

Sixty-Seventh

ANNUAL REPORT

1954

of the

Tennessee Agricultural
Experiment Station

The University of Tennessee
Knoxville

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Tennessee Agricultural Experiment Station



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THE UNIVERSITY OF TENNESSEE — KNOXVILLE

Letter of Transmittal

Knoxville, Tennessee, January 1, 1955

To His Excellency, Frank G. Clement, Governor of Tennessee:

Sir: I have the honor to transmit herewith, on behalf of the Board of Trustees of the University of Tennessee, a report of the work and expenditures of the Agricultural Experiment Station for the year 1954. This report is submitted in accordance with the law requiring that the Board having direction of the Experiment Station shall annually submit to the Governor of the State a report of its operations and expenses.

Very respectfully,
C. E. BREHM, President

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Sixty-Seventh Annual Report, 1954

Introduction

Agriculture will share in the growth and prosperity ahead of us to the extent it continues to apply science and technology to its production and merchandising, Secretary of Agriculture Ezra Taft Benson pointed out recently. And, in a speech observing the 100th birthday of America's first State agricultural college, the Secretary further emphasized the urgency of an expanded agricultural research program.

"Today's farmer produces as much food and fiber as five farmers did a century ago. A man-hour of farm produces about three times as much grain and oil crops as it did in 1910.

"In 1940 it took 47 man-hours to produce 100 bushels of wheat; now it takes 31 hours. It took, in 1940, 191 man-hours to grow a bale of cotton; now it takes 143. Before World War II, it took 83 man-hours to produce 100 bushels of corn; now it takes only 45. These are averages. On top farms, the man-hours are much less.

"In 1954, despite widespread drought, 18 percent fewer farm workers produced 14 percent more total output than in 1947 . . . This progress would have been impossible without a system such as the USDA-Land Grant College setup of producing knowledge and getting it to individual farmers."

The Agricultural Experiment Station of the University of Tennessee can point with pride to a share in the matter of producing scientific agricultural knowledge, and getting it to farm families. The Station, with branches in major physiographic areas of the State, concentrates research on matters affecting the agricultural economy of Tennessee. It is natural that much of the research is done cooperatively with the research agencies of the U. S. Department of Agriculture. Funds used by the Station come from many sources besides the State appropriation. Included are funds from the Federal Government and the USDA; and those resulting from contracts with the Tennessee Valley Authority, the Atomic Energy Commission, and several industrial organizations.

It is significant that within the fiscal year publicly supported

agricultural research in the United States, both State and Federal, received about 143 million dollars. Yet the estimated annual loss from cattle diseases alone run five times that much.

Within its 73 years of existence, the Tennessee Agricultural Experiment Station has spent approximately 12 million dollars. Yet yearly returns from Station research, in the form of greater yield, greater savings, better marketing, etc., amount to several times the total, all-time Station expenditure.

Developments and information from the Station are given to the people of the State through publications, field days, special events; and, of course, through the Extension Service whose function it is to extend the facts of research to off-campus persons.

The Station still must attempt within its funds to meet competition for skilled research people.

On the physical side, the Station has made considerable improvement in facilities this year. At the West Tennessee Station buildings have been repaired, with new siding, roofing, etc., provided for the residence of the Station superintendent, and for the office building. Barns and other buildings have been repaired for longer life and continued service.

FINANCIAL STATEMENT

THE UNIVERSITY OF TENNESSEE AGRICULTURAL EXPERIMENT STATION

In account with

The United States Appropriations under the Hatch, Adams, Purnell, and Bankhead-Jones Acts,
and Non-Federal Funds, 1953-54

	Federal Funds						Non-Federal Funds
	Hatch	Adams	Purnell	Bankhead-Jones Section 5	Bankhead-Jones Section 9	Title II	
Receipts							
From United States Treasurer..	\$15,000.00	\$15,000.00	\$60,000.00	\$92,293.90	\$166,311.08	\$9,000.00	
From Other Sources.....							\$776,435.92
Expenditures							
Personal Services.....	14,149.92	14,999.88	56,734.19	82,989.43	138,244.73	6,564.73	449,492.42
Travel.....			181.12	752.93	4,322.53	108.76	21,010.55
Transportation of Things.....			14.13	49.91	159.44		5,201.26
Communication Service.....	.08	.12	4.13	.28	85.44	4.54	7,694.86
Rents and Utility Services.....			80.93	23.86	10.46		10,808.70
Printing and Binding.....	850.00				46.70		6,862.26
Other Contractual Services.....			22.66	324.01	2,181.66	1.50	27,957.20
Supplies and Materials.....			663.25	5,316.43	10,172.27	1,699.81	158,217.34
Equipment.....			2,299.59	2,837.05	9,459.85	248.70	89,191.33
Land and Structures..... (Contractual)					1,628.00		
Total Expenditures.....	\$15,000.00	\$15,000.00	\$60,000.00	\$92,293.90	\$166,311.08	\$8,628.04	\$776,435.92

Residence houses have been built for superintendents at the Plateau and Highland Rim Stations, and houses for laborers have been built at these two Stations, and at the Tobacco Experiment Station. Tobacco barns have been built or repaired at these Stations. Beef cattle facilities at the Highland Rim and Plateau Stations have been improved and increased, the additions including a cattle barn, a shed, and five silos. A pole-type dairy barn was built at the Middle Tennessee Station; and at the Dairy Experiment Station, a granary and feed storage and milling facilities have been constructed. Improvements on the Blount Farm, near the main Station include a house for an employee, repairs to one barn, and a new sheep barn.

Agricultural Economics and Rural Sociology

As the American economy continues to grow, the economic and social relationships between agriculture and the rest of the economy become more complex and more important to the farmer's welfare. When agriculture was largely self-sufficient—when farmers grew what they ate and ate what they grew—"hard times" were the result primarily of unfavorable natural circumstances, such as drouth, pests and plant and animal diseases. These are still important to the individual farmer; but now almost everything he produces, he sells; and almost everything he consumes, he buys. Therefore, his level of living depends very much upon the relationship between the prices he receives for his products and the prices he must pay for what he consumes. Although local disasters, such as drouth, seriously affect local areas, general "hard times" for farmers now usually result from the failure of the economy to operate properly or from the improper integration of agriculture into the total national economy.

With each passing year this dependence of agriculture upon the proper functioning of the total economy increases—and the dependence of the rest of society upon a healthy agriculture increases also. In the relatively brief period since 1920, the American nonfarm population has almost doubled, while on the other hand the farm population has decreased about 30 percent. Research must continue to press into the problems of economic and social adjustment which must inevitably be faced by farm-

ers as a result of these tremendous changes in the structure of the American economy.

The Department of Agricultural Economics and Rural Sociology is carrying on a many-pronged research attack on these problems. Roughly, however, the several research projects of the department fall into one of four general categories. They are: (1) the study of adjustments in the organization and operation of individual farms, so that the farmer may make more efficient use of his labor, capital and land resources and thereby make larger profits. (2) the study of means of improving the markets for Tennessee-produced farm products, and improving the efficiency of marketing those products, so that less of the consumer's dollar needs to go to cover marketing costs and more may go directly to the farmer for his product. (3) the study of means of better integration of agriculture with the rest of the economy, so that rural people may share more fully in the generally rising level of income. (4) the study of ways of improving the effectiveness of the activities and programs by which farm families translate their incomes into levels of living and general social well-being.

Research Projects

The following research projects are under way in the Department of Agricultural Economics and Rural Sociology:

Marketing Livestock in Tennessee (A Contributing Project to Reg. Res. Proj: SM-7) (M. B. Badenhop)

Sub Project 2—An Analysis of Relevant Price Factors and Their Relationship to Slaughter Cattle and Calves with Particular Emphasis on Price-Grade Differentials (M. B. Badenhop).

A Study of Rural Organizations in Tennessee (H. J. Bonser).

Economics of Part Time Farming (H. J. Bonser).

The Economics of Fertilizer Use (P. P. Dorner).

Economics of Marketing Milk in Tennessee (M. L. Downen).

Financial Problems of Farmer Purchasing Associations in Tennessee (John L. Fischer).

Costs and Efficiency of Fluid Milk Processing and Distribution in Tennessee (A Contributing Project to SM-10) (A. J. Garbarino).

- Buying Policies and Other Practices of Vegetable Marketing Organizations in Tennessee (A Contributing Project to SM-8) (W. E. Goble and E. J. Long).
- Marketing Tennessee Horticultural Specialties (A Contributing Project to Regional Research Project SM-12) (E. J. Long and A. J. Garbarino).
- Economic Analysis of Dark Tobacco Growers' Associations in Tennessee and Kentucky (E. J. Long).
- Farm Organization in Particular Types of Farming Areas (B. H. Luebke-R. B. Hughes).
- Impact of Industrial Development upon Tennessee Agriculture (J. A. Martin and R. B. Hughes).
- An Economic Study of Labor Inputs on Tennessee Farms (W. P. Ranney).
- Broiler Marketing (A Contributing Project to Regional Research Project SM-6) (B. D. Raskopf).
- Hatchery Egg Marketing (A Contributing Project to Regional Research Project SM-6) (B. D. Raskopf).
- To Appraise the Effects of Various Factors on The Demand for Poultry and Poultry Products (A Contributing Project to Regional Research Project SM-15) (B. D. Raskopf).
- Factors Affecting Cotton Prices in Local Markets (A Contributing Project to Regional Research Project SM-1) (B. D. Raskopf).
- Marketing of Cottonseed for Planting Purposes (A Contributing Project to Regional Research Project, SM-1) (B. D. Raskopf).
- Farmers Financial Problems in Tennessee (R. G. Spitze).
- An Evaluation of the Use of New Techniques Applied on Test Demonstration Farms in Tennessee (T. J. Whatley and Luther H. Keller).
- Possibilities of Farm Enlargement and Its Influence on Farm Organization and Returns under Varying Economic Conditions (T. J. Whatley and S. W. Atkins).
- Over-all Management and Land Use for the Ames Plantation (T. J. Whatley).
- Pulliam Tract, Ames Plantation (T. J. Whatley).
- Farming Adjustments in Tennessee with Emphasis on the Economics of Conservation Farming (T. J. Whatley).

Bulletins, Articles and Reports

Badenhop, M. B.

State Regulation Governing Livestock Marketing Operations in States of the Southern Region. Farm Economics Circular No. 4, July 1954.

Downen, M. L.

International Trade in Dairy Products by the United States. Dairy News, January 1954.

World Dairy Trade. Dairy News, Feb. 1954.

Fluid Milk Marketing Agencies. Dairy News, March 1954.

Grades and Classes of Milk. Dairy News, June 1954.

Milk Price Pools. Dairy News, July 1954.

Fluid Milk Price Formulas. Dairy News, Sept. 1954.

Supplies of Manufactured Dairy Products. Dairy News, Oct. 1954.

Fischer, John L.

What I See Ahead in the Financing of Farmer Cooperatives. American Cooperation, 1954, October 1954.

Cooperative Progress in the United States. American Cooperation, 1954. Oct. 1954.

The Economy, The Farmer and Cooperation. Farm Economics Circular No. 2, June 1954.

Garbarino, A. J.

The Effect of Methods of Paying Farmers for Milk on Seasonality of Production in Selected Southern Markets. Southern Cooperative Series, Bull. 37, June 1954.

Hughes, R. B.

Marginal Returns on Agricultural Resources in a Southern Mountain Valley. Journal of Farm Economics, May 1954.

Hughes, R. B., Thorpe, D. M., and Keller, L. H.

Tennessee Agriculture and Foreign Trade. Farm Economics Bulletin No. 6, Sept. 1954.

Long, E. J.

"A Reply to Kutish's The Value Question," Journal of Farm Economics, Nov. 1954.

Assisting Low Income Farmers, U.S.D.A. Graduate School Newsletter, Dec. 1954.

Economics of Agricultural Production and Resource Use. (A review-comment). Land Economics, Feb. 1954.

- Long, E. J., Hughes, R. B., Jr., and Bowers, F. P.
Elements in a Cooperative Membership Information Program.
Agricultural Experiment Station Bulletin 238, Dec. 1954.
- Long, E. J., and Dorner, P. P.
Excess Farm Population and the Loss of Agricultural Capital.
Land Economics, Nov. 1954.
- Martin, Joe A., and Gambill, Eugene
Conservation and The Public Interest. Farm Economics Bulletin No. 7, October 1954.
- Ranney, W. P.
Labor Used in Crop Production in Tennessee, 1953—Part I, Cotton. Farm Economics Circular No. 5, August 1954.
Labor Used in Crop Production in Tennessee, 1953—Part II, Corn. Farm Economics Circular No. 5, Sept. 1954.
Labor Used in Crop Production in Tennessee, 1953—Part III, Small Grains, Soybeans and Miscellaneous Seed Crops. Farm Economics Circular No. 5, December 1954.
- Raskopf, B. D.
Comparisons of One-Variety with Multiple Variety Cotton and Related Economic Considerations. Southern Cooperative Series Bull. No. 41, November 1954.
Cotton Wilt Damage in Tennessee. The Plant Disease Reporter, pp. 304-308, U.S.D.A. Vol. 38, No. 4, April 15, 1954.
Financing Production and Marketing of Broilers in The South. Southern Cooperative Series Bull. No. 38, June 1954.
- Raskopf, B. D., Epps, James M., and Andes, J. O.
Economic Changes Occurring in The Cottonseed Crushing Industry. (A series of 10 articles). Cotton Trade Journal Weekly, Dec. 18, 1953 to March 5, 1954.
- Spitze, R. G., and Walrath, F. J.
The Issue of Farm Subsidies. Farm Economics Bulletin No. 3, Aug. 1954.
- Spitze, R. G., and DeFriesse, F. M.
Agricultural Price Supports. Farm Economics Bulletin No. 5, Sept. 1954.
- Suddarth, Emma E.
Some Organizational Problems of Tennessee Rural Libraries in a Changing Society. Master's Thesis, August 1954.

Whately, T. J., DeFriesse, F. M., and Keller, L. H.

Is Your Dairy Farm in Balance? Farm Organization Income and Expenses on 49 Grade A Dairy Farms, East Tennessee, 1951. Farm Economics Circular No. 1, July 1954.

Increasing Net Returns on a Tennessee Farm. Farm Economics Circular No. 3, July 1954.

Estimated Costs and Returns from Major Farm Enterprises, Tennessee—1952. Rural Research Monograph No. 268, Feb. 1954.

Woodard, Almer W.

Quality and Price of Fresh Market Strawberries in West Tennessee. Master's Thesis, August 1954.

Luebke, B. H.

"Problems Created by the Douglas Reservoir in East Tennessee, Journal of the Tennessee Academy of Science, Vol. 29, Number 4, October, 1954.

Agricultural Engineering

The Department of Agricultural Engineering this year concentrated on studies in the following projects: equipment and techniques in the production, harvest and storage of grass and legume seeds. Studies were made regarding harvesting, windrowing and air drying.

Investigation in structural and mechanical equipment for storing and handling hay and silage resulted in the development of a device to remove silage from the bottom of an upright silo and a device to distribute silage in a manger built around the silo.

Electric heating panels that may be made at a low cost are under use tests. Construction materials for low-cost farm dwellings have been developed to a point where they are practical for common use. The project on roofing materials for hog houses did not give positive results, but will be continued. In the food machinery field a machine is under development to trim the stem end of okra. Some investigations have been made regarding water management and irrigation.

Research Projects

The following projects are under way in the Department of Agricultural Engineering:

Water Management and Irrigation (A. L. Kennedy).

Paints for Galvanized Roofs (M. A. Sharp).

Materials and Construction Methods for Low Cost Farm Dwellings (M. A. Sharp).

Development of Electric Heating Panels (M. A. Sharp).

Design and Construction of an Effective Mechanical Self-feeding Silo (H. A. Arnold).

Roofing Materials for Hog Houses (Cooperative with An. Husb.) (C. W. Brown and Erwin K. Boyce).

Distributor for Silage in a Manger Around a Silo (H. A. Arnold).

Investigations in Structural and Mechanical Equipment for Storing, Drying and Handling Hay (H. A. Arnold).

Jumbo Sweet Potato Sizer and Okra Stem End Trimmer (A. H. Morgan).

Equipment and Techniques in the Production, Harvesting, Processing and Storage of Grass and Legume Seeds (C. W. Brown and Erwin K. Boyce).

Curing Air-cured Tobacco (R. B. Stone, U.S.D.A.).

Determination of the Effects of Electro-magnetic Energy on Plants and Animals and its Possibilities for Control of Insect Pests and Plant Diseases (O. A. Brown, U.S.D.A.).

Bulletins, Articles and Reports

The following bulletins and articles have been published by members of the Agricultural Engineering Department during the year:

Sharp, M. A.

New Type Block Enhances Safety, Economy, and Permanence of a House. Tennessee Farm and Home Science, June 1954.

Agronomy

The Department of Agronomy conducts research on problems relating to field crops and soils, such as the development of new and better varieties, better or more efficient methods of crop production, new methods of weed control, better management

and fertilization of soils, and the classification and mapping of soils within the State.

The evaluation of varieties of the important field crops was continued during 1954. This is a service of considerable importance to Tennessee farmers in providing them with information as to which of the available varieties perform best in the various sections of the State.

Studies on the fertilization of the major field crops in Tennessee continued during the year. Some added information was obtained on the rates of potassium needed to produce optimum yields of forage crops and at the same time to maintain the soil supply of available potassium. Extensive occurrence of zinc deficiency on corn was observed on the Cumberland Plateau as well as in the Central Basin. Experimental work has indicated that other minor elements in addition to zinc may be needed on the Plateau, and experiments to study this problem were started.

Irrigation studies were initiated at Jackson during the year, and one season's results were obtained on sudangrass. Irrigation equipment has been installed at Columbia, as well as at Jackson, and plans were developed for initiating irrigation work at two other substations in the near future.

Cooperative work with SCS on Soil Survey and soil classification problems was intensified and extended during the year. A cooperative study with TVA was initiated to determine the relative productivity of soils in Haywood County for cotton. Plans are being developed for more extensive productivity index studies.

Chemical weed control experiments were continued in 1954. Pre-emergence application of certain herbicides on cotton proved injurious to the replanted crop when the first planting was destroyed by disking. Experiments were started this year which should give information about the nature and rapidity of herbicide decomposition in the soil, and about the effect on plants of herbicide residues in the soil.

Chloro IPC again gave excellent weed control on cotton, and its use is being recommended to the cotton farmers of Tennessee.

Research Projects

The following research projects are underway in the Department of Agronomy:

Breeding for New and Extended Properties in Cottons in the Southeast (D. M. Simpson and E. N. Duncan, U.S.D.A.).

- Improving Breeding Methodology (D. M. Simpson and E. N. Duncan, U.S.D.A.).
- Methods for Controlling Seedling Diseases of Cotton (D. M. Simpson and E. N. Duncan, U.S.D.A.).
- Corn Breeding (F. D. Richey and L. M. Josephson, (U.S.D.A.), and H. C. Kincer).
- Annual Lespedeza (J. K. Underwood).
- Vetch (J. K. Underwood).
- Crimson Clover (J. K. Underwood and L. N. Skold).
- Improvement of Cultivated Grasses (J. K. Underwood, and L. N. Skold).
- The Relation of Soil Types to the Availability of Nutrients to Crops (L. F. Seatz (on leave) and W. L. Parks, Acting leader).
- Minor Element Availability to Crops as Related to Soil Properties (W. L. Parks, W. E. Black, Eric Winters).
- Potassium Fertilization of Farm Crops on Different Soil Series in Tennessee (W. L. Parks).
- Crop Response to Time and Rate of Potash Fertilization as Influenced by Soil Fertility Levels (L. F. Seatz (on leave) and W. L. Parks).
- The Comparative Value and Relative Efficiency of Various Phosphate Fertilizers under Different Soil and Cropping Conditions (O. H. Long and W. L. Parks).
- Fertilizing, Liming, and Manuring of Farm Crops (O. H. Long and W. L. Parks).
- Pasture Fertilization and Forage Quality Studies (O. H. Long, J. K. Underwood and K. B. Sanders).
- Pasture Production Investigations (J. K. Leasure, J. K. Underwood and L. N. Skold).
- Chemical Weed Control (J. K. Leasure).
- Variety Trials of Field Crops (C. D. Fisher (Military Leave), R. H. Gibson (Acting leader), J. K. Leasure and L. N. Skold).
- Effects of Sub-soiling on Crop Yields (J. N. Odom).
- Evaluation of New Plants (J. K. Underwood Coop., N. I. Hancock, L. N. Skold and B. S. Pickett).
- Soil Survey (R. J. McCracken and Eric Winters).
- Movement and Persistence of Herbicides in the Soil (S-18) (J. K. Leasure).

- Soybean Culture and Improvement (L. N. Skold).
Alfalfa Culture and Improvement (L. N. Skold).
Comparison of Perennial and Winter Annual Grass-Legume Mixtures for Winter Grazing (L. N. Skold).
Influence of Fertilization and Soil Properties on Yield and Composition of Alfalfa (S-14) (W. L. Parks).
Moisture Sorption Characteristics of the Major Soils of Tennessee (S-24) (W. L. Parks and A. L. Kennedy).
The Effects of Various Management Variables on Orchard Grass, Fescue, Ladino Clover and Alfalfa (S-12) (J. K. Leasure and L. N. Skold).

Bulletins, Articles and Reports

Anonymous

- More and Better Soil Testing. Tenn. Farm & Home Science No. 11, 1954.

Fisher, C. D.

- Variety Performance Trials of Cotton, Corn, Barley, Oats, Wheat, Red Clover, Alfalfa and Soybeans. Exp. Sta. Bull. No. 237, April 1954.

Leasure, J. K.

- Persistence in the Soil of Weed Control Chemicals. Tenn. Farm & Home Science, No. 12, 1954.

Long, O. H.

- Influence of Soil and Fertilization on Crop Yields in Lawrence County. Tenn. Farm & Home Science No. 9, 1954.

- Nitrogen on Clover-grass and Pure Grass Pastures. Farm Forum No. 51, July 1954.

- The Fertilization of Small Grains in a Pasture and Feed Program. Farm Forum No. 52, December 1954.

Overton, J. R., Edwards, Max J.

- The Soil Survey in the Lawrence County, Tennessee, Farm Planning Program. Soil. Sci. Am. Proc., Vol. 18, No. 3. July 1954.

Parks, W. L.

- Fertilizer Utilization As Related to Soil Moisture. Farm Forum, No. 50. March 1954.

Richey, Frederick D., Dawson, R. F.

- Thicker Aleurone Inadequate Explanation for Higher Niacin in Sugary Maize. Plant Physiology 29:194-196. 1954.

Seatz, L. F.

Phosphate Activity Measurement in Soils. Soil Science, Vol. 77, No. 1 pp. 43-51. January 1954.

Seatz, L. F., Tisdale, S. L., Winters, Eric

Crop Response to Fused Tricalcium Phosphate. Agron. Jour. 46-574-579. December 1954.

Simpson, D. M.

Natural Cross-pollination in Cotton. U. S. Dept. Agr. Tech. Bul. 1094. 17pp. 1954.

Simpson, D. M.

"Radical Methods" Seek Hybrid Cotton Vigor. Tenn. Farm and Home Science. No. 9, p 4, illus. 1954.

Animal Husbandry-Veterinary Science

The Animal Husbandry-Veterinary Science Department conducts research on problems in and methods of improving breeding, feeding, management, marketing and herd health of beef cattle, swine, and sheep. The research projects are aimed at developing methods of increasing the net income of livestock producers of Tennessee and producing a quality product for consumers of meat. Although research is going forward on all the projects listed, major emphasis during the past year has been in some of the following fields:

Methods that producers can use in selecting cows and bulls that will make the optimum return on Tennessee pastures and feeds. The present results indicate that knowing the weaning weight of the calf and adjusting it to a standard age, age of dam, and sex, enables the producer to cull his cows fairly accurately on the first calf, and very definitely on the first two calves produced.

Much information is being obtained on the basis of feeding tests on bull calves to show their future productive ability as sires of fast growing, high quality calves.

Dwarfism in beef cattle has received much attention during the past year. The lumbar vertebra of more than seventy calves have been X-rayed as a possible method of detecting dwarfism in calves that appear normal but carry the dwarf gene. More

X-ray studies and breeding tests will be made. Preliminary results indicate that this research should be followed as a possible method of detecting carrier animals.

The use of new type cottonseed meal as the sole source of protein along with farm grain is being studied with swine. The college swine herd has been put on a production testing basis.

Preliminary analysis of the results of the sheep production studies to evaluate the different type of replacement ewes indicates that the Northwest yearling ewes and the early native ewe lambs bred as lambs are good sources of replacement ewes. Southwestern yearling ewes have been added to the project during the past year since these have been the cheaper source of replacement ewes on per-head basis during the past year. Much information is being gained on the ability of rams of various types to sire pasture-gaining lambs. The rams used in the breeding test are evaluated from the time they are weaned as lambs until they are old enough for use in the herd.

Research on the effects of different levels of flourine in cattle has been reported in Experiment Station Bulletin 235.

A study with yearling steers continues to compare the following treatments of pastures as they affect total weight and gain per day.

(1) Native blue grass-clover pasture, fertilized according to recommendations based on soil tests; (2) Similar pasture plus a hundred pounds of ammonium nitrate applied every 60 days during the summer; (3) Same as Group 2, plus the addition of water by irrigation.

The pasture project using calves from the time they are weaned in the fall until the following fall, comparing orchard grass and ladino clover, to fescue and ladino clover with nitrogen, is in progress. Because of drought some of the orchard grass is disappearing. Therefore these combinations should be studied further before conclusions are drawn.

Still carcass studies are being made, comparing the different types of swine, especially the US 1, 2, 3, and medium grades. Animal measurements and carcass data are being obtained to determine most desirable slaughter time from standpoint of the maximum amount of lean meat and the minimum amount of fat.

Research Projects

The following research projects are under way in the Department of Animal Husbandry-Veterinary Science:

- The Improvement of the Producing Ability of Beef Cattle (C. S. Hobbs, H. J. Smith, E. J. Warwick, R. P. Moorman, J. W. Cole, J. Hugh Felts, J. A. Odom, J. M. Bird, E. J. Chapman, J. B. McLaren and L. Safley).
- Effects of Certain Atmospheric Effluents Upon Plant and Animal Life at Two Locales in Tennessee (C. S. Hobbs, R. P. Moorman, G. M. Merriman, J. M. Griffith, G. Stowe, and M. C. Bell, in cooperation with the Chemistry Department).
- Effects of Fluorine Levels of Soil and Water on Grazing Cattle under Different Systems of Management (C. S. Hobbs, J. M. Griffith, R. P. Moorman and W. H. MacIntire).
- Evaluation of Orchardgrass, Tall Fescue and Ladino Clover in Combinations and at Various Rates of Nitrogen Fertilization as Reflected in Beef Gains and Forage Yields (C. S. Hobbs, H. R. Duncan, and L. Safley of the Animal Husbandry Department; and L. N. Skold, O. H. Long, and J. K. Underwood of the Agronomy Department).
- The Influence of Different Methods of Wintering, and Nitrogen and Water Applications on Bluegrass Pastures During the Summer, on the Production of Slaughter Yearlings (H. R. Duncan, C. S. Hobbs, J. Hugh Felts and A. L. Kennedy).
- The Use of Urea in Rations for Cattle and Sheep (M. C. Bell, C. S. Hobbs et al.).
- Study of the Poisoning of Cattle Pastured on Fescue (G. M. Merriman, M. C. Bell, J. B. McLaren, E. J. Chapman, and C. S. Hobbs, of the Animal Husbandry-Veterinary Science Department; and J. K. Underwood and Eric Winters, of the Agronomy Department).
- Effects of Radiation on Reproductive Physiology of Farm Animals (R. L. Murphree, C. S. Hobbs, H. J. Smith, E. J. Warwick and J. Merrill Bird).
- Calcium and Phosphorus Metabolism in Animals (Sam L. Hansard and C. S. Hobbs).
- Studies of Endocrine Relationships in Farm Animals (R. L. Murphree et al.).
- Studies of So-Called "X" Disease of Cattle (R. P. Gregory, Jr.).

Pasture Investigations with Swine—Use of Cottonseed Meal as a Principal or sole Source of Protein Supplement for Growing-Fattening Swine on Pasture (C. C. Chamberlain, E. R. Lidvall and J. W. Cole).

Effect of Animal Shelter Temperatures and Radiated Heat on Live-Stock Production. I. Roofing Materials for Hog Houses (C. C. Chamberlain, E. R. Lidvall, and H. J. Smith of the Animal Husbandry Department; and M. A. Sharp and R. Prince of the Agricultural Engineering Department).

Carcass Yield Investigations with Pork (J. W. Cole, L. E. Orme and C. S. Hobbs).

Sheep Production for Tennessee (H. J. Smith, E. R. Lidvall, C. S. Hobbs, H. R. Duncan, J. W. Cole, H. Felts, J. A. Odom, E. J. Chapman, and J. B. McLaren).

A Comparison of a "Graded-Up" Flock with a Cross-Breed Flock for the Production of Ewes and Spring Lambs (H. R. Duncan and J. Hugh Felts).

Bulletins, Articles and Reports

The following bulletins and articles have been published by members of the Animal Husbandry-Veterinary Science Department during the year:

Bell, M. C., Murphree, R. L., and Hobbs, C. S.

The Use of Urea and Stilbestrol in Rations for Fattening Yearling Steers. *Journal of Animal Science* 13:976.

Cannon, C. C.

The Effect of Steroid Hormones on the Rate of Gain and Feed Utilization in Lambs. Master's Thesis, U of T, August 1954.

Chamberlain, C. C., Bell, M. C., and Kemp, H. N.

A Comparison of the Nitrogen Content of Wet and Dry Feces of Cattle and Sheep. *Proceedings of Assn. Southern Agric. Workers*, February, 1954.

Chamberlain, C. C., and Lidvall, E. R.

Cottonseed Meal Wins New Friends and Influences Production with Pigs. *Tennessee Farm and Home Science* 10 (April) 1954.

Chamberlain, C. C., and Lidvall, E. R.

Is Your Hog Feeding Program Balanced? *Southern Livestock Journal*, September, 1954.

Cole, J. W., Orme, L. E., and Hobbs, C. S.

The Importance of Fat Firmness in Evaluation of Pork Carcasses. *Journal of Animal Science* 13:968.

DeLoach, Dennis C.

Investigations of the Poisoning of Cattle Consuming Fescue Grass. Master's Thesis, August 1954.

Duncan, H. R., Hobbs, C. S., and Felts, J. Hugh.

Results in Using Nitrogen and Irrigation on Bluegrass-Hop and White Clover Pasture with Yearling Steers. *Proceedings of Assn. of Southern Agric. Workers*, February 1954.

Duncan, H. R., Hobbs, C. S., and Odom, John.

Value of Buckwheat in Swine Rations. *Tennessee Farm and Home Science* 12 (October) 1954, pp. 7.

Galey, Harmon E.

The Uses of Aluminum Sulfate Hydrate in the Alleviation of Abnormally Increased Levels of Fluorine in Cattle and Sheep. Master's Thesis, June 1954.

Gregory, R. P., Jr., Wise, J. C., and Sikes, Dennis

Experimental Production of Bovine Hyperkeratosis with a Feed Concentrate Exposed to Vapors of a Highly Chlorinated Naphthalene. *Journal of the American Veterinary Medical Association* 125, No. 930, Sept. 1954, pp. 244-246.

Griffith, J. M., Hobbs, C. S., Moorman, R. P., Merriman, G. M., Gregory, R. P., Jr., and MacIntire, W. H.

Effects of Dietary Fluorine on Fluorine Content of Bones in Cattle and Sheep. *Journal of Animal Science* 13:984.

Hansard, Sam L., Comar, C. L., Crowder, H. M., and Davis, George K.

Factors Affecting the Physiological Behavior of Calcium in Cattle. *Proceedings of Assn. of Southern Agric. Workers*, February 1954.

Hansard, Sam L., Crowder, H. M., and Comar, C. L.

The Utilization by Cattle of Calcium from Various Sources. *Journal of Animal Science* 13:986.

Hansard, Sam L., Somer, C. L., and Plumlee, M. P.

The Effects of Age Upon Calcium Utilization and Maintenance Requirements in the Movine. *Journal of Animal Science* 13:25-36.

Hobbs, C. S., Moorman, R. P., Jr., Griffith, J. M., West, J. L., Merriman, G. M., Hansard, S. L., and Chamberlain, C. C., with collaboration of MacIntire, W. H., Hardin, L. J., and Jones, L. S.

Fluorosis in Cattle and Sheep. Tenn. Exp. Sta. Bulletin No. 235, November 1954.

Merriman, G. M., Hobbs, C. S., Moorman, R. P., Bell, M. C., West, J. L., and Pardue, J. B.

The Effects of Feeding High Levels of Fluorine to Beef Cattle. Proceedings of Assn. of Southern Agric. Workers, February 1954.

Moorman, R. P., Hobbs, C. S., and Duncan, H. R.

A Comparison of Winter Pasture and Silage for Fattening Calves. Proceedings of Assn. of Southern Agric. Workers, February 1954.

Murphree, R. L. Cannon, C. L., Odom, J. A., and Hobbs, C. S.

The Influence of Sex Hormones on the Fattening of Utility and Cull Spring Lambs. Journal of Animal Science 13:1027.

Plumlee, George D.

The Effects of Different Levels of Fluorine Intake on Digestibility and Mineral Balance in Beef Cows. Master's Thesis, U. of T., June 1954.

Smith, H. J., Warwick, E. J., Paysinger, J. R., Guill, J. T., and Hobbs, C. S.

Repeatability of Cow Performance. Proceedings of Assn. of Southern Agr. Workers, February 1954.

Botany Department

The primary objective of the Botany Department continued to be the breeding and improvement of certain crop plants.

The 1954 growing season at Jackson station—driest on record—gave valuable information for our cotton breeding program. Yields and lint percentages were low. Fiber length and perimeter were unaffected, while strength was markedly reduced. Apparently the reduction in strength was associated with size of fiber walls, which were much thinner than normal.

Tenn. 241 and Tenn. 818 cottons were among the first four commercial varieties having the highest 3-year-average yield of lint per acre in tests over the state. In addition they had an advantage in earliness of 80% against 64% for the other two leading varieties. Plants of the fourth backcross of the triple-species hybrids to selections of upland (*hirsutum*) crosses continued to give high breaking strengths on the Stelometer.

Heavy rainfall and winds from late May to mid-June caused excessive lodging of some small-grain varieties. High applications of nitrogen caused lodging at all stations. Thus resistance to lodging becomes as important a factor as resistance to diseases in production of small grains in Tennessee. The weight of head and uppermost internode averages 60% of plant weight, thus all small grains are top-heavy and are subject to lodging under severe stormy conditions. Parental material which has added strength of culm or straw in progenies of oat varieties are winter Santa Fe types and LeConte; of barley varieties Wong and more recently Montcalm—a spring type mutation obtained by radiation treatments of seed in Canada; of wheat varieties Atlas 66 and Genessee.

The primordia of panicles or spikes (heads) of grain begin their growth in early spring at ground level when the plant begins to stool. It was found that the initiation and rate of growth up through the culm or stem varied considerably between winter and semi-winter types, as well as with climatic conditions. It is obvious that grazing at a time when these primordia have grown 3 to 5 inches above ground will injure the yield of grains, as each culm produces but one head. These head primordia can be seen by splitting the culm at the uppermost node, and should be a good criterion of time to discontinue grazing.

Field plantings of a wild barley, *Hordeum bulbosum*, were very promising—but this vigorous, perennial tetraploid is virtually sterile. Several series of colchicine treatments were given to local diploid barleys, to induce tetraploidy and thus make crosses with the wild plant possible.

An induced tetraploid of rye, "Tetra-Petkus," was imported from Germany and field tested. This variety is extremely stiff of straw, but is slow growing as a seedling and rather late to flower. An extensive series of colchicine treatments was given to Balbo rye, to elucidate the best means for inducing tetraploidy, thus promising fertility in crosses with Tetra-Petkus.

The projects for the improvement of the annual forage legumes saw their first full calendar year of research in 1954. During this period: (1) a laboratory was completed; (2) some 200 lots of seed from various parts of the world were spring- and fall-planted for observation; (3) hybridizations were attempted; (4) seeds were exposed to gamma radiation for induction of mutations; and (5) seeds and seedlings were treated with colchicine to induce polyploidy ("doubling").

Attempts at hybridizing annual with perennial lespedezas were made, among Kobe, Korean, and Sericea. Such a cross has never been successful, and in an effort to prevent the usual early abortion, embryos were removed from the ovules and cultured aseptically. None survived longer than 3 weeks. Further attempts, with different media, will be made in 1955. Colchicine treatments yielded 3 plants that appeared tetraploid; chromosome counts will be made when seed dormancy has ended. Preliminary exposures to gamma rays were made for mutant induction.

The apparent lack of genetic variability in crimson clover, giving little hope of improvement through ordinary breeding, was attacked with colchicine and with radiation. Seeds from colchicine-treated plants (C_2) were field planted for identification of tetraploids. More extensive tests to determine the most productive and reproducible means of administering colchicine were made. Head collections were made on farms at 14 locations over Tennessee, some of which had reseeded naturally for several years. It is hoped that genetic variation, including re-seeding types, will be found among these selections.

A search for vetches combining the erectness of existing strains with the winterhardiness requisite for culture in Tennessee was instituted. Over 50 strains of *Vicia* species were field-planted for observation and crossing. Seeds of local "crown vetch" (*Coronilla varia*) were harvested and planted, and preliminary colchicine tests were made on common vetch for crossing with this tetraploid. Preliminary irradiation studies were made, and field tests based on this information.

Research Projects

Production and Improvement of Cotton Varieties Suitable to Tennessee Conditions (N. I. Hancock).

Oat Breeding (N. I. Hancock).

Wheat Breeding (N. I. Hancock).

Breeding and Genetics of Lespedezas (T. S. Osborne).

Barley Breeding (N. I. Hancock).

Breeding and Genetics of Crimson Clover (T. S. Osborne)

Breeding and Genetics of Vetches (T. S. Osborne).

Bulletins, Articles and Reports

Osborne, T. S.

"Micro-Film" in Photomicrography. *Stain Technology*, 29:41-42. 1954.

Osborne, T. S. (with K. Yamashita)

One Year's Experimental Wheat Schedule. *Japanese Journal of Breeding*, 4:1-2. 1954.

Chemistry

The activities of the soil chemistry laboratories were devoted to furtherance of the several projects: The comparative neutralizing effectiveness of Limestone, Dolomite and Calcium Silicate slag of equal particle size; the leachabilities of magnesium from additions of "sulfomag" and magnesium sulfate, as affected by degree of calcium saturation of the soil; the solubilities of various flourine compounds added to the soil as indicated by the analysis of the drainage; the effects that effluent hydrofluoric acid exerts upon soil composition.

Considerable effort was directed to the evaluation and improvement of procedures for chemical analysis of soils and liming materials. Through the adoption of flame photometric techniques, the contents of exchangeable calcium, magnesium, and potassium in a single soil extract can be determined within 24 hours. The findings will be presented in the Proceedings of the Soil Science Society of America. Another contribution was a modification of the official procedure for the analysis of liming materials, whereby limestones of high content of iron can be evaluated correctly. Report of the work was made in a paper to appear in the Journal of Association of Official Agricultural Chemists and will be included in the "Official" Methods of the Association.

Personnel of the Department participated in collaborative

work with the Agricultural Research Service for the development of a modification of the official procedure for the extraction of water-soluble phosphate from normal, concentrated, and ammoniated superphosphates.

The remarkable distinction between the behavior of equivalent incorporations of the fluorides of potassium and calcium was established by means of a 6-year lysimeter experiment. The selective fixation of fluorine from the fluoride of potassium was reported at the New York meeting of the American Chemical Society in September 1954.

Because of the uncertainty as to effects that fluoric effluents exert upon the composition and fertility of selected Tennessee soils, a 4-year lysimeter study of the results from sprinklings and incorporations of hydrofluoric acid was also reported at that meeting.

Most of the work done by the two fluorine laboratories comprised analyses of survey collections of vegetation and soils; rain, pond, and stream waters; some 1300 samples of feed, pastures, bones, urine and other animal excretions and organisms. Additional crops, plot-grown on three soils of various fluorine content, were analyzed to determine the effect of soil splash on fluorine content of the crops.

Two new experiments were set up to measure incidence of atmospheric fluorine by means of a series of Spanish moss exposures in suspended open mesh bags in parallel with slightly-porous bags to register localized occurrences and, possibly, to differentiate between gaseous forms of dust phases as causes for fluoric contamination of vegetation. The moss exposures were made at twelve locations in the Middle Tennessee area and at Crossville. Differences in the fluorine fixed by the two types of exposures were determined and the findings are being evaluated. In the second experiment, month-long, lime-treated filter papers are exposed in containers so arranged as to assure good ventilation for fluorine intake from the atmosphere while affording protection to the paper against rainfall. Analyses of three series of the paper exposures indicate significant results in the two areas where the effects of atmospheric fluorine on plant and animal life are under study.

The UT-TVA cooperative studies were concerned with laboratory and greenhouse evaluations of several new fertilizers.

During the year, further evaluations were made on the effectiveness of fused tricalcium phosphate, as determined on different particle size fractions, and also on the effect of the added phosphoric acid upon the granulation of that material.

Several new highly concentrated fertilizers—ammonium metaphosphates—were evaluated to determine the effectiveness of their contents of nitrogen and phosphorus. These materials, which were made only in laboratory quantities, contained 70 to 77 percent P_2O_5 and 14 to 17 percent nitrogen and the initial results with two crops on one soil showed to be efficacious fertilizers. Nitrification studies on the ammonium metaphosphates established the fact that they were readily nitrifiable, more so than ammonium sulfate.

Research Projects

The following research projects are under way in the Department of Chemistry:

Comparative Leachabilities of Five Incorporated Fluorides, With and Without Cropping (W. H. MacIntire, W. M. Shaw, S. H. Winterberg, A. J. Sterges, B. Robinson, and L. B. Clements).

Leachability of Fluorine from Incorporations of Hydrofluoric Acid in Soils of Four Types (W. H. MacIntire and A. J. Sterges).

Comparative Liming Effectiveness of Limestone, Dolomite and TVA Slag of Equal Particle Size (W. H. MacIntire, W. M. Shaw, and B. Robinson).

Lysimeter Experiment on the Comparative Availabilities of Magnesium Incorporated as Magnesium Oxide, Magnesium Sulfate and "Sulfomag" in Four Soils (W. H. MacIntire, W. M. Shaw, and A. J. Sterges).

Decomposition of Calcium and Magnesium Carbonates in Soils under Field Conditions, Including Leaching Investigations (W. H. MacIntire and W. M. Shaw).

Single and Cumulative Additions of Calcic and Magnesian Materials in Lysimeters (W. H. MacIntire, W. M. Shaw, and Claire Veal).

Migration, Fixation, Availability and Nature of the Combinations that Ensur When P_2O_5 is Supplied to the Soil by Acid Phosphate With and Without Supplements of Limestone and Dolomite. (W. H. MacIntire, W. M. Shaw, Brooks Robinson, S. H. Winterberg, and A. J. Sterges).

Potassium Metaphosphate Availability (W. H. MacIntire, W. M. Shaw, and Claire Veal).

Fluorine Contamination in Ground Waters from Incorporations of Fluorides (W. H. MacIntire, W. M. Shaw, and B. Robinson).

The Effects of Certain Atmospheric Effluents Upon the Growth and Composition of Plants, and Upon Animal Life, at Locales in East and Central Tennessee (W. H. MacIntire, L. J. Hardin, and analysts).

Chemical Studies of New Fertilizer Compounds and Mixtures (W. H. MacIntire, S. H. Winterberg, A. J. Sterges, and L. B. Clements).

Bulletins, Articles and Reports

Hardin, L. J.

Report on the Determination of Flourine in Soils. Jour. AOAC, 37:277-278, 1954.

Hardin, L. J., MacIntire, W. H., and Tubb, Mary Ellen

The Use of Potassium Hydroxide as a Fusion Agent in the Determination of the Flourine Content of Vegetation. Jour. AOAC, 37:552-553, 1954.

MacIntire, W. H.

Report on Soils and Liming Materials. Jour. AOAC, 37:268-269, 1954.

MacIntire, W. H., Winterberg, S. H., Sterges, A. J., and Clements, L. B.

Soil Conditioner—Chemical Effects of a Soil Conditioner Upon Plant Composition and Uptake. Agr. & Food Chem., 2:463, 1954.

MacIntire, W. H., Hardin, L. J., and Hardison, Mary.

Atmospheric Fluorine—Flourine Acquired by Forage Cultures in Outdoor and Washed Atmospheres at Columbia, Tennessee. Agr. & Food Chem., 2:832-35, 1954.

MacIntire, W. H., Shaw, W. M., Robinson, B., and Veal, Claire.

Potassium Fixation—Differential Fixation of Potassium from Incorporation of Metaphosphate and Sulfate in Two Soils. Agr. & Food Chem, 2:85-91, 1954.

Shaw, W. M.

Colorimetric Determination of Fluorine in Waters and Soil Extracts. *Analytical Chemistry*, 26:1212-1214, 1954.

Report on Exchangeable Hydrogen in Soils—pH Values as Related to Degree of Calcium Saturation under Varying Conditions. *Jour. AOAC*, 37:270-277, 1954.

General Chemistry

With a view to further improvement in quality of foods preserved by freezing, canning, and dehydration, and to assist in selecting varieties of fruits and vegetables best suited to the several methods of preservation, and those preferred by the consumer, numerous experimental studies were conducted during the year.

Work was initiated to learn something of the causes of off-flavors and toughness occurring in some varieties of green beans preserved by freezing, after they have been stored in -0° F. temperature. Results thus far indicate that there is some enzyme activity—probably enzyme regeneration—in frozen beans during storage. While not conclusive, results point to underblanching as the major cause of flavor instability.

Results of our tests have shown that pie stock or puree made from pumpkin can be satisfactorily preserved by freezing. The “drier” varieties having a total solids content of 16 to 20 percent are best suited for frozen pie stock.

Experiments were conducted in dehydrofreezing of sweet corn, diced white potatoes, and peach slices. Color and flavor of the reconstituted products were found to be satisfactory. The white color of the potato pieces is preserved well by dipping in a 1.5 percent solution of sodium bisulfite for 1 minute prior to dehydrating. Preliminary experiments were performed with the object of learning something concerning the compounds formed and chemical reactions responsible for the brown-black discoloration which develops during the dehydration of untreated white potatoes. Work thus far suggests that reactions between dextrose sugar and certain amino acids may be responsible for the color complex formed. Since sulfur dioxide will largely prevent discoloration, an oxidation reaction is indicated.

Studies were made of the use of Irish moss extractives for firming whole and sliced strawberries prior to freezing. The added carbohydrate-like substances effected a much higher drained weight of fruit after defrosting but the flavor of the product was inferior to the controls to which no colloid was added. The use of specially prepared pectinates for lessening bleeding of defrosted berries is receiving attention.

Observations were made on the physical condition, chemical composition, and mold growth of strawberries during a period of storage in 36° F. temperature. Ascorbic acid, total sugars, pH values, mold counts, and taste tests were determined on stored, uncapped, hand capped, and machine capped strawberries that were unwashed, washed in tap water, and in water containing 6 to 10 parts per million of chlorine. Mold contamination and cellular breakdown of berry tissue proved to be valuable criteria for determining storage life of strawberries. Uncapped strawberries may be held in cold storage for longer periods than those capped by hand in the field at the time of harvesting.

Our experiments show that very few coliform bacteria of sanitary significance are present on fresh strawberries. Closely related bacteria with similar characteristics, common residents of the soil, are generally present.

We find that epiphytic bacteria of green beans vary in number with climatic conditions, and are not removed quantitatively during processing for freezing; therefore, desirable sanitary practice in the processing plant by means of the direct microscopic examination cannot be determined.

Considerable work was done to ascertain the protective qualities of various wrappings and packaging materials currently offered for home and commercial uses in the freezing preservation of foods.

The study of the effects of different fertilizers on the protein and mineral content of pasture forage was continued. Analysis was completed on all samples from pasture fertilization and forage quality project experimental fields.

The effects of liming rates and fertilizer rates on the chemical composition of orchard grass, Kentucky bluegrass and upright and prostrate types of tall fescue are being studied. Protein and mineral analyses were completed on 3 of 6 cuttings of

grasses grown in the greenhouse. In connection with this work a comparison of methods for the determination of magnesium in plant material was made, using the Beckman Flame Photometer and the Colorimetric procedures of Sterges and MacIntire (Analytical Chemistry 22:351-3, 1950) and Young and Fill (Analytical Chemistry 23:751-4, 1951). Acidity of soil from 64 2-gallon crocks used in this study also was determined. This work is being done in connection with the Improvement of Cultivated Grasses project.

Research Projects

The following projects are under way in the Department of General Chemistry:

- Preservation of Fruits and Vegetables by Freezing (G. A. Shuey, Ivon E. McCarty, and Mildred Haigler).
- Home Preservation of Fruits and Vegetables by Dehydration (G. A. Shuey, Ivon E. McCarty).
- Factors Affecting the Quality of Strawberry and other Fruit Juices (G. A. Shuey and Ivon E. McCarty).
- Nitrogen and Ash Constituents of Cultivated Grasses and Legumes as Influenced by Environmental Factors and Cultural Practices (K. B. Sanders).
- Pasture Fertilization and Forage Quality (O. H. Long, K. B. Sanders, and J. K. Underwood).
- Improvement of Cultivated Grasses (J. K. Underwood, J. K. Leasure, and L. N. Skold).
- Determination of the Presence of Coliform Bacteria on and in Fresh and Frozen Small Fruit, and Study Methods of Elimination (J. O. Mundt, G. A. Shuey, and Ivon E. McCarty).
- Bacteriology of Green Beans and Other Frozen Vegetables by Direct Microscopy (J. O. Mundt and G. A. Shuey).

Bulletins, Articles and Reports

The following articles have been published and manuscripts prepared by members of the General Chemistry Department during the year:

- Drain, Brooks D., and Shuey, G. A.
Breeding and Testing Fire Blight-Resistant Pears. Tenn. Agr. Exp. Sta. Bul. No. 236. 1954.
- Tennessee Research on Blight-Resistant Pears. Southern Florist and Nurseryman, Feb. 26, 1954.

Mundt, J. Orvin, Shuey, G. A., and McCarty, Ivon E.

The Coliform Bacteria of Strawberries. J. Milk and Food Tech. Vo. 17, No. 12, 1954.

Sanders, K. B. and Kennedy, A. L.

Phosphate Penetration Through Undisturbed Natural Soil from Sod Fields. (Manuscript prepared).

Sanders, K. B.

Silicon in Plants: A Partial Review of the Literature. (Manuscript prepared).

Do Fertilizers Improve the Quality of Pasture Forage as well as Increase Yields? (Manuscript prepared).

Phosphate Rate Effects on Korean Lespedeza Composition and Yield. (Manuscript prepared).

Shuey, G. A.

Home Freezing of Foods. Tenn. Agr. Exp. Sta. Bul 215, 1950. Reprinted as Agr. Ext. Serv. Publication 345, Feb. 1954. This publication is being revised.

Dairy Department

Investigations in darying in 1954 have included studies of improving the quality of market milk and cheese as well as of numerous phases of dairy cattle management.

Raw milk stored at 40°F for four days, which simulates the extremes of farm bulk tank milk storage systems, developed some stale and unclean flavors as well as very high populations (over 200,000 per cc.) of bacteria. Most of the bacteria were psychrophiles. A lipolytic enzyme was discovered in raw milk which might be a factor in cheese ripening since it is active in an acid medium.

A summary of acute mastitis cases studied showed that 51% were caused by streptococci, 19% by micrococci, and 22% by other organisms. All of the streptococci isolated from infected udders were easily killed by penicillin in vitro, indicating no resistant strains developing due to former treatments.

Improving the milk production of cows through breeding has been demonstrated in two substation herds which have increased 1500 and 1600 lbs. of milk per cow over a six-year period. Further improvement in inherited milk production ability is being

sought through the use of good proved sires and the proving of good prospective young sires. Alfalfa-orchardgrass pasture, hay and silage have been shown to be excellent forages for milking cows. Maintenance of legume and grass stands and yields was satisfactorily achieved by delayed and rotational grazing over a five-year period. Irrigation of summer pastures continued to show a large profit in dry 1954. Winter grazing of clover-cereal grass mixtures was equal to 1161 lbs. of hay from October to March, inclusive.

Calves were raised very satisfactorily with only 10 to 16 lbs. of marketable whole milk fed per calf. Utilization of all colostrum for calf feeding and the use of milk replacement feeds and calf starters at an early age made such economy possible. Feeding the calf liberally on milk (replacement) and weaning at about 6 weeks produced larger calves at a lower cost than more extended periods of limited milk feeding. Allowing calves to suckle for veal production resulted in the loss of 1500 lbs. of milk, compared to about 1180 lbs. consumed by hand fed veal. The suckled veal, although selling for more, returned only \$2.67 per cwt. for milk while the hand fed veal returned \$3.00.

Identical twin cows raised on a super-growth regime milked only 52 per cent as much as their normal mates in the first 5 weeks of their first two lactations. Sections of udders from both pairs showed that early fattening had inhibited normal mammary gland development. Identical twins calving for the first time at 3 years outmilked their second lactation mates 23.9%. This was due to greater persistency of production since the second lactation heifers attained higher peak lactation levels. Investigations of thyroid physiology and thyroxine feeding have been continued with identical twins and other cows. Hot weather effects override thyroxine stimulation of milk yields and depress the activity of the cows' thyroid glands. Thyroxine feeding in winter has continued to produce economical increases in milk production. The weight loss associated with thyroxine feeding was shown to be largely a difference in fill or paunch size which returned to normal quickly after stopping thyroxine supplements.

Research Projects

The following research projects are under way in the Department of Dairying:

- The Effect of Supernormal Growth of Dairy Heifers Upon Their Milking Qualities (E. W. Swanson).
- Maintaining or Improving Fertility of Dairy Bulls or their Semen Used for Artificial Insemination (E. W. Swanson).
- Elements of a Program to Control Mastitis in Pen-Type Barns (B. T. Throop, W. W. Overcast, and E. W. Swanson).
- Feeding Thyroidally Active Materials to Dairy Cows (E. W. Swanson, S. A. Hinton, and B. T. Throop).
- Radioisotopes in the Investigation of the Physiology of Milk Secretion (R. A. Monroe, E. W. Swanson, and C. L. Comar).
- Importance of the Dry Period and Management of Dairy Cows During the Dry Period (E. W. Swanson and S. A. Hinton).
- Raising Dairy Calves—I. A Comparison of Two Methods of Milk Feeding, With and Without Rumen Inoculation, Upon the Growth and Feeding Efficiency of Dairy Calves. II. Comparison of an Extracted-Fat Milk Replacement Fed Unchanged or With 25 Per Cent Whole Milk for Dairy Calves. III. Comparison of Open Outdoor Pens With Indoor Barn Pens for Raising Dairy Calves to Four Months (E. W. Swanson, S. A. Hinton, and C. E. Wylie).
- The Effect of Veal Production by Leaving the Suckling Calf with Its Dam Upon the Lactation Curve and Milking Economy (E. W. Swanson, C. E. Wylie, and S. A. Hinton).
- The Influence of a Previous Lactation Upon the Milk Production of Three-year-old Heifers (E. W. Swanson).
- The Proteolytic Activity of Bacteria in the Ripening of Pasteurized Milk Cheddar Cheese (W. W. Overcast).
- The Influence of Holding Raw Milk at 4°C. Upon the Bacterial Content and the Flavor (W. W. Overcast).
- Bacteria from the Environment of Dairy Cattle and the Relationship of These Bacteria to Mastitis (W. W. Overcast and B. T. Throop).
- Study of the Factors Responsible for the Normal Development of the Cheddar Cheese Flavor (T. W. Albrecht and H. O. Jaynes).
- Ice Cream Made from Lactose Hydrolized Milk (T. W. Albrecht and J. P. Gracy).
- Study the Enzymes in the Milk Secreting Tissue of the Mammary Gland as They Are Related to Cheddar Cheese Ripening (T. W. Albrecht).

Development of Strains of Dairy Cattle Especially Adapted to Southern Conditions (R. H. Lush, B. P. Hazlewood, A. G. Van Horn, W. M. Whitaker, and R. O. Thomas).

The Effect of Early and Delayed Grazing on Milk Production of Legume Mixtures (A. G. Van Horn, W. M. Whitaker, and R. H. Lush).

The Effect of Irrigation on Pastures for Dairy Cattle (A. G. Van Horn, W. M. Whitaker, R. H. Lush, and J. R. Carreker).

Comparative Value of Perennial and Winter Annual Grazing Crops for Cool Weather: Crimson Clover vs. Ladino Clover with Tall Fescue (A. G. Van Horn, W. M. Whitaker, and R. H. Lush).

Feeding Value for Milk Production of Legume Hay Fed with Silage vs. Silage as Sole Roughage (A. G. Van Horn, W. M. Whitaker, and R. H. Lush).

Winter Grazing for Dairy Cows (R. H. Lush, E. J. Chapman, J. B. McLaren, and C. E. Wylie). (Inactive)

Bulletins, Articles and Reports

The following bulletins and articles have been published by members of the Dairy Department during the year:

Lush, R. H., Van Horn, A. G., Whitaker, W. M., and Throop, B. T. Alfalfa-Orchardgrass Grazing Results. Abstract, Journal of Dairy Science 37(5):610, May, 1954.

Lush, R. H., Van Horn, A. G., and Whitaker, W. M.

Hay Crop Silage vs. Silage and Hay for Milk Production Abstract, Journal of Animal Science 13(4):1009, Nov. 1954.

Lush, R. H., Van Horn, A. G., Whitaker, W. M., Hazlewood, B. P., and Thomas, R. O.

Breeding Jerseys for Milk Production. Abstract, Sou. Agr. Workers, Feb., 1954.

Lush, R. H.

Pasture Management for Dairy Cattle. Tennessee Agricultural Experiment Station Bulletin No. 234, 1954.

Tennessee Breeds Jerseys for Higher Milk Production, Jersey Journal, Aug. 20, 1954.

Costs and Returns from Pasture Irrigation. Plant Food Journal, Vol. 8, No. 4, Oct.-Dec., 1954.

Irrigating for More Pasture. The Progressive Farmer, April, 1954.

How to Get the Most Milk Per Acre from Your Pasture. Mid-South Milk Producers Dairy News, April, 1954.

Improvement Through Artificial Breeding. Guernsey Breeders' Journal, April 15, 1954.

Van Horn, A. G., Whitaker, W. M., and Lush, R. H.

Value of Perennial and Winter Annual Grazing Crops. Abstract, Sou. Agr. Workers, Feb., 1954.

Albrecht, T. W.

University of Tennessee Dairy Products Research. Tennessee Farm and Home Science, No. 9, Jan., Feb., March, 1954.

This Problem of Watered Milk. The Milk Products Journal, July, 1954; also The Milk Dealer, Vol. 43, No. 11, p. 58, 1954.

Overcast, W. W. and Cook, R. C.

In-Place Cleaning of Milk Lines Cuts Costs. Tennessee Farm and Home Science, No. 10, p. 8, June, 1954.

Hinton, S. A.

Raising Dairy Calves. Tennessee Farm and Home Science, No. 12, p. 3, October, November, December, 1954.

Swanson, E. W.

The Effect upon Milk Production and Body Weight of Varying Withdrawal Periods After Thyroactive Supplement Feeding. J. Dairy Sci. 37:1212-1219. 1954.

Testing Programs. (Problems in improving dairy cattle breeding). Tenn. Market Bulletin. 26(5):5. May, 1954.

Swanson, E. W., Monroe, R. A., and Comar, C. L.

Using Identical Twin Dairy Cows to Determine the Effect of Iodinated Casein (Protamone) on Milk Production, Thyroid Activity, and Body Weight Changes. J. Dairy Sci., 37:659. 1954 (abstract).

Swanson, E. W. and Spann, T. R.

The Effect of Rapid Growth with Fattening Upon Lactation in Cattle and Rats. J. Animal Sci. 13:1032. 1954 (abstract).

Spann, T. R.

The Effect of Rapid Growth with Fattening Upon Lactation in Cattle and Rats. M. S. Thesis, Univ. of Tenn., 1954.

Williamson, J. H.

A Comparison of Two Methods of Milk Feeding, With and Without Rumen Inoculation, Upon the Growth and Feeding Efficiency of Dairy Calves. M. S. Thesis, Univ. of Tenn., 1954.

Jaynes, H. O.

Milk Lipase. M. S. Thesis, Univ. of Tenn., 1954.

Entomology

Sever draught conditions continued in 1954 and again some common pests were greatly affected. The bean beetle practically disappeared from experimental plots. The plot work on sweet potatoes, using combinations of insecticides and fertilizer, was of little value as the infestation in the untreated rows was very small. The dry fall was not favorable for Hessian fly, thus preventing infestation counts.

Spraying tests on cotton at Knoxville and Jackson resulted in no significant yield differences; however, similar tests in Lawrence County showed definite gains from insecticide applications. An interesting trend was that Cobal variety responded more from insecticide treatments than DPL No. 15.

House fly control is promising again as some of the phosphate insecticides have been found to be very effective, especially in baits. Within the past season six phosphate compounds were tested with three baits—dark Karo syrup, black strap molasses, and malt extract. The tests revealed that dark Karo syrup was the best bait and Dipterex the best poison. Malathion was found also to be a good poison. These compounds are highly recommended for house fly baits as they are effective and also quite safe.

Treating seed with insecticides is a convenient method of combatting certain soil insects. However, since little is known about the effect of such treatments on germination, tests were started with corn and cotton, using lindane, aldrin, and dieldrin. Tests thus far show no ill effects. The treated seeds are still in storage and will be tested again this coming season.

Before new insecticides can be accepted for use on tobacco it is necessary to conduct organoleptic tests to determine whether

the insecticide introduced an obnoxious taste or odor. In 1952 five insecticides—lead arsenate, Dilan, TDE, malathion, and demeton—were used on burley tobacco. Similar samples of the tobacco were sent to three tobacco manufacturers for organoleptic tests. None of the materials were found to be prohibitive. In 1953 three insecticides—TDE, demeton, and endrin—were used on burley and the samples were sent to only one company for testing. It was reported that the demeton treated tobacco was different from Rhothane-treated tobacco but that it was not prohibitive.

Spraying of peaches was continued but the lack of insects—plum curculio and Oriental fruit moth—at harvest time prevented obtaining control data. A sample of peaches sprayed with endrin was sent for residue analysis and about twice the maximum desired was found. The peaches were sprayed six times during the season, with the last application two weeks before harvest. The residue probably can be reduced by stopping sprays four weeks before picking.

The woolly apple aphid often causes heavy losses in nursery stock. Many trees can be saved if the aphids can be killed. To test this, three insecticides were used in dipping tests wherein infested trees were submerged in solutions for about 12 minutes. Lindane, malathion, and demeton were used, and all gave 100% control. It appears that malathion will be best to use as it kills other pests such as spider mites which lindane does not.

Although the European corn borer has not caused serious loss to date it is under observation for control measures.

The army worm has caused damage for the past several years and this year studies on this insect were instigated. Although control measures can be successful, much loss occurs before farmers realize that the worms are present. Part of the study calls for the use of light traps to catch moths. These traps will be set out in different parts of the State. States adjoining Tennessee are also operating traps and these records will be collected and summarized to determine if the army worm infestations come from migrations or from local conditions.

Research Projects

The following research projects are under way in the Department of Entomology:

- Flea Beetles Attacking Sweet Potatoes (S. Marcovitch and W. W. Stanley).
- New Insecticides Derived from Coal Tar Products (W. W. Stanley and S. Marcovitch).
- Ecology and Control of Tobacco Insects (W. W. Stanley and S. Marcovitch).
- The Control of Insects Attacking Peach (W. W. Stanley and S. Marcovitch).
- A Study of the Life History and Means of Control of Insects that Affect the Growth of Cotton (W. W. Stanley and S. Marcovitch).
- Breeding for Improvement in Wheat Varieties to Include Resistance to Disease, Hessian Fly, and Changes in Morphological Characters (J. O. Andes, N. I. Hancock, and W. W. Stanley).
- A Study of the Life History, Ecology and Control of Army Worms, *Pseudaletia unipuncta* and related species (W. W. Stanley and S. Marcovitch).
- A Study of the Insects Attacking Legumes, With Special Reference to Alfalfa and Soybeans (W. W. Stanley and S. Marcovitch).
- Control of Woolly Apple Aphis and Other Soil-Inhabiting Pests in Nurseries (W. W. Stanley).

Bulletins, Articles and Reports

The following bulletins and articles have been published by members of the Entomology Department during the year Marcovitch, S.

The Insect Pest Situation in Israeli Agriculture. Jour. Econ. Ent. Vol. 47, No. 1, pp. 19-23.

The Control of Poultry Insects. Agr. Ext. Ser. Leaflet No. 1 (rev.), 1954.

Bean Weevil Control. Progressive Farmer, Sept. 1954, p. 152.

Stanley, W. W., and Kincer, H. C.

Report on Germination Tests With Seed Corn Treated With Insecticides.

Stanley, W. W.

Control of Aphids on Strawberries. Agr. Exp. Sta. Cir. of Inf. No. 90, 1954.

Stanley, W. W. and Marcovitch, S.

Tomato Fruitworm. Agr. Ext. Ser. Leaflet 135, 1954.

Stanley, W. W., and Mullett, R. P.

Garden and Household Insects. Agr. Ext. Ser. Sp. Cir. 30 (rev.), 1954.

Mullett, R. P., Stanley, W. W., Andes, J. O., and Leasure, J. K.

Insecticides, Fungicides, and Herbicides List. Agr. Ext. Ser. Sp. Cir. 394 (rev.), 1954.

Home Economics

Work during the year in child development and family relationships has been concentrated upon the construction of more extensive parent attitude scales to be used in a cooperative Southern Regional Family Life Project. The primary objective is to determine the strength of relationship between certain child-rearing attitudes of Tennessee rural parents and various behaviors of their children. The year's work was devoted to the development of four sets of attitude scales which is the initial phase of the overall project. Each set of scales was designed to measure a parent's attitude toward one of the following: (a) the child's share with his parents in making decisions concerning his own behavior; (b) level of aspiration for the child; (c) protection of the child from physical and/or psychological harm; and (d) acceptance (or rejection) of the child.

Work on frozen batter and dough products has been concerned primarily with yeast doughs. The effect of freezer storage on the gassing power of fermented, and unfermented, shaped, and unshaped doughs was measured. The role of manipulation was studied by shaping part of the rolls before storage and part after storage. To distinguish between the effects of gassing power and manipulation, some of the rolls frozen pre-shaped were reshaped before the pan-proof period.

A sweet yeast dough was used as the standard test product. Doughs were held in 0° F. storage for periods of 2, 4, 8 and 12 weeks. Quality of rolls obtained from fresh and frozen doughs was measured by sensory difference tests.

The research program in home management now includes a

rural marketing study in addition to two continuing investigations: space requirements in rural houses, and farm family incomes and expenditures.

A survey of the factors affecting the purchase, by rural mountain families, of fruits and vegetables which are sources of ascorbic acid has been initiated. This is a contributing project of the Southern Regional Marketing project, Retailing and Family Buying Practices as Related to the Marketing of Food. The schedule to be used in obtaining data from families and a manual of instructions for interviewers have been constructed. Pre-testing of the schedule and the manual of instructions is now in progress.

Analysis of the data obtained in the laboratory experiments on space requirements in rural kitchen-dining areas has been continued. At this point the findings appear to be at some variance with the space requirements now presented in the housing literature.

Analysis of farm family income and expenditure data has been continued. The manuscript of a technical bulletin, "The Effect of Classification on the Coefficient of Income Elasticity of Farm Family Expenditures," has been submitted for publication.

Two projects in nutrition, the utilization of calcium in restricted diets and interrelationships of calcium with other dietary constituents in these diets; and calcium and phosphorus metabolism—interrelationships with other nutrients, were discontinued on June 30. Two new projects were initiated, the utilization and requirements for calcium, phosphorus, and magnesium and their interrelationships with other nutrients in pre-adolescent children (contributing to Southern Regional Nutrition Project S-28); and bone density measurements as a method of assessing calcium and phosphorus status.

Work on the two new projects passed from the planning to the experimental stage with the initiation, on October 11, 1954, of parallel metabolic studies at both the Louisiana and Tennessee Stations. Seven- and 8-year old girls, 5 at Louisiana and 6 at Tennessee, were maintained for 16 consecutive 4-day balance periods on a diet supplying all nutrients at the levels recommended by the National Research Council. The objective was

to find the metabolic pattern of normal children on a fully adequate diet.

In the textiles and clothing studies, 300 articles which were made from two varieties of Tennessee Cotton, Delta Pine 15 and Tennessee 241, have been removed from service. Testing of drapes and of the control fabrics has been completed and the testing of 4 more types of articles (dresses, skirts, pinafores, and shirts) is nearing completion. Testing of overalls, luncheon sets, and laboratory coats has been started. Statistical analysis of the results obtained to date is in progress.

Work for 1954 on the consumer preference study included preparing questionnaires for every participant who had any missing from her records. Following the interviewing period a thorough check was made of each participant's file. A study of the drop-outs was made for the first 12 months of the study. This included only the summary of purchases. Tabulation was done on 6-month and one-year questionnaires. Final tabulation and rechecks were done on blouses and coats. The writing of a final report of the project was begun.

Research Projects

Relationships Between Child Rearing Attitudes of Rural Parents and Selected Behaviors of Their Children. (Harold D. Holloway and Mary E. Keister).

Freezing Preservation of Precooked and Ready-to-Cook Products in Which Wheat Flours are Used. (Bernadine Meyer, Ruth Moore and Ruth Buckley).

Retailing and Family Buying Practices as Related to Purchase of Fruits and Vegetables by Rural Mountain Families. (Phyllis Ilett and Myra L. Bishop).

Space Requirements for Meal Service and Preparation in Southern Rural Homes. (Lorna J. Gassett, Myra L. Bishop; M. A. Sharp of Agricultural Engineering cooperating).

Relationships Between Specified Body Measurements and Space Used for Sitting, Rising, Reaching, and Bending. (Lorna J. Gassett and Myra L. Bishop).

Rural Spending Ways. (Phyllis Ilett and Myra L. Bishop).

The Utilization and Requirements for Calcium, Phosphorus, and Magnesium, and their Interrelationships with Other Nutri-

ents in pre-adolescent Children. (D. E. Williams, F. A. Schofield, E. Morrell, B. B. McDonald, P. S. Richardson and F. L. MacLeod).

Bone Density Measurements as a Method of Assessing Calcium and Phosphorus Status. (D. E. Williams, E. Morrell, B. B. McDonald, P. S. Richardson, F. A. Schofield and F. L. MacLeod).

A Study of Tennessee Cotton: Certain of Its Chemical and Physical Properties Related to its Ultimate Consumer Serviceability. (Ruth L. Galbraith and Ida Adelaide Anders).

Consumer Preference Study of Selected Clothing Items. (Helen Thomas and Ida Adelaide Anders).

Bulletins, Articles and Reports

Moore, Ruth, Meyer, Bernadine, and Buckley, Ruth.

The Effect of Freezer Storage Temperatures on Cake Quality and on the Carbon Dioxide Content of Cake Batters. Food Research 19, 590-596 (1954).

Williams, Dorothy E., McDonald, Bonnie B., Morrell, Elise, and Schofield, Frances A.

Calcium—Natural Foods Best. Tenn. Farm and Home Science No. 10, p. 4, 1954.

Horticulture

Breeding projects of the Department include bramble fruits, strawberries, pears, tomatoes, beans, and sweet potatoes. With each of these projects there is associated a variety testing program established to assist in finding new parent materials. Cultural programs of the Department deal with irrigation and weed control and the mineral nutrition of plants.

Four varieties of pears were introduced. These are Ayres, Mooers, Hoskins and Dabney.

The raspberry breeding work has continued and there was some success in obtaining crosses with *Rubus albescens*.

The use of weed control materials in strawberries indicates that combinations of Craig I and CIPC reduced cultivation time considerably with the least reduction in yields. Yield reduction is still serious, however.

Strawberry breeding suffered a severe setback with the extremely dry weather incurred in West Tennessee this year.

Research Projects

The following research projects are under way in the Department of Horticulture.

Breeding Commercial Strawberries (W. E. Roever, B. D. Drain, B. S. Pickett).

Breeding Tomatoes For Tennessee (W. E. Roever, H. D. Swingle).

Breeding Blackberries (T. H. Jones—G. A. Shuey, cooperator).

Inheritance in Raspberries (B. D. Drain and G. A. Shuey).

Breeding for Fire Blight Resistance (B. D. Drain, G. A. Shuey, Lawson Safley, W. E. Roever, and J. O. Andes).

Inheritance in Garden Beans (A. B. Strand).

Sweet Potato Improvement (H. D. Swingle, W. E. Roever).

Grape Variety Tests (T. H. Jones, T. R. Gilmore).

Vegetable Variety Tests (H. D. Swingle, T. R. Gilmore, W. E. Roever, A. B. Strand).

Tree Fruit Variety Tests (T. H. Jones, T. R. Gilmore, Lawson Safley, W. E. Roever).

Strawberry Variety Tests (T. R. Gilmore, W. E. Roever, T. H. Jones, B. D. Drain).

Fertility Experiments For Vegetable Crops (W. E. Roever, H. D. Swingle, T. R. Gilmore).

Strawberry Fertilization (T. R. Gilmore).

Cultural Methods for Vegetable Crops (T. R. Gilmore, B. D. Drain, W. E. Roever).

Cultural Methods for Strawberries (T. H. Jones, T. R. Gilmore, L. R. Seatz, J. K. Leasure).

Orchard Soil Management (B. S. Pickett, T. H. Jones, B. D. Drain).

Nut Crops (B. D. Drain, Spencer Chase, Lawson Safley, and others).

Nursery Stock Improvement (B. D. Drain).

Insecticidal and fungicidal injury of horticultural plants (B. D. Drain and others).

Propagation Methods (Station Staff).

Irrigation (A. B. Strand, B. D. Drain, W. E. Roever, B. S. Pickett, T. R. Gilmore).

Storage and Marketing (H. D. Swingle).
Peach Varieties (Troy H. Jones, G. A. Shuey).
Liming Vegetable Crops (W. E. Roever).
Tomato Variety Trials (W. E. Roever and H. D. Swingle).
Sweet Potato Variety Trials (H. D. Swingle, W. E. Roever).
Apple Variety Trials (T. R. Gilmore).
Strawberry Rotation Studies (Troy H. Jones).
Bean Variety Trials (T. R. Gilmore).
Cole Crops Variety Trials (T. R. Gilmore, H. D. Swingle).
Vegetable Fertilization Studies (H. D. Swingle, W. E. Roever, T. R. Gilmore, A. B. Strand).
Weed Control in Strawberries (Troy H. Jones and Keith Leasure).
Ornamentals (B. D. Drain, A. C. Koelling).

Bulletins, Articles and Reports

The following bulletins and articles have been published by members of the Horticulture Department during the year:

Drain, Brooks D., and Shuey, G. A.

Breeding and Testing Fire Blight-Resistant Pears. Tenn. Exp. Station Bulletin No. 236, April, 1954.

Blight Resistant Pears of Today and Tomorrow. Presented before and to be published by the American Pomological Society.

Seeding and Planting Guide for Garden Crops. Ext. Service Leaflet No. 134, December 1954.

Jones, Troy H.

Peach Variety Pictue in Tennessee. Presented before and to be published by Tennessee Horticulture Society.

Observations of Winter Injury (1950-51) to Peach Variety Orchard on Highland Rim. To be published by American Pomological Society.

Grapes In Tennessee. Tennessee Farm and Home Science, September, 1954.

Pickett, B. S.

"Good Breeding Counts In Strawberries," Tennessee Farm and Home Science, April-May-June 1954, page 9.

Your University is Planning Too. Proceedings of The Tennessee State Horticultural Society, 1954.

Thompson, Roger B.

Vines for the South. Plants and Garden, Vol. 10, No. 1, Spring, 1954.

Display of Horticultural Products. The Professional Gardener, Vol. 6, No. 9, September, 1954.

Physics

FIBER RESEARCH LABORATORY

The Stelometer mentioned in the 1953 Annual Report is being used to study elongation at break of cotton fibers. The significance of this measurement and some causes of variability in it have been investigated. A great deal of data has been taken and analyzed, and some trends observed.

The Speedar, an instrument for making rapid measurements of fineness and modulus (or compressibility) of a mass of cotton fibers, has proved successful in cotton mill tests. It measures the fineness with about the same precision as the arealometer but much faster (three or four tests per minute). The modulus is a new fiber property whose usefulness remains to be determined. However it varies from variety to variety and depends on the moisture content of the cotton and the degree of mechanical processing the cotton has experienced.

Cotton breeders will be interested in the development of the Lint Percenter or Lint Fraction Balance. In the past it has been necessary to make at least two weighings and perform a calculation to get lint percent. The new lint fraction balance enables the breeder to determine rapidly the lint percent without weighing and calculating. The ginned lint from a batch of cotton is hung on one arm of the balance and the seeds are placed in a tray on the other arm. The percent of lint is then read directly from a scale calibrated in percent.

Research Projects

The following research projects are being conducted by the Fiber Research Laboratory:

Rapid methods for measuring length and other properties of cotton fibers (K. L. Hertel, C. J. Craven, Reba Lawson, Ray Mink, and Sherman Breeden).

Development of new and the improvement of existing instruments and techniques for measuring properties of cotton (K. L. Hertel, C. J. Craven, Reba Lawson, Ray Mink, and Sherman Breeden).

Theory of Textile Fabrics (K. L. Hertel, C. J. Craven).

SPINNING LABORATORY

The spinning test was revised to evaluate the quality of new cotton varieties from breeders throughout the cotton belt by using 1/2-pound samples instead of the 1-pound samples previously needed. Work on the 40-gram test is being held until the minimum size sample for the optimum statistical evaluation can be determined. In the meantime, studies are being made to reduce the time and cost of the 1/2-pound test as far as possible.

To speed sample testing, the card was equipped with a double coiler for simultaneous carding of two samples and a new single delivery draw acquired and equipped with a rapid roll-change system.

The pendulum yarn-strength tester was adapted to use the new miniature skeins for the 1/2-pound sample test. A new direct-reading roving and sliver scale was acquired and a direct-reading yarn skein scale was adapted to speed operations in the test. Conversion of the inclined-plane yarn strength tester for automatic tabulation was completed. Work was held on single strand yarn testers for the present in favor of miniature skein testing.

Study was started on the drag properties of rovings as an aid to determining optimum twist for maximum uniformity in processing and to obtain information on inter-fiber friction. New yarn contraction tables were prepared to permit more accurate spinning to a desired count. Studies are under way on the effects on spinning properties of blends of different cottons. Revisions were made in the method of correcting yarn strength for count to apply to miniature skeins. To aid in correlating fiber properties with spinning performance, cotton standards and a control system were set up in cooperation with the Fiber Testing Laboratory for fiber and skein testing.

Research Projects

Development and Organization of Small Scale Spinning Tests (P. R. Ewald, C. B. Landstreet, Herbert Hutchens).

Development of Apparatus and Equipment for Processing Small Quantities of Cotton into Yarns for Testing Purposes (P. R. Ewald, C. B. Landstreet, Herbert Hutchens).

Development of Instruments for Measuring and Controlling the Strength and Uniformity of Cotton Yarns, Rovings and Slivers in the Spinning Process (P. R. Ewald, C. B. Landstreet).

Experimental and Theoretical Studies of the Strength and Structure of Cotton Yarns, Rovings and Slivers (K. L. Hertel, P. R. Ewald, C. B. Landstreet).

Bulletins, Articles and Reports

Landstreet, C. B.; Ewald, P. R.; Hertel, K. L.; and Craven, C. J. Twist Multiplier for Optimum Strength. Textile World, October, 1954.

Ewald, P. R. and Landstreet, C. B.

A New Method for Predicting Cotton Yarn Strength from the Observed Strength of a Single Count. Textile Research Journal, December, 1954.

Plant Pathology

The current program followed much in the same vein as for the past recent years, but with the exception of two new projects which seek to amplify certain aspects of the older ones. The first covers the field of plant parasitic nematodes with emphasis on practical control methods for field crops and the second envisions a study of soil microbiology. Investigations in these two projects were largely confined to establishing a foundation for future operations, hence the accomplishments were primarily technical.

In the field of fungicides considerable progress was made on evaluating fruit tree sprays, the details of which are translated into practical use in the spray schedules. Certain soil diseases cause heavy losses in a wide range of crops but up to recent years little progress has been made in a control. Utilizing new organic chemicals, two compounds out of a score tested have given encouraging results, particularly for southern blight. Antibiotics gave good control of apple fire blight and tobacco wildfire. One particular formulation for an all-purpose fruit spray mixture gave surprisingly effective results.

Wheat breeding resulted in the acquirement of about 200 hybrid lines for screening against leaf rust and other diseases. Two wheat lines resulting from previous breeding experiments were further evaluated for final appraisal and possible release pending reports from the milling test laboratory. In the case of barley it was found the scald organism could be transmitted to new plantings by seed, and produce the disease. Laboratory tests indicated a possible control measure by seed treatment in such cases. In the cereal root rot study it was found that nematode associations have a much greater role than heretofore recognized. Dark tobacco varieties resistant to mosaic and wildfire again showed up well in quality and yield studies. The lines with resistance to black shank are slowly approaching commercial acceptance with recognizable improvements over last year.

Field studies on cotton *Verticillium* wilt, tomato fruit rot, and strawberry root rot resistances were nullified by the drought. However, two cotton lines gave high yields under the experimental conditions, indicating some progress in development. As an adjunct to some of the projects, strawberry plants were tested for freedom from virus diseases, and techniques perfected to permit determinations necessary to the functioning of the certification system essential to the plant production business in the State. Approximately 250 plant disease specimens were identified during the year, for persons submitting problems requiring laboratory study.

Research Projects

The following research projects are under way in the Department of Plant Pathology:

New Fungicides and Their Relative Efficiency and Practicability as Compared With the Fungicides Commonly Employed at Present (J. O. Andes, James M. Epps, and E. S. Brown).

Breeding for Improvement in Wheat Varieties to Include Resistance to Disease, Hessian Fly and Changes in Morphological Characters (J. O. Andes, N. I. Hancock, and W. W. Stanley).

The Development of Tomato Varieties Resistant to Fruit Rots (E. L. Felix).

Strawberry Root Rots and Their Control (E. L. Felix).

Breeding Disease-Resistant Dark Tobaccos (D. H. Latham).

Black Shank of Tobacco (D. H. Latham and J. O. Andes).

Control of Cotton *Verticillium* Wilt (James M. Epps).

Root Diseases of Small Cereals (H. E. Reed).

Barley Scald and Its Control in Tennessee (H. E. Reed).

Alfalfa Crown Rot Control (J. O. Andes and E. S. Brown.)

Breeding Disease-Resistant Red Clover (James M. Epps and J. O. Andes).

Nematode Control by Fumigants (James M. Epps and J. O. Andes).

Soil Microbiology (J. O. Andes and L. F. Johnson).

Bulletins, Articles and Reports

Andes, J. O.

Trends in Fungicides. Tenn. Farm and Home Sc. No. 12, p. 5, 1954.

Andes, J. O., and Epps, James M.

Fruit Fungicide Studies 1954. Proc. Tenn. State Hort. Soc., 1954.

Andes, J. O.

Nematode Control in Gardens. Agr. Ext. Ser. Sp. Cir. 434, 1954.

Committee (Enomology, Horticulture, and Plant Pathology Departments)

Fruit Pest Control Schedules. Agr. Ext. Ser. Sp. Cir. 438, 1954.

Epps, James M., Raskopf, B. D., and Andes, J. O.

Cotton Wilt Damage in Tennessee. Pl. Dis. Rept. 38: 304-308, 1954.

Mullet, R. P., Stanley, W. W., Andes, J. O., and Leasure, J. K.

Recommended Insecticides, Fungicides, and Herbicides. Agr. Ext. Ser. Sp. Cir. (rev.) 394, 1954.

Poultry

Increased efficiency in the poultry industry is accomplished through the application of research findings. To assist the poultry industry, research in the fields of poultry management, breeding, nutrition, parasitology and poultry products have been undertaken during the year.

Antibiotics and substances reported to possess growth promoting properties were used in broiler rations. Diets considered

to be adequate in all known nutrients for growing chicks were used for control lots. Penicillin, 3-Nitro-phenylarsonic acid or combinations of these two substances were added to the basal ration and fed other lots of chicks. At market time, nine weeks, insignificant differences existed between any of the lots as to degree of pigmentation, feathering, degree of fleshing, amount of body or abdominal fat, rate of growth, or efficiency of feed utilization.

The development of lines of chickens susceptible and resistant to cecal coccidiosis has progressed during the year. Three hundred, forty-one (341) families of New Hampshire and White Rock chickens have been tested. Although inbreeding tends to depress resistance to artificial inoculations with coccidia, tests show that resistance is hereditary.

Crosses between White Laced Red Cornish males and Single Comb White Leghorn females were made during the year as the first step in transferring the dominant white gene and the sex-linked gene for early feathering, carried by Leghorns, to broiler stock being developed at the station. Growth rate of the crosses has been superior to the parental stock but the mature weight intermediate. Production of the F_1 females has been good. F_2 's will be produced and individuals homozygous for dominant white and carrying the gene for early feathering will be segregated.

Selected coccidiostats were compared for their protective value against cecal coccidiosis of chickens. These were fed at recommended preventive levels. According to these tests, the drugs were arranged in order of their protective values, the most effective first; control-non-infected; Arzene, Parabis-90, Sulphur, Nitrofurazone, Sulplus, Megasul, Sulmet, Sulfaquinoxaline, Control-Infected.

Initial tests with the colorimeter to establish a more certain method of measuring the degree of pathogenicity resulting from *Eimeria tenella* inoculations have resulted in the following information: Hemoglobin content showed no decrease on the third day after inoculation as might be expected when the life cycle of this parasite is studied. However, on the 6th day post-inoculation, the Hq. content was extremely low. Data to date indicate this may give an exact method of measuring the patholonicity resulting from an attack of *Eimeria tenella*.

Bacteria were not recovered from the body cavities of the

majority of birds examined during processing, and before and after chilling and storage. Conditions of processing included high and low temperatures of scalding, and several temperatures of chilling.

Practically all muscle tissues from which the skin had been stripped were sterile. Motile bacteria did not penetrate the skin as a membrane into the nutrient broth, with or without added salt or dextrose, except in rare instances.

It would seem, from the experimental work presented, that the processing of healthy birds under sanitary conditions is not conducive to carrying bacteria into or through the body wall.

Research Projects

The following research projects are under way in the Poultry Department:

Drugs in the Control of Internal Parasites (R. L. Tugwell and O. E. Goff).

Pastures for Chickens with Particular Reference to Parasitism (B. J. McSpadden and R. L. Tugwell).

Relationship Between Body Conformation and Meat Yield (O. E. Goff, Fred R. Tarver, Jr., and J. E. Griffith, Jr.).

High Efficiency Rations for Poultry (Homer Patrick and O. E. Goff).

Vegetable Protein Investigations with Chicks (Homer Patrick, Fred R. Tarver, Jr., and O. E. Goff).

Radioactive Isotope Studies in Poultry Nutrition (Homer Patrick, G. K. Schweitzer, and O. E. Goff).

Influence of Water Temperature Used in Scalding Poultry on Quality (Fred R. Tarver, Jr., J. O. Mundt and O. E. Goff).

Improving the Body Conformation of Broiler Chickens (O. E. Goff, G. C. McGhee, and J. E. Griffith, Jr.).

Influence of Wraps on Shelf Life of Chilled and Frozen Poultry (J. O. Mundt, Fred R. Tarver, Jr., and O. E. Goff).

Rate of Cooling Poultry In Various Cooling Mediums (O. E. Goff, G. C. McGhee and Fred R. Tarver, Jr.).

Comparative Feeding Value of Different Grades of Yellow Corn for Broilers (O. E. Goff and Homer Patrick).

Influence of Environment on Performance of Hens (O. E. Goff, Lloyd H. Littlefield, and G. C. McGhee).

Improving Chickens through Breeding (O. E. Goff and R. L. Tugwell).

Bulletins, Articles and Reports

The following publications have been issued by members of the Poultry Department during the year:

Goff, O. E.

Tennessee's Poultry Industry. Amer. Poultry Jour. p. 15, Feb. 1954.

Tennessee Broiler Production. Amer. Poultry Jour. p. 11, April, 1954.

Goff, O. E., McGhee, G. C., and Tarver, Fred R., Jr.

The Dressed Yield of Chicken. Southeastern Poultryman p. 8, May, 1954.

Goff, O. E., and Morgan, W. C.

Improving the Body Conformation of Broiler Chickens. So. States Reg. Poultry Breeding Proj. Sixth Annual Report. p. 56, Oct. 1954.

Mundt, J. O., and Goff, O. E.

Broiler Shelf Life Can Be Prolonged. Tenn. Farm and Home Sci., Tenn. Agri. Exp. Sta. p. 8, Feb. 1954.

Mundt, J. O., Stokes, R. L., and Goff, O. E.

The Skin of Broilers as a Barrier to Bacterial Invasion During Processing. Poultry Sci. 33:799-802. 1954.

Patrick, H., and Schweitzer, G. K.

Factors Associated with the Movement of Calcium from the Food to the Bones of Chicks. Poultry Sci. 33:1199-1201. 1954.

Tarver, Fred R., Jr., and Patrick, H.

Deficiencies in Cottonseed Meals. Poultry Sci. 33:1084. 1954 (An Abstract).

Tarver, Fred R., Jr., Patrick, H., and Goff, O. E.

Influence of Arsenic and Penicillin on Dressing Grades and Quality of Poultry. Poultry Sci. 33:1085. 1954 (An abstract).

Tarver, Fred R., Jr.

The Influence of Procaine Penicillin G and 3-Nitro-4-Hydroxyphenylarsonic Acid upon Broilers. A thesis. University of Tennessee 1-34. 1954.

Tugwell, R. L.

Coccidiosis Control—Sanitation, Drugs or Breeding. Tenn. Farm and Home Sci. Tenn. Agri. Exp. Sta. No. 12 p. 8, 1954.

Tugwell, R. L., Goff, O. E., and Morgan, W. C.

Improving Chickens through Breeding. So. States Reg. Poultry Breeding Proj. Sixth Annual Report p. 54, Oct. 1954.

Ames Plantation

Fayette and Hardeman Counties

Progress has been made toward transforming the Ames Plantation into a research and demonstration center for the College of Agriculture. A forestry project has been initiated on the Plantation woodlands. The College of Agriculture and the Hobart Ames Foundation are preparing a comprehensive land-use and overall management plan for the Plantation's future development. A 310-acre demonstration farm, to show the advantages of recommended farming practices, has been established.

About half the Plantation area is wooded and the University decided that it could be used to good advantage for a forestry project with emphasis on farm woodland management. Dr. Solon Barraclough was employed as forester to begin this work.

During the past year about one million board feet of over-mature, poor risk trees, and trees not contributing a satisfactory rate of return, have been marked for selective cutting and sold through competitive bids. There also has been a small sale of dogwood stumpage, and a beginning has been made in harvesting and marking the old-growth cedar. During the coming year some 100,000 pine seedlings and 20,000 hardwoods will be planted as the first step in a program to reforest nearly 1,000 acres of gullied and open land indicated for planting by the land-use plan.

To prevent fire and grazing damage to the timber in the future a vigorous protection program has been undertaken. Men and equipment are on call at all times to extinguish fires, and an attempt is being made to obtain cooperation of tenants in fire prevention.

A permanent set of records is being developed covering all phases of the forestry program. Major emphasis in these records is placed on providing data which farmers can use in planning their own woodland management. Two other major research projects are scheduled to begin in 1955. One is a study of the effect of soil type on the rate of growth of various tree species. The other is a study of forest markets and timber utilization in the West Tennessee area. The University is offering two Hobart Ames Forestry Fellowships to enable graduate students to spend a year or more on the Plantation assisting with this research. Undergraduate scholarships are also being offered for students to spend three-month periods at the Plantation obtaining experience in forest management.

A committee of University specialists is working with the Plantation management to prepare an overall management and land-use plan for the plantation. The result of putting this plan into effect should be profitable for the Ames Foundation and for the Plantation's tenants. It also should be a practical demonstration of recommended farm management and land-use practices, and it should enable the University to obtain maximum benefit from the Plantation's facilities and endowment.

Accomplishments thus far in preparing the overall plan are:

1. Located on aerial photographs the 1954 land-use areas for cotton, corn, silage, hay, pasture, all fenced areas, woodland, and idle land.
2. Prepared maps locating home of each wage hand, tenant, and sharecropper.
3. Completed a census of every family on Plantation, noting ages, education, crops, livestock, and machinery.
4. Obtained listing of all major machinery owned or rented on central unit.
5. Inventoried storage facilities for feeds, livestock, and machinery.
6. Analyzed operation of Angus and commercial herd for year ending February 28, 1954.
7. Analyzed complete financial statement for year ending February 28, 1954.
8. Established proposed land use areas adapted to row crops, pasture, and woodland for the central unit of the Plantation.

A 310-acre demonstration or "pilot" farm is also being established on the Plantation. Its primary purpose is to show that a family-sized farm unit with adequate capital and management, utilizing up-to-date Experiment Station and other scientific farming information, can be a practical operation. A committee of University specialists is responsible for preparing an annual farm plan while the actual management is under the supervision of Mr. James Bryan, the assistant manager of the Ames Plantation. This farm and the records being kept in connection with its operation should prove helpful to farmers in the West Tennessee area. It may also help to indicate some of the adjustments that might be made on other tenant units on the Ames Plantation in order to make them more profitable for operators and owners.

Dairy Experiment Station

Lewisburg

The project on early and delayed grazing of a mixture of orchardgrass, Ladino clover and alfalfa has been continued through five years. A mixture of orchardgrass, Ladino clover, and alfalfa was seeded in August, 1949 on a field of upland soil, divided into four replicate plots in a manner that would equalize soil types. Plots A and D were rotation grazed all season, April through October, when grazing was available. Rotation grazing was started on plots B and C in June after one cutting had been removed for hay or silage. Each plot was grazed with different numbers of producing Jersey cows according to the forage available, with each area grazed 10 days followed by 20 days with no grazing.

The field was manured and fertilized according to soil tests initially, and topdressed with 200 pounds of muriate of potash and 15 pounds borax during February of 1952, 1953, and 1954. Unpalatable growth was clipped with a mower as necessary.

During the five seasons (1950-54) the plots grazed all-season produced an average of 123 standard cow days and 5,330 pounds milk per acre, and the plots on which grazing was delayed, a cutting of 2,885 pounds hay or 8,425 pounds silage plus 75 standard cow days and 3,530 pounds milk per acre. At current prices for Grade A milk, the net return was 17 percent in favor

of all-season grazing although the calculated yields and distribution of nutrients per acre were progressively in favor of delayed grazing.

The Ladino clover remained in the mixture during the grazing season of 1950 when moisture conditions were favorable and appeared to supply a substantial portion of the grazing but died out during the long drought of 1951. The amount of alfalfa in the early grazed plots gradually decreased and a higher proportion of the grazing was supplied by the orchardgrass, but a considerable portion of the original stand of alfalfa remained during the fifth year in the delayed-grazed plots.

The project studying the effect of irrigation on a legume-grass pasture mixture was continued through the four grazing seasons of 1951-54 with a mixture of orchardgrass, ladino clover, and alfalfa. Fertility additions were made preceding the seeding and each of the following years, except 1951, of potash and of borax.

Irrigated and unirrigated areas were grazed with different numbers of producing Jersey cows, according to the forage available, with each area grazed 8 days followed by 24 days with no grazing. All plots were clipped with a mower as needed to remove unpalatable growth and control weeds. Rainfall was uneven each season and averaged 7.6 inches below normal so that an average of 19.94 inches of irrigation water was applied to maintain soil moisture above 50 percent from April to October. Irrigation cost was \$2.51 per acre-inch. The four-year average was 61 percent more cow days of grazing, 4,566 pounds or 61 percent more fat-corrected milk, with a return above irrigation cost and feed cost of \$100.21 per acre. More Ladino clover and less orchardgrass remained on the irrigated section than on non-irrigated fields.

Cool weather or winter grazing studies were continued. Weather conditions during the fall and winter of 1953-54 were unfavorable for fall grazing due to very little rainfall during the months of September, October and November. A four-acre plot of Balbo rye-crimson clover was grazed by producing cows December 2 through March 31. During this 120-day period, grazing was supplied at the rate of 65 standard cow days per acre and the cows obtained 45 percent of their total requirements from the grazing. A six-acre field of winter oats-crimson clover

from December 7 through March 31 produced grazing at the rate of 39 standard cow days per acre and the cows obtained 46 percent of their total requirements from the grazing. A four-acre plot of ryegrass-buttonclover from February 3 through March 31 produced grazing at the rate of 23 standard cow days per acre and the cows obtained 47 percent of their total feed requirements from the grazing.

Comparative studies were made of the feeding value for milk production of alfalfa-orchardgrass hay fed with alfalfa-orchardgrass silage, versus alfalfa-orchardgrass silage as the sole forage. A feeding trial was conducted during the winter of 1953-54, with three groups of producing Jersey cows, five cows in each group. The trial covered 120 days, with each group receiving silage and ad libitum as the sole forage for 40 days, silage and hay at an approximate ratio of 3:1 for 40 days and 8:1 for 40 days. A grain mixture was also fed. The cows consumed 56.4 pounds of silage and produced 22.4 pounds of milk daily, vs. 46.1 pounds of silage, 4.6 pounds of hay and a production of 24.3 pounds of milk daily on the 8:1 ratio. The 3:1 group was intermediate with no significant difference in milk production. Hay feeding aided in maintaining liveweight, however. These results are in agreement with those obtained from a similar project during the winter of 1952-53. Apparently, well preserved grass silage can serve as the sole roughage in winter for milking cows.

There are 188 females in the Station herd, which include 94 cows of producing age, 74 heifers over six months of age, and 20 under six months. Forty-six heifers are either bred or have reached breeding age. Sixty-nine cows in the herd which are old enough to have completed a production record for at least one lactation, have normal records which average 9,204 pounds milk, 4.97% fat and 457 pounds of fat on 2 x milking for 305 days, mature equivalent. Their best records average about 500 pounds milk higher, indicating a 1,600 pound increase in breeding for higher milk production in 6 years. During the year, 41 first lactation records were completed which averaged 8,555 pounds milk, 5.16% and 442 pounds fat, 2 x, 305 days.

Eighteen daughters of young bull, HVF-212, have completed production records comparable to their dams, with a marked increase in milk, butterfat and in type.

One highly proved bull, Y-87, is being extensively used artificially and nine other young bulls are in line for proof in the herd. Seven have daughters as follows: L-965, 10; G-83, 13; L-976, 11; 1H1, 12; L-6, 13; L-22, 6; S-74, 5. Bull L-965 is the only one of these young bulls which has daughters of producing age.

Bull S-95, purchased a few months ago, is now being brought into service. Another young bull, X-26, was purchased recently. Four of the above bulls are now on loan for further proof in other herds and other young bulls are loaned for first proof to dairymen doing testing.

Forestry Experiment Station

Morgan and Scott Counties

An effort was made this year to follow our management plan whereby some timber cutting will take place each year until the 4,000 acres of Little Brushy Mountain have all of the low quality trees removed.

During the past year two areas were marked for timber sales. The first area is on the south side of East Little Brushy Mountain, covering about 270 acres and containing approximately 41,000 board feet of pine and 212,000 board feet of hardwood. The second sale was marked in a badly burned area on West Little Brushy Mountain. This area, about 163 acres, and contained 161,000 board feet of timber. Of this amount 71,000 board feet was pine and 90,000 board feet of hardwood.

During the past year the Station made one of the largest plantings ever made on the forest. A total of 70 thousand trees were planted on 70 acres of land. This land had been cropland, pasture, or orchard. A planting machine, borrowed from Oak Ridge, was used to plant about 55,000 of the trees on more or less flat land. All steep, rough or very wet land was hand planted.

Three thousand trees of three different species were planted for test. If these trees have a good survival the areas are large enough for some study plots to be laid out in them. These trees are bald cypress and red pine from Illinois, and slash pine from Mississippi.

These trees came from different seed sources, so that in making these plantings a comparative seed source study can be made. In general it might be said survival was fairly good in spite of the hot, dry summer. Red pine showed the poorest survival and largely had to be replanted. This also applies to the white pine which was poor (30%). Slash pine and cypress planted in somewhat low, wet ground, showed the best survival (85%). The other trees were about 70% or better. Fire control was good this year. One fire, on West Little Brushy Mountain, burned over about twenty acres. The fire was reported to the State crew and they were on it in record time. The State Prison furnished six men to help with the fire fighting and mop up work. Stumps and snags were smoking on this area for two days when a shower put out remaining fires.

During both fire seasons this year a stand-by crew of four men was stationed at the farm. A telephone there provides contact with the State fire towers and crews. The Brushy Mountain Prison has been very cooperative by offering and sending men if needed.

A research program is being established and carried out on the Friendship Forest, Hamilton County, in cooperation with the TVA Forest Investigation Branch. During the summer a series of plots for a pine thinning study were laid out and the necessary cutting done.

The annual inspection was made of all fence posts treated in connection with this research project which is being carried out at the Crossville station. No additional treating of fence posts was done this year.

At present only one strip coal mine is operating on the property. The New Paint Rock Coal Company moved equipment off last August after making only one cut around the mountain.

The lines around the south end of the Cassell farm were surveyed and painted. This gives a complete painted boundary around Little Brushy Mountain.

An assistant forester was employed in December to assist with all forestry activities on University property in Morgan, Scott and Hamilton Counties. He and his family will live on the property as soon as suitable living quarters can be made available.

Highland Rim Experiment Station

Springfield

The Highland Rim Experiment Station experienced a severe drought even though the total rainfall for the year was only 2.96 inches below the ten-year average for this location. That is, there was little rainfall during the growing season. Thus dry weather almost eliminated corn, it cut tobacco yields, and severely damaged other field crops. Late summer and fall hay crops were used for pasture. Permanent pastures made very little growth and were over-grazed. Rainfall during April and May helped to cause favorable growth of winter crops and pastures. Feed for the experimental livestock was harvested from growth made during this period.

Work with the Improvement of the Producing Ability of Beef Cattle was continued with eight heifers being saved for breeding purposes. At present the herd has 29 cows that are of breeding age.

The second year of work was completed with the joint Animal Husbandry-Agronomy pasture project. The grazing period was cut short by about two weeks due to dry weather. The pastures were re-stocked early in November as scheduled. The steers made comparatively poor gains during the two-month feeding period, due in part to unfavorable weather.

Uniform variety tests were conducted with corn, soybeans, oats, barley, wheat, alfalfa, and grain sorghum. Wheat studies include work with the soft winter wheat nursery and Hessian fly resistant strains. Other agronomy projects include a study of the source of phosphate using a three-year rotation, phosphate comparison and fertilizer topdressing on alfalfa, and the agronomic phase of the pasture experiment. A Potassium-Phosphate Factorial experiment on alfalfa fertilization and new alfalfa variety tests were initiated this year.

The horticultural work was carried on as outlined in the Horticulture Department report.

Work with tobacco was done on the 3 types that normally are grown in this area; dark fire-cured, dark air-cured, and burley. Major emphasis was on the dark fire-cured, type 22, tobacco.

Dark fire-cured, type 22. The work with dark fire-cured tobacco was conducted along two general lines. One was breeding and selection for resistance to several of the important diseases that affect tobacco, the other was from a cultural or management approach. The breeding work was a continuation of the search for disease resistant lines that will be commercially acceptable to the growers and to the tobacco industry. Particular emphasis was on resistance to black shank, mosaic, and wildfire as well as to lines with resistance to all three diseases.

The work with black shank was done on two leased fields that were used in 1953. More than 100 lines and varieties were tested on the two fields in 1954. Six new advanced generation lines, received from Dr. E. E. Clayton, of the U. S. Department of Agriculture, were included in the 1954 testing.

In the work on mosaic resistance, with dark fire-cured tobacco, 4 replications of each of 18 advanced generation lines and 2 susceptible checks were included in the yield and quality test in 1954. Even though the tobacco made fair late season growth that partially overcame the effects of the drought, the yield and quality were both lowered. Results from a similar test in 1953 show that one of the mosaic-wildfire resistant lines had an acre value approximately \$40.00 above the acre value of Madole, the standard check. Four other lines that carried mosaic resistance only had acre values within \$40.00 of the acre value of Madole. Four of the best of the mosaic resistant lines along with Madole as the check were grown experimentally by five selected farmers in the area in 1953. The tobacco from these plots was all displayed and sold at the same time. Two of the four mosaic resistant lines had an acre value above that of Madole.

Fifty-five lines were included in the search for a wildfire resistant dark fire-cured type tobacco in 1954. Thirty-five of these were from previously tested lines and 18 were advanced generation lines that were being tested for the first time. Two F_2 lines that carry factors for resistance to black shank and wildfire were included in the test. All plants were artificially inoculated for wildfire 3 times in the plant bed. The major portion of the susceptible plants were eliminated in the plant bed. Six of the more promising advanced generation lines were included in the yield and quality test. Several field inoculations were made during the growing season but only the first one, made soon after

the plants began to grow, resulted in the development of wild-fire, even on the susceptible checks. Because of this, plant selections in late season were made primarily on the basis of field appearance. These lines will be screened in the plant bed in the spring of 1955 and only those that appear to be highly resistant will be field planted.

The curing project, cooperative with U. S. D. A., was continued in 1954. The curing methods were only slightly different in 1954 from the methods used in 1953. The information available at this time indicates that the methods and equipment used in the curing project can be used to make a satisfactory "cure" but that a satisfactory "finish" can not be put on the tobacco with that equipment.

A different approach to the problem of curing dark fire-cured tobacco was undertaken in cooperation with one of the Tobacco Companies in 1954. This approach will be based primarily on chemical analyses to try to determine the components of the smoke used in making the cure and of tobacco cured with and without smoke.

The height of topping, the spacing, the type and amount of cultivation, and the source of potash studies were all discontinued during the year because of the poor and uneven growth of the tobacco in the field.

An effort to control the development of suckers on tobacco through the use of certain growth regulating or prohibiting chemicals was made in 1953. That limited test was modified and repeated in 1954, using all three types of tobacco.

Dark air-cured, type 35. In the average acre value of the 5 One Sucker varieties in the yield and quality test there was a difference of less than \$60 per acre between the highest and the lowest acre values. The variety that gave the greatest value in 1954 also gave the highest acre value in 1953. However, the difference was considerably less in 1954.

Burley, type 31. The yields in the burley tobacco variety test were approximately 10% lower in 1954 than they were in the 1953 test. The quality, as judged by the value per 100 pounds, was somewhat higher in 1954 than in the previous year. In both years, however, the yield and quality have been somewhat low because of the extremely dry weather.

Middle Tennessee Experiment Station

Columbia

The third consecutive drought was experienced during the growing season at the Middle Tennessee Experiment Station in 1954, although total rainfall for the year was near normal. Summer crops such as corn, tobacco, and hay, suffered severely with yields being reduced by 50 per cent or more.

In the spring of 1954 negotiations began between the University of Tennessee and Monsanto Chemical Company whereby each would transfer to the other certain land. By virtue of this transfer, it is expected that this new land will enable the Middle Tennessee Experiment Station to expand both the beef and dairy herds to the extent that sufficient animals will be available for many kinds of animal husbandry and dairy research. It is also expected that the new farm will be used to a large extent for reclamation studies of mineral land.

At the present time research at the Middle Tennessee Experiment Station is conducted in three major fields:

(1) Animal Husbandry. The Animal Husbandry program involves the following animals: 77 purebred Hereford cows and heifers; 6 grade cows; 40 yearling steers and heifers; and 214 experimental ewes.

(2) Dairy Husbandry. The dairy program involves 46 Holstein cows; 23 heifers over one year of age; 21 heifers under one year of age.

(3) Agronomy. A complete agronomic research program is being conducted at the Middle Tennessee Experiment Station which involves experimental work with all of the major crops of the Central Basin.

Special projects in each major field are conducted in cooperation with the various departments. These projects are listed elsewhere in this report.

Plateau Experiment Station

Crossville

With the end of the third drought season adjustments have been made to meet the difference in seasonal conditions over the previous wet seasons. The general emphasis has shifted from interest in hay driers to irrigation equipment, and from lespedeza and Ladino to red clover and alfalfa.

Irrigation of all tobacco plots gave an estimated increase in yield of 1,000 lbs. per acre and made measurements of results practical in this dry year. Burley 21, the newly named wildfire-resistant variety, stands second only to Burley 2 in yield, and in dollars' return per acre, among the named varieties at the Plateau Station. It has not failed to produce stocky, vigorous, wildfire free plants in the beds. All tobacco work at this station is done in cooperation with the Tobacco Station at Greeneville.

Among the alfalfa varieties which have been under test for five harvest seasons here, Narragansett leads all varieties by an approximate half-ton per acre yield of finer stemmed and more leafy hay. Having received annual application of phosphate, potash and boron, the stand in this test is still sufficient for good yields.

Studies with potash, phosphates, nitrogen and minor elements are being carried on under the project leadership of Agronomist staff, along with the variety work in corns, small grains, and clover.

Exploratory work under the project leadership of a staff agronomist was started with new chemicals for killing trees in land clearing. Dusts scattered on the ground in the dormant season killed oaks and other species. More intensive work is being planned to include testing of other materials, determining rates of application, and general practicability for and clearing use.

The purebred Angus herd at Grassland Farm now numbers 82 head of cows and heifers which are used as a unit of the Southern Regional Beef Breeding program. The grade Short-horn herd of 37 head at the War Camp farm are used in bull testing and their excellent production record serves as a yardstick in our purebred work.

The sheep flock is composed of ewes from four replacement sources which are in a comparison study. Late wether lambs were fall finished again with the inclusion of growth hormones in the feed and in an injected pellet. Reports on this and other livestock projects are covered in the Animal Husbandry Section of this report.

Horticultural projects are the most important group of projects at this station. They are carried on under the supervision of the Staff Horticulturalist stationed here. They include work with apples, grapes, beans, strawberries, cauliflower, broccoli, and pimento pepper. Reports on this work are included in the combined Horticultural report in this publication.

Potato breeding work is continuing in cooperation with U.S.D.A. under the leadership of a member of their staff who makes his headquarters at the Louisiana Station and conducts the Southeastern Potato Breeding Program. This Station is now yield testing the choice white variety numbers being developed in this program. Some are very promising in yield quality, and resistances to late blight and scab.

More than 800 posts with individual records of handling and treatment are now in service fence lines where they undergo annual inspection to determine the span of live service and the cause of failure. One of the most practical developments in post treating for the average farmer who wishes to produce his own posts from non-durable timber, is to debark small cull oaks with sodium arsenite and cold soak with an oil-based preservative such as "Penta" (Pentachlorophenol) or copper naphthenate. The details of this method are simple, and require very limited calculations and timing.

Tobacco Experiment Station

Greeneville

The weather of the spring and early summer was good for crop production. Row crop prospects were good until early August. After that came a severe drouth and high, hot winds. The Burley tobacco plots suffered in yield and quality; corn yields were cut in half; and fall hay and pasture both suffered severe losses.

The beef cattle breeding project has been converted to a study to determine dwarf carriers in both male and female animals.

Burley 21, the first wildfire resistant tobacco variety to be developed, was released for planting in 1955. Introductory seed produced at the Greeneville Tobacco Experiment Station has been distributed in all of the eight burley producing States. It is estimated that 15,000 acres of Burley 21 may be grown the first year. The variety has combined resistance to wildfire, tobacco mosaic and black root rot. In variety tests for the past four years, yield and quality have been comparable to standard burley varieties when grown in absence of either wildfire or mosaic. The variety is nearly immune to the wildfire disease at all stages of plant growth including the small seedling stage in plant beds. Wildfire has been very destructive in burley plant beds in recent years.

Another important development during the past season was the discovery that the antibiotic, streptomycin sulphate, is effective in controlling wildfire in tobacco plant beds. Experimental results showed that low concentration sprays of the antibiotic were effective both as a protectant and eradicator.

Burley 11A and Burley 11B, released for 1954 planting, showed good performance in both black shank and fusarium wilt infested fields in Tennessee last season.

Work is in progress to produce burley varieties with combined resistance to five important tobacco diseases; i.e., resistance to wildfire, mosaic, black shank, fusarium wilt and black root rot.

Various breeding lines have been isolated with a lower nicotine and total alkaloid content than present in varieties now commonly grown. More emphasis will be placed on this phase of the breeding work during the 1955 season.

All phases of these investigations are conducted in cooperation with the United States Department of Agriculture.

For the third consecutive year, rainfall at the Greeneville Station was inadequate to produce a desirable crop of tobacco. There was sufficient rain in the early part of the growing season, but dry weather after topping prohibited the proper maturity needed to produce a crop of high quality.

Most of the established fertilizer tests were continued in the 1954 season. Although responses in crop production to large amounts of fertilizers are usually small in dry seasons, definite benefit was noted in improving tobacco yield and quality by applications up to 60 pounds nitrogen, 120 pounds phosphoric acid, and 300 pounds potash (K_2O).

Because of the current interest among growers in irrigating tobacco, an irrigation project was begun this year. Two water applications of approximately one inch each increased tobacco yields by about 350 pounds, valued at \$175 per acre.

Work on sucker control with chemicals was continued. This year, one of the least injurious mineral oils and maleic hydrazide were compared with the usual practice of suckering by hand. Tobacco yields were similar for all three treatments. Maleic hydrazide applied as a spray produced some premature yellowing of plants which may not be desirable. In past years, the use of oil to control suckers has been noted to increase the nicotine content of tobacco.

Certain fertility and cultural practices are known to influence the amount of nicotine the tobacco plant will store in its leaves. The height of topping is one factor that affects nicotine content of tobacco and a new series was begun in 1954 to make a thorough study of the influence of several topping heights on the nicotine content of the cured leaf.

Bulletins, Articles and Reports

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Control of Wildfire with Streptomycin Sulphate. Plant Disease Reporter Vol. 38 (a) ; 661-665, illus.

Heggestad, H. E., Clayton, E. E., and Felts, J. Hugh.

Wildfire Resistant Tobacco. Tennessee Farm and Home Science No. 11, July, Aug., Sept. : pp 4-5, illus, 1954.

U-T, AEC Research

Oak Ridge

The research program of the UT-AEC laboratories is divided into studies on fission products, calcium and phosphorus absorption, excretion and retention; iodine metabolism as related to

thyroid activity, influence of irradiation on reproduction of cattle, and whole body irradiation of cattle, sheep, burros, swine and dogs.

The following summarizes the work during the current year :

UT-AEC Project 2: About 0.16% of a daily Sr^* intake was found to be secreted per kg. of milk from the dairy cow; the higher the calcium intake, the less Sr^* appearing in the milk. At a 25g daily Ca intake the relative Ca/ Sr^* appearance in milk was as high as 27; at a 100g daily Ca intake, the ratio fell between 6 and 10.

From a double tracer experiment with cattle it was shown that Sr^{89} was slightly less absorbed from the tract than was Ca^{45} ; the absorption of both was decreased with increasing age.

It was demonstrated that calves on a milk diet were able to absorb more Ca^{45} and Sr^{89} than similar animals on a non-milk diet.

Lambs injected with 250 uc of Sr^{90} per kilo body weight died after about 17 days. Lambs injected with 25 uc of radium per kilo body weight were still alive at 2½ months after injection.

Experiments have shown that the tailbone of cattle can be used for survey of skeletal accumulation of bone seekers. However, the concentration in the tailbone will be lower than in other bones depending upon the age of the animal and time between sampling and exposure.

From continuous feeding experiments with rats it was shown that dietary calcium was preferentially used over Sr^{90} for fetal formation by a factor of about 5. Only small amounts of the Sr^{90} deposited in the bones of the dam was transferred to the fetus; this amount was increased if the dam was placed on a low calcium diet.

In 1 experiment about 16% of ingested I^{131} was secreted into the milk of the dairy cow. As with Ca^{45} and Sr^{90} it appeared that the amount getting into the milk depended upon how much milk was produced.

UT-AEC Project 3: It was shown in cattle that over a 6 month period a sub-optimum dietary calcium did not reduce the fecal endogenous loss.

In an experiment of practical importance to the feed man-

ufacturer, it was demonstrated that calcium was equally available to cattle from fine or coarse textured limestone.

UT-AEC Project 4: Experiments on the metabolism of fluorine 18 in domestic animals were made possible by the availability of relatively large amounts of activity from a ppn reaction in the Oak Ridge cyclotron.

A detailed report is presented of the absorption, excretion and movement of calcium in the body of rats as a function of age and dietary calcium level. Another detailed report is presented of the behavior of phosphorus and calcium in the growing rat as affected by various levels of these 2 elements in the diet.

UT-AEC Project 7: Studies of thyroid function in dairy cows have shown the effect on I-131 accumulation in the thyroid gland of environmental temperature, lactation, and the iodine content of the diet.

The udder of the dairy cow was shown to contain a metabolic pool of calcium over and above that contributed by the residual milk.

UT-AEC Project 8: A detailed report is presented concerning the use of Ca-45 labeled calcium carbonate to determine the proportions of native and incorporated calcium in lysimeter leachings and plant uptake. Increases in calcium input caused increases in outgo of total calcium and additive calcium in both leachings and plant uptake.

UT-AEC Project 10: Exposure of burros to 25 r per week for 14 weeks caused blood changes, a decrease in the respiratory quotient and an increase in blood pyruvates.

A preliminary study is reported of bacterial transfer in burros subjected to lethal total body radiation. It appeared that bacteremia was not itself the predominant cause of radiation death.

Surgeon General's Project: Feeding experiments with rats and dogs indicated no toxicological manifestations from ingestion of products from animals heavily exposed to total body irradiation.

Grayson Foundation Project: The action of commercial phenothiazine in reducing thyroidal uptake of I-131 has been studied. There was no evidence that this effect upon the horse was significantly or permanently harmful.

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West Tennessee Experiment Station

Jackson

Cold, wet conditions in early May with a frost on May 4 severely affected some plants in agronomy work at this station. Nearly all the experimental cotton required replanting. Rain-fall totalled only 9.63 inches for June through November. Spring conditions were generally favorable for small grains, cover crops and first cutting of alfalfa. Conditions for later crops were severe.

Variety trials of corn, cotton, alfalfa, oats, barley, wheat, soybeans and grain sorgham were conducted in cooperation with C. D. Fisher and L. N. Skold, of the Agronomy Department.

Weather conditions were generally favorable for production and harvesting of small grains.

Nine entries of barley were tested. Kenbar was high with 77.8 bushels and Jackson No. 1 was low with 32.5. There was considerable lodging. Scald damage was severe on several entries and affected all.

Eight winter oats were tested, with yields ranging from 82.9 bushels per acre for Forkedeer to 104.7 for Victorgrain 48-93. LeConte yielded 85.3 bushels. There was considerable lodging. Six-year averages at this location for Forkedeer and LeConte are 79.9 and 71.2 bushels per acre, respectively.

Nine wheat entries were planted. Bird damage was severe on some entries and comparisons of yield are not valid. Fulcaster 612 was hardly touched by birds. Some of the new entries, as Genessee, looked promising.

Yields of 36 corn entries ranged from 7.2 to 23.2 bushels. Pollination was adversely affected, and drought practically wiped out the crop.

The alfalfa trial seeded in 1952 on Range 3 was continued. Three cuttings were made. Yields ranged from 4.81 tons for Narragansett to 5.45 for Kansas Common.

Six soybean varieties were tested, with yields of each averaging about 13 bushels. Pollination of Ogden and Volstate were adversely affected by weather conditions.

Twenty cotton entries were tested with a range of lint yields

per acre from 317 for DPL 15, to 453 for Ute 15. Per cent lint ranged from 30.7 for Auburn 56 to 36.7 for Ute 15. Staple length ranged from 29/32 for T89 to one inch for 4 other entries. The only picking was made September 20-21.

Thirteen grain sorghum entries were planted, including one early and one late corn. Bird damage was severe and no sorghum heads were harvested.

Sweet Sorghum—Variety testing was done in cooperation with personnel of U.S.D.A. Sugar Plant Field Station, Meridian, Mississipi. Eight entries were tested. Green weights ranged from 15.5 tons per acre for Honey to 25.4 tons for Sart. Average sirup (indicated) ranged from 286 gallons per acre for Honey to 433 for Mer. 52-1 (experimental).

A uniform variety test of vetches and winter peas was conducted in cooperation with J. K. Underwood of the Agronomy Department, and the U.S.D.A. Six vetches and 3 peas were planted. Harvests of green and dry weight were made March 26, April 7 and 29 to compare "early, medium and late" production. Papago peas showed slight winter injury. The Romack pea and Oregon Wooly Pod vetch performed well.

Twelve corn varieties for silage were planted and harvested at silage stage. Yields were low and variable. Drought severely affected yield and maturity and results are not considered a good comparison.

Four varieties of annual lespedeza were compared with and without soil nematocide treatment in cooperation with James M. Epps, of the Plant Pathology Department.

Cotton tests were conducted under supervision of N. I. Hancock of the Botany Department. Four new strains tests and four progeny tests were conducted each consisting of ten entries and five replications. Insect control was maintained including one application of insecticide for spider mites. The strains tests had to be replanted. Top yields were about one bale per acre.

Experiments in fertilization were continued in cooperation with O. H. Long, Department of Agronomy. Reports on these projects are given by that Department.

Chemical weed control work was conducted in cooperation with J. K. Leasure, Department of Agronomy.

Dinitro Chloro IPC, Crag 1, Natrin, Sesin, Dalapon, Karmex D and Karmex W were applied as overall pre-emergence applications using one to 3 rates of each material. Control was accomplished on each treatment. Significant reductions in stands were experienced in many cases of crop-treatment combination. All chemical treatments reduced stands of sorghum.

Pasture work included a comparison of annual and perennial species for winter pasturage. The 1954 yields were near the average for the 3 years. Annuals out-yielded perennials. Rye was high with 4,099 pounds dry matter per acre.

In the experiments with barley and lespedeza, yields of barley were high but no significant differences occurred. Lespedeza succeeded only where barley was not seeded. Barley in 14-inch rows produced more heads per linear foot than in 7-inch rows.

Effects of methods of harvesting barley on interplanted lespedeza were studied with Jackson No. 1 barley, and Kobe lespedeza over-seeded in the following March. Lespedeza succeeded only where some barley growth was harvested in April. Yields of T.D.N. were highest where lespedeza succeeded and lowest where barley was harvested only for grain.

Irrigation studies are under way, under supervision of Dr. W. L. Parks, of the Agronomy Department. Four levels of moisture were studied with 30, 60, 90 and 120-pound rates of nitrogen on sudan grass. No irrigation, 2, 5 and 9 atmospheres tension minimum moisture levels maintained in 0-6" depth. Soil in non-irrigated plots was at wilting point for a period of 18 days in August. Irrigations were of 1-acre inch.

Plant population studies on corn were made in cooperation with Dr. Parks. Tenn. 29 corn was planted and thinned to populations of 8, 10 and 12 thousand plants per acre. Three-foot rows were used. Yields were low, and no significant differences occurred. It is planned to continue this test.

Cotton insect control studies were in cooperation with W. W. Stanley, Department of Entomology. DPL 15 and Empire cottons were planted in alternating plots. Applications consisted of Toxaphene dusts. Treatments were to compare one, two, three and seven insecticide applications with an untreated check. Yields of seed cotton were not increased by treatment.

Observation plots (1 each) of Coastal, Midland and Suwannee Bermuda were established. Satisfactory stands were obtained and will be continued for observation.

Texcel Guar, an experimental forage species, was planted June 1 in three-foot rows and cultivated twice. Single areas were harvested, showing the following production: August 16, 12,240 lbs. green wt. per acre; or 3,619 lbs. dry wt. per acre; October 20, 288 lbs. clean seed per acre.

One plot each of Lahoma and Common Sweet sudan, Starr and Common pearl millet were planted, cultivated and cut. Observations were made on yield and maturity and type of growth.

Cotton defoliation work is under way. Many different defoliant and concentrations were used. Results vary, requiring detailed description.

Considerable work has been done by personnel of this Station in cooperation with that of Ames Plantation.

Some progress was made in studying Soil Associations of West Tennessee. Nearly all the available association maps have been collected.

Several talks were made to farmers in West Tennessee on results of agronomy work. Numerous inquiries were answered by letter.

A paper "The Soil Survey in The Lawrence County, Tennessee, Farm Planning Program," by Edwards and Overton was published in Soil Science Society of America Proceedings, Volume 18, No. 3, July 1954.

**THE UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION
KNOXVILLE, TENNESSEE**

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