HIGHLIGHTS

of agricultural research

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Agricultural Experiment Station
AUBURN UNIVERSITY

DIRECTOR'S COMMENTS

E. V. Smith

NEARLY A GENERATION AGO, a leading farmer asked my predecessor, "Dean, what per cent of your students go back to the farm?" Just recently another leading farmer asked me essentially the same question. His question was specifically, "What do the graduates of the School of Agriculture do?" The similarity of the two questions asked about 40 years apart made me stop and think.

I remember that my predecessor had replied to his questioner, "In round numbers, zero." It is significant to note that in those days Auburn offered only two agricultural degree courses – Agricultural Science and Agricultural Education.

In contrast, today some of the better farmers in Alabama are graduates of the School of Agriculture. Some, particularly in northern Alabama, are mechanized cotton farmers. Many are growing soybeans or peanuts. Others are cattlemen, dairymen, swine producers, or engaged in some phase of the poultry business. Smaller numbers specialize in truck crops, fruits, or even pecans.

Compared to the limited degree courses of my predecessor's time, the School of Agriculture has major curricula in Agricultural Science, Agricultural Business and Economics, Agricultural Engineering, Biological Sciences, Forestry, and Ornamental Horticulture.

Furthermore, a student in Agricultural Science may major in Animal Science, Dairying, Poultry, Agronomy or Horticulture; one in the Biological Sciences in Botany, Entomology, Fisheries, Wildlife, Zoology, or even Marine Biology; and one in Forestry in Forest Management or Wood Technology. There's no simple answer to my friend's question, "What do your graduates do?"

We've already seen that many of them are successful farmers. They man professional agricultural agencies such as the Extension Service and the Soil Conservation Service. They fill staff positions in farm and commodity organizations. Agribusiness has employed a large percentage of graduates during the past 10 years.

They are agricultural engineers, employed in the farm machinery industry or in soil and water conservation. They are foresters working in the pulp and paper or other timber industries. They are nurserymen or greenhouse and garden center operators; wildlife management specialists with State and Federal conservation agencies, and leading fisheries experts in many parts of the world.

They are agricultural and biological scientists. They are teachers, research workers, and administrators in colleges and USDA.

Graduates of Auburn's School of Agriculture are in every facet of the basic industry broadly defined as American Agriculture.

look for these articles

may we introduce . . .

Dr. Claude H. Moore relates the history of the Department of Poultry Science in the story on page 11. He joined the staff of the Agricultural Experiment Station in 1956.

Moore is a native of Hanceville, Cullman County Alabama. He received the B.S. degree from Auburn University in 1947, M.S. from Kansas State College in 1948, and Ph.D. from Purdue University in 1952.

Before joining the staff at Auburn Dr. Moore served as a graduate teaching assistant at Kansas State College for 2 years; research assistant and assistant professor at Purdue University for 8 years; and assistant coordinator Regional Poultry Breeding Projects with the U.S. Department of Agriculture. At Auburn he has been associate professor and associate poultry husbandman and professor and head of the Department.

He is a member of Alpha Gamma Rho, Gamma Sigma Delta, Alpha Zeta, and Sigma Xi. In addition he is a member of various professional societies.

HIGHLIGHTS of Agricultural Research

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ON THE COVER. Row at left, cultivated June 12, and one at right that was uncultivated until July 18 show effect of early season weeds. Photo made late July.

ZOYSIAGRASS RUST

ROBERT T. GUDAUSKAS, FERNANDO J. SUBIRATS, and J. A. LYLE

Department of Botany and Microbiology

ALABAMA HOMEOWNERS often notice that their zoysiagrass lawns take on a red-yellow to orange cast during the summer. Lawn equipment, shoes, and bare feet become discolored with "red dust" after passage through the grass. The red dust is actually masses of spores of the fungus, *Puccinia zoysiae*, which attacks zoysia and causes the disease known as rust of zoysiagrass or zoysia rust. The fungus is closely related to those that cause the famous rusts of grain crops.

Zoysiagrass rust was discovered in Maryland, Missouri, and Florida in 1965, and is now known to occur generally throughout the Southeast. The disease was reported from Alabama in 1966; however, the widespread occurrence and often severe character of rust at that time indicated it had probably been present but overlooked in previous years.

In lawns around Auburn, rust usually appears in early May and continues to build up during the month reaching peak incidence throughout June. Incidence declines by mid-July and the disease often disappears during late July and early August. Frequently, outbreaks reoccur during the late August-early September period. The most conspicuous signs of the disease are the masses, or pustules, of orange-colored spores along leaf blades. Pustules turn brown to black as they age. Observations in Alabama and other states have indicated that disease incidence is usually higher in shaded areas.

In 1969, experimental plots were established in widely-separated, rusted zoysiagrass lawns in Auburn to evaluate effectiveness of selected fungicides for controlling the disease. Fungicides tested along with rates (amount in 5 gal. water to spray 1,000 sq. ft. of lawn) were: benomyl (Benlate 50W) – 5 oz.; tetradifon (Daconil 2787 75W) – 4 oz.; dyrene (Dyrene 50W) – 4 oz.; zinc ion + maneb (Dithane M-45, Fore 80W) – 4 oz.; hexachlorophene (Nabac 25 EC) – 0.2 oz; and plantvax (Plantvax 75W) – 1½ oz. All materials were applied with hand sprayers on weekly, biweekly, and monthly schedules from June to August. Plots were rated weekly for rust incidence on a 0-3 scale where 0 = no rust, 3 = heavy rust.

In 1970, tests were conducted in a similar manner except that fungicides were applied as preventive treatments on some non-rusted grass in early May and at intervals thereafter as needed (rust rating of 1 or higher). Additional fungicides or mixtures with rates tested were: maneb (Tersan LSR 80W) – 4 oz.; 12 oz. Dyrene + 6 oz. Plantvax/gal. – 1 qt.; 12 oz. folpet (Phaltan) + 12 oz. Daconil 2787/gal. – 1 qt.; 3:1 blend Dyrene 50W + Plantvax 75W – 8 oz.; and 2.3% Plantvax granules – 5.5 lb.

Test results for the 2 years (1969, 1970) were similar. All fungicides tested reduced rust incidence as compared to unsprayed plots. Data for the most effective treatments are illustrated in Figures 1-3. Adequate control with two applications was obtained with Plantvax, Figure 1, and Plantvax + Dyrene, Figure 2. Disease incidence was reduced with three applications of Phaltan + Daconil 2787, Figure 1, and with four applications of Benlate, Figure 2, Daconil 2787, and Tersan LSR, Figure 3. Early application (May 6) of Plantvax or Plantvax + Dyrene delayed disease appearance approximately 2 weeks. As in previous years, rust disappeared in mid-July but reappeared in late August.

Data from 2 years' testing indicate rust can be controlled, but not completely eradicated, by presently available fungicides. Future research with additional materials, rates, and times of application may reveal more effective controls. This research has underscored the importance of applying a fungicide to rusted zoysiagrass. Turf in some unsprayed plots has appeared less vigorous and shown evidence of thinning out as compared to that sprayed with most of the fungicides tested.

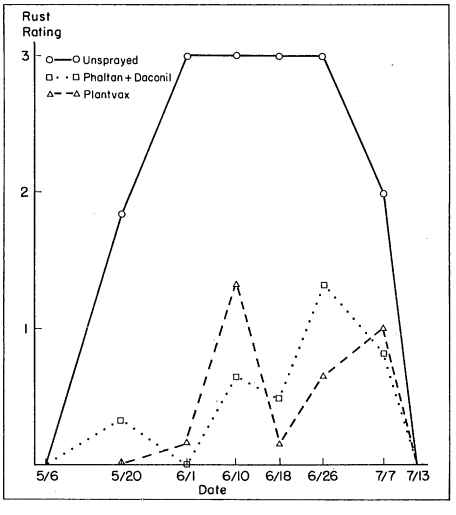


FIG. 1. Rust incidence in zoysiagrass plots treated with Plantvax on 5/6 and 6/12; Phaltan + Daconil 2787 on 5/6, 6/12, and 6/26; or unsprayed.

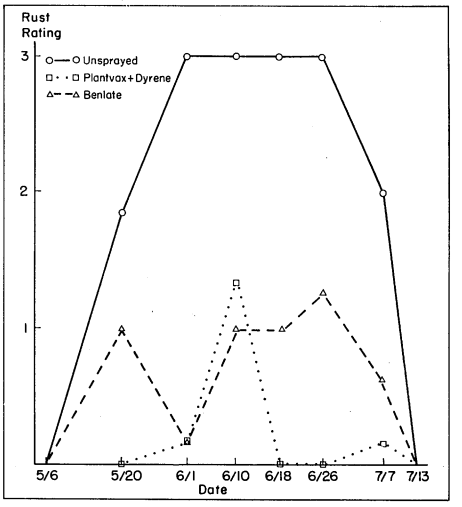


FIG. 2. Rust incidence in zoysiagrass plots treated with Plantvax + Dyrene on 5/6 and 6/12; Benlate on 5/6, 5/22, 6/12, and 6/26; or unsprayed.

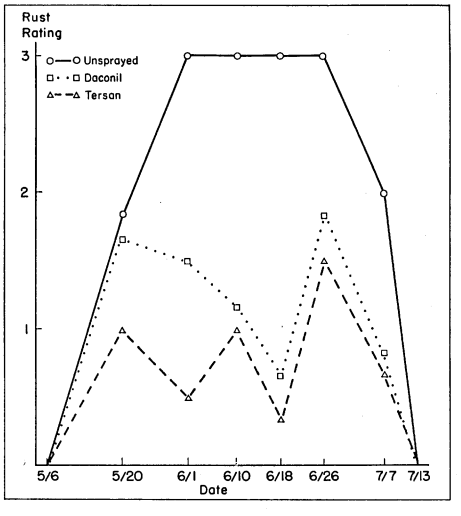
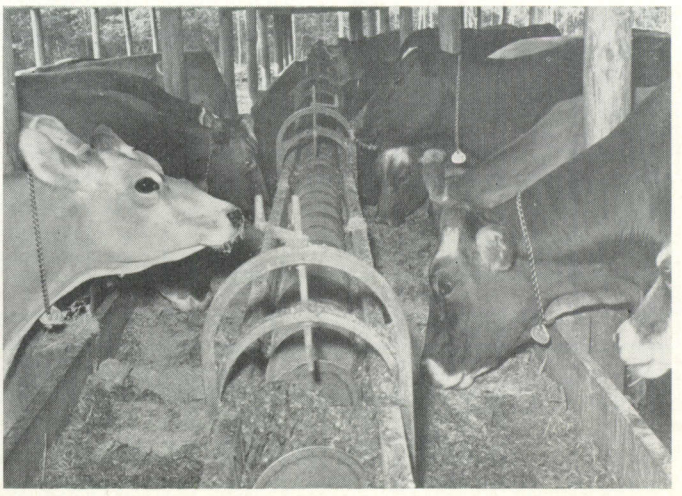


FIG. 3. Rust incidence in zoysiagrass plots treated with Daconil 2787 or Tersan LSR on 5/6, 5/22, 6/12, and 6/26; or unsprayed.

Using Chopped Hay in Blended Dairy Rations

J. A. LITTLE
Department of Animal and Dairy Sciences



BLENDED RATIONS represent one of the newer approaches to feeding dairy cattle. Interest in this type of ration has been stimulated by the continued increase in herd size and the increased cost and decreased availability of labor.

In Alabama and throughout much of the Southeast, corn silage, Coastal bermudagrass hay, and johnsongrass hay represent the principal harvested forages used in dairy rations. Of these only corn silage has been used extensively in blended rations. Coastal and johnsongrass hays generally are fed in the long form.

If dairymen are to utilize these hays as sources of forage in blended rations, animal performance must be determined and problems associated with feeding identified. To resolve these questions a study involving three blended rations fed to 12 lactating Holstein and Brown Swiss cows in a switchback design with three 28-day periods was conducted in 1969-70 by the Agricultural Experiment Station at Auburn. Cows were housed and fed in individual stalls. To ensure that quantity fed would not be a limiting factor cows were fed more of their respective ration than they consumed.

Rations (dry matter basis) compared were: Ration I, 40% concentrates – 60% corn silage; Ration II, 60% concentrates – 40% Coastal hay; and Ration III, 60% concentrates – 40% johnsongrass hay. Ingredient and chemical composition data are given in Table 1. With minor exceptions the chemical composition of the rations were similar. The hays were coarsely ground (particles averaged ¾ to 1 in. in length) through a hammer mill equipped with a 1-in. screen and blended with the concentrate ingredients in a horizontal mixer. Essentially no segregation of the hay and concentrate portions occurred during subsequent handling of the blended feeds. Corn silage and concentrates were mixed just prior to feeding.

TABLE 1. INGREDIENT AND CHEMICAL COMPOSITION OF EXPERIMENTAL RATIONS[1]

Ingredients	Rations		
	I	II	III
	Lb.	*Lb.*	*Lb.*
Ground shelled corn	200	200	200
Corn distillers' dried grain w/sol	290	390	390
Citrus pulp	100	400	400
Soybean meal (44% CP)	50	50	50
Molasses	100	100	100
Urea (45% N)	20	20	20
Salt, trace mineral	20	20	20
Dicalcium phosphate	20	20	20
Corn silage	1,107	-----	-----
Coastal hay (chopped)	-----	800	-----
Johnsongrass hay (chopped)	-----	-----	800
	Pct.	*Pct.*	*Pct.*
Crude protein	16.4	15.4	14.7
Crude fiber	15.6	16.9	17.4
TDN	64.3	61.7	61.7

[1] Silage and chemical composition values expressed on dry basis, other components on air dry basis.

Performance data are given in Table 2. Average daily FCM production by cows fed the Coastal (II) and johnsongrass (III) hay rations was almost identical and averaged about 7.5 lb. more than that produced by cows on the corn silage (I) ration. These differences were significant and were closely related to level of feed intake. Cows fed the silage ration failed to consume sufficient energy to support a higher level of milk production. In contrast, the additional energy consumed by cows fed the blended hay rations was more than sufficient to meet the energy needs for the extra milk produced. Accordingly, cows on the hay rations gained weight each period, whereas, those on the corn silage ration averaged losing a small amount of weight.

Percentages of milk fat, solids-not-fat, and milk protein were not affected significantly by the rations. In addition, no health disorders were observed that could be attributed to ration composition.

Results indicate that blended rations containing either 40% chopped Coastal or johnsongrass are palatable to dairy cows and will support high levels of milk production. However, the following factors relating to the physical nature of blended hay rations should be considered: (1) they are bulky, thus increasing size of storage space required; (2) due to the bulkiness they are not well adapted to completely mechanized feeding systems; and (3) chopping hay too fine may result in depression of milk fat per cent.

TABLE 2. PERFORMANCE OF DAIRY COWS FED BLENDED RATIONS CONTAINING CORN SILAGE, COASTAL HAY, AND JOHNSONGRASS HAY

Ration	Average responses					Ration intake/day[1]	
	FCM/day	Milk fat	Solids-not-fat	Milk prot.	Wt. chng./day	Per cwt.	Total
	Lb.	*Pct.*	*Pct.*	*Pct.*	*Lb.*	*Lb.*	*Lb.*
I	48.8	3.3	8.5	3.0	−0.2	2.86	37.2
II	56.4	3.4	8.6	3.0	+2.8	3.81	51.4
III	56.5	3.4	8.5	3.0	+1.0	3.87	51.3

[1]Dry matter basis. Dry matter contents of Rations I, II, and III averaged 47.7, 94.6, and 94.6%, respectively, as fed.

Slaughter Steers from Winter Grazing with Supplemental Feeding

W. B. ANTHONY, *Department of Animal and Dairy Sciences*
J. G. STARLING and C. A. BROGDEN, *Wiregrass Substation*
E. L. MAYTON and H. E. BURGESS, *Piedmont Substation*

OVER 10 MILLION CATTLE are fattened every year in the United States, most in feedlots handling more than 1,000 head annually.

Alabama has not developed a cattle feeding industry, but cattle population has increased rapidly to 17th among the states. This growth is based on a favorable environment for production of forage. Permanent pasture crops are widely grown in Alabama and are well suited for beef brood cows. But despite high total production, these warm season pastures do not produce the high quality feed needed for slaughter steers.

Cool Season Crops Better

Cool season annuals (rye, ryegrass, oats, wheat) can be grown throughout Alabama and these forages excel permanent pasture in nutritive value. In grazing trials, yearling cattle made excellent growth on these annuals without supplemental feeding. Steers gained around 400 lb. each on rye-ryegrass-clover pasture from November until the following May. Some cattle grown on this type pasture went directly from pasture to slaughter and yielded USDA Choice carcasses, but the usual grade was Good.

The demand for Choice beef generally calls for getting more finish on young cattle grazing cool season annuals. One method, to graze the animals after cool season grazing on permanent, warm season pastures, was tested at the Wiregrass Substation. Rye and ryegrass were sown on land immediately after harvest of either corn or peanuts and yearling cattle grazed this from early fall until mid-April. Cattle were removed from the pasture in April (so land could be prepared for a new crop) and divided into two groups for summer grazing on Coastal bermudagrass. One group was fed grain on pasture and the other was grazed without feed.

In 1968-69, yearling steers were stocked 2 per acre on the rye-ryegrass. They grazed it for 123 days and gained an average of 230 lb. each. Following winter grazing the steers grazed Coastal 157 days. Those not fed grain on this pasture gained an average of 164 lb. and those getting 6 lb. of feed daily averaged 205 lb. Stocking rate on Coastal was 2.8 steers without feed and 4 with feeding. Feeding on pasture raised slaughter grade of the steers – 18% Choice and 82% Good, as compared with 65% Good and 35% Standard for those pastured without feed.

Feeding on Cool Season Pasture

Feeding grain to yearling cattle on cool season annual pasture to improve finish, so steers could go to slaughter without holding for summer grazing, was investigated at the Wiregrass and Piedmont substations.

At the Wiregrass, steers grazed rye-ryegrass pasture established on fallowed land. Treatment groups were (1) grazed without supplemental feed, and (2) fed shelled corn on pasture, 5 lb. per day initially and increased to 7 lb. later in the period. Half of each treatment group was slaughtered at the end of cool season grazing and the others were drylot fed for 95-99 days.

Steers grazed on rye-ryegrass without feed gained an average of 260 lb. the first year and 233 lb. the second year. Those getting shelled corn averaged 267 lb. gain the first year and 246 lb. the second. This shows only slight per animal gain increases by feeding shelled corn. But an important result was the increased stocking rate from supplemental feeding. The increase was 1.1 and 1.49 steers per acre for first and second years. Of equal importance, the feeding improved carcass grades. Directly off pastures, carcasses were 87.5% Good for those fed on pasture, but only 37.5% Good for those not fed.

In contrast to the Wiregrass test, pastures at the Piedmont Substation had arrowleaf clover seeded in the rye-ryegrass. These pastures furnished grazing for 209 days during 1969-70, as compared with only 133 days for the rye-ryegrass at the Wiregrass. Steers grazing the rye-ryegrass-Yuchi arrowleaf pastures without supplemental feed gained an average of 380 lb. Those full-fed shelled corn (9.9 lb. daily) gained 412 lb.

Stocking rate at the Piedmont Substation was 1 animal per acre. The two groups of cattle were rotated, so stocking rate differences because of feeding could not be measured. However, there was more surplus forage when corn was fed. When slaughtered directly off pasture, 55% of the Piedmont cattle fed corn yielded Choice carcasses. Without grain, only 21% graded Choice.

The research reported is still in progress, but results to date suggest that feeding shelled corn on rye-ryegrass pasture (1) permits higher stocking rate, and (2) improves grade of animals slaughtered directly off the pasture.

FEEDING SHELLED CORN TO YEARLING CATTLE GRAZING RYE-RYEGRASS PASTURE

Item	Pasture only		Pasture + corn	
	First year	Second year	First year	Second year
Wiregrass Substation				
Steers, number	16	13	24	16
Days on pasture	140	133	140	133
Average initial weight, lb.	382	562	434	584
Average final weight, lb.	642	795	700	830
Average daily gain, lb.	1.86	1.75	1.90	1.85
Animals per acre	2.30	1.94	3.40	3.43
Piedmont Substation				
Steers, number	14		14	
Days on pasture	209		209	
Average initial weight, lb.	543		543	
Average final weight, lb.	923		955	
Average daily gain, lb.	1.82		1.97	
Animals per acre	1		1	

PRECOMMERCIAL THINNING OF LOBLOLLY PINE STANDS

L. E. DeBRUNNER, *Department of Forestry*

W. J. WATSON, *Lower Coastal Plain Substation*

A COMMON PROBLEM associated with natural seedling stands of loblolly pine in Alabama is that too many seedlings become established and subsequent growth of individual trees is not satisfactory. Although dominant trees will express themselves and stands do not stagnate, the length of time required for crop trees to overcome competition and reach merchantable size is increased and potential income is delayed.

To help alleviate this problem, a study was established in 1967 to evaluate hand and mechanical thinning procedures. Three locations were selected; one at the Lower Coastal Plain Substation, Camden, and two on the holdings of Wilmon Timberlands of Vredenburgh. At each location three plots were established to test possible treatments. Treatments applied were hand thinning (using an ax or brush ax) to approximately an 8- x 10-ft. spacing; mechanical thinning using a heavy disk behind a large crawler tractor that resulted in narrow strips of trees (approximately 2 ft. wide) between disked strips about 10 ft. wide; and a check (no treatment).

At the outset of the study, pine stems per acre in these 8-year-old stands numbered as high as 11,000 and averaged about 8,000. For comparison, an 8- x 10-ft. spaced plantation requires only 545 seedlings per acre. This indicates that the initial stocking was almost 16 times that usually deemed necessary for adequate stocking if the seedlings are uniformly distributed.

By 1970, the unthinned (check) plot stockings had been reduced through natural mortality to an average of 3,618 stems per acre. This is still more than 6 times the amount necessary for adequate stocking.

FIG. 1. Hand thinning treatment after one growing season.

The disking treatment presumably reduced stocking to more desirable levels. However, growth on individual stems, as shown by height and diameter measurements for 1970, Table, was less for the disked plots than for the check plots. In fact, the results tend to indicate that disking was detrimental to growth. This is probably caused by two factors. Disking was not selective and trees left on plots were left solely because of position and not on the basis of growth performance up to the time of treatment. Numerous trees beginning to express dominance were eliminated in the disking treatment. The disking also damaged root systems of trees that were left and recovery from this root injury has not yet been sufficient to allow trees to take advantage of reduced competition for light, moisture, and nutrients.

The hand thinning treatment has resulted in a near doubling of diameter. This is probably a direct response to the selectivity of the method; the more competitive, faster growing (larger) trees were those left to continue their growth. Trees removed were primarily those that were suppressed (smaller) and poorly formed.

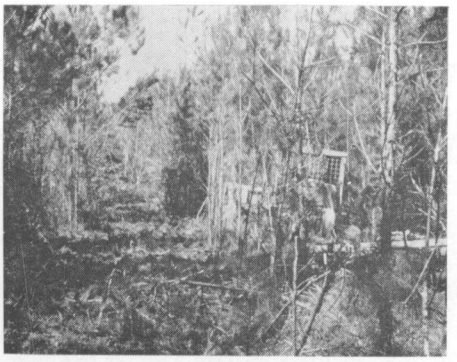


FIG. 2. Strip disking treatment at time of application.

Again, there was no significant height growth response to the thinning process. This was to be expected as site quality, rather than competition, is recognized as having more effect on height growth. No treatment in this study could be construed as an attempt to improve site quality.

The evaluation of what the increased returns to the landowner might be is presently impossible. However, hand thinning most certainly has shortened the time before which a commercial thinning can be made. The hand thinning method does not lend itself to large scale operations, though it could be a very useful tool for the small landowner who lives on or near his timberland. No costly equipment is necessary and only limited skill in selecting trees to be left is required. Such thinnings should be carried out during cold weather, but the landowner still must be prepared to spray for insects in the event that there is an infestation.

EFFECT OF THINNING METHODS ON HEIGHT AND DIAMETER OF LOBLOLLY PINE THREE YEARS AFTER THINNING IN OVERSTOCKED STANDS

Location and treatment	Trees per acre	Average DBH	Average height
	No.	*In.*	*Ft.*
Substation			
Check	3,989	1.1	11.2
Hand thin	401	2.1	14.4
Disk strip	958	1.1	10.0
Wilmon No. 1			
Check	4,425	1.9	23.3
Hand thin	523	2.5	19.4
Disk strip	1,533	1.6	15.4
Wilmon No. 2			
Check	2,439	1.7	17.0
Hand thin	470	3.1	19.7
Disk strip	836	1.6	14.7

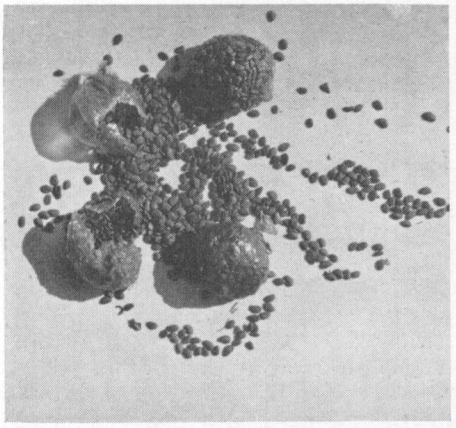
New Plants for QUAIL MANAGEMENT

LAMAR ROBINETTE and DAN W. SPEAKE
Alabama Cooperative Wildlife Research Unit

Two PLANTS recently tested for their value in quail management have shown considerable potential for quail food and cover. A strain of *Desmodium perplexum,* known as Clanton tick-clover or beggarweed, and Nova vetch, a reseeding annual variety resulting from a cross between *Vicia sativa* and *Vicia cordata,* were tested both in the laboratory and in the field.

Clanton tick-clover was selected for evaluation for the following reasons: (1) mature plots of tick-clover, unlike bicolor (*Lespedeza bicolor*) which has been a problem to control on some regularly burned areas in Alabama, grow low enough to permit hunting; (2) native perennial desmodiums in central Alabama are preferred quail foods; and (3) desmodiums have been found to respond to fire and fertilizers more than other native legumes.

A recent study conducted in the Piedmont of Alabama showed that vetches were important quail foods from October through March. The new Nova vetch permits the establishment of semi-permanent quail food plots that require less maintenance than non-reseeding vetches.



Crops of four quail taken from tick-clover plots planted near Sylacauga, Ala.

Reseeding vetch seed mature in late May or early June and lie dormant during the summer. Germination of the Nova vetch seed occurs during the autumn when cool temperatures and adequate moisture prevail.

Tick-clover and Nova vetch were tested, using both pen-reared and wild quail in pens, to determine the palatability of these species in relation to some quail foods known to be palatable. These palatability tests showed that Nova reseeding vetch and tick-clover ranked higher than bicolor when offered to both groups of confined quail.

Tick-clover and Nova vetch plots were established on the Hugh Kaul Estate, a 5,000-acre quail management area located 23 miles south of Sylacauga, Ala. Tick-clover plots were broadcast seeded at the rate of 7.5 lb. per acre or were planted in rows at the rate of 4.5 lb. per acre. Reseeding vetch seed were broadcast at the rate of 35 lb. per acre. The plots were from ¼ to ⅓ acre in size.

Vetch has been shown to be particularly sensitive to soil acidity and low levels of phosphorus and potassium. Fertilizer and lime were applied according to soil test recommendations.

It was found that tick-clover plots deteriorated over a 4-year period in the absence of fire. The beneficial effects of fire on tick-clover plots were noted in reduced litter and weeds, increased growth, and reproduction.

Nova vetch is susceptible to a disease called *Sclerotinia trifoliorum* and may also be affected by abnormally cold or dry weather conditions. Larger plots would provide more seed and aid reseeding in the event of disease or abnormal weather. It is possible to maintain vetch plots by adding seed to unprepared, fertilized plots each fall.

The experimental plots were hunted in 1968 and data were recorded on the number of coveys flushed per hunting hour. Quail were shot and crops examined to determine the volume and occurrence of each species of seed.

Field evaluation indicated that tick-clover plots supported as many quail as bicolor plots. Tick-clover was much easier to hunt because quail could easily be seen rising from waist-high tick-clover while bicolor often grew higher than a man's head, obscuring both dogs and quail.

Crops taken from quail shot in tick-clover plots showed the extensive use of tick-clover seed as food. Crops taken from tick-clover plots contained 94.1% *Desmodium* spp. by volume with occurrence in 97.1% of the crops. Tick-clover plots attracted quail the first year they were planted.

Vetch plots were heavily used by quail during the summer months. Crops taken from birds shot in vetch plots contained 79.8% by volume of vetch with occurrence in 83.3% of these crops.

On a year-round basis, bobwhite quail prefer a great diversity of environment. No one or two species of plants can satisfy all such needs. Tick-clover and Nova vetch may prove to be valuable supplements on well-managed quail range when climate and soil are suitable for these plants.

A limited quantity of Nova vetch seed will be available in 1971. There are no tick-clover seed commercially available at this time.

Cotton infested with a severe stand of broadleaf and grass weeds like this test plot is certain to suffer yield loss.

WHEN DO WEEDS COMPETE?

GALE A. BUCHANAN, *Dept. of Agronomy and Soils*

EARL R. BURNS, *Formerly Dept. of Agronomy and Soils, Now Cooperative Extension Service*

To the casual observer, weeds compete any time they are present in a crop. This is not necessarily true. Weed competition experiments over the past 3 years at the Tennessee Valley Substation and Prattville Experiment Field reveal that weeds exert their maximum effect early in the growing season. A particularly critical period was found to be the first 7 to 8 weeks after emergence of cotton.

Two types of study were made. In one experiment, cotton was cultivated initially; at various intervals thereafter certain plots were dropped from cultivation, allowing weeds to grow for the remainder of the season. For the other experiment, there was no cultivation early but at various intervals thereafter certain plots were weeded.

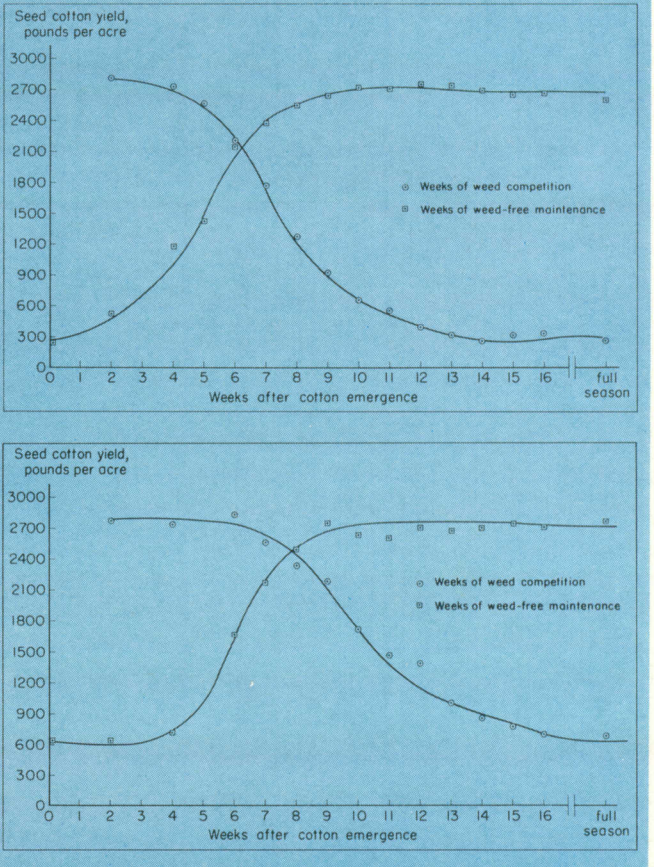
The first series of experiments showed how long weed control is required before the cotton can exert sufficient competition to control weeds. In the second series, it was learned how long weeds can remain in cotton before removal without reducing yield.

As shown by the graphs, the critical weed-free requirement was 6 to 8 weeks at Prattville and 7 to 8 weeks at the Tennessee Valley Substation. This means that if cotton were kept clean for 6 to 8 weeks after emergence, competitiveness of the cotton plant itself would be sufficient to suppress weeds emerging after this time. The result would be production of maximum yields. It would not be unreasonable to consider this as "free" weed control.

This critical weed-free requirement should be taken into consideration in planning weed control programs and, in the long run, in herbicide development. Using herbicides with persistence much beyond the critical requirement is both unnecessary and aggravates the problem of herbicide carryover. Developing chemicals that persist only as long as weed control is needed would help avoid residue problems in the future.

When weeds were allowed to compete as little as 6 weeks after emergence, cotton yields were reduced at the Tennessee Valley Substation in some years. Similar results were observed at the Prattville Field. This means that cotton is able to stand substantial competition early in the growing season, if weeds are then carefully removed, without suffering yield loss. Consequently, a grower has considerable time to clean his crop if preemergence treatments fail to work satisfactorily, or if such herbicides are not used. Of course, weeds will be larger and hard to control after growing several weeks. Also, wet weather could hold up weeding past the critical time and cause yield reduction.

Such plant characteristics as plant height, stem diameter, boll size, and seed size were generally not affected except under most severe weed competition. Neither were percentage lint and fiber properties changed. Seed cotton yield is, by far, the most sensitive indicator of weed competition, and the factor having most effect on profits.



How yield of cotton was affected by various periods of weed-free maintenance or weed competition is illustrated here. The top graph shows averages of three experiments at the Tennessee Valley Substation and the bottom one for the same number of experiments at the Prattville Experiment Field.

Dairying—Big Business on the Farm in Alabama

LOWELL E. WILSON and THOMAS M. LONG, *Department of Agricultural Economics and Rural Sociology*

FEWER BUT LARGER. . . .

That adequately describes today's Grade A milk industry, in Alabama and nationally. Since 1961 the number of Alabama Grade A producers has dropped over 40%, but total production has more than doubled.

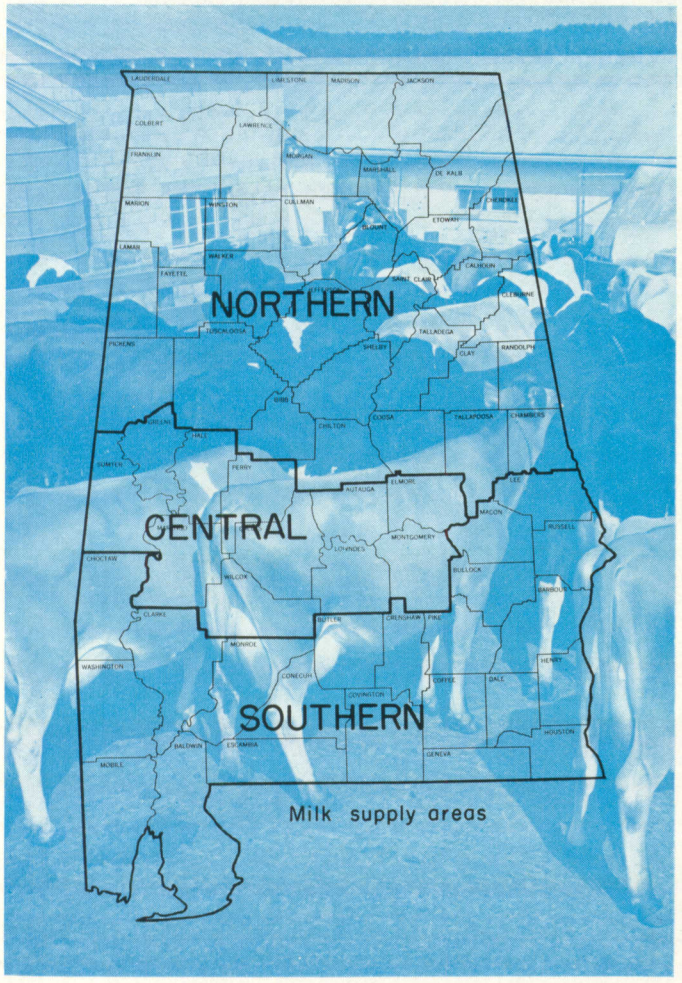
In 1969, approximately 850 Grade A dairymen in Alabama sold $45 million of milk. Production per farm averaged about 800,000 lb. and income $54,000. Adjustments by dairymen have made the industry modern and efficient.

Adjustments being made by dairymen were topics of a 1969 Alabama study. Alabama and out-of-state producers who shipped into Alabama were surveyed to determine present structure of the industry.

A questionnaire was mailed to each Grade A producer licensed by the Milk Control Board and to out-of-state producers. Of 686 responses used in the analysis, 486 were from Alabama dairymen and 200 from producers in Tennessee (100), Mississippi (75), Georgia (15), and Florida (10).

Survey information was analyzed by herd size and supply areas. Herd size categories used were small (fewer than 70 cows), medium (70-109), and large (more than 109). Supply areas were northern, central, and southern Alabama (see map) and out-of-state.

The average Alabama herd consisted of 100 cows, 81 in milk and 19 dry. Central Alabama herds were largest, averaging 115 cows. About half of all Alabama herds are in the northern supply area. Out-of-state producers reported an average of 78 cows, 64 in milk and 14 dry, with these state averages: Tennessee 62, Mississippi 83, Georgia 147, and Florida 87. Over half had less than 70 cows, as shown by the following summary:



Cows per herd	*Per cent by size category*		
	Alabama	*Out-of-state*	*Total*
Under 70	36	60	43
70-109	34	24	31
Over 109	30	16	26

The average Alabama dairyman was 46 years old and farmed 540 acres, of which 313 were related to dairying. Over 75% of the producers received 80% or more of their farm income from dairying. Largest units had been operating longest but were operated by youngest dairymen. In a 1964 study, the large units were operated by older dairymen who have since left the business. Now the small herds are operated by the older dairymen. A large percentage of these will end operations as the dairymen retire.

Dairymen with large herds more often use pipeline milkers, mechanized feeding systems, and artificial breeding than do small producers. Large producers more frequently indicated ability to adjust production to meet demand and to remain in business.

Out-of-state producers generally had smaller herds and a capacity to expand – characteristics similar to Alabama dairymen 5 to 10 years ago. A substantial growth in production by these dairymen is likely, especially if they get the same benefits and protection from the Milk Control Board as do Alabama producers.

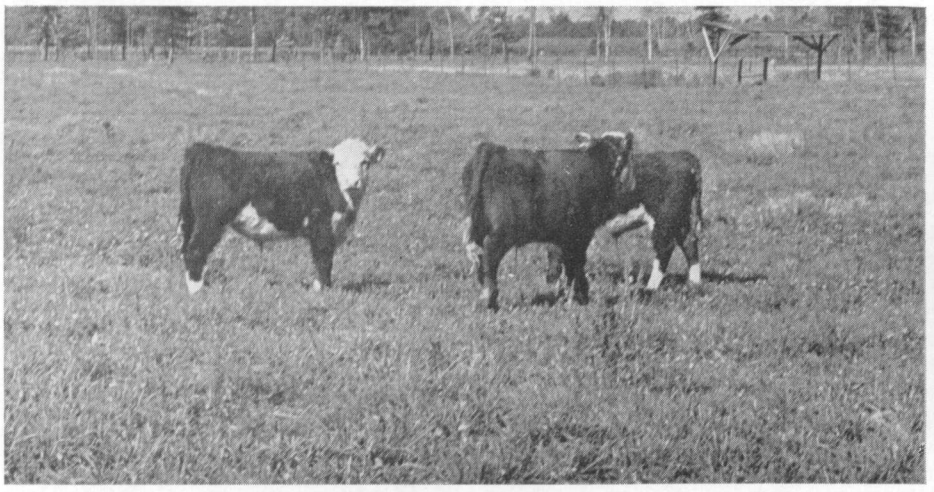
The average unit of 100 cows has put the dairy beyond a family enterprise. Labor supply is now a concern, and there is an apparent need for wage rates and other benefits to attract hired labor.

As size of unit has increased, dairymen have become more specialized and more dependent on purchased supplies. Most grain and a large proportion of hay are now purchased. Large units require big investments in feeding facilities, including more on-the-farm feed preparation and greater silage capacity.

Plans to expand were indicated by a larger percentage of out-of-state than Alabama dairymen. However, more immediate production growth is expected from Alabama producers because of their greater excess capacity.

If Alabama dairymen are to maintain their 80% proportion of total commercial supply requirements, they need to increase annual per farm production to about 1.2 million lb. by 1975. And by 1980, average production should exceed 1.5 million lb. annually. Unless per farm sales in Alabama reach these levels, processors will become more dependent on milk from other sources.

Prices paid to out-of-state producers have been unregulated by the State Milk Control Board. And prices paid were below Alabama producer prices. However, the growth of cooperative marketing is likely to equalize Class 1 prices to producers. Thus, out-of-state dairymen will have a strong incentive to increase their share of the Alabama market supply.



This fescue-clover at the Tennessee Valley Substation was one of the perennial combinations evaluated for beef production.

Perennial Pastures for Beef Steers in Northern Alabama

R. R. HARRIS and W. B. ANTHONY
Dept. of Animal Science
J. K. BOSECK, *Tennessee Valley Sub.*

THAT COOL SEASON annual grazing crops are more suitable for slaughter beef production than warm season perennial pastures has been established in Alabama research. However, perennial grasses may cost less to produce and may be grown on soils not suitable for small grains or row crops. Cool season annual crops might also be seeded into warm season perennial sod to lengthen the grazing season and improve animal performance.

In an effort to use perennial crops to greater advantage, several combinations were tested during 1965-70 at the Tennessee Valley Substation, Belle Mina. Fescue and orchardgrass were tried alone with nitrogen fertilization and in combination with white clover. Coastal bermudagrass with sod-seeded vetch or rye was also evaluated.

Each forage combination was established on 2-acre, replicated test pastures and grazed by yearling beef steers weighing about 550 lb. initially. The put-and-take system of pasture management was used, with animals weighed at about 28-day intervals.

Commercial nitrogen was applied on orchardgrass, fescue, and rye-Coastal pasture at the rate of 150 lb. of N per acre. Vetch-Coastal got only 100 lb. of N and swards containing clover did not receive commercial nitrogen. All pastures got mineral fertilizer according to soil test.

Hairy vetch or Explorer rye was usually seeded about October 15 in the dormant Coastal, using a grain drill. Following seeding, the residual Coastal forage was cut as close as possible.

The fall grazing season began September 25 and averaged 52 days for fescue and orchardgrass. Test pastures were stocked with about 2 steers per acre during fall and cattle gained approximately 1 lb. daily on all forage combinations. Fall gain per acre ranged from 100 to 118 lb.

Gains during spring and summer on fescue and orchardgrass combinations were similar, about 250 lb. per acre. These gains were from stocking rates of about 1.5 animals per acre on orchardgrass and about 2 animals for each acre of fescue. Steer daily gain averaged greater on orchard than on fescue (1.77 vs. 1.30 lb.). Inclusion of clover in the fescue increased average daily gain from 1.2 to 1.4 lb.

Annual gain per acre of the Coastal combinations, 494 lb., was considerably greater than that of fescue or orchardgrass, 368 and 344 lb. Much of the difference can be attributed to increased carrying capacity and a slightly longer grazing season. Cattle grazed the fescue, orchardgrass, and Coastal pastures a total of 156, 144, and 160 days annually during the test. Adding vetch or rye increased days of grazing on Coastal.

One of the most practical measures of forage evaluation is the gain per animal when grazed continuously for the season. Cattle averaged gaining 124, 153, and 197 lb. during March-September while grazing fescue, orchardgrass, and Coastal bermuda pastures, respectively. These animals graded high Utility and Standard at end of the grazing season. Consequently they were fattened in drylot to desirable slaughter finish.

Four major findings summarize results:

(1) Fescue and orchardgrass provided 60 days or less of grazing during fall months even though the forages were rested between June 25 and September 25. When stocked at about 2 steers per acre, yearling cattle gained approximately 1 lb. daily.

(2) Rye seeded in Coastal bermudagrass sod furnished grazing 15 days earlier than the vetch-Coastal combination (March 18 vs. April 2), but both combinations gave grazing earlier than Coastal alone.

(3) Gains per acre for the March-June grazing season on both fescue and orchardgrass swards were approximately 250 lb. Rate of gain was somewhat better on orchardgrass, but stocking rate favored fescue.

(4) Total annual gain per acre was 368, 344, and 494 lb. for fescue, orchardgrass, and Coastal combinations.

PERFORMANCE OF STEERS ON PERENNIAL PASTURES AT TENNESSEE VALLEY SUBSTATION, 1965-70

Performance measure	6-year average, by pasture combination					
	Fescue + N	Fescue + clover	Orchard + N	Orchard + clover	Vetch-Coastal	Rye-Coastal
Fall						
Gain/acre, lb.	118	108	100	100	-----	-----
Grazing days	60	52	47	52	-----	-----
Stocking, animals/acre	2.19	2.08	1.96	2.08	-----	-----
Tester[1] av. daily gain, lb.	1.03	.99	1.09	.99	-----	-----
Spring-summer						
Gain/acre, lb.	262	248	237	250	482	507
Grazing days	100	100	92	96	153	168
Stocking, animals/acre	2.24	1.86	1.59	1.53	2.64	2.41
Tester av. daily gain, lb.	1.20	1.40	1.76	1.78	1.28	1.27
Tester gain/head, lb.	114	133	142	164	183	211
Total annual gain/acre, lb.	380	356	337	350	482	507

[1] Tester cattle are those grazed continuously for the season.

A History of Poultry Science at Auburn University

CLAUDE H. MOORE, *Department of Poultry Science*

DURING THE INFANCY of the poultry industry in Alabama, students studying poultry in Auburn University's School of Agriculture were given instruction to acquaint them with problems related to feeding, management, and housing of chickens.

The first such course listed separately, general poultry, appeared in the 1912 Auburn University catalog in the Animal Industry Department. As a carry-over from the 19th century, judging was also an important part of the teaching program. Even though the course number and student level changed frequently, materials presented to the student remained relatively constant until a major in Poultry Husbandry, with six courses, was offered in 1928. The original course appeared in the first Home Economics curriculum in 1920 and was taught by Professor W. H. Eaton of the Animal Industry Department. Since farmyard poultry was considered the responsibility of the housewife, General Poultry remained in the Home Economics curriculum until the decade of 1940 at which time the poultry industry in Alabama evolved as a commercial industry.

The graduate program in poultry had its beginning in 1947 with the first graduate degree, Master of Science, being awarded in December 1948 to Professor Theo Coleman, now on the teaching and research staff of Michigan State University. When the Animal Husbandry and Zoology-Entomology Departments were approved to offer work leading to the Doctor of Philosophy, the Poultry Husbandry Department was given approval to cooperate with these departments in offering the degree. This arrangement has continued to the present time. The first Ph.D. degree was awarded in June 1961 to Dr. Harry Herlich, now in a research position with the Agricultural Research Service of the U.S. Department of Agriculture. Since the beginning of the graduate program in poultry, 46 Master of Science and 18 Doctor of Philosophy degrees have been awarded. Of these 58 graduates (some received both M.S. and Ph.D. degrees) 32 are in university or government research or administrative positions, 17 are in poultry industry positions, 7 are continuing graduate study with only 2 having employment not related to their training.

The first employee of Auburn University to work specifically in the area of poultry husbandry was Miss Gladys Tappan who was employed in 1920 as an extension specialist. John E. Ivey came into that position in 1923 then moved into the Animal Industry Department in 1924 to direct poultry teaching, research, and extension.

The year 1924 appears as a landmark for poultry at Auburn. Two additional positions were created in the Extension Service, one filled by G. A. Trollope and the other by J. D. Sykes. The Alabama Bankers Association recognized the growing importance of poultry to the economy of the State by underwriting the support for Mr. Sykes. This was the year that the present poultry farm was acquired and the physical plant built. That year the first egg laying contest in the South was begun at Auburn under the supervision of the Extension Service. This physical plant was purchased by the Agricultural Experiment Station in 1944. Most of the early buildings continue to be used for poultry teaching and research. Additional office and laboratory facilities were provided in the Animal Sciences Building in 1960.

In 1929 the Animal Industry Department was renamed the Animal Industry Group with the Department of Poultry Husbandry emerging as one of the departments with Mr. Trollope as head. Upon the resignation of Mr. Trollope in 1934, Poultry Husbandry was reincorporated with Animal Husbandry in the Animal Industry Group with J. C. Grimes heading the combined groups and D. F. King directing work in the poultry section. The arrangement was continued until 1947 when Poultry Husbandry became a separate department. Mr. King remained head of the department until 1959 at which time he moved into a research position and Dr. C. H. Moore, the present head, was named. The name Poultry Science Department was adopted in 1961.

The first research work with poultry was an attempt to upgrade nutrition in the early developing industry by comparing different sources of local protein materials. This work was started by Mr. Ivey upon completion of the poultry research plant in 1924 and continued into the depression years when the emphasis of "live at home" programs influenced teaching and research. Management research such as forced molting was conducted in the early 1930's in an attempt to produce eggs the year round, but principally in the fall months of the year.

The early recognition that diseases and parasites must be controlled to have a profitable poultry industry has greatly influenced the direction of teaching and research programs in the department. Attempts were first begun in 1934 with the development of the Auburn Strain of Single Comb White Leghorns. From this early beginning, research workers demonstrated genetic resistance to diseases and parasites in poultry and foundation breeding stock was supplied from the Auburn Leghorn to most primary breeders of egg production stock. This strain of birds continues to be useful in research projects at Auburn.

In addition to the demonstration of genetics resistance to diseases and parasites of poultry, the Poultry Science Department has made many other contributions to the growth of the poultry industry in the Southeast and the nation. Effective vaccines have been developed for the control of poultry coccidia and cholera. Pioneering work was conducted on the use of cages for layers in the Southeast and the whole concept of light management for maximum growth and egg production has been modified primarily as a result of work at this Station.

In recognition of the importance of controlled environment and management to the present-day poultry industry, cooperation was begun in 1966 with the Department of Agricultural Engineering to construct and maintain a modern avian environmental laboratory with partial support from the National Institutes of Health, PHS.

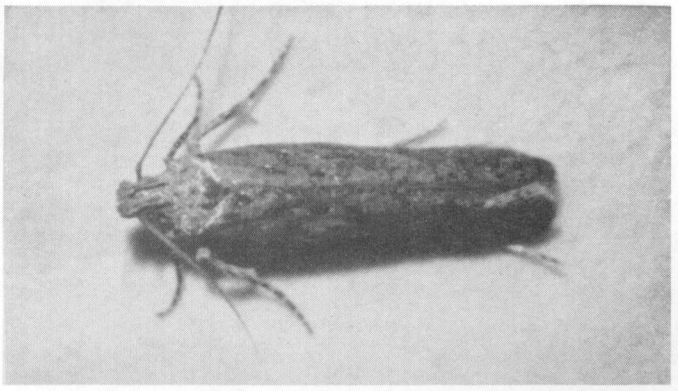
The present academic staff of 9 continue to recognize the importance of diseases, parasites, environment, and management as important to the maintenance and growth of a modern industry by work in 18 State and Federal projects in these areas.

Early leadership in the department was instrumental in assisting with development of the State Poultry Improvement Program and the Alabama Poultry Industry Association.

THE POTATO TUBERWORM in SW ALABAMA

COSTAS A. KOUSKOLEKAS
Dept. of Zoology-Entomology

FRANK GARRETT
State Dept. of Agriculture and Industries

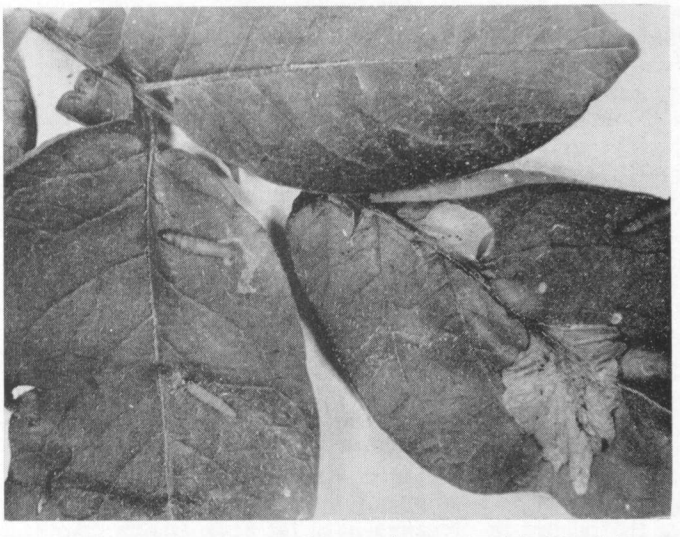


Potato tubermoth, adult of potato tuberworm.

THE POTATO TUBERWORM (*Phthorimaea operculella* (Zeller)) is a cosmopolitan insect pest of Irish potatoes. In Alabama it is of importance mainly in the southwestern portion of the State, which includes Baldwin, Mobile, and Escambia counties. In this area approximately 15,000 acres of Irish potatoes are cultivated each year.

The potato tuberworm attacks potatoes both in storage and in the field. Under storage conditions, it may breed throughout the year. Under field conditions, the first broods infest the aerial portions of the plants and the larvae develop as leaf miners. The symptoms of early-season feeding by the potato tuberworm are difficult to detect. High temperatures and drought conditions are favorable to this pest. Under favorable conditions, two generations can develop before harvest. When the tubers start developing and the soil cracks, the adult insects work their way into the soil and lay eggs on the tubers; consequently, the tubers may be infested before harvest. Potatoes with a tuberworm infestation in excess of 5% can not be sold through interstate commercial channels, resulting in substantial financial losses for the producer. Alabama farmers had their first serious encounter with this pest in 1967 when, as a result of widespread infestations, considerable potato acreage in Baldwin Co. was not even harvested.

Cooperative experiments with farmers in Baldwin Co. were conducted to evaluate the effectiveness of insecticides in controlling the tuberworm. Results of a field trial conducted in 1968 are presented in the table. DDT + methyl parathion, endosulfan (Thiodan), azinphosmethyl (Guthion), phosphamidon (Dimecron), and dimethoate (Cygon) at the rates shown provided effective control. A field experiment conducted in 1969 largely confirmed the above results and also indicated that endosulfan at 0.67 lb. technical/A. and methyl parathion at 1.0 lb. technical/A. were effective.



Potato tuberworms on potato leaves. Insects feed inside of leaves causing damage such as that shown. These insects came out after leaves were removed from plant.

Since 1968, potato farmers have incorporated a complete insecticidal program in their standard fungicidal spray schedule. At present, azinphosmethyl, endosulfan, methyl parathion, and dimethoate are widely used and have been consistently effective when applied in a regular spray program. As a rule, five applications at 7 to 10-day intervals are made during the season, beginning when the potatoes are 6 in. high. A major drawback of azinphosmethyl is it allows buildup of potato aphids.

Treatments to control the tuberworm are applied to prevent infestation of the tubers. Experience has shown that effective control can best be obtained if the buildup of populations is prevented by interrupting the development of the first broods which feed on the above-ground portions of the plants. Control measures initiated after the infestations are well established have generally been found ineffective. The preventive programs adopted by the farmers over the last 3 years eliminated the field populations of this pest throughout the infested area. The prevailing weather conditions, highlighted by late killing frosts in 1968 and 1969 and abnormally high rainfall in 1969, may have been factors that contributed to the overall control.

Despite the successful elimination of the field populations, the tuberworm has not been eradicated. Surveys in the area revealed that tuberworm populations are maintained by breeding in stored potatoes, small potato plantings in home gardens, and piles of cull potatoes which are frequently dumped in the woods. These areas are important sources of field infestations as evidenced by localized tuberworm infestations in fields where no insecticides were applied.

POTATO TUBERWORM CONTROL ON IRISH POTATOES WITH FOLIAR SPRAYS OF INSECTICIDES, FAIRHOPE, ALABAMA, 1968[1]

Insecticide	Rate of application	Mined leaves per 1.200 row feet
	Lb. tech./A.	*No.*
DDT	1.0	50
DDT + methyl parathion	1.0 + 0.5	3
Endosulfan	1.0	0
Azinphosmethyl	0.5	0
Phosphamidon	0.5	8
Dimethoate	0.25	2
Untreated		200

[1] Insecticides were applied on April 8, April 17, April 26, and May 6. Evaluation of infestations was made on May 7.

Saliva Important in Ruminant Nutrition

GEORGE E. HAWKINS, *Dept. of Animal and Dairy Sciences*

SALIVA SECRETED by cattle is alkaline and, like baking soda, it neutralizes acids and acts as a buffer. In cattle, saliva helps keep the pH of rumen contents within limits favorable for (1) microbial fermentation of feeds, and (2) absorption of the volatile fatty acids (VFA) resulting from the fermentation. The VFA are important sources of energy and their ratios in the rumen affect the composition of milk produced by dairy cows. Thus, these rumen processes are of critical importance to dairy cows. An Auburn study was made to learn more about the role of salvia in ruminant nutrition.

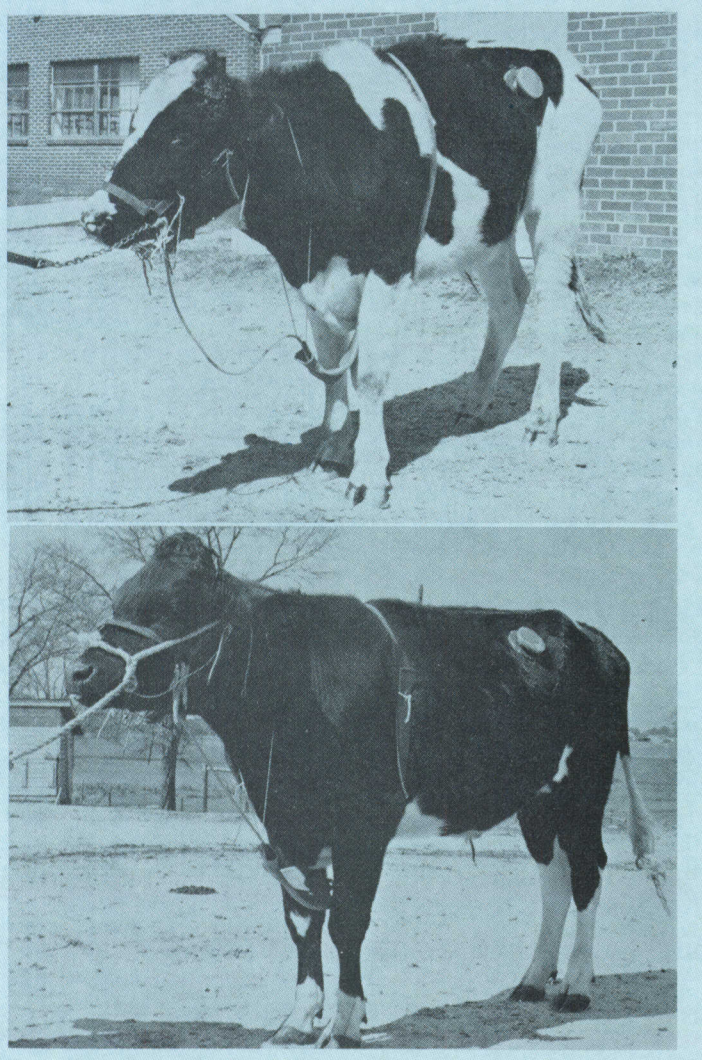
Reportedly, 50% of all saliva is secreted by a pair of parotid glands in the mouth. The duct of the right parotid gland of test cattle was opened surgically, a cannula (tube) inserted, and saliva collected as shown in the photo. Effects of ration on volume and properties of saliva were evaluated from the secretion of this fistulated gland. This gland was considered to produce about 25% of total salivary secretion, and this proportion was used in measurements on three or more cows or steers per treatment.

Saliva Volume and Composition

Amounts of saliva secreted daily by a parotid gland of cattle were associated with amounts and composition of feed eaten and time spent eating and ruminating. For each 1% increase in crude fiber of green-cut forage fed to cattle, saliva from the fistulated parotid increased approximately 1 pt. daily. Thus, a 1% increase in crude fiber probably increased total salivary secretion by 4 pt. daily and a 5% increase would be expected to increase volume by 2.5 gal. per day.

Saliva from cattle fed green-cut millet was higher in sodium and that from cattle fed green-cut Coastal bermudagrass or millet was lower in potassium than from animals eating green-cut alfalfa or alfalfa hay. Other feeds affected the buffering capacity of saliva.

Since saliva secreted by the fistulated parotid gland was lost from the animal, it was a continuous drain on body sodium stores. The animal's system compensated for this sodium drain with a corresponding increase in potassium content of saliva. It was found that adding 0.65 or 1.1% dietary sodium prevented the decrease in salivary sodium, but when only 0.22% sodium was added salivary sodium decreased and the animal went off feed, consumed little water, and became dehydrated, dull, and listless (see photos).



Appearance of test steers with parotid fistulas illustrates effects of sodium level in ration. Animal at top got low level (0.22%) and one at bottom got high level (1.10%) sodium in feed.

For meeting ruminant dietary requirements, most feeds contain an excess of potassium and a deficiency of sodium. There is an interrelationship between potassium and sodium in nutrition. Nevertheless, there are sodium needs for which potassium cannot substitute, and dietary needs usually are met by including 1% salt in the concentrate and by feeding salt free choice. The importance of supplying enough sodium in the diet is illustrated in the photographs.

Saliva Substitute and Supplementation

A 1.275% sodium bicarbonate solution added to the rumen was a satisfactory substitute for saliva, on an equal volume ratio. Adding to the rumen twice as much saliva as secreted by the parotid gland increased saliva dry matter, pH of rumen contents, and daily urinary output of sodium. However, this decreased the concentrations of VFA in the rumen to 70.2% that of the controls.

Among treatment means there was a negative relationship between the pH and concentration of VFA of rumen contents. Molar percentages of VFA in rumen fluid were not affected by levels of dietary sodium fed to cattle deprived of saliva from one parotid gland or by saliva supplements added to the rumen.

Results of these investigations show that volume, composition, and properties of saliva vary with the ration fed. Changes in these properties of saliva altered rumen pH and levels of volatile fatty acids in the rumen. Thus, adequate sodium (usually supplied as salt) is necessary for optimum saliva volume and composition.

Fertilizing Improved Varieties of Pine

JAMES W. GOODING and MASON C. CARTER
Department of Forestry

PRESSURE TO PRODUCE more and more wood on less and less land has forced managers to seek new management techniques. Fertilization offers one possibility. Improved tree species offer another. It has been estimated that per acre wood yields in the Southeast could be improved 15% through use of improved hybrids and 20% through fertilization.

The effect fertilization would have on different lines of improved hybrid pine seedlings was not known, however. To discover what interactions, if any, existed between lines and fertilizer, Auburn University researchers began a study involving controlled pollinated lines of loblolly pine grown with and without fertilization. Results presented here were obtained at the end of 9 years of study.

Test Methods

In January 1961, 11 lines of hybrid pine seedlings were obtained from the Southeastern Forest Experiment Station and the Georgia Forestry Commission. Each of the lines represented a different female parent. Ten of these 11 lines were produced from loblolly females crossed with the same loblolly male parent. Line 1027 was produced by crossing a loblolly female parent with a mixed lot of slash pine pollen. Seedlings were hand planted – 6x10 ft. spacing – in an abandoned pasture on Piedmont soil in Chambers Co., Alabama. Site preparation consisted only of burning. Four plots containing 12 rows of 10 trees each were established. One row was a control of 10 ordinary nursery-run seedlings. All seedlings in each of the remaining 11 rows were from 1 of the 11 hybrid lines studied. Each seedling in two of the plots received 100 g. of 8-8-8 commercial fertilizer applied in a circle 1 ft. in radius about the base and worked lightly into the soil with a hoe.

Evaluation

In March 1970, diameter at 4.5 ft. (dbh) and total height of every tree was measured. These measurements were used to calculate cu. ft. volume for each tree inside bark to a 3.0 in. top outside bark. Volume per acre was calculated from the sample data. The effects of line, fertilization, and line x fertilization interaction on dbh, height, volume per tree, and volume per acre were determined from a split-plot analysis.

TABLE 1. VOLUME OF WOOD PER ACRE PRODUCED BY 11 CONTROLLED CROSSES OF LOBLOLLY PINE AT THE END OF NINE GROWING SEASONS ON A PIEDMONT SITE

Line	Volume per acre[1]			
	Unfert.	Fert.	Diff.	Av.
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
1078	1,795	1,781	−14	1,788*
1122	1,537	1,570	+33	1,554*
1109	1,518	916	−602	1,217
1112	1,502	1,186	−316	1,344
1111	1,457	1,505	+48	1,481
1090	1,407	1,312	−95	1,359
1117	1,281	774	−507	1,027
1091	1,228	1,341	+113	1,285
1102	1,164	1,093	−71	1,129
1106	1,140	1,312	+172	1,226
Cont.	1,135	1,189	+54	1,162
1027	978	506	−472	742*
Av.	1,345	1,207	−138	1,276

* Indicates significant difference from control ($P < 0.05$).
[1] Merchantable volume inside bark to 3.0 in. top outside bark.

Initial survival was good – 88% or greater for all lines with or without treatment. Overall growth for the 9-year period was very good. Average height and dbh for all trees was 34 ft. and 5.7 in., respectively.

Effect on Growth

There was a highly significant difference in tree growth between lines. Lines 1078 and 1122 produced the greatest volume per acre in both fertilized and unfertilized plots, Table 1. Independent of fertilizer treatment, line 1078 produced about 35% more volume per tree and 50% more volume per acre than the control seedlings.

The effect of fertilization on tree growth was less apparent than the effect of line. Much variation occurred within lines after application of nutrients. The control seedlings and lines 1122, 1111, 1091, and 1106 produced more volume when fertilized; the remaining lines grew less after application of nutrients. The average effect of fertilizer on volume per acre across all lines was slightly negative; however, none of these differences were statistically significant.

Fertilization trials, established after the start of the present study, have shown that application of nitrogen fertilizers at planting time sometimes results in reduced survival and growth of pine seedlings. Whether this effect is a result of stimulated competition or a direct nutrient toxicity has not been established, but experience indicates that nitrogen should not be applied until seedlings are at least 2 years old. When nitrogen has been applied after the second year, increased growth has occurred. A second fertilization, 200 lb. of nitrogen per acre, was applied to the trees in this study and future growth will be recorded.

Selection a Factor

It should not be too surprising that most of the lines in the present study failed to respond to increased fertility. The parent trees were selected for their performance under natural conditions where soil fertility levels were probably quite low by agronomic standards.

The lines tested in the present study displayed a marked growth superiority over average nursery seedlings under conditions of low fertility, but to obtain genotypes capable of maximum response to fertilization, it may be necessary to select parent trees showing superior perpormance under high fertility conditions.

Row-Terrace Arrangements Affect Machinery Field Time

E. S. RENOLL and W. T. DUMAS
Department of Agricultural Engineering

Terraces have been used for years as a soil conservation practice on sloping row-crop land. Their usefulness is well known. From the standpoint of machinery utilization, however, terraces can adversely influence row length. Conventional terracing systems with uneven intervals between terraces cause short point rows and reduce the average row length per field. This increases total turning time and thus total machine time to cover the field.

Parallel terracing is conducive to long rows and thereby reduces machine time in the field. Unfortunately, not all land in need of terracing can be parallel terraced.

In many fields row length can be increased by placing the rows crosswise to the major field slope but not necessarily parallel to the terraces. In this row arrangement the rows cross the terrace at an angle. Agricultural engineers at Auburn University Agricultural Experiment Station have been studying such an arrangement.

The row-arangement study was conducted during a 3-year period on an 18.5-acre field on Lower Coastal Plain soil. The field was rectangular and was approximately 600 ft. by 1,350 ft. The field contained five terraces and had an average cross slope of 3%. The terraces were broad base type and could accommodate four 40-in. rows between the channel and the ridge and on the back slope. The terrace ridges were 12 to 18 in. higher than the channels.

The three experimental row arrangements used in the study are shown in the figure. Each arrangement was used for 1 year. Three machine operations — planting, cultivating, and harvesting — were used on the cotton crop.

Results from the study can be divided into two general parts. The first deals with the physical row distribution on the field for the three row arrangements.

Row arrangement 2 has the least rows and arrangement 1 has the most. Arrangement 2 also has the largest number of rows covering the entire field length. Arrangement 2 has all turns made at field edge while the other two each have some turns within the field.

Turning at field edge has advantages over within-the-field turns. These turns usually are easier to complete and thus should reduce wear on the tractor and fatigue on the operator. Within-the-field turns usually damage more crop than field-edge turns.

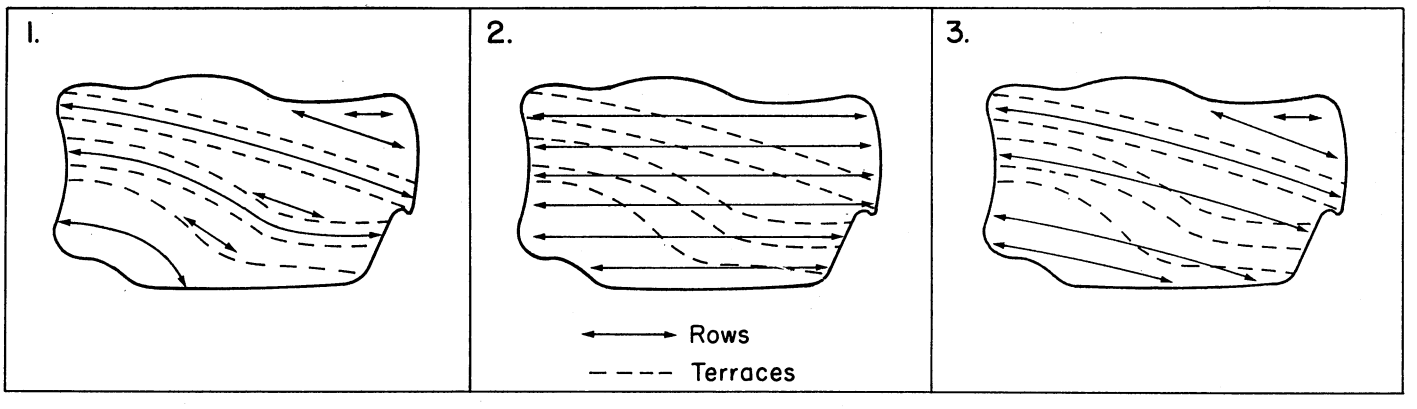
Part two deals with the influence of these different row arrangements on total turning time of machines used on the field. Since total turning time is directly related to total time needed to complete a field-machine operation, it can be used as an indicator of efficiency of the different row arrangements. Data from three machines used on each row arrangement are presented in the table.

Row arrangement 2 had the least total turning time for all operations and arrangement 1 had the most. Total turning time while planting was 21% less on arrangement 2 than on 1 and 8% less on 3 than on 1. For cultivating, arrangement 2 was 20% better than 1 and 7% better than 3 in turning time. Turning time for cotton picking was 17% less for arrangement 2 than for 1 and 5% less for 3 than for 1.

Machine Turning Time for Three Row Arrangements on An 18.5-Acre Field

Field operation	Total time spent turning per field operation		
	Row arrangement 1	2	3
	Min.	*Min.*	*Min.*
Plant (4-row)	18.2	14.3	16.8
Cultivate (4-row)	16.6	13.2	15.4
Pick (1-row)	89.6	74.8	85.0

Results from this study show that in some nonparallel terrace fields, running rows across the terraces is one possible way of making the field more efficient for machinery use. Rows that run across terraces can present some problems. Operating across terraces requires machines that are somewhat flexible and some current models are too rigid for such use. Planter and cultivator sideway as these machines cross the terrace can cause crooked rows and plowed-up plants. Machines crossing the terraces tend to move some soil from the terrace ridge into the channel and thus reduce the effectiveness of the terrace. Wet weather conditions can also present some problems in this terrace-crossing system.



Row-terrace arrangements used in this study. Arrangement 1 is a conventional pattern with rows parallel to the terraces. Arrangement 2 has the rows parallel to one edge of the field and crosswise to the major field slope. Arrangement 3 has rows parallel to some terraces and crossing others.

SURVEY of COUNTY 4-H PROJECT WINNERS

J. E. DUNKELBERGER, *Department of Agricultural Economics and Rural Sociology*

D. J. PRESLEY, Cooperative *Extension Service*

THE 4-H CLUB PROGRAM is designed for girls and boys between the ages of 9 and 19 years. Traditionally, 4-H has operated in rural schools as a major extra-curricular activity. In recent years it has been introduced into city schools through projects of wide interest to urban and nonfarm youth.

Problem Encountered

A serious problem encountered by 4-H Extension and volunteer leaders has been the failure of older teenagers to continue club membership. Member turnover is virtually complete every 4 years and only three-fourths of the members in any year re-enroll. Pre- and early teenagers have high membership rates, but the involvement of youth in the mid- and late teens is very low.

Older youth do better in project competition because of the experience gained over several years of involvement. Project participants usually serve an "apprenticeship" during which they become familiar with their project and develop the skills which lead to a winning effort. Who are the youth who persevere in their 4-H activities to the point of winning a county contest?

Characteristics of Project Winners

During the summer of 1967, 263 county project winners taking part in district eliminations completed special questionnaires as a part of a survey conducted by the Department of Agricultural Economics and Rural Sociology. These young people were competing in public speaking, electricity, dress, dairy, and breads projects and livestock judging teams. A total of 74 boys and 189 girls were contacted. The largest number (37%) of participants were in public speaking. Electricity projects had the fewest participants (4%).

Project winners were most often in their early teens. One-half were 15 years of age or younger. The median number of years of club membership was 6 to 7 years. Youth on the livestock judging teams were the oldest, while those competing with electricity projects the youngest. Most of these project winners had been in 4-H work since their pre-teen years.

The appeal of 4-H projects for farm youth was quite apparent in spite of the shift in program emphasis to more nonfarm oriented projects appealing to town youth. More than half the contest winners came from farm homes compared to one-fourth who lived in small towns and cities. Town youth most often participated in the public speaking and electricity contests. Only one-fourth of the fathers had farming as their principal occupation, and one-third of the fathers were employed in white collar jobs.

Project winners were most likely to attend small schools with fewer than 50 students in the class. Electricity, breads, and dress projects had more participants from large schools than did other projects. Many contest winners reported only a few 4-H members in their school class. More than 60% indicated fewer than 10 classmates were members. The peer group influence did not appear to be an important factor influencing continued participation in club activities. Moreover, county project winners did not limit their extra-curricular involvement to 4-H. More project winners were active in three to four other in-school and three out-of-school activities.

Interpretation

These findings suggest that some student acceptance of the 4-H program is being realized among nonfarm youth. Similarly, the findings show that 4-H does not serve as a haven for farm youth lost in consolidated high schools. These county project winners all appear to be socially "well" adjusted students participating in a wide variety of teenage organizations and groups.

AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY
AUBURN, ALABAMA 36830
E. V. Smith, Director
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