

HIGHLIGHTS

of agricultural research

VOL. 21, NO. 1/SRING 1974

Agricultural Experiment Station
AUBURN UNIVERSITY



DIRECTOR'S COMMENTS

AS WE PLAN for the future in agriculture, we must consider the past and especially the turbulent 1973. Some observations that appear to be particularly germane to Alabama and its Agricultural Experiment Station System are as follows:

(1) Nationwide there is increased concern for production of farm and forest products. Products are needed to meet the needs of our country, where one farmer provides for himself and 50 others. Also, some products are needed for export in order to gain a favorable balance of trade. Because Alabama and her sister Southeastern States provide the greatest potential anywhere in the Nation for expanded production, there is increased responsibility on this Agricultural Experiment Station for research in production and marketing of farm and forest products. Today the need for modern agricultural research facilities is more important than when I discussed it in this column a year ago. The conditional bond money approved by the Alabama Legislature and Governor Wallace was most timely and it is imperative that this money be made available as soon as possible.



R. DENNIS ROUSE

(2) The energy crunch throughout the Nation and excessive pressures on the environment in heavily populated and industrial portions of the Nation make development of Alabama's other natural resources even more attractive. This means more jobs for people, and larger local markets for food and forest products, but it also places greater pressure on the environment, and makes demand for services associated with the good life — good water, waste management systems, utilities, and recreational facilities — even greater. The popular term "Rural Development" takes on new emphasis for the Experiment Station. It is a national policy to make rural living more attractive. The passage by Congress of Public Law 92-419, known as the Rural Development Act of 1972, administered through the U.S. Department of Agriculture, indicates Congressional support of the policy. Although USDA agencies will carry out most legislation for this Act, responsibilities for a pilot research and Extension program have been delegated to the Land Grant Colleges of 1862.

(3) Population pressures and urban sprawl — residential housing, commercial and industrial developments — have taken much good agricultural land out of production. To prevent harmful demands being placed on remaining agricultural areas, land use planning must be initiated. It is anticipated that Congress will pass a law dealing with this in 1974. Most of us object to this idea, especially in sparsely populated parts of the Nation, including most of Alabama, but it is becoming increasingly evident that farmers need protection of land use planning as they plan for the future.

In summary, the Alabama Agricultural Experiment Station is planning a research program not only directed toward solving problems of production, marketing, and processing products of farm and forest for consumers, but also providing research information that is needed for sound rural development and land use planning that will ensure the continued productivity of an abundance of agricultural products and at the same time provide guides for better living in rural as well as urban Alabama.

may we introduce . . .

E. Wayne McCoy, associate professor of Agricultural Economics and Rural Sociology. Dr. McCoy is a native of Sparks, Nevada and earned the B.S. and M.S. degrees from the University of Nevada. He earned the Ph.D. from the University of Tennessee in 1966. His principal field of specialization was agricultural economics. His undergraduate major was general agriculture with a minor in agricultural economics. His graduate major was in agricultural economics with a minor in statistics. His major areas at Auburn are econometrics and resource economics.



Dr. McCoy teaches undergraduate and graduate level courses at Auburn and is currently doing research work on econometrics and rural development including recreation and aquaculture. A story on a phase of his research program is featured on page 3.

Before coming to Auburn in 1967 Dr. McCoy was an assistant professor at Arkansas State College. Since coming to Auburn Dr. McCoy has authored numerous research publications and articles. He is a member of Phi Kappa Phi and Alpha Zeta, honor societies.

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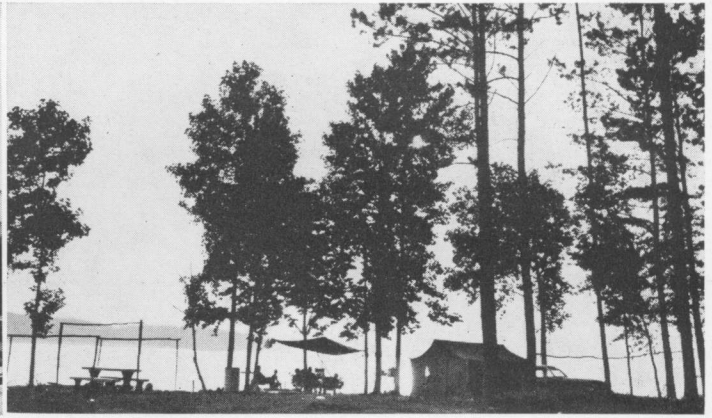
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ON THE COVER: Marinas such as this are being seen more and more in Alabama. See story on recreation research, page 3.





More marinas as at left and camping sites, right, are coming into prominence in Alabama as a result of increased research on outdoor recreation.

CAMPING, OUTDOOR RECREATION and PARKS as RELATED to EVERYDAY LIVING

E. W. McCOY, and C. L. VANLANDINGHAM

Department of Agricultural Economics and Rural Sociology

OUTDOOR RECREATION interests virtually everyone. Until recently, however, outdoor recreation was primarily a private concern. So long as America was predominately rural, open space was fully available. People swam and fished in the creek, hunted in the woods, and played ball in a pasture or vacant lot. With increased urbanization and the loss of open space, provision of outdoor recreation services became a concern to governmental and other agencies. Recognition of this trend led to the creation of the Bureau of Outdoor Recreation, which coincided with a federal grant program to assist state and local governments in providing outdoor recreation opportunities.

In order to establish and maintain eligibility for federal grant funds, each state is required to prepare and update a comprehensive outdoor recreational plan. The Department of Agricultural Economics and Rural Sociology at Auburn University Agricultural Experiment Station under contract with the Alabama Department Of Conservation and Natural Resources has prepared and updated the plan. In 1967, the first update of the plan was completed under the direction of J. H. Blackstone. This plan outlined Alabama's responsibility in outdoor recreation. Subsequently, 17 specialized studies on outdoor recreation in Alabama have been completed. A summary of the 1970 recreation plan is available in every library within the State. Research must be done continuously, however, because the situation changes in a dynamic fashion.

The changing nature of recreational research can be demonstrated by the impact of energy shortages on recreational activities. Sales of motor homes, which

represented a growth industry, plummeted after the advent of gas shortages. Recreational participation is extremely volatile since the range of activities is large and choices can be made almost instantaneously.

Camping research financed by university funds has been in progress for many years. Publications are available indicating the costs of providing camping facilities and factors to consider in locating a campground. Studies of camper motivations and expenditures are presently underway. Study of additional recreational facilities including golf courses, marinas, and recreational use of forest lands are also in progress. Each of these studies is designed to enhance recreational enjoyment by providing information for the improvement of recreational facilities.

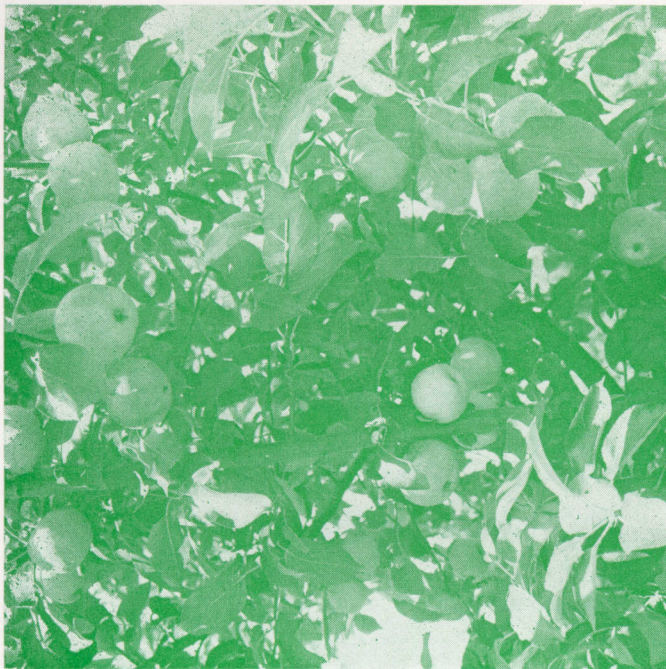
A long-term project measuring the impact of large scale investments in recreational facilities is also underway. Preliminary studies indicate that investments in one area of Alabama result in increased income in many areas of the State. Further study may indicate that the returns from recreation exceed those of small industry in terms of jobs and income to the local area.

Recreational research, like much of social science study, deals with the "human factor," a consideration which complicates the process. However, in recreation research, which is partially designed to plan for the future, such subjective information as people's goals and values cannot be ignored. For example, is the present value placed on outdoor recrea-

tion likely to be altered and if so, what socioeconomic and societal factors will have influence? The most productive approach in recreational research involves multidisciplinary studies. For example, agricultural economists who are interested in costs and returns collaborate with rural sociologists who consider social and demographic factors. Such a blending of the expertise of several disciplines produces more useful research findings.

The end product of any research should be solutions to the problem that instigated the study. While all outdoor recreation problems are not solved and many may require a shift in priorities, tangible results are presently available. After languishing for many years, there has been an extensive building program going on in the State parks of Alabama. Several new or completely renovated parks have been opened to the public during the last few years, including Gulf Shores, Camden, DeSoto, Cheaha, Oak Mountain, Joe Wheeler, Lake Guntersville, and others. Many local governments have upgraded recreational facilities in their jurisdictions. The Federal Government is increasing the number of recreational sites around reservoirs and within the National Forests. The State is moving to increase the availability of hunting and fishing areas within the State.

The research at Auburn is directly related to the increase of recreational facilities in the State. As income and leisure time continue to increase, so shall demand for outdoor recreational needs.



Chemical Regulators Affect Growth and Fruiting of Apple Trees

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E. L. MAYTON and WALLACE GRIFFEY, *Piedmont Substation*

A MAJOR PROBLEM encountered in apple production in Alabama is excessive vegetative growth on young trees. The problem with this condition is that it makes trees slow to come into fruit production. If vegetative growth could be suppressed and flower bud formation induced, the trees would be easier to manage and there would be both earlier and heavier fruiting.

Chemical Regulators Tried

Possible use of chemical regulators to control growth and alter fruiting characteristics of apple trees has received considerable attention in recent years. One of the most promising of these regulators is alar (succinic acid 2, 2-dimethylhydrazide). It has given interesting results in recent year Auburn University Agricultural Experiment Station tests at the Piedmont Substation, Camp Hill.

Foliar spray of alar was applied at rates of 2,000, and 4,000 p.p.m., 21 days after petal fall, to 7-year-old 'Wellspur' Red Delicious apple trees in 1971 and 1972. Comparable trees were left untreated for comparison. Two trees were used for each treatment plot, and each treatment rate was repeated six times.

Five shoots per tree were measured and tagged 1 day before treatment. (Shoots of equal length were tagged for each comparison.) The shoots were measured 2, 4, 6, and 15 weeks after treatment to determine how alar affected fruit quality and repeat bloom.

Alar spray was found to affect several aspects of apple

growth and development. In addition to affecting vegetative growth, it also resulted in differences in repeat bloom, fruit quality, and apple yield.

Growth Affected

Vegetative growth was suppressed by both the 2,000 and 4,000 p.p.m. alar treatments in 1971. In 1972, however, the chemical treatment had little effect because of a rain that occurred approximately 30 minutes after the spray was applied, as shown by the following data:

Treatment	Shoot growth after 15 weeks	
	1971	1972
Untreated.....	55.8 cm.	56.4 cm.
2,000 p.p.m. alar.....	25.2 cm.	49.3 cm.
4,000 p.p.m. alar.....	18.7 cm.	43.3 cm.

The reduction in vegetative growth resulted from alar suppressing cell elongation in the internode region of the shoot. As shown by observation, treated shoots had as many leaves as non-treated, but the leaves were closer together following alar spraying. Since the alar treated trees had the same number of leaves, they probably had about the same photosynthetic capacity as non-treated ones.

Quality Factors Influenced

Spraying with alar (both 2,000 and 4,000 p.p.m.) increased fruit firmness, decreased the percentage of soluble solids, and reduced size of apples. It had little effect on the percentage of red surface color of the apples, however, as evidenced by data in the table.

The increased fruit firmness and reduced soluble solids indicated that fruit ripening was delayed by alar spraying. If the treated apples were left on the tree long enough to reach the same maturity as non-treated fruit, then the percentage of red surface color would have been increased.

Blooming, Yield Increased

A higher proportion of fruit spurs bloomed in spring following alar treatments than on non-treated trees. The percentage of ½-in. or longer spurs that bloomed in spring averaged 23.1 for non-treated, as compared with 82.9 and 86.5%, respectively, for 2,000 and 4,000 p.p.m. alar. Apples per 100 fruiting spurs ½ in. or longer were counted after the June drop. The average was 90.3 and 89.3 for the alar treated (2,000 and 4,000 p.p.m.) trees, but only 29.0 on non-treated. Thus, the number of apples per 100 fruiting spurs closely paralleled the percentage of spurs blooming. These findings indicate that alar's effect on fruit set is a reflection of its influence on repeat bloom.

After the June drop, fruit was thinned by hand to space the apples about 4 to 6 in. apart on alar treated trees. Non-treated trees did not need to be thinned. Both the 2,000 and 4,000 p.p.m. alar treatments increased fruit yield. Amount harvested averaged 54.8 lb. from non-treated trees and 68.8 and 80.5 lb. each for the 2,000 and 4,000 p.p.m. treatment rates.

EFFECT OF ALAR ON FRUIT QUALITY OF RED DELICIOUS APPLES

Alar treatment	Firmness rating		Pct. soluble solids		Size, in.		Pct. red color	
	1971	1972	1971	1972	1971	1972	1971	1972
Untreated.....	17.2	17.3	8.4	8.5	2.82	2.89	84.6	68.6
2,000 p.p.m.	21.0	21.0	8.0	8.0	2.61	2.61	90.1	56.4
4,000 p.p.m.	21.4	21.4	8.0	7.9	2.56	2.56	86.2	52.4

REPRODUCTIVE PROBLEMS cause serious losses in dairy herds. It is common in many herds to cull about 10% of the cows and heifers annually because they fail to reproduce. It is possible to induce lactation without pregnancy by injections of progesterone and estrogen. This is often desirable in animals that have been highly productive or heifers that show promise of being outstanding producers.

Normal udder development and milk secretion depend largely on an adequate supply and proper balance of hormones, mainly estrogen, progesterone, prolactin, and somatotrophin (growth hormone). It has been known for many years that lactation may be induced in non-pregnant cattle by a schedule of low level estrogen-progesterone injections over a period of 6 to 9 months. However, this prolonged procedure is not practical for use by dairymen.

At Auburn University Agricultural Experiment Station two hormone treatment schedules were used to concentrate the dosages of estrogen and progesterone, in order to bring non-pregnant cows and heifers into milk production during an academic quarter. The purpose was to provide students in "Physiology of Lactation" with an effective example of hormone induction of lactation. In schedule one, Estrogen - (Repositol diethylstilbesterol - DES) - 75 mg. per week for 4 weeks, was injected subcutaneously in 3 equal doses of 25 mg., 3 days of each week. During the 5th week DES level was doubled to trigger initiation of lactation. Progesterone (repositol form) - 750 mg. per week for 4 weeks, was injected in 3 equal doses of 250 mg., 3 days of each week. This hormone was not injected the 5th week.

In schedule two, twice daily injections were made for a 7-day period. Each injection consisted of:

1. Estrogen - 30 mg. (60 mg./day).
2. Progesterone - 75 mg. (150 mg./day).

The hormones used were of the repositol form and injections were made subcutaneously. The estrogen hormone used for most animals was diethylstilbesterol (DES). However another estrogenic compound, estradiol, is effective and has been used successfully.

As the udders developed and showed evidence of milk secretion, milking was started. Under Schedule I this usually was during the 6th week after injections were initiated. Under Schedule II milking usually was commenced about 14 days after the first injections.

Unlike natural lactation, the level of milk flow was very low initially, but increased slowly to a peak within 4-6 weeks after milking was started.

LEVELS OF MILK PRODUCTION OF TYPICAL ANIMALS UNDER THE TWO TREATMENT SCHEDULES

Cow no.	Age yr.	Days in milk	Milk produced (lb.)		
			Total	Av./day	Projected 305 day total
Schedule I. Injections through 5 weeks.					
219	6	305	11,248	37	-----
277	3	305	10,700	35 ¹	-----
320	2½	107	4,182	39	9,790
493	8	153	7,680	50	12,600 ²
Schedule II. Injections through 7 days.					
327	2½	133	3,942	30	7,290
508	13	305	16,450 ³	55	-----

¹ Continued milking 5 additional months at an average level of 28 lb.

² Av. of 5 previous lactations for cow 493 was 19,812 lb. milk, 305-day basis.

³ Av. of 9 previous lactations for cow 508 was 19,037 lb. milk, 305-day basis.

Initiation of Lactation In Non-Pregnant Cattle

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The data in the table show levels of milk production of typical animals under the two treatments.

Results of these treatments and similar studies at other stations have shown that:

1. About 60-70% of the treated animals can be brought into milk.

2. Heifers are more responsive than cows.

3. Level of production may be in the range of 50-70% of that of a normal lactation. Under these short-term treatments there is not adequate time for full development of the udder.

4. Milk composition of treated animals is normal.

5. The treatment does not solve reproductive problems, though some problem animals may conceive and reproduce after treatment.

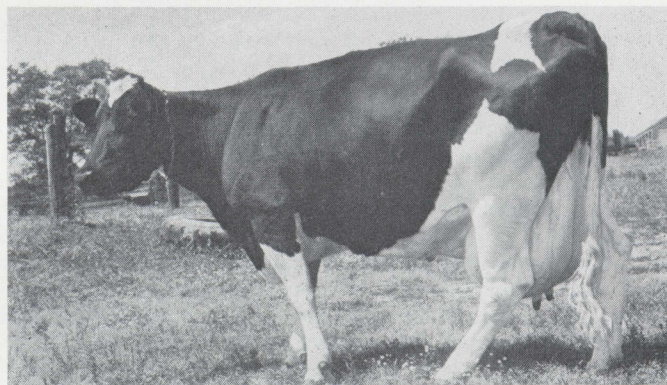
6. Estradiol apparently is as effective as DES for initiating lactation. Thus, since the use of DES is banned by FDA, estradiol may be used, since blood and urine levels of estrogen drop to normal in 10-20 days after completing injections. Thus there appears to be no human health hazard involved in using milk of treated animals.

Precautions and recommendations:

1. Treat only open, non-lactating animals.

2. Treat only healthy cows that have no apparent infections.

3. Separate treated animals from the rest of the herd until after treatment is completed.



The cow shown (top) had lactation initiated April, 1973, using schedule II. The photo was taken in June, 1973. The heifer shown (bottom) had lactation initiated in the summer of 1972, using schedule I. The photograph was taken one year after initiation.



Healthy deer, like the eight-point buck shown in this picture, are greatly dependent on the variety and abundance of year-round food supplies. In this study, Japanese honeysuckle's value as a food source for deer in pine forests is investigated.

Honeysuckle As A Year-Round Food For White-Tailed Deer In Southern Pine Plantations

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THERE HAS BEEN increasing concern in recent years that the even-aged planted pine stands of the "South's Third Forest" will not produce the variety and abundance of food plants necessary to sustain an abundance of different wildlife species on a year-round basis. It is generally acknowledged that as the diversity of the forest is decreased, the diversity of animal life inhabiting the forest also will decrease. This does not preclude the existence of considerable numbers of any given species in even-aged monocultures. White-tailed deer are adaptable to many environmental conditions and may do well in areas intensively managed for pine pulpwood and sawtimber. However, the availability of adequate food resources in pure pine stands of certain ages and at certain times of the year may be critical even for deer.

Japanese honeysuckle grows well in pine forests of Alabama and is one of the most important plants in the diet of southern white-tailed deer. It is an evergreen with leaves that remain nutritious throughout the year. Honeysuckle is also eaten by rabbits, turkeys, quail and other species of wildlife.

Wildlife researchers at Auburn University recently investigated the value of honeysuckle as a year-round food resource for white-tailed deer in a planted pine habitat. The study area in Talladega County was intensively managed for pine pulpwood and sawtimber and contained a minimum of mast producing hardwoods.

Honeysuckle occurred naturally in the understory of the area studied and covered approximately 44% of the forest floor. This plant was by far the most important food item in the year-round diet of the deer. Of the total volume of woody browse consumed by deer, honeysuckle amounted to 55% in the spring, 54% in the summer, 83% in the fall, and 70% in the winter.

This particular area supported a white-tailed deer per 7.3 acres of land. Over 350 deer killed on this area during the study period were examined to determine their external physical condition and antler development. Female deer were collected and checked for reproductive rates based upon the number of embryos per adult female. The volume of data collected indicated the deer were being maintained in good physical condition and reproducing at an excellent rate. Antler development of the male deer was comparable to that of deer from other areas of Alabama.

The availability and utilization of Japanese honeysuckle was considered the prime reason for the high population and general well being of white-tailed deer in this forest which was managed primarily for pine. The importance of grasses and other herbaceous plants in numerous openings on the study area undoubtedly contributed significantly to the carrying capacity of the area.

Honeysuckle is a shade tolerant species and grows well under pine stands. It has long been cited for its wildlife value and can be planted and propagated under a variety of forest conditions. Honeysuckle can become a nuisance under certain conditions, but it can be controlled with silvicultural techniques such as prescribed burning. Honeysuckle has the potential for greatly increasing the carrying capacity of pine stands for deer and many other species of wildlife.

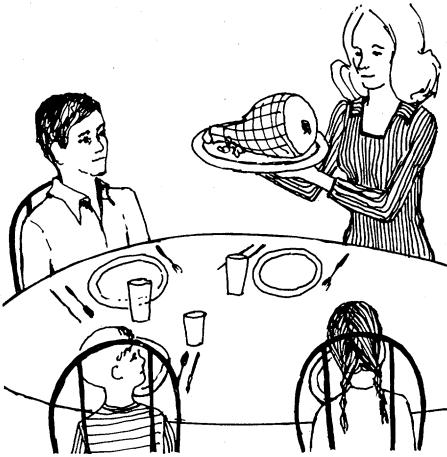
SEASONAL FOODS AMOUNTING TO 2 OR MORE PER CENT OF THE YEAR-ROUND DIET OF 33 WHITE-TAILED DEER COLLECTED FROM THE ALABAMA ARMY AMMUNITION PLANT, CHILDERSBURG, ALABAMA, BETWEEN OCTOBER 31, 1970 AND MARCH 27, 1972

Food item	Spring		Summer		Fall		Winter		Weighted average	
	Occ.	Vol.	Occ.	Vol.	Occ.	Vol.	Occ.	Vol.	Occ.	Vol.
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Japanese honeysuckle (leaves, stems).....	100.0	39.9	100.0	23.4	100.0	59.1	100.0	52.7	100.0	49.4
Blackberry (leaves, stems).....	100.0	7.5	40.0	2.6	64.3	1.0	50.0	3.7	60.6	2.9
Flowering dogwood (leaves).....	---	---	20.0	0.2	7.1	0.2	50.0	7.8	21.2	2.5
Greenbriar (leaves, stems).....	50.0	2.3	60.0	4.6	21.4	1.1	40.0	6.4	27.3	5.2
Winged sumac (seed).....	---	---	---	---	35.7	2.1	40.0	6.4	27.3	2.9
Oak (acorns).....	---	---	20.0	1.8	28.6	6.5	30.0	1.3	15.2	4.0
Crab-apple (fruit).....	---	---	---	---	14.3	5.6	---	---	6.1	2.4
Wild blackcherry (fruit).....	---	---	40.0	12.6	---	---	---	---	6.1	1.9
Muscadine (fruit).....	---	---	40.0	11.2	7.1	0.1	---	---	9.1	1.7
Grasses.....	100.0	9.8	80.0	3.2	85.7	3.0	90.0	6.9	87.9	5.0
Mushrooms.....	25.0	3.3	80.0	7.6	71.4	4.0	40.0	2.1	57.6	3.9

The remaining 18.2% of the year-round diet of the deer was furnished by plants averaging less than 2% of the total yearly volume.

HOW CONSUMERS have BENEFITED from INCREASED PRODUCTION

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



MOST CONSUMERS take for granted the many food items on supermarket shelves. Many of these items were not in existence 10 years ago. However, in the past several months, when some items disappeared and food prices showed substantial increases, consumers became more concerned.

Consumers have a real stake in a productive and prosperous agriculture. In the latter part of 1973, and even today, questions are being raised about the capacity of American agriculture to produce enough to meet both domestic needs and the export market. The response that producers make to new prices, costs, and shortages, and a new government program will tell the story.

Increased Production

The U.S. system of agricultural production has been the most fantastic in the world. It has provided an abundance of food and fiber at reasonable costs. Since 1967, farm output has increased 11%. Based on 1972 data, the production of cotton lint and cottonseed increased 81%, oil crops 29%, and sugar crops 39%. Yet increases in food grains and vegetables were only 1% each, and dairy products 2%.

As has been generally true over the years, increases in total production were

achieved with fewer acres of cropland harvested. In 1950 there were 345 million acres of crops harvested compared with only 296 million acres in 1972. In 1972, about 1 acre of land per person was used to supply domestic needs while 2 acres were required in 1950. The higher production per acre in American agriculture is a major achievement. Applications of scientific and technological advancements, that in a large measure came from research and educational efforts, were responsible for yield advancements.

Improved Efficiency

Associated with increased yields per acre and per unit of livestock has been the growing efficiency in agriculture. In other words, output per unit of labor, fertilizer, seed, feed, etc. has increased. According to the USDA index of farm production per hour, there has been a 48% and a 43% increase in productivity for dairying and poultry, respectively, since 1967. The index of farm production per man hour increased since 1967 for all categories, with the smallest increases in vegetables, fruits and nuts, and tobacco.

Changes in production, farm, and retail prices of broilers for Alabama during the past several years are indicated in the table. Production has expanded despite

the decline in prices received for the product. Efficiencies in production were responsible in a large measure for the expansion of production at lower prices. The consumer benefited from the gains in efficiency of production.

When farm productivity grew sharply in the 1950's, food was plentiful and some products, particularly grains, were in surplus. In no other country but the U.S. have consumers been able to buy their food with less than 16% of their disposable income.

Consumers have also had great variety in selection of various food forms, sizes, shapes, and degree of preparedness. Again, increased production and the ingenuity of processing, packaging, and merchandizing together with the application of science and technology made all of this possible.

American consumers are also able to exercise their choices for various food items over many more months of the year than was possible at one time. Improvement in harvesting time, packaging, transportation, and storage have extended the traditional season for food.

Exports Grow

With growing demands for feed grains and food on the part of foreign nations, exports increased in the 1960's. The U.S. then spent beyond her means overseas and realignment of currencies resulted in devaluation of the dollar. Through increases in agricultural exports in recent years further devaluation was avoided. Foreign made products would be considerably more expensive if further devaluation had occurred.

With the changes and events of recent months, agricultural producers and agribusiness firms find themselves in a new ball game. Unstable agricultural prices, changes in the structure of markets and trade, shortages in energy and certain other inputs, as well as inflationary pressures will cause continued consumer concern about food.

BROILERS: PRODUCTION, PRICE, AND GROSS INCOME

Year	Number produced ¹	Price received ²	Gross income ³	Retail price ²	Per capita consumption ³
	Thous. birds	Cents/lb.	Thous. dol.	Cents/lb.	Lb.
1950	13,114	27.0	9,560	59.5	8.7
1955	57,764	24.5	43,872	57.4	13.8
1960	176,654	16.2	91,577	42.7	23.4
1965	285,077	14.3	138,604	39.0	29.5
1970	376,112	12.2	160,600	40.8	37.3
1971	384,347	12.6	169,497	41.0	37.2
1972	399,274	13.1	188,298	40.9	39.5

¹ Alabama.

² U.S. average for frying chickens.

³ U.S. broiler consumption.

Is Fertilizer Nitrogen An Environmental Pollutant?

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B. D. DOSS, Soil Scientist (Coop. USDA, ARS)

SOME ECOLOGISTS CONSIDER the use of fertilizer N (nitrogen) to be a threat to water quality and human health. They associate the nitrate occurring in many water sources with the ten-fold increase in use of fertilizer N during the past 20 years in the United States. Farmers, however, see fertilizer N as essential to economic crop production.

Nitrate in ground water is not a new problem. Streams and wells in the prairie and semi-arid regions often have high nitrate contents. The fertile soils of these regions have released abundant nitrate since first cultivated. Nitrate becomes concentrated in ground water by evaporation of soil moisture and limited rainfall or irrigation. In the Southeast, however, soils of low organic matter contents release little N and a humid climate provides great dilution of nitrate in ground water.

Crops seldom utilize all of the fertilizer N applied. Actively growing sod crops are most efficient, but recovery of applied N by row crops frequently is only about 50%. Since plant roots do not permeate all of the soil pore space containing fertilizer N, some N is inaccessible. Nitrogen in the soil solution moves into or out of zones of root absorption. In addition, gaseous losses of N may accompany changes in chemical forms of fertilizer N in the soil. Some fertilizer N will wash off cropland, but research shows extreme conditions are required for appreciable loss. Most fertilizer N is so soluble that it dissolves and enters the soil readily with water. Losses of organic N by soil erosion have been historically more significant than wash-off of fertilizer N. Trends begun in the 1930's toward concentrating intensive cultivation on level land and maintaining sloping land in pasture or forest are reducing erosion losses.

Experiments were begun in 1969 to determine the rate and extent of nitrate leaching in both cropped and bare soil. Field plots were established on a level

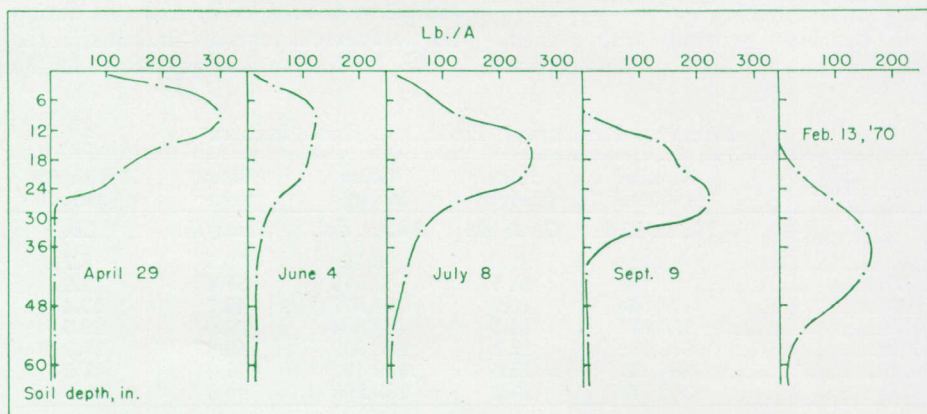
area of Lucedale sandy loam in Coastal bermudagrass at the Foundation Seed Stocks Farm at Thorsby, Alabama. One set of plots was irrigated as needed for maximum growth, a second set was not

MOVEMENT OF NITRATE IN LUCEDALE SANDY LOAM AND RECOVERY OF N APPLIED AS SODIUM NITRATE TO COASTAL BERMUDAGRASS

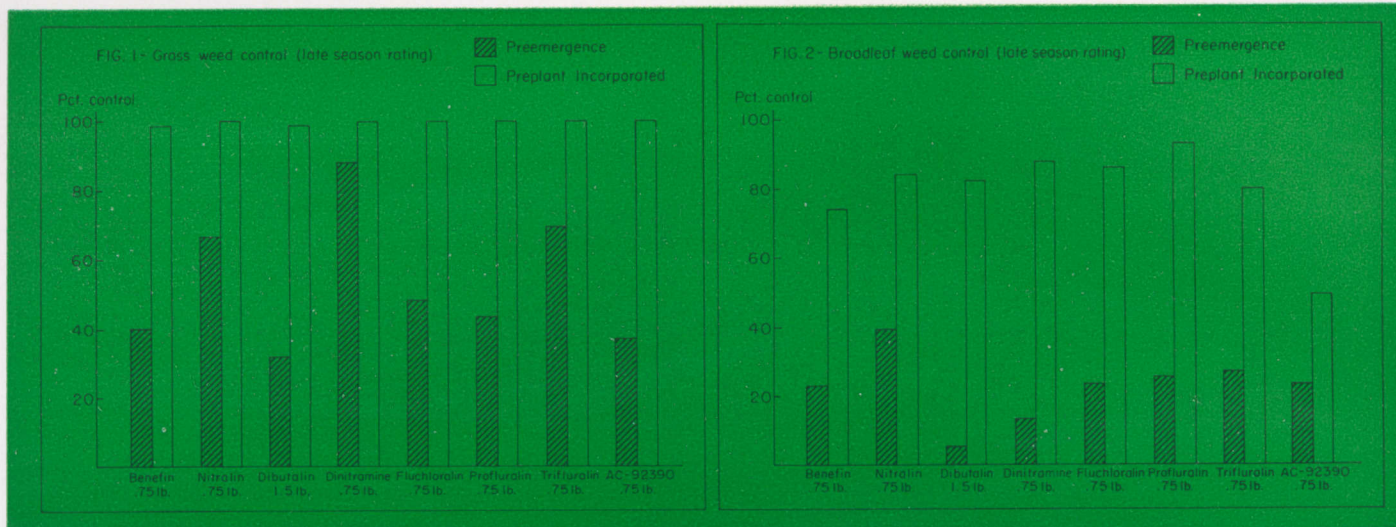
Date	Zone of max. nitrate	Rainfall and irrigation	Recovery of applied N
	In.	In.	Pct.
Coastal, no irrigation			
Apr. 29	6-12	4.5	---
June 4	6-12	9.5	7
July 8	12-18	13.2	18
Sept. 9	24-30	22.5	37
Feb. 13	36-48	41.0	---
Coastal, irrigated			
Apr. 29	12-18	5.9	---
June 4	24-30	17.2	9
July 8	24-30	26.3	23
Sept. 9	36-48	42.0	41
Feb. 13	48-60	62.1	---
No crop, irrigated			
Apr. 29	6-12	5.9	---
June 4	24-30	17.2	---
July 8	30-36	26.3	---
Sept. 9	36-48	42.0	---

irrigated, and a third set was irrigated but kept without plant growth by use of herbicide. Sodium nitrate (NaNO_3) was applied on all plots in March at 1,200 lb. N per acre. While this is several times the rate that would be used in practice, it facilitated measurement of nitrate movement and uptake. Hay was harvested four times during the season and total N removed was determined. Soil in each plot was sampled initially and at intervals during the spring, summer, and winter, using a hydraulic coring machine to provide soil samples to a depth of 8 ft. for analysis. Ammonium, nitrate, and organic N were determined in 6-in. sections of soil to 3 ft. depth, then in 12-in. sections to 8 ft.

Results in the table show nitrate to be relatively stable in this situation. There was no evidence of tie-up of added N in organic forms in soils. About 40% of the applied N was removed in forage and most of the residual N was accounted for as nitrate within the soil profile. Zones of nitrate concentration moved progressively deeper (see figure) with rainfall and irrigation, averaging about 1 in. per inch of water. Even with this single excessive application and after nearly a year with 62 in. of water, the nitrate had not left the profile or entered the ground water. The downward movement of nitrate in soil without plants followed the same pattern as nitrate in cropped soil. Crop uptake did not slow the downward movement; it only reduced the amount of nitrate available to move. With continued leaching this subsoil nitrate would ultimately enter the ground water. In practice, however, the farmer regulates the N application rate and time to match the need for N by the growing crop. Except in unusual situations, there is little surplus N in cropland and it seldom constitutes a pollution problem.



The graphs show movement of NaNO_3 (sodium nitrate) in the soil. The area inside the graph shows the amount of nitrate from fertilizer N at different soil depths.



THREE DINITROANILINE type herbicides — benefin, trifluralin, and nitralin — are used for weed control in peanuts. Benefin is used in the Southeastern States and trifluralin in the Texas-Oklahoma peanut growing area. Nitralin is labeled for peanut use, but is used less extensively in both regions.

New Materials Evaluated

Several new dinitroaniline herbicides are now available and under test. In a series of experiments beginning in 1971 at the Wiregrass Substation, these new materials were compared with the presently used dinitroaniline types. The experiments were done on a Dothan sandy loam soil, with the herbicides listed below:

Trade name	Common name	Manufacturer
Balan	Benefin	Elanco
Planavin	Nitralin	Shell
Amex 820	Dibutalin	Amchem
Cobex	Dinitramine	U.S. Borax
Basalin	Fluchloralin	Basf-Wyandotte
Tolban	Profluralin	CIBA-Geigy
Treflan	Trifluralin	Elanco
-----	AC 92390	American Cyanamid

Predominant weeds present in the test area were crabgrass, Florida pusley, and Florida beggarweed. Florunner peanuts were planted in plots six rows wide and 20 ft. long. Herbicides were applied both preemergence and incorporated with a power driven rotary hoe. Comparisons were made with peanuts cultivated and hand hoed as necessary to control weeds.

Herbicides were applied in 16-19 gal. of water per acre. A tractor-mounted compressed air sprayer was used and it delivered a spray at pressure of 30 p.s.i.

Dinitroaniline Type Herbicides About Equal for Peanut Weed Control

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Department of Agronomy and Soils

JAMES S. BANNON and HENRY IVEY, Wiregrass Substation

Preplant Incorporated Best

Preplant and incorporated applications of each herbicide gave essentially complete control of grass weeds as indicated by late season ratings, Figure 1. Similar rates applied as a preemergence application gave erratic grass control, and were always less effective than pre-plant incorporated applications.

Control of broadleaf weeds was generally poorer than grass weed control with either preemergence or preplant incorporated treatments, Figure 2. Again, preplant incorporated applications were superior to conventional treatments. However, broadleaf weed control was still marginal. For the most part, broadleaf weed control ratings reflect control of Florida pusley and little control of Florida beggarweed.

Herbicides Prove Safe

None of the treatments described caused any noticeable injury to foliage of peanuts. Safety of the rates tested was also reflected in the peanut yields recorded in the table. Higher rates of several of the herbicides, such as trifluralin and nitralin, reduced yields.

Based on the results obtained at these

rates of application, there does not appear to be major differences in weed control among the dinitroaniline herbicides. Furthermore, peanuts appear to have sufficient tolerance to allow use of these types of herbicides.

YIELD OF PEANUTS TREATED WITH VARIOUS DINITROANILINE HERBICIDES, COMPARED WITH CULTIVATED AND HOED PEANUTS

Herbicide and rate per acre	Yield/acre by years	
	1971	1972
	Lb.	Lb.
Benefin, 0.75 lb.	4,670	2,400
Control	4,570	2,390
Nitralin, 0.75 lb.	4,520	2,730
Control	4,360	2,390
Dibutalin, 1.5 lb.	4,720	2,330
Control	4,570	1,830
Dinitramine, 0.5 lb.	3,230	1,740
Control	2,180	1,830
Fluchloralin, 0.75 lb.	2,910	1,710
Control	2,550	1,830
Profluralin, 0.75 lb.	2,440	2,330
Control	2,570	1,800
Trifluralin, 0.75 lb.	4,350	2,410
Control	4,360	2,390
AC 92390, 0.75 lb.	3,030	2,130
Control	3,030	1,970



Some 125,000 forest fires such as this occur in the U.S. each year damaging millions of acres of forest land.

fires were much younger than those in accidental fires. More than three-fourths of those involved in incendiary fires were less than 40 years old, and half of these were less than 20. Also, more than three-fourths of the accidental offenders were 40 years old or older with almost half of these 65 or older.

Marital status. Incendiary offenders were usually single, whereas accidental offenders were usually married. Widowed, divorced, or separated persons were involved about equally in both types of fires.

Education. Involvement in forest fires was associated with a lack of education. More than 80% of the accidental offenders had completed fewer than 8 years of schooling compared to 65% of the incendiary. Only four fires involved persons with education beyond high school.

Residence. Almost two-thirds of the offenders were rural people. Of the five who lived in cities, four were involved in accidental fires. Persons from small towns were implicated in incendiary fires almost twice as often as accidental fires.

Employment. On the basis of information available for about half of the cases it was found that the majority of offenders were employed full-time at the time of the fire. Less than 20% were unemployed.

A high proportion of accidental fires involved farmers and farm and forest workers. More than half the incendiary fires were associated with unskilled, non-farm laborers in manufacturing and construction.

Record and reputation. Less than 4% of the accidental and only 20% of the incendiary offenders had a previous police record. There was no evidence of a history of law violations.

The investigating fire officers provided two other evaluations of the offender. These consisted of a good, questionable, or bad rating of their financial and social reputations. Financial ratings showed that one-third of both the incendiary and accidental offenders were rated in each category. This same pattern occurred for the incendiary offenders' social rating, but the opposite was true of accidental offenders with 85% given a good social reputation rating.

These findings indicate that most persons involved in forest fires are farm workers or those small town residents living near forest areas. Preventative education must be directed to such people as farmers, farm workers, and forestry employees, with perhaps less emphasis on programs geared for urban and better educated audiences.

PEOPLE WHO START FOREST FIRES

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Department of Agricultural Economics and Rural Sociology

FOREST FIRES burn millions of acres in the United States each year. Of the estimated 125,000 forest fires that occur annually, about 90% are caused by man as a result of either incendiarism or accident. The Southeastern region has more than half (65%) of the incendiary forest fires in the Nation.

A study was begun in 1972 to review official fire reports for all fires occurring in the National Forests of Alabama, Georgia, Louisiana, Mississippi, South Carolina, and Tennessee from 1960 through 1971. Visits were made to each state where the case reports for forest fires occurring during this 12-year period were reviewed. Available information describing the nature of the case and characteristics of offenders were extracted.

Although a large number of incendiary fires had occurred in this six-state area during the study period, investigators were able to trace relatively few to specific offenders. Only 49 incendiary fire reports existed which provided sufficient information about the person or persons involved. By comparison the offenders in the majority of accidental cases were

identified and case reports available. For purposes of comparison, a sample of 53 accidental cases also were reviewed. The information reported here involves these two types of cases—incendiary and accidental—and the people involved in each.

Accidental cases were found to result primarily from two activities—debris burning (40%) and land-clearing (34%)—which got out of control and spread onto National Forest Lands. Use of alcoholic beverages entered in some way as a factor in 41% of the incendiary cases.

It was found that accidental fires were almost always the result of a single individual's action, but incendiary fires involved a single individual in only 35% of the cases. Incendiary cases usually involved a group action.

Race and sex. Persons involved in both types of fires were almost always white males. Only six offenders were black. Moreover, only 18 offenders were women, and they were primarily involved in accidental fires.

Age. Persons involved in incendiary

VIRUS DISEASES are among the most serious problems encountered in the production of southernpeas in Alabama. Most varieties grown in the State are susceptible to damage by virus diseases. Certain varieties grown in commercial production areas are so severely damaged that they can no longer be grown successfully.

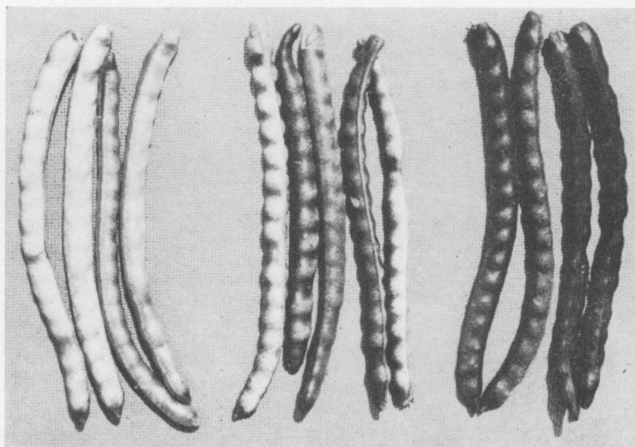
Breeding for virus resistance has been a major objective of our southernpea breeding program. The breeding effort in progress has benefited greatly from the cooperation in the past between the Department of Horticulture¹ and the Department of Botany and Microbiology.² The following information from that research provided basic preliminary background on which the breeding program was built. It was found that most southernpea varieties grown in the State are susceptible to at least three viruses: the cowpea strain of bean yellow mosaic (BYMV), cowpea chlorotic mottle (CCMV), and cucumber mosaic virus (CMV). The most damaging virus was found to be BYMV. The best sources of resistance to the three viruses were procured from the plant introduction collection maintained at the Regional Plant Introduction Station, Experiment, Georgia. Inoculation and screening techniques were developed for use in studying the inheritance of resistance and for screening progenies in the breeding program. Inheritance studies indicated that resistance to BYMV and CCMV is controlled by single recessive genes which result in a high level of resistance. Early studies of inheritance of resistance to CMV indicated that resistance was controlled by dominant genes. Selection criteria based on symptom expression were established as a practical means of screening for resistant selections in the breeding process.

Knowledge of the mode of inheritance of resistance greatly enhances the virus resistance breeding program. Since single genes are involved breeding is simplified. The backcross breeding method is being used to transfer resistance from resistant plants with few desirable characteristics to more desirable commercial varieties. First priority is being placed on the development of a BYMV resistant Knuckle Purple Hull, since this seems to be a most desirable variety for fresh market and is severely damaged by BYMV. Other varieties to which virus resistance is being transferred are Mis-

¹Dr. J. D. Norton (succeeding Dr. S. T. Jones, deceased) and Graduate Research Assistants B. D. Reeder and K. M. Rogers.

²Dr. R. T. Gudauskas and Graduate Research Assistant A. N. Harrison.

Producing virus resistant Knuckle Purple Hull peas is a top priority, because of their desirability as a fresh market vegetable. The photograph shows Knuckle Purple Hulls in an immature stage (left) more mature (center), and mature, as a virus resistant Knuckle Purple Hull variety should look when research work is completed.



Breeding Southernpeas For Resistance to Virus Disease

O. L. CHAMBLISS

Department of Horticulture

issippi Silver (brown crowder type), Princess Anne (blackeye type), and breeding line Ala. 562.3-1-2 (cream type). Although Mississippi Silver was susceptible to BYMV and CCMV when inoculated by our technique, it is reported to be tolerant to some viruses. Additional resistance to BYMV and CCMV should make it a most valuable multiple virus resistant variety. A new purple hull variety, Mississippi Purple, has the same potential since it has the same disease resistance as Mississippi Silver. Although its pod color and shape are different from Knuckle Purple Hull, it is available for the fresh market until a virus resistant Knuckle Purple Hull is developed.

The breeding program was initiated by crossing resistant introductions with commercial varieties. Resistant selections from segregating generations were made in screening tests, conducted in a controlled environment growth chamber. Seedlings were inoculated 7 days after planting by rubbing abrasive-dusted primary leaves with inoculum from freshly ground infected leaves. These inoculated seedlings were examined for virus symptoms 14-21 days after inoculation. Among the seedlings inoculated in a segregating

population, resistant plants were evident by having no visible symptoms. Symptoms on susceptible plants ranged from light to severe mottling. Resistant selections were made among seedlings with no visible symptoms. Resistant plants were backcrossed to recurrent, commercial parents and new selections made in the next segregating generation to begin the next backcross cycle. These backcrosses have been made and are currently being advanced to the next generation which will be screened for segregating resistant plants. The next backcross and screening cycle should produce virus resistant selections approaching the commercial parent type. In addition to transferring virus resistance to commercial varieties by the backcross program, new types have been selected in the early stages of the backcross program. Some of these are productive and appear to be valuable.

After meeting the more immediate need for fresh market varieties with BYMV resistance, breeding efforts in the future will be directed toward developing new varieties with resistance to BYMV, CCMV, CMV and other viruses which have become serious southernpea virus diseases in Alabama.

The Auburn University Herbarium: A Record of the Plants of Alabama

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AUBURN'S HERBARIUM, a collection of pressed and dried plants, is a multipurpose facility that works behind-the-scenes in many branches of agricultural science. It is a record of what kinds of plants can be found, and where, and when; as such it furnishes basic information for work in plant breeding, forestry management, landscaping, weed control, outdoor recreation, and many other fields.

An herbarium also can be viewed as a collection of historical documents representing more than just a museum for plants. Habitat notes included on the label for each plant specimen provide clues to the environmental requirements of various species. Likewise, locality and collection data accompanying these specimens may be used to determine ranges of occurrence, relative abundance or rarity, dates of introduction and spread of certain weeds, as well as flowering times and fruiting times for attractive wildflowers or native edible plants. Ecological impact studies, now legally required to precede any project causing major disruption of the natural environment, often begin with the inventory of plant life available in an herbarium.

The main value of an herbarium is the potential for scientific study that it represents. The specific means of realizing the most from this potential are reflected in the responsibilities of the person, usually a plant taxonomist, who curates the collection. The curator must: (1) safeguard the scientific collections held in trust by his institution; (2) make collections available to qualified personnel; (3) derive and publish information from the collections; and (4) augment the collections to increase their usefulness. An accepted principle of curatorship is the idea that any collections which form the basis of a published scientific study automatically become public domain and that whoever possesses them is ethically bound to maintain them in such a way that any responsible scientist who wishes to examine them may do so. Thus, the scientific value of herbarium specimens tends to increase with passage of time as more and more information is extracted from them.

Growth of the Auburn University Herbarium (designated AUA in scientific literature) has been by purchase of collections, donations, exchange of specimens, and personal collections by staff and students. The E. F. Andrews Collection, which forms the nucleus of the present AUA herbarium, was purchased during the 1950's and is historically important for two reasons: (1) Miss Andrews was author of a botany textbook published in 1911, and (2) her herbarium contained many specimens (about 1,000) collected by A. W. Chapman, author in 1897 of one of the earliest regional floras of the southern United States.

Before pressed and dried specimens are incorporated into the herbarium, they pass through a series of preparatory steps: (1) typed or printed labels are prepared stating where, when, by whom and under what environmental conditions the plant was collected; (2) the plant specimen and

its label are glued, taped, sewed or otherwise attached to 11½ in. × 16½ in. sheets of high-quality heavy rag paper; (3) finished specimens are fumigated to prevent destruction by insect pests; and (4) the accession is entered in herbarium records. Ultimately such specimens must be filed in fireproof cases according to some orderly retrieval system for future use. Specimens at AUA are filed alphabetically according to their scientific classification as to family, genus, and species and can thus be found as easily as a name in an index. Specimens of the same species are arranged according to the locality of collection by state and county.

Growth of the Auburn Herbarium during the past 5 years is summarized below:

Year	Specimens mounted and shelved
1969	3,357
1970	3,737
1971	3,640
1972	2,100
1973	1,420
Total	14,254
Cumulative through 1968	11,300
Present holdings	25,554

Although the increases in specimen number shown above may appear substantial, the herbarium is still quite small considering the enrollment, public service functions, and geographical location of Auburn University. Several university collections in the United States number well over a million specimens, and some maintain herbaria of more than 5,000,000, to which 20-30 thousand new specimens are added each year. Despite its small size and the relatively short time that rebuilding has been underway, the herbarium at Auburn is rapidly becoming one of the best sources of basic information about the plant life of Alabama.

Probably the most obvious function of any herbarium, whether large or small, is the identification of plant specimens. It is only at such a facility, with appropriate reference literature and adequate comparison material, that accurate identifications can be assured. When expert identifications are made for other plant taxonomists or collectors, the institution providing the service customarily receives duplicates of the specimens identified as remuneration. When this service is requested by the public or other individuals or departments within the University, every effort is made to answer the request as a gesture toward good public relations. The primary concern of curator and staff is that a sample received be adequate for the identity to be determined; it should consist of flowers, fruits, stems with leaves, and habitat data, if at all possible.

Continued expansion of the Auburn University Herbarium is expected. New opportunities for public service and basic research will occur as AUA continues to acquire documentation of the flora of Alabama and the Southeastern United States.

IRRIGATION . . . ORGANIC MATTER . . . FERTILIZER

Necessary Inputs for High Yield of Watermelons

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IRRIGATION, ORGANIC MATTER, AND FERTILIZER are triple inputs that combine to give high watermelon yields in Alabama. Each input alone increases production, but all three together gave highest yield in Auburn University Agricultural Experiment Station research on deep sandy soil low in organic matter. Marketable yield went as high as 685 cwt. per acre.

Rates of Fertilizer, Organic Tested

The research evaluated different rates of fertilizer and organic matter, both with and without irrigation. Rates of fertilizer used were none, 24-18-23, 48-35-46, and 72-53-69 lb. of N-P-K per acre. The organic matter used was either 6 tons of animal manure or 6 tons of green vetch per acre, applied in combination with medium and high rates of fertilizer. A 12-ton animal manure rate was tried with the high fertilizer rate. Irrigation consisted of 1 in. of water per week during the growing season when rainfall was deficient.

Watermelon seed were planted in hills 7.5 ft. apart in 9-ft. rows. Two plants per hill were left at thinning. Three weeks before planting, a 3-ft. row band was fumigated with a broadcast application of ethylene dibromide for rootknot nematode control. One-third of N and half of P and K were applied in the row before planting. This application rate was repeated as a side application 3 to 4 weeks after planting. Remaining N was put on when vines began to run.

Rainfall was sufficient the first study year and there was little or no response to irrigation. The second year was dry during the first 2 months of the growing period and yields were highly responsive to irrigation. Marketable yields shown by the graph are averages for the 2 years.

Yield data are given as marketable melons, according to



size ranges. The 20- to 29-lb. size is the most popular for the retail grocery trade, while the 30 to 39 and 40 to 49 weights are generally handled by roadside markets and other outlets.

Fertilizer Proves Essential

Value of fertilizer was established conclusively. There was no marketable yield where no fertilizers were applied.

Without organic materials added, increasing rates of fertilizer gave a consistent increase in total marketable yield and in yield of 20- to 29-lb. size melons. This was true both with and without irrigation.

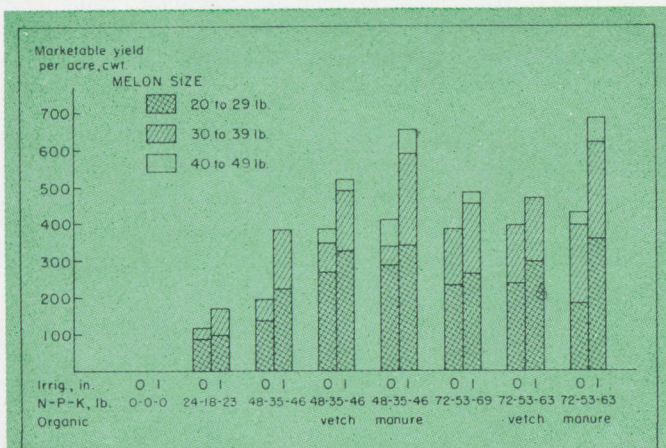
The high rate of fertilizer without organic or irrigation resulted in high production of melons of 30- to 39-lb. size — about three times as many as from lower rates of N, P, and K.

Organic Matter Boosts Yield

Adding 6 tons of green vetch or 6 tons of animal manure greatly increased yields at the medium fertilizer rate (48 lb. N, 35 lb. P, and 46 lb. K). The two organic sources gave about equal yield increases without irrigation, but with irrigation manure boosted yield more than vetch.

Going from medium to high fertilizer rate showed no yield advantage when the 6 tons of organic matter was used. A 12-ton manure rate was tried, but it gave no higher yields than were made following application of 6 tons.

Irrigation gave a consistent increase in yield with each fertilizer and organic treatment, as shown by 2-year averages recorded in the graph. A combination treatment of commercial fertilizer and animal manure, with irrigation, produced highest yields.



Effects of fertilizer rates, organic materials, and irrigation on yield of marketable size watermelons.

FACTORS ASSOCIATED with SUCCESS of CONTRACT BROILER GROWERS in ALABAMA

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MORRIS WHITE, *Department of Agricultural Economics and Rural Sociology*

THE BROILER INDUSTRY serves as an example of the success that may be achieved when a relatively young and growing industry continuously strives to solve its own problems and remains relatively free of government assistance. Information presented here is a portion of the results obtained from one industry-supported effort to make improvements.

Performance records indicated that some broiler growers were consistently more successful while others consistently were less successful with the broiler enterprise. Industry representatives cooperated in an effort to determine the factors contributing to this situation and to determine corrections that might be made. This effort involved obtaining detailed information from 167 broiler growers and 5 contracting firms. Ninety-one of the growers were among those who were successful (Group A), and 76 were among the less successful growers (Group B).

Information obtained included personal characteristics and attitudes of the growers, physical facilities used, and management practices followed in the growing operation.

These data revealed that the median age of the growers in Group A was 10 years above the Group B growers. However, growers in Group A had fewer years of formal education. A smaller proportion of both husbands and wives in Group A had off-farm jobs, and those who did work away from the farm worked fewer days at their non-farm jobs. More of the growers in Group A grew crops and livestock for sale. Although these enterprises did require time, most of it was spent on the farm and, consequently, growers were not

completely separated from the broiler operation for an extended period.

During the on-farm inspection the interviewer evaluated and ranked a number of items generally associated with a successful operator. Although the proportion that received a rating of "Excellent" was fairly low on some items for both groups of growers, the proportion that received the excellent rating was much higher on all items for growers in Group A. The proportion that received a "Good" rating was not significantly different between the two groups of growers. However, no grower in Group A received a "Poor" rating on any item that was rated. This information, recorded in the table, shows that the state of repair of buildings and equipment and the general appearance of a farmstead was associated with a successful broiler enterprise.

A majority of the growers in both groups felt that growing broilers provided an opportunity for them to do the kind of things they did best. But the proportion of Group A growers who felt they had little or no chance to do what

they could do best was only about half that for growers in Group B who expressed this feeling. Memberships in farm organizations were more prevalent among Group A members and they attended more meetings of the organizations during the past year, although attendance at meetings of this type was poor for growers in both categories.

Generally, growers agreed that servicemen were well trained. Growers in Group A disagreed less often with the servicemen's suggestions, but when there was disagreement they were most likely to cooperate with what servicemen suggested than were the Group B growers.

Growers in both categories who expressed a preference for contracts that provided for reasonable price guarantees plus performance bonus for doing a superior job had the best performance records. Eighty-four per cent of the Group A growers and 61% of the Group B growers expressed a preference for this type contract.

An area in which improvement could apparently be made was grower-company relations. A majority of growers in both groups had not visited the company's office in the past year, and more than two-thirds reported they were almost never complimented by a company representative other than a serviceman for performing an outstanding job.

Physical Facilities

There was a wide variation among the growers within the groups and between the two groups in the physical facilities being used. Although approximately four-fifths of all houses were of a pole type construction, more growers in Group A than in Group B had clear span houses. Other characteristics of Group A farms were more insulated roofs, better ventilation, and level topography. Ninety-five per cent of Group A houses were in good or medium condition, while only 65% of Group B grower houses were in equally good condition.

EVALUATION OF BUILDING AND PROPERTY CONDITION, BY GROWER GROUPS,
SELECTED BROILER OPERATIONS, ALABAMA, 1970-71

Item	Condition			
	Excellent		Poor	
	Group A	Group B	Group A	Group B
	Pct.	Pct.	Pct.	Pct.
Appearance of farmstead.....	37	6	0	2
Outside of broiler house.....	38	13	0	6
General state of repair.....	40	9	0	1
Drainage around house.....	26	10	0	0
Other farm buildings.....	11	2	0	4
Dwelling house.....	45	26	0	0
Yards.....	54	34	0	3
Equipment storage.....	18	11	0	0
Roads to buildings.....	26	16	0	0
Fields.....	20	7	0	0

VALUE OF ADDING protein supplement to steer finishing rations showed up in Alabama research. Steers fed basal mixtures containing protein supplement performed better than those fed the same mixture without added protein.

Basal mixtures of grain and roughage usually contain 8.5% to 9.0% crude protein as fed. In one recent trial, average steer gain was increased almost 0.2 lb. per day when the protein content was boosted from 8.4% to 11.6%. Other data also indicate that supplementary protein is needed in finishing rations even for cattle going directly from excellent grazing to the feedlot.

Either cottonseed meal (CSM), soybean meal (SBM), or peanut meal has been the supplementary protein source in fattening mixtures during the past 15 years of feedlot research by Auburn University Agricultural Experiment Station. Recently, however, limited availability and increased cost of these oilmeals has prompted livestock producers to use other sources. Interest has grown in possible use of whole cottonseed or soybeans and non-protein nitrogen materials.

Cottonseed to Replace CSM

Whole cottonseed typically contain about 23% each of crude fat (ether extract) and protein. When fed to cattle, cottonseed have total digestible nutrient (TDN) content of approximately 84%. In contrast, common fattening mixtures are 65% to 75% TDN.

In some early Auburn studies, ground cottonseed replaced CSM on a 2:1 basis. The mixtures containing CSM supported 8% higher rate of gain, but feed conversion was 11% more efficient on the mixtures containing cottonseed. This increased feed efficiency can be attributed to the high oil content of the cottonseed and the resultant higher TDN content of the mixture. These cottonseed-containing blended mixtures were full-fed to both yearling steers (750 lb.) and weanling calves (450 lb.). Both sizes of cattle made good use of the protein in cottonseed when used to make up 15% of the blended mixture.

Soybeans vs. SBM

Like cottonseed, full-fat or unextracted soybeans are high in energy because of their oil content and can be used as a protein source. This legume seed typically contains about 18% crude fat and 38% crude protein, with TDN content for beef cattle approximately 85%.



Several Protein Sources Suitable for Finishing Rations

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Soybeans contain certain enzymes (lipase, urease, trypsin inhibitor) that may cause undesirable effects if fed raw. Heat will inactivate these enzymes, therefore, cooked or heat-treated soybeans can be effectively used as livestock feed. Equipment is commercially available to roast the beans for feeding.

Three steer-feeding trials were conducted in which full-fat soybeans heated in a gas-fired "roaster" were substituted for SBM on an approximately equal basis. Cattle fed these mixtures had daily gain and feed conversion similar to performance when corn was the principal energy source. Substituting milo (grain sorghum) for the grain source resulted in more erratic animal response, but performance was still comparable between the two supplementary protein sources (SBM vs. heated soybeans).

Animal performance was similar in another finishing trial when raw full-fat soybeans were compared with heated soybeans as a source of protein. However, the mixture containing raw soybeans had a slight laxative effect, a condition that was not noted with the mixture containing heated beans. Raw soybeans should not be fed to cattle that are getting urea, nor should they be fed at a level above 15% of the mixture.

Non-Protein Nitrogen (NPN)

Microbes present in the digestive tract of ruminants can convert NPN into protein provided adequate energy is also available. Bacterial action combines nitrogen and a component of the energy source to form amino acids. These amino acids are then combined to form protein that is used by cattle.

A dry, urea-containing protein supplement (Auburn-65) was compared with CSM as a protein source in finishing rations for yearling steers. Rate of gain was comparable (2.7 vs. 2.6 lb. daily) and feed conversion was similar (10.8 vs. 11.3) during the three trials.

Liquid NPN supplements are available commercially and currently are good buys per unit of protein equivalent. Three such supplements proved satisfactory when compared with other sources of protein for fattening cattle. Feed intake, feed conversion, rate of gain, and carcass characteristics were comparable to those of steers fed CSM or Auburn-65 supplement.

Results from several Alabama feeding trials indicate that cottonseed or soybeans are satisfactory sources of supplementary protein in finishing rations. Certain non-protein nitrogen sources (either dry or liquid) also are effectively utilized as protein sources by fattening steers.

Shipping Fever Complex Causes Costly Cattle Problem

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SHIPPING FEVER — a common name for the “bovine respiratory-shipping fever” complex — is nothing new to cattlemen. It has been associated with the cattle industry since early times. Feedlot operators are especially hard hit by shipping fever, often suffering heavy losses of young animals.

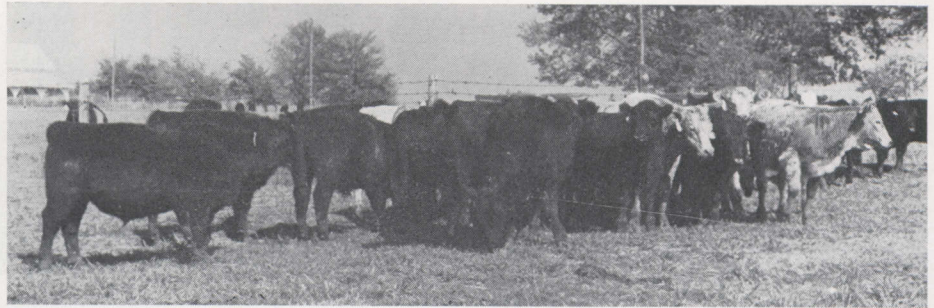
Any cattle purchased through a sales barn, shipped long distances, subjected to severe stress of any type, or exposed to sick animals or contaminated objects may develop signs of shipping fever. There may be occasional outbreaks on the home premises during the stress of weaning or as a result of introducing an exposed or sick animal into the herd. Feedlot operators would be reluctant to purchase calves from the same producer year after year if shipping fever becomes a regular problem.

The generally accepted cause of uncomplicated respiratory disease of cattle is a combination of parainfluenza-3 (PI-3) virus and two bacteria, *Pasteurella multocida* and *P. hemolytica*. Over the years, however, at least eight different viruses have been associated with outbreaks of respiratory disease and shipping fever complex. Viruses thought to cause most serious complications to the shipping fever complex are infectious bovine rhinotracheitis (IBR, red nose) and bovine virus diarrhea-mucosal disease (BVD-MD). In addition, a variety of bacteria other than *Pasteurella* may contribute to the disease or be involved as opportunists.

A preconditioning program — weaning 1 month before shipping and vaccinating against a variety of diseases which may or may not be associated with shipping fever — has been recommended. It is designed to minimize death loss from stress and disease during transfer of calves from farm to feedlot.

This preconditioning program may have little value, however, based on an experiment at the Piedmont Substation. Preweaning of calves and vaccinating for PI-3, IBR, BVD-MD, and *Pasteurella* organisms failed to protect the animals from respiratory disease or the shipping fever complex.

Fifty-three calves were divided into two groups, and half of each group were vaccinated with a commercial multivalent vaccine containing modified live virus of IBR, BVD-MD, and PI-3 and bacterin for *Pasteurella hemolytica* and *P. multocida*. This was repeated after 2



weeks, with the following management imposed on each group:

Group 1 (preweaned and preconditioned) — calves were weaned, then placed in a lot and fed shelled corn, supplement, and sorghum silage for 30 days.

Group 2 — calves remained with dams 30 days longer than Group 1 before being weaned.

After the 30 days, groups 1 and 2 were placed together and 20 calves that had been exposed to shipping fever were purchased from a stockyard and placed with the test animals. Half of the purchased calves were vaccinated on arrival.

All calves were observed daily for 30 days for signs of shipping fever. Blood samples for serum neutralization tests were taken from all calves initially and at 2-week intervals throughout the experiment.

There was no correlation between preconditioning or vaccination (or both) and clinical signs of shipping fever. All animals showed some degree of respiratory disease. Four vaccinated and four non-vaccinated calves required treatment. One vaccinated calf died of acute

respiratory disease. A nearly pure culture of *Pasteurella hemolytica* was isolated from its lungs. However, attempts to isolate virus from nasal swabs of sick calves or from lungs of the one that died gave negative results. Tests indicated that the viruses of IBR, BVD-MD, PI-3, and bovine adenovirus-I were not involved in respiratory diseases of these calves.

The fact that vaccinated calves were not protected in the experiment does not mean that the vaccines are not effective. The vaccines used provide protection only for the specific disease for which they are manufactured. Since these particular viruses were not involved in the disease complex that occurred, no effect of vaccination could be expected.

Effectiveness of *Pasteurella* bacterins has always been questioned. In this test it appeared to offer little protection.

The many varieties of disease producing agents that may be involved in any given outbreak of shipping fever complex makes control difficult. Good management and proper medical treatments must be considered, as well as available preventative measures.

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