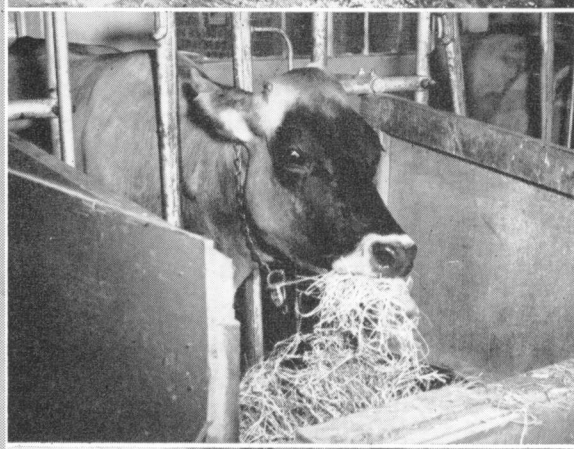
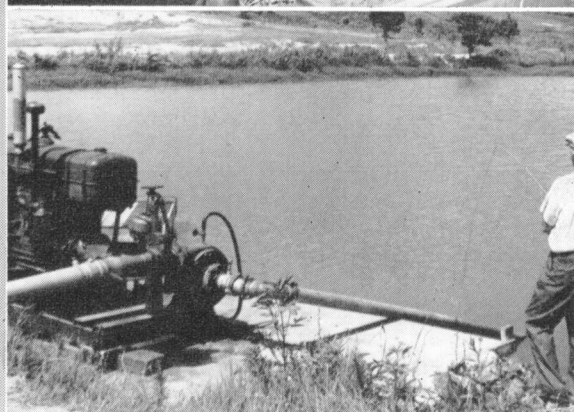
VOL. 5, No. 3 FALL 1958

HIGHLIGHTS of AGRICULTURAL RESEARCH





AGRICULTURAL EXPERIMENT STATION SYSTEM of the ALABAMA POLYTECHNIC INSTITUTE

A QUARTERLY REPORT OF RESEARCH
SERVING ALL OF ALABAMA

HIGHLIGHTS of Agricultural Research

VOLUME 5, No. 3 FALL, 1958

Introducing . . .

With this issue we bring you an enlarged "HIGHLIGHTS of AGRICULTURAL RESEARCH." It is a logical outgrowth from an expanded research program.

"HIGHLIGHTS" is 5 years old. Since its establishment in 1954, you have been kept informed on the progress of agricultural research in Alabama. You have had reports on results relating to animal nutrition and diseases; production of meat, dairy, and poultry products; the business or economics of farming; farm engineering and equipment; field crops, soil fertility, and soil management; forest products; food processing; fruit and truck crops; marketing; plant disease and insect controls; water conservation; game and fish management.

Letters from you readers have been most encouraging. It is our intentions to make the enlarged HIGHLIGHTS equally as useful and informative as past issues.

E. V. Smith

Director

In this issue . . .

Published by

AGRICULTURAL EXPERIMENT STATION of the ALABAMA POLYTECHNIC INSTITUTE

Auburn, Alabama

New and Timely PUBLICATIONS

Listed here are timely and new publications reporting research by the Agricultural Experiment Station.

Bul. 311. Household Use of Eggs in Gadsden, Alabama, reports effects of different factors on egg consumption by 629 families in that city.

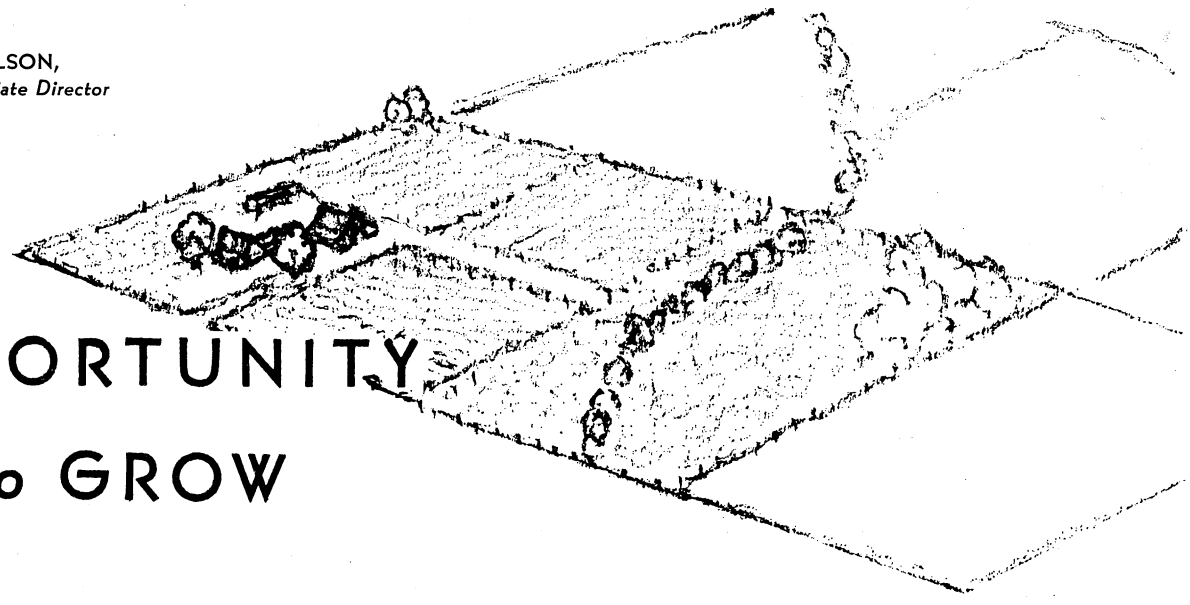
Bul. 312. Sulfur in Relation to Soil Fertility forecasts probable need for sulfur fertilization program in State.

Cir. 125. Fertilization of Camellias presents results of experiments done to measure fertilizer needs of plant.

Leaflet 55. Young Oat Forage . . . reports tests showing young green oat forage as a highly palatable and digestible feed.

Free copies may be obtained from your county agent or by writing the API Agricultural Experiment Station, Auburn, Ala.

COYT WILSON,
Associate Director



OPPORTUNITY to GROW

OPPORTUNITY TO GROW is the greatest need of Alabama farmers. With more than 73 per cent of the State's farms smaller than 100 acres in size, the opportunities for increasing efficiency are limited.

Growth may consist of acquiring more acres or in developing more intensive production practices. In either case, growth should lead to greater farm income.

All state and national programs designed to assist the "small farmer" should contribute to providing opportunity for growth. Such programs should provide opportunity for freedom of choice by individuals. Farmers should not be forced off their land or forced to remain in situations where opportunity is not there.

Taking advantage of opportunity usually requires adjustment to changing conditions. Within the last 25 years, Alabama's agriculture has changed greatly. The typical farmer of 1930 has disappeared. He has adjusted to a new pattern of farming or he has left for some other type of employment. In the same way, the farmer of today must adjust to succeed.

The nature of the adjustments that will be required are unknown at present. For instance, contract farming, or vertical integration, may or may not become more common. Part time farming may increase as industrialization increases. The diversified family farm may give way to the specialized commercial farm. Or, present trends may be reversed, giving rise to more full-time farmers on medium sized farms with a diversified program.

The role of agricultural research is to develop information that will contribute to improved opportunities. This research program should be broad enough and basic enough to serve all types of farmers. All people, including farmers, have need for more information on such things as improvement in efficiency, improvement in quality of agricultural products, and conservation of natural resources.

Production Efficiency

Regardless of the systems of farming being followed, successful competition is dependant upon efficient production. Research results have shown that it is possible to produce four bales of cotton per acre in Alabama. Yet more research is needed to determine if it is economical. Efficient production involves more than making high yields per acre. More information is needed on methods of reducing labor requirements and on economics of various production practices. Likewise, production of corn, small grains, fruits, vegetables, and hay crops must become more efficient if Alabama farmers are to compete successfully with those in other regions. Efficient production of livestock and poultry will require better control methods for parasites and diseases, reduction in labor requirements, and improved management practices.

Better Quality

Research on methods of improving quality can contribute to greater opportunities for Alabama farmers. Much has been said about the low quality of beef and pork produced in the South. Research is needed to show how high quality slaughter calves and steers may be produced efficiently. Hogs must carry more lean meat and less fat. Urgently needed are methods of standardizing quality in milk and other dairy products. In some instances, the problem is to retain, during the marketing process, the quality that is present. Fresh fruits, eggs, and certain vegetables are examples of products that deteriorate rapidly. Research is needed to develop ways of preventing such deterioration.

Conserve Resources

Opportunity for future generations is as important as opportunity for those who live today. Research on methods of increasing crop yields should provide information on methods of maintaining soil fertility. There is a continuing need for research on plants adapted to the various soil types and slopes that are found in Alabama. Ways must be found of using our water resources more efficiently if future generations are to have the opportunities they deserve. Means must be found of maintaining wildlife under increasing pressures of urbanization, and greater use of pesticides.

Through coordinated efforts of all concerned, opportunities can be improved for the present and can be made to increase, rather than diminish, as time marches on. . . .

Concentrate feed containing the antibiotic comes in 50-lb. bags. The proper quantity (by weight) is added to the laying ration. Varying amounts of the antibiotic tested at Auburn failed to increase production of caged layers.

Do ANTIBIOTICS *increase* EGG PRODUCTION?

GEORGE R. INGRAM, *Associate Poultry Husbandman*

ARE YOU WASTING MONEY on antibiotics for layers? Efforts have been directed toward convincing poultrymen that continuous use of antibiotics in laying rations is essential.

These compounds have been sold as a cure for all evils. They have done tremendous good for sick birds, and as growth stimulants for chicks. However, results of experiments by the API Agricultural Experiment Station have shown that antibiotics are not always helpful. They also show that the poultryman is probably spending money needlessly when he feeds layers a high level, antibiotic feed as a routine practice.

Antibiotics Used

Three experiments were conducted to determine advisability of adding antibiotics to laying rations.* In the first experiment, terramycin and 3-nitro were tested with a flock of caged White Leghorns. In the second and third experiments, White Plymouth Rock broiler breeders were used to test bacitracin.

In the first experiment, a cage house with hens that had been in production for about a year was used. Cull birds were replaced by pullets. The birds were in a very low rate of production at the time the tests were started. Duplicate groups of 63 birds each were started on identical rations except for different drugs at various levels. Ration 1 had nothing added; ration 2 had 50 gm. of terramycin per ton added; ration 3, 10 gm. of terramycin per ton; ration 4, 45 gm. of 3-nitro per ton; and ration 5, 50 gm. of terramycin per ton added to the feed one day each week. Production of the birds on the 5 rations has been divided into 3, 4-month periods, Table 1. The data show that the control birds increased in production at about the same rate as the groups receiving the antibiotic. This is in opposition to some reports that feeding a high level of antibiotic to low-producing hens will rapidly increase egg production. The control group had the highest rate of production throughout the year and neither the antibiotic nor the 3-nitro caused any increase in egg production.

Other Tests

Two experiments with White Plymouth Rock broiler breeder hens were conducted using 75 gm. of zinc bacitracin per ton of mash for comparison with non-medicated groups. In both experiments mash was fed at the rate of 2 parts to 1 part corn. This gave a level of 50 gm. of the antibiotic per ton of ration. In the first experiment, about 1,000 breeders were divided. Half the birds were given medicated feed and the others were fed a non-medicated ration. The birds had been in production 5 to 6 months and were laying at a very low rate when the test was started. Under conditions of this test, there were no benefits from the antibiotic.

For the second experiment with breeders, two houses of approximately 1,000 birds each were selected. The group with the lowest production was placed on feed containing the antibiotic. The difference in production at the beginning was present throughout the test, and the uniformity of this difference indicates that the antibiotic did not improve production.

Summary

These data are not in agreement with some published reports. Experiments of the API Station failed to show any response in egg production, feed conversion, or mortality from feeding high or low levels of antibiotics to laying hens. Three-nitro also failed to demonstrate any beneficial effects. During periods of infection or disease outbreaks, the results might be different. . . .

TABLE 1. PRODUCTION OF CAGED LAYERS FED ANTIBIOTICS

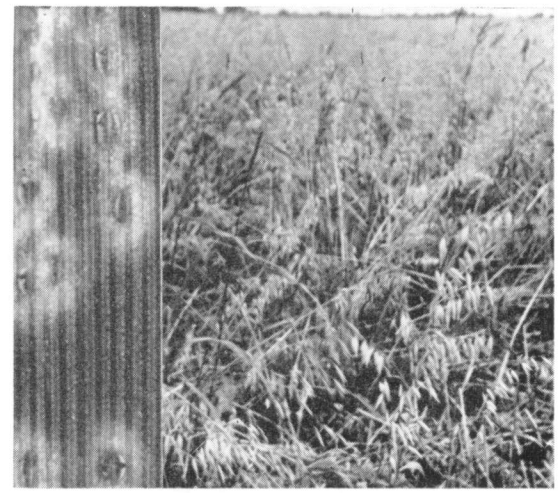
Treatment	Prod. by 4-month period 1	2	3
	Pct.	*Pct.*	*Pct.*
None	44	63	68
Continuously			
Terramycin, 50 gm. per ton	46	58	62
Terramycin, 10 gm. per ton	46	62	67
3-Nitro, 45 gm. per ton	44	61	64
Weekly			
Terramycin, 50 gm. per ton	43	61	66

* Materials for this study were supplied by Cosby Hodges Milling Co., Commercial Solvents Corp., and Charles Pfizer & Sons.

DISEASE CONTROL *of* SMALL GRAINS

has twofold purpose

J. A. LYLE, *Head*
Department of Botany and Plant Pathology



Here is shown damage from small grain diseases. At left, a portion of a leaf from a susceptible wheat plant having leaf rust infection. At right is a badly lodged field of oats that was caused by Victoria blight.

YOU CAN HAVE more grazing for your livestock and put more grain in your bins by controlling small grain diseases.

Thus, disease control can serve a twofold purpose in production of oats, wheat, and rye – major forage crops in all sections of Alabama.

Results of research at the API Agricultural Experiment Station show that by controlling small grain diseases, both forage and grain yields may be increased. In recent years increases in yields at the Station have resulted from the use of resistant varieties, seed treatment, and crop rotation – the best known control measures.

Oat Diseases

Victoria (*Helminthosporium*) blight and leaf (crown) rust are the major diseases of oats. Both occur throughout the State, but leaf rust is more prevalent in southern and central Alabama.

Victoria blight, a serious threat to the oat crop, affects the root system, crown, and foliage. It may kill or seriously weaken the plants at any age. High temperature and rainfall favor rapid development of this disease. Damage may cause reduction of stand to such an extent that reseeding is necessary. Farmers have experienced such losses from early plantings. The organism that causes the disease lives on the seed and in the soil.

Use of resistant varieties will help control this disease. Seed treatment tests using an organic mercurial, such as Ceresan M or Panogen 15, have proved these materials partially effective in controlling seedling infection. Rotation of susceptible varieties with non-grain crops is a good practice.

Leaf rust, the other major oat disease, may appear early, especially when temperature and high humidity favor disease development. In some years this disease has caused near failure of grain yields. Heavy infections may cause lodging and early ripening.

By planting adapted, resistant varieties, such as Victorgrain 48-93, Arlington, and Fulgrain, losses can be reduced.

Other oat diseases of less importance are anthracnose, leaf blotch, culm rot, loose smut, powdery mildew, stem rust, Septoria black stem, halo blight, red leaf (yellow dwarf), and several kinds of mosaics.

Wheat Diseases

Leaf rust and powdery mildew are the most widespread and important wheat diseases in the State. Leaf rust infection has caused old varieties to perform poorly. The only recognized control measure is use of adapted resistant varieties, such as Anderson and Atlas 66.

Powdery mildew is common on wheat, particularly in southern and central Alabama, when soil fertility is high enough to stimulate vigorous plant growth. The disease occurs on leaves and leaf sheaths from mid-winter to early spring, during periods of cool, cloudy weather. A severe infestation will destroy leaves, reduce foilage palatibility, and reduce grain yields.

There are no varieties resistant to powdery mildew. However, Anderson and Atlas 66 show some resistance.

Less important diseases of wheat include anthracnose, basal glume rot, loose smut, scab, Septoria leaf and glume blotch, and stem rust.

Rye Diseases

Leaf rust occurs on rye every year, but does not always cause damage. It is more prevalent in southern and central Alabama causing premature dying of leaves and shriveling of grain. The only known control is to plant an adapted resistant variety, such as Gator.

Anthracnose, a soil-borne disease, has been prevalent and sometimes damaging throughout the State, particularly in areas having low fertility or open coarse soils. Continuous grass-cereal culture also promotes development of this disease. The disease organism lives in the soil and in old crop debris.

Disease damage is reduced by rotation with legumes, improved soil fertility, and plowing under infested crop debris after harvest.

Minor parasitic diseases of rye include bacterial blight, ergot, scald, stalk smut, and stem rust.

Seed Treatment

Tests have shown that it pays to treat before planting all small grain seed with fungicides, such as Agrox, Ceresan M, Panogen 15, and similar seed protectants. Advantages of such seed treatment are: (1) It kills certain seed-borne disease organisms; (2) it protects the seed against soil-borne diseases, thus enabling the seedlings to get a good start and produce thicker stands of healthy plants; and (3) the cost of seed treatment is very small. . . .

NEW USES *for low grade* SWEETPOTATOES

HUBERT HARRIS and J. M. BARBER,
Department of Horticulture

Sweetpotato pies made from a puree developed at Auburn to find markets for No. 2 and jumbo grades.

SWEETPOTATO GROWERS can easily lose 40% or more of their crop due to unsatisfactory markets for low grades.

Fresh markets provide good outlets for No. 1 grade and canners use small No. 2. The problem facing growers is finding a profitable market for No. 2 and jumbo grades of sweetpotatoes. These off-size or off-shape potatoes usually can be marketed only at unsatisfactory prices.

New Processes Developed

Food technologists at the API Agricultural Experiment Station, through research, have developed new processes that will utilize these grades of sweetpotatoes. Results show that the jumbo grade can be used in making a sugar-blanched, frozen strip, excellent for use as candied yams.

A new sugar-cook process uses jumbos, No. 2's, and other grades in making a superior quality frozen puree. This product is excellent for making pies and souffles. These grades are also usable for making a high quality non-sugared puree, suitable for use as baby food and other specialty foods.

Sweetpotato processors from a number of southern states have expressed keen interest in these new processes and products. Some processors have already started making one or more of the products or plan to start with this fall's sweetpotato crop. These products are believed to offer a good outlet for all sweetpotato grades not suitable for the fresh market.

Sweetpotato grades: No. 1 (left), ideal for fresh market; small No. 2 (center), preferred for canning; No. 2 and jumbo (right), suitable for puree and strips.

SWEETPOTATO PIE OR SOUFFLE MIX

Ingredient	Per cent by weight	To make 9-inch pie
		Cups
Sugar-cooked puree[1]	65.0[1]	1.85
Sugar	13.0[1]	0.75
Whole milk	15.7	0.50
		ts
Milk powder	1.5	5.0
Egg	2.5	4.0
Oleo or butter	2.0	4.0
Salt	0.3	0.5

[1] If non-sugared puree (70% moisture) is used, reduce puree to 56% and increase sugar to 22%.

Frozen strips are made by cutting peeled jumbo potatoes into strips, blanching for 4½ minutes in a 60% sugar solution at boiling temperature, cooling in another 60% sugar solution, packaging, and freezing.

Sugar-cooked puree is made by adding 1 lb. of a 65% sugar solution to each 4 lb. of peeled sweetpotatoes, cooking in a covered vessel at a low boil for approximately 1 hour, and pulping to remove fiber. Non-sugared puree is made by a similar process, the main difference being that water is used as a cooking medium instead of the sugar solution. The amount of water used and the rate of boiling may be regulated to give the desired moisture content in the finished puree. Moisture contents of 55% or higher are obtainable.

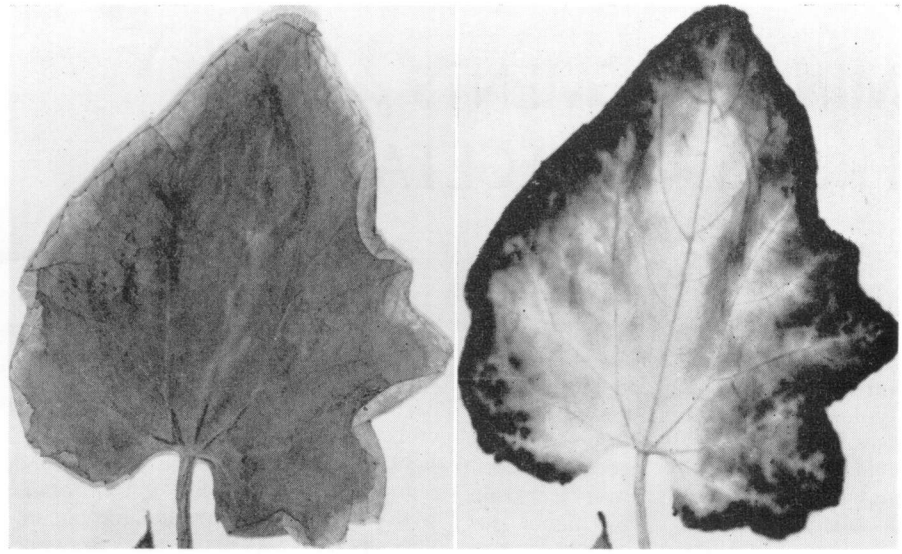
The prepared purees, whether made with or without sugar, may be preserved by conventional freezing or canning methods. In preserving by freezing, the hot puree may be packaged in metal containers and cooled in the container, or it may be precooled in a tubular heat exchanger and packaged in any suitable frozen food container. The former method incorporates less air in the product and results in better color of puree. The packaged products keep well at 0° F. storage. Canning involves packaging the hot puree in suitable containers, exhausting, sealing, processing under steam pressure, and cooling.

These products have been tested widely in college dining halls, school lunchrooms, and in commercial cafeterias; results are reported in Station Circular 121. A rating of good or excellent was given in 98% of the evaluations.

Improved Recipes

Another phase of the research has been concerned with improvement of recipes for making sweetpotato pies and souffles from the prepared puree. Experimental pies were made by 161 different formulas in which the ingredients were varied in kinds and amounts. The formula that rated the highest as a plain mix is given in the table. This mix was used as the standard base mix for testing different supplementary flavor ingredients. The mix had a soluble solids content of 44%, total solids content of 47.6%, and was fluid enough to level out in a pie shell. A 1¾-lb. package was enough for a 9-in. pie or a family-size casserole souffle. As flavor ingredients, cocoanut, pineapple, and vanilla scored highest in ratings. Others in order of preference were plain mix, cinnamon, lemon, and orange.

Baking required about 40 minutes for pies and 20 to 35 minutes for souffles at 400° F. The products were properly baked when they puffed and bubbled. Upon cooling, the products "set" to an excellent consistency. . . .



Leaf from cucumber plant at left shows typical simizan injury. Note the dead areas along the edge. An autoradiograph of the same leaf is shown at right. The darker areas are regions of higher concentration of radioactive simizan.

RADIOACTIVE HERBICIDES *aid research*

D. E. DAVIS, H. H. FUNDERBURK, JR., and N. G. SANSING, *Department of Botany and Plant Pathology*

THE KILLING POWER of an herbicide depends on the amount that gets into the plant and where it goes after entering.

Many factors, such as temperature, rainfall, waxiness of the leaf, kind of herbicide, and the wetting agent, affect the penetration and movement of an herbicide in the plant. By making it radioactive, it is possible to determine the effects of these factors on absorption and translocation of the herbicide.

Use of Autoradiograph

These effects are recognized by means of autoradiographs or by a Geiger counter. In making autoradiographs, the negative is darkened by radiation from the isotope rather than from light. No camera is used in this method. Instead, the negative is covered with a very thin sheet of plastic and the subject pressed tightly against it. The darkened negative thus becomes an exact record of the areas of isotope concentration in the subject. The Geiger counter is a device that can very accurately measure the radiation given off by a small sample. From this it is possible to determine the actual quantities of material involved.

One of the primary advantages of the radioisotope method is that it measures very tiny amounts. Less than one hundred millionth lb. of herbicide caused the injury to cucumber leaf shown above left. This amount of herbicide weighs less than the ink required to make the period at the end of a sentence. Nevertheless, in 3 days it killed the tissues along the edge of the leaf and the same concentration was enough to eventually kill the whole plant. Such small amounts can not be determined by a routine chemical analysis, but radioisotopes have made it possible to easily measure such small amounts.

The leaf at the right above is from a cucumber plant grown in a nutrient solution containing a radioactive herbicide. After the roots had been in the solution for 3 days, the top was cut off, pressed, dryed, mounted on cardboard, and covered with a thin sheet of Saran Wrap. The plant was placed in the dark in contact with X-ray, no-screen film. After 2 weeks the negative was developed. A picture printed from the negative is a result of the invisible rays given off by the radioactive herbicide in the leaf. The darker regions correspond to places of higher herbicide concentration. These parts may also be placed in a Geiger counter and the degree of radioactivity used as a measure of the amount of radioactive herbicide in the plant parts.

Research Results

Research at the API Agricultural Experiment Station has made use of the foregoing techniques in studies on simazin. It is a relatively new herbicide with unusual promise for pre-emergence weed control in corn. The first experiments dealt with (1) absorption and translocation of radioactive simazin from nutrient solution by corn, cotton, and cucumber and (2) the relative tolerance of these plants to the herbicide. It was found that corn was very tolerant to the chemical, cotton intermediate, and cucumbers very sensitive. All three species absorbed the chemical quite freely from solution, but the distribution pattern was different. The simazin was concentrated in certain areas in the cucumber, while it was less localized in the cotton, and evenly distributed throughout the corn. It is possible the radioactivity observed in the corn plant was not simazin but rather a decomposition product resulting from a change of simazin to non-toxic materials. This has been confirmed in other laboratories.

The second series of experiments dealt with leaf applications of simazin. It was found that when sprayed on leaves intact, even the Geiger counter could not detect any movement of the radioactive simazin into the plant. However, if the leaf was cut off and the cut end placed in the herbicide or if the surface was roughed with sandpaper before simazin was applied, then the chemical entered the plant. Apparently the wax-like covering of the leaf forms an impenetrable barrier to the chemical. Hence, one would expect that it would be possible to use the chemical as a post emergence spray on a relatively sensitive crop to control newly germinating weeds whose roots must grow in the chemically treated soil surface.

Radioactive herbicides have made it possible to predict the probable behavior of the chemicals in the field and to understand how they work. The end result will be more, better, and cheaper herbicides. . . .

MINOR ELEMENTS *for* FRUITS *and* VEGETABLES

JOHN I. WEAR, *Assoc. Soil Chemist*
T. B. HAGLER, *Assoc. Horticulturist**

DO YOUR FRUITS and vegetables show signs of starving even when enough nitrogen, phosphate, and potash are applied? If so, certain minor elements may be needed.

Minor elements are becoming more important with increased use of organic insecticides and fungicides, higher purification of fertilizers, and greater use of lime. Continuous cropping with heavy feeding crops, such as fruits and vegetables, may deplete the soil of minor elements.

Fruits

A condition resembling zinc deficiency was noted on peaches at the Wiregrass Substation, Headland, in 1957, photo 4. Soil and spray applications were made to determine effects on growth and zinc uptake. The most effective treatment without serious leaf burn was a spray application of zinc sulfate (36%) at rate of 4 lb. per 100 gal. Zinc in leaves was increased from 32 p.p.m. to 164 p.p.m. by the spray. New growth on the trees appeared normal in the spring of 1958.

The effect of minor elements on muscadine grapes was studied in greenhouses at Auburn. Growth of plants was much greater when full nutrient solutions were used than when either boron or molybdenum was omitted or no minor elements were used, photo 1.

Extreme chlorosis on young apple leaves was observed at the Main Station. Trees showing chlorosis were sprayed with minor element mixtures. Those sprayed with ferrous (iron) sulfate at the rate of 3 lb. and 2 oz. per 100 gal. of spray were greener by the third day after spraying. After 2 weeks, all sprayed leaves looked normal.

Vegetables

Although most Alabama gardens are grown without their addition, many garden crops need extra minor elements. Such crops as cauliflower, broccoli, turnips, cabbage, rutabagas, beets, and carrots require added boron for good quality and high yields and dry weather increases the need. Broadcast applications of 20 to 25 lb. of borax per acre are recommended for these crops (1 lb. per 2,000 sq. ft.). On light sandy soil that has been limed, boron is essential for good results. Borax is not recommended for cucumbers, peas, snapbeans, and strawberries, since these crops may be burned or show toxic symptoms from the 20- to 25-lb. rate.

Deficiency Symptoms

Close observation will reveal if vegetable crops are deficient in boron. Quality will be poor and yields low with crops that show the following symptoms:

BEETS. Dark spots on the surface and extending into the flesh of beets indicate deficiency. Canker or internal dead areas are prominent between rings. The growing tip of the plant may die or it may have dark green or thickened leaves.

CAULIFLOWER. The most characteristic symptom shown by cauliflower is the dark center with dead tissue. Leaves may be brittle and thick and dark areas may appear on the head, photo 2.

CABBAGE AND BROCCOLI. Boron deficiency causes young leaves to curl before the head is formed. Heads may have discolored or watery core.

CARROTS. The edible portion may split and leaves become yellow to pinkish because of boron deficiency.

TURNIPS. Root tubers of boron-deficient turnips have brown heart or watery core. In more deficient plants, leaves may appear purplish yellow and may die from the margins.

Sweet corn may be zinc deficient on light sandy soil that has been limed. Yellow to white streaks on leaves and a yellowing of the bud usually indicates zinc deficiency, photo 3. Application of 10 lb. per acre of zinc sulfate (about 1 lb. per 4,000 sq. ft.) at time of planting will prevent the deficiency.

* Resigned.

Effects of minor element deficiency is shown here: (1) muscadines without minor elements (left), without boron (center), and with all minor elements (right); (2) boron deficient cauliflower; (3) sweet corn with zinc deficiency; and (4) zinc deficient peach leaves.

J. T. COPE, JR.,
Associate Agronomist

WINTER LEGUME CROPS *for* GREEN MANURE

GROWING WINTER LEGUMES to supply nitrogen for corn is still a good practice. Results of many Alabama experiments, old and new, show that corn following a good crop of winter legume turned for green manure will produce as much or more than corn receiving commercial nitrogen. And, the cost is less than for commercial nitrogen.

The best legumes for green manure are hairy vetch and crimson clover. This is shown by results of experiments at the Aliceville, Brewton, and Monroeville Experiment Fields from 1931 through 1957 (see table). Yields are given for the last 5 years.

In these experiments, all plots received 600 lb. of basic slag and 100 lb. of muriate of potash annually, either to the corn or the legume. Corn following legumes was not fertilized. That on non-legume plots received 500 lb. of sodium nitrate in addition to the slag and muriate.

Vetch and Crimson Clover

Hairy vetch and crimson clover are both well adapted to all areas of Alabama. They averaged more than 12,000 lb. of green weight per acre in the three experiments reported. This is enough to supply about 100 lb. of nitrogen, since the green legumes contain about 0.8% nitrogen. These legumes have produced as much or more corn than 80 lb. of nitrogen at all three locations. Hairy vetch is easier to establish than crimson clover, especially when planted early on light soil for the first time.

Other winter crops tried in these experiments at various times during the last 26 years are Willamette and Monantha vetch, Austrian winter peas, lupine, red clover, and rye. All were inferior to hairy vetch and crimson clover. Rye as a winter cover crop did not increase corn yields. It is not a legume and, therefore, does not add nitrogen to the soil.

Lupine has been a productive legume in these experiments. Blue lupine was used at Brewton and Monroeville and white lupine at Aliceville. Lupines are no longer recommended for most locations, however, because of susceptibility to damage from cold weather, diseases, and nematodes.

New Vetches

The API Agricultural Experiment Station has two new vetches that are in the seed increase stage.[1] Auburn woolypod vetch is a new strain that grows off much earlier than hairy vetch. When used for grazing or green manure, it is ready much earlier than hairy. Auburn common vetch is an early strain that produces large yields of both green matter and seed. It is resistant to the insects that reduce quality and yields of seed of hairy and other vetches. It shows great promise of producing satisfactory seed yields under Alabama conditions. Most seed of the vetches normally grown in Alabama are produced in the West.

To produce winter legumes successfully for green manure or for winter grazing, they must be planted in September or early October. November and December plantings are too late most years to produce satisfactory growth.

Cotton-Corn Rotation

Winter legumes can be used most successfully ahead of corn in a 2-year rotation with cotton. They are less satisfactory ahead of cotton because it is often difficult to produce good legume growth in time to turn under for cotton. It is necessary to delay planting 2 to 3 weeks after turning to avoid worm damage to young seedlings.

The cost of producing winter legumes is less than the cost of 80 lb. of commercial nitrogen. Thus, there is the possibility of increasing profits by using winter legumes in rotation with corn. This is especially true for farmers who have hogs or cattle that can graze part of the early production of these legumes. Relative costs of legumes and commercial nitrogen were presented in an article in the 1955 Fall Issue of **Highlights of Agricultural Research. . . .**

[1] No seed are available at this time.

YIELDS OF VETCH, CRIMSON CLOVER, AND LUPINE AND THEIR EFFECTS ON CORN YIELDS, THREE LOCATIONS, 1952-56

Treatment	Legume green weight				Corn yield			
	Brewton	Monroeville	Aliceville[1]	Av.	Brewton	Monroeville	Aliceville[1]	Av.
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Hairy vetch	9,570	14,900	12,430	12,300	50.6	45.4	37.3	44.4
Willamette vetch	3,130	6,160	8,140	5,810	41.6	42.6	35.2	39.8
Crimson clover	8,020	16,140	14,760	12,970	42.7	40.7	40.6	41.3
Crimson, 80 lb. N[2], alternate years	7,870	17,810	13,830	13,170	40.5	42.6	36.9	40.0
80 lb. N	----	----	----	----	41.4	41.2	32.7	38.3

[1] Six years, 1952-57, at Aliceville.
[2] The 80 lb. of nitrogen was from 500 lb. sodium nitrate.

PEANUTS *lose* WEIGHT *in* STORAGE

J. H. YEAGER, *Agricultural Economist*
H. S. WARD, *Botanist*

How much weight do farmers stock peanuts lose in storage? This question is of interest to peanut buyers, warehousemen, shellers, and farmers.

When a load of peanuts leaves the farm, it normally contains loose shelled kernels, foreign material such as sticks, leaves, small stones, and sand, and peanuts in the hull with a certain kernel moisture content. Peanuts are bought, graded, and usually placed in a warehouse prior to cleaning and shelling. Under these conditions buyers are uncertain of the weight and quality of peanuts that will come out of storage.

In the fall of 1952, a study was begun on peanut storage to determine changes in quality and weight of farmers stock peanuts stored in farm size bins. Four important peanut-producing states — Alabama, Georgia, Virginia, and Texas were included in the study. The Commodity Credit Corporation and USDA Agricultural Marketing Service cooperated in the study. The Alabama study was conducted at the Wiregrass Substation, Headland.

Storage in Small Bins

Used in this study were small metal or wooden bins of various structural designs with 2- to 10-ton capacity. Results indicate that peanuts lost an average of 1.4% of their initial dry kernel weight each year of storage. The longer the storage period, the greater is the total loss in weight. Four bin lots of peanuts were stored from the fall of 1952, 4 from fall of 1953, 4 from fall of 1954, 5 from fall of 1955, and 6 from fall of 1956 to June, 1957. All of these bins were emptied in June, 1957. In certain bins, insect control measures were applied. In others, no control was practiced. Average weight loss as a percentage of the dry kernel weight of peanuts placed in bins was 6.8, 4.2, 4.2, 4.1, and 1.2, respectively, for the 1952 through 1956-crop peanuts stored.

In a ton (net inweight), the loss in weight of kernels averaged 20.7 lb. or $3.84 per year, according to the tests. This is based on the condition that peanuts graded 26% hulls, 0 to 1% damage, and 8% other kernels, 65% sound mature kernels (SMK); that the weight loss rate was the same in sound mature kernels as in other kernels; and a value of 20¢ per lb. prevailed for sound mature kernels and 8¢ per lb. for others.

Loss Calculations

Weight loss was calculated as follows: The amount of foreign material, based on the grade factor percentage for foreign material, was subtracted from the gross weight of peanuts placed in each bin. Next, the weight of hulls, based on the grade factor percentage for hulls, was subtracted. This left the weight of kernels or meats. The kernel moisture content of peanuts placed in storage varied considerably. Therefore, the weight of kernels was adjusted to 0 or a dry weight basis. When the bins were emptied, the same procedure was followed in arriving at the dry weight of kernels. To determine the weight loss, in- and out-weights were compared.

Why Loss?

Many factors, some related to length of storage period, influence the amount of weight loss. Insects — species, numbers, and their environment — play a major part in weight loss. One bin lot of 1952-crop peanuts was never treated to control insects from 1952 through 1957. When the bin was emptied in June, 1957 and weight calculations were made, the loss in kernels dry weight was 10.4% of the dry weight of kernels placed in the bin almost 5 years earlier. Insect control in stored peanuts is necessary if weight loss is to be minimized and quality maintained.

There are other factors that influence weight loss. Stored peanuts come to a balanced moisture level with their environment after they are placed in storage. As fluctuations take place in this environment, the kernels and hulls change in moisture content. Generally, the kernel moisture content of peanuts stored in various kinds of bins was highest in December and January. It was lowest during the summer months. Lows of slightly below 4.5% moisture were reached in the summer of 1954 and 1955.

The peanut seed is a living organism that carries on the normal processes of life. These processes are at a low level if seed moisture content is 7.0% or less. However, some loss of weight may occur as the result of these processes.

Rats and mice, if not controlled, also are responsible for losses of peanuts and reduction of quality during storage.

There are also sources of error in measurement of the many factors related to weight loss. Foreign material, in particular, is quite variable. Obtaining a respresentative portion of foreign material in samples drawn from a peanut mass is quite difficult.

Therefore, practices to control insects, rats, and mice must be carried out by those who store peanuts. There is also a need for better methods and techniques in obtaining a representative sample from the various loads of farmers stock peanuts placed in storage.

LACY L. HYCHE, *Assistant Entomologist*

INSECTS *are* FORESTS' WORST ENEMY

INSECTS TODAY ARE forests' worst enemy! They are 7 times more destructive than fire and 2 times more than disesase in the United States.

Forests are one of our most important resources. They occupy some two-thirds of Alabama's total land area, or about 21 million acres. We lead the Mid-South in timber production and are second among all southern states in pulpwood production.

Yet silently and often unobserved, forest insects take a heavy toll of timber every year, attacking all stages of tree growth.

For 2 years, the API Agricultural Experiment Station has had under way research on forest insects for the purpose of determining the most important pests and developing more effective controls. For the present, the work has been concerned mainly with insects attacking pine.

Bark Beetles

Results of studies indicate that the bark beetles are the most destructive single group attacking pine forests. This includes the southern pine beetle, black turpentine beetle, and the Ips engraver beetles. These feed on the inner bark girdling and killing the tree. The first sign of attack is the presence of white to reddish-white pitch tubes along trunks and limbs where the adult forms have entered the tree. If tree is of low vigor, pitch tubes may be absent, with only boring dust in the bark crevices indicating beetle presence. Foliage of infested trees soon begins to fade, turning yellow and finally red. Bark beetle activity is greatest during the warm months of the year from spring until fall.

The most destructive insect of the group is the southern pine beetle. This tiny, ⅛-in. long, dark brown to black insect may attack pines from 2 in. in diameter to mature trees. The adults construct easily recognizable winding S-shaped tunnels in the inner bark. Under favorable conditions the southern pine beetle is capable of destroying large stands of pine in one season.

The black turpentine beetle is similar in form and appearance to the southern pine beetle but is much larger. It varies in size from ¼ to ⅜ in. long and generally attacks large pines. Black turpentine beetle attacks are usually concentrated along base and lower trunk and are seldom found above 10 to 12 ft. from the ground. The larvae feed heavily in the cambium often killing large patches of bark, thus weakening and killing the tree.

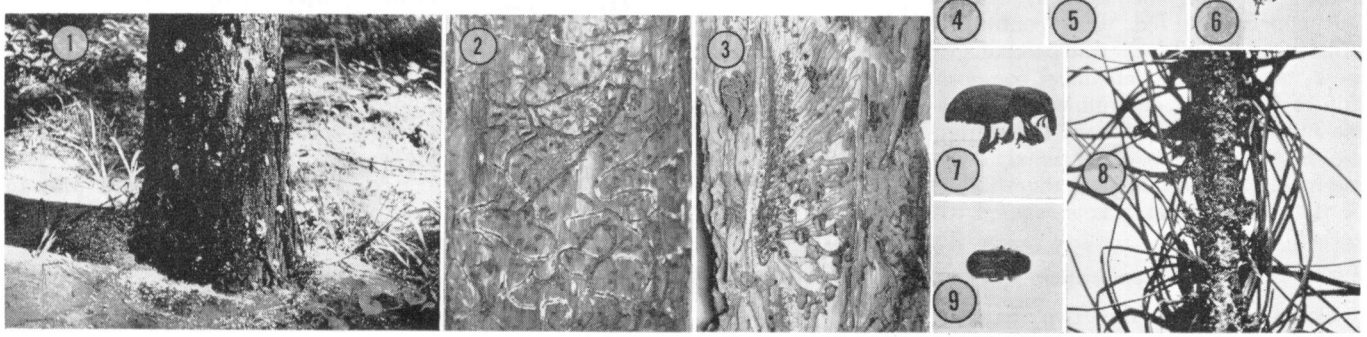
Ips engraver beetles are readily identified by the peculiar shape of the rear end of the body, which is scooped or hollowed out and surrounded by several small tooth-like spines. There are 3 species of engravers common to Alabama. They are reddish-brown to black in color and vary in length from about ⅛ in. for the smallest species to nearly ¼ in. for the largest. Ips beetles infestations are generally associated with trees weakened by fire, lightning, or other injury. However, they will attack apparently healthy trees when large populations build up in weakened or freshly cut pine.

Pests of Young Pine

Two very important pests of young pine reproduction are the pine pitch-eating weevil and the pales weevil. These snout-beetles are reddish-brown to black in color, and ¼ to ½ in. long. They feed on bark of young seedlings girdling and sometimes stripping the entire plant of bark and needles. In experiments these weevils have destroyed as high as 45% of planted slash seedlings during the first season. Damage appears to be heaviest in plantations established within one year after cutting of the previous stand.

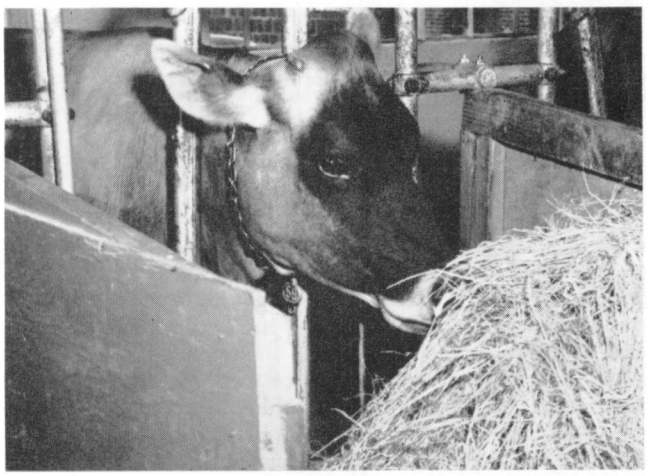
The Nantucket pine tip moth is another serious pest of young plantations. Although the tip moth seldom, if ever, kills a tree, feeding by the small yellowish larvae in terminal tips often kills back twigs as much as 2 to 4 in. resulting in a loss in growth. Young pines up to 10 ft. in height are usually most heavily attacked.

In addition to the foregoing, forest insects also cause losses by defoliating trees, damaging cones and seed, and injuring nursery stock. . . .



Pitch tubes on trunk (1) are signs of presence of black turpentine beetle (9); damage to inner bark by southern pine beetle (2) and Ips engraver beetle (3); adult, southern pine beetle (4); adult, Ips engraver beetle (5); adult, pales weevil (6); adult pitch-eating weevil (7); and typical damage to pine seedlings by pales and pitch-eating weevils (8).

COASTAL BERMUDAGRASS *vs.* ALFALFA HAY *as a* DAIRY FEED



G. E. HAWKINS,
Assoc. Dairy Husbandman

COASTAL BERMUDAGRASS has been widely publicized. The high forage yields produced by this grass under ideal moisture and fertility conditions are well known.

Rapid increase in acreage of Coastal Bermuda on dairy farms has made this grass important in the dairy feeding program in Alabama. For this reason, a series of tests was begun at Auburn to study the feeding value of Coastal.

Experiment Completed

An experiment has been completed comparing Coastal Bermudagrass and alfalfa hays as sources of roughage for dairy cows. Twenty cows were used in two tests – 5 were fed Coastal and 5 alfalfa in each test. Before going on test, all cows were fed a similar ration of U.S. No. 2 alfalfa hay and concentrates.

Coastal Bermuda hay tested was cut at about 15 to 18 in. in height. That fed during the first test was cut in September, 1956. Hay for the second test was cut in July and August, 1957. During the test, the amounts of hay and concentrate fed were controlled. Milk weights and butterfat percentages were measured and chemical composition of feeds was determined. Digestible nutrient values of hays fed during the first test were determined separately. In the second test, digestibility of the entire ration was measured together.

Chemical Composition

Composition of the two hays is shown in the table. Coastal Bermuda averaged lower in crude protein and ash contents, but was higher in crude fiber than the alfalfa hay. Content of TDN (total digestible nutrients) of the two hays was similar. Digestible protein content, however, was much lower for Coastal Bermuda. Thus, there is an obvious danger of a deficiency of digestible protein and minerals when cows are fed Coastal Bermudagrass hay as the only roughage. This danger is greater when the hay is fed to high producing cows on a wide grain-to-milk ratio.

The first Coastal hay was fed to supply 67% of the TDN intake. In the second test it furnished only 50% of TDN. Cows fed alfalfa consumed similar percentages of their nutrients as hay. Concentrates supplied the other nutrients in each ration.

Both Coastal and alfalfa hays were eaten readily by the cows. Amounts of each hay refused averaged about 1/10 lb. daily.

AVERAGE COMPOSITION AND DIGESTIBILITY OF COASTAL BERMUDAGRASS AND ALFALFA HAYS

Chemical component	Alfalfa	Coastal Bermuda-grass
	Pct.	*Pct.*
Dry matter	90.4	91.0
Crude protein	18.0	10.8
Crude fiber	26.0	29.5
Ether extract	1.9	1.9
Nitrogen free extract	36.2	43.1
Ash	10.3	5.7
Digestibility of hay[1]		
TDN	52.2	50.5
Protein	11.2	9.0
Digestibility of rations[2]		
TDN	58.4	58.3
Protein	12.1	7.9

[1] First test.
[2] Second test.

Milk Production

Milk production of cows fed Coastal Bermudagrass was lower than that of cows on alfalfa hay. The difference was greater in the first than in the second test. In the first test when concentrate was fed at the rate of 1 lb. to 3 lb. of 4% milk, cows fed alfalfa produced 2.8 lb. more milk per cow daily than those on Coastal. The difference was only 0.2 lb. per cow daily in the second test when the grain to milk ratio was 1 to 2. Average daily production of 4% milk is shown below for the two rations:

	Daily Production	
	Coastal Bermudagrass	Alfalfa
First	22.2 lb.	25.0 lb.
Second	24.1 lb.	24.3 lb.
Average	23.1 lb.	24.7 lb.

In this experiment Coastal Bermudagrass was a poor substitute for alfalfa for dairy cows when concentrate was fed at the rate of 1 lb. to 3 lb. of 4% milk (first test). However, the data indicate that Coastal may be almost equal to alfalfa when the rate of concentrate feeding is 1 lb. to 2 lb. of milk (second test).

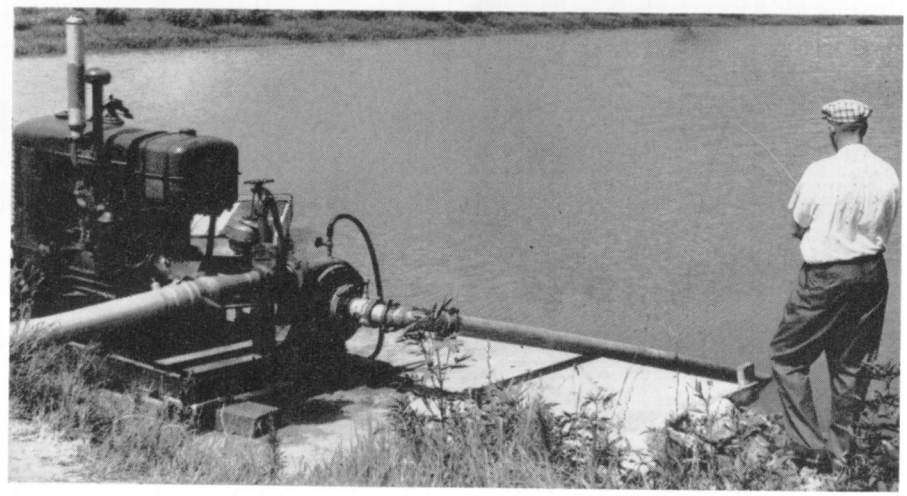
Other Tests Needed

As shown by results of the experiment reported, composition of Coastal Bermuda and milk production by cows fed the hay varied. TDN content was similar to alfalfa, but digestible protein content was lower. Average milk production for the two tests was 6.4% higher for the cows on alfalfa.

Additional research is under way to determine effects of stages of maturity, season when cut, and different levels of concentrate feeding on the nutritive value of Coastal Bermudagrass for milk production. . . .

J. A. HUTCHINSON and MORRIS WHITE,
Dept. of Agricultural Economics

Are farm PONDS WORTH *the* MONEY?



PONDS ARE a desirable feature on a farm. They conserve water for irrigation and livestock uses and provide fishing and other recreation. On the other hand, ponds are costly to build and maintain and many wonder if they are worth the money.

An article in the 1958 Spring Issue of **Highlights of Agricultural Research** gave research results showing that farm ponds used for commercial fishing can be profitable if managed properly. But, what about the many ponds on Alabama farms? Are they profitable as used by farmers?

Lee County Study

A study of 51 ponds was made in Lee County in 1957 to learn about farm pond costs and returns. With minor adjustments, the information obtained will apply to other areas with climate, soils, and topography similar to that of Lee County.

Costs

Although total construction costs were greater for large ponds, per acre cost was higher for small ponds. Among the ponds used for commercial purposes, irrigation ponds were largest. Commercial ponds cost an average of $203 per surface acre (see table). Cost of building noncommercial ponds ranged from $590 per acre for small to $211 per acre for large ponds.

Annual costs varied from a low of $7.24 per acre for commercial irrigation ponds to $30.81 per acre for ponds used by clubs. Annual costs were near $30 for 4 of the 6 groups of ponds. Upkeep costs for large ponds were low because they received little or no fertilizer.

Returns

Selling day fishing permits returned an average of $44.26 per acre of water annually, with net return of $15.80. This was computed without charging for family labor. Had family labor been charged at 75 cents per hour, the ponds would have shown a loss.

Clubs provide a profitable but limited market for pond use. Renting to a club returned one pond owner $75 per acre plus annual upkeep. On two farms, clubs built and maintained ponds in return for a long-term lease. One lease was to run for 10 years and the other 15. In both instances owners had fishing, boating, and livestock watering privileges.

Owners of small noncommercial ponds reported an average catch of 192 lb. of fish per acre and medium-size ponds yielded 135 lb. per acre of pond. Fish were valued at 39 cents per lb. by the owners. At this price, returns from small ponds were $74.88 per acre and $52.65 from medium-size ponds. No information was available on returns from large noncommercial ponds.

AVERAGE SIZE AND COST OF CONSTRUCTION PER SURFACE ACRE, SAMPLE PONDS, BY USE, LEE COUNTY, ALABAMA

Use	Average pond size	Per acre construction cost
	Acres	*Dollars*
Commercial		
Club	8.9	$358.14
Fishing permits	9.6	341.93
Irrigation	11.6	202.53
Noncommercial		
Small	1.0	590.41
Medium	3.3	306.32
Large	18.7	211.01
AVERAGE	---	$268.04

Irrigation Costs and Returns

Returns data were available from half of the irrigation ponds. All irrigation costs were computed on the basis of acre-in. of water applied to crops. Irrigation cost averaged $4.40 per acre-in. of water for pasture, silage crops, and small grains, and $7.95 for cotton. One reason for the greater cost for irrigating cotton was the extra investment for equipment.

Irrigating pastures, small grain, and silage crops gave a net return of 51 cents per acre-in. of water. For cotton the net return was $6.48 per acre-in. Return per acre of pond depends on amount of irrigation water used.

No evaluation was made of recreational, site improvement, livestock water, and other uses of farm ponds. Intensity of the use for recreational purposes varied widely. However, uses for this purpose were reported by most pond owners, though some indicated a decrease in use for this purpose with an increase in the age of the pond.

An answer to the question of whether a pond will be profitable is not provided by the data reported. They do, however, indicate that the profitableness of a pond depends upon management and use. . . .

NEMATODES *and* ROOT-ROT *cause* SEEDLING DAMAGE

BRUCE E. HOPPER,
Assistant in Botany

Nematode injury to slash pine in a tree nursery is pictured here. Infected seedlings in foreground showed chlorosis and stunting, and died as compared with more normal seedlings in the background.

THE DEMAND for forest seedlings has far exceeded the supply making it necessary to expand established nurseries and to create new ones.

This expansion, plus the fact that the seedlings are grown at high densities, provides a situation favorable for appearance and multiplication of disease-producing organisms. Among the organisms that may prove harmful to forest seedlings are the plant-parasitic nematodes.

Survey of Nurseries

A survey of 43 pine forest nurseries extending from North Carolina to Texas made by the API Agricultural Experiment Station, in cooperation with the U.S. Forest Service, revealed the presence of at least 20 genera of nematodes capable of feeding on seedlings. Of the number that feed on pine, evidence available at present shows only a few that cause economic injury.

The table summarizes the most important data compiled from visiting these nurseries.

TYPE INFESTATION	No. NURSERIES
Plant parasitic nematodes	43
High number of plant parasitic nematodes	17
High number of pine parasitic nematodes	8
High number of pine pathogenic nematodes	5
Nematode loss	3
Root rot	4
Root rot and high no. of plant parasitic nematodes	2

Disease Found

The most common disease encountered and by far the most important is root-rot, sometimes referred to as "black root-rot." This condition is thought to be a result of the interaction of plant-parasitic nematodes and pathogenic fungi.

There are two possible ways in which nematodes may be associated with root-rot. They may (1) by their feeding action create openings through which the fungi enter or (2) their feeding injuries may be unnecessary for fungal entrance. The fungi involved may be quite capable of penetrating and causing the disease when wounds caused by nematodes are lacking.

This particular root-rot may be easily recognized as having three economic stages. At first the disease is evidenced by swollen, blackened areas on the tap and larger lateral roots. Next, the disease spreads killing a major portion of the root system. A seedling in this condition is worthless. Finally, if the seedling remains in the ground long enough, an increased growth of lateral roots develops. This often results in a seedling having a larger root system. A seedling in this stage of the disease does just as well when outplanted as do uninfected seedlings.

The standard nursery practice of grading all seedlings protects the buyer from purchasing seedlings having the intermediate stage of the disease.

The use of selected chemicals has been known to result in a production increase from 50,000 to 1 million plantable seedlings per acre.

Research Conducted

Research by the API Agricultural Experiment Station on nematode damage includes:

(1) Various species of plant-parasitic nematodes recovered during the survey are being tested to determine if they utilize pine as a host.

(2) The life cycle and development of the pine cystoid nematode, one of the few found to cause injury to pine seedlings exclusive of fungi, is under investigation. In this study the changes in structure of the host root are being determined.

(3) In a further attempt to determine the role of the various nematodes found in nursery soils, tests are being conducted to find out if soil fungi serve as host plants. At the present time a species of nematode has been successfully raised on several different kinds of soil fungi. This information will prove valuable in determining whether the nematode feeds on the roots, or if the fungus enters the root and the nematode in turn feeds on the fungus.

(4) Population studies at a root-rot infested nursery are being conducted. Preliminary data collected in 1957 indicate a large population of nematodes where the disease is worse.

Other Damage

In a few nurseries in Louisiana and Texas, injury has occurred as a result of the presence of hundreds of individuals of a stunt nematode. Although fungi may have caused some damage in these nurseries, nematodes probably were responsible for most of the injury that made seedling roots susceptible to the fungi. In this case the fungi followed the nematode and caused injury only after it had first weakened the plant. . . .

S. A. EDGAR,
Poultry Pathologist

WORMS-- *cut production of* CHICKENS

WORMS WERE AMONG the first organisms recognized by ancient Chinese and early Egyptians as one cause of diseases of man and animals.

In the last 2 centuries, a wealth of information has been gained about hundreds of species throughout the world. It includes description, classification, life cycles, and damage done, particularly about those that infect man, animals, and plants.

Nevertheless, facts about the damage poultry worms do have been meager, and hence their economic importance has been questioned. It is for this reason that the API Agricultural Experiment Station began research to determine effects and importance of the most common poultry parasites.

Flukes, tapeworms, and round worms have been reported as the cause of serious poultry losses. Surveys in the Southeastern States revealed that large round worms and cecal worms are common in broilers. They also showed that these two species as well as certain thread worms and several species of tapeworms are common in laying flocks. Their occurence depends to some extent on the type of management practiced. In contrast, flukes are rarely encountered in this area.

Tapeworm Infections

EFFECT ON GROWTH. Under confined floor management and where riddance of whole flocks (depopulation) is routine, tapeworms are seldom found in broilers or laying hens. However, birds often become heavily infected with one or more species when allowed to run in yards or range, or as replacements are allowed to mix with older birds.

All poultry tapeworms to complete their life cycle must have an intermediate host, such as beetles, flies, earthworms, or slugs. Five species of tapeworms are most common in chickens in the Southeast.

In controlled tests using 3 of the most common species, all retarded growth of chickens. One was the smallest tapeworm, yet it was the most damaging of the 3 species. Growth of chickens infected with the smallest species was retarded significantly within 4 weeks. Maximum effect occurred by the 5th and 6th weeks after inoculation.

EFFECT ON EGG PRODUCTION. Hens experimentally infected with two tapeworm species dropped 20% to 50% in egg production. The reduction started by the 2nd week. Reduced production persisted throughout the 13 weeks.

Round Worms

EFFECT ON GROWTH. Round worm infections are common among broilers and laying stock reared on litter or in yards and on range. In Auburn tests a few deaths have occurred within 2 to 4 weeks after inoculation. These have been attributed to infections of 2,000 to 5,000 larvae per bird. Previously unexposed pullets infected for the first time after coming into production have been killed by infections that filled 10 to 15 in. of the small intestine.

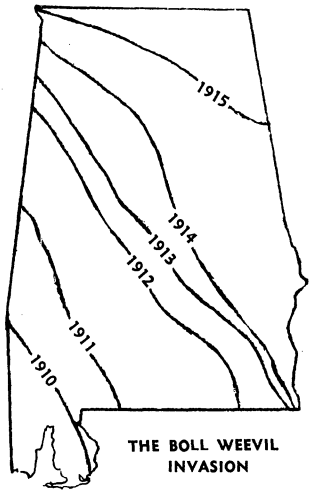
EFFECT ON EGG PRODUCTION. Hens that were exposed for the first time after having layed 3 to 6 months dropped in egg production enough to be important. The decline did not occur until 3 to 4 weeks after infection and continued through the remaining 13 weeks of the experiment. In another type of experiment, pullets were infected with large round worms during the growing period. After laying 3 to 9 months in laying cages, they were inoculated with 1,000 to 4,000 embryonated worm eggs. Although no additional infection was established after this inoculation, in each of the 3 tests the birds declined sharply in egg production about 4 days after inoculation. By 4 weeks, their production had dropped from an average of 71% to 46%; they then began to recover. Some birds failed to lay again during the remaining 12 weeks of the experiment. This sharp drop was attributed, tentatively, to their coming in contact with the foreign protein of the worm to which they were sensitive.

Conclusions

Surveys of flocks throughout Alabama and adjoining states revealed worm infections in birds in excess of those in the foregoing experiments in which both growth and egg production were significantly retarded.

Therefore, control of tapeworms and round worms is economically important to the poultry industry.

There are two important steps in controlling round worms and tapeworms in chickens by breaking the life cycle: (1) sanitation, such as routine cleaning of houses and yards; and (2) worming with recommended drugs. For round worms either piperazine, phenothiazine, or nicotine is used. Tin compounds are recommended for tapeworm control. Life cycle of the tapeworm may be broken also by confining birds to houses to reduce intermediate hosts – flies, earthworms, beetles, and slugs. . . .



THE BOLL WEEVIL INVASION

BOLL WEEVILS

-then and now

KENNETH B. ROY, *Editor*
F. S. ARANT, *Entomologist*

FIFTY YEARS AGO consternation was abroad in Alabama. Ever moving eastward, the boll weevil was then within 120 miles of the State's southwestern border.

The weevil first entered the United States from Mexico in 1892 by way of Texas. By late 1909 it was at the Mobile County line. Within 12 months, infestations involved all of Mobile and Washington counties, and portions of Choctaw, Clarke, and Baldwin counties. Since crossing the Rio Grande River, it had spread in 18 years over much of Texas, all of Louisiana, and sizeable areas of Oklahoma, Arkansas, and Mississippi. All but six Alabama counties had become infested by 1915. The rapid spread of the weevil in the State was attributed to high winds from the west and southwest.

Early Measures

All of this took place despite monumental efforts of farm leaders of that day to halt the weevil's advance. Yet, the transition from quarantines to mechanical and cultural devices to poisons is a dramatic story of research that involved entomologists, agronomists, chemists, and engineers.

The first move by Alabama was passage of a quarantine law in 1903. It was intended to prevent the weevil from hitching rides to fresh territory in seed cotton, old pick sacks, cotton seed, Spanish moss, and even household goods. Transport of such items from infested to weevil-free territory was prohibited.

But the weevil was no respecter of law. Under favorable weather conditions, it enveloped 75- to 100-mile strips of "new territory" in a year.

Forefront in the fight were farmers, bankers, businessmen, and the API Agricultural Experiment Station. Beginning in 1904, the Alabama Station produced many publications concerning the boll weevil, methods of combating the pest, and even one on "Heading Off Boll Weevil Panic."

With no known insecticides effective against the weevil, the logical attack was to cut off its food supply. Destruction of green cotton at least 3 to 4 weeks before usual killing frost was recommended. This was said to be the most important single step in a cultural system under boll weevil conditions. There were those who predicted that in the presence of weevils there could never be late cotton.

In addition to planting early, various mechanical contraptions were devised, such as chain drags to sweep fallen, infested squares into the middles for exposure to the hot sun; and a long sack fastened to a sugar-barrel hoop for collecting overwintered weevils and infested squares on young cotton.

Coming of Poisons

London purple and Paris green were the first arsenicals tried – both were ineffective. Then came lead arsenate. Applied as a dust, it produced the first real encouraging results. This was followed by development of a new material carrying a higher percentage of arsenate than the lead form. This new poison called calcium arsenate was highly effective. Thus, cotton production was entering a new era marked by development of better insecticides and improved dusting equipment. The first Alabama experiments involving calcium arsenate were in 1918 at Auburn, Hartford, Headland, and Smyrna.

Calcium arsenate was to remain some 30 years as the standard insecticide for boll weevil control. Following World War II came new compounds – the chloronated hydrocarbons DDT, BHC, toxaphene, heptachlor, dieldrin, and endrin; and the organic phosphates parathion, malathion, methyl-parathion, and guthion. The most recent development is a carbamate – Sevin.

All of these required critical testing to determine effective killing power, economy of application, how best to use, hazards if any, and many other questions to be answered.

Thus, after 50 years of experimentation, boll weevil investigations continue to provide answers to ever-arising new problems and to further refine methods of control.

Research is never ending! . . .

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