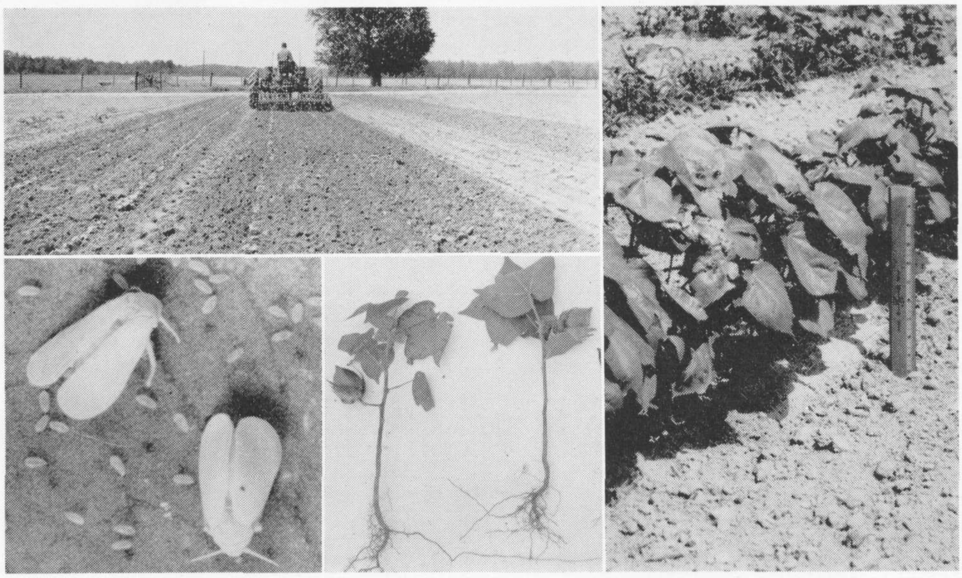
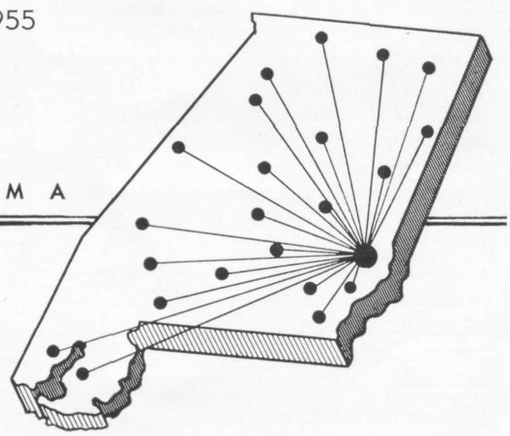
HIGHLIGHTS *of* AGRICULTURAL RESEARCH



In this issue—Cottons and Corns Are Products of Years of Plant Breeding . . . Systemics—A New Approach to Fighting Ornamental Plant Insects . . . Nematodes—Tiny But Mighty . . . Planting and Cultivating Are Important Steps in Cotton Mechanization . . . Chemical Weed Control in Cotton Can Cut Hoe Labor 80 to 100 Per Cent . . . Even More Meat Per Pound of Feed.

VOL. 2, No. 1 — SPRING 1955

SERVING ALL of ALABAMA



AGRICULTURAL EXPERIMENT
STATION SYSTEM
of the
ALABAMA POLYTECHNIC INSTITUTE

NEW COTTONS *and* CORNS Are Products of Years of Plant Breeding

A. L. SMITH, *Pathologist**
F. S. McCAIN, *Associate Plant Breeder*

BREEDING OF COTTON AND CORN varieties is not a game of chance!

It is a highly skilled technique of breeders who know their plant history and who carefully study plant material before lines are finally selected for combining into new varieties. In some cases, many years are spent by the plant breeder in developing a new variety especially adapted to a given area.

As early as 1908, the API Agricultural Experiment Station had started its cotton breeding project. Although some breeding work had been done earlier with open-pollinated corn varieties, it was not until 1946 that a modern hybrid corn breeding program was begun in Alabama.

The breeding of cotton and corn – Alabama's two major farm crops – has many problems in common. The most important consideration is yield. All the breeding work for yield improvement of these two crops has as background information the extensive variety testing programs conducted throughout the State. In addition to yield, both crops have other characters on which improvement work is being done: namely, lodging, disease resistance, insect resistance, adaptation to mechanical harvesting, improved quality, and many others.

Corn Breeding

Corn breeding by hybridization methods had its beginning in the U.S. in the early part of this century, but it was not until 1947 that suitable hybrids became available for Alabama. Although the first recommended hybrids were an improvement over the open-pollinated varieties, it was realized at the time that better hybrids could be obtained through plant breeding methods. As a result, the API Agricultural Experiment Station started a corn improvement program in 1946. This program has not been in operation long enough to have developed a new hybrid but significant advances have been made. Inbred lines that offer promise in hybrids have been developed and tested. These new lines are now incorporated into hybrids that must undergo further testing before they can be fully evaluated.

In addition to the efforts to develop new hybrids, companion studies on nematode and earworm resistance have been initiated. Still another function of the corn breeding program is to supervise the maintenance of breeder's and foundation seed of certain hybrids now in production. Foundation seed of Dixie 18 and North Carolina 27 were produced in 1954. Plans are underway to expand this program to include other hybrids.

Cotton Breeding

Cotton varieties released by the API Experiment Station are constantly being improved from the yield standpoint. Additional work is underway to better adapt them for harvest with the spindle picker and to improve fiber qualities and disease resistance.

The breeding of wilt-resistant cottons has long been the number one problem of cotton breeders in Alabama. The first study conducted in the South on the problem of wilt and nematodes of cotton was made at Auburn by George F. Atkinson in 1890. Breeding for resistance to wilt was initiated in 1908. The first highly resistant cotton variety, Cook 307, was released in 1917. This variety was well adapted to production on all wilt soils of the southern and central parts of the State. Later a strong demand developed for a longer staple length of all cotton varieties. Cook 144 and several other Cook varieties with a staple length of about one inch were released during 1920 to 1930. Cook 144 became the most popular variety for production on wilt soils from 1930 to 1940.

The purchase of the Plant Breeding Unit at Tallassee, Alabama, in 1945 gave a strong impetus to the cotton breeding program. After many years of searching for a soil severely infested with wilt and nematodes, this area was located. The infestation of the soil with these organisms is severe enough to give quick elimination of susceptible plants, making possible rapid progress in breeding resistant plants. This enabled the early release of the wilt-resistant variety, Plains, in 1949. As indicated in variety tests, Plains is adapted for production in all parts of the State, and it outyields introduced varieties by about 5% at most locations. A recent review of all variety test data in the Cotton Belt shows that locally developed varieties usually outyield those developed in other regions.

A second variety, Auburn 56, was released in 1952. It is the most wilt- and nematode-resistant variety developed anywhere and shows the full effect of the possibilities of breeding under the severe wilt and nematode conditions at the Plant Breeding Unit. Auburn 56 is more stormproof than other commercial varieties and appears to have possibilities for use with spindle pickers.

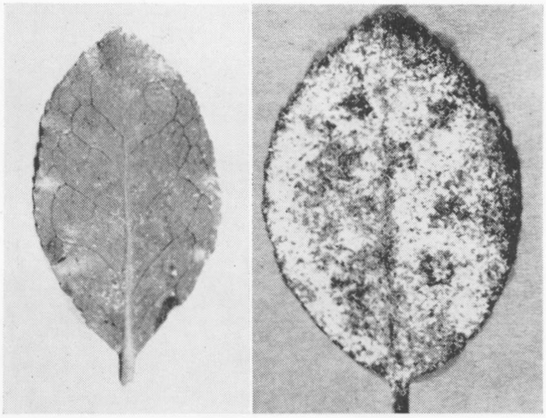
Work now under way is concerned with maintaining a supply of breeder seed of these two varieties and in adding newly developed characters from other sources. The present commercial varieties have hairy leaves that tend to cling to the open cotton and increase the pepper trash in mechanically harvested cotton. A smooth-leaf Deltapine variety developed at the Delta Branch Station of Stoneville, Mississippi, has been combined with Alabama bred varieties to decrease leaf hairs. There are several other characteristics related to the improvement of varieties for mechanical harvest which are being utilized in the breeding program; these are: higher fruiting, shorter fruiting branches, more upright plant type, and better stormproof qualities. Work has been in progress since 1946 to develop a variety with improved tensile strength. Cottons having greater strength – Hopi wild cotton, Sea Island, Acala 1517, and Wilds – are being crossed and backcrossed into local wilt-resistant material. Bacterial blight resistance has been discovered in unadapted upland cottons and improved nematode and wilt resistance was found in wild cottons from Central America. These two characteristics have been crossed into Station breeding lines.

* In cooperation with USDA.

SYSTEMICS—

A New Approach to Fighting Ornamental Plant Insects

B. WAYNE ARTHUR, *Assistant Entomologist*



Left—Leaf from systemic-treated camellia free of tea scale; Right—leaf of untreated plant showing heavy tea scale infestation.

ORNAMENTALS CAN BE MADE death traps to many important plant insects!

The answer is systemic insecticides, which are a completely new group of chemical compounds and the outgrowth of a new concept of plant insect control.

What are systemics? They are chemicals that are readily taken up by plants through the leaves and roots. These chemicals are carried to all plant parts by the sap. Thus, the plant becomes toxic to insects that suck plant juices.

Systemic insecticides are more effective against insects with sucking mouthparts than against those with chewing equipment. Since most of our major ornamental pests are "suckers," systemics are very likely to become an important weapon for ornamental pest control.

Tea scale, camellia scale, southern mite, azalea lace bugs, whiteflies, thrips, and aphids are some of the most important pests. All reduce vitality of plants and lower quality and number of blooms. In commercial nurseries, the sale of plants may be greatly reduced. Heavy infestations of these insects can cause death to plants.

Research on Systemics

Much of the research on ornamental pests done by the API Agricultural Experiment Station in the last 2 years has involved the use of systemic insecticides for insect control.

Briefly, here are some results:

(1) Of six systemics tested, demeton (Systox) and Compound 21/116 (related to Systox) were the most effective, and controlled tea and camellia scale, azalea lace bugs, whiteflies, and thrips.

(2) Best mixture rate is 1 teaspoon of 50% emulsifiable concentrate of either compound to 1 gallon of water.

(3) Best results were obtained from two applications 30 days apart.

(4) Plants were found free of scale even 3 months after application.

Some insects (greatly magnified) controlled by systemic treatment: upper left—whiteflies; upper right—lace bugs; lower left—camellia scale; lower right—thrips.

(5) Applications of the mixture to the soil were equally as effective as applications to plant foliage; they may be applied any time.

(6) In applications to soil, the best results were obtained from applying a half pint of mixture to soil around base of plants 18 to 24 inches tall. Larger plants required larger amounts.

(7) In case of sprays, the plants were wet thoroughly and to the extent that there was some run-off of the solution. Thorough coverage of the underside of leaves was found important. Effectiveness of control by spray method depends to a large extent upon thoroughness of spraying.

(8) Spider mites are harder to kill than the other insects. To obtain control, it was necessary to double the dosage rate (2 teaspoons to 1 gallon of water) of demeton or Compound 21/116 applied either to soil or foliage. It was also necessary to apply the heavier dosage often enough to maintain control.

(9) After applying systemics to soil or foliage, it takes 2 to 3 weeks to determine if scale insects or whiteflies are dead. Dead scales or whiteflies will begin to drop from leaves after 5 to 6 weeks. Although good control may be obtained, appearance of leaves to the naked eye may be unchanged for several weeks.

(10) Systemics are highly toxic to warm-blooded animals. Therefore, to use them one must be willing to comply with the precautionary measures listed by the manufacturer.

Systemic insecticides appear to be the answer to the home owner's and nurseryman's dream of a simple and effective method of keeping ornamental plants free of insects.

NEMAT

Tiny B

Research Unde Development Cheaper

E. J. CAIRN

NEMATODES ARE GIANTS in the damage they do to many of our important crops, even though they are only microscopic in size!

Causing crop losses in the U. S. estimated at a half billion dollars annually, these eel-like soil worms are of increasing concern to farmers and agricultural leaders.

Soil and plant nematodes range from a 5th to a 100th of an inch in length. While some are beneficial, others are plant parasites. Nearly all crops and ornamentals are possible host plants. The damage is directly or indirectly related to feeding habits of "nemas," particularly in or on roots. In this process of feeding or entering plant tissue, wounds are made that provide "ports of entry" for harmful fungi and bacteria in the soil. In addition to making wounds, nematodes may also introduce toxic materials that spread in the plant. Some types of nematodes cause abnormal formations, such as distorted, knotted, or galled roots.

Controls Limited

Present major controls are soil fumigation, crop rotation, and use of nematode-resistant plants. Despite usefulness of each, there still remains need for further improvements in known methods and for searching out new ways of nematode control.

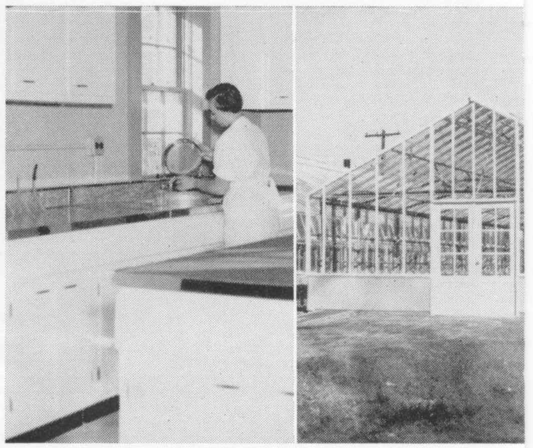
FUMIGATION. Soil fumigation is economically sound and is used for such high-value crops as cotton, tobacco, potatoes, orchards, and nursery stock. However, for lower value crops and perennials, increased yields following fumigation may not be enough to pay the cost of treatment. Therefore, more research is needed for developing cheaper fumigation chemicals and easier ways of application.

ROTATION. There are nematodes that are so particular about their food that they live only on the plants of their liking. Thus, on a soil containing such "nemas," a rotation that includes one or two unappetizing crops would successfully "starve out" the tiny worms. Unfortunately, there are other nematodes that are not as choosy about the kinds of plants on which they feed. Therefore, crop rotation might not be effective on a soil containing several species having varying "food" tastes. Another complication is finding suitable crops for the rotation that are of value to the farmer. Thus, there needs to be determined the host range and expected damage from each of many species of nematodes found in the soil. With this knowledge, growers could be advised exactly the kind of rotation plan to use, depending on the nematodes determined to be present in their fields.

PLANT BREEDING. Some weeds are known to be immune or quite tolerant of nematode attacks. Man has been

ABOVE—Nematode damage to corn roots results in lowered plant vigor and yields.

Severely stunted cotton plants (10" high) caused by nematodes; two plants produced a single boll each, the third plant none.



Above photos show part of the new facilities for soils for nematode population counts; center—new plants of important economic crops for nematode re

ODES—

Mighty

Way Points to of Better and Controls

Nematologist

able to breed nematode resistance into some varieties of commercial plants. However, more research is needed to determine the nature of various kinds of resistance and the nematode species against which they are effective.

Research Expanded

Realizing that basic research is needed if substantial progress is to be made in control of plant nematodes, the API Agricultural Experiment Station 11 months ago broke ground on an expanded research program. This is aimed specifically at obtaining basic information on characteristics, feeding habits, and weaknesses of the many species of plant nematodes.

The Association of Southern Experiment Station Directors, concerned over the seriousness of "nemas" on southern crops, made financial plans 2 years ago for attacking the problem on a regional basis. Because of the active interest and the plans developed at Auburn for both research and teaching in this special field, the Agricultural Experiment Station was designated as a center to serve the interests of surrounding states.

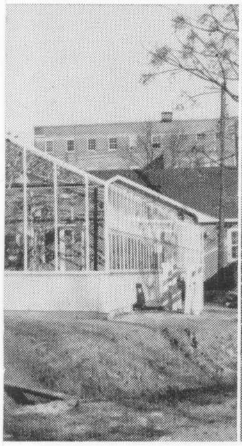
The program at Auburn is three-fold: (1) basic research on how nematodes cause plant disorders, (2) undergraduate and graduate training in nematology, and (3) service to growers and scientific workers of the region in identification of nematodes and improvement of techniques for research in nematode control.

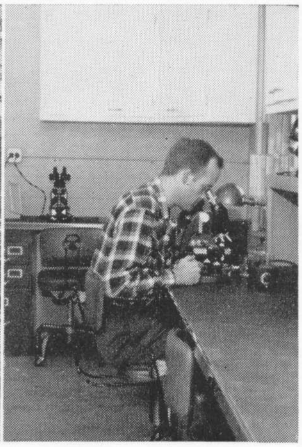
Considerable progress has already been made in getting the program into operation. A nematologist to head the project was employed early last year. Construction of a greenhouse and laboratory has been completed. Arrangements have been completed for cooperative research between this Station and the USDA Section of Nematology, and for appointment by that Section of an assistant nematologist who will also do further graduate work at Auburn. This Station assisted in the first annual nematology workshop for state experiment station workers. Two graduate students have in progress research that involves study of resistance of certain corn varieties to two different types of nematodes that are of importance to Alabama and other Southeastern States.

Grant Made

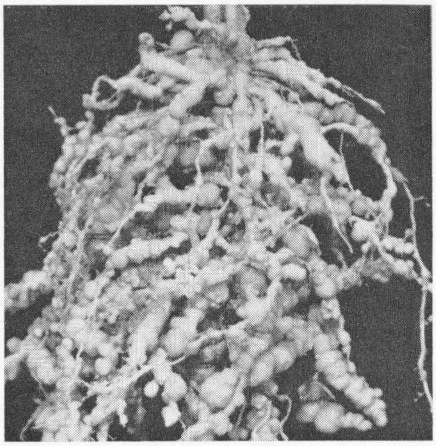
To further support this expanded research program, the Rockefeller Foundation last fall made a grant of $45,000 to the Alabama Polytechnic Institute for research and training in nematology. This fund was made available for a 3-year period, beginning the first of this year.

Increased knowledge of nematodes will be one source from which more effective and less costly controls of nematodes will be developed in the future.





natode research at Auburn. Left—technician screens eenhouse to be used in year-round production of ırch; right—graduate student at work in laboratory.



Nematodes caused severe root knot damage to this tomato plant, resulting in failure to set fruit and death of plant.

ABOVE—Damage to roots and nuts of peanut plant caused by root knot nematodes.

FIG. 1. The rotary hoe aids in controlling weeds in young cotton.

PLANTING *and* CULTIVATING Are Important Steps in Cotton Mechanization*

T. E. CORLEY
C. M. STOKES
F. A. KUMMER
Department of Agricultural Engineering

Good stands and effective mechanical cultivation of cotton are not accidents; they stem from good planning. Land selection and preparation, selection and adjustment of equipment, row layout, and timing of operations must be considered in forming and executing a well-organized plan. (See winter edition of *Highlights,* Vol. 1, No. 3, information on land selection and preparation.)

Good stands and effective mechanical cultivation are important from the standpoints of labor, costs, yield, and mechanical harvesting. Each year many farmers use excessive hand labor for controlling weeds and spend thousands of dollars replanting cotton; others suffer the consequences of weedy cotton and poor stands. Poor stands mean poor yields, weedy "skips," and nonuniform plant size and boll maturity, all of which are undesirable for mechanical harvesting.

Planting

Tests have shown that plant spacing in the drill can vary considerably without materially affecting the yield as long as the plants are uniformly distributed. Since cotton is a very adaptable plant in respect to spacing, it can be planted to a stand to eliminate hand thinning. When planting to a stand, too many plants are better than too few. Close spacing in the drill tends to produce small, uniform plants with short and high fruiting limbs, which prove best for mechanical harvesting. Also, close spacing aids in shading out grass and weeds.

A bushel of good seed per acre or 10 to 12 seed per foot uniformly drilled at the same depth throughout the field usually results in a satisfactory stand. In most cases, several rotary hoe cultivations eliminate enough plants for a desirable stand of approximately 40,000 plants per acre at harvest time. Flat planting reduces the hazard of soil silting in from beating rains, is desirable for chemical weed control, and leaves the row more accessible for effective rotary hoe cultivation.

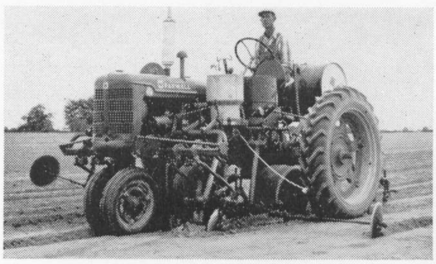


FIG. 2. Planting cotton and applying pre-emergence chemical treatment for weed control. Note well-prepared seedbed and row marker, and wide press wheel and mounted sprayer for applying chemicals.

Long, straight, uniformly spaced rows (preferably 40 inches) are desirable. A row marker aids in obtaining uniform row width.

For the most efficient use of equipment, especially mechanical harvesters, turn rows or about 20 feet of turning area is needed.

Most commonly grown varieties are suitable for mechanical harvesting. Varieties having extremely fluffy bolls with locks that "string out" and fall to the ground are undesirable because of high losses from weather and harvest.

Cultivation

The main objective of cultivation is to control weeds. The rotary hoe proves very beneficial in controlling weeds in their early stages of growth, Figure 1. Tests have shown that in most cases proper use of a rotary hoe reduces hand hoeing by 50 per cent or more. Also, it aids greatly in obtaining a stand after hard rains. The rotary hoe must be used frequently and is most effective when used as the weeds begin to emerge. Weeds are also successfully controlled with chemicals, applied before and after cotton comes up. Figures 2 and 3 show equipment used for applying chemicals. (For details, see "Chemical Weed Control in Cotton" on next page.)

Sweep cultivation is the best method for controlling weeds in the middle. When properly used, it controls many of the weeds in the row. Sweeps must be set properly for effective, fast, and precision work. They should be set to run flat and shallow. Flat sweep cultivation does not ridge the row but leaves the middle slightly lower than the row, which is desirable for mechanical harvesting. Cotton to be harvested mechanically should be cultivated late into the season to reduce weeds at harvest time.

There is no magic way for getting a good stand and controlling weeds; however, a well-planned program of mechanized farming helps.

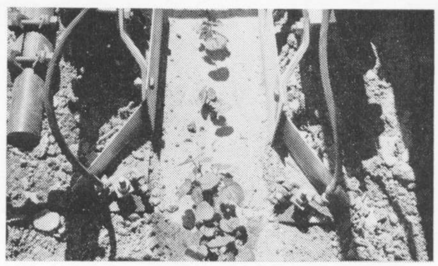


FIG. 3. Applying post-emergence chemicals for control of weeds, using parallel action shields. Note spray nozzle setting.

*Cooperative study with Farm. Mach. Div., Agr. Engin. Res. Br., A.R.S. of U.S.D.A.

Chemical WEED CONTROL *in* COTTON Cuts Hoe Labor 80-100%

V. S. SEARCY, *Assistant Agronomist*

CHEMICAL WEED CONTROL can cut hoe labor 80 to 100 per cent!

Weed control is one of the major costs of cotton production in Alabama. The amount of hand hoeing required to produce an acre of cotton has changed very little since the beginning of cotton production.

With the advent of cotton mechanization, it became apparent that the hoe had to be replaced. Research workers throughout the Cotton Belt realized that chemicals offered one of the best answers to the problem. Research conducted by the API Agricultural Experiment Station for the past 5 years shows that most small seeded annual weeds can be controlled with chemicals.

Chemical weed control is a highly specialized series of operations beginning with seedbed preparation. Each succeeding operation thereafter must be done properly if the best results are to be expected.

Planting

To eliminate chopping, cotton must be planted to a stand. This can be done by planting 3 to 4 pecks of good seed per acre. The object is to get from 30,000 to 40,000 plants per acre to come up. Research conducted by this Station shows that the stand of cotton can range from 8,000 to 40,000 plants per acre without affecting yield as long as they are uniformly distributed. Cotton should be planted on beds that are slightly above ground level so that excess water will drain away from the row. After planting, the top of the beds should be flat and 16 to 18 inches wide.

Treatments

A pre-emergence treatment is applied any time after planting and before the young cotton plants break the surface of the soil. Normally, a pre-emergence treatment will keep the cotton row free of weeds for a period of 1 to 4 weeks, depending on weather conditions. The most economical application of a pre-emergence treatment is obtained by mounting the sprayer on a tractor and applying the chemical at the time of planting. Solid press wheels 12 inches wide, or a roller 12 inches wide following the regular press wheel should be used to smooth the surface on which the chemical is applied.

If needed the first post-emergence treatment can be made when the cotton plants are as small as 2½ to 3 inches high. Parallel action shoes or shields may be used for applying post-emergence spray. The spray nozzles are adjusted so that the spray will strike the young cotton stalks just above the soil surface. *Post-emergence sprays recommended for cotton will kill cotton plants if sprayed on the leaves.* The middles can be cultivated at the time post-emergence spray is being applied to the row.

Recommendations

"Dinitro"[1] or CIPC[2] is applied as a pre-emergence treatment at the rate of 1 to 1½ pounds per acre, to a 12-inch band, in 40-inch rows on light sandy soil and 2 to 2½ pounds per acre on heavy soils. These materials are applied in water at the rate of 10 gallons per acre to the band. Dinitro will kill young cotton seedlings if they emerge without rain and during temperatures of 85° F. or above.

If control is not obtained with pre-emergence treatment, post-emergence herbicidal oil is applied. *Herbicidal oil for cotton is a special oil made for killing weeds in cotton, and no other oil should be used.* It is applied at the rate of 5 gallons per acre per application to a 10-inch band in the drill. Oil is never applied more frequently than 5-day intervals, and no more than 3 applications are made per season. No application is made after true bark begins to form at the base of the plant. This usually occurs when cracks appear in the bark. Oil is more effective on small weeds 1 to 1½ inches high or less. It is applied when the weeds are dry.

The most effective and consistent weed control obtained with chemicals has been done by using a pre-emergence treatment followed with post-emergence treatments as needed. (For more complete information contact your County Agent.)

Row at left received chemical treatment as described and recommended. Weedy cotton at right was not treated. The cotton was 1 month old when pictures were made.

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[1] Dinitro-o-sec-butylphenol

[2] Isopropyl-N-(3-Chlorophenyl) Carbamate

EVEN MORE MEAT Per Pound of Feed May Be Expected from Poultry Nutrition Research

G. R. INGRAM, *Associate Poultry Husbandman*

ONE POUND OF CHICKEN for 2 pounds of feed! Is it too much to hope for? Or, will it be attained within 2 years as was the last goal of 1 pound for every 2½ pounds of feed?

No other phase of agricultural research has advanced so rapidly as has poultry nutrition during the last quarter century, nor have laboratory results moved so quickly to the farmer. The inclusion of antibiotics (penicillin, aureomycin, terramycin, and bacitracin) together with arsenic compounds in poultry feeds has been one of the remarkable developments in the last 4 or 5 years. Poultry nutritionists 10 years ago could not have formulated satisfactory broiler rations in use today.

Results from feeding experiments by the API Agricultural Experiment Station show that a growth increase of 10% to 15% is obtained from adding these compounds to an otherwise adequate ration. The addition of an antibiotic to an all-plant ration (with no added animal proteins) resulted in 15% more growth of chickens than those fed a ration containing fishmeal, liver meal, and other animal products but without an antibiotic. There was a 47% increase in growth when an antibiotic was added to the all-plant ration. The best gain was obtained from a complete ration containing both animal products and an antibiotic.

Another ration development is the addition of fats, which furnish 2¼ times as much energy as grains. This has resulted in better feed efficiency – more pounds of chickens from a sack of feed with little additional cost.

Up to 1950, poultry nutrition research tended to center on vitamins and unknown growth factors, with less attention given to protein and amino acid nutrition in chickens. In some experiments at Auburn, research pin-pointed the deficiency of lysine (an amino acid) in peanut meal rations. With the addition of lysine, the protein value of the peanut meal was greatly increased. Other examples are already known of amino acids increasing the value of certain proteins. As purified amino acids become available commercially, more efficient utilization of proteins for feeding poultry will be possible. Accumulating evidence at Auburn and elsewhere shows that proper balance of amino acids is as important as total amount. Too much of certain amino acids can retard growth. The most striking developments in the next few years will undoubtedly come from the study of proteins.

The advent of the cage-layer system throughout the Southeast, research on which was pioneered at Auburn, has created new problems in feeding. Results from Auburn tests dealing with protein requirement indicate that cage layers need a ration containing 17% protein which is considerably higher than the commonly accepted amount.

There is no reason to believe that advances in poultry nutrition in the future will not be just as spectacular as some of the discoveries of recent years. Several unidentified factors that stimulate growth are being investigated. One is apparently present in fish products and liver. Another occurs in whey and certain fermentation products. A third factor has been reported in egg yolks. New antibiotics are being investigated and one may be found that will dwarf the results of present antibiotics.

Yes, we can expect 1 pound of chicken for 2 pounds of feed. Now, we may not even know what is good nutrition!

New and Timely PUBLICATIONS

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

Bul. 286. Alabama Agriculture—Its Characteristics and Farming Areas is a history of Alabama agriculture since Civil War, an analysis of factors affecting Alabama agriculture since 1930, and description of present-day agriculture by farming areas.

Cir. 113. Partial Poisoning of Overcrowded Fish Populations tells what materials to use, and when and how to poison.

Leaflet 45. Control of Insects and Foliage Diseases of Tomatoes in Alabama summarizes the major insects and diseases affecting tomatoes in Alabama and the best methods and materials for their control.

Special Leaflet. Advancing Soil and Water Conservation Through Research reviews results of soil and water conservation research conducted by the Experiment Station since its establishment in 1883.

Free copies may be obtained from your County Agent or by writing the API Agricultural Experiment Station, Auburn, Alabama.

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