WALNUTS: The behavior of plantings of walnut varieties at this Station indicates that this nut is poorly adapted as a commercial crop in the Coastal Plain of Georgia.

QUINCE: This fruit is highly susceptible to blight and for that reason has not been successfully grown at this Station.

OTHER FRUITS: Plantings of apricots, prunes, and chestnuts have died as a result of blight and until blight resistant strains are developed these fruits hold no promise of successful production in this section. Also the entire planting of hazlenuts has died, indicating that this fruit is poorly adapted.

TOBACCO

The tobacco experimental work at the Georgia Coastal Plain Experiment Station is being carried on in cooperation with the Division of Tobacco and Plant Nutrition of the United States Department of Agriculture and the University of Georgia College of Agriculture.
Since practically the whole tobacco nutrition research program was revised in 1933, results from the revised program cannot be considered reliable. The time covered by these tests has not been sufficient to justify conclusions. Final results of most of the original tests have been published in Bulletin No. 92, “Bright Tobacco Culture in the Coastal Plain of Georgia”, which may be obtained upon request to this Station. However, for those who do not care to go into the detailed information given in this publication it is believed that a short summary will be in place here.

**SOILS:** The Coastal Plain soils best adapted to tobacco are the light friable types of the Tifton and Norfolk series. The most important of these are the Norfolk sandy loams and the light phases of the Tifton sandy loams. Good tobacco soils have good water holding capacity and yet are well drained, light and fluffy with a comparatively low ammonia reserve.

**VARIETIES:** The light, highly colored cigarette tobacco, now so much in demand, can be produced easier with such varieties as Jamaica, Bonanza, Yellow Mammoth, Yellow Pryor, Cash and similar varieties than with the heavier varieties such as Warne, Gold Leaf and Adcock.

**SEED BEDS:** The selection of the soil and location for tobacco seed beds is one of the most important factors in the successful production of tobacco plants. The soil should be moist and loamy with an abundance of organic matter. A heavy growth of gallberry bushes or blackberry plants indicate this type of soil. Soil that has washed down from fields should be avoided as such soil may result in heavy nematode infestation on the plants. Seed beds should be located with a southern or southeastern exposure, having a wind break on the north and northwest side. All trees should be cut on the south side so that the sun can reach the bed throughout the day. When possible, the soil should be sterilized either by steaming or by burning with brush, wood or any other material available. In order that the heat may penetrate, the soil should be loosened up thoroughly before the heat is applied. If it is not practical to sterilize the seed beds, new locations every year are advisable. Only tobacco fertilizers should
be used. The rate of application will depend on whether or not the same location has been used before. On new locations two to three pounds of high grade fertilizer per square yard should be used. On old locations that have been sterilized, 1 to 1½ pounds per square yard is sufficient. Seedlings should be made at the rate of one tablespoonful of good seed per 100 square yards of bed area. The seed should be sown in late December and early January.

The effect of proper and improper tobacco fertilizers. Plot "A" received an unbalanced fertilizer. Plot "B" a complete fertilizer.

FERTILIZERS

FORMULAS AND RATES OF APPLICATION: In the light of all available data it is generally concluded that under most conditions tobacco fertilizers should contain eight parts phosphorus (P₂O₅), three parts ammonia (2.47 parts nitrogen) and from five to eight parts potash (K₂O). It is not necessary that the formula be an 8-3-5 or 8-3-8 but it is desirable that these proportions of phosphorus, ammonia and potash be maintained. Potash tests show rather conclu-
sively that the higher potash formulas are to be preferred over the five per cent goods.

The soils used for tobacco vary so much in fertility that it is impossible to give any hard and fast rule as to the rate of application of fertilizer for tobacco. On the light sandy Norfolk soils the rate of application may range as high as 1200 to 1400 pounds per acre with highly profitable results. However, under ordinary conditions 1000 to 1200 pounds per acre is sufficient.

PHOSPHORUS: The virgin soils of the Coastal Plain of Georgia contain less phosphorus than any element essential to plant growth. Soils that have had applications of phosphorus naturally contain sufficient residual phosphorus to produce a fair sized plant for a few years. Continued cultivation without applications of phosphorus would eventually result in growth approaching the size of plants receiving no fertilizer at all. Phosphorus deficiency is characterized by a small green plant that never reaches normal size or maturity. It is impossible to properly cure tobacco that has grown under phosphorus deficient conditions. Too much phosphorus causes premature ripening or "firing" of the lower leaves in the field, and often under drought conditions causes the plant to ripen faster than it can be handled to best advantage. Formula tests with tobacco indicate that the per acre application of phosphorus should be about 80 pounds, or the amount contained in 1000 pounds of a fertilizer analyzing 8 per cent phosphorus. Superphosphate is the most satisfactory and convenient source of this element.

AMMONIA: The color of the cured tobacco leaf depends more on the amount of nitrogen used to grow the plant than any other factor. It is therefore highly necessary to have the nitrogen supply under complete control. Too little nitrogen produces a small yellow plant that cures well but does not yield profitably. Excess nitrogen produces a rough, coarse plant with plenty of weight but one that is difficult to cure to a desirable quality. The ideal situation with regard to nitrogen is to supply enough to get good yields but not enough to make curing too difficult.

Tests with varying rates of application show that 30 pounds of
ammonia (24.79 pounds of nitrogen) is about the proper rate of application per acre. Thirty pounds of ammonia is the amount contained in 1000 pounds of a fertilizer analyzing 3 per cent ammonia. The materials from which ammonia is derived also have an important bearing on the quality of tobacco produced. Without going into all the advantages and disadvantages of the various materials, it is only necessary to state here that the ammonia in tobacco fertilizers should be derived as follows: one-third from high grade organic materials such as cotton seed meal, fish meal and high grade tankage and two-thirds from inorganic nitrates, or urea, or a combination of these materials.

**ANIMAL MANURES:** Horse or cow manure, when well rotted and finely pulverized can be used very profitably in producing tobacco of excellent quality. Such manures should be used at the rate of from 2 to 3 tons per acre and should be applied in the drill ten days or two weeks in advance of the application of commercial fertilizer. The manure should then be covered and left until the fertilizer is applied. The row is reopened and the fertilizer applied in the usual quantity and manner. Fresh raw manures should not be used.

**POTASH:** The amount and kind of potash used in tobacco fertilizers has an important bearing on the quality of tobacco produced. Plants deficient in potash are small and rough and have a drawn, rusty appearance. Extreme potash deficiency causes the plants to fire around the margin of the leaf and between the veins. These areas soon drop out, causing the quality to be of the lowest order. There is little danger of applying too much potash with formulas now being offered the growers. The maximum amount of potash that can be used profitably has not been determined but it is rather conclusive from present data that where tobacco fertilizers are applied at the rate of 1000 pounds per acre it is profitable to use as much as 8 per cent potash (K₂O) in the mixture. In all tobacco fertilizers 2 units of the potash should be derived from muriate of potash and the remainder from sulphate of potash or a mixture of this material and sulphate of potash magnesia.

**MAGNESIA:** In order to avoid trouble from sand drown (magnesia hunger) it is believed that all tobacco fertilizers should contain approxi-
mately 2 per cent magnesia, one-half of which should be obtained from water soluble materials. While magnesia hunger is not very prevalent in the tobacco belt of Georgia, it has been known to appear and should be guarded against.

**SPACINGS IN DRILL AND ROW:** Results of tests with spacings and heavy fertilizer applications, in an effort to determine the comparative value of close spacing and heavy fertilization, show that it is not profitable to space tobacco closer than 22 inches in the drill in rows 48 inches apart. Closer spacing increases the yield but lowers the quality due to the crowded condition of the plants. Where the plants are crowded they produce long, spindling stems with small leaves which are thin and low in quality.

**CURING:** The curing procedure is based on so many variable factors that no definite program has yet been devised that will apply with any degree of satisfaction. Proper curing is easily accomplished when uniform, well ripened tobacco is put into the barn and close attention given it until the cure is finished.

**PROGRESS REPORT ON TOBACCO TESTS BEGUN IN 1933:**
An outline and general description of these tests were given in the last Annual Report, Bulletin 24. It is therefore not necessary to repeat this outline. Realizing that data from two years results are without value in forming conclusions it is believed that only a brief report of trends will be sufficient here.

**AMMONIA TESTS:** Fertilizers containing only phosphorus, nitrogen and potash from pure chemicals is not a complete plant food and causes damage to the growing plant. The nitrate nitrogen sources showed decided evidence of leaching during the month of May, 1934 (there were 12.42 inches of rainfall during this month) The animal manures (cow and horse), cotton seed meal and sulphate of ammonia produced comparatively good yields under wet weather conditions. Of these, the manures when used as an extra application previous to the regular fertilizer application, produced the best results.
CALCIUM AND SULPHUR TESTS: Since results from this series will depend largely upon the length of time it will take to deplete the soil of some of the elements involved, the data from these plots as yet have not indicated any definite trends.

FORMULAS: There is quite a definite indication from these tests that more phosphorus and potash than is applied in an application of 1000 pounds of 8–3–5 per acre may be used profitably. The maximum amounts that may be applied with profit have not been determined. However, the present recommendation is that tobacco fertilizers contain 8 per cent phosphorus, 3 to 4 per cent ammonia and 8 per cent potash.

FRACTIONAL APPLICATIONS OF FERTILIZER: In order to simplify the meaning of this heading we may for all practical purposes call this series of tests “Topdressing Tests”. During the wet weather of May it was quite evident that topdressing had a distinct value. Under ordinary conditions topdressing is of no value and usually creates more complications than it does good. Where topdressings are used, an application of 50 to 60 pounds of nitrate of soda about 20 days after transplanting is the best known procedure.

POTASH SOURCES: These plots are much the same as the tests reported in Bulletin No. 22, and the results correspond closely.

PHOSPHORUS SOURCES: Basic slag and soft phosphate are apparently too slowly available to be profitably used in tobacco fertilizers. Super-phosphate, triple phosphate and bicalcic phosphate are satisfactory sources and approximately of equal value per unit of phosphorus.

FERTILIZER PLACEMENT TESTS: In 1934 the placing of fertilizer in an unmixed band directly beneath the roots of the seedlings caused a heavy mortality of the plants. The placement producing best results was one in which the fertilizer was placed to the side of the roots. However, the behavior of tobacco on the various placements depends largely on weather conditions immediately after transplanting. These tests were conducted in cooperation with the Bureau of Agricultural Engineering of The United States Department of Agriculture.
Nematode injury on virgin Norfolk Loamy Sand.

TOBACCO DISEASES

No new diseases appeared in the 1934 tobacco crop. Freezes and downy mildew (blue mold) were responsible for the principal losses in plant beds. By the time mildew was first seen freezes had killed at least 10 per cent of the Georgia plants. This was the third consecutive season in which the damage from cold equaled or exceeded that from plant bed diseases.

Less than five per cent of the plants were killed in 1934 by downy mildew. It did not begin to develop in the earliest sections until the first week in March and nearly six weeks passed before the entire belt was involved. Consequently many fields had been set before the beds were attacked. With the exception of a few cloudy or foggy days and nights during the latter half of March, the Spring season was not favorable for rapid mildew spread or serious disease development.

No other plant bed disease of consequence was observed. Damping-off (Pythium sp. and Rhizoctonia sp.) was of minor importance
while traces of frog eye leaf spot (Cercospora nicotianae) were identified in two beds. No mosaic appeared on tobacco seedlings during the season.

Much difficulty was experienced in securing good stands in 1934. Most of the Georgia crop was set the first half of April during which time dry windy weather predominated, making conditions very unfavorable for freshly transplanted seedlings. Where mildew affected plants were set before they had sufficiently recovered a large percentage of them failed to survive.

The principal handicap to many fields was unusually wet weather in May that caused considerable drowning. In limited areas losses from drowning ranged from 25 to 60 per cent. Later in the season dry weather still further reduced the crop, with the combined result that production was considerably below what was expected.

TOBACCO ROOT KNOT—CROP ROTATION TESTS: Of the various methods attempted for controlling root knot, rotation of tobacco with nemat resistant crops remains the most practical and profitable. Several field rotation experiments are being conducted to determine the length of rotation necessary for control, kind and variety of crop most suitable, and cultural practices that influence the activity of nematodes in the soil. Three year systems are receiving most attention. Rotations are being sought that will not only reduce root knot damage to a minimum but also improve the quality of tobacco and maintain soil fertility at the proper balance for crop production in general. Observations are also made to determine whether certain rotations tend to encourage or discourage the development of other tobacco diseases such as Granville wilt (Bacterium solanacearum) and Southern Root Rot (Sclerotium rolfsii). Thus far, Granville wilt has not been an important disease in Georgia, and legume rotations have been used successfully.

The peanut, either Spanish or Runner, promises to be the most effective of common field crops in preventing root knot in tobacco rotations. Preliminary experiments indicate that where peanuts are grown for two successive years in advance of tobacco the disease is reduced to a minimum. Usually, a good quality leaf can be grown
after harvested Spanish peanuts, but a rough green growth often develops after either variety that has been hoggled off.

Velvet beans also show some value in preventing root knot in the rotation. Both this crop and Runner peanuts rate as excellent soil builders, and for nutritional reasons it is usually advisable to include these in the rotation system two years in advance of the tobacco.

Other leguminous plants are being compared and among these Crotalaria promises to be at least as beneficial in preventing root knot as Velvet beans. The two species being tested are Crotalaria spectabilis and Crotalaria retusa. However, both of these are soil building plants and it has not always been advisable to set tobacco immediately following them without making due compensation in the fertilizer formula. One field test was recently begun to determine whether good quality tobacco could be grown immediately after root knot resistant soil building crops by reducing the nitrogen content of the tobacco fertilizer. Plants being compared in this experiment are Crotalaria, velvet bean, Laredo soybean, Spanish peanut and Runner peanut.

The growth of weeds on land for two successive years in advance of tobacco has shown satisfactory, though not complete, prevention of root knot. In one series of experiments a mixture of Florida pursley (Richardia scabra), beggarweed and crab grass precedes tobacco. The first two are more resistant to gall nemas than crab grass which appears at times to be moderately susceptible.

Certain weeds promise to be of particular value because frequently a very high quality leaf can be grown after them. For this reason considerable emphasis is now being placed on rotations with weeds. Last year a test was begun in which tobacco is grown after 17 common weeds native to this section. Some of these are quite susceptible to nematodes and the purpose of the test is to determine the ones that will be of most value in reducing root knot and in improving quality of leaf. Several grasses, forage and grazing crops are also being compared in this test.

Rotations with winter oats followed by native weeds have shown very favorable results to date. Since oats are the most important
small grain in the belt, attempts are being made to fit this crop advantageously in the tobacco cropping system.

Due to the fact that corn is only moderately resistant to root knot, corn rotations are not always successful in insuring the safety of a succeeding tobacco crop. Cotton has been observed to be less beneficial than corn in this respect. Rotations are now being tested to determine whether either corn or cotton, or both, may be safely included in the system where they are grown two or three years in advance and a highly resistant crop like peanuts allowed to intervene.

Sweet potatoes and other truck crops have been found unsafe in many tobacco fields. Likewise, cow peas, such as Clay and Whippoorwill, Austrian winter peas and Monantha vetch are quite susceptible to nematodes and are unsafe. Brabham peas are more resistant than certain other varieties of cowpeas but they have not proven sufficiently resistant in the experimental rotations.

ROOT KNOT—RELATION OF CULTIVATION PRACTICES: One field test is being conducted to determine whether nematodes can be sufficiently controlled by cultivation practices so as to allow the production of tobacco on the same land every year. A comparison is being made between fall fallow cultivation and a winter rye cover crop as contrasted with the usual practice of leaving the tobacco stalks to stand over winter. Present indications are that disease damage can be lessened by plowing out the stalks immediately after harvest, practicing fallow cultivation every two weeks until November when a cover crop of rye or oats may be sown. However, unless the cover crop is turned under a month or six weeks in advance of transplanting time, difficulty is encountered in securing stands of tobacco. The use of cover crops has also encouraged an increase in cutworms, making the application of poison baits necessary.

Tobacco set on a level bed in 1934 was equally as affected by root knot as that set on a ridge. The method of cultivating the crop after it was set had no apparent influence on disease development in the roots. However, heavy rains in May caused much drowning of plants set on a level, whereas those set on a ridge withstood the rains to better advantage.
A comparison of dates of setting indicated that tobacco set early in 1934 (the last week in March at Tifton) was less severely affected by root knot and produced a much higher quality than that set two weeks later.

**TESTS WITH DOWNY MILDEW ("BLUE MOLD"):** Attempts to control this seedbed disease by high temperatures in artificially heated beds were again successful this season. There was no appreciable mildew damage where the daily temperatures were kept within the range of 70 to 100 degrees Fahrenheit and where sufficient light for good growth was permitted to reach the plants. Best results were obtained in glass covered beds heated with flues or electric cables. Glass substitutes have not proven successful as covers.

Plantbed spray tests were continued during the spring season, but mildew was not severe enough to warrant the use of sprays generally. Copper containing sprays continue to show most promise as a preventive. During seasons of mild outbreaks the efficacy of sprays cannot be adequately proven.

**SUGGESTIONS FOR CONTROL OF MILDEW:** Destroy all holdover tobacco plants in old seedbeds and in fields. It is advisable to do this before they produce seed from which volunteer seedlings might arise the following fall and winter.

Locate beds in new places where possible, or in old beds that have been thoroughly burned. Select protected, sunny locations where the plants will receive sunlight throughout the day.

Sow more and smaller beds, locating them in different places. Sow some of these beds early. Avoid extremely thick or thin stands.

As soon as the plants are large enough to withstand open air conditions, remove the covers on clear days to admit more light. Do not permit beds to become extremely dry nor extremely wet.

Where possible, transplant before mildew appears. If this cannot be done, allow the seedlings to recover and develop new leaves before setting them in the field. Otherwise, poor stands may result.