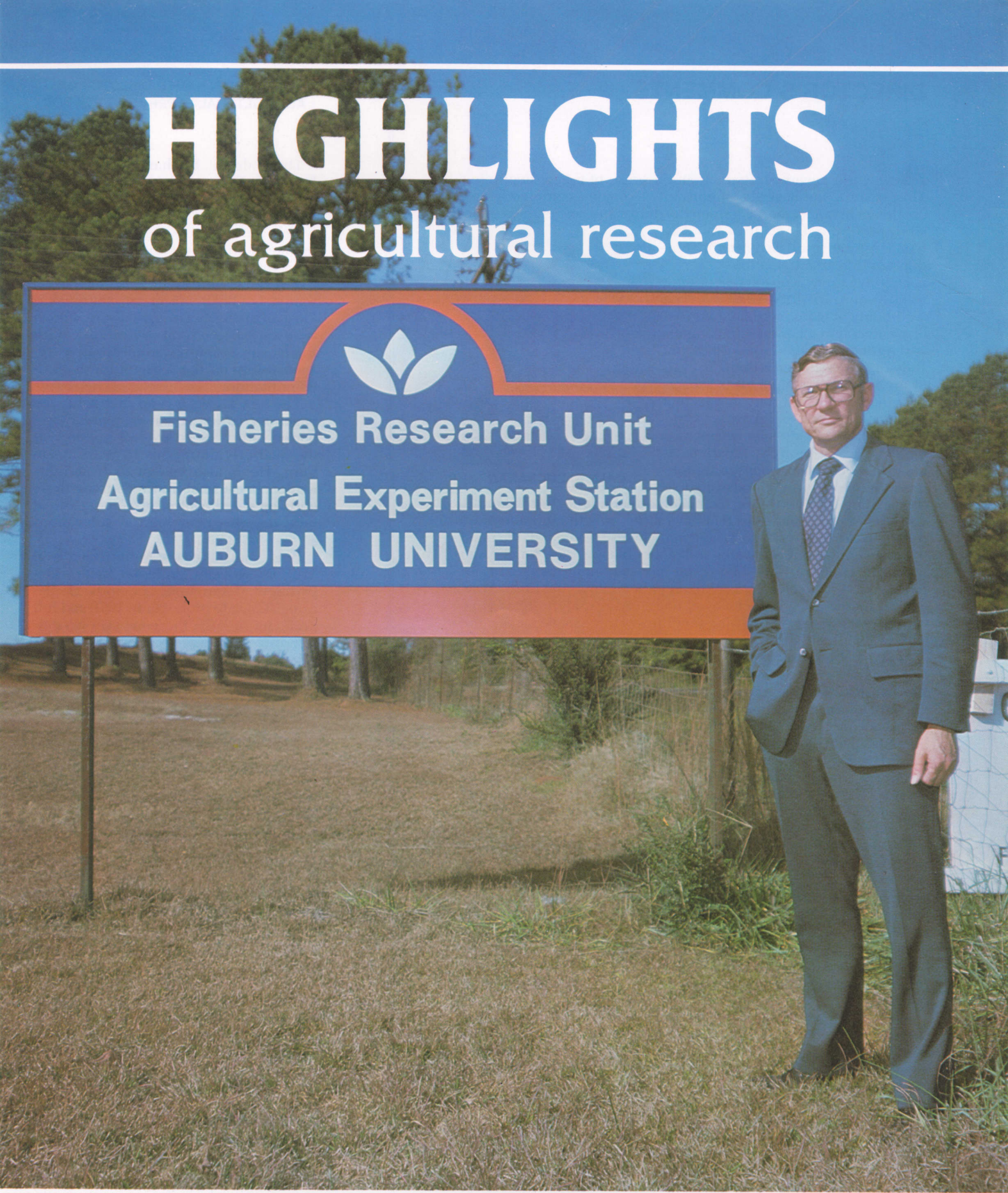
HIGHLIGHTS
of agricultural research



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AGRICULTURAL EXPERIMENT STATION
GALE A. BUCHANAN, DIRECTOR

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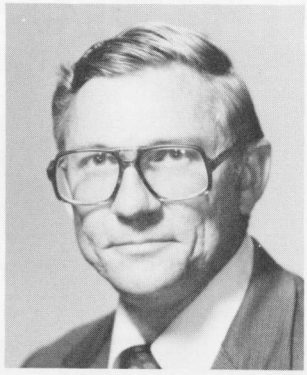
DIRECTOR'S COMMENTS

A NEW JOB means excitement and a sense of a new beginning. Most of us do not have the opportunity to enjoy a completely new challenge in mid career. I assume the duties and accept the responsibility as your Director of the Alabama Agricultural Experiment Station with great anticipation.



GALE A. BUCHANAN

I believe there is no job that offers a greater opportunity to serve the well-being of mankind than does that of a scientist in a Land-Grant University Agricultural Experiment Station. Indeed, the challenge is there for each of us. This challenge, and its accompanying responsibilities, is one that we should accept willingly.

Just what does such an acceptance mean? A fair enough question. It means recognizing agricultural problems and devising methods to solve them. Many problems are technology dependent. For example, varieties of crops and trees that have faster growth rates and more resistance to diseases, insects, and nematodes are needed. We need to know more about soil water and more efficient ways for crops to utilize it. How can breeding make more efficient gainers of our livestock? How can we increase the numbers of pigs per litter? How can we increase feed efficiency of hogs, cattle, and broilers? How can we get faster growth of pine seedlings? How can we make more corn or cotton on an acre?

Many problems of agriculture cannot be solved by technology. For example, as we strive for greater efficiency through mechanization, we are challenged by those with little concern or understanding of modern agricultural production technology. They recognize increased productivity, but show little concern for such added benefits of mechanization as relief from human drudgery. The mushrooming movement for "human rights" for animals promises to offer a severe challenge to traditional animal production. In Western Europe, at least one country has already banned the use of cages for laying hens, resulting in decreased productivity and increased cost of eggs.

The real, as well as the imagined, problems of pesticide use have been well documented. We are yet to reach a point in our pest control strategies, however, where pesticide use is not crucial for economic production.

These are but a few of the problems and challenges facing agriculture. To deal with them effectively, we will need a major effort from each scientist. Not only must we solve the technological problems, but we must dispel the unwarranted fears that modern agricultural technology creates in the minds of the non-agricultural public.

Agricultural commodities constitute the single most important positive factor in our international balance of payments with the world community. We produce enough food, feed, and fiber to meet our domestic demands and still export over $40 billion worth of agricultural products each year.

I am well aware of budget constraints that we presently face and have faced during the past few years. It has been difficult and will continue to be a problem for at least this coming year. These shortages in operating and support funds translate to older equipment, less technical support, and fewer research supplies which requires even greater diligence for satisfactory research accomplishments. However, I am confident that we shall receive a higher level of support in the not too distant future. We must all work together as we face the challenge of providing the research support of Alabama's most important and mankind's only essential industry—agriculture.

BUCHANAN NAMED DIRECTOR OF AGRICULTURAL EXPERIMENT STATION

Dr. Gale A. Buchanan is the new Dean for Research and Director of the Agricultural Experiment Station at Auburn University. His appointment, which was effective October 1, reflects the new agricultural organization at Auburn that separates the top administrative responsibilities for teaching and research. Dr. R. Dennis Rouse continues as Dean of the School of Agriculture, Forestry, and Biological Sciences, with Buchanan assuming administrative responsibility for the Agricultural Experiment Station.

The new Director is no stranger to the pages of *Highlights*, having regularly reported on his weed control research in the quarterly during his 15 years at Auburn. He is also known to *Highlights* readers because of his down-to-earth reports on weed control research given at field day programs held at substations across the State.

Buchanan joined the Auburn faculty in 1965 as assistant professor in the Department of Agronomy and Soils. He became associate professor in 1970 and full professor in 1976, the same year his outstanding work was recognized with the title of "Alumni Professor."

HIGHLIGHTS of Agricultural Research

WINTER 1980 VOL. 27, No. 4

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

ON THE COVER. Director Gale A. Buchanan poses with one of the new signs that identify units of the Agricultural Experiment Station across Alabama.

Combination Feeding of Extruded and Pelleted Diets for Catfish

TOM LOVELL
Department of Fisheries and Allied Aquacultures

MOST POND-RAISED CATFISH in the United States are fed extruded (floating) diets because fish farmers benefit from being able to see how much and how vigorously the fish eat. However, extruded diets are approximately 20% more expensive than pelleted (nonfloating) diets. Extrusion processing requires more expensive equipment than pelleting, more steam is used, the mixture is heated to a higher temperature, and heat is required in drying extruded diets. Pelleting requires less steam, less heating, and heat is not necessary for drying.

In addition to floatability, other advantages of extruded over pelleted diets are increased water stability and increased digestibility of starch in the diet, caused by the additional heating. However, research has shown that catfish growth rate is about the same when equal amounts of a diet are consumed in extruded and pelleted forms, provided the two preparations are adequate in essential nutrients and digestible energy.

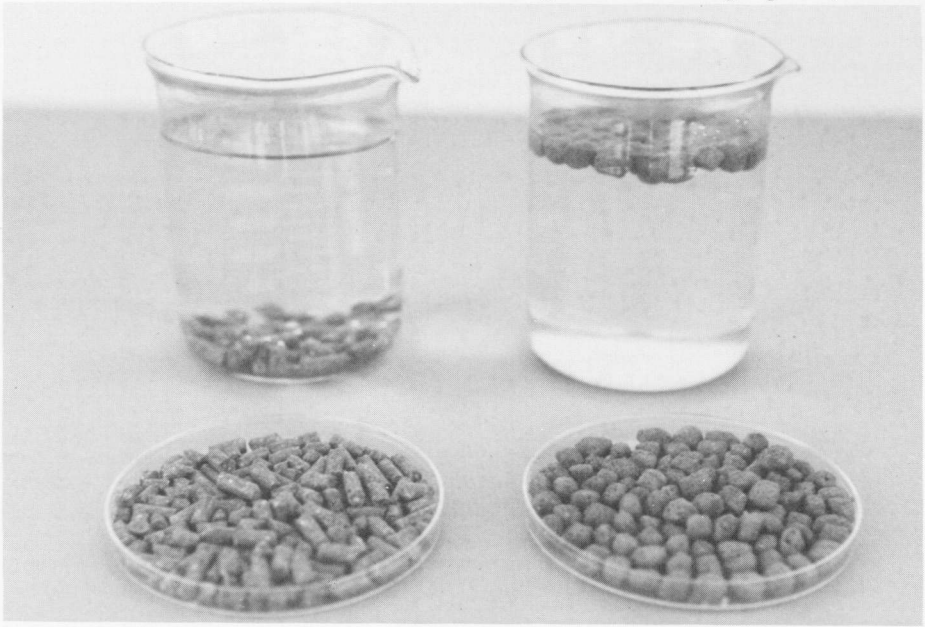
With the cost difference between extruded and pelleted diets increasing with rising energy costs, fish culturists must reevaluate the management versus cost benefits of these two types of diets. This served as the basis for a hyphothesis that feeding a combination of extruded and sinking diets in the same ration may result in lower feed cost and still allow the management benefits of using a floating diet.

A pond feeding study was conducted at the Fishery Research Unit, Auburn University Agricultural Experiment Station, to compare the feeding of catfish with various combinations of extruded and pelleted diets to the feeding of catfish with either extruded or pelleted diets alone. A catfish diet formula was processed into extruded and pelleted particles and fed to channel catfish, from fingerling to harvest size, by four feeding regimes: 100% extruded diet; 45% extruded and 55% pelleted; 15% extruded and 85% pelleted; and 100% pelleted. The fish fed 100% extruded diet were fed to satiation and food allowance for the other groups was based on the amount this group consumed. The fish were fed once daily, 7 days per week.

There was no significant difference in fish growth or feed conversion rate among the four feeding regimes, thus indicating that the combination of 15% extruded diet and 85% pelleted diet was as productive as feeding an all-extruded diet. The fish fed the combination of diets tended to consume the sinking diet first, then the floating diet. It was assumed that if all of the floating feed was consumed, all of the sinking feed was also consumed. This assumption is justified since weight gain and food conversion were nearly the same for the fish fed the combinations of diets as for those fish fed only the extruded diet.

The fish fed the combination diets were observed to consume their food allowance quicker than those fed only the extruded diet. The fish fed 15% extruded diet and 85% pellets consumed the same weight of food in 1 to 3 minutes as those fish fed the all-extruded diet consumed in 15 to 30 minutes. This may mean that catfish can consume more food when part or all of their ration is in pelleted (less bulky) form. It certainly indicates that catfish can consume a satisfactory food allowance in a shorter time and probably with less waste when most of the ration is in pellet form.

Feeding the 15:85 combination of extruded and pelleted diets resulted in a 17% reduction in feed costs, assuming the pelleted diet would cost 20% less than the extruded diet. A major problem in the practical feeding of such a diet combination will be the inconvenience of handling two types of feed by the manufacturer and farmer. However, if this feeding technique proves as successful in large ponds, where it will be further evaluated, as in the 1/10-acre experimental ponds, the technology for handling the diet combination should most certainly become available in short order.



Extruded (floating) catfish diets (right) are made by cooking, expanding, and drying the ingredient mixture which requires more energy than the compression process for making pelleted diets (left).

SICKLEPOD AND COFFEE SENNA
related weeds that present different problems

D. H. TEEM[1], C. S. HOVELAND, and G. A. BUCHANAN, Department of Agronomy and Soils

ALTHOUGH SICKLEPOD AND COFFEE SENNA are related weeds (different species within the same genus), they have marked differences in pest potential. These non-nodulating legumes are found in the United States and throughout tropical America, Asia, and Africa.

In the United States, sicklepod is generally observed as a serious pest, while coffee senna is an occasional pest. Studies were conducted at the Auburn University Agricultural Experiment Station to determine why the pest potential of these similar weeds is so different.

In a survey of extension weed specialists in each of the 50 states, it was found that sicklepod is a problem in 11 Southern States and increasing in 12 states. Coffee senna was cited as a problem in seven states and increasing in eight. Sicklepod was found to be far more troublesome throughout the South, but both species are increasing problems in Alabama.

In the Auburn study, seed of both sicklepod and coffee senna germinated over a wide range of temperatures, figure 1. Optimum germination occurred in the range of 75 to 97°F. At 102°F, coffee senna germination was lower than that of sicklepod. The poor seed germination of coffee senna was associated with growth of the fungus, *Rhizopus*. Rapid growth of the fungus following seed treatment with sulfuric acid suggests that the fungus was internal.

Both sicklepod and coffee senna have a hard seedcoat, so some type of seed scarification is necessary for germination.

Seedlings of both weeds emerged from a soil depth of 5 in., but neither species emerged when seed were 6 in. deep, figure 2. Three days after planting, more sicklepod than coffee senna seedlings had emerged from depths of 1, 2, or 3 in. After 3 days at the 1-in. depth, only 22% of the coffee senna seedlings had emerged, as compared with 63% of the sicklepod seedlings. After 9 days, both species had emerged from 5 in.; however, more coffee senna than sicklepod emerged from this depth.

The ability to emerge from deep in the soil offers both of these weed species an excellent chance to escape most soil-applied herbicides. In addition, the rapid emergence of such a high percentage of sicklepod seedlings would give this species a competitive advantage over most crops.

As indicated by the Auburn test results, sicklepod and coffee senna (1) have the ability to germinate over a wide range of temperatures, (2) can emerge from deep in the soil, (3) are tolerant to many herbicides, and (4) can grow over a wide range of soil pH. It is not surprising that these species are reported to be increasing as problem weeds.

Differences occur between the two species, and these generally favor sicklepod. Coffee senna is susceptible to anthracnose disease, whereas sicklepod is tolerant. This suggests that sicklepod will continue to be a more serious weed problem than coffee senna in the near future.

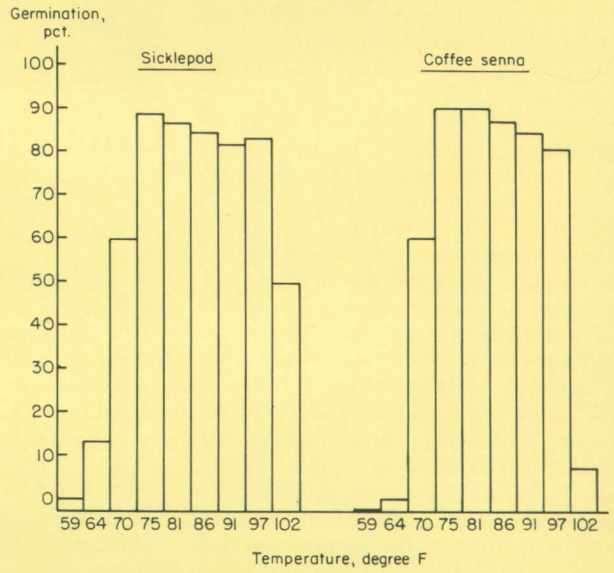


FIG. 1. Germination of sicklepod and coffee senna after 48 hours at nine temperatures.

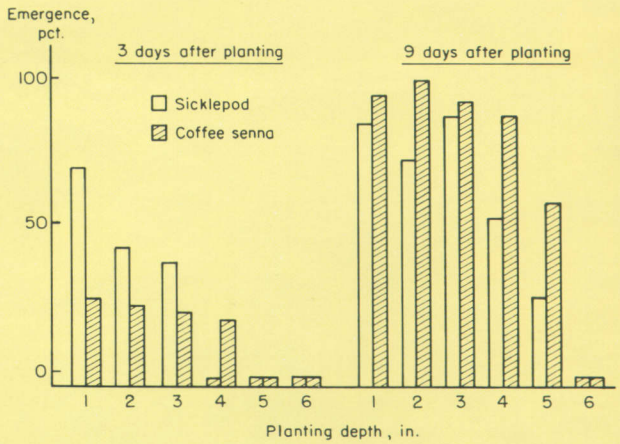
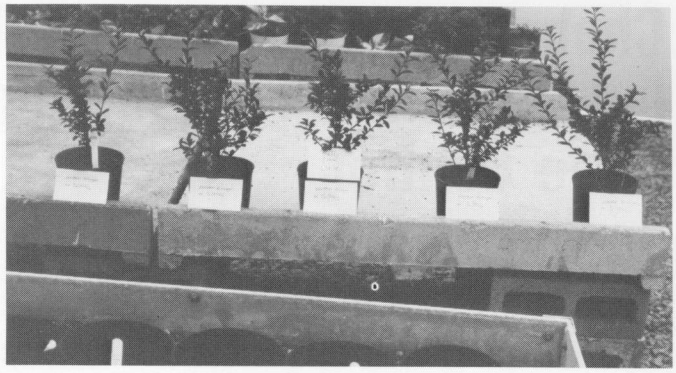


FIG. 2. Emergence of sicklepod and coffee senna from six depths after 3 and 9 days.

[1]Now at University of Florida Institute of Food and Agricultural Sciences.



Increasing Nitrate Fertilizer Decreases Iron Foliage Content of Container Grown Holly and Azalea in Pine Bark Medium

FRED B. PERRY
Department of Horticulture

MANY PROBLEMS develop in container plant production where plants are confined to small volumes of medium requiring frequent watering and fertilization.

Under frequent irrigation, nutrient leaching occurs faster from small containers of soil than from undisturbed field soils. Cation movement in soil columns increases with the amount of water moving through the soil and also the percentage of large pore space increases.

A study by researchers in the Department of Horticulture, Agricultural Experiment Station, was conducted to determine optimum rates and sources of nitrogen for the production of hollies and azaleas in an all pine bark medium and subsequent effects on plant growth and foliar nutrients.

Pine bark milled to pass a 1/4 in. screen containing 20-30% fine dust when amended with lime, phosphorus, and minor elements, makes an excellent, well drained, disease resistant medium for the production of nursery plants.

Therefore, a potting medium was prepared from fresh milled pine bark of particle sizes of 4%-5/16 in., 32%-3/16 in., and 64%-less than 3/16 in. in size. The pH of the medium was adjusted to 5.0-5.5 by the addition of 15 lb. of dolomitic lime per cu. yd. Superphosphate (20%) was incorporated at the rate of 2.4 lb. per cu. yd. Fritted trace elements and Fe 330 chelated iron were added at the rate of 4 oz. per cu. yd.

Uniform rooted cuttings of *Ilex crenate* 'Hetzi' and *Rhododendron japonicum* 'Hinodegeri' were planted in 6 in. black plastic containers April 18. One-half of the containers were placed in a greenhouse and one-half placed in the open field. Six rates of nitrogen were applied weekly and four replications per species duplicated inside the greenhouse and in the field. The weekly nitrogen rates were 50, 150, 250, 350, 450, and 550 p.p.m. from calcium nitrate. Potassium was added weekly with nitrogen treatments at 200 p.p.m. from potassium chloride.

Plants were grown from April 18 until August 18. The average high temperature in the field was 94.3°F and in the greenhouse 93.1°F, while the low was 67.8°F and 66.6°F, respectively. Plants in the field received an average of .70 in. of water daily as opposed to .35 in. for the plants in the greenhouse. Light intensity on a clear day was three times more in the field than in the greenhouse.

TABLE 1. CHANGES OF FOLIAR FE IN CONTAINER GROWN HETZ HOLLY WITH INCREASING RATES OF N FROM CA $(NO_3)_2$ IN A PINE BARK MEDIUM.

Weekly N rate	Greenhouse-containers		Field-containers	
	Foliar Fe	Change	Foliar Fe	Change
p.p.m.	*p.p.m.*	*Pct.*	*p.p.m.*	*Pct.*
50	111.30	100	167.10	100
150	55.10	50	121.30	73
250	55.83	50	90.11	54
350	50.18	45	73.84	44
450	41.85	38	75.21	45
550	33.28	30	60.62	36

TABLE 2. CHANGES OF FOLIAR FE IN CONTAINER GROWN HINO AZALEA WITH INCREASING RATES OF N FROM CA $(NO_3)_2$ IN A PINE BARK MEDIUM

Weekly N rate	Greenhouse-containers		Field-containers	
	Foliar Fe	Change	Foliar Fe	Change
p.p.m.	*p.p.m.*	*Pct.*	*p.p.m.*	*Pct.*
50	282.3	100	228.7	100
150	260.5	92	211.2	92
250	169.4	60	173.9	76
350	170.9	60	174.3	76
450	194.0	69	130.1	57
550	206.8	73	135.5	59

Generally, iron concentration in the foliage of holly and azaleas, container grown both in the greenhouse and in the open field, decreased with increased rates of nitrogen applied as calcium nitrate, tables 1 and 2. Hetz Japanese holly grown under greenhouse cover had a reduction of 50% foliar concentration of iron when nitrogen fertility rates were increased from 50 p.p.m. weekly to 250 p.p.m. weekly. As nitrogen fertility rates were increased another 200 p.p.m. to 450 p.p.m. weekly, foliar iron was reduced to under 40% and further reduced to 30% when nitrogen rates were increased to 550 p.p.m. weekly. Similar reductions of foliar iron concentrations were observed on field grown container Hetz Japanese holly with the foliar iron concentration reduction being about 5% less at each level than in the greenhouse, table 1.

Although increased nitrogen fertilizer rates on azalea followed a similiar trend on foliar iron reduction, the effect was not as severe as with Hetz holly. Increasing nitrogen rates from 50 p.p.m. to 350 p.p.m. weekly on azaleas reduced foliar iron concentration by 60% in greenhouse grown plants and 76% in field grown plants, table 2.

The foliar mineral element ranges for woody ornamentals, table 3, are sufficient for iron at 50 to 700 p.p.m. These ranges are approached for holly, both in the field and in the greenhouse, when nitrogen in the form of calcium nitrate is added at weekly rates of 250 p.p.m. per week or more. Although severe deficiency symptoms of iron were not observed on azalea foliage under this schedule of fertility, 25% to 40% reductions of foliar iron concentrations were observed.

TABLE 3. FOLIAR N AND FE CONCENTRATION RANGE LEVELS FOR WOODY ORNAMENTALS

	Low	Sufficient	High
N (%)	1.00	1.50-3.50	5.50
Fe (p.p.m.)	.30	50-700	1,000

Changes in the Alabama Dairy Industry Since Termination of Retail Price Control

LOWELL E. WILSON
Department of Agricultural Economics and Rural Sociology

WITH THE EXPANSION of milk markets the ability of the Alabama Dairy Commission to regulate the dairy industry within the State has been reduced. Also, effective authority of the Commission to establish producer quotas and prices has been lost through unfavorable court actions.

Absence of these controls has subjected the industry to disruptive marketing practices. Although all sectors of the industry were affected, participants particularly influenced were quota holding milk producers and single unit proprietary milk handlers in Alabama. In the absence of producer quotas, milk processors became free to acquire milk supplies from any source desired. Since minimum prices were not established by the Commission on milk purchased from sources outside the State, some processors began to acquire milk supplies from out-of-state producers at prices below those set by the Commission. Also, out-of-state processors expanded packaged milk sales in the State.

Request for a Federal Order

Growth in interstate commerce in milk movements led to a decline in state regulatory programs and subsequent growth in federal milk orders. In late 1979, Associated Milk Producers, the major dairy cooperative in Alabama, petitioned the Dairy Division of the U.S. Department of Agriculture for a federal milk order for Alabama and four counties in west Florida. A proposed order prepared by the cooperative was submitted to the USDA. After preliminary investigations, a public hearing was held by the USDA in Montgomery in late June 1980 to receive testimony concerning the marketing of milk and the proposed order.

Marketing Area

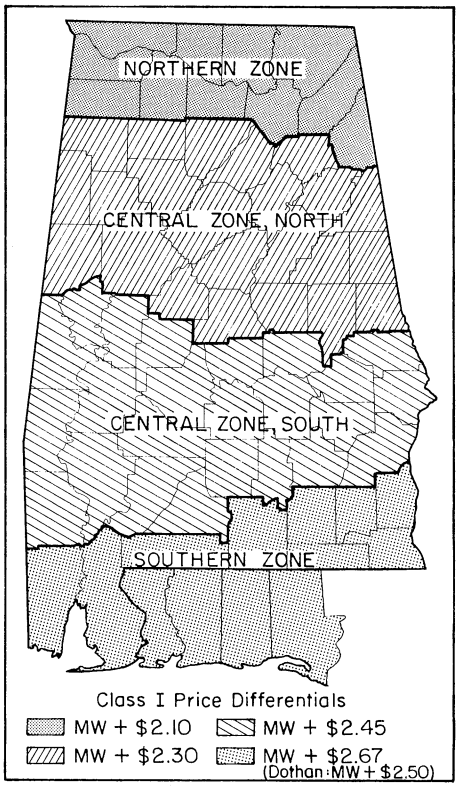
A study of the distribution of fluid milk products in the proposed market was conducted in May 1980 to establish the extent of the market and identity of processors in the area.[1] Results were presented at the hearing. A total of 523 grocery stores located in the area was surveyed to determine identity of milk processors and volumes of sales. Of 37 processors with sales in the area, 20 were either located in the market or would probably be fully regulated in the proposed order. These processors had 89% of fluid product sales in the area. Seventeen processors located in eight states outside the market had the remaining 11% of the sales. Packaged milk products were being distributed regularly in the market from plants located as far away as Indiana and Missouri.

Four Class I pricing zones were proposed, see figure. The Class I pricing formula included the Minnesota-Wisconsin manufacturing milk price, plus a differential for each zone. A processor located in the Northern Zone would pay the lowest Class I price, while processors located in the Southern Zone would pay the highest Class I price in the market. If the proposed order was in effect in December 1980, the minimum Class I price in the Central Zone, North would be $14.72 ($12.42 M-W, plus $2.30).

Milk Supply

In mid-1980, approximately 950 milk producers were regularly supplying milk to processors that would likely be fully regulated under the order. Number and location of the producers were: 439 Alabama; 378 Tennessee; 106 Mississippi; 27 Florida; and 5 Kentucky. Almost three-fourths of the dairy farmers were members of the three cooperatives furnishing raw milk to processors in the market. The cooperatives were Associated Milk Producers; Dairymen, Inc.; and Southern Milk Sales. The remaining dairy farmers who were not coop members shipped directly to specific processors.

Milk supply and use information available from the Dairy Commission showed that in 1979, 53% of the raw milk supply for Alabama was produced in other states and 47% of the supply was from dairy farms in the State. During the past 4 years, from 87 to 91% of the milk supply available to Alabama processors was used in fluid milk products.



Four Class I proposed pricing zones.

Need for an Order

Indicative of the need for effective market regulation was testimony that no uniform producer pricing system existed within the proposed area. Some prices paid producers were flat prices and were not based on use. Reconstituted buttermilk, which is priced as a Class I product in federal order markets, was not being priced in Alabama. Inadequate market information was available for Alabama and practically no information existed for the four-county Florida area. Concern was expressed over the existing milk auditing program in Alabama. An unequal sharing of surplus milk among producers was reported. Cooperatives acted as supply balancers for the market and much of the milk diverted to manufacturing use at lower prices by cooperatives was not pooled in the market.

The next step in acquiring the federal order will be a recommended decision and order issued by the USDA, probably in early 1981. The industry will have the opportunity to file exceptions to the recommended order. After a final order is issued, producers will vote in a referendum whether or not to approve the order. The order becomes effective after producer approval, probably after mid-1981.

[1]WILSON, LOWELL. Distribution of Fluid Milk Products in the Proposed Alabama-West Florida Federal Order Milk Marketing Area. Alabama Agricultural Experiment Station, June 1980.

DEODAR WEEVIL
and its association with Coniferous Trees

L. L. HYCHE, Department of Zoology-Entomology

PINE TREES DYING or declining for whatever reason—disease, insects, drought, old age—attract attention. Likewise such trees promptly attract many species of insects.

Because of their presence these insects may be judged, rightly or wrongly, as responsible for the tree's condition. Among insects may be primary species capable of causing mortality; purely secondary species present because of tree condition; or, predaceous and parasitic species seeking their hosts. In some cases, certain of these insects may even be considered as either primary or secondary depending on species of tree or circumstances involved. The common deodar weevil is a case in point.

Secondary Insect

The usual role of deodar weevil in Alabama is that of secondary insect. It is most commonly found developing in native pines felled or killed during late summer and fall, figure 1. The adult, figure 2, is primarily active only in late September and October. During this period females cut small holes through the outer bark of suitable host trees and deposit eggs in the inner bark. Larvae tunnel, figure 3, and feed in the inner bark throughout the fall and warm periods of winter. Pupation occurs in late February and March in chip-covered cells excavated, figure 4, in the sapwood by mature larvae. Adults emerge in April and early May and feed briefly on buds and tender bark of pines. When hot weather arrives, they estivate in the duff and litter, remaining inactive until fall. There is only one generation per year.

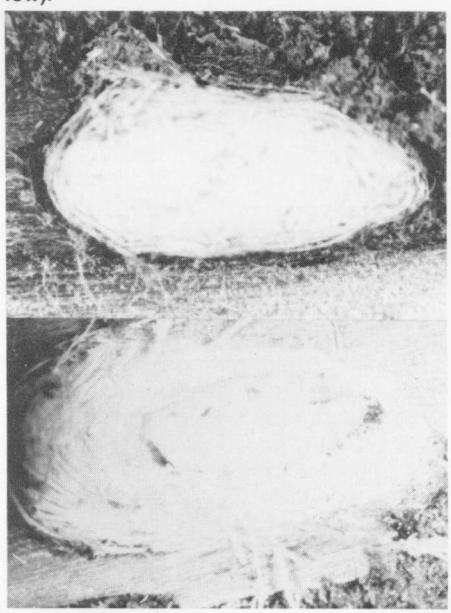
Primary Pest

Deodar weevil is occasionally found infesting living trees in Alabama. Such conifers as deodar and atlas cedars, cedars of Lebanon, and white pine, grown as ornamentals, and loblolly pine, have been attacked. During late September and October, adults puncture the outer bark of twigs and terminal leaders and feed on inner bark. If extensive, feeding may cause twig mortality and leader dieback. Females may oviposit in weakened leaders and additional dieback may result from feeding of larvae in the inner bark of leaders. Severely weakened trees may be killed.

Primary Role Questioned

Historically, deodar weevil has been known as a secondary insect because of its habit of attacking and successfully breeding in freshly cut, killed, and/or weakened low-vigor conifers. Its presence in seemingly healthy trees prompts a question as to the actual condition of these trees. For example, white pine and true cedars mentioned are not native to Alabama, thus may be of low vigor and stressed as result of attempts to grow and maintain them under unfavorable conditions. In any event, keeping trees healthy and vigorous is the best protection against injury by deodar weevil.

FIG. 1. Weevil habitat of felled native pines (left); FIG. 2, adult weevil (title picture); FIG. 3, larva tunnel under bark (above); and FIG. 4, excavated chip covered cells (below).



Nematodes Damage Perennial Forage Legumes

C. S. HOVELAND, R. L. HAALAND, D. SIDES, AND C. WEAVER
Department of Agronomy and Soils
R. RODRIGUEZ-KABANA, Department of Botany, Plant Pathology, and Microbiology

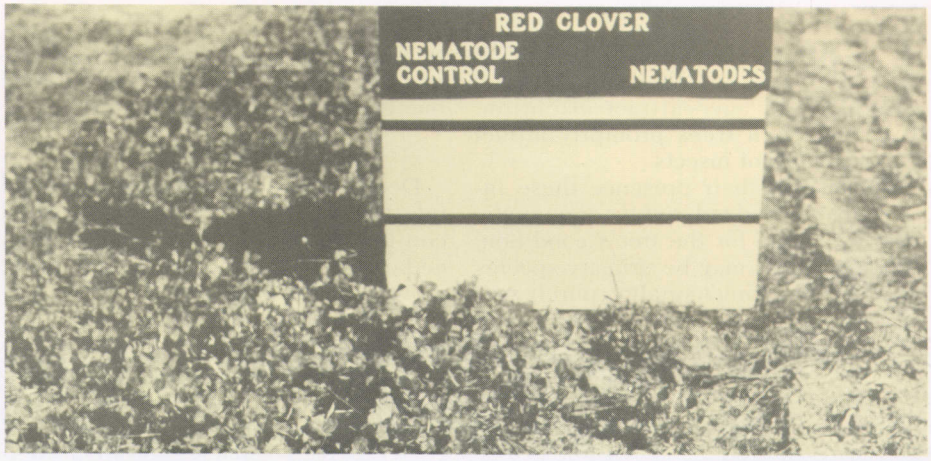


FIG. 2. Red clover plots above showing nematode control, left, and no control at right.

FIG. 1. Alfalfa plots left showing nematode control, left, and no control at right.

PERENNIAL FORAGE LEGUMES often do not persist and fail to remain productive on sandy soils in central and southern Alabama. Results of a 3-year experiment at Auburn University's Agricultural Experiment Station Plant Breeding Unit, Tallassee, indicate that soil nematodes are an important factor in the lack of success with these perennial legumes.

Gladiator alfalfa, Redland red clover, and AT-1 birdsfoot trefoil were planted in early October 1977 on a sandy loam soil. Some of the plots were treated with methyl bromide for nematode control and others were left untreated. Forage was harvested in the hay stage during the next 3 years.

Plots treated with methyl bromide for nematode control made the highest yields during the establishment year, table 1. However, yields of all three legumes on untreated soil were reasonably good the first season.

By the second season, 1979, stands of red clover were eliminated and birdsfoot trefoil stands were nearly gone. Alfalfa stands were still good on untreated soil but yields were reduced about 25%. Stands of alfalfa were reduced by the third year, 1980, and forage yields were only one-third that on plots having nematode control. Alfalfa yields were lower than normal in 1980 because of a severe drought.

Nematode populations were greatly affected by the soil treatment, table 2. Parasitic nematodes were highest on red clover, beginning with the first year. Stubby root nematodes were the most prevalent species on alfalfa while on red clover and birdsfoot trefoil, rootknot was the major species. Many stunt nematodes were also found on red clover.

Soil treatment with methyl bromide may reduce soil fungi as well as nematodes, probably benefiting the legumes. However, the rapid increase in populations of parasitic nematodes on untreated soil indicates that they are likely a major cause in stand and forage yield reduction.

Results of this experiment help explain why red clover and birdsfoot trefoil fail to persist more than 1 year on nematode-infested sandy soils of central and southern Alabama. Alfalfa apparently has greater nematode tolerance than the other two legumes and can be expected to remain productive for at least two seasons.

Treatment of forage legumes with methyl bromide or a nematicide is not economical under current conditions. Nematode-tolerant perennial legume varieties would extend the useful range of these valuable forage plants.

TABLE 1. FORAGE PRODUCTION OF THREE LEGUMES AS AFFECTED BY NEMATODE CONTROL, PLANT BREEDING UNIT, TALLASSEE

Legume	Dry forage yield per acre					
	1978		1979		1980	
	Treated soil	Untreated soil	Treated soil	Untreated soil	Treated soil	Untreated soil
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Alfalfa	7.4	6.2	4.2	3.2	3.0	1.0
Red clover	4.8	4.0	2.4	0	0	0
Birdsfoot trefoil	3.7	3.2	1.6	.2	1.1	0

TABLE 2. PARASITIC NEMATODE POPULATION IN SOIL AND ROOTS OF THREE LEGUMES AS AFFECTED BY NEMATODE CONTROL

Legume	Nematodes per 50 cc soil and roots			
	1978		1979	
	Treated soil	Untreated soil	Treated soil	Untreated soil
	No.	*No.*	*No.*	*No.*
Alfalfa	0	28	18	37
Red clover	34	86	86	103
Birdsfoot trefoil	0	49	13	46

Farrowing House Conditions INFLUENCE Baby Pig Performance

D. N. MARPLE, R. M. McGINNIS, and T. J. PRINCE,
Department of Animal and Dairy Sciences
V. K. GANJAM, Department of Animal Health Research
J. F. PRITCHETT, Department of Zoology-Entomology

BABY PIGS are particularly sensitive to cold and chilling. Although new-born pigs can increase their heat production in a cold environment, conservation of body heat is a problem. The application of radiant heat from heat lamps or catalytic heaters can reduce heat loss from the baby pig and decrease the piglet's metabolic rate. Producers also have been encouraged to dry piglets at birth to prevent heat loss associated with natural drying by evaporation.

Although many farrowing houses today have insulated or heated floors and supplemental heat, there are limited data to show how supplemental heat and drying of pigs at birth affect piglet survival. Therefore, a study was designed to examine the effects of floor temperature, supplemental heat, and drying pigs at birth on rectal and skin temperatures, weight gain, and survival rate to 5 days of age.

Different Floor Temperatures Maintained

The Auburn University Agricultural Experiment Station study involved a total of 326 pigs from 33 litters. Sows were placed in a farrowing house that had conventional farrowing crates, concrete floors, and hot water heat in the creep area. The floor of the creep area on one side of the house was maintained at 86°F, while the creep area of the remaining crates was held at 68°F. Air temperature was approximately 72°F.

Alternate litters within each floor temperature group were provided with supplemental heat in the form of a 250-watt heat lamp. For the remaining litters, a 100-watt light was suspended over each crate. The heat lamp increased the temperature of the nursing area floor to approximately 115°F, but the light bulb did not alter floor temperature.

Drying at Birth Evaluated

Alternate pigs within litters were dried at time of birth and birth weight was recorded at 1 hour. The skin temperature of each pig was recorded at 30 minutes and 1 hour after birth and at hourly intervals for 8 hours. Rectal temperatures also were taken at hourly intervals for 8 hours. Survival rates were monitored daily and body weights were recorded at 1, 2, and 5 days of age.

Results of the Auburn study indicate that piglets exposed to heat lamps had higher skin and rectal temperatures from 4 to 8 hours after birth. These differences were expected, although increased skin and rectal temperatures did not show any particular advantage on the basis of body weight and survival data recorded. The responses to drying pigs at birth were not the same for the two floor temperature treatments. On the warm floor, pigs that were dried had higher rectal temperatures than those not dried, whereas pigs on the cool floor that were not dried had higher temperatures than those which were dried.

EFFECTS OF FLOOR TEMPERATURE AND DRYING OF PIGS AT BIRTH ON SELECTED VARIABLES

Variable	Pigs dried	Pigs not dried
Rectal temperature of pigs		
On 68°F floor	101.1°F	101.3°F
On 86°F floor	101.3°F	100.9°F
Pig body weight at day 5		
On 68°F floor	4.4 lb.	4.2 lb.
On 86°F floor	4.2 lb.	4.4 lb.
Percent survival at day 5		
On 68°F floor	80.9%	97.2%
On 86°F floor	94.5%	93.1%

Economic Questions Answered

Two questions of economic importance were addressed in the study: (1) Which factors altered body weight at 5 days of age, and (2) which factors improved or altered survival rate to day 5?

At day 5, body weights and survival rates were not improved or otherwise altered by providing supplemental heat from heat lamps. The relationship between floor temperature and drying at birth was significant for body weight, in that pigs on the warm floor which were not dried weighed more than those that were dried. In contrast, pigs on the cool floor which were dried weighed more.

Survival data also revealed that pigs not dried at birth and those on the warm floor had similar high rates of survival to day 5. However, pigs dried at birth and maintained on the cool floor had approximately a 12-16% lower survival rate. Thus, baby pigs can survive well on a cool floor (68°F) without supplemental heat provided they are not dried at time of birth.

The results suggest that expenditures for supplemental heat in the farrowing house (either floor heat, heat lamps, or catalytic heaters) may not be necessary so long as pigs are maintained in a moderately warm (68°F) environment and provided the sows and litters are free of any health related problems. Supplemental heat may be beneficial during periods of disease stress if the pigs are subjected to environmental temperatures below their comfort level (approximately 86°F). Furthermore, supplemental heat may be of value when floor temperatures are lower than those maintained in the study reported.

Results of these Auburn studies suggest that drying pigs at birth increases heat loss from the skin surfaces. Pigs that were not dried had lower skin temperatures during the first 8 hours after birth, but they survived better than those that were dried. Therefore, it may be that the normal responses of the pigs to a cool environment (cool floors and not dried at birth) triggered mechanisms responsible for the conservation of body heat and energy by the pig, and this may have improved their rate of survival.

FOREIGN OWNERSHIP OF AGRICULTURAL LAND

J. H. YEAGER, Department of Agricultural Economics and Rural Sociology

HOW MUCH AGRICULTURAL land is owned by foreigners? Where is it located? Why was it purchased? What are some of the implications for Alabama and U.S. farmers?

These are some questions that have been raised in recent months. Some facts are available to help answer these questions, but complete information is lacking.

How Much and Where

On October 14, 1978, the President signed the Agricultural Foreign Investment Disclosure Act which became effective in 1979. The act required all foreign persons holding land as of February 1, 1979, to file a report of such holdings with the Secretary of Agriculture by August 1, 1979. All foreigners who acquired or disposed of agricultural land on or after February 2, 1979, are required to report such transactions within 90 days of the transfer. Copies of the completed report forms are sent periodically to the commissioner of agriculture or comparable official in the state where the land is located. The information is also sent to county ASCS offices in which the foreign-owned land is located.

In 1979 in Alabama, 162,430 acres of agricultural land were reported as foreign owned. This was 0.5% of the total land and 1.4% of the land in farms based on the 1978 Census of Agriculture. For the United States, less than 0.5% of the agricultural land is foreign owned.

Tennessee, Georgia, and South Carolina were the states with the largest amount of foreign-owned agricultural land. The ratio of foreign-owned agricultural land to all privately held land was highest in Nevada, South Carolina, and Tennessee.

Individuals were the most common type of foreign owner, although corporations held by far the greatest acreage, 81% of the foreign-owned agricultural land.

Large Farms the Rule

Large size holdings tend to predominate among foreign owners. This is indicated by the fact that 31% of the holders with 300 acres or more held 97% of the U.S. foreign-owned agricultural land. The definition of agricultural land included extensive uses such as ranching and forestry as well as intensive uses such as for orchards and vegetable crops.

It was difficult to determine the country of the foreign owner because a firm or individual in one country could invest in another foreign firm that bought farmland in the United States. The predominant country whose interest was most direct in the ownership of agricultural land was reported as the foreign owner. In terms of acres of agricultural land owned, the United Kingdom, Luxembourg, and West Germany were the countries with the greatest land holdings. U.S./U.K. corporations owned 66% of all timberland reported. The largest three groups of holders of cropland were foreign persons from West Germany, Canada, and the Netherlands Antilles. There was no strong indication that the foreign-owned land would be taken out of agricultural production.

Why Foreign Purchases?

There are several reasons for the interest in and purchase of agricultural land by foreigners.

The United States, with its stable and free government system, has been a major attraction to foreign capital. Although the net income from agricultural holdings may not be a major attraction, the possibilities for appreciation in value and capital gains from foreign land ownership are probably major considerations. Since 1975, capital gains from appreciation in farm assets have been much greater than farm income on a current dollar basis. No doubt foreign investors also are giving consideration to areas of potentially high growth and development in the United States.

In a number of cases, foreign investors are in countries where the value of their currency has strengthened in recent years. Although agricultural land prices have increased in the past, buyers from certain countries where the currency has strengthened find U.S. farmland less expensive than for the U.S. investors, in terms of dollars. There also may be some tax advantages to the foreigner, but this varies from country to country.

Implications

It has been implied that foreign investors drive up the price of land. In individual cases this may be true; however, the major purchaser of farm land continues to be the American farmer.

Some are concerned that foreigners are absentee owners who rely on managers and tenants to operate their land. Foreign owners are displacing some U.S. landowners, but it is unlikely that the tenure structure of farms will be greatly changed. Some say that foreign owners may make poorer use of agricultural land and achieve lower levels of productivity. The data acquired by USDA indicated that little change was made in land use after purchase by a foreign owner.

Negative effects on communities are cited as a result of foreign ownership. Depopulation may or may not occur, depending on land use and other factors. More distant markets are sometimes used to sell products and buy inputs.

Absentee ownership is not just associated with foreign owners. A recent survey by USDA showed that 20% of the private land in the United States is held by owners who do not reside in the county in which the land is located. Absentee owners, whether foreign or domestic, may not take the interest or pride in community development that local owners take.

No doubt foreign ownership of agricultural land will continue to draw considerable interest. It should be monitored and researched to better understand the reasons underlying purchases and the implications of foreign ownership.

Range of Traveler Irrigation EXTENDED by Use of Delayed Start Mechanism

EUGENE W. ROCHESTER, Department of Agricultural Engineering

WATER APPLICATION UNIFORMITY is an important consideration when designing and selecting traveler irrigation systems. Factors such as lane spacing, nozzle size, and pressure determine application uniformity.

Many systems depend on starting the irrigator some distance inside the field boundary to achieve maximum lane distance. This practice, which may result in underwatering near the field boundaries, is the subject of a study now being conducted at the Auburn University Agricultural Experiment Station. The study utilizes computer simulations and experimental field data to predict water application in the field under no-wind conditions. Wind effects are being evaluated in a separate study.

Simulation Shows Variable Watering

The first simulation, figure 1, presents water application amounts for two 850-ft.-long travel lanes spaced 325 ft. apart. Water application at each of the grid points on a 25-ft. spacing was computed and lines of constant water application plotted. The area bounded by the lanes and the start and stop positions is used as a reference area. This area has an average application of 1 in., with most of it receiving between 0.75 and 1.25 in.

The high application area located between lanes is caused by utilizing recommended lane spacings for moderate winds, thus providing a closer spacing than desirable for no-wind conditions. The low application areas along the lanes are caused by operating the sprinkler with a 30-degree dry angle to the front.

The wetted distance to the rear is equal to the wetting radius of the sprinkler (in this case 230 ft.). This wetted area can be utilized well when the starting point is in the middle of the field and another travel lane can be utilized to overlap this end wetting area. If the starting point is near the edge of the field, however, no overlapping can occur, and the best location of the starting point becomes questionable.

In the example shown in figure 1, the application behind the sprinkler varies from 0.75 in. near the sprinkler to none at the outer edge, leaving this area underirrigated. The alternative is to start the irrigator at the edge of the field and to waste the water applied behind the starting point.

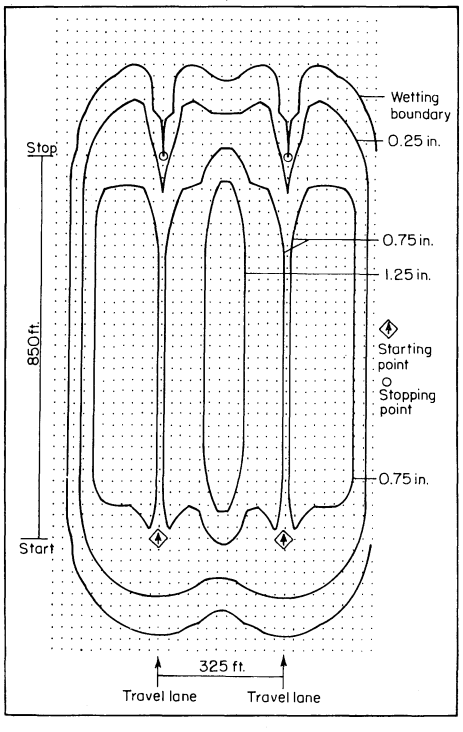


FIG. 1. Wetting pattern from a traveler with no delay.

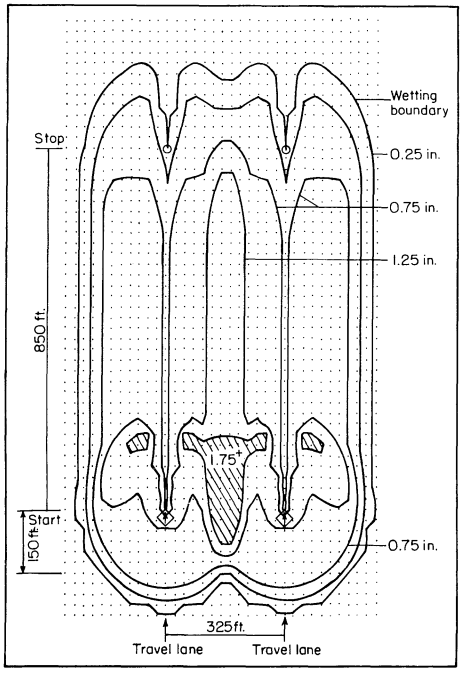


FIG. 2. Wetting pattern from a traveler with initial delay.

Delayed Start Mechanisms Available

As an option to the alternatives described, some manufacturers are offering delayed start mechanisms to provide additional water behind the start position. (Delayed starts can be accomplished on any traveler manually.) The desired result is to extend the effective length of the travel lane.

One proposed delay time is computed utilizing travel speed and sprinkler wetting radius and is equal to the time required for the travelers to move one sprinkler radius. In this example, the travel speed is 2 ft. per minute and the wetting radius is 230 ft.; thus, the proposed delay time is 115 minutes.

Figure 2 shows the result of a 115-minute delay. Water application at the stopping end of the field remains unchanged. At the starting end, however, more water has been applied so that an additional 150 ft. of field has been irrigated with at least 0.75 in. of water. Unfortunately, a portion of the field between lanes has had an excess of 1.75 in. applied. The trade-off then has been to extend the effective lane distance while at the same time applying extra water in front of the sprinkler. Of course, a shorter initial delay would decrease the overwatering problem but would also decrease the extra lane distance. In fact, one manufacturer[1] recommends this delay as a maximum time, with one-half this value being the minimum delay.

Additional studies underway at Auburn will provide further information about travel delays, both initial and final, and will consider field application uniformity and energy usage.

[1]Telephone conversation with Alain Vezes, Vice President, Irrifrance U.S.A., Inc., October 20, 1980.

The structure of the agricultural credit market

WILLIAM E. HARDY, JR.
Department of Agricultural Economics and Rural Sociology

TOTAL FARM DEBT in the United States increased from $10.7 billion in 1950 to $132.2 billion in 1979—an increase of more than 1,135%. During the same period, total farm production expenses rose from $19.5 billion to $114 billion, a 484% increase. Total farm cash receipts rose about 359%, increasing from $28.8 billion to $132.1 billion.

With production expenses increasing faster than farm receipts, farmers who were once self-sufficient in terms of generating adequate capital to continue and expand farming operations, are less able to do so. Profit margins have narrowed and, subsequently, the farmer's ability to finance his operation with equity capital from profits earned in previous years has decreased substantially. In many instances, increased utilization of credit has become a necessary component of the farm management plan.

Increased dependence upon borrowed funds and leverage in farming has developed from at least three occurrences:

(1) The consolidation of agriculture into fewer and larger farms to achieve greater economies of scale from improved technology and management techniques;

(2) High land values brought about by capitalization of the benefits of new technology, economies of scale, government payments, and increased demand for farmland from nonagricultural sources; and

(3) The increased substitution of purchased for non-purchased inputs, and the increased prices of these inputs caused by inflation.

An obvious consequence of the increased use of borrowed capital has been a growing pressure on financial institutions to provide more loanable funds. All agricultural lenders have higher levels of outstanding loans than ever before. However, the relative importance of each lender has changed over the years. Some have been more aggressive in the agricultural lending market and , as a result, have a larger market share than in the past.

When one looks at the farm real estate market, the Federal Land Banks have emerged as the primary institutional

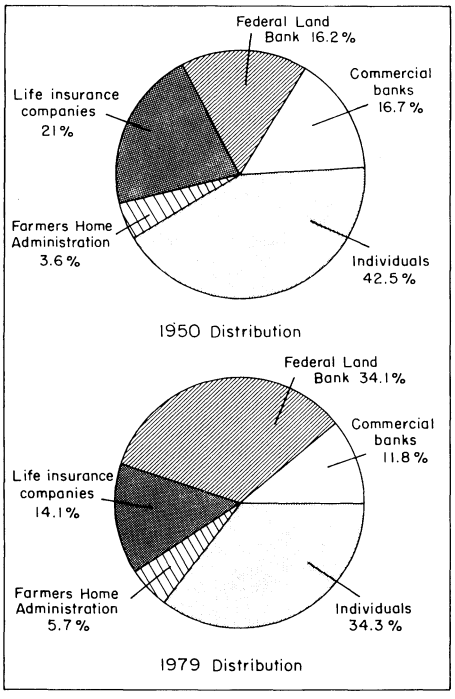


FIG. 1. Distribution of real estate debt by lending source, 1950 and 1979.

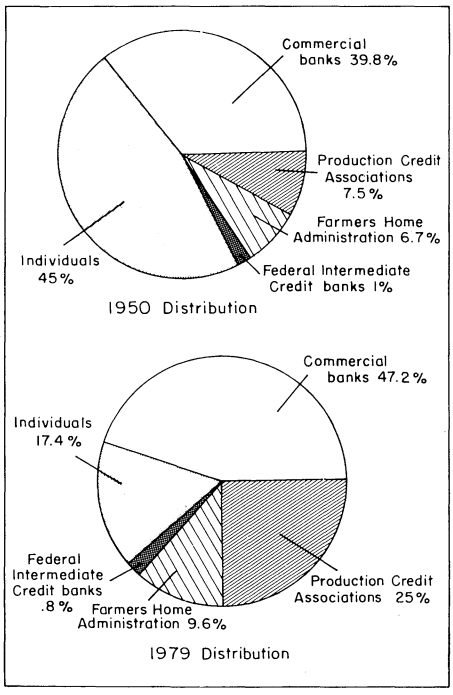


FIG. 2. Distribution of non-real estate debt by lending source, 1950 and 1979.

supplier of credit, lending $24.6 billion for real estate purchases in 1979, about 34% of the total market. Individuals were also important, providing 34.3% of the total volume, $24.8 billion. This importance of individuals as a source of funds was emphasized during the tight credit periods of 1979.

Life insurance companies were the third largest farm real estate creditor, $11.9 billion, followed by commercial banks, $8.6 billion, and the Farmers Home Administration, $4.4 billion. The relative positions of these lenders in 1950 and 1979 are illustrated in figure 1.

Commercial banks have long been the major source of non-real estate credit in the United States, providing at least 40% of the total each year since 1950. In 1979, they supplied $28.3 billion, 47.2% of the total market. Competition in this market has increased, however, with the Production Credit Association share rising from 7.5% in 1950 to about 25% in 1979. While the Farmers Home Administration and private individuals supply a substantial amount of non-real estate credit, neither offers a significant challenge to the major market portions held by commercial banks and PCA's. Figure 2 illustrates market shares held by the principal non-real estate lenders in 1950 and 1979.

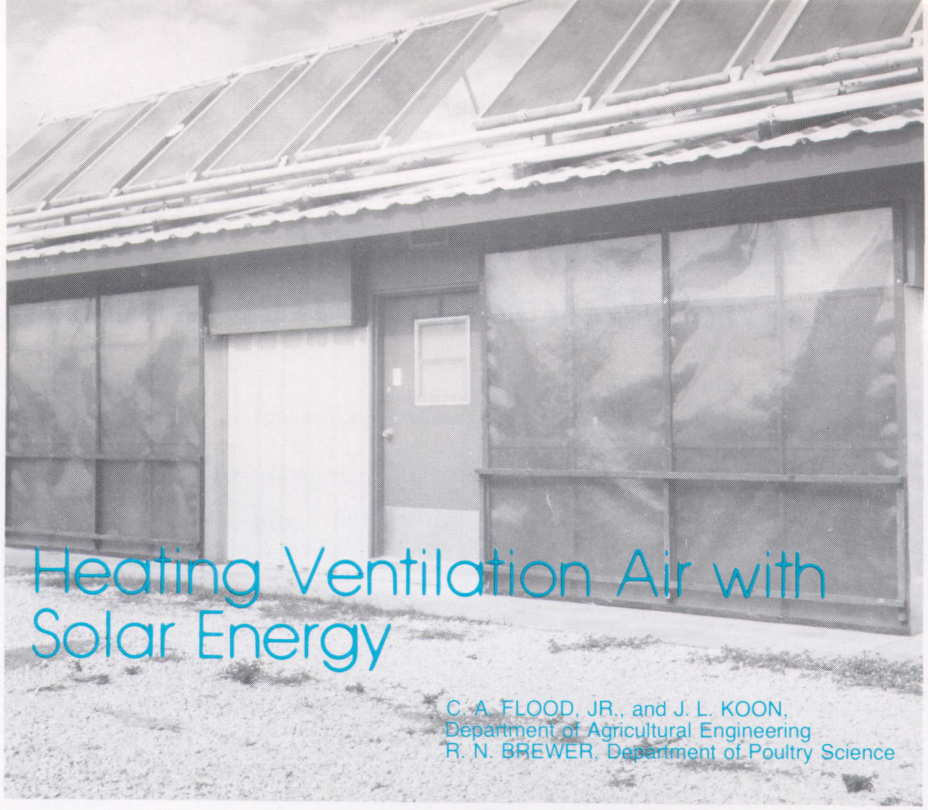
In looking to the future, the agencies of the Farm Credit System (Federal Land Banks and Production Credit Associations) will likely continue to have a major share of the total agricultural credit market. These organizations have services and operating policies tailored to meet farmer needs.

Commercial banks will probably continue to be a primary source of credit, particularly for non-real estate purchases. Some banks in agriculturally oriented areas are hiring lending specialists trained in handling agricultural credit problems.

The individuals category, which is composed of private individuals and nonfinancial businesses who extend credit to help in the promotion and selling of their products, will continue to decline in importance. They are becoming less willing to bear the expense and risk associated with lending. The reluctance of individuals to extend credit is intensified when interest rates are high. This occurs because funds are not as readily available and the cost of capital to the business increases, making the credit service very expensive.

The same trend is likely to be found with insurance company participation in the farm land market. Recent history has shown clearly that insurance companies are preferring to invest their funds in ventures other than lending for farm land.

The level of participation of the Farmers Home Administration is dependent upon congressional appropriations and the balances in the revolving funds of the organization. All indications, however, point to continued strong lending, particularly in specialized categories such as emergency, young farmer, and community development loans.



Heating Ventilation Air with Solar Energy

C. A. FLOOD, JR., and J. L. KOON,
Department of Agricultural Engineering
R. N. BREWER, Department of Poultry Science

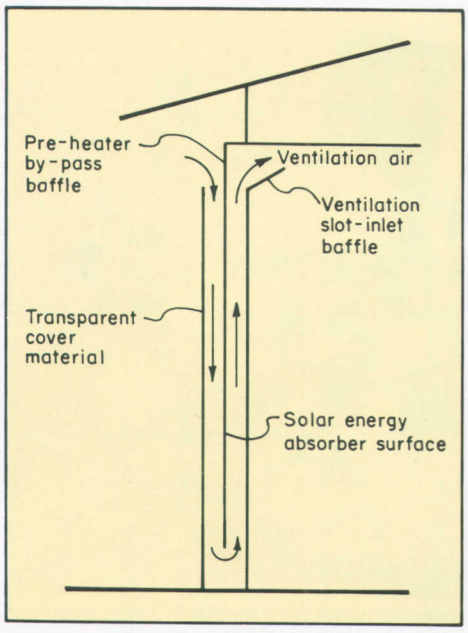
YOUNG LIVESTOCK, particularly pigs and chickens, require a heated environment during the first few weeks of life. If housing unit temperatures are too low, then poor feed conversion, growth rate, and low disease resistance can result.

Common practice in the livestock production industry has been to use LP gas or electricity as the energy source for heating young animals. As long as these forms of energy were relatively cheap, there was little interest in considering alternative energy sources. Likewise, anticipated energy need was a minor consideration in facility design, location, and construction.

However, the rapid and continuing increase in fossil fuel prices, which began in 1973, has led to a renewed interest in ways to utilize solar energy to partially or completely satisfy heating requirements. Much work has been done on systems made up of solar energy collectors and energy storage units. Heat is removed from the storage as it is needed in the livestock housing facility.

Needs for a young animal are usually highest when it is first placed in a house and decrease as it grows older. Heat requirements also vary greatly with season of the year. These variations in heat requirements make it difficult to design an economically feasible solar collector and storage unit for conventional housing systems.

An analysis of the sources of heat loss from a livestock confinement building reveals that a major portion of heating energy is needed to replace heat lost in exhausted ventilation air. Moisture produced by animals makes it necessary to use much higher ventilation rates than are used in houses for humans.



Pre-heater cross-section.

Because incoming ventilation air must be heated to the desired environmental temperature, Auburn University Agricultural Experiment Station researchers began to study ways that solar energy could be used for this job. One solution derived from the study was a simple ventilation air pre-heater which can be constructed by farm labor with commonly available materials.

The drawing shows a cross-section of the heater as it would appear installed on an enclosed confinement house which is ventilated through a slot inlet. The vertical wall heater consists of an absorber surface covered by a transparent glazing material. Ventilation air enters the top of the unit, passes downward between the glazing and solar energy absorber, goes back up between the absorber and building wall, and enters the building through the ventilation slot inlet.

A way for air to enter the building without going through the solar heater must also be provided. This can be accomplished by placing a by-pass baffle at the top of the collector. When no heating of ventilation air is needed, the baffle can be opened to permit air to enter the building directly.

A picture of the Auburn heater installed on the solar poultry house is shown above. The absorber surface is 30 lb. building felt stapled to the back of 2 x 2 in. framing members. The glazing material is transparent fiberglass. Each heater is approximately 80 sq. ft. and heats ventilation air for one 20 x 35 ft. room. In operation through one winter, the heater supplied about 15% of the heating needs through warming of incoming ventilation air.

The table shows heater performance on a typical day. A small fan was operated continuously to move about 100 c.f.m. (0.1 c.f.m. per bird) of air through the heater. On a clear day, temperature rises of 50°F were common.

Most poultry houses in the Southeast have curtain sides and are fan ventilated. A system similar to this could be easily utilized on any poultry house with a south-facing sidewall. Two curtains, separated by 2 x 4 in. spacers, can be placed on the building with one rolling up and one rolling down. The outer curtain should be transparent. Ventilation air passed between the curtains will be warmed during daylight hours by solar energy in a manner similar to that described. Although this system is not designed to furnish all brooding energy, it is a relatively cheap method of cutting energy costs.

TYPICAL PRE-HEATER PERFORMANCE, FEB. 10, 1979

Time	Outside air temperature, °F	Pre-heater air temperature, °F	Increase in temperature, °F
9:30 a.m.	34	105	71
10:00	36	113	77
10:30	38	117	79
11:00	40	120	80
11:30	43	98	55
12:00 noon	45	116	71
12:30 p.m.	46	91	45
1:00	48	92	44
1:30	48	106	58
2:00	50	87	37
2:30	49	85	36
3:00	50	88	38
3:30	49	78	29
Av.	44	100	55

Efficient Tractor and Machine Fuel Use

ELMO RENOLL
Department of Agricultural Engineering

EFFECTIVE UTILIZATION of nearly 8 billion gal. of fuel per year in agriculture is a major concern to the United States farmer. This concern revolves around the ever-increasing price or potential shortage that could interrupt his operation. Thus, it is important that the farmer use each tank of fuel to its greatest advantage and that he give careful consideration to tractor selection and operation.

There are a number of things the Alabama farmer can do to reduce fuel needs and costs for his tractors and machines. Some of these are easily handled and others require a change in machines, crops, or cropping systems. The following suggestions should be helpful.

If you have a choice of fuels, use diesel. For tractors of equal horsepower or size doing the same amount of work, the diesel engine uses less fuel. For example, if it takes 75 gal. of diesel fuel to handle a specific field operation, a gasoline tractor will use about 100 gal. and an LP gas tractor about 120 gal. This occurs primarily because diesel fuel contains more energy per gal. than the other two fuels and also the diesel engine is a little more thermal efficient.

Do a better job of matching the load to the tractor. Use a small tractor for lighter loads. For larger tractors, consider coupling equipment together to do several jobs at one time. This will save extra trips over the field and will operate the tractor nearer full load where fuel efficiency is high.

When pulling these heavier loads, be careful not to excessively overload the engine. To do so causes excessive engine wear, increased maintenance costs, increased fuel consumption and, sometimes, excessive wheel slippage. If the tractor is not fully loaded, throttle back and shift into a higher gear. This not only saves fuel, but it reduces engine wear.

Keep your tractor and other farm engines in good condition. A gasoline engine that is properly adjusted for carburetion and ignition will use 12 to 15% less fuel than one improperly tuned. Keeping the diesel engine well tuned pays off in a 10-12% fuel savings. Dirty air cleaners restrict air flow and cause increased fuel consumption and reduced horsepower.

Avoid spillage when filling fuel tanks. Minimize gasoline evaporation by selecting a shaded or underground storage location, painting the tank a light color, and by keeping the tank caps properly closed.

Plan all field operations carefully. Keep idle field travel of self-propelled machines and tractors to a minimum. Shut the engine off while making field adjustments, loading supplies, unloading field crops, or servicing equipment.

Good tire traction is essential for all field operations. Excessive wheel slippage wastes fuel and also causes undue tire wear. Change wheel weights depending on tractor load and field conditions to assure good traction without excessive wheel weight or slippage. Consider radial tires the next time you buy tires or a new tractor.

Are your fields scattered around at several locations? Judicious planning here can save fuel. Transport tractors and equipment by truck rather than driving them. It not only saves fuel, but it is safer. If a pickup truck is an important part of your farming operation, consider changing to a compact one. It may meet most of your needs and will lower fuel costs.

Operate machines at proper ground speeds. Keep them properly serviced and correctly adjusted. Keep cutting edges sharp and properly spaced. Operating forage choppers and mowing machines that have dull knives or are improperly adjusted can increase power requirements as much as 20 to 30%. Badly worn plow shares can increase power requirements by 10 to 15%.

Using minimum tillage or other cultural practices in place of conventional plowing may reduce fuel requirements and hours of operation. A number of new machines especially designed for minimum tillage planting, for example, make these practices attractive for some specific crops and soils. Minimum tillage for corn and soybeans can reduce energy requirements as much as 25%.

Field size, shape, topography, and row arrangement can have significant influences on fuel needs. Small or irregularly shaped fields with short rows result in low field efficiency, increased fuel consumption, and lowered machine capacity. Combining several small fields into a larger one with long rows will save fuel and time.

Tractor power and machine size should be carefully matched. This results in a field operation that makes efficient use of the tractor and tends to minimize fuel consumption.

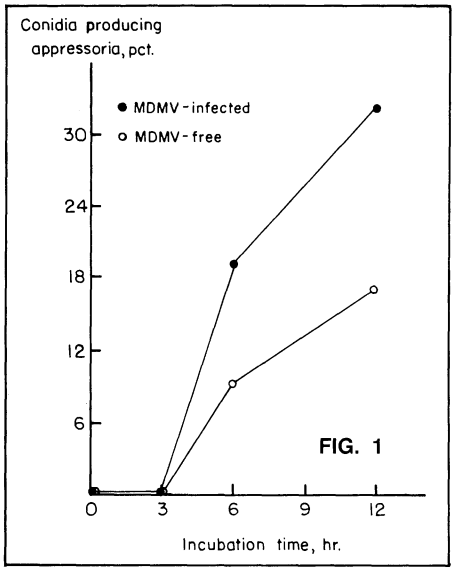


FIG. 1

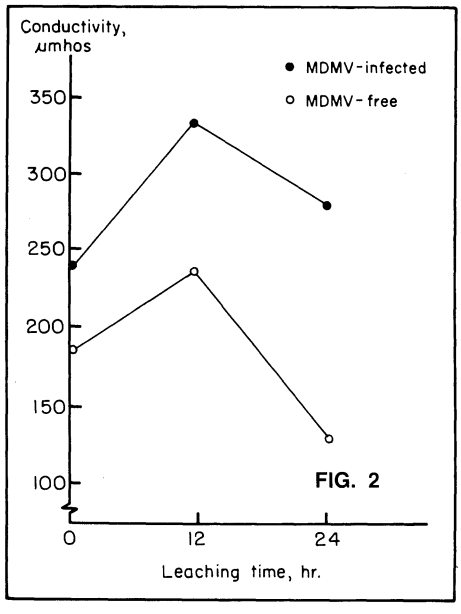


FIG. 2

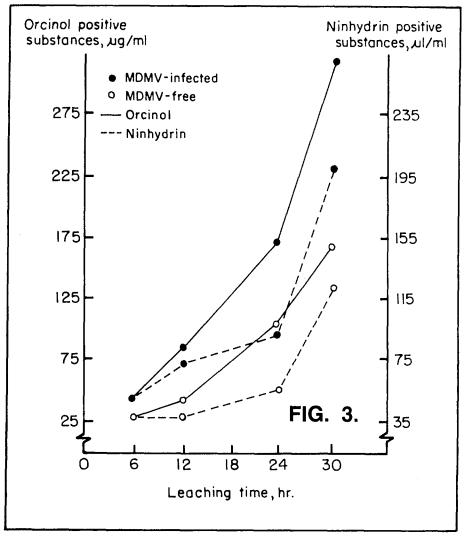


FIG. 3.

The Predisposing Effect of . . .

Maize Dwarf Mosaic Virus Infection . . . in Corn

CLAUZELL STEVENS and ROBERT T. GUDAUSKAS
Department of Botany, Plant Pathology, and Microbiology

MAIZE DWARF MOSAIC VIRUS (MDMV) is an important pathogen of corn in Alabama and other states. Not only are there direct detrimental effects from MDMV which can lead to reduced growth and yield, but it has also been established that corn plants infected with this virus are more susceptible to attack by root and leaf-infecting fungi.

Earlier work at the Auburn University Agricultural Experiment Station showed that Race T of the southern corn leaf blight fungus, *Helminthosporium maydis*, produced more and larger lesions on leaves of MDMV-infected corn than it did on virus-free corn. Recently, similar results were obtained using the more common Race O of the fungus. Some of this work, along with that aimed at determining possible mechanisms for this increased susceptibility of MDMV-infected corn, is summarized here.

Reactions On MDMV-Infected Plants

A drop of water containing conidia (spores) of *H. maydis* was placed on each of several leaf sections from MDMV-infected and virus-free plants. The leaf sections were incubated in moist chambers and the numbers of conidia that germinated and formed appressoria (pad-like structures that facilitate attachment and penetration by the fungus) were determined periodically. In another experiment, corn seedlings were inoculated with MDMV and after symptoms of virus infection appeared, the plants were sprayed with a suspension of *H. maydis* conidia. An equal number of virus-free seedlings were inoculated with the fungus to serve as controls. All plants were placed in moist chambers for 24 hours, and the numbers and lengths of *H. maydis* lesions were determined 24-48 hours later.

The percent germination of *H. maydis* conidia was similar on both types of leaf sections. However, twice as many conidia on MDMV-infected sections produced appressoria as those on virus-free sections, figure 1. Also, the fungus produced 37% more lesions on MDMV-infected seedlings and the lesions were 70% larger than those on virus-free seedlings.

From top: Appressorium formation by *H. maydis* conidia on leaf sections from MDMV-infected and virus-free corn seedlings; electrical conductivity of leachates from MDMV-infected and virus-free leaf pieces; and concentration of orcinol-and ninhydrin-positive substances in leachates from MDMV-infected and virus-free leaf pieces.

Analyses of MDMV-Infected Plants

Leaves were removed from MDMV-infected and virus-free corn seedlings and cut into small pieces that were suspended in sterile water in flasks on a rotary shaker. At intervals of time, samples were removed from the flasks and analyzed for electrical conductivity and for cations, carbohydrates, and amino acids and similar compounds leaked from the leaf pieces. In another experiment, intact, infected, and virus-free seedlings were suspended in water in flasks and the contents were sampled periodically and analyzed as above.

Samples from MDMV-infected plants showed 30-100% greater conductivity, figure 2, and 20-100% more orcinol-positive (some carbohydrates) and ninhydrin-positive (amino acids and similar compounds) substances, figure 3, than samples from virus-free plants. The samples from virus-infected plants contained 60-100% more copper and potassium ions than did those from virus-free plants. The total amino acid content of samples from MDMV-infected leaves was over twice that of samples from virus-free leaves. Seventeen amino acids were identified in the samples and all occurred in higher concentrations in samples from virus-infected leaves.

These results indicate that MDMV infection alters the permeability of affected tissues, and consequently there is an increased leakage of metabolites into intercellular spaces and onto leaf surfaces. These metabolites in turn could serve as nutrients for a subsequently invading pathogen like *H. maydis*, leading to greater and more rapid development of the fungus in the virus-infected plants. Further, the enhanced development of a pathogen like *H. maydis* on MDMV-infected plants could lead to greater production of spores or inoculum of the fungus available for dispersal to other plants.

BORON *deficiency* Tough on Plums

J. D. NORTON, Department of Horticulture
J. W. ODOM, Department of Agronomy and Soils
C. C. CARLTON and K. S. SHORT, Chilton Area Horticulture Substation

BORON DEFICIENCY isn't a new problem for Alabama plum producers. Deficiency symptoms were first observed on trees of the Ozark Premier variety in 1963 in central Alabama. Today the application of boron is considered essential for successful plum production.

Deficiency symptoms on fruit show up as brown sunken areas in the flesh varying from a single small spot to practically covering the entire fruit. The brown flesh beneath the sunken areas is firm in texture and in severe cases extends to the pit. Fruits showing symptoms of deficiency usually develop red color early and drop. Gum pockets may form in the flesh of the fruits that show deficiency symptoms. This will vary from a few fruits to the entire crop. Vegetative growth is affected only in cases of severe deficiency, with restricted growth and short internodes being characteristic symptoms.

Tree Life, Yield Reduced

Tree life and yield also are adversely affected by boron deficiency, as revealed in Auburn University Agricultural Experiment Station research. Severe deficiency resulted in heavy tree losses and decreased yields.

In preliminary tests (Experiment 1, Chilton Area Horticulture Substation), treatments of 0, 0.028, 0.057, and 0.085 lb. of boron per tree were tried on 5-year-old Ozark Premier plum trees. Diameter of the sunken areas of fruits decreased as the rate of applied boron increased. Deficiency symptoms appeared only on the first fruits to mature on trees receiving boron, table 1.

In a grower's orchard (Experiment 2, Marvin Durbin Orchard in Chilton County), treatments of 0, 0.028, 0.057, 0.085, 0.114, and 0.142 lb. of boron were applied to 5-year-old Ozark Premier trees that had severe deficiency symptoms. Fruit symptoms were similar to those from the preliminary study, table 1, but wide differences in tree longevity also were found. After 3 years, all trees that received 0.085 lb. or more of boron were alive, but all trees getting no boron applications were dead, as shown below:

Boron applied[1] per tree	*Number of dead trees*
None	16
0.028 lb.	9
0.057 lb.	5
0.085 lb.	0
0.114 lb.	0
0.142 lb.	0

Boron, Calcium Applied

A planting of Ozark Premier trees (Experiment 3, Chilton Area Horticulture Substation) was made during the winter of 1970-71 to learn how boron and calcium interact to affect the expression of boron deficiency symptoms. Results were similar to those reported in table 1. Deficiency symptoms were corrected by application of either boron or calcium alone, as well as by applying both nutrients together. Yields of marketable fruit increased with applied boron and calcium, as shown by the percentages of fruit that were free of boron deficiency symptoms, table 2.

Boron deficiency symptoms have not developed on all varieties. However, regular application of boron is suggested to avoid boron deficiency. The suggested rate is 1 lb. of boron per acre (5 tablespoons borax per tree) annually. In addition, soil pH of 6.5 to 7.0 should be maintained.

TABLE 1. EFFECT OF BORON ON THE DIAMETER OF SUNKEN AREAS ON PLUM FRUIT

Experiment[2]	Diameter of sunken areas, by lb. of boron/tree[1]					
	0	0.028	0.057	0.085	0.114	0.142
	In.	*In.*	*In.*	*In.*	*In.*	*In.*
1	0.10	0.04	0.03	0.02	—	—
2	.18	.13	.10	.08	.08	.08

[1]Fertilizer borate-65, concentrated, applied uniformly to drip of tree from September 20 to September 30.

[2]Boron (B) was 0.09 p.p.m. in Experiment 1 and 0.04 p.p.m. in Experiment 2 in soils at beginning of the experiments.

TABLE 2. EFFECT OF BORON AND CALCIUM ON YIELD OF OZARK PREMIER PLUM TREES, EXPERIMENT 3[1], CHILTON AREA HORTICULTURE SUBSTATION, CLANTON

Boron and calcium applied per tree[1]	Total yield per tree	Fruit free of boron deficiency symptoms	Diameter of sunken areas
	Lb.	*Pct.*	*In.*
None	21.4	49.6	0.15
0.028 lb. B, no Ca	22.1	90.7	.06
0.057 lb. B, no Ca	28.0	87.7	.05
Ca spray[3] only	24.5	86.4	.06
0.028 lb. B+Ca spray	33.4	83.4	.05
0.057 lb. B+Ca spray	40.9	90.6	.05

[1]Boron (B) and calcium (Ca) were 0.08 p.p.m. and 531 p.p.m., respectively, in soil at beginning of experiment.

[2]Fertilizer borate-65, concentrated, applied uniformly to drip of tree from September 20 to September 30 each year.

[3]The calcium spray contained 3 lb. of $CaCl_2$ per 100 gal. Four applications were made, at weekly intervals, beginning after petal drop.

[1]Fertilizer borate-65, concentrated, applied uniformly to drip of tree from September 20 to September 30 each year.

Variety test plots, March 22, 1979, at the Wiregrass Substation (left) show differences in date blooming begins; rape ready for harvest on May 7, 1979 (right) at Plant Breeding Unit.

RAPE Crop of the Future For Alabama?

C. S. HOVELAND, J. W. ODOM, and R. L. HAALAND[1], Department of Agronomy and Soils
W. B. WEBSTER and V. H. CALVERT, II, Tennessee Valley Substation
F. T. GLAZE, Prattville Experiment Field
L. A. SMITH and H. W. GRIMES, Black Belt Substation
J. G. Starling, Wiregrass Substation
E. L. CARDEN, N. R. McDANIEL, and F. B. SELMAN, Gulf Coast Substation

RAPE MAY OFFER a new double-cropping opportunity for Alabama farmers. This oilseed crop is grown in the winter, so it may be a suitable cash crop for double-cropping with soybeans or grain sorghum.

A relative of the turnip, rape is an upright annual plant that can be planted in October or early November. It grows during winter and produces bright yellow flowers in March or April, depending on variety. Seed mature and can be harvested in May.

Varieties have been developed that produce large quantities of seed containing 31-35% high quality oil. The oil can be processed and utilized similar to soybeans, except for some varieties containing erucic acid which prevents its use for vegetable oil.

Seed yields of rape can be as high as in 1978 when caged plots in an Auburn University Agricultural Experiment Station forage test made 3,600 lb. per acre. This production was made with the Dwarf Essex variety at the Plant Breeding Unit, Tallassee. Harvested yields in variety trials during the past 2 years have been much lower, however, as shown by data in the table. These low yields were largely a result of shattering losses from heavy rains.

A heavy seed crop was produced at the Gulf Coast Substation, Fairhope, in 1980, but most of it shattered. Some varieties are more shatter resistant than others. Several experimental lines grown in 1980 exhibited exceptionally good shatter resistance.

Rape can be grazed for forage, but in the Auburn trials, removal of leaves in fall and winter reduced oilseed production. Thus, rape that is grown for oilseed should not be grazed.

Since rape is not a legume, nitrogen fertilization appears necessary for good production. Early application is needed to encourage fall and early winter growth, and winter application is needed to assure good seed yields. Rape also has a high requirement for both boron and sulfur.

Only one insect pest, aphids, has been noted on rape in Alabama. Aphid attacks are especially damaging during blooming. Effective insecticides are available for aphid control.

Because of its winter growth habit, rape may fit into rotations with soybeans or grain sorghum. This would provide cover for the land during winter, reduce soil erosion, and furnish income between summer crops. At present there is no market for rape in the Southeast as there is in western Canada and Europe where it is an important oilseed crop. Research is continuing to find varieties adapted to Alabama.

SEED YIELDS OF FOUR RAPE VARIETIES AT FIVE ALABAMA LOCATIONS

Location	Yield per acre, by variety			
	Gullivar	Brink	Midas	Dwarf Essex
	Lb.	*Lb.*	*Lb.*	*Lb.*
Tennessee Valley Substation, 1 year	700	1,430	*	1,000
Prattville Experiment Field, 2 years	1,430	1,480	1,070	1,300
Plant Breeding Unit, 2 years	1,310	930	1,010	880
Wiregrass Substation, 1 year	670	—	330	—
Gulf Coast Substation, 2 years	810	—	240	540

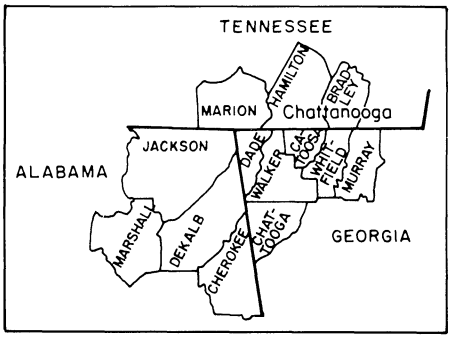
*Winter killed.

[1]Resigned.

POTENTIAL for expanded sales of local produce:

A Case Study of the Chattanooga Trade Area

JOHN ADRIAN
Department of Agricultural Economics and Rural Sociology



MARKETING is a crucial aspect of any farm business. Ultimate success of the firm hinges to a large extent on its ability to locate and utilize viable markets. This is especially true for fruit and vegetable operations which produce for the fresh market. Direct market outlets such as farmers' markets, roadside stands, pick-your-own operations, peddlers, and even wholesalers and retailers have received increased attention in recent years in this respect.

Little current information exists concerning the status and potential of fresh fruit and vegetable production and marketing in a region outside the traditional fruit and vegetable supply areas. Thus, research was initiated by Auburn University's Agricultural Experiment Station in cooperation with the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority to describe and analyze the existing fruit and vegetable marketing system in the Chattanooga, Tennessee, area. Special emphasis was given to examining the potential for expanded sales of locally grown produce to wholesalers and retailers and through direct market outlets in 13 counties in the tri-state area.

Data were collected from 18 produce wholesalers and 52 retail food stores in the Chattanooga metropolitan area and 108 fruit and vegetable producers in the Chattanooga trade area, see figure. These surveys were completed between June and August 1979.

Analyses of farmer, wholesaler, and retailer data indicated that much latent potential existed for expanded sales of locally grown produce in the Chattanooga area. However, markets were not readily available to farmers because many impediments to entry and use were present, especially for wholesale and retail outlets. On the farmers' side of the market, fruits and vegetables were often being produced on small operations which lacked the labor, volume of product, and manager's time to meet the requirements of the market. Producers were often older individuals or part-time farmers who were attempting to supplement their income; i.e., they were not full-time produce farmers. These characteristics plus the farmers' preference for direct markets, especially farmers' markets, resulted in infrequent marketings to wholesalers and retailers. Farmers seemed to be generally satisfied with markets even though the availability of buyers and distance to markets were commonly expressed problems.

There was little reason to believe that producers in the area had the willingness or desire to initiate an expansion in production. Overall, only half of the producers felt "good" about the future of their fruit and vegetable operation. Further, in terms of production, farmers indicated indifference to hypothetical higher price levels. Insufficient labor, health and age of the operator, and lack of time were frequently mentioned reasons for this lethargy.

On the demand side of the market, wholesalers and retailers were basically pessimistic concerning the relationship of local farmers to their businesses. Managers of both outlets indicated that they were willing to purchase locally grown produce if reasonable quality and price levels could be achieved. Both wholesalers and retailers identified the primary impediment to purchasing locally grown produce as the inability of farmers to provide a dependable volume of a quality product for a reasonable period of time, generally about 2 months. A few outlet managers indicated that they had established a good relationship with a few producers who could meet the needs of the marketplace. However, in other cases, problems of grading, packaging, and handling locally grown produce precluded a viable relationship.

Given the characteristics of participants in this market and the requirements for effective entry, it would seem doubtful that wholesale and retail outlets could be developed and utilized adequately by local producers. For example, assuming that all production was identified in the Chattanooga area, all of it met grade standards for wholesale and retail markets, the percentage of production was evenly marketed by weeks, and all of the local produce was marketed through retail outlets in Chattanooga, local producers could provide 69% of the tomatoes, 32% of the sweet corn, 24% of the okra and field peas, and 19% of the green beans, and 15% of the watermelons within the peak production month. Thus, with the exception of tomatoes, local producers had the potential to satisfy only a small portion of the retail demands even in the peak production month with all production marketed at these outlets. Even then, this would entail cooperation among farmers in terms of volume, assembly, handling, grading, and packaging, an unlikely occurrence. Also, retail outlets must be willing and able to disrupt their normal supply channels to accept this produce for a short time period. This analysis was not intended to present wholesale and retail outlets as prime alternatives for producers. It was intended to provide an illustration to the substantial expansion in use of these outlets that could occur under the appropriate circumstances.

Given the extent and nature of fruit and vegetable production in the Chattanooga area, expanded utilization of direct markets seemed to be the most favorable alternative. Farmers were generally satisfied with these outlets although they expressed some dissatisfaction with prices received and market availability. Market alternatives were evident in the area because the majority of the farmers used at least two outlets. However, they expressed a desire for more farmers' markets. Even with more farmers' markets and the availability of other direct market outlets, marketing can be a problem. As one farmer indicated, sitting in the open air or sun for a long period of time with little produce and few customers is often an unpleasant experience.

The Relationship of Intermittent Dark or Lighted Periods to the Performance of SCWL Hens

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

A GOOD DEAL of interest has been generated in intermittent lighting regimes for chickens during the past decade. Most of the research has dealt with broilers and generally encompassed repetitive short periods of light and dark. This essentially resulted in intermittent activity and feeding with improvements in feed conversion. More recent work with commercial layers has produced similar results. However, a totally-enclosed, environmentally-controlled house is necessary and few totally-enclosed poultry houses exist in Alabama. Consequently, a study was designed to further investigate the basic principles of intermittent lighting regimes and their possible utilization in open poultry houses.

Twenty HISEX SCWL hens were housed at 22 weeks of age in each of five environmental chambers at the Avian Environmental Physiology Laboratory at Auburn University's Agricultural Experiment Station. The chambers were maintained at 75°F and 40% relative humidity throughout the 40 weeks of production. The 20 hens were divided into two replicate groups so feed consumption could be determined on a weekly basis. Egg production was determined daily on an individual hen basis. Average time of lay, egg weight, and shell quality (specific gravity) were determined from 4 consecutive days at 4, 8, and 32 weeks of production.

Five different lighting regimes were employed. The control regime was 15 hours of light (15L) followed by 9 hours of dark (9D) thus producing a 15L:9D cycle. This and the remaining cycles began at 7 a.m. (c.s.t.). The second cycle was 15L:5D:1L:3D. This was designed to mimic the midnight feeding often used during hot weather. The third cycle was basically a 15L:9D cycle. However, a 1D period was imposed during the 15L so the cycle changed daily. The 1D was moved backward so daily cycles of 14L:10D, 13L:1D:1L:9D, 12L:1D:2L:9D, etc., were produced. This unusual regime was employed to illustrate two important principles. First, a bird essentially ignores a short dark period between two lighted periods with respect to daylength. Simply stated, the bird considers daylength to be the period from the beginning of the first lighted period to the end of the second. However, the bird probably does consider the dark period important with respect to synchronizing important metabolic events. Second, a bird can "store" lighting information for several days so a reduced photoperiod restored to normal within several days should not harm reproductive performance. The fourth cycle of 1L:1D:13L:9D was designed to subject the hens to a dark period early in the day. The fifth cycle of 13L:1D:1L:9D was designed to expose the hens to a dark period late in the day. Both of the latter cycles could be employed in open houses.

The results of the experiment are shown in the table. The 15L:9D cycle should be considered a normal management situation and represents the control. Only the 13L:1D:1L:9D cycle significantly affected the average time of lay with these hens laying eggs 36 minutes earlier than any other cycle. This cycle also produced the only significant improvement in egg production when compared to the control group (15L:9D). This improvement in egg production was also reflected in the numerically best feed conversion. However, the 13L:1D:1L:9D cycle also exhibited the lowest egg weight. Therefore, this cycle produced more eggs by reducing egg size. A simple calculation reveals that the total pounds of eggs produced was the same for both the 13L:1D:1L:9D and 15L:9D cycles.

The 15L:15D:1L:3D cycle resulted in the lowest egg production. However, it should be noted that this cycle performed as well as any other treatment initially. It would appear this type of cycle has adverse effects on a long-term basis.

The performance of the 15L(1D):9D cycle indicated that SCWL hens are quite flexible with respect to their lighting cycles. The hens demonstrated an ability to perform on reduced daylength on 2 out of 15 days. This supports the idea that hens can "store" the daylength for several days. In a practical sense, the egg producer can correct short-term problems with time clocks (i.e. power interruptions) with minimal damage.

A comparison of all the performance factors revealed that the 1L:1D:13L:9D cycle was equal to or exceeded the control (15L:9D) in all categories. This was noteworthy since it may be possible to use this in an open house situation.

The results of this research indicate that with further research in avian environmental physiology and applied management technology, the benefits of intermittent lighting can be extended to open-type houses.

RELATIONSHIP OF SPECIFIC LIGHTING REGIMES TO PERFORMANCE OF SCWL HENS DURING 40 WEEKS OF PRODUCTION

Lighting regime[1]	Average time of lay	Hen-day production, pct.	Feed conversion, lb./doz.	Egg weight, oz./doz.	Egg specific gravity
15L:9D	12:25	84.04	3.45	24.19	1.0836
15L:5D:1L:3D	12:32	80.07	3.56	23.46	1.0837
15L(1D):9D[2]	12.29	85.56	3.65	24.45	1.0854
1L:1D:13L:9D	12.11	87.29	3.43	24.14	1.0851
13L:1D:1L:9D	11:35	88.39	3.19	23.14	1.0833

[1]L refers to continuous lighted hours, D refers to continuous dark hours. All regimes begin at 7 a.m. (c.s.t.).

[2]The 1D period was moved backward through the 15L period on a daily basis so that a complete cycle was completed every 15 days. Therefore, this regime produced a 14L:10D cycle on 2 days and an intermittent cycle on 13 days.

Soiling and Soil Removal Traits of Flame Retardant Cotton-Polyester Blend Fabrics

IAN R. HARDIN and
CAROL L. WARFIELD
Department of Home Economics Research

THE INFLUENCES OF FINISHES on the soiling characteristics of cotton with polyester blend fabrics have been extensively investigated. The fact that such finishes may increase soiling and decrease soil removal became evident during the early 1960's when resins were applied in significant add-ons to cotton to achieve durable press properties. The increased problems with soiling were caused by either the increased softness of the surface of the fiber, in which soil particles became embedded, or an increase in the hydrophobicity of the fiber surface caused by the finish.

The passage of the 1967 amendment to the Flammable Fabrics Act of 1953 brought about the enactment of several standards for textile products. Interest in developing effective flame resistant finishes for cotton with polyester blend fabrics was stimulated by the proposed general apparel flammability standard put forward in 1979 by the Consumer Product Safety Commission (CSPC). Since cotton with polyester fabrics are ubiquitous in the marketplace, the necessity for finding flame-retardant systems for these fabrics was evident. Several potential finishes to apply to cotton with polyester blend fabrics were developed under the encouragement of a large National Bureau of Standards grant administered by Clemson University.

The research described herein was done at Auburn University and was supported by the USDA Textiles and Clothing Laboratory at Knoxville, Tennessee. The purpose of the research was to determine the effectiveness of the flame retardant (FR) finishes on the soil and soil removal characteristics of the cotton with polyester blend fabrics.

Four, 50% cotton with 50% polyester fabrics were examined. They were untreated (A), treated with a dimethyloldihydroxyethyleneurea (DMDHEU) durable press finish (B), treated with decabromodiphenyloxide - antimony oxide (DBDP) finish with a polyacrylate binder (C), and the same DBDP finish, but with a polyurethane binder (D). The soiling conditions included a particulate soil (BB), particulate bound to mineral oil (BB+0), and particulate bound to artificial sebum, human skin oil (BB+S). The laundering conditions included four types of detergents with water of varying mineral hardness.

Table 1 gives the flammability characteristics for the fabrics. Neither flame resistant fabric was durable to 50 launderings. Both the vertical flame test and the oxygen index, as well as nitrogen and bromine analyses, indicate that considerable flame retardancy was lost during the launderings.

Tables 2 and 3 give the results for soil present on the fabric after soiling and soil removal after laundering, respectively. The results show that the untreated and durable press fabrics had higher levels of both soil pickup and soil removal than the FR finished fabrics. As the number of laundering cycles increased, the percent soiling tended to increase slightly, though the largest increase came after the first soil/laundering cycle. Although the work is not conclusive, the FR fabric seems to bind the soil more tenaciously than the untreated and DP fabrics, and may require either modification of the finish for further soil release or a modified detergent formulation.

TABLE 1. EFFECT OF LAUNDERING ON FABRIC FLAMMABILITY

	Vertical flame test[1] (char length)		Oxygen index	
	Warp	Filling	Warp	Filling
	Cm	*Cm*	*Pct.*	*Pct.*
Fabric A				
1 laundering	BEL[2]	BEL	18.0	18.0
50 launderings	BEL	BEL	17.7	17.8
Fabric B(DP)				
1 laundering	BEL	BEL	19.8	20.0
50 launderings	BEL	BEL	19.2	19.0
Fabric C (FR-A)				
1 laundering	1.3	3.1	30.8	30.6
50 launderings	BEL	BEL	23.0	23.0
Fabric D (FR-U)				
1 laundering	3.4	7.3	26.4	26.8
50 launderings	BEL	BEL	19.7	19.8

[1]According to FF-3-71 Standard.
[2]BEL = burned entire length.

TABLE 2. SOIL PRESENT (PCT.)

Soiling cycle	Fabric			
	A (untreated)	B(DP)	C(FR-A)	D(FR-U)
1	26.8	30.6	24.9	18.0
2	29.4	29.7	28.2	23.1
3	28.8	28.9	26.4	26.5
4	30.7	30.0	28.0	30.7
5	31.8	31.0	27.9	32.4
Av.	29.5	30.0	27.1	26.1

TABLE 3. SOIL REMOVAL (PCT.)

Soiling cycle	Fabric			
	A (untreated)	B(DP)	C(FR-A)	D(FR-U)
1	61.6	60.9	34.0	28.8
2	42.1	43.4	37.4	24.7
3	30.8	33.7	26.5	20.6
4	25.0	26.8	24.5	23.2
5	23.5	28.7	23.0	31.7
Av.	36.6	38.7	29.1	25.8

AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY
AUBURN UNIVERSITY, ALABAMA 36849
Gale A. Buchanan, Director
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