In 1970, soybeans were grown on only 22% of the harvested crop acreage.

Today, the market for soybeans and soybean products is dynamic. Growers are operating under conditions of high uncertainty regarding markets and prices, and the financial risks to growers and buyers alike are great. Such conditions have increased forward contracting ("booking") and the use of futures markets in an effort to achieve higher returns for growers and reduce financial losses.

For several reasons, a larger number of Alabama growers have chosen to book with local buyers instead of using the futures market. Even though booking may be the right choice for individual growers, knowing how the soybean futures market functions and being aware of current activity in that market could be beneficial.

The reason for this is that a price offered by contract buyers is different, but directly related to a price quotation in the futures market. The cash or booking price offered by a buyer in Alabama will generally be less than the quotation in the futures market, except in extreme supply situations. The amount by which an offered price differs from a futures quotation should represent a buyer's cost of operation plus a normal business profit.

"Basis" is the term used in referring to the difference between a local cash price and a price quotation in the futures market. Basis is the single most important factor to those who hedge regularly and to farmers who use futures to "set" a price.

Basis fluctuations are small compared to fluctuations in cash and futures prices, see chart. Factors that affect basis, such as handling and transportation costs, do not change as quickly as cash prices for beans. An illustration of why basis doesn't fluctuate with market prices is that the facilities and hours of labor required for handling a given volume of soybeans are the same regardless of whether the price of beans is $5 or $10 per bushel.

The basis figures presented here are the averages of daily differences which occurred between futures quotations and cash prices at 21 market locations in Alabama from September 1975 through August 1979. Variations in basis among market areas in Alabama were not significantly different except in Mobile where prices and fluctuations in prices are influenced significantly by export demand for beans, which is often highly variable.

The soybean marketing year extends from September of one year through August of the following year. Basis was greatest during the harvest season and smallest in January, February, and March. The most and widest fluctuations in basis occurred in August and September during the transition from an old to a new marketing year.

Since the factors that determine basis are not major price determining factors, there was no established pattern of relationship between changes in basis and changes in soybean prices. For example, in March cash and futures prices rose from just under $5 per bushel in 1976 to approximately $8 per bushel in 1977, while basis changed from 15¢ to 14¢ per bushel.

Alabama soybean buyers base a large part of their transactions on the November futures quotation when they book beans for future delivery. November is the futures trading month closest to the end of a normal soybean harvest season. When they prepare price offers to soybean growers, buyers subtract from the November quotation an amount that is equal to what they estimate the basis to be.

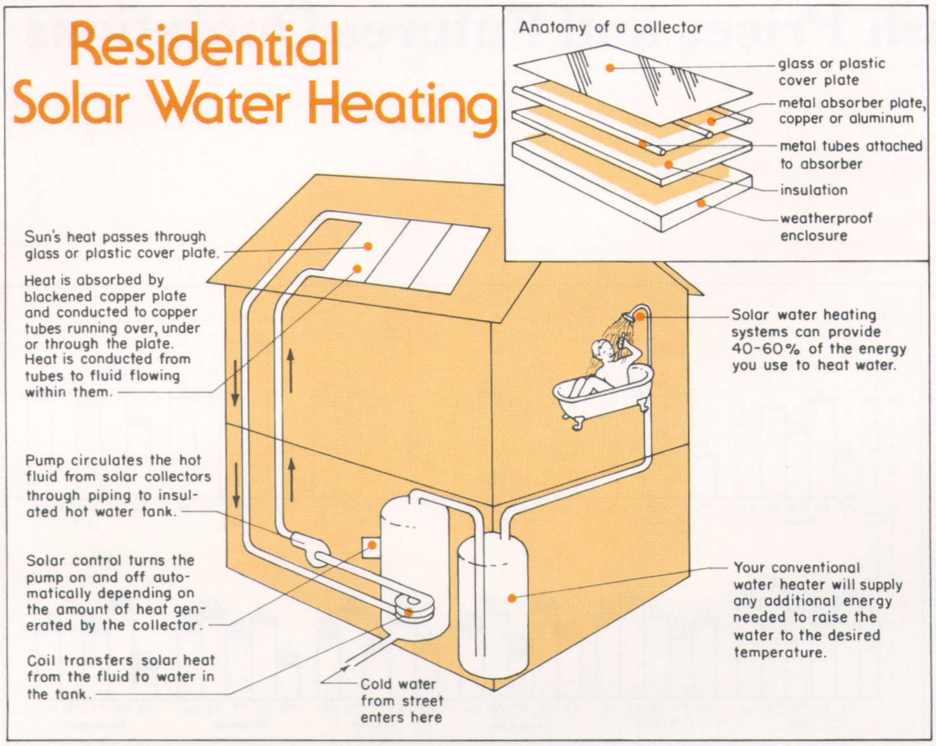
If the price is satisfactory and the booking transaction with the grower is completed, the buyer immediately places an order with a broker to sell contracts in the futures market that will balance that which was purchased from growers. Having done this, the buyer now has only the financial risk that results from relative changes in basis.

As an illustration, consider a farming situation in June, in which a farmer has a good stand of beans on 600 acres. He has been producing an average of approximately 23 bu. per acre, and estimates that he will harvest between 13 and 14 thousand bushels in the fall. From records, he determines that he would be willing to sell beans at $7 per bushel.

He knows that for the last 3 years the prices to growers in his area at harvest time have been about 30¢ per bushel lower than the November futures quotation. He learns through a market report that the November futures quotation is $7.45 per bushel, and a buyer is offering to book beans at $7.05. This is a 10¢ greater negative basis than the average for the past 3 or 4 years. However, he realizes that increases in transportation and general business operating costs could result in a larger negative basis.

What this farmer knows about basis and the futures market enables him to know that the buyer's offer of $7.05 is a reasonable offer under existing conditions. He can now confidently make a decision to accept the offer on 10,000 bu., or to continue carrying the risk of financial loss from a price drop, while waiting for a price increase.

Residential Solar Water Heating



WILLIAM E. BOLES, Department of Home Economics Research

A SOLAR WATER HEATER installed in one's home has become, although not commonplace, more recognizable than it used to be. However, potential problems still exist for the buyer of one of these systems, not the least of which is consumer confidence. For this reason, a survey was conducted of 50 homeowners throughout Alabama to assess the levels of consumer satisfaction with their solar water heaters.

The respondents were asked a variety of questions about their decision-making process in purchasing the units, their experience with installation of the units, the performance of their systems, and their overall levels of satisfaction with sales claims and money savings.

The 50 homeowners who participated in the evaluation all lived in traditional, single family detached homes and the average age of the system reported on was 27 months (long enough to shake down any problems and remain in use for several seasons). Twenty of the 50 households in the evaluation installed their units themselves (8 of these were builders and contractors installing the units on their own homes), while the remaining 30 families had the units installed for them. Seventy percent of the sample had their units installed in less than 2 weeks and 62% of the units were installed in less than 1 week. Electricity was the most common auxiliary fuel source for heating water and the most common size of the water heater tank was 80 gal. (40 gal. was the smallest and 300 gal. was the largest). Either water or oil was used most frequently as a transfer medium in the collectors.

The table lists the reasons given for purchasing the units.

Reasons for purchasing a solar water heater in descending order of importance and mean score (1=first reason, 2=second reason, etc.) of importance

	Score
Monetary savings	1.4
Energy savings	1.7
Curiosity in new technology	2.0
Gain experience in solar energy	2.0
Tax incentives	2.6
Unique innovation worthy of attention	3.5

The top two reasons cited by the solar water heater users for purchasing their systems were (1) expected monetary savings and (2) expected energy savings. Interestingly, the federal energy tax credit (40% of the purchase cost) played a small role in the decision to buy the unit. The majority (86.7%) of the solar users paid cash for their systems, which, on the average, cost $2,505 (the cheapest reported unit cost $200 while several of the contractors installed units costing $5,000 or more).

Responses to the "satisfaction" questions give reason for both encouragement and concern. Forty out of 48 households responded that their solar systems performed as they were led to believe (2 families did not answer), and 37 out of 43 households believed the system was worth the time and money spent (7 said it was too early to tell). These were fairly high rates of satisfaction; however, there were several consumers who seemed to be having trouble with their solar units. The reported problems fell into three types: (1) leaks in the system, (2) seller/installer bankruptcy, and (3) an inadequate supply of hot water. The third problem would require on-site study to locate the exact problem (e.g., collector plate undersize or wrong collector plate orientation), while the first two could have been avoided by following the recommendations listed below:

How to Select a Solar Water Heater

1. Ask your installation contractor how the solar heating system will interface with your conventional system which remains to be used as backup.
2. Ask the solar contractor for a written quotation for the total installed cost of the system.
3. The system's performance should have been calculated and preferably tested by an independent, recognized laboratory, (e.g., Alabama Solar Energy Center).
4. With family size, hot water consumption, and use patterns in mind, obtain (in writing) an estimate of the system's performance at your site.
5. Select a system with well-insulated pipes (R4 or better) and tank (R11 or better).
6. Select a system with adequate protection against freezing (where applicable).
7. Select a system whose proper operation can be monitored.
8. Require the contractor to pressure test the system for leaks.

How to Choose a Solar Contractor

1. Consult several solar contractors before making a selection.
2. Determine the contractor's qualifications and experience.
3. Request references from the contractor and check them.
4. Require written warranties, both on the system and on the installation work.
5. Require an owner's manual.

The following contacts may also be used in evaluating a solar system: The Alabama Solar Energy Center, Huntsville, 800—572-7226; The Alabama Department of Energy, Montgomery, 832-5101; Southern Solar Energy Center, Atlanta, Georgia, 404—458-8765; The Alabama Attorney General's Office of Consumer Protection, Montgomery, 800—392-5658; Fuel Substitution/Utilization Program, Auburn, 800—392-8098; and the Alabama Cooperative Extension Service, Auburn, 826-4970.

Minimum Tillage Controlled Traffic System for Double-Cropping of Cotton and Crimson Clover

W. T. DUMAS
Department of Agricultural Engineering

THE INCREASING COST OF ENERGY and the loss of soil by erosion are major topics of concern for farmers. But, many farmers are seeing tillage reduction as the best way to reduce fuel usage, while at the same time conserving soil and water.

The concept of double-cropping cotton with reseeding crimson clover under various tillage treatments has been studied during the past 4 years at the Auburn University Agricultural Experiment Station. The objectives of this study were to develop a cropping system for double-cropping cotton with crimson clover and to evaluate machinery requirements for the system.

Field plots for the study were located on a Norfolk sandy loam soil at the Agricultural Engineering Research Unit at Marvyn. The six treatments consisted of clover and no clover plots with three levels of tillage on each. The plots were established in a randomized design and replicated four times. Prior to seeding crimson clover, the entire plot area was plowed and chiseled to a uniform depth below any existing hard pan. Crimson clover was seeded in the fall of 1975 and reseeded itself each year thereafter.

Each year in the spring, after the clover seed were mature (about May 15), cotton was planted in a 2 and 1 skip-row pattern with the skips serving as permanent traffic lanes for wheel traffic. Tractor and sprayer wheels were extended to 120 in. on center to operate in the center of the skipped rows. This reduced compaction in the root zone caused by wheel traffic, thereby eliminating the need for primary tillage each year.

YIELD OF SEED COTTON PER PLANTED ACRE FROM VARIOUS TREATMENTS, AGRICULTURAL ENGINEERING RESEARCH UNIT, MARVYN, ALABAMA, 1975-1979

Treatment	Seed cotton per planted acre (4-yr. av.)
	Lb.
80 in. rotary till	
No clover, 75 lb. N sidedressed	2,212
Clover, no N sidedressed . .	2,144
16 in. strip rotary till	
No clover, 75 lb. N sidedressed	2,070
Clover, no N sidedressed . .	1,948
No till	
No clover, 75 lb. N sidedressed	2,050
Clover, no N sidedressed . .	1,992

The first year, inadequate stands of cotton were established in the clover because the mulch prevented good soil to seed contact. This was solved by mounting a fluted coulter in front of the planter to cut through the mulch, followed by a disc furrower attachment on the seed opener that pushed away the mulch from a 6-in. wide strip where the seed were planted. These two modifications made possible good control of seed depth and good soil to seed contact.

Photos from top to bottom include: Crimson clover blooming in early April; planting cotton around May 15, in clover residue; a stand of cotton 2 weeks after planting; cotton 6 weeks after planting.

At planting, 250 lb. per acre of 8-24-24 fertilizer was banded beside the row on all plots. The no-clover plots were sidedressed with 75 lb. of nitrogen per acre. The clover plots were not sidedressed. All plots were mechanically and chemically cultivated as needed. The plots were harvested with a one-row cotton picker mounted on the tractor with 120-in. wheel spacing.

This minimum tillage control traffic system for double-cropping cotton and crimson clover has the possibilities of producing a soil cover to reduce soil erosion and promote water infiltration, producing supplemental nitrogen for the cotton, increasing soil organic matter, and conserving energy by reducing tillage requirements.

Cotton can be grown with no primary tillage in crimson clover residue at a minimal yield reduction and a maximal savings of energy and expense inherent in conventional cotton production systems.

Easy Establishment of Ladino and Red Clover in Tall Fescue Sod

C. S. HOVELAND, R. L. HAALAND, and M. W. ALISON, Dept. of Agronomy and Soils
W. B. WEBSTER and V. H. CALVERT II, Tennessee Valley Substation

ADDING LADINO OR RED clover to tall fescue pasture sod offers a double-barreled advantage. It (1) improves the nutritive value of the forage, and (2) supplies nitrogen to the grass.

Unfortunately, some methods of renovation can be expensive, and getting a good clover stand is not certain. But these problems can be avoided. Renovation was both successful and economical in Auburn University Agricultural Experiment Station research at the Tennessee Valley Substation.

Existing equipment was used in the tests, in which Paraquat® was applied in narrow strips. This herbicide treatment reduced grass competition and permitted establishment of clover seedlings. Findings of recent tests, planted in both autumn and spring, illustrate the results of several years of study at the Substation, tables 1 and 2.

Paraquat was sprayed in 5- to 6-in. strips, 12 in. apart, followed by broadcast seeding on the ground surface of Regal ladino or Redland red clover. The resulting clover establishment was equal to or greater than planting in rows with a Pasture Pleaser®. With fall seeding, red clover generally had better establishment than ladino clover.

With autumn seeding, striped field crickets often destroy clover seedlings; therefore, Diazinon® insecticide must be applied. Even with insecticide application, the cricket problem is so severe in some years that control is poor and erratic clover stands result.

> Paraquat® — contact herbicide produced by Chevron Chemical Co.
> Pasture Pleaser® — sod-seeder manufactured by the Tye Manufacturing Co.
> Diazinon® — insecticide produced by Ciba-Geigy Corporation.

TABLE 1. PERCENTAGE CLOVER IN FORAGE AS AFFECTED BY SEEDING METHOD ON TALL FESCUE SOD (SEEDED SEPTEMBER 26, 1979), TENNESSEE VALLEY SUBSTATION

Harvest dates	Ladino clover		Red clover	
	Rows	Broad-cast	Rows	Broad-cast
	Pct.	*Pct.*	*Pct.*	*Pct.*
April 28	10	32	38	49
May 23	10	29	25	26
June 19	11	50	50	52

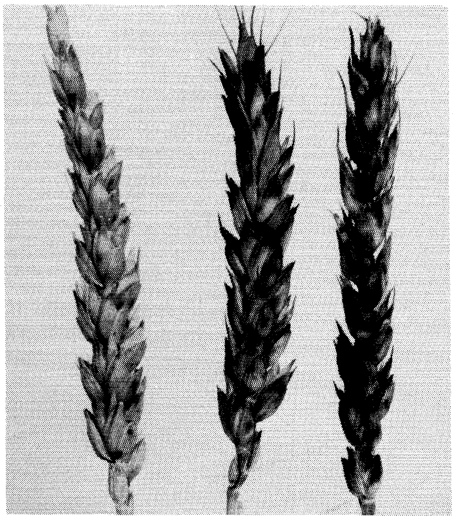
Late winter seedings have been quite successful as crickets are not a problem at that time of year, table 2. Broadcast seeding of either red or ladino clover along with spraying Paraquat in strips resulted in good clover establishment. Red clover generally provided more forage than ladino clover. Row planting was no better than broadcast planting with red clover and was less effective with ladino clover, possibly because seed could have been planted too deep. Generally, ladino clover has added 1,500 to 3,000 lb. per acre dry forage to the total pasture yield, while red clover may add 2,000 to 4,000 lb.

TABLE 2. PERCENTAGE CLOVER IN FORAGE AS AFFECTED BY SEEDING METHOD ON TALL FESCUE SOD (SEEDED MARCH 13, 1979), TENNESSEE VALLEY SUBSTATION

Harvest dates	Ladino clover		Red clover	
	Rows	Broad-cast	Rows	Broad-cast
	Pct.	*Pct.*	*Pct.*	*Pct.*
April 28	14	29	40	34
May 23	18	17	21	29
June 19	13	24	26	26

Sod-seeding clover into tall fescue sod can pay handsome dividends, although there is always the possibility of failure if drought occurs. However, applying Paraquat at ¼ to ½ lb. per acre with a simple boom sprayer and broadcast seeding clover (ladino at 3 lb. and red at 6 lb.) is cheap. Late winter seeding is more dependable than autumn seeding; however, if crickets are not a problem autumn seeding is as good or better than late seeding.

Sod-seeding with clovers offers a tremendous opportunity to easily and inexpensively improve tall fescue pastures to improve animal productivity. Cattlemen can cash in on this opportunity by using the simple and economical methods that proved successful in Auburn research.



Wheat heads showing increasing severity of glume blotch, from left (healthy) to right.

Septoria Glume Blotch of Wheat

R. T. GUDAUSKAS, Department of Botany, Plant Pathology, and Microbiology
E. L. CARDEN, N. R. McDANIEL, and F. B. SELMAN, Gulf Coast Substation
J. A. LITTLE and W. J. WATSON, Lower Coastal Plain Substation

SEPTORIA GLUME BLOTCH is one of the most widespread and damaging diseases of wheat in Alabama and possibly the Southeast. The disease is caused by the fungus *Septoria nodorum* that attacks the leaves, leaf sheaths, upper stem, and head of the wheat plant. Glume blotch can cause heavy losses by reducing seed set, size, and weight.

On leaves, symptoms of glume blotch begin as small, dark spots that later enlarge to boat-shaped lesions that are tan to brown or black in color and measure ¼ in. or more in length. Tiny, round black structures may be seen in the lesions. These are the spore-producing bodies, or pycnidia, of the fungus.

Glume blotch appears on wheat heads as a gray to brown discoloration of the glumes or outer coverings of the kernels. Pycnidia are formed in abundance on the diseased glumes.

The fungus survives between crops on seed and in wheat debris in the soil. Spore production, spread, and infection are favored by warm, wet weather. Generally, such conditions occur in the spring months in most parts of the State, however, weather conditions conducive for glume blotch can also develop in the fall and winter.

Control of glume blotch and significant yield increases have been obtained in Alabama and other states with aerial applications of mancozeb (Dithane M-45® or Manzate 200®), the only fungicide presently labeled for glume blotch control on wheat. The fungicide is applied at the rate of 2 lb. per acre in one to three applications beginning at boot or pre-boot stages.

Over the past few years, several fungicides and fungicide combinations have been tested at the Auburn University Agricultural Experiment Station for effectiveness in controlling glume blotch. All test materials were applied to plots of Arthur 71 and Coker 68-15 wheat using hand sprayers; treatments were usually replicated five times. Results from some tests conducted in 1979 are summarized in table 1. First applications of some chemicals were made when the wheat was in the boot-stage. Although glume blotch incidence generally was not high, disease control and yield increases were obtained with most of the fungicides.

In 1980, additional chemicals were tested with some initial applications being made before the flag leaf had emerged. Glume blotch incidence generally was high in all tests. Yield analyses have not been completed; however, as shown in table 2, excellent control of glume blotch and other diseases was achieved with several treatments. These results, and those obtained earlier, have identified several fungicides and combinations that show good potential for control of glume blotch. Additional research on rates and times of application is needed to determine their practical effectiveness.

Use of resistant varieties is an effective control for some diseases of wheat and other small grains. However, most of the wheat varieties commonly grown in Alabama are susceptible to glume blotch. Ratings for glume blotch and other diseases on entries in small grain variety tests are included in the Small Grain Variety Report published annually by the Department of Agronomy and Soils. Along with agronomic characteristics, disease susceptibility should be taken into account when selecting a variety.

TABLE 1. GLUME BLOTCH SEVERITY AND YIELDS[1] IN COKER 68-15 WHEAT TREATED WITH FUNGICIDES

Fungicide (rate/a.)	Applications[2]	Glume blotch[3]	Yield[4]
Benomyl 50 WP + mancozeb 80 WP (0.25 lb. + 1.5 lb.)	3	1.5	34.0
Benomyl 50 WP + mancozeb 80 WP (0.25 lb. + 2.0 lb.)	3	1.2	33.0
Benomyl 50 WP + mancozeb 80 WP (0.5 lb. + 1.5 lb.)	3	1.4	32.0
Benomyl 50 WP + mancozeb 80 WP (0.5 lb. + 2.0 lb.)	3	1.0	35.5
Chlorothalonil 500 F (1.5 pt.)	3	1.5	30.6
Chlorothalonil 500 F (2.0 pt.)	2	1.3	31.1
Chlorothalonil 500 F (3.0 pt.)	2	1.3	30.3
Chlorothalonil 500 F (4.0 pt.)	1	1.8	32.5
Mancozeb 80 WP (2.0 lb.)	3	1.4	31.0
Check	-	2.6	27.5

[1]Data are averages from two locations.
[2]Three applications: 1st at late boot, 2nd at initial head emergence, 3rd at full head. Two applications: 1st at initial head emergence, 2nd at full head. One application: late boot.
[3]0-5 scale; 0 = no disease, 5 = severely diseased.
[4]Bushels/acre.

TABLE 2. DISEASE SEVERITY[1] IN TWO WHEAT VARIETIES TREATED WITH FUNGICIDES

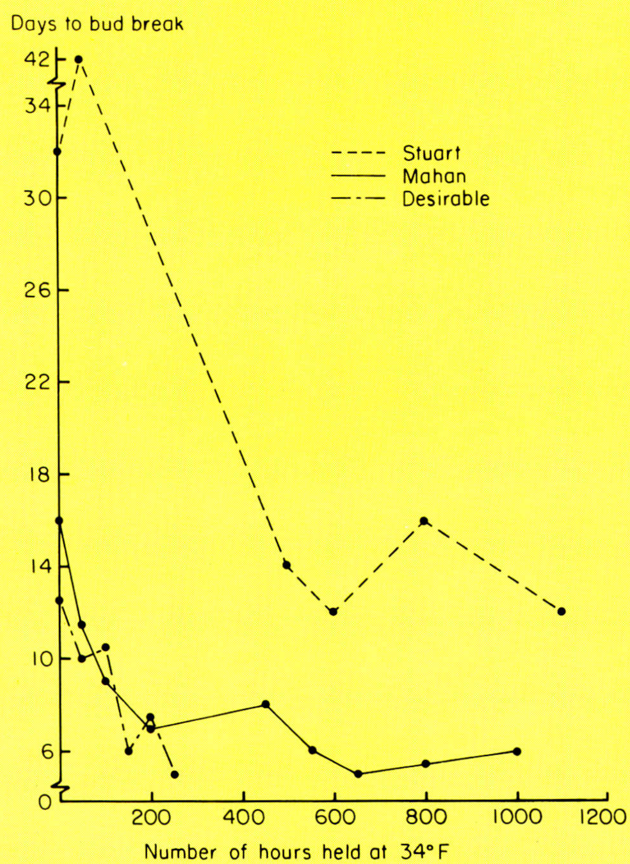
Fungicide (rate/a.)	Applications[2]	Coker 68-15[3]		Arthur 71[3]	
		Glume blotch	Powdery mildew	Glume blotch	Leaf rust
Benomyl 50 WP + triadimefon 50 WP (0.25 lb. + 0.25 lb.)	3	4.3	1.0	2.0	0
Benomyl 50 WP + CGA-64250 3.6E-A (0.25 lb. + 0.25 pt.)	3	1.0	.2	1.5	1.0
Benomyl 50 WP + DPX 7331 3.8F (0.5 lb. + 2.6 pt.)	3	2.6	2.6	2.1	4.1
CGA-64250 3.6E-A (0.5 pt.)	2	1.1	.8	1.0	.2
Chlorothalonil 500F (2 pt.)	2	3.0	3.4	2.3	4.3
Mancozeb 80 WP (2 lb.)	3	2.7	3.2	2.1	4.6
Maneb 4F (2.4 pt.)	3	3.7	3.6	2.6	4.6
Check	-	4.7	4.5	2.9	4.5

[1]Data are averages from two locations.
[2]Three applications: 1st at jointing stage, 2nd at flag leaf expansion, 3rd at full head. Two applications: 1st at flag leaf expansion, 2nd at full head.
[3]0-5 scale; 0 = no disease, 5 = severely diseased.

DELAYED DORMANCY IN PECANS

research on onset, intensity, and dissipation of rest established problem of delayed dormancy of Stuart trees

H. J. AMLING and K. A. AMLING,* Dept. of Horticulture



DELAYED DORMANCY and its effect on fruit production are generally recognized. Now there is solid evidence to indicate that Stuart pecan trees also may be subject to delays in spring bud break when trees develop high rest intensity and do not get adequate hours of chilling temperatures to break the rest. The dollars and cents result is reduced nut production.

Conditions were right for delayed dormancy of Stuart trees in 1980, and the result verified the Auburn University Agricultural Experiment Station findings that had earlier identified the problem. A substantial percentage of flowers and flower clusters dropped off Stuart trees prior to and during the pollination period. Since 1980 was an "on year" in terms of crop load, this flower shedding resulted in sizable yield reductions.

Existence of Rest Established

The Auburn research established the existence and intensity of rest in pecan buds, a growth-inhibiting condition that develops internally in buds. This rest condition can be quantitatively dissipated in intensity by exposure of buds to periods of chilling temperatures. The Auburn findings reveal that the Stuart variety, which accounts for the largest proportion of trees planted in Alabama, can develop a much higher intensity than any other variety evaluated. This is shown by the graph comparing three standard varieties.

In the study, terminal current season shoots were collected from mature trees at various times during late summer through late winter. Shoots were defoliated and then subjected to chilling temperatures of 34°F. When shoots had received specific accumulated cold hours, they were transferred to a growth chamber that was maintained at 80°F. The number of days until green tissue developed from a bud was recorded, which reflected the degree of rest intensity present in the bud.

Mild Fall, Winter Affect Rest

Most pecan varieties apparently develop only a low level of rest in areas having mild falls and winters, giving them the appearance of having little or no chilling requirements. However, these same varieties grown in areas having chilling temperatures in the fall, when green leaves and fruits are still present, would develop a much higher level of rest intensity. In such an environment, cold temperature dissipation of rest would have to occur before trees commence satisfactory growth in the spring. Insufficient chilling hours to break their intensity of rest would result in development of delayed dormancy symptoms, including flower abortion.

The magnitude of delayed dormancy symptoms would depend on the intensity of rest remaining in the bud when growth commences in the spring. In repeated Alabama observations, defoliation of Stuart trees prior to mid-September has caused bud break and renewed growth. Defoliation may occur after this time without subsequent bud break. This appears to be the result of sufficient intensity of rest developing in buds by mid-September to prevent bud break.

Delayed Dormancy in South Alabama

Bud break of Stuart trees in south Alabama occurs 1 to 2 weeks later than in central Alabama. This difference reflects a degree of delayed dormancy occurring in south Alabama, and indicates a greater dissipation of rest taking place in central Alabama. In 1980, yield of some Stuart trees was reduced as much as 30% below potential crop prospects because of delayed dormancy. This was true not only throughout Alabama, but in other Southeastern States as well.

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*Former Research Associate.

MORE CONTROL — LESS PESTICIDE

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A VARIETY OF PESTS limits production of soybeans in Alabama. These include numerous weeds, insects, diseases, and nematodes.

Controls for each type of pest have been developed by researchers working in their own respective areas of expertise. For example, entomologists have developed insecticides for use against each insect pest, and plant pathologists have developed fungicides for the various fungal diseases of soybeans. Years of such work at the Auburn University Agricultural Experiment Station and at other state experiment stations have resulted in a set of recommended materials and practices for control. These recommendations involve use of a chemical or pesticide for each specific pest that may occur on the crop during the season.

Most chemical pesticides are not entirely selective for a given pest species, but have varying degrees of activity against a variety of living organisms. The Auburn team involved in soybean pest control research reasoned that a chemical used to control one type of pest or pest complex, for example a fungicide, might also have an impact on other pests — insects, weeds, or nematodes. Various field and laboratory tests at Auburn and around the country have supported this idea.

Non-target Effects Studied

Going one step further, the Auburn research was designed to learn if pesticides commonly used on soybeans might actually provide protection against non-target pests as well as those for which they were being applied. During the past 3 years, field plot tests have been established at several locations over the State to determine impacts of fungicides, nematicides, herbicides, and insecticides on each group of pests.

Registered pesticides have been used singly and in all possible combinations according to Auburn recommendations and standard farming practices. In these tests, the nematicide was applied as a preplant treatment, the herbicide was applied at planting time, fungicides were used at early pod set and again 2 weeks later, and insecticides were applied when economic thresholds of any insect pest developed.

By working cooperatively on the same project, a pathologist, nematologist, entomologist, and weed scientist have been able to accurately monitor populations of each pest group. Further, by using plots treated with only one pesticide or any combination of two, three, or four classes of pesticides (fungicides, insecticides, herbicides, and nematicides), it has been possible to determine (1) single effects on all pest groups, and (2) any possible additive, synergistic, or adverse effects on these populations that may result during a growing season.

Multiple Pest Activity Found

Results to date demonstrate that certain pesticides can indeed have multiple pest group activity. For example, the nematicide Nemacur® applied preplant was found to significantly reduce populations of the three-cornered alfalfa hopper and total leafhopper populations for nearly 2 months. Similarly, the fungicides Duter ® and Benlate® had definite insecticidal activity against several foliage-feeding insect larvae as well as against total nematode populations, see table. Use of the insecticide carbaryl provided excellent control of several major insect pests in 1 year's test, but also appeared to stimulate populations of an important plant pathogenic nematode. No activity of herbicides on organisms other than weeds has been noted to date.

AVERAGE LEVELS OF NEMATODES, SELECTED INSECT PESTS, AND YIELDS IN SOYBEAN PLOTS TREATED WITH TWO RECOMMENDED FUNGICIDES, TALLASSEE, 1979

Treatment	Pest populations, as pct. of non-treated population			Yield/acre	
	Pathogenic nematodes	Soybean loopers	Green clover-worms	1978	1979
	Pct.	*Pct.*	*Pct.*	*Bu.*	*Bu.*
None	100	100	100	33.2	46.5
Benlate	91	85	36	35.7	51.3
Duter	53	38	36	34.8	50.1

It is emphasized that findings are preliminary and represent a variety of field and pest conditions that changed from test year to test year. Thus, at least another year of testing is needed before definite conclusions can be made from these studies. From results to date, however, it is clear that certain pesticides can do more than the single job for which they are intended. Timing, rates, pesticide selection, and many other factors will determine the total benefits from a given application.

Once the total potential for each commonly used pesticide is known, the pest complex present in a given field at a given time could indicate the choice of a pesticide which could give multiple pest control. This would eliminate the need for multiple pesticide applications with a reduction in costs to the growers—**more protection with less pesticide.**

FIG. 3. Adult lace bug on underside of leaf.

LACE BUG INJURY TO ORNAMENTAL TREES AND SHRUBS IN ALABAMA

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LACE BUGS, like scale insects, are major pests of ornamental trees and shrubs. When these insects feed they can cause a loss of desirable uniform leaf color and reduction of plant vitality, in addition to reducing the ability of the plant to withstand disease and winter damage. Such damage not only means a loss to homeowners through the possible reduction of property values but it can also result in serious economic losses to commercial growers of ornamentals.

The nymph and adult lace bugs usually suck plant juices from the undersides of leaves resulting in a splotched, stippled, or blanched appearance of the upper leaf surface, figure 1. Nymphs and adults with the cast skins of nymphs can be found on the underside of damaged leaves along with brown patches or black droplets of excrement, figure 2.

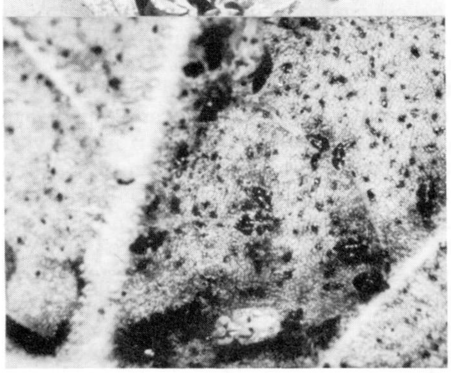

FIG. 1. Lace bug feeding injury on pyracantha; and FIG. 2. underside of leaf showing lace bug nymphs and characteristic black droplets of excrement.

Depending on the species, lace bugs overwinter as eggs attached to the underside of leaves or as adults hidden in protective crevices of the host plant, and in the spring the adults lay eggs. The nymphs which hatch from these eggs or from overwintered eggs begin feeding on the underside of leaves. They generally resemble the adults, but they do not have the beautiful lacy wings of the adults. Many species have darker bodies and are covered with large pointed spines, figure 3.

The complete life cycle, developing from an egg into an adult, may take approximately 30 days. In Alabama there may be as many as three generations a year. The highest populations, which result in the greatest damage, occur in the late summer and fall. During dry weather, heavy infestations of lace bugs are capable of defoliating their host plant.

The azalea lace bug, *Stephanitis pyrioides* (Scott), is a major pest of azaleas wherever they are grown. The damaged leaves usually have a splotched and stippled appearance on the upper surface. Plants in sunny locations have higher populations and because of this receive more damage than those plants located in the shade. This heavy damage causes leaves to dry out and drop. In Alabama there are usually two generations a year with dense populations. They are in March through May and again in July through September.

The hawthorn lace bug, *Corythuca cydoniae* (Fitch), is a serious pest of pyracantha in Alabama, and it is also found on hawthorn and Japanese quince. This bug causes a loss of color to the upper leaf surface in a speckled pattern and to the undersurface with several small dark spots of excrement. The bugs appear in April, and the highest populations can be found in late summer and early fall until October.

The sycamore lace bug, *Corythuca ciliata* (Say), is common on sycamore trees in Alabama. It can also be found occasionally on ash, hickory, and mulberry. The typical speckled pattern of color loss appears on the upper surface of those leaves that have been lightly damaged, and leaves with heavy damage due to high populations turn white and drop prematurely. During dry weather, heavy leaf loss can result in serious injury to ornamental plantings of sycamore. There may be two or more generations a year in Alabama.

Other lace bugs of importance in Alabama as pests on ornamental trees and shrubs are listed in the table.

Natural enemies such as lacewings, assassin bugs, lady beetles, spiders, and predaceous mites control the lace bug population early in the year. The use of pesticides is recommended only after light populations are no longer controlled by natural enemies and damage is increasing. Pesticide recommendations can be obtained from your local Alabama Cooperative Extension Service office. For more effective control, all pesticide sprays should be applied to the undersurface of leaves by directing the spray from below the plant foliage.

LACE BUGS OF IMPORTANCE AS PESTS IN ALABAMA

Common name	Scientific name	Major host plants
Alder lace bug	*Corythuca pergandei* Hiedemann	alder, hazel, elm, birch crabapple
Elm lace bug	*C. ulmi* (Osborn & Drake)	American elm
Hawthorn lace bug	*C. cydoniae* (Fitch)	pyracantha, hawthorn Japanese quince
Oak lace bug	*C. arcuata* (Say)	various oak species
Sycamore lace bug	*C. ciliata* (Say)	sycamore, ash, hickory
Willow lace bug	*C. mollicula* (Osborn & Drake)	willow
Andromeda lace bug	*Stephanitis takeyai* Drake & Maa	andromeda
Azalea lace bug	*S. pyrioides* (Scott)	azalea
Rhododendron lace bug	*S. rhododendi* Horvath	rhododendron

Exposure to Ozone Affects Growth of Tall Fescue

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AIR POLLUTION is a continuing problem in or near metropolitan and industrial centers of northern Alabama. Several pollutants, such as ozone, sulfur dioxide, and nitrous oxides, are known to be detrimental to numerous plant species.

Tall fescue is the best adapted grass species for both turf and forage use in much of northern Alabama. Research by the Auburn University Agricultural Experiment Station has shown that tall fescue can be damaged by exposure to ozone.

Tall fescue seedlings from diverse genetic origin were grown under controlled conditions and exposed to ozone concentrations (0.08 p.p.m.), commonly occurring in urban areas of Alabama, for a period of 6 weeks. At the end of exposure the plants were harvested and measurements of growth and nutrient contents were made. At this time, plants exposed to ozones exhibited brown flecking on the leaf blade.

Weights of leaves, roots, and stems were reduced by exposure to ozone, table 1. This indicates ozone could cause problems in establishment and maintenance of tall fescue stands.

The mechanism of growth reduction by ozone in tall fescue has not been determined. The above ground portions of both treated and control plants were analyzed for amount of chlorophyll and several elements important in plant growth, table 2.

Ozone caused reductions in chlorophyll, phosphorus, potassium, calcium, and magnesium. These reductions may be responsible for the reduced growth rates observed in the seedlings exposed to ozone.

Other studies at Auburn indicate that certain genetic lines are more tolerant to ozone than are others.

Top: test plots of tall fescue at Experiment Station. Bottom: tall fescue damaged by exposure to ozone exhibits flecking on leaf blade.

TABLE 1. EFFECT OF OZONE ON TALL FESCUE GROWTH

Measurement	Ozone (p.p.m.) 0.00	Ozone (p.p.m.) 0.08	Change
			Pct.
Leaf fresh weight (mg)	408	341	-16°
Stem fresh weight (mg)	240	191	-20°
Root dry weight (mg)	36	33	- 8
Leaf dry weight (mg)	66	55	-17°
Stem dry weight (mg)	32	28	-15
Leaf area (cm^2)	16.5	14.3	-13°
Tiller number	3.6	3.3	- 8

°Significant at $P < 0.05$.

TABLE 2. EFFECT OF OZONE ON NUTRIENT AND CHLOROPHYLL CONTENT IN FOLIAGE OF TALL FESCUE

Nutrient or chlorophyll	Ozone (p.p.m.) 0.00	Ozone (p.p.m.) 0.08	Change
			Pct.
Total chlorophyll (mg/g)	1.19	1.03	-13°
P (pct.)	.34	.31	- 8
K (pct.)	2.92	2.81	- 4
Ca (pct.)	.53	.50	- 6
Mg (pct.)	.30	.22	-27°

°Significant at $P < 0.05$.

Improved Recovery and Ease in Handling of

STEAM-PEELED SWEET POTATOES

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EXCESSIVE PEELING and trimming losses, high labor costs, and oxidative discoloration are some of the major problems encountered by sweet potato processors.

Under ideal conditions, peeling should remove only a thin outer layer of the sweet potato, and leave no eyes, peels, or blemishes to be removed by hand trimming and also leave the newly exposed surface of the root unchanged by contact with chemicals or heat. An optimum peeling depth for sweet potatoes is 0.1 - 0.3 mm when the peeled roots are to be canned.

Present commercial peeling of sweet potatoes is generally accomplished with lye immersion followed by spray washing, although some processors use steam peeling. Either method produces a satisfactory processing product, however, peeling depths are greater than the optimum levels already described, and peeling and trimming losses are correspondingly high. These losses vary with the duration of the peeling treatment and in the case of lye peeling, with the concentration of lye used. Prolonged peeling treatments increase peeling losses but reduce trimming, resulting in a more attractive product by decreasing oxidative darkening. Recoveries of 50% are not uncommon, and the breakdown of surface tissues during the peeling operation makes the potato slippery and difficult to hand trim and pack.

Research was conducted by the Auburn University Agricultural Experiment Station to determine the effect of rapid cooling by direct cold water injection into the peeling chamber of a high pressure steam peeler and the resultant pressure drop due to steam condensation on the effectiveness of the peel and on the peeled and trimmed yield of sweet potatoes.

Cured roots of the Red Jewel cultivar with a mean diameter and weight of 2.22 in. and ¾ lb., respectively, were used.

A tumbling, batch-type commercial steam peeler of 5-bu. capacity was adapted to accept direct injections of water at 18°C into the peeling chamber through the steam diffuser system. During operation high pressure steam rapidly filled the peeling chamber through the diffusers. This ensured rapid transfer of heat to the moisture under the peel. As the steam was exhausted, cold water was injected directly into the chamber, thus condensing the steam and causing an almost instantaneous reduction in pressure which resulted in dynamic imbalance. The boiling water under the skin flashed off as steam, rupturing the skin and exploding it away. The roots were then discharged and conveyed through a rubber-studded roll washer and then hand trimmed of eyes, fiber, and defects.

In addition to the sweet potatoes peeled by this method of high pressure steam, controls consisted of sweet potatoes peeled in the high pressure steam peeler and wash-cooled after discharge from the peeler, and sweet potatoes peeled in a caustic peeler and charged with a 10% w/w solution of NaOH with an exposure time of 5 minutes followed by the wash process used with the other treatments.

The total peeled and trimmed yield was determined by weighing the sweet potatoes before and after peeling and trimming. The depth of heat penetration was determined by the direct measurement of the translucent zone of gelatinized tissue of the peeled and washed roots. The peeled sweet potatoes were noted for appearance, ease of handling, and trimming, and assigned numerical scores on a 10-point scale with 10 being excellent and 6 being the border line of acceptability.

Direct injection of cold water into the atmosphere of the high pressure steam peeling chamber resulted in a recovery of peeled and trimmed sweet potatoes equal to or higher than either high pressure steam peeling by itself or caustic peeling, see table. This peeling method is characterized by the rapid release of heat treatment. In high pressure steam peeling without cold water injection, the steam pressure is reduced more slowly and there is no direct cooling action by cold water. These roots leave the peeler hot and they are not fully cooled until they pass into the washer.

Mean heat penetration into the flesh of the root, see table, was not as deep in the high pressure steam peeled with cold water injection potatoes as in the two control groups. Enzymatic darkening or "heat ring" formation at the boundary of heat penetration was slower than either of the controls. This suggests that heat penetration was stopped abruptly while temperatures were still high enough for enzyme inactivation.

Roots peeled using the water injection method required little hand trimming, primarily of fiber at the ends of the roots. Eyes and blemishes were removed in peeling and required little or no hand operation. Roots peeled by the other two methods required more trimming and were difficult to handle due to slippery surfaces resulting from the breakdown of surface tissues.

Color and appearance of roots from both steam peeling methods were rated as excellent. The color of lye-peeled roots was less brilliant but still highly acceptable. The retention of good surface color indicates that all samples received enough heat to blanch the outer tissues.

Flash cooling, when added to a properly optimized steam peeling operation, can reduce peeling and trimming losses, greatly reduce the difficulty of hand trimming operations, eliminate the need for expensive caustic solutions, and result in higher quality sweet potatoes for further processing.

EFFECT OF PEELING METHOD ON PEELED AND TRIMMED YIELD, HEAT PENETRATION, HEAT RING DEVELOPMENT, APPEARANCE, AND EASE OF HANDLING OF CURED RED JEWEL SWEET POTATOES

Peeling method	Mean yield Pct.	Mean heat penetration mm	Heat ring development time min.	Color and appearance	Ease of handling and trimming[1]
HPSFC[2]	81.1	1.9	60-120	10.0	9.0
HPSWC[3]	73.7	2.2	20- 45	9.0	6.5
Lye	80.3	4.7	10- 30	7.5	7.5

[1]Ten point scale with 10 being excellent and 6 being the border line of acceptability.
[2]High pressure steam peeled with flash cooling.
[3]High pressure steam peeled with water cooling.

West Alabamians Anticipate the Coming of THE TENNESSEE-TOMBIGBEE WATERWAY

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THE TENNESSEE-TOMBIGBEE WATERWAY will connect 1,600 miles of inland water systems to the Port of Mobile. Eliminating hundreds of miles from the existing barge route between inland agricultural and industrial centers and the Gulf of Mexico, the Waterway may enhance the potential for economic growth in counties that border this new transportation route.

The anticipated effects of the project as perceived by county residents and leaders of eight west Alabama counties (Choctaw, Clarke, Greene, Hale, Marengo, Pickens, Sumter, and Washington) were included in this study. Their attitudes will be an important consideration for an area preparing itself for increased economic development.

Leaders were identified on the basis of the elected or appointed position they held, the federal or state agency they administered in the county, or the development-related committee or advisory group to which they belonged. In the summer of 1979, 525 leaders completed a mail questionnaire, about 66% of those contacted. A second phase of the research was comprised of interviews with a 1% sample of county residents who were age 18 and over. A total of 926 persons was interviewed, representing 85.6% of the households identified in the sample.

The table shows the responses of leaders and household residents to a series of questions about the anticipated effect of the Waterway on their county. The introduction read:

> "A lot of people have been talking about the changes the Tennessee-Tombigbee Waterway might bring to Western Alabama. We'd like your opinion about some of the things the Waterway may or may not do for the area. What kind of effect will the Waterway have on . . .?"

The table lists the items in order of the leaders' expected positive effects.

Item 1 shows the expected effect of the Waterway on the county as a whole. The majority of both groups of respondents thought the Waterway would bring about positive effects on the county. More leaders expected substantial positive effects of the Waterway on industry in their county (Item 2). Both groups were positive about the Waterway's effect on businesses in the county, but nearly one-third of the household respondents saw no difference or simply did not know (Item 3).

A frequently-voiced concern among rural residents is the need for job opportunities for local high school graduates who would otherwise be forced to move out of the area to find employment. Item 4 shows both groups having positive expectations about this concern. Both groups were positive about population growth connected with the Waterway development (Item 5). Leaders were particularly hopeful for new growth stemming from the Waterway development.

Item 6 shows that both groups expressed much indecision or saw no difference in the effects the Waterway might have on agriculture, although the majority was positive in both cases.

Leaders and household residents alike expected increases in the quality of life, with leaders being more optimistic than the residents (Item 7). Items 8 and 9 show lower levels of positive expectations for the Waterway's effect on poor and minorities living in the area.

Item 10 illustrates the most negative perceived consequence of Waterway development that was found in the study. Almost 30% of the leaders and 17% of the household residents expected negative effects on the natural environment in their county, as some public controversy has surrounded the environmental impacts of the construction.

It still remains to be seen whether the positive expectations west Alabamians have for development will motivate an active effort to recruit new industry and to improve the community facilities and services that support an expanding local economy.

LEADER AND HOUSEHOLD RESIDENT EXPECTATIONS FOR THE TENNESSEE-TOMBIGBEE WATERWAY

Item	Expect positive or negative effects*				
	++	+	0	-	--
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
1. On your county as whole:					
Leaders (N = 514)	58.6	35.8	3.9	1.0	0.8
Residents (N = 877)	38.9	25.9	32.5	1.4	1.4
2. On industry:					
Leaders (N = 512)	61.7	30.5	6.4	.8	.6
Residents (N = 874)	35.8	31.1	30.8	1.6	.7
3. On businesses:					
Leaders (N = 514)	50.0	42.8	5.8	.8	.6
Residents (N = 874)	37.3	31.8	28.6	1.6	.7
4. On employment for high school graduates:					
Leaders (N = 514)	38.1	47.3	13.2	.8	.6
Residents (N = 874)	47.7	33.6	17.7	.6	.3
5. On county population size:					
Leaders (N = 512)	29.3	52.0	17.6	.8	.4
Residents (N = 870)	35.1	33.0	27.4	3.6	1.0
6. On agriculture:					
Leaders (N = 514)	27.6	39.5	28.2	3.9	.8
Residents (N = 873)	27.0	28.3	40.1	2.4	2.2
7. On the quality of life:					
Leaders (N = 514)	27.6	44.0	23.5	4.1	.8
Residents (N = 871)	23.9	33.3	37.9	2.8	2.2
8. On poor people:					
Leaders (N = 515)	29.7	39.2	26.8	3.7	.6
Residents (N = 878)	23.7	30.2	36.9	4.7	4.6
9. On minorities:					
Leaders (N = 510)	27.3	42.0	26.9	2.0	2.0
Residents (N = 874)	24.4	34.4	37.4	2.1	1.7
10. On the natural environment:					
Leaders (N = 509)	22.2	25.5	22.8	23.4	6.1
Residents (N = 872)	16.9	25.8	39.8	11.6	6.0

*Response categories were:
++ = large positive effects
+ = small positive effects
0 = make no difference/don't know
- = small negative effects
-- = large negative effects

Comparison of Cost in Relation to Functional Properties of Four Wall Sheathing Panels Used in Housing

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ORIGINALLY, WALL SHEATHING MATERIAL for framed houses consisted almost exclusively of tongue and groove wood boards, ¾-in. thick and 6-in. wide. These boards were nailed to the wood studs diagonally at approximately 40° angles. The function of the sheathing boards was to brace the studs and provide rigidity to house walls to resist particularly shear stresses that develop in the walls during high winds.

In the early 1950's sheathing wood boards were gradually replaced by ½-in. thick, 4 x 8 ft. plywood panels. This substitution resulted from the lower costs of plywood (per unit area) and the lower installation cost of plywood panels compared to sheathing boards. In addition, the plywood sheathing increased the structural rigidity of the walls. Later, in late 1960, a new sheathing material appeared—the insulation sheathing board (blackboard), ½-in. thick, was manufactured from pressed wood fibers without glue. Substitution of plywood with "blackboard" for wall sheathing began primarily because of the lower cost of blackboard (less than 50% of plywood), but also because of the better insulating characteristics of the blackboard (about two times better insulator than plywood). The structural properties of blackboard do not match those of plywood (as the table indicates). The shear strength of plywood is 10 times larger, the shear stiffness 5 times, and the flexural strength and stiffness is 30 and 50 times greater than that of blackboard. There is no doubt the structural integrity of walls is decreased by substituting blackboard for plywood. The question, however, remains whether there is any thermoinsulating benefit to houses from this substitution.

A research project underway at the Auburn University Agricultural Experiment Station was designed to answer questions concerning energy requirements for heating and cooling of one-room houses constructed with different materials. Experimental results from this project indicate the following: Energy requirements are the same for heating two experimental houses to the same inside temperature (66°F) with the only difference among them being that one had plywood wall sheathing, the other blackboard.

In the last several years, with the cost of energy for heating and cooling rising steadily, other insulating panel products emerged, namely 1-in. thick styrofoam and ¾-in. polyurethane panels used instead of wall sheathing. These materials are very weak structurally, as shown in the table. They are used solely for their insulating value (R = 5.25 to 5.5), and their cost is higher than ½-in. plywood. These panels do not contribute to the structural rigidity of the walls. Very often, attempts to reinforce the wood studs diagonally with wood board bracing further weakens the studs because of notching to insert the bracing. Thus, the end result is weakened stud wall structure without real sheathing. The question again is how much thermoinsulation these insulating panels on the walls add to the house?

Experimental results of the ongoing study mentioned earlier indicate that energy requirements are the same for heating two experimental houses at the same inside temperature (66°F) with the only difference that one has plywood wall sheathing, the other commercial ¾-in. aluminum-surfaced, polyurethane insulation board.

The fact that the two houses have the same energy requirements for heating, although the walls are constructed with materials that differ greatly in thermoinsulating values, can be explained as follows: first, the outside walls constitute only a portion of the total exposed area and therefore the ceilings and subfloor spaces have as much influence. Second, during installation these panels are often damaged and do not fit airtight; therefore, the full thermoinsulating ability of the material cannot materialize for the benefit of the total house insulation.

This information may be valuable to individuals who plan to build a house and decide themselves what wall sheathing materials to use, considering the cost of the materials, structural and insulating characteristics, as well as actual energy requirements for heating.

FLEXURAL AND SHEAR PROPERTIES, THERMOINSULATION VALUE R, AND COST OF FOUR WALL SHEATHING AND INSULATION PANEL BOARDS[1,2]

Wall boards	Flexural		Shear trough thickness strength p.s.i.	Plate shear stiffness G p.s.i.	Thermo-insulation value R	Panel cost, 4x8 ft. $
	Stiffness M.O.E. p.s.i.	Strength M.O.R. p.s.i.				
Plywood CDX Southern pine ½" thick	1,451,000	7,171	973	61,700	0.65	8.00
Insulation sheathing "blackboard" ½" thick	32,900	257	91	12,800	1.5	3.20
Styrofoam insulation board 1" thick	3,220	63	12	2,042	5.25	8.40
Polyurethane sheathing ¾" thick	14,350	75	21	-	5.4	9.60

[1]Each value represents the average of six specimens.
[2]Flexural properties and shear strength were determined according to ASTM D 1037-72, plate shear stiffness according to ASTM D 3044-76, thermoinsulation R-value according to ASTM C 518-76.

The field prototype of a powered rotary chisel in an early stage of its development (NTML Photo No. A10, 305a).

Designing and Testing

An Experimental Powered Rotary Chisel

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CHISELING UNDER THE ROW has many advantages. After a plowpan has been broken, crop roots can penetrate deeper and make use of subsoil moisture, which results in increased yields in many years. Chiseling takes less energy and requires fewer trips across the field than does plowing and disking. And, under-the-row chiseling fits into reduced tillage conservation practices.

After observing early work on under-the-row chiseling, it became apparent there should be a more efficient way to do the job.

The objective of this study was to investigate the power requirements and the tillage performance of an experimental powered rotary chisel, which was powered by a drive-line attached to the tractor PTO (rather than from drawbar pull). The concept of the powered rotary chisel was based on three factors: (1) power can be transmitted to the chisels via a mechanical drive-line more efficiently than it can be transmitted via drawbar pull; (2) reduced draft of tillage tools reduces the need for heavily weighted wheels, thereby reducing soil compaction; and (3) reduced draft will allow chiseling to be done in difficult traction conditions, increasing the timeliness of the chiseling operation.

Design Considerations

The powered rotary chisel was designed to operate in what is called the forward direction (it turned in the same direction the tractor wheels turn) so the resistance of the soil against the chisel blades would result in a force in the forward direction and push itself across the field. To reduce the power requirement, the blades were designed to turn at a slow rotary speed. The shapes of the blades were designed so the back sides of the blades did not press into uncut soil. Using all the listed requirements, an experimental model was designed, and a 4-ft. diameter experimental rotary chisel, having six blades, was constructed.

Testing

The experimental chisel was operated in three soil types (a sandy loam, a loamy sand, and a clay loam), over a range of rotary speeds, in the soil bins at the National Tillage Machinery Laboratory in Auburn. Measurements were made during the tests of draft force, forward speed, rotary speed, and torque; from those measurements draft power and rotary power were calculated. The tillage performance of the rotary chisel was determined by measuring the volume of soil disturbed and the final clod-size distribution of the disturbed soil. The amount of tillage done and the power required by the rotary chisel were compared with the tillage done and power required by a rigid chisel in the same soil conditions.

Results

The rotary chisel developed a significant forward thrust during the tests. The magnitude of the forward thrust in all three soil types was approximately half the drawbar force required to pull a rigid chisel under the same conditions. The thrust developed by the rotary chisel was very cyclic, which pointed out the need for having a multi-row rotary chisel assembly (and having the positions of the blades of the two assemblies staggered) so the resulting thrust could be evened out. Tractors are not designed to be operated with large forward-thrust forces on the drawbar, therefore, other draft tools such as coulters, planters, or tillage implements should be added to make use of the forward thrust and prevent its being applied to the tractor.

The total power requirement for the experimental rotary chisel was about 30% higher than for a rigid chisel in all three soils. But when making calculations to predict the relative power requirements under field conditions, a power transmission efficiency of 82% can be expected for a mechanical drive-line compared with a 49% efficiency for pulling a rigid chisel by drawbar pull (the lower efficiency being caused primarily by the low efficiency of tires operating on soil). Then, in predicted field conditions, a rigid chisel would require an average of 20% more engine power than would a powered rotary chisel.

The tillage performance of the tools was judged by the resulting soil breakup, the amount of the soil disturbed, and the soil surface condition. The rotary chisel broke up the soil to a greater degree than did the rigid chisel. The cross-sectional area of the soil disturbed was 30% greater for the rotary chisel because of its piercing and tearing action. The soil surface condition following the rotary chisel was more broken, with more clods turned over, than following tests of the rigid chisel.

Since the laboratory test results looked promising, a two-row, field-size (chisel blades 5 ft. in diameter) rotary chisel is being constructed. The figure shows the field unit in an early stage of construction. The field prototype will be operated to determine its power requirements and its agronomic potential in various soil conditions. The tests will be conducted in cooperation with researchers of the Agricultural Experiment Station of Auburn University and the USDA-SEA Soil and Water Research Unit.

Corn-Wheat-Soybean Rotations and Their Response to Nitrogen, Phosphorus, Potassium

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GROWING A 37-bu. crop of wheat between corn and soybeans did not decrease yield of either soybeans or corn. This was shown by averages from 2-year rotation experiments at six Alabama locations over the 11-year period, 1968-78. Only at the Tennessee Valley Substation did full-season soybeans outyield those double-cropped following wheat, table 1.

Data in the tables are for the best 7 of 11 years. Yields were severely limited by drought, poor stands, or diseases in about 1 year in 3 at most locations. Averages for all years (last column in the tables) were 20-25% less for corn and 10-15% less for soybeans and wheat than yields for the 7 "good years."

These data are from Auburn University Agricultural Experiment Station experiments that have been in progress since 1929. Revisions have been made through the years to adapt to changing conditions, but the treatments were not changed during 1968-78. Locations throughout the experiment have been: Brewton Experiment Field; Monroeville Experiment Field; Prattville Experiment Field; Wiregrass Substation, Headland; Sand Mountain Substation, Crossville; and Tennessee Valley Substation, Belle Mina.

Different rates of nitrogen (N), phosphorus (P), and potassium (K) have been compared during the 11 years. Results are given in table 2.

Corn Response to N

The data show that 90 lb. of N per acre was adequate for corn following soybeans at all locations except at Crossville and Belle Mina. At these locations, the highest yields (131 and 103 bu., respectively) were from 120 lb. of N per acre. Other data showed that inclusion of wheat, which received 80 lb. of N, in the rotation did not change the N rate needed for corn.

Response to P

The plots that received no phosphorus had not been fertilized with P since 1957. In 1968, the soil test P level was **High** at Prattville and Headland, **Medium** at Brewton and Belle Mina, and **Low** at Monroeville and Crossville. Crops grown on soils that were **High** in P in 1968 did not respond to P over the next 11 years.

At Crossville, where soil P was **Low**, responses to P of 31, 11, and 10 bu. per acre were produced by corn, soybeans, and wheat, respectively. The other locations produced moderate yield responses to P, as predicted from the soil tests.

Response to K

Plots that received no potassium have not been fertilized with K since 1929. Rates of K for the other treatments have been continuous as shown since 1957. Soil test K levels were **Medium** in 1968 at Prattville and Belle Mina and **Low** on the other four soils.

Response to 30 lb. of K_2O was noted at all locations on corn and soybeans, averaging 22 bu. of corn and 8 bu. of soybeans. Only the Crossville experiment responded to more than 30 lb. per acre of K_2O, and 60 lb. annually was adequate at this location. Wheat showed very little response to K at any location.

TABLE 1. YIELDS OF CORN, WHEAT, AND SOYBEANS FROM THREE-CROP AND TWO-CROP ROTATIONS AT SIX ALABAMA LOCATIONS, 1968-78

Cropping sequence	Yield per acre, average of best 7 of 11 years: Brewton	Monroeville	Prattville	Headland	Crossville	Belle Mina	Av. all locations	Average all years
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
3-crop rotation								
Corn	97	89	77	100	131	103	100	77
Wheat	24	26	39	40	46	45	37	32
Soybeans	39	39	39	32	38	29	36	33
2-crop rotation								
Corn	93	83	78	86	119	108	95	77
Soybeans	34	34	36	30	40	41	36	32

TABLE 2. YIELDS OF CORN, WHEAT, AND SOYBEANS FROM DIFFERENT RATES OF N, P_2O_5, AND K_2O AT SIX LOCATIONS IN ALABAMA, 1968-78

$N-P_2O_5-K_2O$, lb./acre	Yield per acre, average of best 7 of 11 years: Brewton	Monroeville	Prattville	Headland	Crossville	Belle Mina	Av. all locations	Average all years
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Response of corn following soybeans to N								
0-60-60	66	60	45	64	66	53	59	46
90-60-60	96[1]	92	77	96	116	97	96	75
120-60-60	97	90	76	100	131	103	99	76
Response of corn to P and K								
120-0-60	84	83	78	102	100	99	91	70
120-60-0	51	76	64	93	61	97	74	55
120-60-30	94	90	77	99	117	98	96	74
120-60-60	97	90	76	100	131	103	99	76
120-60-120	96	91	74	97	131	103	99	75
Response of soybeans to P and K								
0-0-60	28	37	36	36	27	29	32	28
0-60-0	25	35	30	34	15	29	28	25
0-60-30	39	38	38	36	32	32	36	32
0-60-60	39	39	39	35	38	32	37	32
0-60-120	40	40	37	35	39	32	37	33
Response of wheat to P and K								
80-0-60	18	24	38	40	35	50	33	28
80-60-0	22	26	39	41	41	46	36	31
80-60-30	24	28	40	39	44	43	36	32
80-60-60	24	26	39	41	45	45	37	32
80-80-120	23	26	39	38	43	44	36	31

[1]Yields from the most practical rates of N, P_2O_5, and K_2O are underlined. Phosphorus and potassium were applied broadcast before planting corn and wheat. Soybeans received only residual fertilizer except when grown as a full season crop.

Landscape Value of Native Rhododendrons

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THE ABUNDANCE of native, deciduous azaleas, commonly called "bush honeysuckle" in the South, is generally known. But most native southerners are astounded to learn they have native rhododendrons that are not evergreens.

Only in the last decade have the native azaleas come into their own, largely through the spreading of their fame by such gardens as Callaway Gardens, in Georgia. Commercial nurseries have responded to this interest and provided supplies of reliable plants for landscape use.

Large Selection Available

Southern gardeners are fortunate to have a large selection of hardy evergreen and deciduous azaleas and rhododendrons. These range from dwarf to large shrubs, fine to coarse branches, and white to red flowers, with varied fragrances and exotic form — all well adapted to the region.

Azaleas, botanically, are rhododendrons. But most hobby gardeners call the deciduous types azaleas, and refer to the large-leaved, evergreen species and varieties as rhododendrons.

In the early years of America's settlement and exploration, many of the native shrubs were eagerly sought by the nobility and famous botanists of Europe. Highly prized were the native, deciduous azaleas. The swamp azalea, *Rhododendron viscosum*, was exported to England in 1680, followed quickly by the pinxterbloom, *R. nudiflorum*. Many of these exports were used in breeding to produce the Ghent, Knaphill, and Exbury hybrids.

Bloom Spring to Summer

Natural beauty is available each spring for years to come if native azaleas are planted in the landscape. These hardy plants with variable colored and fragrant blooms can provide colorful beauty from early spring to summer.

Many kinds of native azaleas are available for planting. Most are either native to Alabama or adapted to most areas of the State. Perhaps the largest collection of these native beauties can be found at Callaway Gardens. Given below is information about some of the species studied, listed in the order in which they bloom at Callaway Gardens:

Florida azalea *(Rhododendron austrinum)*—Fragrant yellow flowers; late March, early April flowering; native to north and west Florida, southwest Georgia, south Alabama, southeast Mississippi; height over 12 ft.

Piedmont *(R. canescens)*—White to light pink, fragrant flowers; late March, early April; north Florida to North Carolina and Texas; height to 15 ft.; generally not stoloniferous, not forming colonies. (Often first species to bloom at Auburn.)

Oconee *(R. speciosum)*—Orange to orange-red; usually flowers after Piedmont azaleas; western Georgia to South Carolina; varies from low shrubs to plants 6 ft. tall.

Pinxterbloom *(R. nudiflorum)*—White, pale pink to violet red, fragrant; early to mid-April; North Carolina to Tennessee; usually dwarf, sometimes 4-6 ft. tall; forms colonies.

Pinkshell *(R. vaseyi)*—Rose pink with green throat and orange-red dots; mid-April; mountains of western North Carolina; tall; second to flame azalea for garden value; deeper shades preferred; white cultivar, "White Find."

Alabama *(R. alabamense)*—White with yellow blotch, lemon scented; mid- to late April; north-central Alabama and isolated areas of west-central Georgia; 3-6 ft. tall.

Coastal (*R. atlanticum*)—White flushed with red, fragrant; Carolinas; low, 1-3 ft. tall; very hardy; stoloniferous.

Swamp *(R. viscosum)*—White; mid-May, early June; strong, spicy fragrance; Alabama, Georgia northward; usually low-growing, up to 5 ft. tall; stoloniferous.

Flame *(R. calendulaceum)*—Splendid show of orange to yellow flowers; late May, early June; northern Georgia northward; tall, up to 10 ft.; few, if any, peers.

Sweet *(R. arborescens)*—Best of the white natives; late May, early June; fragrant with heliotrope scent; Alabama, Georgia northward; one form, the Georgiana azalea, flowers in July and sometimes August; tall, upright, 6-10 ft.

Texas *(R. oblongifolium)*—White, fragrant; much like swamp azalea, but native to southwestern Arkansas, east Texas, Oklahoma.

Cumberland *(R. bakeri)*—Yellow, red; late June, early July; at high elevations in Kentucky, Tennessee, northern Georgia, Alabama; 2-5 ft.; closely allied to flame azalea.

Hammock Sweet *(R. serrulatum)*—White, fragrant; late July to early August; Georgia to central Florida and Louisiana; very tall, 6-10 ft.

Plumleaf and Prunifolia *(R. prunifolium)* — Orange to deep red, non-fragrant; early July to early September; southwestern Georgia, eastern Alabama; to 20 ft. tall; unique to a relatively small section of southern Georgia and Alabama.

Natural Hybrids Exist

In addition to the identified and named species, many natural hybrids varying in color and height can be found.

The five broadleaf evergreen rhododendrons native in this area are *R. carolinianum*, *R. catawbiense*, *R. chapmanii*, *R. maximum*, and *R. minus*. These are described, in the order that they bloom in the Auburn-Opelika area:

R. chapmanii—Chapmans rhododendron. Funnel-shaped, pale pink to rose; April 15-May 1; coastal plain of northwest Florida; similar to *R. carolinianum* in appearance; height 6-8 ft.

R. minus—Piedmont rhododendron. Medium size flower clusters, lavender-rose; around May 1; large spreading shrub, up to 10 ft.; heat resistant.

R. carolinianum—Carolina rhododendron. Bell-shaped, pink, lavender-pink, or rose; around May 1; glossy green leaves on a broad but upright plant; up to 6-8 ft.

R. catawbiense—Catawba rhododendron. Magenta to purple flowers in great profusion; around May 15-June 1; grows to height of 6-10 ft.

R. maximum—Rosebay rhododendron. Lavender to purple-pink flowers; around June 1-15; dark green, drooping leaves; the giant of American species, up to 6-12 ft. tall.

Futures Trading

A Marketing Strategy for Feeder Cattle in Alabama

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GROWING STOCKER CATTLE on cool season grazing has traditionally been a profitable enterprise for Alabama farmers, but during the 1979-80 production year farmers were faced with declining feeder cattle prices just prior to their normal spring marketing season. Production and marketing risks now appear to be greater than ever before, and the successful producer will probably be the one who knows his market.

In our complex livestock industry, marketing expertise is necessary to survive in the long-run. For example, average monthly real prices (based on 1967 dollars) for feeder cattle have averaged $45 per cwt., ranging from $32 to $58 per cwt. for the period 1972-1979, figure 1. Price variation is caused by the volume of sales of feeder cattle at the Montgomery market and these price variations present marketing risks to Alabama producers.

For the alternative marketing strategy of commodity futures trading, the producer passes risks of price volatility to others in the marketplace. The producers who shift these risks are called hedgers since they have the physical product to merchandise. On the other side of the market are the speculators who neither produce the physical product nor wish to own it. The speculator is in the position of a risk bearer, making a profit through market price fluctuation. A hedger buys or sells a contract of feeder cattle (42,000 lb.) for some future month with the certainty that a profit can be made with minimum risks.

The commodity futures for feeder cattle was established in 1972 by the Chicago Mercantile Exchange. The contract trading months are designated as 6 months during the year. Alabama's cattlemen would probably be interested in trading April and May contracts because they coincide with the normal marketing period for feeder cattle produced on cool season grazing. Trading for each contract month begins 11 months before the contract maturity month.

The feasibility of the commodity futures market for Alabama producers is analyzed by examining the behavior of the *basis*. Basis is the cash price (CP) at Montgomery minus the futures price (FP) for a particular contract month. The basis behavior determines acceptability of the futures market for hedging. If the cash and futures price move together over a certain amount of time, a producer may lock in a profit. If the basis does not follow this pattern, the producer could take a loss in the market as a hedger.

In order to analyze the basis, the Montgomery weekly average feeder cattle cash price and the Chicago futures price for the April and May contracts were collected for the period 1972 through 1979. The average monthly basis was figured for the 11 months before the delivery of the two contracts. A contract consists of Choice feeder cattle weighing between 550 and 650 lb. with a total weight of 42,000 lb.

FIG. 1

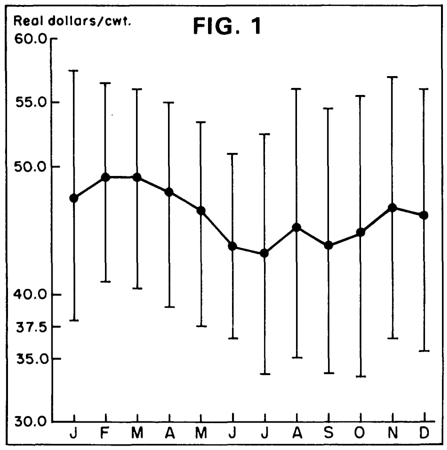
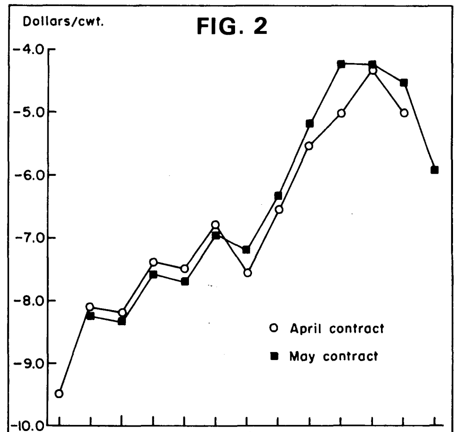


FIG. 2



Average monthly bases are illustrated in figure 2. The bases are negative and the greatest difference between cash and futures prices occurs in the months most distant from the delivery month. Bases are usually widest here because of the uncertainty and lack of information in the marketplace as well as the decline in demand for feeder cattle in this State during the period June through November. The trend during this time is downward with some volatility because cow/calf sales influence the sale of stocker calves. After November, when the average basis for 8 years was -$7.55 for the May contract, the basis begins to narrow steadily as cash and futures prices approach each other. This narrowing begins after most stocker cattle pass the first handler, the cow/calf operator.

The basis for the April and May contracts reaches the narrowest point during February and March and then it begins to widen, figure 2. This widening is the result of increased supplies of feeders being marketed which causes the cash feeder cattle prices in Montgomery to decline, see figure 1.

As the delivery month approaches and the basis narrows, the livestock producer may benefit by hedging April and May contracts. Locking-in a profit in the commodity market and completing the "roundturn" before delivery can reduce production and marketing risks. According to the basis movements in Alabama, open contracts for April should be closed in the month of March when the average basis is the narrowest at -$4.30. Open contracts for May should normally be closed in February or March before the basis starts to widen again.

The delivery of feeder cattle in Alabama to close out a contract is discouraged by a $6.00 per cwt. differential under the St. Louis price. The Chicago Mercantile Exchange has set this differential to cover transportation and marketing charges. In most instances the producer should offset his contract sale by a contract purchase and then sell his cattle through the normal marketing channel.

If the basis follows the 8-year pattern observed, it will narrow as the contract approaches maturity. For those producers who want to minimize the risk in production and marketing of feeder cattle, the behavior of the basis is such that it is rather predictable; and producers may use futures trading to shift risks and to assure a profit in feeder cattle production. Each producer, however, will need to examine his financial portfolio to determine if margin requirements and calls can be maintained for the duration of a contract period.

Sow Reproductive Performance Not Increased by Extra Feeding in Late Gestation

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PROPER NUTRITION of the sow during gestation is necessary for optimum reproductive performance and also affects birth weights and survival of the offspring.

However, some controversy exists as to the best level of feeding during the last trimester of gestation, which is the period of most rapid fetal growth. The greatest increase in fetal pig weight occurs during the last 30 days of pregnancy, and some producers believe that increasing the level of feeding during this period will result in heavier, more thrifty pigs at birth. Other producers feed a constant level (approximately 4 lb. per day) throughout the entire gestation. The higher level of feeding results in increased feed costs and higher sow weight gains but the effect on reproductive performance and litter performance is uncertain. The following experiment was conducted by the Auburn University Agricultural Experiment Station to determine the effect of feeding level during late gestation on reproductive performance of the sow and the growth and survival of her offspring.

Crossbred gilts were individually fed 4 lb. per day of a 14% protein corn-soybean meal diet from breeding to day 90 of gestation. The gilts were then divided into two groups with one group remaining on the 4 lb. per day feeding level while the second group received 7 lb. per day from day 90 until farrowing. The gilts remained on these treatments for three farrowings. All sows were self-fed a 14% diet during lactation. Pigs were allowed access to creep feed at 21 days of age and were weaned at 42 days of age. The sows were then bred on the first estrus after weaning. Sows were weighed at breeding, day 90, and day 110 of gestation and 21 and 42 days after farrowing. The pigs were weighed at birth, 21, and 42 days of age.

Weight gains for the two groups of sows were similar from breeding to day 90 of gestation, but sows fed the higher level of feed gained 60% more weight during the last 20 days of gestation. Sows fed 4 lb. per day throughout gestation tended to lose more weight during lactation while consuming 3.5% more lactation feed.

LITTER SIZES AND WEIGHTS AND SOW PERFORMANCE

Item	4 lb. per day	7 lb. per day
Sow weight change, lb.		
breeding to day 90	90	84
day 90 to day 110	20	32
day 110 to weaning	-71	-62
Pigs per litter		
born	11.1	10.6
born alive	10.5	9.8
at 21 days	9.1	8.8
at 42 days	8.9	8.7
Litter weights, lb.		
birth	32.6	31.9
at 21 days	104.7	105.9
at 42 days	190.6	197.0
Lactation feed consumed, lb.	528	510
Days to estrus	5.4	10.5

Although the sows fed extra feed in late gestation gained more weight, no increase was seen in reproductive performance as measured by litter sizes or litter weights at birth. Sows fed the standard 4 lb. per day farrowed larger litters (11.1 vs 10.6 pigs) with heavier litter weights. Thus, the extra weight gains by sows fed 7 lb. per day were in body tissue gain and not in increased growth of the fetus during late gestation.

Survival of pigs to weaning was not significantly affected by gestation feeding level. Survival was slightly lower for sows fed 4 lb. per day but their litter size was still larger at 21 and 42 days than for sows fed 7 lb. per day. Preweaning growth rates of the pigs were similar for the two treatment groups, with litters from sows fed the higher level of feed weighing slightly more at 42 days.

Another important economic trait which was evaluated was the number of days required for sows to return to estrus following weaning. Sows fed 7 lb. per day required an average of 5 days longer to reach the first estrus postweaning than sows fed 4 lb. per day. Thus, sows fed extra gestation feed would be out of production over 10 days per year more than sows fed the recommended 4 lb. per day.

In summary, the results of this study show that increasing the level of feed for sows during late gestation does not increase reproductive performance or litter birth weights and the extra feed costs for the higher feeding level cannot be economically justified. Producers should ensure that their sows receive adequate daily nutrition and maintain constant feeding levels throughout gestation.

SUBSOIL ACIDITY
Reduces Sweet Potato Yields

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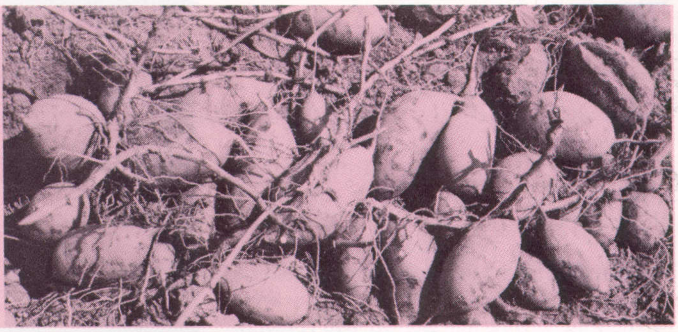
C. E. EVANS, Department of Agronomy and Soils



SOIL ACIDITY is generally recognized as a limiting factor in crop production in Alabama. Low soil pH restricts root and top growth of many crops, which can result in a limited root system and reduced drought tolerance. This is often the reason that plants fail to develop deep, vigorous root systems and are unable to effectively utilize stored water in the soil profile. The ultimate result is reduced yields and lowered profits.

Problems from subsoil acidity are not as widely recognized as from surface soil acidity, although this is a common problem in many Alabama soils. Acidity of subsoil often is intensified by the continued use of acid-forming fertilizers without a balanced liming program.

Sweet potatoes is one of the crops that is adversely affected by subsoil acidity. Low subsoil acidity was found to reduce marketable yield and increase yield of culls in 1979 tests by the Auburn University Agricultural Experiment Station.

The field studies were conducted on Orangeburg sandy loam soil at the E.V. Smith Research Center to determine the effect of subsoil acidity on growth and yield of sweet potatoes. The surface soil (0- to 6-in. depth) of the test field was uniformly limed to pH 6.0. Subsoil (6- to 12-in. depth) pH levels ranged from 4.3 to 6.0. Planting was done May 14, using Red Jewel variety.

Rainfall from planting to harvest totaled 18.7 in. in 1979. Distribution records show that rainfall amounts were below normal in May, June, and August, and above normal in July and September.

Results show that subsoil pH had almost no effect on early plant growth or in amount of final vine growth before harvest. However, effect of acidity showed up in yield comparisons. Marketable yields went up as subsoil pH increased, with an accompanying decrease in cull yields.

Maximum marketable yields and minimum cull yields occurred at the highest subsoil pH (5.8 to 6.0)—476 bu. marketable and 60 bu. culls per acre. This compares with 340 bu. marketable and 96 bu. culls at the lowest pH (4.3 to 4.5).

Soil rot is a common sweet potato disease reported in Louisiana, and it is intensified by soil pH levels above 5.2. To date, this disease has not been identified as a widespread problem in Alabama. Therefore, soil acidity can be regulated to the level that will provide maximum yields — about pH 5.8 to 6.0, according to the results reported.

EFFECT OF SUBSOIL PH ON SWEET POTATO YIELDS, E. V. SMITH RESEARCH CENTER, 1979

Subsoil pH range	Per acre yield	
	Marketable	Culls
	Bu.[1]	*Bu.*
4.3-4.5	340	96
4.6-4.8	356	120
4.9-5.2	346	80
5.3-5.7	390	74
5.8-6.0	476	60

[1]Bushel = 50 lb.

Subsoil pH of 5.8-6.0 produced higher yields than soils with more acid subsoils in this 1979 experiment at the E. V. Smith Research Center.

AGRICULTURAL EXPERIMENT STATION
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