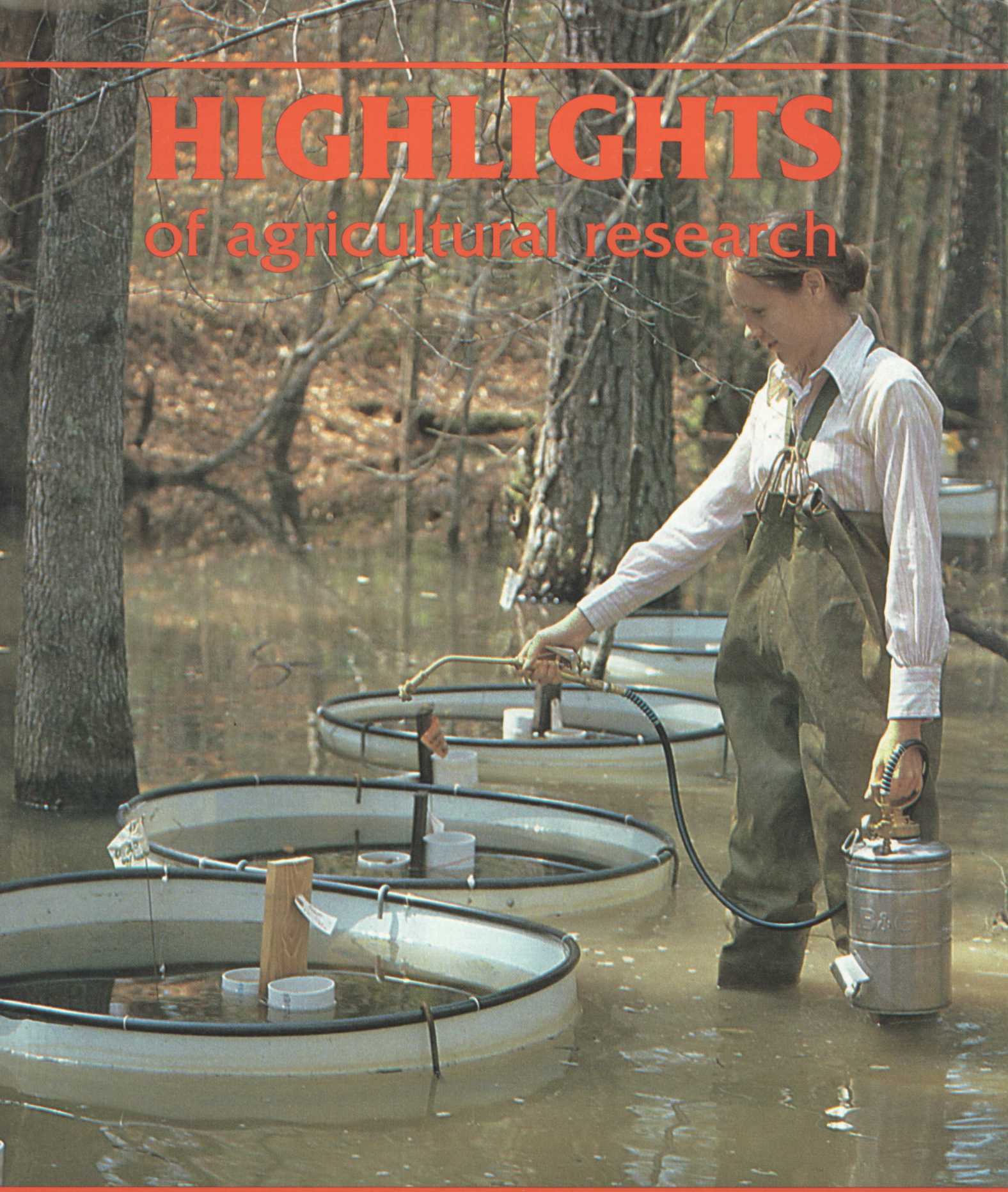
HIGHLIGHTS
of agricultural research



Vol. 29 No. 2
AGRICULTURAL EXPERIMENT STATION
GALE A. BUCHANAN, DIRECTOR

Summer 1982
AUBURN UNIVERSITY
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DIRECTOR'S COMMENTS

EVEN WITH RECORD or near record yields of many Alabama farm commodities this past year, the economic crunch continued as strong as before. As a result, farmers are facing one of the toughest years in over a quarter of a century. Indeed, 1982 is a "make or break year" for many farmers across this State as they seek to break the string of losing crop years.

GALE A. BUCHANAN

Low profits for farmers in 1981 can be largely attributed to poor market situations and increased costs of production, a somewhat different situation than in two previous years. Poor returns in 1979 and 1980 had been caused primarily by widespread drought that cut yields below the profitable level.

While uncertain and weak markets, along with unfavorable weather, are perennial problems that farmers must regularly deal with, steadily increasing cost of production inputs has moved to the top of the list of farm problems in recent years. On the average, expenditures for all production inputs used by Alabama farmers increased a staggering 12 percent per year from 1976 to 1980. Increasing costs have been noted for almost every production input, with net rent paid to non-operator landlords being the sole exception, but some inputs have shown unusually large increases. For example, interest on farm mortgage debt and operational costs increased 90 percent during the 1976-80 period.

Since prices farmers have received for their products have held fairly constant, or even dropped in some cases, the result of rising input costs has been a serious cost-price squeeze. This is dramatized by figures showing the percentage that farm prices are of gross farm income. During the past decade, production expenses have generally been in the high 70 or 80 percent range when compared to farm sales. The lowest figure recorded was 71 percent. In 1980, however, farm production expenses hit a *full 100 percent* of gross farm income. This clearly illustrates the critical need for an added dimension to research efforts of the Alabama Agricultural Experiment Station. No longer is it sufficient to determine the effectiveness of a new variety, a new method of controlling pests, or a new production practice on productivity alone. The real test is a critical economic analysis that shows whether the practice is desirable in the face of current economic conditions facing farmers.

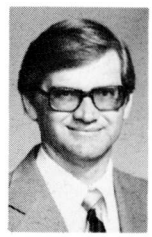
Many things must be considered in evaluating farming practices and programs. A valid economic analysis is inextricably tied to various production parameters. Such factors as geographical location, environmental condition, and managerial expertise, as well as the nature of specific farm programs involving a given commodity, can impact on such an economic analysis.

With the rapid escalation in cost of production inputs in relation to value of commodities produced, it becomes more and more important that the issue of production costs be critically evaluated. As an example, the cost-benefit ratio for a peanut production practice may be favorable for quota peanuts but not for non-quota peanuts that sell at a lower price.

We have numerous experiments being conducted by teams of agricultural economists and production scientists to evaluate the relationships between production level and profits. We must continue our efforts in these areas to ensure the maximum possible profit relationship for Alabama farmers in the years ahead.

may we introduce . . .

Dr. David A. Roland, Sr., alumni professor, Department of Poultry Science. Born in Cochran, Georgia, Dr. Roland attended Middle Georgia College in Cochran from 1961-1963, received his B.S. in pre-vet from the University of Georgia, Athens, Georgia, in 1966, and his doctorate from the University of Georgia in 1970. While at the University of Georgia he served as a research assistant (1966-1967) and as an NDEA Research Fellow (1967-1969). Prior to coming to Auburn in 1976, Roland served as an associate professor at the University of Florida, Gainesville, Florida. Dr. Roland carries on Station research in poultry nutrition and teaches graduate and undergraduate courses in that same area.



He is a member of the Poultry Science Association, the American Association for the Advancement of Science, the World's Poultry Science Association, the Florida Academy of Science, and the Southern Association of Agricultural Scientists, Inc.

HIGHLIGHTS of Agricultural Research

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ON THE COVER: Mosquito larvicide (B.t.i.) field test in Tuskegee National Forest.

FREQUENCY OF RAIN & HOURS OF LEAF WETNESS Influence Intensity of Pecan Scab

A.J. LATHAM, Department of Botany, Plant Pathology, and Microbiology

WEATHER PLAYS an important role in development of pecan scab. Frequency of rain and hours of leaf wetness were the specific factors found to influence scab development in Alabama Agricultural Experiment Station research.

The study was done to relate meterological factors to dispersal of airborne *Fusicladium effusum* conidia (causal agent of pecan scab) to subsequent disease development. The conidia were trapped from April to mid-July in unsprayed pecan orchards near Auburn during 1975 and at the Turnipseed-Ikenberry Place, Union Springs, during 1980. Rainfall, humidity, temperature, wind speed, and leaf wetness were monitored.

Scab Development Determined

Scab development was determined weekly both years by collecting 20 compound leaves per tree from four different branches on each of 12 Schley trees. The first leaf on the shoot was collected and, as younger leaves developed, the second through sixth compound leaves were collected until the end of May or first week of June. Lesions on each leaflet were counted and the average number per leaf calculated for the week. Lesions on nutshucks were counted weekly from 60 nuts on marked branches from the first week of June to July 14.

For each week of the test, 12 scab-free Schley pecan trees were grown in individual plastic bags. Six were inoculated with a suspension of *F. effusum* conidia and six were left uninoculated. The trees were suspended from the limbs in the orchard at heights ranging from 6 to 18 ft. After exposure for 1 week, all trees were returned to the laboratory.

Test trees were placed in a greenhouse and observed for 30 days for disease development. No water was allowed to contact the foliage during this period. The test was repeated over a period of 6 consecutive weeks from May 29 to July 14, 1980.

As rains washed conidia from overwintering *F. effusum* stroma onto developing pecan leaves, leaf tissue and scab lesions increased in proportion to the increase in number of conidia. Rains provided favorable infection periods and led to rapid increases in numbers of lesions per leaflet.

The number of lesions recorded for the fourth week of April 1975 (36.2) was of similar magnitude to that found in 1980 during the fourth week of May. Subsequently, the number of conidia increased 80-fold during the first week of May and reached a peak of 16,500 during the fifth week of May.

Fungicides Needed

The high numbers of *F. effusum* conidia produced from mid-May through June emphasize the need for fungicides at this time. The peak number of conidia was associated with an average of 300 lesions per compound leaf, which was a conservative count on leaves that were almost completely covered with lesions. Disease incidence became so high that trees defoliated from mid-July through August during the scab epidemic of 1975.

Rain fell each week, except the fourth week of April, and the number of shuck lesions more than doubled each week during June. Coalescence of lesions during the second week of July made accurate counts difficult. Nutlets shriveled, dried, and fell from trees until only 7 of the 60 nuts monitored for disease development were found on July 25.

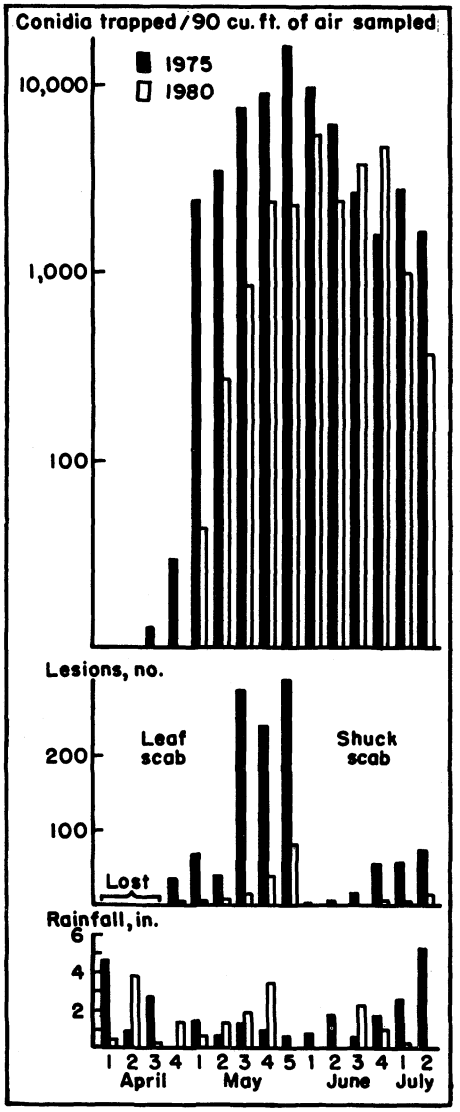
An analysis of lesion numbers for the fourth week of April showed that numbers for 1975 were 6.6 times greater than in 1980. A comparison of conidia and rainfall totals showed 63% more conidia and 39% more rainfall in 1975 than 1980. As revealed in the graphs, high numbers of conidia and weekly frequency of rain were the most obvious factors related to the scab epidemic.

Noninoculated trees exposed in the orchard for 1 week beginning May 29, June 9, and July 7, 1980, failed to develop scab on leaves. Inoculated trees exposed for 1 week beginning July 7 also failed to develop scab. No rain fell during the periods May 24 through June 18 and July 7 through 14.

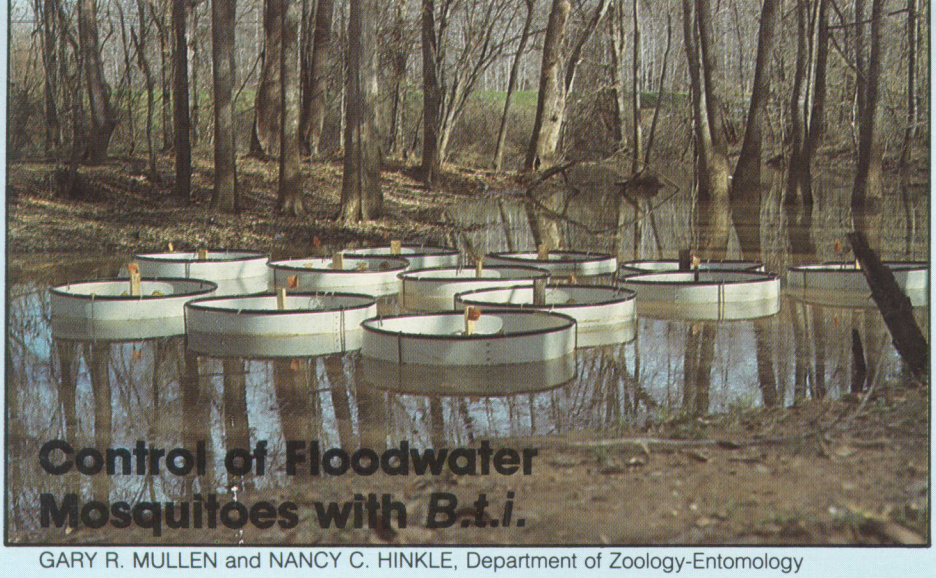
Scab Developed When Rain Fell

All inoculated test trees that were exposed for periods beginning June 16, 23, and 30—a time when there was rain—developed scab. Noninoculated trees getting the same exposure also developed scab lesions 7-9 days after a rain. Leaf wetness that accompanied rains of June 19 and 23 and July 6 lasted 16, 12.75, and 12 hours, respectively.

Amount of rain did not appear to be critical for infection and lesion development. As little as 0.03 in. on June 23 provided sufficient moisture for infection. The important criterion was hours of leaf wetness following rainfall. Scab developed on test trees 7-9 days after a rainy day when leaves remained wet 12 to 16 hours. Test trees did not become infected during an extended rainless period when relative humidity of 100% occurred for only 1 to 11 hours per day.



Number of *Fusicladium effusum* lesions and conidia in relation to weekly total rainfall during 1975 and 1980.



Replicated tests for control of floodwater mosquitoes.

Control of Floodwater Mosquitoes with *B.t.i.*

GARY R. MULLEN and NANCY C. HINKLE, Department of Zoology-Entomology

FOLLOWING PERIODS of heavy rainfall during the spring and summer months, Alabama residents are troubled by large numbers of mosquitoes emerging from woodland pools, roadside ditches, low-lying pasture areas, and standing water left as swollen streams and rivers recede. Species which breed in such temporary waters are commonly referred to as floodwater mosquitoes and represent some of the most annoying pests of man and livestock in the Southeast.

Floodwater mosquitoes deposit their eggs in damp soil and ground litter along the margins of rain-water pools. The eggs lie dormant, enduring prolonged periods of drought as well as freezing temperatures. After overwintering, the eggs which have accumulated during the previous year or more hatch as the soil is covered by rain water or by flooding of adjacent streams. In one to several weeks following hatch, depending on water temperature, enormous numbers of mosquitoes emerge, often creating severe local problems.

Auburn researchers have been investigating the effectiveness of various formulations of *Bacillus thuringiensis* var. *israelensis* (*B.t.i.*) for control of floodwater mosquitoes. *B.t.i.* is a bacterial agent closely related to Thuricide® and Dipel® which have been widely used to control insect pests of field crops. Unlike these other products, however, *B.t.i.* is highly toxic to mosquitoes and has shown considerable promise as a safe and effective mosquito larvicide.

Laboratory tests revealed that mosquito larvae exposed for as little as 4-5 minutes to low concentrations of *B.t.i.* applied to the water surface experienced virtually 100% mortality within 1 hour after treatment. The larvae ingest the bacterial spores and a potent endotoxin produced by the bacterium. This toxin is released in the mosquito midgut where it destroys the cells of the digestive tract causing paralysis and death.

Small-plot field tests of *B.t.i.* in Alabama in 1980 and 1981 have demonstrated the effectiveness of this agent in killing floodwater mosquitoes such as *Aedes canadensis*, *A. sticticus*, *A. vexans*, and *Psorophora ferox*. Abbott Laboratories' WP formulation of *B.t.i.*, ABG-6108-II, was compared with Teknar®, another *B.t.i.* product, applied at manufacturers' recommended rates and with the widely used mosquito larvicide Abate 4-E as a standard.

All field tests were conducted in circular, plastic-sided, open-bottom pools delimiting a surface area of 1 m^2. PVC cylinders were attached to a wooden stake within each test plot and positioned with the screened lower end in contact with the substrate, providing a column of water virtually identical to that of the natural pool. Prior to treatment, 20 III- and IV-instar larvae of a given species were placed in each test cylinder, eliminating predators and providing a convenient means by which mortality could be accurately assessed following treatment. Water temperatures were recorded to determine the effect of temperature on larval mortality following *B.t.i.* applications. All materials were applied to the surface of each test plot with 1-gal. compressed-air sprayers.

At water temperatures of 50-68°F, the 3 higher rates of the Abbott formulation provided a level of control comparable to that of the 3 rates of Teknar® and Abate 4-E, table. At 77°F, Teknar® and Abate 4-E continued to provide good control, whereas the effectiveness of the Abbott material dropped significantly. This was especially noticeable at the lower application rates. A similar decrease in larvicidal activity with the Abbott formulation was observed at water temperatures below 50°F. The performance of other *B.t.i.* products and formulations needs to be evaluated at these lower temperatures to establish whether or not they, likewise, are relatively ineffective in killing mosquito larvae in cold water early in the season. Research is continuing to determine if this effect is caused by changes in toxicity of *B.t.i.* formulations at different water temperatures or if it simply reflects reduced feeding activity, and thus reduced ingestion of *B.t.i.* spores, by mosquito larvae at temperatures above or below 50-68°F.

Field tests at Auburn have confirmed that *B.t.i.* is quite specific in killing mosquitoes and the larvae of a few other related aquatic flies while exhibiting virtually no adverse effects on other nontarget organisms.

Three commercial *B.t.i.* products are currently being marketed as mosquito larvicides. Bactimos® by Biochem Products and Vectobac® by Abbott Laboratories are both wettable powders, whereas Teknar®, a product of Sandoz, Inc., is available as an aqueous concentrate. All three products appear to provide good to excellent control of floodwater mosquitoes within the range of water temperatures at which most mosquito larvae develop in the Southeast.

MEAN PERCENT MORTALITY AT INDICATED TEMPERATURES, 24 AND 48 HOURS POST-TREATMENT

Treatment	47°F		50-58°F		58-68°F		77°F	
	24 hr.	48 hr.	24 hr.	48 hr.	24 hr.	48 hr.	24 hr.	48 hr.
ABG-6108-II, WP (1.5 kg/ha)	78	94	98	100	100	-	89	100
ABG-6108-II, WP (1.0 kg/ha)	73	90	78	93	97	-	74	98
ABG-6108-II, WP (0.5 kg/ha)	15	45	86	94	100	-	65	92
ABG-6108-II, WP (0.25 kg/ha)	33	53	41	55	93	-	45	87
Teknar (2.0 pt/a)	-	-	94	99	-	-	-	-
Teknar (1.0 pt/a)	-	-	95	99	99	-	98	100
Teknar (0.5 pt/a)	-	-	86	98	96	100	100	100
Abate 4-E (0.5 oz/a)	-	-	87	93	98	100	100	100
Control	0	0	1	1	0	0	0	0

Cork spot shows up as blushed areas on the skin of apples (right), but also may extend down into the flesh of apples (left).

Foliar Spraying with BORON and CALCIUM Reduces Cork Spot of Apples

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CORK SPOT is one of several fruit corking disorders of apples. It often appears as small blushed areas on the skin of apples above corked spots in the flesh. The corked area may be located anywhere between the core and the skin. Tissues in the affected area cease to grow and the tissue becomes much harder than the surrounding healthy tissue.

Cork spot may begin to develop as early as 14 days after bloom and as late as 8-10 weeks after bloom. It does not increase after harvest.

Conditions which result in large fruit, such as high nitrogen nutrition, small crops, and heavy pruning, may lead to cork spot development. More cork spot has been observed when nitrogen was supplied as ammonium N than when nitrate N was used. It is more severe on young, vigorous trees with small crops than on older, heavy fruiting trees. As much as 60-70% of fruit can be affected.

The actual cause of cork spot is not known. It is reported to be related to low calcium or low boron levels, or both, in the fruit. Results of Alabama Agricultural Experiment Station research support these reports.

An Auburn study to determine whether foliar sprays of calcium and boron would affect cork spot incidence was begun in spring 1971 at the Chilton Area Horticulture Substation. Treatments were applied to 9-year-old Starkrimson Red Delicious apple trees on seedling rootstock. Four treatments were used:

1. Control—no treatment.
2. Two foliar sprays of boron (2 lb. Solubor® per 100 gal. of spray); first spray applied during late bloom and second 2 weeks after petal fall.
3. Four foliar sprays of calcium (3 lb. of calcium chloride per 100 gal. of spray) applied at 2-week intervals beginning 2 weeks after petal fall.
4. Combination of the boron and calcium treatments (treatments 2 and 3).

Sprays were applied with a John Bean Speed Sprayer®.

The incidence of cork spot was significantly reduced by both boron and calcium treatments—alone or in combination—in all years except the first, table 1. There was little incidence of the disorder in 1974 due to the large crop that followed a no-crop year in 1973. The trees in 1974 produced a large crop of medium size apples that were not highly susceptible to cork spot development. Even so, it was evident that calcium and boron treatments suppressed cork spot development. Over the 6-year study, the incidence of cork spot was reduced 5.6 to 6.8%. This would amount to increasing the marketable yield by 30 to 40 bu. per acre on a 600 bu. per acre crop and 40-54 bu. per acre on an 800-bu. crop. In some years the sprays reduced cork spot as much as 9%.

Calcium and boron content in leaves, corked fruit, and noncorked fruit was increased by all treatments, table 2. The application of either calcium or boron also resulted in greater accumulations of other elements in both leaves and fruit. The greatest accumulation of calcium and boron occurred when the two nutrients were applied in combination, reflecting the fact that both calcium and boron affect the translocation of each other.

The incidence of cork spot was generally lowest when both elements were applied.

TABLE 1. EFFECT OF BORON AND CALCIUM SPRAY TREATMENTS ON CORK SPOT INCIDENCE ON APPLES

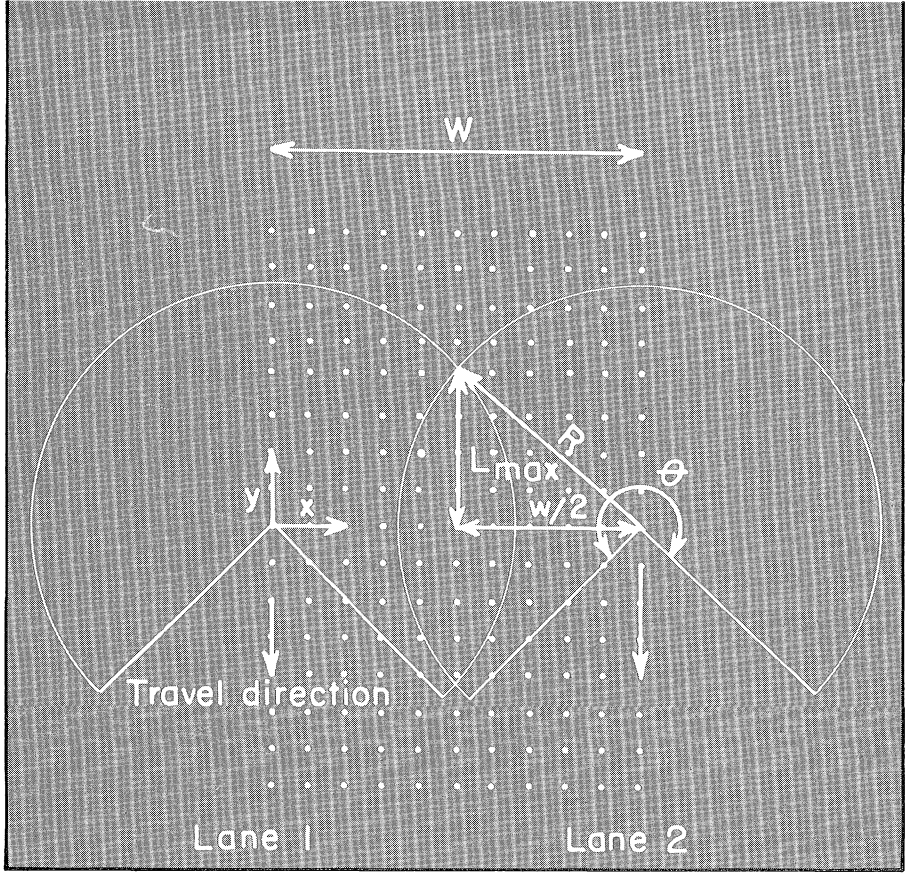
Treatment	Fruit with cork spot							Av. reduction
	1971	1972	1973	1974	1975	1976	5-yr. av.	
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Control	18.3	14.4	--	7.8	18.6	17.7	15.4	--
Boron	16.9	7.4	--	4.4	10.6	9.8	9.8	5.6
Calcium	14.5	7.2	--	3.4	11.8	10.2	9.4	6.0
Boron + calcium	13.8	6.6	--	3.2	9.4	9.8	8.6	6.8

TABLE 2. EFFECT OF BORON AND CALCIUM SPRAY TREATMENTS ON THE BORON AND CALCIUM CONTENT OF LEAVES AND FRUIT OF RED DELICIOUS APPLES

Treatment	Leaves		Corked fruit		Noncorked fruit	
	Ca	B	Ca	B	Ca	B
	Pct.	*p.p.m.*	*p.p.m.*	*p.p.m.*	*p.p.m.*	*p.p.m.*
Control	1.06	50.2	298	39.6	307	40.6
Boron	1.12	63.6	327	68.9	322	73.1
Calcium	1.15	55.1	328	45.7	327	45.4
Boron + calcium	1.19	66.6	324	78.7	347	83.2

Adequate Irrigation at Field Boundary with Traveler Irrigation

EUGENE W. ROCHESTER
Department of Agricultural Engineering



Field layout showing initial sprinkler positions.

EFFICIENT UTILIZATION OF WATER and energy in irrigation is a necessary component of a successful system. With this requirement as a goal, research is now being conducted at the Alabama Agricultural Experiment Station to improve water and energy efficiency of various irrigation systems. One type of system being studied is the traveler, a system consisting of a wheeled carriage and a high volume sprinkler which is towed across the field with a cable or a hose.

Recent studies have focused on water application amounts near the "start-up" position of the traveler. This is the area that receives less water because it obtains water from only a portion of the sprinkler's wetting pattern. For many years the accepted method was to start the traveler at the field boundary. With this method some water is wasted outside the field boundary and the under-irrigated zone is limited to a distance of one wetting radius in front of the sprinkler.

The amount of the deficit is a function of the operating angle of the sprinkler. For example, a sprinkler operating at half circle would have no deficit in the field area while one operating at full circle would have the greatest deficit. Generally, the deficit is ignored and normal travel speed is initiated at the same time the system is pressurized.

Some manufacturers of hardhose travelers are offering an initial-delay option which allows a period of stationary application before the traveler begins moving. This delay can be used to increase the amount of water applied in front of the sprinkler, but can also be used to irrigate behind the start-up position of the sprinkler. However, start-up delays will generally result in excess water being applied at some locations. The farmer must be concerned about the effects of these excesses and deficits on crop response, but he must also be concerned about the cost of pumping the unused water.

A typical arrangement, see figure, includes a number of parallel lanes spaced a constant distance apart (W). This spacing is less than twice the sprinkler's wetting radius (R) so that an appropriate overlap can be achieved. Both the spacing (W) and the wetting radius (R) have an effect on the area behind the sprinkler which gets complete coverage. The maximum distance behind the sprinkler (L_{max}) for which complete coverage occurs, see figure, can be computed by the following equation: $L_{max} = \sqrt{R^2 - (W/2)^2}$. For example, if lanes are spaced 300 ft. apart and the sprinkler has a wetting radius of 215 ft., then the maximum distance behind the sprinkler to the end of complete coverage would be 154 ft. (L_{max}). Of course, complete coverage means that only a few drops of water are applied at that location, certainly not an adequate amount.

Auburn Study

The Auburn study relates to whether the use of start-up delay can provide adequate irrigation behind the start-up position and what effect the delay will have on wasted water. In the evaluation, adequate irrigation was considered as 75% of the average application. Thus, if the traveler speed is set to provide a 1-in. application, then at least a 3/4-in. average application would need to be applied between lanes for that location to be considered adequately irrigated. Water applied beyond this location is considered wasted. Likewise, water applied in excess of the 1-in. average application was also considered wasted even though some of it would probably be utilized by the crop. Therefore, wasted water is the combination of water applied beyond the field boundary and excess water within the field boundary.

The study evaluated start-up delays for several lane widths and sprinkler wetting angles. The delay times were determined to provide adequate irrigation amounts at various locations behind the sprinkler.

The conclusions of the study confirm that an initial delay can be used to effectively increase the travel lane lengths without substantially affecting the total amount of wasted water. However, the longer initial delays will substantially increase the areas obtaining excess irrigation.

Foliar Blight Cuts Vigor, Seed Yield of Some Low-tannin Sericea

E.D. DONNELLY, Department of Agronomy and Soils

EFFORTS TO BREED SERICEA with low tannin content have been successful at the Alabama Agricultural Experiment Station. A problem was discovered, however, in that some low-tannin lines are susceptible to a foliar disease caused by *Rhizoctonia* sp. Later research then identified low-tannin lines that were resistant like the normal, high-tannin sericea (see Breeding Low-tannin Sericea for Resistance to Foliar Diseases, *Highlights of Agricultural Research*, Vol. 28, No. 4).

Importance of resistance to the foliar blight showed up in other studies. Results showed that the disease can (1) seriously reduce seed yields, and (2) reduce vigor of plants, which could damage stands.

Tests to measure effects of Rhizoctonia blight were established at the Tuskegee Experiment Field and the Plant Breeding Unit, Tallassee, in spring 1974 and at Auburn in spring 1976. There were 42, 36, and 90 lines, respectively, studied at these locations, of which 36 were common to Tuskegee and Tallassee. The sericea lines were grown in 5-ft. rows 3.3 ft. apart at Tuskegee and Tallassee and in 3- x 3-ft. broadcast plots at Auburn.

The same low-tannin, disease resistant control line was used at Tuskegee and Tallassee. All three locations had the same high-tannin and disease susceptible control lines.

All plots at Tuskegee and Tallassee were rated for vigor and disease in October 1975 and 1976, and at Auburn in October 1976 and 1977. Seed from each plot at Tuskegee and Tallassee were harvested in October 1975 with a cutter bar type mower, placed in a cloth bag, and dried. Seed were then threshed, cleaned, and weighed. At Auburn, seed were harvested in October 1977 with a small plot combine. Also at Auburn in 1977, forage was cut twice at the hay stage with a small plot harvester prior to seed harvest in October.

Reaction Varies Among Lines

Low-tannin lines varied from highly resistant to highly susceptible at each location, table 1. The low-tannin, disease resistant control had no disease symptoms at Tallassee (where it was selected as resistant), but at Tuskegee it appeared as susceptible as the low-tannin, disease susceptible control line. Thus, more than one strain of *Rhizoctonia* sp. may be involved.

A higher percentage of low-tannin lines apparently were more disease resistant at Auburn than at the other two locations. Six of the low-tannin lines were as disease free as the high-tannin control. Lines at Auburn were more highly bred for disease resistance than those at the other locations.

Table 1. Susceptibility of Low- and High-tannin Sericea Lines to a Disease Caused by *Rhizoctonia* sp., 1975 and 1977 in Central Alabama

Tuskegee, 1975		Tallassee, 1975		Auburn, 1977	
Disease ratings[1]	Lines with same mean	Disease ratings[1]	Lines with same mean	Disease ratings[1]	Lines with same mean
	No.		*No.*		*No.*
1.0	1[2]	1.0	2[3]	1.0	7[4]
1.8	3	1.2	1	1.3	24
2.0	10	1.8	1	1.7	20
2.2	9	2.0	1	2.0	22
2.5	6	2.2	6	2.3	12
2.8	3	2.5	4	2.7	1
3.0	2	2.8	7	3.0	1
3.2	3[5]	3.0	2	3.7	1
3.5	2	3.2	2	4.0	1
3.8	1	3.5	2	4.3	1[7]
4.0	2	3.8	4		
		4.0	2		
		4.5	2[6]		
Total lines	42		36		90

[1]Scale of 1.0 to 5.0, where 1.0 = no disease symptoms and 5.0 = severe defoliation.
[2]High-tannin control line.
[3]Includes one high-tannin control line and one low-tannin disease resistant control line.
[4]Includes one high-tannin control line and six low-tannin lines.
[5]Includes both the low-tannin disease resistant and susceptible control lines.
[6]Includes the low-tannin disease susceptible control line.
[7]Low-tannin disease susceptible control line.

Table 2. Seed Yields Per Plot of Sericea Lines at Three Central Alabama Locations

Location and year	Yield, ounces		No. of lines
	Range	Mean	
Tuskegee, 1975 ...	3.0- 9.0	5.4	42
Tallassee, 1975	1.3-10.0	3.0	36
Auburn, 1977	0.7- 9.2	5.0	90

Seed Yield, Vigor Affected

Seed yields varied greatly among lines at all three locations, table 2. The low-tannin, disease susceptible control was among the lowest seed producers, while the high-tannin control line was among the highest. This was attributed primarily to the high disease resistance of the high-tannin line.

Severity of the disease determined the extent of reductions in vigor, seed yields, and hay weights in the Auburn test. As disease severity increased, vigor, seed yields, and hay weights decreased. Results indicate that disease severity accounted for 27-30% of the variation in vigor and 22-29% of the variation in seed yields among locations.

Since the disease becomes more prevalent late in the season, it may be more harmful to seed production than to forage production. However, it appears likely there would be a gradual reduction in vigor of susceptible germplasm and stands would thin over a period of several years.

Based on these findings, resistant, low-tannin germplasm resulted from crossing low-tannin breeding stocks with high-tannin lines that had a gene or genes for resistance.

INOCULATE PEANUTS?

D.L. HARTZOG, FRED ADAMS, A.E. HILTBOLD, Department of Agronomy and Soils

FARMERS ARE continually searching for those fields for peanuts with the effect of a long-term rotation. These areas include bahiagrass pastures, Coastal bermudagrass hay fields, idle land, fields recently cleared of trees, and others that have not been planted to peanuts in a long time. With this new land coming into peanut production, farmers must decide if it is necessary to inoculate peanut seed at planting with nitrogen-fixing bacteria.

A field study was conducted by the Alabama Agricultural Experiment Station in 1980 and 1981 on farmers' fields to determine benefits of inoculation of peanuts by *Rhizobium* bacteria in fields having gone many years without being planted to peanuts. Soil samples were taken from each farmer's field and the number of peanut *Rhizobia* present in the soil was counted.

Treatments included (1) check, no inoculum or fertilizer, (2) 50 lb. per acre of nitrogen as ammonium nitrate, and (3) inoculum drilled into the seed furrow at 15 lb. per acre at planting (only 5 lb. is recommended). Fifteen pounds were used to ensure more than enough inoculum on all soils. No pesticides were applied at planting in order to avoid any potential injury to the *Rhizobium*.

Two experiments were harvested in 1980, both on Bill Deloney's farm in Dale County. One experiment was on a Lucy loamy sand that had been in bahiagrass for the past 10 years. The other experiment was on an Alta Vista fine sandy loam, which had been cleared from native hardwood trees in 1978 and planted to soybeans in 1979. These past histories resulted in very low *Rhizobia* populations, which should have favored the need for peanut inoculation. However, yields and grades in both experiments were just as good without inoculation as they were with it.

Four experiments were conducted on farmers' fields in 1981. One was on a Dothan loamy sand in Dale County that had not been cropped for the past 20 years. It showed rapid vine growth and plant development. There were no leaf or stem diseases, and yields were about 4,000 lb. per acre. There was no yield or grade increase resulting from inoculum.

A second experiment was conducted on a Troup loamy sand that had been cleared from native trees in 1980. There was excellent vine growth throughout the growing season. There was no yield or grade increase from either the inoculation or nitrogen fertilizer.

A third experiment was on a Lucy loamy sand that had not been planted to row crops since 1945. The field was isolated from other fields by trees. The plants grew very rapidly until they had lapped in the middles. Yields were about 4,000 lb. per acre with no increase in yield or grade from inoculum or nitrogen fertilizer.

The fourth experiment was on a Red Bay loamy sand that had not been planted to a row crop since 1952. Twenty-year-old pines were harvested in 1978. Peanuts were planted the last week in May, and plants grew very rapidly and were lapped by August 1. Yields of about 4,000 lb. per acre showed no increase due to inoculation or nitrogen fertilizer.

Rhizobia numbers in these soils ranged from 6 to 1,300 per gram, which are very low populations. Fields where peanuts are grown regularly will have hundreds of thousands of *Rhizobia* per gram of soil. These experiments showed that even the very low numbers of *Rhizobia* present in these soils were enough to provide effective nodulation and maximum yield and SMK (sound mature kernels). The failure of nitrogen fertilizer to increase yields also supports this conclusion.

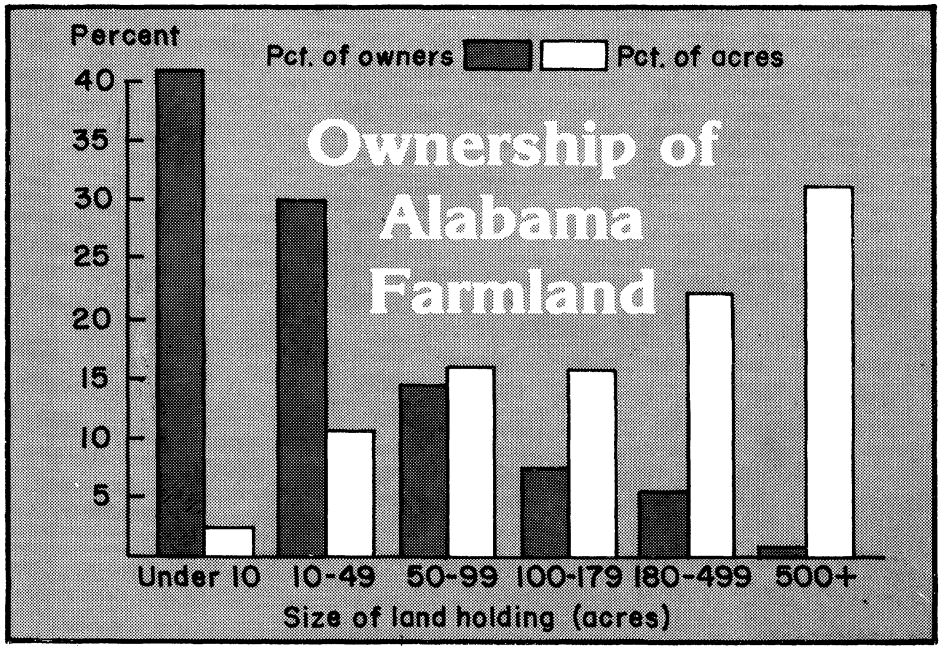
These experiments show no need for inoculating peanuts in Alabama, even under conditions where its need would appear to be most likley.

YIELD AND GRADES OF FLORUNNER PEANUTS IN INOCULATION EXPERIMENTS

County—grower	Soil type	*Rhizobia* per gram soil	Per acre yield	SMK
		No.	*Lb.*	*Pct.*
Dale—Deal Bros.	Dothan loamy sand	1,300	3,930	76
Pike—Harden and Sons	Red Bay loamy sand	490	4,170	79
Pike—R. and B. Price	Lucy loamy sand	32	4,040	75
Henry—C. Trawick	Troup loamy sand	12	4,190	74
Dale—B. Deloney	Alta Vista fine sandy loam	11	2,600	74
Dale—B. Deloney	Lucy loamy sand	6	2,910	71

CONSIDERABLE CHANGE has occurred in the pattern of land ownership in the United States and Alabama. The nature of this change has not been clearly documented and understood, especially at the state level. To provide current information on ownership of farmlands, the Economics, Statistics and Cooperative Service (ESCS) of the U.S. Department of Agriculture conducted a national Landownership Survey in 1978.

Primary data obtained were made available to Alabama Agricultural Experiment Station researchers. Survey results reveal that about 1.35 billion acres of land in the United States is owned by private individuals or organizations. This accounts for 58% of all land. Farm and ranch lands represent 69% of all privately owned lands (approximately 938 million acres). Alabama has about 14.85 million acres of this farmland held in more than 235,000 ownership units or land parcels. These ownership units are not farms, however, as many farm operations combine multiple ownership units.



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Form of Private Farmland Ownership

The most prevalent type owners in Alabama are sole proprietors who hold 42% of the farm and ranch units amounting to 45%of the land or 6.6 million acres. Families represent another 35% of all farm and ranch units and 34% of the acreage. Almost all the remainder of Alabama's private farmland is held as partnership units, family 13% and non-family 2%, and corporations, family 2% and non-family 3%. Compared to the United States, Alabama has a larger proportion of its farm acreage owned by individuals or families, 93%, compared to 90% for the United States. These farmland units exclude forest lands and do not reflect the large tracts of such lands owned by corporations throughout the State and Nation.

Size of Farmland Holdings

In focusing on farm and ranch ownership units, an interesting inverse relationship is seen between the proportion of owners and the size of land holdings. Ownership units of less than 10 acres account for 41% of the owners but only slightly more than 2% of the acreage, see figure. On the other hand, 7.3% of the owners control 54% of the farmland in units larger than 180 acres.

Pronounced differences exist between Alabama and the Nation. Only 29% of U.S. farmland is in units smaller than 10 acres. Ownership units of less than 100 acres represent only 13% of all U.S. farmland. Comparable Alabama percentages for these smaller units are 30% higher than those for the United States.

How did ownership of Alabama's farmland come about? As might be anticipated, the most common way was through direct purchase from unrelated individuals. More than half of the privately owned acreage, 54%, was obtained in this way. Inheritance accounted for the next largest proportion at 24%. Another 19% of the farmland was purchased from relatives. Patterns of acquisition tended to be similar across the United States in this regard. Nationally, slightly fewer acres were acquired through inheritance when compared to Alabama.

Characteristics of Owners

The vast majority of owners of Alabama farmland, 93%, live in the county where the property is located. These individuals control 81% of the privately owned acreage. Another 4% of the owners live in another Alabama county. Alabama has a higher proportion of local, within county ownership than exists in the United States, 84%.

Many owners of farmland units are elderly. Over one-fourth, 28%, of the ownership units in Alabama are held by persons 65 years of age or older. Acreage controlled by persons in this age group represents one-third, 34%, of all farmland. This proportion is 4% larger than that for the United States. Conversely, persons younger than 45 years of age hold 24% of the ownership units and 15% of the acreage. Both percentages are smaller than those for the United States.

The widespread practice of renting and leasing farmland in Alabama is vividly portrayed. Only 15% of the ownership units are held by persons identifying their principal occupation as a farmer. These individuals own 28% of the farm acreage in the State. Retired persons own 27% of the units and an equal proportion of the acreage. Some of these were probably farmers prior to retirement. Still, the majority of farmland owners are involved in nonfarm occupations. White collar professionals, managers, and administrators owned 9% of the ownership units and 18% of the acreage. Blue collar workers represent the largest proportion of units, 45%, but they hold only 19% of the acreage.

Farmers control 10% fewer ownership units in Alabama than is true for all United States farmers. Marked acreage differences exist also. Farmers across the United States own 51% of the farmland as compared to Alabama's 28%. Retirees in the United States hold 11% less land than in Alabama and nonfarmers 16% less.

Ownership of Alabama farmland varies from the United States as a whole. These differences need to be considered by local, state, and national leaders as programs relating to agriculture are debated and implemented. The fact that many tracts of farmland and considerable acreage are owned by nonfarm operators in Alabama is significant. These owners may be less responsive to market conditions and price-cost factors. Ultimately, it is the landowners who hold the key to continued development of agriculture and its success in meeting future domestic and international food needs.

Broiler Litter in Finishing Ration Reduces Beef Feeding Cost

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ALABAMA'S BEEF CATTLE INDUSTRY has traditionally consisted largely of cow-calf production units, with most calves sold at weaning to feedlot operators in the West and Midwest. A smaller number of calves remain in Alabama following weaning to be fed further in either stockering or feedlot programs.

The relatively small number of cattle entering feedlots is largely due to Alabama being a grain deficient state. The high cost of purchased grains has restricted the potential profit margin from cattle feeding programs.

Interest in Cattle Feeding

Recently, however, there has been interest in finishing cattle by using grains such as wheat or milo, which can be economically grown in Alabama, supplemented with broiler litter to replace corn. Broiler litter is of particular interest as an economical replacement for soybean meal, cottonseed meal, or urea, since there is an abundant supply and the cost is relatively low.

Cattle can utilize ingredients such as litter since the rumen has a large microbial population capable of digesting nitrogen-containing dietary components and synthesizing high quality protein. For this to be successful, however, the diet must be formulated to provide the essential nutrients needed by the microbial population for maximum bacterial growth and digestion of dietary components.

Research Shows Value of Chicken Litter

Recent Alabama Agricultural Experiment Station tests at the Sand Mountain Substation, Crossville, have shown that broiler litter can be used to good advantage to replace soybean meal or urea as a protein source in rations for cattle heavier than 700 lb. The low cost of broiler litter gives a potential profit advantage over feeding rations made with traditional protein supplements.

Crossbred steers of Angus, Hereford, or Angus x Hereford breeding that weighed an average of 585 lb. were used in the experiment. Sixteen steers (8 per pen) were randomly assigned to either a corn silage-corn grain basal diet or to the diet supplemented with either urea, broiler litter, or soybean meal. All diets were calculated to contain an equal amount of usable energy and 11.4% crude protein, except the unsupplemented basal diet which contained 8.3% protein, table 1.

The unground broiler litter was stored in a covered, deep stack for at least 10 to 14 days before feeding so the heat of fermentation could destroy many of the pathogenic organisms that may be present in the litter. It was incorporated into the complete diet without grinding at time of feeding. Grinding is generally undesirable because it causes excess dustiness and a fine texture that may decrease feed intake. During the initial 56 days of the trial, supplementation of the basal diet with all the sources of protein increased cattle weight gains and feed efficiency, table 2. Daily gains by the steers fed urea and soybean meal were similar and slightly higher than gains made by steers fed the broiler litter ration. Comparison of the amount of feed required per unit of live weight gained also suggests that the protein in broiler litter may be utilized slightly less efficiently than that of urea and soybean meal. Growth rate over the entire 130-day trial, however, was similar regardless of the source of supplemental nitrogen.

Close similarity in performance of all groups over the entire trial was expected due to the decline in protein requirement as steers reached heavier weights. As cattle approach finished weights, the composition of live weight gain changes from one of largely protein in the light weight animal to that of a greater percentage of fat and less protein in the heavier animal. This decline in protein requirement, along with the greater capacity for microbial protein synthesis in the rumen, allows nitrogen sources such as urea and broiler litter to support weight gains equal to those made by cattle fed soybean meal.

Using Litter Cuts Feed Cost

Results of this study suggest that the nitrogen in broiler litter may be of less value than that from either urea or soybean meal when fed to light weight cattle. With cattle weighing 700 lb. or more, however, equal performance can be expected regardless of the protein source. The inclusion of low cost litter in cattle diets greatly reduces feed costs, thereby increasing the profit potential. Cost per pound of gain and dollar return per steer over feed costs greatly favors the inclusion of broiler litter in rations for finishing cattle.

TABLE 1. COMPOSITION OF TEST DIETS (AS-FED BASIS)

Ingredient	Content, by test ration			
	Basal	Urea	Litter[1]	Soybean meal
	Pct.	*Pct.*	*Pct.*	*Pct.*
Corn silage	46.8	46.9	46.6	46.8
Cracked corn	39.2	39.4	34.0	34.7
Cottonseed hulls	12.1	11.4	7.7	12.1
Soybean meal	--	--	--	4.7
Broiler litter	--	--	11.0	--
Urea	--	.9	--	--
Dicalcium phosphate	.7	.7	--	.6
Limestone	.5	.5	.4	.5
Dynamate®	.4	.4	--	.3
Salt, T.M.	.3	.3	.3	.3
Cost per ton[2]	*$89*	*$90*	*$73*	*$95*

[1]Broiler litter contains (dry matter basis) 78-90% dry matter, 50-55% total digestible nutrients (TDN), 2% calcium, 1.6% phosphorus, and 18-30% protein equivalent. Approximately 50-75% of the crude protein is natural protein, and the balance is nonprotein-nitrogen in the form of ammonia or uric acid.

[2]Costs of individual ingredients were: corn, $3.83/bu.; soybean meal, $279/ton; cottonseed hulls, $156/ton; broiler litter, $10/ton; corn silage, $25/ton; and urea, $260/ton.

TABLE 2. SUMMARY OF FEEDLOT PERFORMANCE

Performance item	Ration			
	Basal	Urea	Litter	Soybean meal
Initial 56 days				
Starting weight, lb.	589	609	584	609
Daily gain, lb.	2.1	2.7	2.5	2.8
Feed consumed/day, lb.	31.0	36.9	35.4	36.7
Feed/lb. gain, lb.	14.8	13.7	14.2	13.1
Entire 130 days				
Final weight, lb.	862	914	880	912
Daily gain, lb.	2.1	2.3	2.3	2.3
Feed consumed/day, lb.	33.0	38.3	38.3	38.1
Feed/lb. gain, lb.	15.7	16.7	16.7	16.6
Feed cost/lb. gain[1]	70¢	75¢	61¢	79¢

[1]Based on feed costs given in table 1.

Aerial Seeding for Ryegrass-Soybeans Double Cropping

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N.R. McDANIEL and E.L. CARDEN, Gulf Coast Substation

AERIAL SEEDING of ryegrass into soybeans offers the chance for speeded-up double cropping. Such a double-cropping system has been successful in Alabama Agricultural Experiment Station research during 2 years at the Gulf Coast Substation, Fairhope.

Good Soybeans, Early Grazing

Seeding ryegrass ahead of soybean harvest has allowed fairly early stocking of winter pastures and provided good rate of gain and high beef production per acre. Soybean yield has been good, too—26 bu. per acre in 1979 and 34 bu. in 1980. (Hurricane Frederic hit the area September 12, 1979, which undoubtedly damaged the 1979 crop.)

During the 2-year study, soybeans were planted during late June and harvested in early November. Seeding of ryegrass was done about 30 days before soybean harvest. After cattle were removed from grazing, remaining ryegrass vegetation was turned under and a good seedbed prepared for the following soybean crop.

Mineral fertilizer and lime were used according to soil test recommendations. Complete fertilizer was applied immediately following soybean harvest, with additional application of nitrogen (66 lb. each) in late February and late March. Preemergence herbicides were used each year to control weeds in soybeans.

Eighty pounds of ryegrass seed were put on by aircraft in early October. Half was put on in one direction and half applied perpendicular to the first application. The ryegrass seed were applied while most of the soybean leaves were still on the plants, so the leaves acted as cover to retain soil moisture and helped the ryegrass seed germinate.

RESULTS FROM SOYBEANS-RYEGRASS CROPPING SEQUENCE, GULF COAST SUBSTATION, 1979-81

Performance item	Result, by year	
	1979-80	1980-81
Ryegrass data		
Date seeded	10/10/79	10/14/80
Date grazing began	1/31/80	12/15/80
Date grazing ended	5/26/80	5/18/80
Gain/acre, lb.	488	653
Average daily gain, lb.	1.59	2.77
Grazing days/acre	306	235
Stocking rate, steers/acre	1.80	1.53
Soybean data		
Date planted	6/19/79	6/30/80
Date harvested	11/6/79	11/11/80
Yield, bu./acre	26	34

Ryegrass Established at Soybean Harvest

Soybean harvest occurred approximately 30 days after aerial application of the ryegrass seed. Therefore, the ryegrass seedlings were well established at soybean harvest. Use of a straw spreader on the combine is considered desirable.

Once the plant canopy was removed, the ryegrass plants grew rapidly. The ryegrass was available for grazing by mid-December, but the bulk of its growth was produced during February, March, and April.

Stocker cattle weighing 600-700 lb. limit-grazed the 25-acre test pasture during December and January. They grazed continuously from mid-February until late May.

Ryegrass is an excellent quality forage crop, as evidenced by performance of grazing steers given in the table. Total gain per acre averaged 488 and 653 pounds, respectively, during the 1979-80 and 1980-81 grazing seasons. Average daily gain was 1.59 and 2.77 lb., respectively.

Cattle Performance Good

Cattle performance on the ryegrass is about typical for cool season annual pastures grown under a single-cropping system, and certainly justifies this double-cropping sequence. A realistic cost for producing an acre of this type forage would be $100, which would make cost of gain about 20-25¢ per pound.

Results from the two completed tests and a third in progress indicate that soybeans followed by aerially-seeded ryegrass is a practical method of increasing productivity from good land.

What Farmers Can Do To Reduce Costs

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MANY FARMERS, as well as other business operators, are facing serious financial problems. There are numerous factors affecting farm finances and each farm situation is different. For these reasons farmers need to thoroughly analyze their situation, make the best decisions possible, and act in an attempt to overcome the problems.

It is important to understand the farm financial situation from the standpoint of assets and claims as well as income flows and costs.

Assets and Liabilities

For many years farmers have substituted capital for labor. They have bought more and bigger machines, purchased more chemicals and nonfarm-produced inputs, and expanded by adding additional acreage to their operations. In some cases additional acres were purchased and in others they were rented. Attempts were made to increase volume of business and become more efficient. Generally, the objective to be achieved through expansion was to lower per unit production costs. Continued inflation, higher interest rates, and several other economic forces have worked against farmers catching them in a cash flow squeeze. Increases in farm real estate values have slowed in the past year and the farmer's equity position has increased less than in previous years. In the past, increasing equity made it possible to borrow additional funds and continue the cycle of increased investment and expansion.

As an average, Alabama farmers remain in a rather strong position from the standpoint of total assets to total claims. As of January 1, 1981, the last year for which asset and liability data are available for all Alabama farms, total assets were six times total liabilities. This was a good ratio, but the distribution of assets and liabilities is what is important in so many cases. About 79% of the total assets of Alabama farmers is in farm real estate, or fixed assets. Such assets are not normally sold to meet financial obligations. Assets in terms of crops and livestock that are normally marketed are important in meeting the financial obligations when they become due.

Increased Costs

Inflation and rather rapidly rising farm costs have been major factors contributing to the farmer's presently poor financial situation. From 1979 to 1980, interest on the farm mortgage debt paid by Alabama farmers increased 20.3%, see table. Repairs and operation of capital items increased 18.3%, while the cost of seed, fertilizer, and lime increased slightly more than 15%. These increased operating costs coupled with relatively low crop and livestock prices as a result of large production and supplies on hand have resulted in a real financial hardship for farmers.

This situation is best illustrated by the proportion farm expenses have taken out of farm income in the past several years. In 1978 in Alabama, farm expenses were 79.5% of farm income, in 1979 they were 82.3% of farm income and in 1980, because of the drought and other economic forces, expenses were 99.6% of farm income. This vividly illustrates the cash flow problem farmers face, not only in meeting expenses but in family living and debt repayment.

What Can Be Done?

Each farm situation is different and no "best" set of actions can be given for all cases.

Many farmers strive to hold machinery costs down by holding off on buying farm machinery and equipment. From an income tax standpoint, investment credit and accelerated depreciation are not needed when farm income is down. In many cases, additional years of use can be made of existing farm machinery and equipment. Part-time labor may be cheaper than more or bigger machinery in striving for timeliness. Consider repairing rather than replacing machinery and equipment or buying used instead of new items. The hiring of custom operations for spreading fertilizer or harvesting crops may also be a more affordable alternative than buying new equipment. Also, if you have excess labor, power, and equipment, consider doing work for others.

Some investments other than in machinery and equipment may also be postponed. These may include farm service buildings, irrigation systems, and silos or grain bins.

It may be possible to cut costs and improve cash flow in both crop and livestock production practices. Soil testing continues to be a must. There is no point in applying certain fertilizer elements to fields where they are not needed. It may also be possible to reduce herbicide costs by changing herbicide material used or method of application. The same is true for insect control measures. For some crops, seeding rates may be cut without a reduction in yield. For both crops and livestock, do a better job of buying inputs such as fertilizer, insecticides, herbicides, feeds, and supplies. For livestock, monitor feed consumption and reduce feed wastage. Culling of certain animals may be in order.

Some farmers may be able to make fuller use of their land resource by more double cropping. This aids in spreading fixed costs and reducing per unit of production costs but increases per acre costs.

Analyze the costs and returns for the crop and livestock enterprises you now have. Some adjustments may be in order to reduce out-of-pocket costs and to change risks incurred. Care should be taken in cutting costs so that total income is not reduced more than costs.

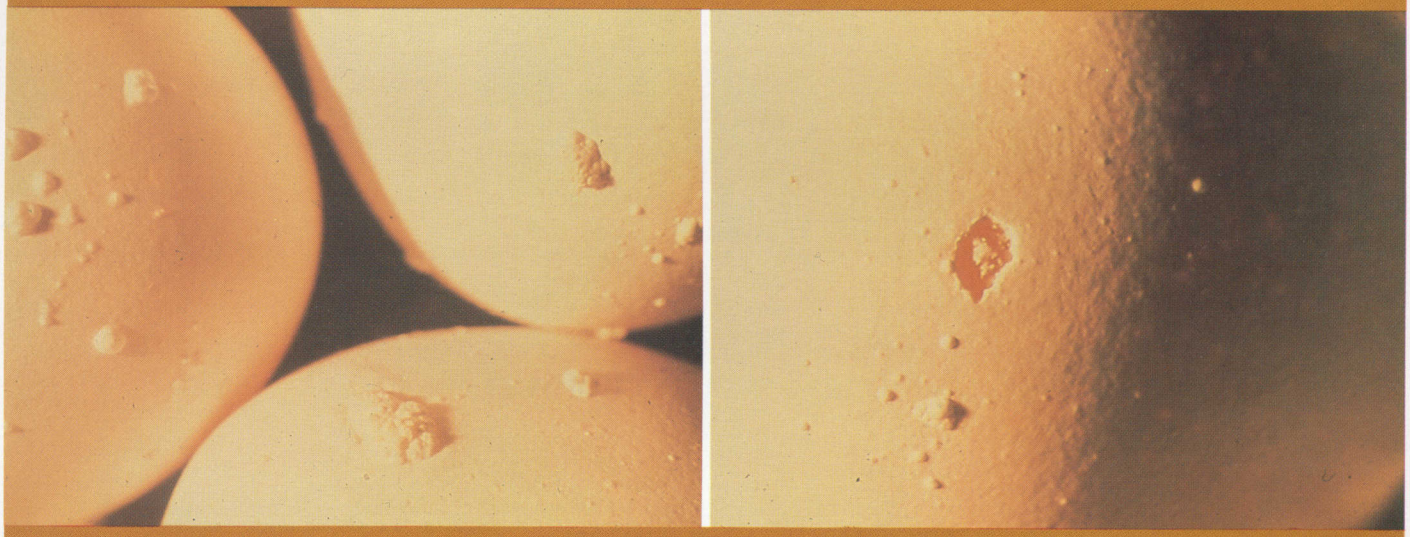
Now is also a time for farmers to look at their marketing strategies and plans and to exercise prudence in the use of borrowed capital to minimize interest costs. Better overall management, with particular emphasis on improved financial management, is the key to overcoming the problems farmers face today and in the immediate future.

PRODUCTION EXPENSES INCURRED BY ALABAMA FARMERS

Item	1979	1980	Change
	Mil. dol.	*Mil. dol.*	*Pct.*
Feed	454.8	456.2	.3
Livestock	101.0	103.4	2.4
Seed	67.7	77.9	15.1
Fertilizer and lime	104.9	120.7	15.1
Repairs and operations	198.4	234.8	18.3
Hired labor	86.8	97.9	12.8
Depreciation	280.9	302.1	7.5
Taxes (property)	13.0	13.6	4.6
Interest on mortgage debt	83.2	100.1	20.3
Net rent	25.4	20.9	-17.7
Miscellaneous	359.6	388.0	7.9
Total	1,775.7	1,915.6	7.9

Source: ERS, USDA

EGGSHELL PIMPLING



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LEFT: Eggs with both types of pimples. The larger pimples are more easily broken off.

RIGHT: The result of a pimple being broken off of the egg. If the shell membrane adheres to the shell a "leaker" results.

A ROUGH EGGSHELL texture condition known as "pimpling" is of major concern to commercial egg producers. These pimpled eggs, so named because of the calcareous deposits protruding through or adhering to the shell surface, have the potential to be leakers and can result in a large economic loss to the poultry industry.

There appears to be at least two types of pimples. The surface type consists of various sizes of deposits on the exterior surface of the shell. If these pimples are removed there is no damage to the integrity of the shell. The second type, however, is attached to the egg anywhere between the shell membrane and the exterior surface of the shell, and can be easily broken, creating possible leakers.

It is believed the pimpling condition is caused by foreign material in the oviduct which adheres to the shell during the calcification process. This phenomenon increases as the hen ages causing greater losses in older flocks. It has been suggested that the continuous use of the oviduct, with possible increased fragmentation and sloughing of cells, may explain the increase in pimples as the hen ages.

Recent reports in popular press have also suggested that rough or abnormal shell texture may be influenced by the diet, including excessive use of antibiotics, excess calcium, and excessive or deficient levels of phosphorus. There has been some indication that the addition of sodium bicarbonate to the diet had a beneficial effect on reducing eggshell pimpling but the results were inconclusive.

The objectives of these studies were to evaluate some of the more recent untested hypotheses that have been suggested to have been an influence on the severity of pimpling.

Eight experiments were conducted utilizing a total of 31,460 single comb White Leghorn hens of various ages. In Experiment 1 through 4, treatments consisted of calcium levels ranging from .09 to 5.5%, phosphorus .32 or 1.0%, sodium bicarbonate .25%, chlortetracycline .55 g/kg of diet, and vitamin-mineral premix added to the diet at 1.5 times the control level.

In Experiment 5, hens were fed diets containing 3.5, 3.75, or 4.5% calcium for the first 11 months of production.

In Experiment 6, hens were housed 1 or 3 per cage and received either a 15- or 18-hour photoperiod.

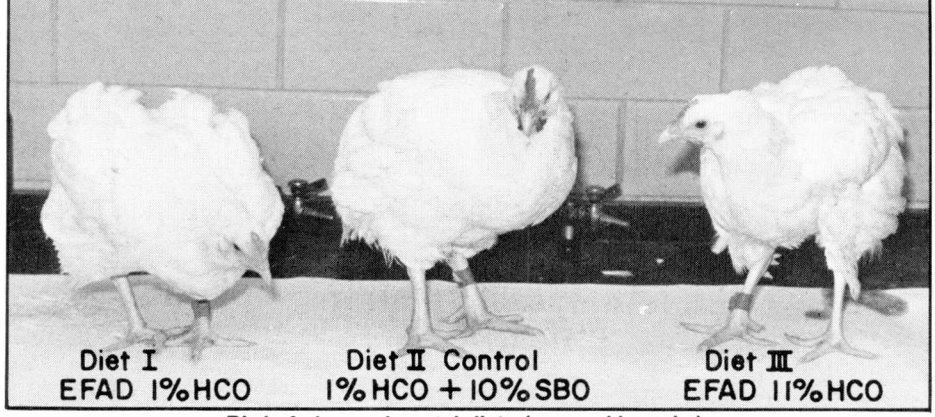
In Experiments 7 and 8 hens were force molted using a typical commercial type feed and water restriction program and kept for a second laying period.

The low calcium treatments, fed for 6 to 10 days, significantly lowered the average pimpling scores in two of three experiments, but the pimpling score increased to control levels immediately after the calcium levels were restored. It was hypothesized that by quickly reducing the hens' supply of calcium, the calcareous-like fragments in the oviduct would be reduced (mobilized) resulting in a decrease in pimpling. However, this did not prove to be successful for more than a 2- or 3-week period and would, therefore, have no practical application. Even though improvement was obtained by feeding low levels of calcium for short periods of time, various higher levels of calcium when fed for both short or long periods had no influence on pimpling. This suggests that higher levels of calcium are not involved in pimpling.

Treatments of 5.5% calcium, high or low phosphorus, chlortetracycline, sodium bicarbonate, or excess vitamin-mineral premix had no influence on pimpling. There was however a significant increase in pimpling with hen age with all three calcium levels (3.5, 3.75, or 4.5%).

Eggs with severe pimpling had significantly lower specific gravity (shell quality) when compared to eggs with less pimpling. Force molting significantly reduced the incidence of eggshell pimpling for at least 6 months; however, the incidence of pimpling appeared to gradually increase during the postmolt period similar to that which would be expected during a bird's first year of lay.

It was concluded that force molting can be successfully used to reduce the severity of eggshell pimpling; however, this management procedure may not be economically feasible in all cases.



Birds fed experimental diets (age = 11 weeks).

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The Chicken: Can it be used as a model for cystic fibrosis?

A RECENT STUDY conducted by researchers in the Alabama Agricultural Experiment Station has confirmed a 1963 study at Cornell University which reported that chickens fed a diet deficient in essential fatty acids developed respiratory disease. The Auburn study has extended the Cornell report in an attempt to use the chicken for investigating the relationship between dietary essential fatty acids and respiratory disease.

In recent years, this work has been cited by medical investigators in support of the theory that low amounts of essential fatty acids seen in patients with cystic fibrosis may be related to their susceptibility to lung infection.

Cystic fibrosis, a genetic disease, is the most common cause of life-threatening pulmonary disease in childhood and adolescence in the United States. Because of a decreased ability to absorb fat, children with cystic fibrosis have low blood levels of the essential fatty acids, linoleic acid and arachidonic acid.

Table 1. Major Fatty Acids in Serum Lipids of Chickens Fed Essential Fatty Acid Deficient and Control Diets for 11 Weeks*

Fatty acids	Treatment		
	Diet I	Diet II	Diet III
Palmitic acid	14.2±1.2	18.5±1.5	16.1±1.3
Palmitoleic acid	3.0±1.4	0.5±0.1	6.4±1.6
Stearic acid	12.1±1.6	16.2±2.6	14.1±0.5
Oleic acid	56.3±3.4	10.6±2.5	41.7±2.7
Linoleic acid	0.7±0.4	31.2±3.6	3.0±1.5
Eicosatrienoic acid	8.6±1.4	n.d.	7.7±0.7
Arachidonic acid	n.d.**	12.6±1.9	0.2±0.02

*Values are given as percent of total fatty acids ± S.D.
**n.d. = not detectable.

These fatty acids, which must be supplied in the diet, are the precursors of a group of compounds called prostaglandins. These compounds are necessary for the normal functioning of the body. Abnormal patterns of prostaglandins in blood of patients with cystic fibrosis have been observed.

The experiment was designed to investigate the relationship between essential fatty acids in the diet, prostaglandins, and respiratory disease. Sixty day-old chickens were divided into three groups and fed one of three diets. The fat in Diet I was 1% hydrogenated coconut oil (HCO), a fat which contains no essential fatty acids. Diet II was a control diet, containing 10% soybean oil (SBO), as a source of essential fatty acids, plus 1% HCO. Diet III contained 11% HCO, the same amount of total fat as in the control diet. At the end of 5 and 8 weeks of age, three birds from each of the three groups were killed. At 11 weeks of age, six birds in Group I, nine in Group II and five in Group III were killed. Mortality after the second week was 12% for Group II birds, compared to 42% and 40% in birds fed the essential fatty acid deficient diets (I and III).

Growth of chickens fed diets I and III was less than that of birds fed Diet II. This poor growth was due, in part, to decreased feed intakes. General appearance of birds in the deficient groups was poorer than in the control group (see photo), and sexual development was delayed as evidenced by comb growth and testes size. Serum fatty acids for groups I and III were consistent with that normally seen in essential fatty acid deficiency. As shown in table 1, the deficient chickens showed increases in palmitoleic acid, oleic acid, and eicosatrienoic acid but decreases in linoleic acid and arachidonic acid compared to Group II.

Table 2. Prostaglandins Produced by Lungs of Chickens Fed Essential Fatty Acid Deficient and Control Diets for 11 Weeks*

Prostaglandin	Treatment		
	Diet I	Diet II	Diet III
Prostaglandin $F_{2\alpha}$	7.1[b]±1.5	15.5[a]±1.2	5.2[b]±1.6
Thromboxane B_2	13.8[b]±4.7	38.1[a]±5.1	9.2[b]±5.1
6-keto-prostaglandin $F1\alpha$	8.3[b]±3.0	20.7[a]±1.9	5.9[b]±2.6
Prostaglandin E_1	6.5[b]±4.2	23.1[a]±3.1	9.5[b]±4.2

*Values are given as nanograms per gram of tissue ± S.E.M.
[a,b]Means in the same row with different superscripts are different ($P<0.05$) as tested by Duncan's Multiple Range Test.

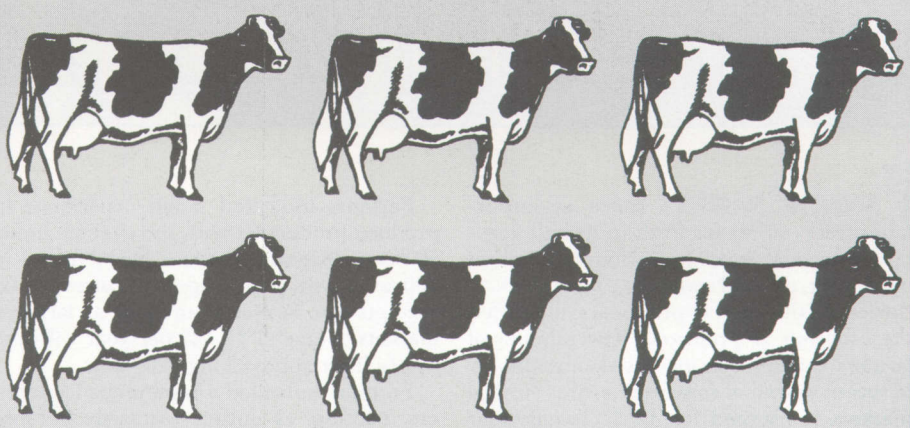
The production by the lung of four prostaglandins was measured. As shown in table 2, production by the lung was found to be significantly decreased in tissues obtained at 11 weeks in both essential fatty acid deficient groups (I and III) when compared to the control group (II). Similar results were obtained for the 5 and 8 weeks samples. Pathological examination of lung tissue at 11 weeks indicated that chronic respiratory disease was more prevalent and more severe in the deficient Group I chickens.

Results of this study indicate that chickens fed an essential fatty acid deficient diet have a higher mortality, lowered prostaglandin levels, and a greater incidence of lung disease than chickens fed a diet supplemented with essential fatty acids. These observations are consistent with the theory that abnormally low levels of essential fatty acids in cystic fibrosis patients may be related to their susceptibility to lung disease.

One discrepancy, however, still exists that needs to be resolved by future research. Prostaglandin $F_{2\alpha}$ has been found in increased levels in the blood of cystic fibrosis patients, whereas this prostaglandin in lung was decreased in the essential fatty acid deficient chickens. Differences may exist between prostaglandin production by the lung compared to the blood. Also, the marginal essential fatty acid deficiency in cystic fibrosis patients may have a different result than that caused by the clearly deficient state in the experimental birds.

[1]This research was funded in part by Cystic Fibrosis Foundation Grant No. G311C.

Bacterial Quality of Alabama Raw Milk



R.Y. CANNON, Department of Animal and Dairy Sciences

THE QUALITY and flavor of milk cannot be improved after it leaves the dairy farm. Milk quality deteriorates with age and may reach the point that consumers raise serious objections. Good quality raw milk is free of off flavors, has a low somatic cell and bacterial content, and is practically free of bacteria that grow at refrigeration temperatures.

Grade A standards for raw milk in Alabama require that the bacterial content does not exceed 100,000/ml on the farm and 300,000/ml after being commingled with milk from other producers in the tank truck during hauling or in the raw milk storage tank at the processing plant. Although these bacterial levels are the legal maximum limits, the bacterial quality of raw milk should be well below these limits.

A survey was conducted by the Alabama Agricultural Experiment Station during 1979 to 1981 to determine the bacterial quality of raw milk delivered to six Alabama dairy plants. Milk at each plant was sampled three times during this period. Milk samples were obtained from farm bulk tanks, from tank trucks at time of delivery to the plant, and from the milk plant storage tanks at the time of processing. The bacterial quality of the milk samples was determined by the standard plate count (SPC) and the preliminary incubation count (PI), a count made on the sample following incubation at 13°C (55°F) for 18 hours. PI counts are based on the premise that bacteria in milk originating in the udder will not grow at 13°C, while bacteria that gain entrance to the milk through contamination from the teat cups, pipelines, etc., will grow at 13°C. Thus the PI count will indicate the extent of contamination of the milk during handling. Milk of excellent quality will have bacterial SPC's below 10,000/ml and PI count below 20,000/ml.

The distribution of bacterial counts obtained on the raw milk samples from the producer farm tanks, tank trucks, and plant storage tank is shown in table 1. These results indicate that the raw milk going to processing plants can be improved in terms of bacterial quality. Only 48% of the milk at the farm was in the excellent range based on the SPC and 17% was rated excellent by the PI count.

As milk was transported from the farm to the processing plants, the bacterial quality of the milk deteriorated, with 50% of the tank truck and storage tank samples having SPC's over 100,000/ml and 80% and 90% of the samples having PI counts over 100,000/ml. This deterioration of bacterial quality during transport from the farm to the plant is also shown in table 2. Since producer samples were not available from all tank trucks received at the processing plants, the results in table 2 include only those tank trucks for which producer samples were available. The 10-fold increase in both SPC and PI counts from the farm tank to the tank truck is excessive and indicates poor sanitary practices during the pickup operation. Similarly, the increases in SPC and PI counts of the milk during transfer from the tank trucks and subsequent storage in the plant before processing indicate the need for improved sanitary practices.

Raw milk of good bacterial quality can be produced on the dairy farm if recommended procedures for cleaning and sanitizing cows and milking equipment are followed. Proper cleaning and sanitation of tank trucks and milk transfer equipment would maintain the quality during hauling of the milk to the plant. That, along with good cleaning and sanitation of the plant lines and storage tanks, would provide excellent quality raw milk for processing into pleasing milk products for the consumer.

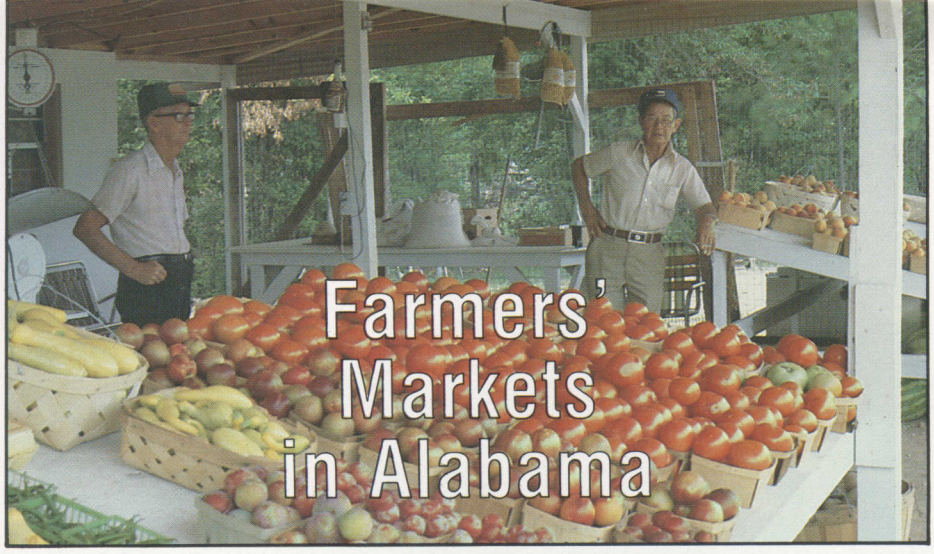
TABLE 1. DISTRIBUTION OF BACTERIAL COUNTS ON RAW MILK SAMPLES OBTAINED FROM INDIVIDUAL PRODUCERS, TANK TRUCKS, AND PLANT STORAGE TANKS

Count range	Producer		Tank trucks		Storage tanks	
	SPC	PI	SPC	PI	SPC	PI
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
≤ 10,000	47.7	17.3	7.7	0	0	0
10,000-100,000	36.0	37.6	42.3	19.2	50.0	6.3
100,000-1,000,000	12.7	28.9	30.8	19.2	37.5	12.5
> 1,000,000	3.6	16.2	19.2	61.6	12.5	81.2

TABLE 2. CHANGES IN BACTERIAL QUALITY OF RAW MILK DURING TRANSPORTATION AND HOLDING

Sample source	SPC	PI
	—Mean bacterial count/ml—	
Farm tank	14,000	91,000
Tank truck[1]	130,000	1,100,000
Tank truck	56,000	740,000
Raw storage tank	170,000	2,500,000

[1]Includes only those tank trucks for which producer tank samples were available.



Farmers' Markets in Alabama

JOHN L. ADRIAN, Department of Agricultural Economics and Rural Sociology

FARMERS' MARKETS serve as important direct outlets for fresh fruits and vegetables in Alabama. In various studies of marketing of local produce, two-thirds to three-fourths of the producers identified these outlets as preferred. The number of farmers' markets has increased substantially in recent years and construction of additional markets is planned for 1982. Twenty-four markets were in operation in 23 counties in 1981. These ranged from locations having adequate fixed facilities to mere open lots being allocated for use by local farmers.

A survey of farmers' markets was initiated by the Alabama Agricultural Experiment Station in the summer of 1981 to identify the nature of, problems with, and the potential for these outlets. Managers or overseers of the 24 markets plus 118 consumers and 113 farmer/sellers at markets were contacted.

Markets

Fifty-four percent of the managers of the 24 markets identified the lack of adequate facilities as the dominant factor limiting successful operation of their markets. Seventeen facilities had a covered shelter, 14 had electricity, 13 had restrooms, 12 had display tables and stands, and 8 had an office for the manager. Four each had cooling facilities, sink and cleaning facilities, and a shelter. Only two had grading and sizing equipment. Beyond the lack of facilities, managers mentioned lack of interest and use of markets by farmers, 24%, as being an important limitation.

Farmer/Sellers

Farmers averaged selling six different produce items at markets during the season. Dominant among these were field peas, corn, and tomatoes with 67%, 66% (38% sweet and 28% field), and 52% of the producers reporting sales, respectively. Other important produce items marketed were okra, 43%, watermelons, 42%, squash, 42%, butterbeans, 36%, greenbeans, 35%, cucumbers, 32%, and cantaloupes, 31%.

Farmers indicated much experience in produce production with the average being 20 years. Size of operations varied from 1 to 500 acres with an average of 26 acres. Gross receipts per farmer from sales at farmers' markets averaged $2,425 per year with the upper limit approaching $20,000.

Farmers indicated a preference for farmers' markets as outlets primarily because these outlets offered several positive aspects not exhibited by other market types, such as presence of more buyers, easy way to sell, convenience, and better prices. On balance, producers noted little future change in the extent of use of these outlets: 59%, 29%, and 16% of the producers planned to use farmers' markets the same, less, and more, respectively.

Producers traveled an average of 26 miles one way to access farmers' markets with some producers traveling great distances. When this is translated to an average of approximately 1 hour of travel time per day and is coupled with several hours spent at the market, marketing at these outlets can be seen as quite time consuming. Generally, the labor must have few alternatives for this to be economically feasible. Tuesday, Thursday, and Saturday were days most favored for marketing at these outlets. As would be expected, the day of greatest sales was Saturday.

The importance of effective pricing of produce sold at farmers' markets cannot be overstated. Prime factors to consider in pricing include the competition's prices as well as product availability relative to customer activity. Pricing should be used as a tool to ration the available quantity in the case of scarcity and to promote sales when product is abundant or the marketing day is closing. A majority of farmers contacted followed these practices in that 89% evaluated prices charged by other farmers at the market and 79% stated they used prices at retail grocery outlets to establish their prices. Also, 57% and 56% noted time of day and their production costs plus a return as factors influencing pricing.

Consumers

To be successful, farmer/sellers must recognize characteristics of consumers at farmers' markets and design their sales efforts to cater to the needs of these individuals. Consumers purchased an average of four different produce items at markets during the season. Items purchased by over 50% of the consumers contacted were: field peas, 74%, corn, 68%, and okra, 55%. Other commonly purchased items were: watermelons, 45%, tomatoes, 43%, butterbeans, 34%, and cantaloupes, 25%.

Shoppers at farmers markets can be generally classified as 81% white and 89% females, respectively, from average size households, 3.5 members. They are typically over 25 years of age, with the distribution being 28% for 25-39 years, 37% for 40-55 years, and 32% for greater than 55 years. Use of these outlets was fairly consistent for individuals with less than $8,000, 29%, and from $8,000-15,000, 25%, income. However, the largest number of customers was included in the $15,001 to $25,00 income grouping, 36%. Consumers at farmers' markets lived near the outlet, with the average one-way distance being 3.3 miles. From the standpoint of competition, consumers indicated they resided an average of 1.5 miles from grocery stores. Also, a third of the consumers grew some produce.

Price and freshness were by far the most important factors influencing consumers' decisions to purchase produce at farmers markets. Tuesday, Thursday, and Saturday were days consumers usually shopped. Seventy-seven percent usually shopped in the morning with the most preferred hours being 8-9, 29%, 9-10, 15%, and 10-11, 15%. Thirty-one percent of the consumers indicated they shopped at the market twice a week during the market season while a fourth visited once a week.

Farmers' markets will continue to serve as prime outlets for locally grown produce. In fact, indications are that increases in usage will occur. Reasons for this relate to the advantages exhibited by these outlets: limited liability for customers by farmers since they are not on the farm premises, attracting customers is a function of the market, facilities (parking, restrooms, etc) are not the responsibility of the farmers, and a diverse supply of produce is available; thus, the variety of produce offered by an individual farmer is not as crucial to the market. Shortcomings of these outlets related to policies of the market (advertising, hours, rental space, etc.), location of the market, and time requirements for transporting and selling produce.

Control of Rhizoctonia Web Blight in Low-Tannin Sericea Seed Production

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E.D. DONNELLY, Department of Agronomy and Soils

WEB BLIGHT, a foliar disease of low-tannin sericea (caused by *Rhizoctonia* sp.), can greatly reduce seed yields. However, *the disease is not important in older, normal high-tannin sericea.* Although the new low-tannin variety, AU Lotan, has shown a good level of field resistance to the disease, it is possible that under conditions favorable for disease development, seed yields would be reduced. Hot, wet weather during August, September, and October favors a buildup of the disease (see Breeding Low-tannin Sericea for Resistance to Foliar Disease, Highlights of Agr. Res., Vol. 28, No. 4, Winter 1981).

This report of web blight control on low-tannin sericea is not a recommendation, since it is based on 1 year's results from an experiment performed in 1977. Due to dry weather since then, there has been very little foliar disease on low-tannin sericea making verification impossible. However, the effects of fungicide treatment on seed production in 1977 were so striking that these data are being released now.

To determine the effectiveness of certain fungicides in the control of *Rhizoctonia* aerial web blight, 36 plots were established in March, 1977, with a disease-susceptible sericea line. Plots were four rows spaced 40 in. apart and 20 ft. long. Four fungicides were tested at two rates each, see table. These eight fungicide treatments, plus a control plot that received no fungicides, were randomized and replicated four times. Fungicides were applied with a high-clearance sprayer on August 11 at the first appearance of the disease. Nothing further was done for disease control. On October 11 the plots were rated for disease development. Shortly thereafter, the two middle rows from each plot were harvested for seed yield using a small plot combine.

Low-tannin sericea with defoliated control on right and leafy Difolatan-treated plot on left.

FUNGICIDES AND RATES USED IN CONTROL OF *RHIZOCTONIA* AERIAL WEB BLIGHT ON SERICEA WITH DISEASE RATINGS AND SEED YIELD OF PLOTS

Fungicide	Rate ai/acre	Disease rating* on 10/11	Seed yield	
			Weight	Increase over control
			g	*Pct.*
Difolatan 4F®	64 oz.	1.5	222	236
Difolatan 4F®	32 oz.	2.3	183	177
Benlate® 50% WP	4 oz.	3.3	138	109
Benlate® 50% WP	8 oz.	3.8	130	97
Terrachlor® 75% WP	10 lb.	3.5	93	41
Terrachlor® 75% WP	5 lb.	3.5	76	15
Vitavax® 3F	8 oz.	4.0	81	23
Vitavax® 3F	16 oz.	4.0	66	0
Control	--	4.5	66	0

*1 = no symptoms, 5 = severe.

Weather conditions in 1977 were very favorable for the development of *Rhizoctonia* aerial web blight on sericea. It first showed up early in August as a fine mycelial web on the lower leaves. Under humid conditions the webbing progressed to the top of the plants and eventually caused almost complete defoliation, see figure. Accompanying the defoliation was flower drop and loss of seed. The fungicide-treated plots showed varying degrees of disease control from almost none with Vitavax to excellent with Difolatan, see table. The two rates of Difolatan gave control superior to that of the other fungicides with the 64 oz. rate giving the best.

Seed yield showed a similar pattern, see table. Although most of the fungicides showed some disease control, only the two rates of Difolatan produced seed yields which were significantly higher than that of the control. There was more than a threefold increase in seed yield for the 64 oz. Difolatan treatment over that of the control.

These results indicate that Difolatan 4F® is very active against the fungus *Rhizoctonia*. It is persistent and possibly is redistributed by rainfall to new growth on the plant. These are properties which can enable one application in August to remain effective until harvest time. During extended periods of high humidity when a web blight epidemic threatens, an application of Difolatan 4F® can make a tremendous difference in the seed yield of low-tannin sericea.

Effect of Diet on Lipid and Cholesterol of Liver and Cholesterol of Blood Serum

RALPH STRENGTH, Department of Animal and Dairy Sciences

FOODS OF ANIMAL ORIGIN provide proteins of highest nutritional value and digestibility; they also serve as exceptionally good sources of certain vitamins and trace minerals required by man and animals. Although experiments indicate a potential health hazard to man or animals consuming excessive quantities of fat and cholesterol, there is no clear indication that moderate consumption of animal fat or cholesterol represents any risk to the health of the general human population. Moderate intake of a wide variety of foods including meat, milk, or eggs, assures the balanced diet required by man and animals.

Many studies of the atherogenic process in experimental animals used diets designed to create a metabolic crisis quickly; usually, the experimental diet included an excessive quantity of fat and simple sugars as well as an excessively high level of cholesterol. Other diets had restricted amounts of choline, methionine, vitamin B_{12}, and folic acid, nutrients that aid in metabolism of fat.

This report summarizes a series of nutritional experiments to illustrate the individual and combined effects of nutritional deficiency and imbalance of nutrients on fat and cholesterol in tissues of rats.

The results of figure 1 were obtained using a basal diet of 20% protein (10% soybean protein-10% casein) with all of the recommended accessory nutrients except those indicated. This diet is low in methionine and growth in weanling (45g) rats was increased by addition of this amino acid. The diet contained 20% lard, 46% starch, and 12% sucrose. Various combinations of choline (C), methionine (M), vitamin B_{12} (B_{12}), and folic acid (F) were fed as indicated at levels recommended for rats.

The bar graph illustrates body weight gain in 12 days, liver weights and total liver lipid contents at the end of the experiment. The results clearly indicate the role of choline in maintaining normal liver lipid and the effect of methionine on growth. Vitamin B_{12} and folic acid aid in utilizing methionine, reduce liver fat in the absence of choline, and utilize choline to stimulate growth slightly.

The results presented in figure 2 show the effects of various carbohydrates fed to 27-day-old rats (65g) on growth and liver lipids. The various sugars comprised 46% of the diet.

The results in the table compare 1.5% of corn oil, 20% corn oil, 20% hydrogenated corn oil, and 20% of lard with and without added cholesterol; measurements of liver lipid, liver cholesterol, and blood serum cholesterol were made at the termination of a 52-day trial. The 24-day-old rats were fed diets containing 46% starch plus choline, methionine, vitamin B_{12}, and folic acid.

Analysis of the results presented in the table showed that corn oil alone of the three fats at the 20% level increased deposition of fat in tissues of rats. Corn oil at 20% significantly increased both liver lipid and liver cholesterol as compared to the two other fats. Corn oil fed with 0.5% of cholesterol gave the highest values for both total liver lipid and liver cholesterol; this combination also produced the highest serum cholesterol level.

Results of this experiment and others indicate that 1.5% of corn oil, either with or without cholesterol, gave the lowest values for fat and cholesterol in tissues; this level supplies an adequate quantity of essential fatty acids. Commercial hydrogenated corn oil did not promote deposition of cholesterol in tissues in this study.

Conclusions drawn from this study are that corn oil fed at the 20% level increased tissue fat levels in rats in long-term studies; cholesterol at a moderately high (0.5%) dietary level was deposited in tissues if fed with 20% of fat; corn oil (polyunsaturated fat), fed either alone or with cholesterol, deposited the highest levels of fat and cholesterol in rat tissues.

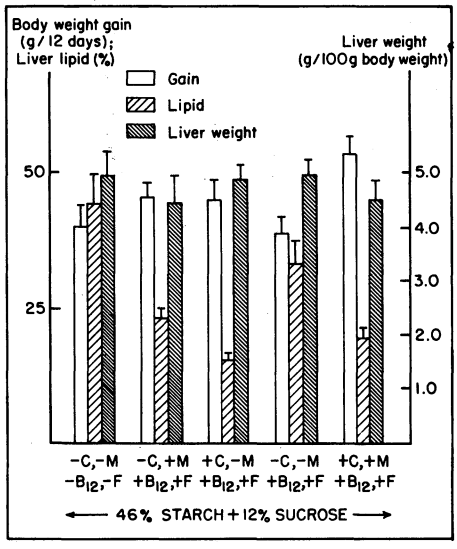


FIG. 1. Body weight gain, liver lipid contents, and liver weight as affected by choline, methionine, folic acid, and vitamin B_{12} in the diet.

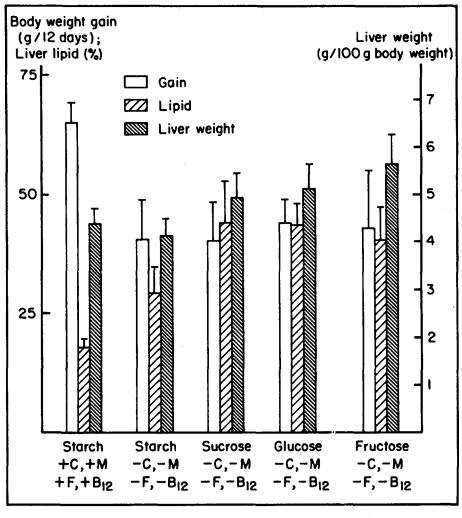


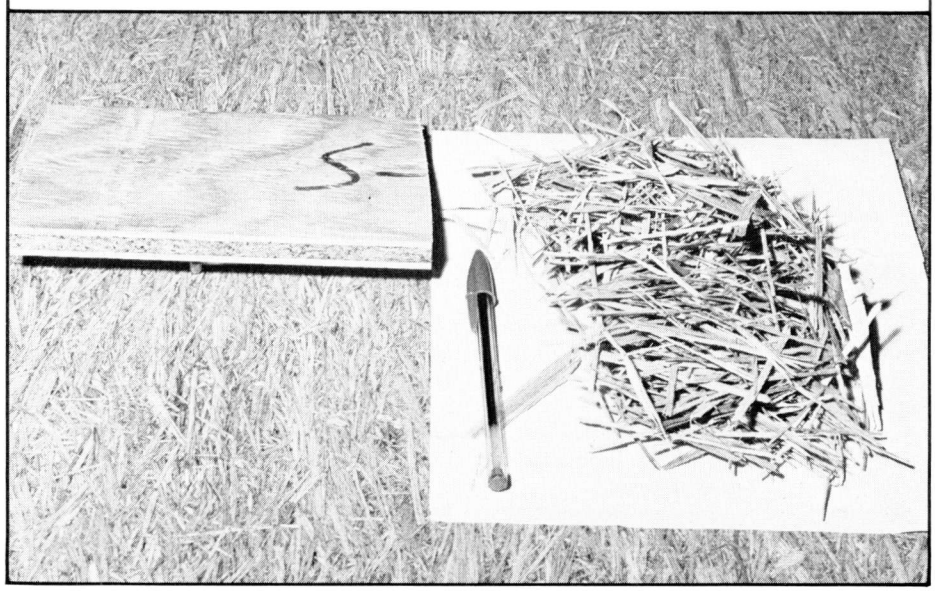
FIG. 2. The effect of type carbohydrate on weight gain, liver lipid contents, and liver size.

EFFECT OF DIET ON LIPID AND CHOLESTEROL OF LIVER AND CHOLESTEROL OF BLOOD SERUM

Diets	Body weight gain 52 days	Liver lipid	Liver cholesterol	Serum cholesterol
	g	*Pct.*	*mg/g*	*mg/dl*
1.5% corn oil	272.6±33.6	18.1±2.9	4.33±0.8	70.3±4.7
1.5% corn oil +0.5% cholesterol	263.4±20.0	19.8±1.2	4.43±0.3	73.4±5.1
20% lard	314.6±12.4	18.5±1.2	4.70±0.3	70.4±3.8
20% lard +0.5 cholesterol	295.4±30.3	25.1±3.3	7.06±0.8	94.2±5.3
20% corn oil	318 ±30.8	24.8±2.5	6.50±0.3	83.7±6.4
20% corn oil +0.5% cholesterol	292.2±18.7	26.9±3.2	8.78±2.2	102.3±6.1
20% hyd. corn oil	288.0±28.3	17.6±0.7	3.69±0.2	75.6±9.2
20% hyd. corn oil +0.5% cholesterol	291.2±11.8	23.92±1.2	6.63±1.8	82.9±4.8

Properties of Composite Plywood with Southern Pine Veneer Faces and Oriented Southern Oak Strand Core

E.J. BIBLIS, Department of Forestry



STRUCTURAL COMPOSITE PLYWOOD has been developed, manufactured, and marketed successfully in the Northwest since 1976. The main justification for development and production of this new panel was to utilize, as core, a considerable volume of low quality grand fir logs (dead and partially decayed) not suitable for other uses.

In the South, where approximately 40% of the Nation's softwood plywood is manufactured from southern yellow pine, an abundance of hardwood species exists, particularly oaks of low quality for which presently there is not much demand.

When the current economic conditions improve and house construction reaches levels to satisfy needs, it is expected that demand for structural plywood will surpass old production levels by 3 to 4 billion sq. ft. (3/8 in. basis) per year. Part of this additional plywood can be manufactured as composite plywood with southern oak oriented board as core and southern pine veneer faces. This would effectively reduce the amount of pine veneer required in a panel by one half, and thus keep the demand price for southern yellow pine relatively stable despite an increased demand for plywood.

Highlighted here are the experimental results of a study concerning possibilities for commercial production and evaluation of certain mechanical properties and dimensional changes of 1/2 in. composite plywood, fabricated from 1/8 in. thick southern pine veneer faces and 1/4 in. unidirectionally oriented strand cores made from a mixture of southern oaks bonded with phenolic resins, see figure.

Procedure

Core panels 1/4 in. thick were manufactured in a pilot plant at Lewiston, Idaho, using strand-type wood particles unidirectionally oriented along the 4-ft. width. One group of panels was made from a mixture of oaks grown in Alabama (60% red oaks and 40% white oaks). The other group of panels was made from 30% southern pine and 70% of the oak mixture. A liquid phenolformaldehyde resin was used at a rate of 6.5% solids for bonding the particles. Core panels, 53 in. width and 102 in. length, were cured in a hot press at 410°F for 5 1/2 min. with an average density of 48 lb. per cubic foot.

FLEXURAL PROPERTIES, PARALLEL TO VENEER GRAIN, OF 1/2 IN. COMPOSITE PLYWOOD WITH OAK STRAND CORE AND 1/2 IN., 4-PLY COMMERCIAL CDX SOUTHERN PINE PLYWOOD

Condition at test	Modulus of elasticity 1000 p.s.i.	Modulus of rupture p.s.i.
Original at 65 RH, 72°F	1,780[1] (1,295)[2]	9,230 (6,550)
Soaked for 48 hours	1,160 (910)	4,470 (4,480)
Cycled[3]	1,490 (1,280)	7,360 (6,790)

[1]Each value is the mean of 12 specimens.
[2]Number in parenthesis represent CDX plywood.
[3]Specimens were soaked then conditioned 65% RH, 72°F.

Fabrication of Composites

Three-ply, 1/2 in. thick experimental composite plywood panels, 4 x 8 ft., were fabricated in a southern pine plywood mill using 1/8 in. thick southern pine veneer faces and 1/4 in. thick perpendicularly oriented strand cores. The same resin and process used currently in the production of southern yellow pine CDX plywood was used to fabricate the experimental composite panels.

Testing

Specimens from core panels were tested according to ASTM Standards in flexure parallel and perpendicular to particle orientation for internal bond strength and for dimensional changes with moisture.

Specimens from composite panels were tested in the following three conditions: (a) original at 65% RH and 72°F, (b) soaked for 48 hours, and (c) cycled, first soaked, then conditioned to original. Testing was made according to ASTM standards in the following properties: Flexure parallel and perpendicular to veneer grain, edgewise shear strength, plate shear modulus, interlaminar shear strength, internal bond strength, and measurement of dimensional changes with change in moisture.

Results and Conclusions

Experimental results indicate that the physical and mechanical properties of the investigated composite panels are equal, and in certain cases, superior to 1/2 in. southern pine CDX plywood and to commercial composite plywood (Douglas fir veneer faces and grand fir core) reported in the technical literature.

Flexural properties of one group of composite plywood panels are shown in the table together with properties of commercial CDX southern pine plywood.

After comparing all the experimental results of the composite panels with similar properties of commercial CDX southern pine plywood, the following can be concluded: composite panels similar to those tested can perform all structural functions required by sheathing panels for walls, roofs, and subfloors over 16 in. spans. The swelling tests also indicate that the dimensional stability of the composite panels tested is comparable to that of 1/2 in. southern pine commercial CDX plywood and, therefore, the composite panels are expected to perform satisfactorily in service.

Production of composite plywood with southern pine veneer faces and unidirectionally oriented oak strand cores could provide a means to more efficiently utilize the low quality hardwood resources in the South.

Several Perennial Ryegrasses Look Good for Putting Greens

RAY DICKENS, RICHARD WHITE, DAVID TURNER,
and KYLE MILLER, Department of Agronomy and Soils

Appearance differences were only minor between varieties of perennial ryegrass varieties, as shown by this test green.

SPRING HAS LONG BEEN a time of dread more than anticipation for golf course superintendents in the South. The transition from annual ryegrass or roughstalk bluegrass to bermudagrass was the cause for much apprehension. In many cases these cool season grasses would die out rapidly, leaving putting greens bare until the bermudagrass could be coaxed out of dormancy.

The need was for a cool season grass that would establish rapidly in the fall like annual ryegrass, have adequate disease resistance, and die out gradually the following spring. The gradual decline is needed to allow time for bermudagrass to develop a dense turf while the cool season grass still provides a green appearance.

Perennial ryegrass was found to fulfill the requirements admirably, and numerous varieties became available that have proved their worth in Alabama Agricultural Experiment Station tests. New varieties are released each year, and these are evaluated at Auburn when they become available.

Testing of new varieties has been done in small plot experiments on a mature Tifgreen bermudagrass turf maintained as a golf putting green. In October each year, the turf was vertically mowed in two directions and the clippings removed. Seed were then uniformly distributed over the 4- by 8-ft. plots using a drop seeder. Seeding rate was 40 lb. per 1,000 sq. ft.

After seeding, the entire experiment was topdressed with a ¼-in. layer of washed mortar sand. The area was kept moist for 14 days to ensure good germination of the ryegrass. Mowing was begun when the ryegrasses were approximately 1 in. high, and the plots were mowed two to four times per week at ¼-in. mowing height throughout the season. The area was fertilized with 1½ lb. of nitrogen per 1,000 sq. ft. per month utilizing activated sewage sludge as the nitrogen source.

Ratings of appearance and general performance of the perennial ryegrass varieties were made every 14 days throughout the growing season. Color and texture ratings also were made.

As shown by ratings in the table, there were no great differences in appearance among the varieties tested. Major differences observed were in color. Caravelle and Regal are darker green than most other selections. Loretta, Score, Showboat, and Sprinter have a light green color. No large texture differences were noted under conditions of this trial.

All varieties were damaged by freezing weather, such as occurs in January and February. Since golf play also is limited by cold, the problem is not as serious as it might seem. By March or April all varieties were performing well.

Based on results of the Auburn trials and comparisons made on a local golf course, it can be said that management is more important than variety in determining quality and appearance of perennial ryegrass putting greens. Thus, the relative price of seed may be the most logical basis on which to choose a variety.

GENERAL APPEARANCE OF PERENNIAL RYEGRASSES OVERSEEDED ON DORMANT BERMUDAGRASS PUTTING GREENS

Variety	Appearance rating[1]											
	1978-79				1979-80				1980-81			
	Jan.	Feb.	Mar.	Apr.	Jan.	Feb.	Mar.	Apr.	Jan.	Feb.	Mar.	Apr.
Acclaim	3.0	3.8	3.8	5.0	3.0	2.7	5.0	5.3	--	--	--	--
Barry	--	--	--	--	3.3	2.7	5.0	5.0	5.0	7.3	8.3	6.7
Caravelle	3.0	3.5	3.2	4.7	3.0	2.7	3.3	5.0	7.0	6.3	8.0	7.7
Delray	--	--	--	--	3.7	3.3	5.7	5.7	5.7	8.0	9.3	7.0
Derby	3.0	4.0	4.3	5.5	--	--	--	--	5.0	6.7	7.3	6.7
Goalie	2.0	3.2	4.0	5.3	3.0	2.7	4.7	4.7	--	--	--	--
Loretta	2.8	4.3	3.5	4.8	3.7	3.0	5.7	5.0	5.3	7.7	7.3	6.7
Regal	2.7	3.5	3.8	5.0	3.0	2.3	5.0	5.0	--	--	--	--
Score	3.0	4.2	3.7	5.7	3.3	3.0	4.7	4.7	5.3	8.0	8.7	7.0
Showboat	2.7	4.3	3.2	4.5	2.7	2.0	4.3	4.3	5.3	7.0	7.7	7.0
Sprinter	2.5	3.7	3.7	4.7	--	--	--	--	5.7	7.7	8.0	7.0

[1]Rating scale of 0 to 10, with 5.0 equal to acceptable and 10.0 excellent.

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