1-1-1955

Science serves your farm.

H. R. Varney

Science

SERVES YOUR FARM

Bulletin 369, Part 1

Fall 1954

EST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Bulletin 369, Part 1 Fall 1954

Science SERVES YOUR FARM

Annual Report, Parts Published Quarterly
by
AGRICULTURAL EXPERIMENT STATION
West Virginia University
Morgantown, W. Va.
Director
H. R. Varney

Editor ..... John Luchok
Assistant Editor ..... Glenn D. Bengtson
Photographer ..... David R. Creel

Publications Committee: G. C. Anderson, O. J. Burger, V. G. Lilly. Science Serves Your Farm will be sent free to any resident of West Virginia in response to a written request to the Director, Agricultural Experiment Station, West Virginia University, Morgantown, W. Va.

Annual Report of H. R. Varney, Director West Virginia University Agricultural Experiment Station for the Period 1954-1955

IN THIS ISSUE

on the calendar . . .

NOVEMBER—

6-13—American Society of Agronomy, Minneapolis, Minnesota.

10-11—Farm Machinery Conference, Jackson's Mill.

19-20—Cumberland-Shenandoah Valley Fruit Workers Conference, Winchester, Virginia.

JANUARY—

5-8—Dairy Short Course, Jackson's Mill.

on our cover

On our cover is the portable sawmill designed and constructed by West Virginia University Agricultural Experiment Station foresters. Extremely mobile, this unit moves the mill to the logs, thus making it possible to profitably harvest smaller units of saw timber than could be done if the logs had to be moved to a permanent mill.

Lumber and other forest products are among the many items the average West Virginia farmer can produce on his land. Approximately one-third of the forest lands in the State are owned by farmers, and nearly one-third of the average farm is woodland. In order to operate his entire farm as efficiently and profitably as possible, the farmer must manage his woodlands as wisely as he does his pastures and his cornfields.

One of the research projects in woodland management at the West Virginia University Agricultural Experiment Station deals with reforesting agricultural wastelands and rundown woodlands. The problem is complex, because of the wide variety of topographical and climatic features of the State, as well as the varying soil, moisture, and temperature requirements of different species of trees. Part of the expense of such an operation lies in the necessity of clearing weed trees from the land before reforestation can begin. Experiment Station foresters are keeping complete financial records of the experiment so that reforestation may be evaluated on a profit basis.

new publications

Bulletins

363, Part 4. Annual Report of H. R. Varney, Director, Science Serves Your Farm, Summer, 1954.

Current Reports

7. Collins Veatch. Weed Control—1954 Recommendations. April 1954.

Editor's Note: All publications available from the West Virginia University Agricultural Experiment Station are included in a list of publications recently released. This list may be obtained by writing to the Director, West Virginia University Agricultural Experiment Station, Morgantown.

Most of the more recent Station publications are also available at your county agricultural agent's office.

grass silage, grass silage and hay, or hay for wintering beef cows

C. J. Cunningham, Associate Animal Husbandman and
E. A. Livesay, Animal Husbandman

FOLLOWING experimental trials which showed that grass-legume silage was approximately equal to corn silage (based on dry matter content) for wintering bred beef cows,* requests began to come from cattlemen asking why they could not winter bred cows on grass or grass-legume silage alone. Previous work at the West Virginia Experiment Station had shown that 2-year-old steers could be satisfactorily and economically wintered on corn silage plus a small amount of cottonseed meal, and there was every reason to expect that grass or grass-legume silage alone might be satisfactory for wintering bred beef cows.

In order to check grass silage alone for wintering bred cows, a project was set up in the late fall of 1949 at the Wardensville Substation. The project called for at least two wintering trials, which were conducted during the winters of 1949-50 and 1950-51.

THESE COWS received only hay. Although they lost average of 31 pounds per cow during 2nd winter, calves were as large and vigorous as those in other groups.

42 Cows Used

Forty-two high-grade Hereford cows were divided into three lots of 14 head each on the basis of type and condition. The three lots were housed under identical conditions and all had free access to water and a mineral mixture composed of 50 per cent salt and 50 per cent steamed bone meal.

The rations fed were as follows:

For winter of 1949-50

Lot I	Grass silage	53 lbs.	or 15.95 lbs. dry matter
Lot II	Grass silage	34 lbs.	or 16.69 lbs. dry matter
	Hay	7.6 lbs.	
Lot III	Hay	19.3 lbs.	or 16.40 lbs. dry matter

For winter of 1950-51

Lot I	Grass silage	38 lbs.	or 12.58 lbs. dry matter
Lot II	Grass silage	26 lbs.	or 13.44 lbs. dry matter
	Hay	5.7 lbs.	
Lot III	Hay	15.5 lbs.	or 13.18 lbs. dry matter

(continued on page 8)

*See West Virginia University Agricultural Experiment Station Bulletin 363, Part 1, September, 1953, *Science Serves Your Farm*, p. 4.

GROUP II cows received both grass silage and hay during the trials. Average gain per cow was 70 pounds during first winter; 94 pounds during second winter.

THESE COWS were among the group receiving only grass silage. Average gain per cow was sixty-six pounds during first winter; forty-three in second winter.

THIS RUN will provide good hunting during the rabbit season. A variety of grasses, herbs, shrubs and trees provide cover and year-round food.

RABBIT TRAPS entered through a

Cottontail Rab

ON WEST VIRGINIA FAR

"HOW many rabbits did you get today, Joe?"

"Aw, we didn't do any good at all—only jumped two rabbits all day, and one of those went right in a hole. How did you do?"

"Why, we had a pretty good hunt. Only out for three hours, but we jumped six rabbits and got four of them."

"Is that right? Say, where were you hunting?"

"Over on Brushy Run. Where were you?"

"Why we were on Brushy Run, too! Wonder why we couldn't find rabbits."

These two parties hunted on the same day, with equally good dogs, on the same watershed, on farms only a mile apart. Yet one group had good hunting, the other poor. Have you ever stopped to wonder why situations like this occur?

Populations Study

As a part of a study of wildlife populations on a Soil Conservation District, the author ran several lines of box traps over a period of five winters to count rabbit populations on various farms in Upshur County, West Virginia.

This census work has revealed some interesting information about this popular game animal.

The objective of this count was to compare rabbit populations on different farms in the same year, and to compare the population in a given area from one year to another. During ten days of good trapping weather, traps were operated continuously over the entire area being counted. Although a completely accurate count would depend on trapping all rabbits in the area, the small percentage which did not enter the traps probably did not affect the comparison, since a similar percentage probably existed on all farms tested. Other experimenters had found that one box trap in each 2½-acre area would make a sufficiently accurate count if operated for ten days.

The traps were simple oak boxes, six inches wide, eight inches high, and two feet long. One end was covered with half-inch mesh hardware cloth, and the other end contained a swinging door. This door was hinged at the top and was held against the ceiling of the box when the trap was set. The trigger that released the door was a false floor that tipped slightly when the rabbit reached the front end of the trap, where the bait was placed.

Several kinds of bait were tried, but the most successful combination was an apple, a carrot, and some green leafy material such as lettuce or cabbage. The traps were run every day, and the bait was kept fresh at all times. In freezing weather it often was necessary to change the green baits each day. In very bad weather no rabbits were caught, because they did not move around. In general, this was true on any night when the temperature remained below 10°.

Traps Were Numbered

Aerial photographs were used as maps to place the traps. Although

k boxes. The rabbits Nibbling at the bait caused the door to drop, entrapping the rabbit. A trap was placed in each 2½-acres of farm census area.

Populations

by R. F. Dugan, Assistant Forester

each 2½-acre square on the farm contained one trap, the trap was not necessarily placed exactly in the center of the square. Instead, traps were set in the most likely-looking spots in order to improve the chances of catching rabbits quickly. It was found that rabbits would go down into a trap more quickly than climb up into one. Probably they are not used to climbing uphill into their holes.

All the traps were numbered, and their locations recorded on a map. As each rabbit was caught, it was numbered. This number, along with the sex and any unusual characteristics of the animal were recorded along with the date caught, and the trap in which it was caught.

Rabbits Marked

Of course it was necessary to mark the rabbits in some way so that they could be recognized when caught again. This was done by clipping toenails according to a regular system. A rabbit has four toes on each hind foot, and these were all that were used for marking. Each toe was given a number starting with the outside toe of the right foot as number one, and ending up with number eight on the outside of the left foot. The first eight rabbits in each area could then be marked by clipping one toenail. By clipping two toenails per rabbit, the following numbers could be identified: 12, 13, 14, 15, 16, 17, 18, 23, 24, 25, 26, 27, 28, 34, 38, etc. This numbering system was sufficient to identify all rabbits caught and rabbits marked in this way were easily identified as long as six weeks after they were first marked.

Rabbits either have short memories or they are willing to spend a night in a box in order to eat the bait. Many of the rabbits were caught two or three times during a ten-day period, and three individuals were caught six times each.

During the period from 1942 to 1948, the lowest population found on the farms censused was three rabbits per one hundred acres. Although this is quite a wide variation, undoubtedly there are areas in the State with both higher and lower populations than these.

Although the data are neither complete or extensive, the results of this trapping indicate one or two very interesting things. First, all areas trapped showed a severe drop in population (roughly one-half) between 1942 and 1945. This was at a time when foxes were quite plentiful which may have had something to do with it. It is also likely that this might have been a downhill portion of the rabbits' population cycle. Most wild animals have more or less regular fluctuations in numbers over a period of 8 or 10 years. From 1945 to 1947, populations on most of the areas built up gradually. But the interesting thing to the farmer and the rabbit hunter is that throughout these fluctuations, the comparison between farms remained the same. On farms with good cover and food, there were always more rabbits than on those with poor habitat. As an example, let's use two farms on the same watershed, less than a mile apart.

Cover Conditions

On Farm A, cover conditions for rabbits were good. Fence rows and stream banks were brushy, the pastures were grown up, and there were plenty of woodchuck dens. On Farm B, cover was poor. The fence lines were cleaned out, the pastures and woods closely grazed, and there were

(continued on page 6)

RABBITS were given individual serial numbers by clipping the toes. One toe was clipped on each foot. This rabbit, No. 27, is identified by the absence of nails on toes 2 and 7. Rabbits retain identity up to six weeks after clipping.

Hatchability in
BROAD-BREASTED BRONZE TURKEYS

T. B. Clark, Associate Poultry Husbandman

TURKEY breeders and hatcherymen have long been concerned with the advantages and disadvantages of outbreeding and inbreeding in connection with the hatchability of turkey eggs. If hatchability is not inherited, as some poultrymen believe, then environment is more important than the relationship of the parents. However, some results obtained at the West Virginia Agricultural Experiment Station show that the relationship of the hens and toms is an important factor in the hatchability of fertile eggs.

Earlier work at this Station showed that hatchability was increased by outbreeding or the crossing of varieties of turkeys. For instance, there was a significant increase in the percentage of poults hatched from eggs laid by Bronze hens mated to Bourbon Red toms over those hatched from Bourbon Red hens mated to the same toms. The increase occurred from this and other crosses over a period of years.

Strain Crossing

Crossing strains of the same variety did not always produce a significant increase in hatchability of the eggs laid by the tom's pen mates. Strain crossing is a milder form of outbreeding. The beneficial effects of strain crosses, if any occur, have been found by other workers to show up in the following generation.

If crossbreeding tends to increase hatchability, do brother-sister matings have the opposite effect on the hatchability of the tom's pen mates? Results obtained at this Station throw some light on the problem of the relationship of the toms and hens. Each year eight single-male matings of B. B. Bronze were studied. Each pen contained three groups of sisters. One group was comprised of the tom's full-sisters, the second was half-sisters, and the third was unrelated to the tom. At the start the amount of inbreeding was about the same in the related and unrelated groups. The first year, 1948, all groups hatched about alike.

The results for three years are shown in Table 1. During each of these years, the sisters not related to the toms showed a higher average percentage hatchability of the fertile eggs than the sisters closely related to the toms. Hatchability in the sister groups related to the toms was lowest even though the hens were selected on a family basis for high hatchability. No families having less than 70 per cent hatchability of fertile eggs were used so as to avoid lethal factors.

Table 1. Per Cent Hatch of Fertile Eggs of Broad-breasted Bronze Turkeys

Relation of Hens to Tom	Year		
	1950	1951	1952
	%	%	%
Full-sisters	68.5	73.7	67.3
Half-sisters	70.8	74.6	69.5
None	73.6	82.7	79.9

These close matings had no effect on fertility. Contrary to expectation there also was no apparent increase in early embryonic mortality. The largest factor contributing to the lowered hatchability in the close matings was the pipped eggs that failed to hatch. This condition often is related to incubator management.

More Information Needed

In large breeding flocks the undesirable effects found here would be small because such close matings would rarely occur. In small flocks the matings could be set up to minimize the effects of close breeding by using several pens and rotating the toms each year. Even though the mating methods used in these and earlier studies were found to influence hatchability, more information must be obtained on the genetics of turkeys before the importance of breeding can be fully determined.

Environmental factors are known to influence hatchability and could account for the large variation obtained from hatch to hatch. Maintaining the egg room at not over 55° F., with the humidity near the saturation point are important factors. However, careful incubator management is probably the most important because turkey eggs are not as easy to hatch as chicken eggs.

It is not generally recognized that incubators may operate differently in different locations. It is advisable to follow the manufacturer's directions, but if poor hatches frequently occur it may be necessary to change the settings in order to find the optimum temperature and humidity. Similarly, the number of eggs in the incubator or hatcher may affect the results. The writer has found that some incubators give better results when run slightly above the recommended temperature if only partly full.

Producers with small incubators frequently write in wondering why their turkey eggs hatched poorly. It should be recognized that small incubators seldom hatch as well as the mammoth machines. Also, the environmental conditions may be changed too soon. The temperature or humidity should not be changed until the twenty-fifth day or just before the eggs start to pip.

COTTONTAILS

(continued from page 5)

very few underground dens. Food conditions were not ideal on either farm, but were somewhat better on A than on B. The results of census work on these two farms are shown on Table 1. The population figures are rounded off to the nearest whole rabbit per one hundred acres.

Table 1. Results of Census Work on Two Farms

Year	Rabbits per 100 Acres Farm A	Rabbits per 100 Acres Farm B
1942	24	14
1945	11	8
1946	14	8
1947	20	7

Notice that the populations were much higher on the farm with good habitat than where food and cover were poor; and that the numbers began to build up more quickly on this farm than on the other. These were actual farms, less than a mile apart, on the same watershed.

DAIRY TRENDS
In West Virginia

By J. H. Clarke, Associate Agricultural Economist, and William W. Jones*

DAIRYING is well adapted to the farming conditions in West Virginia. Concentrations of consumers in non-farm employment today provide outlets for State milk equal to or exceeding the supply in most parts of the State. Despite this, the development of dairying in West Virginia has not progressed fast enough to meet the demands of the larger non-farm population. Many of the large population centers in West Virginia are near the borders of the State. Consumers in these areas often obtain much of their milk from producers outside the State. This is not necessarily an undesirable economic situation. Competition is such that much of the increase in milk supplies provided for our markets has not developed on West Virginia farms.

Milk Cows

The number of milk cows in the State reached a peak of 248,000 in 1934, but by 1951 had declined to about 207,000.

*Formerly graduate assistant in Agricultural Economics.

Figure 1 shows the relative changes in the number of milk cows in West Virginia and the United States. The rate of increase was greater in West Virginia than in the United States from 1867 to 1916 and since that time has about corresponded with changes in all states. Most of the states adjoining West Virginia have had larger relative increases in the number of milk cows.

Milk Production and Sales

Total milk production in West Virginia changed very little from 1899 to 1949, with an increase of only about 5 per cent. This greater production has been possible with fewer cows because production per cow has been increasing slowly in the last decade. It is still low compared with the average for the United States as shown in Figure 2. Even though changes in production have been small, significant changes have been taking place in the utilization of the milk produced. Less milk is used on farms today as compared with the period before 1920 and much more of the milk is sold.

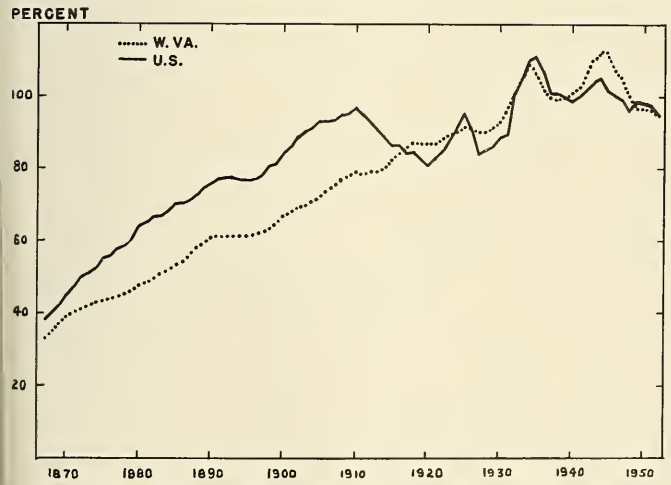


FIGURE 1. Relative changes in the number of milk cows in West Virginia and the United States, 1867-1952 (1939 = 100).

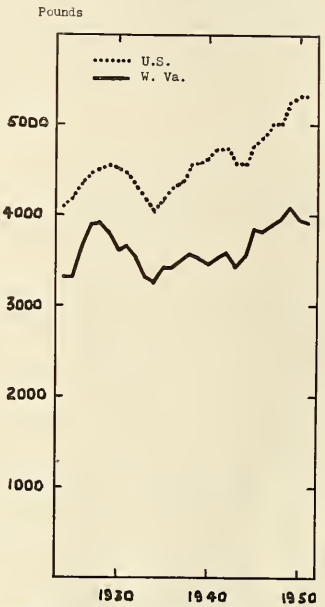


FIGURE 2. Milk production per cow in West Virginia and the United States, 1924-51.

Declines have taken place in the amount of milk used to produce farm butter, while there have been large increases in the wholesale sales of whole milk. Cream sales have changed little since 1928. (See Figure 3.) An increase in the production of creamery butter for a time partially offset the decline in production of farm butter, but both have shown a decreasing trend in more recent years, as indicated in Figure 4.

Income from Dairying

Cash receipts from all milk and cream sold rose from $7.6 million in 1924 to $25.1 million in 1953. In addition, West Virginia farm people in 1953 used another $14.3 million worth of dairy products on their farms. This resulted in a gross in-

(continued on page 8)

BEEF COWS

(continued from page 3)

These rations were fed in a manner that all lots would receive approximately the same amount of dry matter each wintering period and that Lot II would receive approximately 2/3 of the dry matter from silage and 1/3 from hay. The silage and hay each year were made from similar material from the same field and from the same cutting. The silage and hay used in 1949-50 were made from the first cutting of orchard grass, and in 1950-51 from a wheat stubble cutting of ragweed and red clover.

Results

The following table gives the results for the two wintering periods.

	Lot I Grass Silage	Lot II Grass Silage Hay	Lot III Hay
1949-50 (14 Cows Per Lot—84 Days)			
Av. Initial Wt. (lbs.)	1144	1178	1099
Av. Final Wt.	1210	1248	1136
Av. Gain	66	70	37
1950-51 (14 Cows Per Lot—112 Days)			
Av. Initial Wt. (lbs.)	1143	1101	1094
Av. Final Wt	1176	1195	1063
Av. Gain	43	94	—31

Although the wintering periods were short, the results show that bred beef cows can be satisfactorily wintered on grass silage alone. In each trial the cows of Lots I and II made greater gains than the cows of Lot III which received hay alone. The cows of Lot II, receiving 2/3 of their dry matter from silage and 1/3 from hay, made slightly better gains each year, which would indicate that some hay in a grass silage ration is to be preferred to a straight grass silage ration.

Produce Strong Calves

The cows of all lots each year were in good flesh at the start of the trials and all wintered in a manner to produce good strong calves. The cows of Lot III, 1950-51, lost in weight (31 lbs.) during the winter, but the calves were as large and apparently just as vigorous as the calves dropped by the cows of Lots I and II.

The cows of Lots I and II each year lost their winter coats of hair about 30 days earlier than the Lot III cows wintered on hay alone. This was very noticeable shortly after they were placed on pasture.

Note: It is not often that a silage and hay made from wheat stubble composed of at least ½ ragweed is fed in an experimental feeding trial as in 1950-51. This material in the silo made an excellent silage, but for some reason it was not relished in the hay, and in order to equalize dry matter, Lots I and II had to be held back on account of the hay consumption in Lot III.

DAIRY TRENDS

(continued from page 7)

come that year of $39.4 million from dairy products, exclusive of dairy animals sold. Dairy products have also grown in relative importance as a source of cash farm income in West Virginia, rising from 8.4 per cent of the 1909 total to 18.8 per cent of the total in 1949. This percentage change has been due to both increased sales of dairy products and sale in more remunerative form, namely, whole milk. Sales of this product have risen from 4 per cent of the milk produced in 1899 to 39 per cent of the 1949 production.

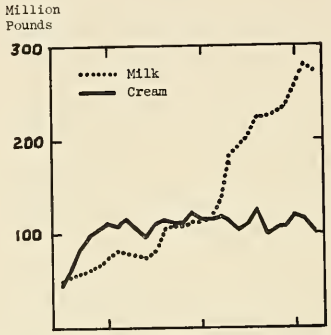


FIGURE 3. Milk and cream sold (Milk Equivalent Basis) in West Virginia, 1924-51.

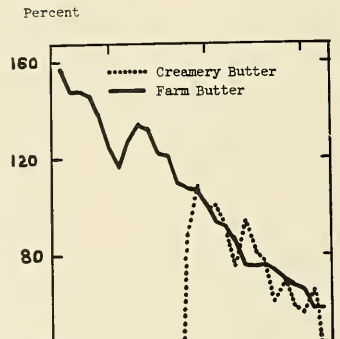


FIGURE 4. Relative production of creamery and farm butter in West Virginia, 1924-51 (1939 = 100).

A recent study made in the Department of Agricultural Economics and Rural Sociology of livestock marketing indicates that 27 per cent of the cattle sold by producers were dairy-type animals and 16 per cent were of mixed beef and dairy breeding. Thus, when sales of dairy animals sold for slaughter are added to dairy products sales, this enterprise is second only to poultry and poultry products as a source of cash income of farmers in the State.

Adequate markets indicate there is still room for further expansion of the dairy enterprise in West Virginia. This can be done if our dairymen are able to compete satisfactorily with out-of-state dairymen now partially supplying many of our markets.

Note: Data used in this report were taken from the various Censuses of Agriculture, USDA publications—*Agricultural Statistics, Production of Manufactured Dairy Products,* and *Farm Production, Disposition, and Income from Milk, West Virginia Agricultural Statistics,* and unpublished studies in the Department of Agricultural Economics and Rural Sociology, West Virginia University.

SOYBEAN BULLETIN

Soybean Variety Trials in West Virginia—1947-1953, a new West Virginia University Agricultural Experiment Station Bulletin, will be ready for release soon.

Written by Collins Veatch, Associate Agronomist in the Agricultural Experiment Station, the bulletin describes research conducted in testing and comparing hay and seed yields of soybean varieties at Morgantown and at Point Pleasant between 1947 and 1953.

Dr. Veatch begins his bulletin with a short history of the soybean industry in the United States, then discusses the development of the various varieties. He describes the methods used in conducting the trials, and includes complete data resulting from the trials.

Science

SERVES YOUR FARM

Bulletin 369, Part 2

Winter 1954

Experimental Farm

Experimental Forest

Forestry Experimental Plot

THE STATE Is Our Laboratory

Reedsville Substation
Reymann Memorial Farms
Kearneysville Substation
Ohio Valley Substation
Dairy Farm
Poultry Farm
Horticulture Farm
Agronomy Farm
Animal Husbandry Farm
Cooper's Rock Experimental Forest
Tygart Valley Experimental Forest
Meadow Creek Experimental Forest
Winding Gulf Experimental Forest
Island Creek Experimental Forest

WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Bulletin 369, Part 2 Winter 1954

Science SERVES YOUR FARM

Annual Report of H. R. Varney, Director West Virginia University Agricultural Experiment Station For the Period 1954-1955

Annual Report. Parts Published Quarterly by AGRICULTURAL EXPERIMENT STATION West Virginia University Morgantown, W. Va.

Director H. R. Varney

Editor ..... John Luchok
Assistant Editor ..... Glenn D. Bengtson
Photographer ..... David R. Creel

Publications Committee: G. C. Anderson, O. J. Burger, V. G. Lilly. Science Serves Your Farm will be sent free to any resident of West Virginia in response to a written request to the Director, Agricultural Experiment Station, West Virginia University, Morgantown, W. Va.

IN THIS ISSUE

A Report . . .

This issue of *Science Serves Your Farm* is devoted to reports from the Heads of Departments explaining what their departments are doing to further the objectives and purposes of the West Virginia University Agricultural Experiment Station. These reports will inform you of the activities of their departments over the past years, their needs, and their plans for progress in agricultural research in future years.

The Agricultural Experiment Station of West Virginia University was established by the Board of Regents in 1888. The Hatch Act, passed by the United States Congress, provided the initial federal financial support for establishing a research institution for conducting original and verification investigations in plant and animal nutrition, plant and animal physiology and pathology, dairy manufacturing, economics, and other researches and experiments bearing directly upon the agricultural industry of the State of West Virginia.

The funds provided by this Act were combined with funds appropriated by the West Virginia Legislature to establish and operate the Experiment Station. The activities of the Station were greatly enlarged by subsequent federal legislation, known as the Adams, Purnell, Bankhead-Jones, and Research and Marketing Acts.

Research activity at the Experiment Station now includes investigations in the fields of agricultural engineering, agricultural biochemistry, agricultural economics and rural sociology, agronomy and genetics, animal husbandry, dairying, forestry, home economics, horticulture, plant pathology, bacteriology, and entomology. These investigations are classified into 165 research projects.

WEST VIRGINIA UNIVERSITY

Morgantown, W. Va.

Publications Available from Your Agricultural Experiment Station

BULLETINS

175. West Virginia Trees. 1920
195. Standard Deviation in the Weight of White Leghorn Eggs. 1925
285. Land-class Maps. 1937
291. Agriculture in Jackson County Conservation Area. 1939
302. Farmer's Mutual Fire Insurance Companies in W. Va. 1941
313. W. Va. Grasses. 1944
315. Four Nitrogen-Carriers in Apple Orchards at Martinsburg, W. Va. 1944
318. A Nutrition Study of W. Va. Students. 1945
319. The Comparative Value of Different Test Organisms in Microbiological Assay of B Vitamins. 1945
327. (Rev.) Pastures Improved with Tillage-Treatment-Seed. 1950
331. Effect of Certain Protein Levels on Egg-Production and Mortality in White Leghorns. 1948
334. Research Powers the Farms. 1948
335. Inventory of Public Lands in W. Va. 1949
339. More Milk Through Better Breeding. 1949
341. Profitable Tree Forms of Yellowpoplar. 1950
342. Science Serves Your Farm. 1950
343. Forage Crop Trials in W. Va. 1950
344T. Yellowpoplar; Reaction to Crown Release and Other Factors Influencing Growth. 1951
345. West Virginia Limestone—A Calcium Supplement for Poultry. 1951
346. Selection for Viability in White Leghorns. 1951
347. Effect of Black Walnut Trees and Their Products on Other Vegetation. 1951
349. Science Serves Your Farm, Parts 1, 2, and 3. 1951-52
350T. Blister-Shake of Yellowpoplar. 1952
351T. Diseases, Insects, and Other Factors in Relation to Red Clover Failure in W. Va. 1952
352. Nutritional Survey of W. Va. Students. 1952
353. Marketing Eggs in Retail Stores of the Northeast, 1949. 1952
354. Retailing Eggs in W. Va. Stores. 1952
355T. Elk Garden, W. Va. Reconnaissance Survey of a Problem Town. 1952
356. A Leaf Analysis of Apple Orchards in W. Va. 1952
357. Science Serves Your Farm, Parts 1, 2, 3, and 4. 1952-53
358T. Property Tax Assessment in W. Va. 1953
359T. Isolation and Identification of the Oak Wilt Fungus. 1953
360. Development of Vegetation on Century-Old Iron-Ore Spoil Banks. 1953
361T. Cooperative Nutritional Status Studies in the Northeast Region. 1953
362T. The Utilization of Sugars by Fungi. 1953
363. Science Serves Your Farm, Parts 1, 2, 3, and 4. 1953-54
364. The Fluidized-Grain Conveyor. 1953
365T. A General-Purpose Garden Pesticide. 1954
366T. The Effect of Certain Pesticides on Nitrification in the Soil. 1954
367. Pricing Medium and Large Eggs Relatively for Maximum Value. 1954
368. Farm and Home Business Center Studies. 1954

CIRCULARS

45. Roadside Marketing. 1927
55. Blackberry Jelly and Jam, Cherry Preserves. 1930
68. Research at Reymann Memorial Farms. 1935
69. Growing Grapes in W. Va. (Rev.) 1951
70. Cicada in W. Va. 1935
71. Lime—Its Use and Need in W. Va. 1936
79. Watch Your Dairy Cattle Grow. 1943
81. Control "Pasting-Up" in Baby Chicks. 1948
82. Christmas Trees—Their Profitable Production in W. Va. 1951
83. Farm Home Business Centers. 1951
84. Farm Fish Ponds in W. Va. 1952
85. The W. Va. Broiler House. 1952
86. Selecting Turkeys for the Breeding Flock. 1952
87. Rooting American Holly from Cuttings—Cold-Frame Method. 1953
88. Cannibalism in Poultry. 1953
89. Crossbreeding in W. Va. 1953
90. Growing Chestnuts from Seed. 1954
91. Dairy Cows Need Larger Stalls. 1954
92. An Adjustable-Height Table for the Laboratory or Home. 1954
93. Spring Oats Trials 1949-53. 1954
94. Consumer's Reaction to Tree-Ripe Peaches. 1954

CURRENT REPORTS

1. Results of Hybrid Corn Yield Trials in W. Va. 1951
2. Cauliflower Seedbed Fumigation with Methyl Bromide. 1952
3. Studies on Sprout Reproduction of Yellowpoplar as Related to Decay. 1953
4. Results of Hybrid Corn Yield Trials in W. Va. 1952
5. Some Aspects of Every-Other-Day-Milk Delivery. 1953
6. Results of Hybrid Corn Yield Trials in W. Va. 1953
7. Weed Control—1954 Recommendations. 1954

SPECIAL CIRCULARS

1. Farmer's Stake in Price Control. 1946
2. Charting a Route for Agriculture in W. Va. 1946

Note: *"T" following a bulletin number designates a technical publication.*

Foreword . . .

Science Serves Your Farm is published four times a year, as a means of reporting the progress being made on various research projects carried on by the Agricultural Experiment Station. Once each year the issue contains a brief report on finances, and publishes a list of the research personnel and publications issued during the year. This issue contains that information plus a brief resume by each subject matter department of some of the outstanding results in recent years, some of the problems now being worked upon, and some of the most pressing needs for the immediate future.

It is hard to realize the role that agricultural research has played in increasing our productivity on the farm, and improving our standard of living; not only on the farms, but in urban areas as well, because never before

in history has the average working man been able to obtain as good a diet for as small a proportion of his weekly income as is possible today.

Today U.S. farmers are producing sufficient food and fiber to provide a reasonably adequate diet for the American people plus additional supplies for export; but the rapid increase in population will soon absorb this production and require much additional food. In 1950, a total of 462 million acres of crop land equivalent were in use for food production. It is estimated that 15 million additional acres could be converted to agricultural use by a release from other uses, and that an additional 30 million acres could be made available by reclaiming land through such projects as drainage and irrigation. However, it seems likely that much of this potential farm land will instead be used for industrial and urban expansion. Much land that has been used for agricultural purposes in the past has already been taken over by industry as is plainly indicated in the Kanawha and Ohio valleys.

What about needs for the future? If our population continues to grow at the present rate, by 1975, at present production rates, it would require 577 million acres to produce the food needed to maintain the present diet. This is more land than there is available and the deficit must be met by an increase in the efficiency of production on the soil resources that we now have.

Many factors are involved in this picture—we must conserve soil resources to the maximum extent economically feasible. We must eventually reclaim land that is now sub-marginal. Greater and more efficient use must be made of fertilizers. Efficiency of production and yield per acre must be stepped up by improving mechanization; developing better varieties of plants; making more efficient use of water resources; controlling insect diseases, parasites, and weeds; improving cultural and farm management practices; and preventing losses during marketing and storage.

The problems will be so numerous that a continued source of new information, methods and materials must be supplied to the producer. These will come only as recent research efforts are increased to get the facts, and as the Extension program is strengthened to get these new facts in use on the farms. Agricultural research must be done largely in publicly supported laboratories because farm businesses are too small and widely dispersed to finance their own research programs.

The success of the research program of the West Virginia Agricultural Experiment Station as well as those in other states depends upon the availability of the necessary funds and a staff of well-trained workers. Research workers should be studying, not only the problems that are facing producers at the moment, but to be most effective they should be anticipating problems so that much of the basic work may be done before the producers are actually faced with them; thus, the answers may be available as soon as they are needed instead of having to wait for a considerable period for research to discover the answer. A good example of the difference this can make may be found in three tree diseases, first, chestnut blight, which struck suddenly and for which scientists had no answer. Before a solution could be developed, the chestnut tree was practically eliminated. In contrast, scientists anticipated the fact that the dutch elm disease might eventually reach this country and had done considerable work before it finally did arrive. They were, therefore, able to come up immediately with some of the answers enabling its partial control, so that in twenty years it has not caused nearly as much damage as the chestnut blight did in four or five. An example, closer home, is the case of the oak wilt disease. It seems likely that we will be able to control it without extensive damage to this great natural resource of our State.

I hope, after examining the material in this issue of *Science Serves Your Farm*, that you will have a better idea of just what the West Virginia Agricultural Experiment Station is, how it is organized, and what some of its problems are. If you have questions or suggestions, we will be glad to hear from you at any time. A list of research publications as issued by the Station during the past years is included in this report. A copy of any of these (except the Journal articles) may be obtained by writing to the Agricultural Editor, Woodburn Hall, Morgantown, W.Va.

Sincerely,

H R Varney

H. R. Varney
Director

agricultural biochemistry

BIOCHEMISTS conduct basic biochemical research, cooperate in experiments on animal nutrition and pathology.

BIOCHEMISTRY has contributed much to the health and welfare of the people of this country. Knowledge of the nature and importance of vitamins, of antibiotics such as penicillin, of pesticides such as DDT, and of many other substances of great importance to farmers has come, to a large extent, from studies in biochemistry.

In recent years work in this department has made contributions to our understanding of such things as: the role of vitamin B_{12} in nutrition; chemicals which affect color development in apples, mastitis in dairy cows, cause of off-flavors in milk, poultry nutrition, and the nutritional status of West Virginia people. The last two subjects are still being intensively studied and will be considered in greater detail.

Poultry Nutrition Work

Current poultry nutrition work is largely concerned with broiler rations for higher feeding efficiency, and a hemorrhagic condition which may be caused by a vitamin deficiency in some cases. This work is in cooperation with the Poultry Section of the Animal Husbandry Department. In one of the first growth trials using a "high energy" ration containing corn and soybean oil meal with vitamin-mineral supplement, it was noted that the results were complicated by excessive death losses due to hemorrhage. About the same time it was observed that broiler growers over the State were suffering heavy losses caused by hemorrhages in various parts of the bird. Investigations here were directed to study the symptoms and ascertain the causes of this trouble in order that the condition could be effectively brought under control. Nutritional studies have been conducted in the laboratory to determine the relationship which vitamin K may have to the condition. Since the disease has been observed only recently, it seemed desirable to determine whether the antibiotics, coccidiostats, or arsenical growth promoting compounds which have recently come into use were increasing the needs of the birds for vitamin K. These studies revealed that the vitamin K content of the ration varied with the ingredients used to formulate the feed. Important variations were noted even between different shipments of soybean oil meals.

Of the antibiotics and arsenical compounds studied, none seemed to contribute to the cause of the condition in the laboratory or in commercial flocks. However, a coccidiostat, sulfaquinoxaline (a sulfa-drug), very definitely increases the vitamin K requirement when fed in high quantities. Yet, if sufficient vitamin K is present, as furnished by 2 per cent good quality alfalfa meal, 0.05 per cent sulfaquinoxaline in the feed had no detrimental effect over a six-week period starting with day-old New Hampshire chicks.

Hemorrhagic Condition Studied

The hemorrhagic condition observed in commercial broiler flocks does not appear to be caused by a simple vitamin K deficiency but rather appears to be associated with a diseased condition. Field flocks in which many birds were lost presumably to hemorrhages later were observed to be infected with a new disease of considerable importance. These birds had ruffled feathers and were anemic, emaciated, weak, and had many enlarged hocks and footpads. Fluid taken from these joints and injected into healthy birds caused the typical symptoms of this disease to appear. Also in many cases hemorrhages were observed. Whether there is a definite relationship between the hemorrhagic condition and this new disease needs further study. The people in the Animal Pathology Section of the Animal Husbandry Department have been the major contributors to the work on the infectious disease aspects of this problem. They hope to continue the work until a means of prevention or cure is developed.

Current work in human nutrition involves vitamin supplementation studies. Beginning in the fall of 1948, a survey of the nutritional status of college students at West Virginia University was made. Since then other surveys have been made of grade school children from the third through the ninth grade. These studies have shown that the diets of many college students and children in Monongalia County, West Virginia, did not contain as much of certain vitamins and minerals as is recommended by the National Research Council. The diets were low in vitamin C, vitamin A, calcium, and phosphorus.

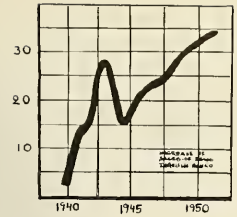
Nutrition Studies Continue

Since many of the subjects studied were consuming what appeared to be inadequate amounts of vitamins, a multiple vitamin supplementation study was begun. It is to continue over a period of two years. During this time school attendance, grades made in school, teacher's evaluations of the performance of the students, and changes in physical signs of malnutrition will be followed. The results obtained should throw considerable light on the value of this type of dietary supplement.

The human nutrition work is done in cooperation with the Home Economics Division and the University Health Service.

Other problems being studied include: nutritional factors required for successful reproduction and lac-

(continued on page 23)



agricultural economics and rural sociology

AGRICULTURAL ECONOMICS is the study of how people in agriculture make a living. The Department of Agricultural Economics is concerned, therefore, with anything that affects the livelihood of those in agriculture. Our chief task is to identify, describe, and classify the economic problems in agriculture so that they may be solved. The objective of the science of economics, in agriculture as anywhere else, is to provide a basis for the economizing of resources; that is, for using them in such a way as to get the most out of them. The resources to be thus economized are commonly named under three heads: natural resources; human resources; and capital goods. Most of our research attempts to find some way for better economizing these resources.

Rural Sociology is the study of the social relationship of rural people to each other and to other nonrural people. The research projects which we conduct investigate some social relationship of the rural people of West Virginia.

Organization of Staff

The staff of the department is composed of eight professional workers, six statistical clerks, and two stenographers. Five of the professional workers teach in the College of Agriculture and, therefore, devote only a part of their time to research.

Many of our marketing research projects were conducted as regional ventures in cooperation with other states in the Northeast Region. We have done work in certain areas of the marketing of livestock, milk, poultry, eggs, apples, peaches, and livestock feed.

Tree-Ripe Peaches Study

In controlled retail store experiment it was found that consumers prefer, at the same price, tree-ripe peaches to hard-ripe peaches and will purchase more of them. A second experiment completed in August, 1954, showed that consumers not only prefer tree-ripe peaches, but will also pay a substantially higher price for them.

MARKET research is important phase of agricultural economics. To obtain actual consumer information, agricultural economists visit the housewife at point of sale.

The relative price of milk in competing markets is an important factor in shifting milk supplies from one market to another. Studies of the relative prices of milk in the Charleston and Huntington markets have provided valuable data in the conduct of the Tri-State Milk Market Order, which includes the West Virginia towns of Huntington, Parkersburg, and Point Pleasant.

Orchardists are interested in knowing the rate of movement of apples at the retail level so as to better regulate their marketings. In cooperation with other states in the Northeast Region we attempted to devise a reporting system which would provide a current dependable rate of movement index. The major result of our work was to prove that a method widely advocated would not yield a dependable index of rate of movement.

For a long time farmers have felt that the marketing of livestock would be improved if cattle could be sold by grade. Most of the auction markets in West Virginia sell veal calves by grade, but none sell cattle in this manner. We have been conducting experiments in three auction markets in an attempt to learn how to sell cattle by grade. These experiments are in cooperation with several states in the Southern Region.

Egg Experiments

Farmers and merchandisers of agricultural products, in an effort to maximize sales, seek to offer the consumer what he wants. In an effort to provide them with some useful information in this field, we have conducted experiments to learn consumer preference for shell color in eggs and their estimate of the relative value of chicken parts.

We think that the most pressing economic problems for West Virginia agriculture lie in the area of production and farm management. Farms are small. Topography, as well as size of farm, limits the use

(continued on page 23)

agricultural engineering

RESEARCH in Agricultural Engineering at the West Virginia Station is relatively new. This Department was organized in 1945, and its research program did not follow until two or three years later. One of the first research projects involved the development of a walnut meat pasteurizer which saved at least one commercial walnut meat enterprise in West Virginia. The pasteurizing process was developed jointly by the Division of Forestry and the Department of Plant Pathology and Bacteriology. Then the agricultural engineers designed and built equipment to carry out the pasteurizing process. Although some changes have been made in the pasteurizer since it was put into use, the unit is doing an exceptionally good job of pasteurizing several tons of walnut meats annually.

Recently this department, in cooperation with the Engineering Experiment Station and the Department of Chemical Engineering, completed work on a continuously fed fluidizer, which may someday provide a new way of transporting bulky material such as grain and ground feed in and about farm buildings. Additional research is needed on the unit before it can be used economically. The fluidizer is able to transport whole wheat at a ratio of about twenty-five pounds of grain to one pound of air, whereas the conventional pneumatic system usually is capable of transporting only about one pound of grain to one pound of air.

Cow Stall Study

More recently this department, along with Dairy Husbandry research workers, completed the first phase of a dairy cow stall study. The study showed that dairy animals, particularly Holsteins, need more space than was usually provided for them. On the average, dairy cows responded by giving more milk per day during the winter months of confinement, incurred fewer injuries, and remained much cleaner when in the larger stall.

Current Research

At the present time agricultural engineers are engaged in research on cow stalls, irrigation, grain drying, and farm mechanization. This research will eventually provide many of the answers farmers are now asking regarding these problems of engineering in their farm management.

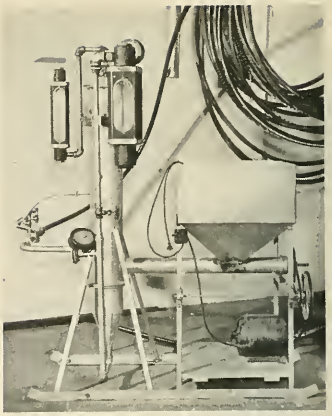
Because the original dairy cow stall study did not cover the conventional make of stall equipment, it seemed desirable to continue this study for at least another three years. Stalls being studied are the stanchion, modified comfort, and comfort. Information on this study will be available within another year.

Although irrigation research has been underway for some time, no real effort was made to promote this work until about a year ago, when the addition of experienced personnel made it possible. Considerable work has been devoted during the past year to determining rainfall deficiency periods at several key weather stations in West Virginia. This information will soon be published.

Mechanization Research

Increased mechanization of grain harvesting has brought about many problems in storing grain, because grain is harvested earlier and the moisture content is usually above that considered safe for storing. Studies under way in this field should help provide answers to the many problems of grain drying, processing, and storing in West Virginia, particularly from the standpoint of properly engineered drying facilities. Design of drying plants are now made on the basis of insufficient information on some of the variables affecting crop drying. Our work should provide fundamental data that will allow the development of more efficient and economical crop-drying equipment.

Mechanization of forage crop harvesting, processing, storing and handling—a new research project in this department in cooperation with the Animal Husbandry and Dairy departments and the Reedsville Experiment Station Farm—will receive a great deal of attention in the months to come. It is a regional project involving nine states in the Northeast Region. This work, if accomplished, will provide many answers to farmers who would like to provide push-button control and mechanization to many of their day-to-day farm chores. Not only will the field harvesting program for hay and silage crops be studied to provide better mechanical facilities, but the job of handling the crop inside of the building during storage, processing, or feeding to the animals will be taken into consideration to remove as much of the hand labor as possible.



FLUIDIZER, moving grain through pipes, represents engineering research to help do farm jobs easier and better.

Mechanization Project New

Although the mechanization project is new on a regional basis, some phases, such as hay drying, which is considered processing, and the development of hay blowers and other related equipment designed to reduce the cost of mechanical equipment, have been underway for some time. These two fields of work have been included in the over-all mechanization studies.

At the present time research workers are particularly interested in mechanical problems involved in the unloading of silage from upright silos. Work underway will give the needed information concerning the practicability of unloading silage by hand, by mechanical

(continued on page 27)

agronomy and genetics

RESEARCH WORK in Agronomy and Genetics was begun soon after establishment of the West Virginia Agricultural Experiment Station. The early work was concerned with the response of various crops to the fertilizers then on the market. The first report of such research was made more than sixty years ago. Since that time the program of research has expanded and much information of value to the agriculture of the state and nation has been secured.

Important Findings

Among the more important findings, the following may be noted:

1. A method of chemical analysis of fertilizers to determine their effect on soil reaction.

2. A method of leaf analysis which aids in determining the nutrient supply in the soil.

3. The soil treatments and soil conditions necessary for growing alfalfa.

4. The lime and fertilizer treatments needed on permanent pastures to secure greater production.

5. A new variety of soybeans (Kingwa) which retains its leaves and consequently produces better quality hay.

6. Corn hybrids which will produce more grain than the old open-pollinated varieties. These are the result of a corn breeding and testing program and include some strains developed here as well as some from other states.

7. The preparation of fertilizer recommendations for various soils and crops in West Virginia as a result of many greenhouse, field, and laboratory experiments on various soils and with the more important crops.

8. The establishment and testing of procedures for the renovation of poor hillside pastures.

9. Evaluation of the physical and chemical properties of soils so these may be used in soil management and conservation.

10. The influence of cropping systems on the organic matter content of soils and the yield of crops.

Current Investigations

At the present time investigations are being conducted on:

1. The phosphorus and potassium supplying power of West Virginia soils.

2. A method for more accurate determination of the lime needs of West Virginia soils.

3. The influence of planting rate of corn on yield.

4. The optimum fertilization for various cropping systems.

5. The value of irrigation for forage production in West Virginia.

6. The production of new corn hybrids and the testing of hybrids produced by other state workers.

7. The improvement of red clover varieties.

8. The production of improved varieties of barley.

9. The fertilization and management of ladino clover grass mixtures.

10. Methods of maintaining profitable stands of alfalfa.

11. Chemical methods for weed control.

12. The production and testing of new varieties of alfalfa.

13. The management of new seedings of alfalfa and ladino clover grass mixtures.

14. Molybdenum deficiencies in soils as related to cauliflower production.

15. Nitrogen fertilization of bluegrass sod.

In developing the future needs it must be remembered that the soil is a dynamic, ever-changing body which is different today than it was yesterday and will not be the same tomorrow as it is today. Plants, too, are continually undergoing change; new varieties are being developed and the old ones are becoming less valuable. Changes in the needs for agricultural raw materials make it essential that the new materials be evaluated and methods be worked out for their economic production. Furthermore, new materials which may be applied directly as fertilizers, or incidentally, as pesticides, need testing for their effect on soils and plant growth.

(continued on page 22)

FOLIAGE brightness indicates advantages of early nitrogen application to pastures on University Dairy Farm. Crops and soils, fertilizers, are agronomy studies.

animal husbandry

THE Animal Husbandry Department has three main sections—Animal Husbandry, Poultry Husbandry, and Animal Pathology.

Duties of the department consist mainly of the training of students and conducting experimental work. Some time is also given to the Extension program by various members of the staff. The college, or student training undergraduate programs are outlined to give students basic training in Animal Husbandry and Poultry Husbandry, and a two-year pre-veterinary science curriculum. Graduate work is offered leading to the degree of Master of Science in Agriculture. At the present time preparations are being made to offer graduate students an opportunity to continue work leading to a Ph.D. Degree in Animal Science.

ANIMAL HUSBANDRY

Cattle

Work in connection with the feeding of grain with grass for finishing both yearling and two-year old steers has shown that both the market grade and price of cattle are increased, usually at a profit.

Comparisons of corn and grass-legume silages for wintering beef cows over a five-year period has shown that a pound of dry matter in a grass-legume silage is equal to a pound of dry matter in corn silage.

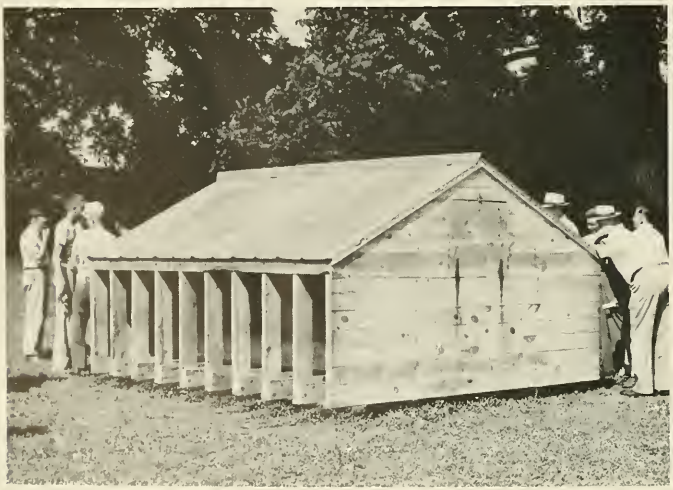
Silage preservatives, as a rule, have not improved grass-legume silages over the wilting method.

Present cattle feeding projects are designed to test various protein and mineral supplements when fed with low grade hays. Experiments are also being conducted to determine the value of creep feeding in the production of quality feeder calves. In other trials newly developed silage preservatives are being tested.

Sheep

Corriedale rams used on native Hampshire-type ewes improved the fleece weight and length of fiber of their offspring over their mothers. The weight increase varied from 40 to 50 per cent.

RESEARCH in animal nutrition includes feeds and feeding equipment. Animal husbandmen strive for increased efficiency in production of sheep, swine, cattle.



Grade Corriedale western ewes proved much superior to native Hampshire-type ewes for the production of market lambs and wool.

Studies are being made of the relative value of grass-legume silages as against hays for wintering breeding ewes, the birth weight of lambs as related to future gains, and the building of ewe flocks by the use of grade western ewes and Hampshire, Dorset, and Corriedale rams.

Swine

Experimental work with brood sow rations definitely shows that baby pig losses can be reduced by feeding sows balanced rations during the gestation period.

Modern rations to growing pigs have produced gains of more than two pounds per day. Some experimental rations have produced 100 pounds of gain on 350 pounds of feed. Pigs fed such rations reach 200 pounds in weight when between 4 and 4½ months of age.

Meat studies are in progress to determine if the rancidity of pork and turkey fats can be prevented. Also, studies are in progress to determine best methods of cooking for freezer holding, etc.

POULTRY HUSBANDRY

Breeding

Selection methods have been compared for the improvement of broiler qualities in New Hampshires. This information was utilized when the West Virginia Poultry Meat Plan was adopted in 1948. In 1953 more than 42,000 pullets with improved broiler qualities were selected under this plan for use in hatchery supply flocks.

Crossbreeding is now being studied as rapidly as facilities will permit, as a possible method for improving both reproductive and broiler qualities.

Deformed keelbones in White Leghorns have been found to be the result of both hereditary and environmental factors. At the end of the brooding periods, the deformed or crooked keels were found only on birds having access to roosts. Resistance to the deformities from roosting was increased by selection.

Breeding work with turkeys at this station showed that crossing varieties of turkeys increased hatchability.

Management

The results of studies indicate that feeding and management prac-

(continued on page 18)

dairy husbandry

THE DAIRY Department has done some very worthwhile research which should be helpful to State dairymen. The research has included studies on oxidized flavor of milk; on the manufacturing of sweet curd cottage cheese; on mineral requirements of growing dairy heifers; on diseases in dairy cattle, especially such diseases as Brucellosis, mastitis, and shy breeding; on the feeding of thyroprotein to dairy cattle; on the growing and utilizing of pasture and forage crops; on the effects of prepartum milking; on the growth and development of dairy animals; on the size and kind of stall best adapted to dairy cattle; on the keeping quality of milk in home refrigerators; and on the breeding of dairy animals.

In recent years, perhaps the results of the breeding project have been of greatest benefit. These results have been published in numerous scientific journals and in Bulletin 339 of the Agricultural Experiment Station. This bulletin summarizes the results of more than twenty-five years of breeding research, combined with studies made in cooperation with the National Ayrshire Breeders' Association. The bulletin includes the results of the continued use of proved sires, and the various things that are necessary in proving a sire and the making of his proof effective. It also shows what should be looked for in the selection of a young unproved sire. It gives results, on a broad basis, of type classification, and how such a program may be used to best advantage. Many of the results of this project have been nation-wide in their influence. They have helped with the approved bull and approved dam programs of the national breed associations, and the results have been used by many Artificial Breeders' Cooperatives as an aid in the selection of their sires.

Present Program Varied

The present research program in Dairying is wide and varied. The long-time breeding project, started in 1922, has been revised several times. A study now is being made to compare the use of young bulls, selected on a study of their complete pedigree, with the use of a proved bull. This study has led into a project in cooperation with the Artificial Breeders' Cooperative in which unproved bulls are being selected by pedigree and sampled and then put aside until their daughters come into production. The final selection is made by using the best of those sampled. Such a study should be a great help to the bull selection committees of the Artificial Breeders' Cooperative.

Another breeding project, involving the use of the Jersey herd, is also being carried out. It is an attempt to breed a herd of high-milk-producing Jerseys by culling those animals from the bottom of the herd which do not meet certain requirements as to milk production without regard to their fat test.

In connection with the breeding work, a study of the breeding history of the entire University dairy herd is being made and will be ready for for publication in a short time.

Calf Feeding Project

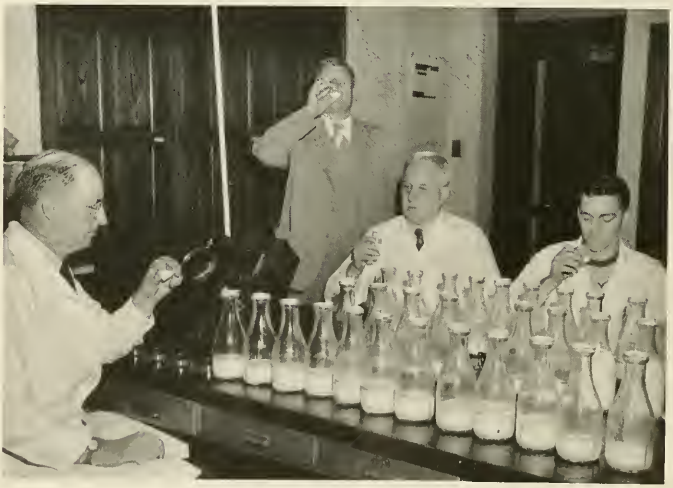
An interesting study is being conducted in the feeding of calves. One group of calves being fed heavy on grain and light on hay, and a second group being fed light on grain and heavy on hay, are being compared with a group fed a normal amount of hay and grain. One-half of the calves in each group are being inoculated with cud from a cow to see if there are any benefits from such a practice. So far, very little advantage has been found for cud inoculation.

Other important projects include a study on the effect of the size and construction of cow stalls on milk production and the causes of shy breeding and sterility in dairy cattle. These studies are being carried on in cooperation with the Departments of Agricultural Engineering and Animal Pathology respectively.

In the manufacturing section of the Dairy Department two projects of particular interest are being conducted. A study has been made of the keeping quality of milk and cream in home refrigerators. A new product known as 1 + 2 milk (1 per cent fat + 2 per cent added solids) has recently come on the market and a study is being made to determine its keeping quality in home refrigerators under ordinary home conditions. A second study on the effect of water hardness on the action of cleaners for dairy utensils is yielding some interesting results.

(continued on page 27)

TASTE-TESTING panel evaluates keeping qualities of milk. Dairy research includes milk production and manufacturing and preservation of quality products.



forestry

WOOD, WATER, and wildlife, in short, all forest resources are the concern of the Division of Forestry in its educational and research work. West Virginia's forests occur from the Canadian life zone with spruce, balsam, and black cherry on the higher mountains to the southern yellow pines and hardwoods of the lower Ohio River Valley counties. With such widely differing conditions of growth, topography, and markets, it has been necessary to develop several research and demonstration forests in various parts of the State so that new ideas for managing forests might be tested for practicability under the conditions in which they might be used.

Accordingly, six forests are being developed: the University Forest Division of Cooper's Rock State Forest and the University Farm Woods near the campus in Monongalia County; the Tygart Valley Forest in Randolph County; the Meadow Creek Timber Management Area in Greenbrier County; the Island Creek Experimental Forest in Mingo County; and the Winding Gulf Experimental Forest in Raleigh County.

Timber Production Research

In the University Forest and in the Farm Woods near Morgantown, research is carried on in timber production and wildlife management. It has been shown that the most profitable height growth for yellow-poplar is two clear merchantable logs. It was also learned that severe thinnings of this species may be accomplished without shock injury, and that there are pronounced and immediate influences of rainfall on the growth of yellowpoplar under conditions of good soil drainage.

One of our serious planting problems has resulted from the spoil banks left after strip mining of coal. Strip mining of iron ore more than seventy years ago created similar spoil banks on what is now the University Forest. It was found the tree growth on these old spoils did not differ greatly from that on neighboring undisturbed soil.

The West Virginia Conservation Commission has cooperated very effectively in carrying out projects on the University Forest. Research in progress on the experimental forests near Morgantown is designed to answer such questions as: How may the cut-over, burned-over forests now in pole-size sprout growth be handled most profitably? There are several hundred thousand acres of such young forests in West Virginia. It is hoped that a large series of plots upon which the timber has been cut in different ways will give the answer.

Planting Study Underway

Some of the burned-over forests in West Virginia are growing up to weed areas of thorn-apple, black gum, sourwood, and grape tangles. How may these be converted cheaply into forests of oak, yellowpoplar, sugar maple, or other desirable trees? A cleaning and planting study involving heavy machinery and weed poisons may help provide the necessary information.

One of the more serious factors which contributes to loss in plantations, especially hardwoods, is damage by rodents and deer. A planting of several different species has been treated with animal repellents to determine their protective effectiveness.

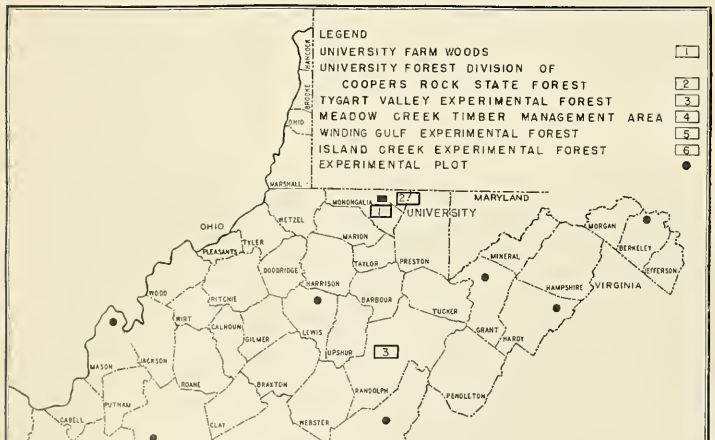
There are numerous and widespread areas in West Virginia where few or no young trees may be found in spite of an ample supply of seed. There is no apparent reason for the failure. This is especially true of the oaks. A study is being made of the factors which hinder the reproduction of hardwoods. It may be learned how to cut them in a logging operation so that reproduction of desirable species may be assured.

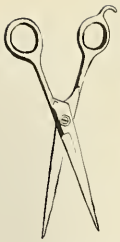
Southern W. Va. Research

On the Island Creek Experimental Forest, operated in cooperation with the Island Creek Coal Company, a comparison of various forestry practices is being made together with a survey of markets available to southern West Virginia timber operators. The forests of southern West Virginia are potentially among the most profitable timber areas in the United States.

(continued on page 18)

EXPERIMENTAL FORESTS and plots of the West Virginia University Agricultural Experiment Station are well distributed in important forest types of the State.





home economics

THE DIVISION of Home Economics has contributed to two publications of the West Virginia University Agricultural Experiment Station during the past year.

Circular No. 92, which describes the design and uses for an adjustable-height table and Bulletin No. 368, a report on studies of Farm and Home Business Centers, were published in June, 1954. Both publications report research done cooperatively with Agricultural Engineering as a part of the Northeast Regional investigation on housing. Both bulletins are illustrated by photographs and drawings.

For the current year home economics will continue as one of the University cooperators in the nutritional status study which is part of the larger study undertaken cooperatively by six states in the Northeast Region.

New Textiles Project

A new project in textiles has been initiated this year. The Division of Home Economics will study qualities in blouses, with special emphasis on the relationship between qualities considered in selection and satisfactions found in wear. This is a supporting project for the Northeast Regional project titled "Selection and Use of Selected Items of Clothing With Emphasis on Blouses and Skirts."

Home economics will also be working with Agricultural Economics in a study of Rural Population Dynamics. This is a supporting project of another Northeast Region study. Population changes have an effect on family life and it is hoped that information relative to such changes may be useful in understanding modern families and provide background information for future studies in family life.

Home economics, like agriculture, is not a simple subject. It is a complex of disciplines often interrelated both within home economics itself and with agriculture. Like agriculture, home economics depends upon the basic principles and techniques from the biological, physical, and social sciences as well as from the arts.

Family Life Emphasized

From the beginning home economics has been concerned with family life. It has attempted to find better ways of providing for the physical, economic, and spiritual well being of families and family members. Research in home economics therefore seeks to add to the sum total of knowledge which will contribute to the fostering, improvement, and maintenance of good homes.

It is the responsibility of research in home economics to find ways in which families may provide for their needs and desires in a changing world. Research in home economics or cooperative research between home economics, agriculture, and industry is needed to determine what goods and services are required by families. Research can also indicate in what amounts these are needed, since families today function more as consumers than as producers. Research in home economics needs to make available to families information which they can use in making decisions and choices. Such information may be used in selecting, using, and caring for such things as food, clothing, home furnishings and equipment. Families need information which will help them judge quality and be economical of time, energy, and money.

Research Aids Educators

Families need help from research in home economics and related fields in the area of human relationships. They need to know what qualities, characteristics, and behavior patterns in homes and communities are most likely to contribute to the development of wholesome personalities and stable homes in a democratic society.

HOME ECONOMICS research includes studies of farm, home business centers.

Research in home economics should provide facts which can be applied by teachers in public schools, by colleges and universities, and by agricultural extension personnel. All of these agencies work directly or indirectly with families. They furnish information which will help families make wise decisions. When the facts supplied by research are applied by members of the family, improved home and family life should result.

There is a great dearth of personnel trained for research in home economics, and one of the important contributions which home economics research can make is to assist in training future research workers.

So far, research in home economics at West Virginia University has been largely cooperative. Home economics has not, in general, assumed a leadership role. It is desirable that this cooperative research continue, but it is also desirable that home economics at West Virginia University undertake some independent research and perhaps give leadership in some of the cooperative ventures. If this is to happen, the Division of Home Economics will need increased space and equipment, additional personnel, and greatly increased financial support.

Encouragement Needed

In addition, home economics will need the support and encouragement from colleagues in agriculture who, on the basis of years of experience in a wide variety of research

(continued on page 23)

horticulture

HORTICULTURAL research at the West Virginia University Agricultural Experiment Station becomes more comprehensive each year. At one time this station's research centered around three crops—apples, peaches, and potatoes. Now it deals with apples, peaches, potatoes, tomatoes, cauliflower, beans, sweet corn, blueberries, strawberries, chestnuts, walnuts, lilies, azaleas, holly, Rhododendron, and Amelanchiers. In the near future, research will be initiated on the storage of packaged cut flowers and floricultural nutrition. Because of their commercial importance, apples, peaches, potatoes, and tomatoes continue to receive the greatest amount of attention from the Experiment Station workers in Horticulture. The apple research program alone requires the services of two full-time technicians.

Current experimental work on apples deals with chemical thinning, color sprays, apple juice blends, and tree nutrition.

Chemical Fruit Thinning

A successful program incorporating chemical fruit thinners or growth hormones applied in the form of spray to apples would represent an estimated annual saving of some $600,000.00 over hand thinning. The total net gain would amount to nearly 12 per cent of the value of the crop and could well represent the difference between profit and loss to the fruit grower.

Active research on chemical fruit thinners has been in progress at the Kearneysville Substation since 1950. Numerous materials have been tested, ranging all the way from the tar oil derivatives and dinitro compounds to such herbicides as 2-4-D and Chloro-I.P.C. Physical measurements as fruits per 20 ft. of growth per tree, fruit size, fruit color, yield, terminal growth, leaf area and chemical analysis of leaves are being studied. All possible combinations of the foregoing factors are being used in order to determine their relationship to the degree of thinning induced by various compounds at various concentrations and different dates of application. From such information it should be possible in two or three years to present to the growers of this State a well-defined practical program of fruit thinning by chemical means on both apples and peaches.

Apple Juice Being Studied

Most of the apple juice on the grocer's shelf is rather tasteless, hence it is a poor competitor with other fruit juices. If a satisfactory kind of apple juice were developed by the addition of crab apple juice or other materials, then the increased consumer demand for apple juice should provide the apple industry with a greatly expanded outlet for its fruit. Our efforts at West Virginia University have been directed toward the improvement of apple juice by the additions of crab apple juices, malic acid, tannins, carbonation or a combination of all the foregoing. Considerable improvement has been made in the taste quality of apple juice, and it is hoped that before long certain definite suggestions can be made to the apple industry.

Some of our apple varieties do not develop sufficient color for them to compete successfully on the fresh fruit market with apples grown in other regions. This is particularly true with the common Red Delicious, Golden Delicious, and Grimes Golden. Earlier work of Dr. R. B. Dustman of this Station indicated the value of thiocyanates in the development of apple color. In the last few years thiocyanates, in combination with 2,4,5-Tp, a pre-harvest "stop-drop" material, seems to offer greater promise for the improvement of apple color than either of the materials alone. With this in mind the above combination has been used at Morgantown and at Martinsburg to determine its possible value to the orchardist. In addition, other materials or combinations of other chemicals with the above are being tried to find a spray that would definitely increase the red color of red apple varieties and the amount of yellow pigment in "green" apple varieties such as Grimes Golden and Golden Delicious.

SPECIFIC gravity, related to potato quality, is measured for improvement study. Studies include fruits, flowers.

Apple Measles

Several different items are being investigated in relation to apple tree nutrition. In a commercial orchard lime treatments have been made to young Red Delicious trees with measles. This work looks promising as a means of reducing or possibly eliminating measles from this experimental block. In the Morgantown orchard the effect of injections of certain chelates is being investigated from the standpoint of recognizing toxicity symptoms as well as corrective dosages in case of a mineral deficiency. A soil conditioner with and without a complete fertilizer has been applied around certain trees in the Morgantown orchard to ascertain the possible value of a soil conditioner and heavier fertilizer applications on poorly drained and poorly aerated orchard soils.

The use of Urea or Nu Green sprays as a method of meeting the nitrogen needs of apple trees was investigated. This method cannot be substituted for the usual ground application of fertilizer. It also caused fruit russeting when combined with certain fungicides.

(continued on page 22)

plant pathology, bacteriology, and entomology

THE DEPARTMENT of Plant Pathology, Bacteriology, and Entomology is responsible for the teaching and research work dealing with plant diseases, insects, and bacteria as they are related to agricultural problems. These three subjects are rather closely related in that the microorganisms which cause plant diseases and those dealt with in agricultural bacteriology are very similar. Also, both plant pathology and entomology deal with the protection of our agricultural crops from various types of injury. The department teaches not only undergraduate students in Agriculture, but also offers graduate work in plant pathology, bacteriology, and entomology. At the present time, twelve graduate students are being prepared for professional work in these fields.

In addition to the teaching and research, the department is responsible for the subject matter phases of Extension in plant pathology and entomology. One Extension specialist is stationed at the Kearneysville Substation and handles the Extension work dealing with diseases and insect pests of orchard fruits. Another specialist, with headquarters at Morgantown, is responsible for Extension work in all other aspects of plant pathology and entomology.

The scope of the work of the department may be seen more readily from the following diagram:

TEACHING

Plant Pathology: Undergraduate
Mycology: Graduate (M.S. and Ph.D.)
Bacteriology
Entomology

RESEARCH

Plant Pathology: Diseases of Fruit Crops
Diseases of Potatoes and
Diseases of Field and Forage Crops
Diseases of Forest and Shade Trees
Mycology: The Physiology and Genetics of Fungi
Bacteriology: Soil Bacteriology
Entomology: Insects of Orchard Fruits
Insects of Potato and Vegetable Crops
Insects of Field and Forage Crops
Insects of Forest and Shade Trees

EXTENSION

Insects and Diseases of Orchard Fruits (Kearneysville)
Insects and Diseases of Other Crops
Insects Affecting Animals

The research work of the department is concerned primarily with solving the practical problems of agriculture in West Virginia, but it also conducts basic research in several fields. Such basic research may not have an immediate practical application, but it adds to the storehouse of knowledge which eventually contributes to the progress of agricultural science. Foremost among this type of research is that dealing with the physiology of fungi. This work deals with the study of life processes of fungi and bacteria, and the work during the past ten or fifteen years has contributed much to the development of our knowledge of the physiology of microorganisms. It has resulted in the publication by two members of the department of the first comprehensive textbook on the physiology of the fungi and has given the workers in this department an international reputation.

Sprays Studied

One of the principal duties of the department is to test the many new fungicides and insecticides that have become available and to work out spray programs for the most effective control of insects and plant diseases. This department is responsible for the many spray experiments conducted at the Kearneysville Substation, where spray programs for the extensive fruit industry are worked out.

Similar spray experiments are conducted on vegetable crops, field crops, and small fruits in various parts of the State. Results obtained in these experiments serve as the basis of our recommendations to the farmers for controlling diseases and insect pests of these crops. One of the outstanding contributions in this field has been the testing and recommendation of a general-purpose spray and dust for the home garden, as published in Bulletin 365T, *A General-Purpose Garden Pesticide*. This spray formulation

(continued on page 21)

PLANT PATHOLOGISTS test chemicals used to control insects and plant diseases. Numerous plots are needed to test application rates and strength of chemicals used.

LOCALLY HIRED teamsters skidded logs from stump to the truck loading points.

COMPARTMENT I after cutting. Seed from on the Compartment and from trees on adj uncut areas are establishing tree reproduc

forest research on the Island Creek Experiment

By A. W. Goodspeed, Forester

ON OCTOBER 3, 1951, an agreement establishing a 3,000-acre research forest in Mingo County was made between the Board of Governors of West Virginia University and the Island Creek Coal Company of Huntington, West Virginia. The agreement runs for ten years and has provision for permitting renewal at the end of the period. The purpose of the agreement was to provide a suitable area under stable ownership where forest production and utilization procedures could be carried out under realistic circumstances.

To prosecute the forestry work under the terms of the agreement, a project entitled "Timber Management for the Market Demands in Southern West Virginia Forests" was set up by the Division of Forestry of the Agricultural Experiment Station. The broad purpose of this project is to determine timber product goals for southern West Virginia hardwood forest types, and to devise and test systems of stand management capable of producing desirable timber suited to the needs of the forest owners. A full-time professional forester is stationed at Holden, a location which permits him to direct the forestry operations in close association with cooperating Island Creek Coal Company personnel.

Area Description

The 3,000-acre forest is located near the town of Dingess and was selected by the University as representative of the region in topography and in timber resources. It lies in steep hilly country typical of most of southern West Virginia and of eastern Kentucky. Topography divides the tract into five natural logging units ranging in size from 250 to 750 acres. The operational history of the forest is characteristic of the region. Cutting in the past took the better trees and left the poorer, a procedure commonly called "high grading." The last cutting on most of the forest was completed about forty years ago. Basal injury to trees of all ages in the present timber stands indicates the frequent occurrence of fires in the past.

The 553-acre Paw Paw logging unit was selected for the initial operation on the forest. This unit consists of the drainage of Paw Paw Branch of the left fork of Laurel Fork and Pigeon Creek, in Mingo County. The major drainage of Paw Paw Branch is to the northwest, but all aspects are represented among the smaller hollows within the unit. Elevation above sea level ranges from 850 to 1,750 feet. The ridge tops are generally 800 feet above the valleys with slopes ranging from 45 to 75 per cent. More than 90 per cent of the area is made up of these steep slopes, with the remainder taking the form of narrow ribbons of gently sloping land along the valley bottoms and a few gently sloping ridge tops. There are many large rocks and fall rock hollows.

The forest cover types of the Paw Paw unit are Appalachian hardwoods. These occur principally in the form of even-aged stands although some, as a result of past cutting and fires, may be considered uneven-aged in character. Poor oaks and hickories occupy the exposed

;EL-POWERED sawmill easily cuts 10,000 board feet per day.

END-STACKING lumber speeds drying and prevents staining.

Forest

drier sites, while oaks, yellowpoplar, beech, basswood, black gum, and maples are found on the protected moist sites and in the coves at the drainage heads.

A careful inspection of the Paw Paw unit revealed many trees which were over-mature, defective, or of undesirable species, a common situation in the region. This suggested that the first operation should be an improvement or conditioning cut designed to remove these trees and leave the unit in better shape for future timber production. This cutting is now being completed on the unit.

Forest Products Manufactured

All merchantable material cut from the Paw Paw unit has been manufactured into marketable forest products. However, because of past cutting practices, a large amount of inferior species, particularly beech, was found in the stands. Also, many large trees were so defective as a result of past fires that they were unmerchantable. Plans to eliminate the worst of these poor trees by poisoning will make the area they now occupy available for growing better timber.

Planned forest production involves the application of silvicultural systems to the forest stands. These systems include definite methods of cutting and regenerating the forest. Four such methods were selected for trial in the Paw Paw unit. They are as follows:

1. Seed trees method—Produces an even-aged stand. Suitable for light seeded and light demanding species. Existing stand is removed except for seed trees of desirable species which provide the reproduction.

2. Shelterwood method—Produces an even-aged stand. Suitable for heavy seeded and light demanding species. Old stand is removed in successive cuts and reproduction is established in the openings created. The remainder of the old stand is removed when reproduction is established.

3. Selection method (10)—Produces an uneven-aged stand. Suitable for many species if carefully applied. Old trees removed from the stand as individuals or in small groups at approximately 10-year intervals.

4. Selection method (20)—This is similar to the preceding selection method except that the cuts are heavier and the period of return is about 20 years.

Methods Under Study

Although the current cutting on the Paw Paw unit is essentially a forest conditioning operation, every effort was made to start the establishment of the silvicultural methods just described. To accomplish this the unit was sub-divided into twelve definitely defined compartments and one silvicultural method was assigned to each of three compartments, thus providing a desirable replication of each procedure. Future cuts will attempt to develop the assigned method in each compartment. In allotting the silvicultural methods to the compartments all possible advantage was taken of existing stand conditions. The shelterwood method was assigned to compartment 12, for example, because there existed an over-story of oak under which there was well-established reproduction.

Trees Marked

When the silvicultural methods had been assigned, a 100 per cent tally of all trees 12 inches in diameter breast high (d.b.h.) and over was made for each compartment. Trees to be removed were marked with yellow paint and their tally kept separately from those to remain. Subsequent operational records have been kept by compartments to permit a comparative evaluation of the results.

The experimental layout of the compartments and the timber volumes selected to be cut and left in thousand board foot units (MB.F.) are presented in Table 1.

The timber cutting and sawmilling operation is being performed ac-

(continued on page 20)

FIELD DAYS

A PICTURE is worth a thousand words, someone once said, and seeing for oneself is worth a thousand pictures. That is why the West Virginia University Agricultural Experiment Station feels that the "Field Day" is one of its most important public services.

Field Days accomplish a number of objectives. In the first place, they permit the farmer . . . who as a tax-payer helps foot the bill . . . to visit the scene of the research and see what he's getting for his money. Secondly, they permit him to observe the latest in agricultural techniques and to hear firsthand the findings of agricultural research and how they are going to affect his own personal farming program. At the same time he will broaden his agricultural knowledge by sharing experiences with other farmers, and by discussing his problems with Experiment Station workers who are vitally interested in solving all problems of agriculture, whether they be in producing, harvesting, storing, or marketing the things the farmer grows.

At the same time, Field Days help the research worker. He is able to talk to farmers, who by their very presence indicate their interest and their desire for better farming. He is able to learn of their problems and the research needed to solve them. He can also test ideas, for farmers are quick to spot the value of an idea and help develop it along lines that are useful and practical.

Some people think that discussion of mutual problems is the first step . . . and the biggest step . . . in arriving at a solution. Field days are ideal for this sort of thing . . . because they bring together the farmer, the researcher, and all of the people in between, where they can discuss and plan for a better farm living through wider agricultural knowledge.

DRESSED BIRDS at this Poultry Day display demonstrate results of the Random Sample Broiler Test. Research results are featured at Field Days.

CONTROL and data recording instruments, used in windowless poultry house project at Poultry Farm, are explained to a Poultry Day visitor.

IRRIGATION system, installed at the Reymann Memorial Experimental Farms, provides water for crops during dry seasons.

School Climate: Assessing a Universal Intervention Design to Reduce Academic Risks and Educate the Whole Child

OBSERVATION of actual research plots, with explanation and discussion by the project leader, permit Agronomy Day visitors to see experimental methods, results at Ohio Valley Substation.

SEVERAL West Virginia University Agricultural Experiment Station Field Days are held annually. In the last week of June, Dairy Day attracts many farmers, dairymen, and townspeople to the University Dairy Farm where they inspect the University herds, see and hear the results of the year's research, and hear an outstanding guest speaker.

Agronomy Day, held at the Ohio Valley Substation near Pt. Pleasant, provides opportunity for farmers, agricultural workers, and seed and fertilizer dealers to see research in forage and grain crops and experiments in plant pathology and entomology.

Poultry Day, held alternately at the Reymann Memorial Experimental Farms near Wardensville and the University Poultry Farm near Morgantown, is devoted to reporting results of research in poultry production, pathology and marketing.

Animal Husbandry Field Days and Agronomy Field Days are held on alternate years at the Reymann Memorial Experimental Farms. Horticulture Field Days are held on occasion at the Kearneysville Substation for the benefit of fruit growers in the panhandle.

All departments of the Experiment Station cooperate to make each Field Day a success.

NEW BUILDINGS and installations are featured on Field Day programs. Visiting poultrymen inspect feed-mixing facilities at Reymann Farms.

A LONG-HAY blower is demonstrated at WVU Dairy Farm. Field Day visitors see experimental model equipment designed to make farming easier.

FORESTRY

(continued from page 10)

It is hoped that the work on the Island Creek Experimental Forest will help landowners south of the Kanawha River to put their fertile mountain sides into profitable production. This work in Mingo County is described in detail elsewhere in this issue of *Science Serves Your Farm*.

The work on the Tygart Valley Experimental Forest has just been started with an inventory of standing timber, and a division by compartments according to natural logging units and timber types. A comparison of forestry practices in this northern West Virginia forest will be made as soon as the trees have matured sufficiently to make such operations practicable.

The Meadow Creek Student Management Area is an 80-acre tract heavily stocked with mature white pine and mixed oak. It is a unit of the Monongahela National Forest reserved by the U. S. Forest Service for study by the students in the University's Division of Forestry. These students spend one summer at Camp Arthur Wood, the University's forestry summer camp, which is located nearby. They carry out a small logging opeartion of their own under the supervision of experienced timber cutters and loggers. Working through the District Ranger, the students purchase a small block of marked timber, for which they pay current stumpage prices. After they have operated the timber the students sell the logs to local sawmills. Research data are taken by the students on each cutting unit and on every tree felled. This single project provides practical experience in surveying, topographic mapping, timber estimating, timber marketing, stumpage purchase, planning of logging operation, felling, bucking, swamping, construction of skidways, skidding, scaling, and sale of logs. Proceeds from the operation are divided equally among the students who participate. The whole project constitutes a research effort in new forestry teaching methods.

Landowners Aid Study

Some problems can only be solved by the cooperation of landowners widely distributed over the State. For example, it was shown that black walnut trees are helpful to some plants growing in their vicinity and harmful to others; and a study of farm ponds was made possible by the active cooperation of a number of owners. Fish management was studied and helpful recommendations made; the efficiency of multiflora rose as a living fence is being measured under a wide range of conditions; and the timber-marketing practices of owners of small woodlands is being studied with the hope of improving the distribution of different woods and of making their production and marketing more profitable.

There are many forestry questions, particularly in wood technology and forest products, which may be answered by laboratory research. One interesting problem in West Virginia has to do with holding up the roofs of coal mines with wooden pins. It is known that hickory dowels have sufficient strength, but a method of anchoring the upper end of the pin well enough to utilize the full strength of the wood has not been devised. The first job seemed to be that of standardizing a method of testing mine pins. With this finished, the next task is to complete the tests of all wooden roof pins that have been developed. If a successful method could be found for utilizing wood mine pins, it would furnish a market for hickory, of which West Virginia has an adequate supply.

Mobile Sawmill

There has long been a need for a mobile type of sawmill which could be set up quickly and saw lumber to close specifications. Such mills that had been developed for other areas failed when tried in West Virginia. Two conditions in this State which greatly affect the construction of mobile sawmills are the heavy hardwood logs and the narrow, crooked back roads. These factors dictated a stoutly constructed machine mounted on a trailer hitched closely behind a truck. Such a sawmill was constructed and tested over a two-year period on fifty separate saw sites where it sawed over a million feet of lumber. On these custom-sawing jobs, the costs varied from $10.85 to $18.00 per thousand board feet for well-sawed lumber. These costs were considered very low for the production of high-quality custom-sawed lumber in unusually small volumes per saw-set.

There is much to be learned regarding the care and use of forests before the two-thirds of West Virginia covered with trees can produce its full share of the State's wealth. We need to know a great deal more about the management of forests for water conservation while producing profitable crops of wood.

Future Goals

The Appalachian hardwoods that cover West Virginia include a larger number of valuable species than any other forest region of the United States. The number of species and the extremely rugged topography combine to make the management of our hardwood forests a very complicated problem. It is hoped that West Virginia University's Division of Forestry may advance the knowledge of forest production and utilization to the place where tree farming will be a stable and profitable business, where the logging of timber and the manufacture of wood products will be a substantial share of the West Virginia economy, where the State's forest and streams will produce abundant wildlife, and where the wooded slopes will absorb enough rainfall to maintain an adequate supply of pure water.

ANIMAL HUSBANDRY

(continued from page 8)

tices during the growing period which affect the age at which the pullet begins to lay may have little or no effect on total egg production or mortality. Early laying pullets lay the smallest eggs, while those maturing later because of restricted feeding lay the largest eggs.

Nutrition

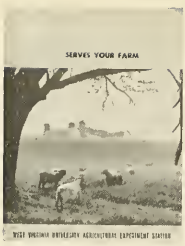
Studies with chicks in the nutritional laboratory have shown that as little as 0.125 per cent of sulfaquinoxaline in a simplified ration to control coccidiosis retarded growth. Penicillin counteracted the growth retarding effect in both fresh and stored feeds. The retarding effect of sulfaquinoxaline was not noted with commercial-type broiler rations.

Hemorrhaging has been causing losses in broiler flocks in this State. This excessive bleeding may be caused by continuous feeding of high levels of sulfaquinoxaline in rations low in vitamin K. Field observations indicate that other factors may be involved, including an infective pathological agent.

Broiler Production

Broiler production problems are being studied in a specially designed brooder house holding 7,600 broilers at the Reymann Memorial Farms

(continued on page 27)



publications and radio

- Your Farm's Future
- Science Serves Your Farm
- Bulletins, Circulars, etc.

ONE of the most important functions of the West Virginia University Agricultural Experiment Station is the publishing of information—information about agricultural research. If experimental results are to be of value, they must be placed in the hands of the farmers, other researchers, extension workers, and all others who use them.

Several different publications are issued for this purpose. Each is designed to tell its story in the most effective manner. "Your Farm's Future," a weekly news release, is a progress report about current research. *Science Serves Your Farm,* the Quarterly Report of the Station Director, carries articles on finished research or phases of current research that are completed. Bulletins, current reports, circulars, and technical bulletins are published as complete reports on finished projects.

All these publications are free upon request to any resident of West Virginia. Station staff members also publicize their work by writing articles for technical journals and magazines.

RADIO is also an important medium for transmitting information from the Experiment Station to the home of farmers and consumers who benefit from agricultural research. Tape recordings, made in the laboratory and at experimental farms, bring news of research, Field Days, and Short Courses to the public.

Radio stations which regularly broadcast tape recordings from the West Virginia Station are WAJR, Morgantown; WPDX, Clarksburg; WJLS, Beckley; WBLK, Clarksburg; WDNE, Elkins; WCHS, Charleston; WMMN, Fairmont; WHNT, Huntington; WZAS, Huntington; WYKR, Keyser; WEPM, Martinsburg; WMOD, Moundsville; WETZ, New Martinsville; WCUM, Parkersburg; WOAY, Oak Hill; WRON, Ronceverte; WEIR, Weirton; WHAW, Weston; WPAR, Parkersburg; and WWVA, Wheeling.

(continued from page 15)

Table 1. Experimental Layout of Compartments and Record of Timber Volumes to Be Cut and Left, Paw Paw Unit

Compartment	Area Acres	Silvicultural Method	Cut M B.F.	Leave M B.F.
1	57	Seed tree	256	97
3	72	Seed tree	238	86
10	26	Seed tree	42	34
	155		536	217
2	57	Shelterwood	159	50
6	25	Shelterwood	79	22
12	34	Shelterwood	77	34
	116		315	106
5	43	Selection (10)	21	40
7	31	Selection (10)	83	81
9	45	Selection (10)	90	62
	119		194	183
4	39	Selection (20)	54	49
8	78	Selection (20)	160	94
11	46	Selection (20)	55	91
	163		269	234
Grand Totals	553		1,314	740

cording to a contract in which the Island Creek Coal Company, the Contractor, and West Virginia University are parties. Cutting started on the Paw Paw Unit in November, 1953, and is now nearing completion. Most of the logging was done by sub-contractors, but is now being handled on an hourly pay basis under the Contractor. Penalties were prescribed in the cutting contract to insure proper operating procedures in the woods, proper utilization of the material cut, and the prevention of unnecessary damage to the trees left. Cutting has been done by cross-cut saws, skidding by teams, and hauling to the mill by trucks loaded from skidways.

Mine Materials Cut

The cutting contract calls for cutting mine materials in such sizes as the Coal Company needs and while so doing to manufacture the maximum possible amount of Number 1 Common and better grade lumber from the more valuable species, thus placing high value material on the lumber market instead of using it at the lower price of mine materials. The Coal Company receives a percentage of the total sales price of the lumber so marketed as compensation for the diversion of this material from mine use. Such an arrangement provides a wide latitude in utilizing the products of the forest.

The Contractor installed on the mill site a Frick No. 1½ diesel circular mill with a power pump for log washing, a log turner, an edger, a double end trimmer, a cut-off saw, a slab conveyor, a sawdust blower, and a mine wedge machine. Much of this machinery is not commonly found in saw mills, but all of it contributes to the manufacture of quality wood products.

The mill site is near but not on the Paw Paw unit. It was selected so as to provide ample space for stacking the lumber as manufactured. This permits air drying the product and also does away with the necessity of forced sales at sacrifice prices, sometimes necessary when storage space is not available. These considerations are important when high-grade lumber is to be produced.

Accurate Sawing Important

Of particular importance in manufacturing grade material is the skill of the sawyer at the mill. Not only must the sawing be accurate to prevent miscut lumber, but also the sawyer must have a good understanding of lumber grades to know how many boards to cut from a log before converting the remainder into mine material. Approval of the sawyer by the University's forester was provided for in the cutting contract. A certain amount of low-grade material must be sawed in squaring up mine materials to the proper dimensions, but a good sawyer can keep this to a minimum.

Each Monday the Contractor receives mine orders for the week from the Coal Company. This mine material must be sound in content, free of bark, and accurately sawed. Delivery at a Company mine or the Company treating plant is required. Each piece is checked by the Company at the time of delivery and rejected if it does not meet specifications. This rigid inspection is a sound policy of the Island Creek Coal Company. However, the sawmill does not get the overrun obtained by other mills sawing mine materials to less rigid specifications. The Contractor is paid the same price for the mine material that the Coal Company pays other mills operating in Company timber.

Grading Practices Differ

The lumber produced by the mill and not used for mine materials is sold by the Contractor at the highest prices obtainable. In the short time the mill has been operating, a considerable improvement has been made in marketing the graded lumber. At the start of the operation checks were made on a number of buyers which revealed a considerable variation in grading practices as between buyers. Some buyers undergraded to an extent that offset the much higher prices they were willing to pay per unit of product. Better results have been secured by selling lumber to firms paying lower unit prices but giving a fair grade to the product. Most of the lumber is graded at the mill and the lower grades are sorted out and sold to local customers for building barns, garages, etc., and for a higher price than can be secured on the grade market.

Air Drying

Air drying sorted lumber in stacks requires from 90 to 120 days. Buyers will pay about $10 per M B.F. more for air dried than for green lumber. The principal purpose of stacking most of the lumber is to have available trailer truck loads of one kind for delivery direct to a purchaser. By holding the lumber long enough to collect sizable quantities of one grade and species, orders were filled at $40 or $50 more per M B.F. than could be obtained by selling green mixed lumber.

During the summer months the lumber from two valuable species basswood and yellowpoplar, tend to blacken when piled in standard stacks. By endstacking the lumber through this period such damage was controlled, and the lumber dried so rapidly that it was salable as air dried lumber after 30 days.

Results of Milling Operation

The results of the milling operation to date are presented in Table 2. The table shows the volume manufactured in thousand board foot units and the average price per volume unit for completed and agreed upon sales. As the operation is currently in progress the data shown are indicative but not final.

TABLE 2. VOLUME MANUFACTURED AND AVERAGE SALE PRICE BY TYPE OF PRODUCT, PAW PAW UNIT

PRODUCT	VOLUME MAN'FD	AVERAGE SALE PRICE
	M B.F.	DOLLARS
Mine timber	1,040	$ 39.56
Low grade lumber	349	50.91
High grade lumber	176	111.05
Totals	1,565	$ 50.13*

*Weighted average sales price.

Cooperative Venture

The research project on the Island Creek Experimental Forest is a new and, in many ways, unique effort to improve forest production and utilization practices in southern West Virginia. While control of the project lies in the Division of Forestry of the Agricultural Experiment Station, the effective prosecution of the work is largely dependent on the active and real cooperation of the Coal Company and the primary contractors involved. This cooperation has been effectively provided.

Objectives

The individual objectives of the research add up to a comprehensive effort to integrate forest production, product manufacture, and marketing into a more efficient pattern than commonly employed, with the controlling consideration that procedures recommended should be practical in nature and suitable for immediate application on similar areas. Experience to date indicates that improved production and utilization practices are feasible. More conclusive results can be expected as the research progresses. New problems, in turn, will arise and attempts will be made to solve them.

It is hoped that the Island Creek Experimental Forest may become valuable to southern West Virginia landowners as a source of information and an example of forestry accomplishment, as well as a demonstration of how interested parties can voluntarily cooperate in an effort to promote the effective use of the forest resources of the State.

PLANT PATHOLOGY

(continued from page 13)

will greatly simplify the control of diseases and pests in the home garden.

Research on Late Blight

Late blight of tomatoes and potatoes is very destructive in West Virginia and has been difficult to control. This department has conducted extensive research on this disease with particular reference to the problem of breeding blight-resistant varieties. The work has involved an intensive study of the pathogenic races of the causal fungus and because of the progress we have made here in the study of this disease, West Virginia University has been selected as a center for coordinating the recent advances in this field. A new blight-resistant tomato variety is now being tested and will be ready for introduction soon.

As a result of the study of the influence of various fungicides and insecticides on the growth of fruit trees when applied to the soil, better methods of control of the woolly aphid on apple trees have been devised. These experiments have also resulted in a recognition of the injury caused to fruit trees by certain species of nematodes. These are now being studied intensively with control measures in view.

Oak Wilt Studies

Since forestry is a very important industry in this State, the department has conducted research in the diseases and insects of forest trees. During the past few years, this Station has made important contributions to the study of oak wilt, proving for the first time that the disease is transmitted over long distances by certain species of insects. New information about the life history of the oak wilt fungus has been obtained, and the symbiotic relationship between the fungus and its insect vectors was recognized and described for the first time. Additional work is being done on disease problems related to yellow-poplar and diseases of forest tree nurseries. Studies are also being made in cooperation with the Division of Forestry on the relation of insects to natural regeneration of oak stands.

The department has also conducted research in the field of forage crops, recently investigating the causes of clover failure with particular relationship to seed production. A new disease, known as *blackpatch*, has been discovered in the State and studied extensively. This disease was shown to be one of the most important limiting factors in seed production in certain areas of the State. Its method of spread through infected seed was discovered. Partial control through seed treatment and crop rotation was demonstrated.

An important research contribution in the field of bacteriology was the discovery and proof that th' acidity of mine drainage waters is dependent upon the oxidation of sulfur by bacteria. It was also shown that the red precipitate of ferric oxide in mine drainage waters is dependent upon a previously unknown species of iron oxidizing bacteria. These discoveries served as a basis for further work on the problem by the Chemical Engineering Department.

Soil Studies Made

A study has also been made of the effect of a number of insecticides and fungicides on the process of bacterial nitrification in the soil. The results (published in Bulletin 366T) indicate that most of the commonly used pesticides are inactivated in the soil quickly enough that no ill effects are likely to result from their use as generally recommended.

In addition to its regular work, the department has made important contributions to national defense through contract research for the Army and Navy. The department has conducted work dealing with: (1) The deterioration of electrical equipment by fungus growth; (2) The variation and stability of certain plant pathogenic fungi; and (3) The chemical and physical properties and biological functions of bacterial exudates.

Plans for Future

Plans for the immediate future call for strengthening the work in entomology, where we have had insufficient personnel for a well-rounded program. More attention will be given to the study of nematodes, which are believed to be more important in reducing yields than has been recognized in the past. Plans also call for more work on the diseases of forage crops and pasture grasses as a needed contribution to development of grassland farming.

HORTICULTURE

(continued from page 12)

West Virginia University Agricultural Experiment Station workers, along with Cornell and Washington State, did the pioneer testing of 2,4,5-Tp, which is the standard stop-drop spray used today in commercial apple orchards. This spray has increased by 10 per cent the amount of hand-picked fruit in orchards where it is applied.

Vegetable Research

Vegetable research takes the full time of one man.

Potato research has been carried on during the last thirty years. Today much of this work is in a national program of breeding selection and improvement. In the near future a new variety will be named and made available to growers. This potato is now known as B2070-30 and is outstanding for West Virginia conditions. It has disease resistance, high yields, excellent cooking qualities, is uniformly smooth, and is a late white variety.

Other potato work has dealt with cultural practices, such as foliar nutritional sprays, chemical weed killers, defoliant sprays, cover crops, and rotations.

Also, vegetable research work has included variety trials with sweet corn, tomatoes, broccoli, and cauliflower. The collection and testing of heirloom beans is now in its second year. A tomato breeding project has produced an outstanding selection which will be named and introduced following more extensive field trials next summer. This tomato selection (X-17) is highly disease resistant and has excellent horticultural qualities which make it superior to several of the now popularly grown varieties.

In some cauliflower research it was found that a small amount of molybdenum would correct "whip tail" on all strains and varieties. Also, a practical method of soil sterilization with MC-2 was developed. This makes grower production of their own transplants requirements profitable.

Small Fruit Research

Small fruit research requires about 50 per cent of the time of one man.

Strawberries are the most important small fruit in West Virginia. One of the perennial problems of strawberry producers for many years has been controlling weeds without an excessive expenditure of time and money. Recently, Crag Herbicide 1 has been used with very satisfactory results. It kills germinating seeds with little if any injury to strawberry plants. When a strawberry planting is cultivated during the early part of the growing season, cleaned up very carefuly as the runners begin to root, and then sprayed with Crag Herbicide 1 at three-week intervals for the rest of the season, weed control is simplified considerably. The material is used at the rate of four pounds per acre per application on heavy soils, and two to three pounds per acre on lighter soils.

Frost injures the strawberry crop in West Virginia to some extent at least one year out of two on the average. Preliminary Station studies with the use of rolls of water-resistant paper for covering in frosty periods indicate that this may be a practical method. Certain difficulties in application, weighting, and removal of the paper still need to be worked out before definite recommendations can be given.

Blueberry Breeding Project

In 1938 a long-range breeding project was begun on blueberries with the hope of obtaining varieties that would be suitable for growing on some of West Virginia's acid soils. Selections of high quality and satisfactory size and color have been obtained, but are not yet ready for naming.

Research in ornamental and nursery crops is a new phase of work in horticulture which was initiated at the request of State garden clubs, the Nurserymen's Association, and West Virginia florists.

To date six new lily varieties have been selected, named, and placed in trade channels. Techniques have been developed for easier propagation of azaleas and hollies. Also, a holly breeding and pruning project is in progress which should be productive of better types and methods.

Research on nut trees has been reactivated.

An inexpensive method is being tested for establishing a properly placed orchard of improved varieties of nut trees without transplanting shock.

Chestnut Research Continues

On a limited scale, seeds are being gathered from apparently resistant American chestnut trees still surviving in West Virginia. A block of several hundred young American chestnut trees grown from these seeds is under observation for possible blight resistance.

Grafting or budding chestnut trees is unsatisfactory because union is usually defective, and the tree dies after a period of years. Research is being conducted in rooting chestnuts from cuttings. Results are encouraging.

The chestnut program is seriously handicapped by lack of both facilities and personnel.

An outlay of three thousand dollars for expanded facilities, and twenty-five hundred dollars each year thereafter should prove adequate for labor, supplies, and maintenance in a greatly improved program. This project has the support of some rather important public leaders in West Virginia.

Future Needs

As to future needs in the horticultural research program, capital expenditures on a new greenhouse and some rather expensive modern scientific apparatus should be at the top of the list. Without such facilities additional sums spent for personnel, supplies, travel, and maintenance would not be economical. Today's research requires accurate temperature, atmosphere, light, and humidity controls. It also requires apparatus that permits comprehenhive analysis, pilot plant evaluations, and tracer element diagnosis. The topography, soil, and climatic variations in West Virginia present problems of plant adaptation to be solved through research that are more complex than those found in other states. In the future, West Virginia must contribute more to the State's food and fiber supply if the population increase due to the great industrial development along our rivers is to continue to enjoy its present level of good living.

AGRONOMY

(continued from page 7)

With these factors in mind the needs of the future may be briefly outlined as follows:

1. Soil classification — An inventory of present soil resources. The Soil Conservation Service is now providing all of the information being secured in West Virginia. This should be a cooperative project with the State furnishing its share of the personnel and costs of such an inventory.

2. Soil fertility studies—Information is needed from field studies on the status and improvement of the fertility of West Virginia soils to enable us to produce optimum crops. This will require numerous tests in cooperation with farmers as well as long-time experiments on State owned and operated substations at strategic locations in the State.

3. Soil management studies to determine how various practices influence the economic production of crops and the maintenance of productive soils.

4. Greenhouse and laboratory studies of soil fertility status. Experts in classification have separated more than 100 different soil series in West Virginia. In addition to field trials on some of the more important ones, there is also needed some greenhouse and laboratory studies on the others to help secure optimum fertility and production on all lands.

5. Forest soils studies. Because much of the land in West Virginia is best suited for forests, information of such soils is needed to secure optimum production of forest products.

6. Crop varieties. The development of new varieties of field crops which will add to the productive capacity of West Virginia farmers is an important phase of work which needs expansion. Although forage crops are most important because of the acreage involved, there is also need for the development and testing of all field crops to aid in securing the optimum production on each farm.

7. Crop management. New varieties or kinds of crops and new uses make continuing studies of crop management imperative in order to realize the maximum value of crops. Weed control, as one phase of management, needs additional research as new chemicals are produced.

8. Pasture and forage crops. With most of the farm income from livestock or livestock products, and with pasture, hay and silage, furnishing the major portion of the feed for the various kinds of livestock produced, much research is needed on species, varieties, and management of these crops to enable farmers to produce the feed necessary for efficient livestock production.

In addition to the above, which are primarily local or State problems, there is a vital need for work on fundamental problems in Agronomy and Genetics in which West Virginia takes its part along with other state experiment stations and the federal government.

AGRICULTURAL ECONOMICS

(continued from page 5)

of machinery, and the farm for many is a place to live or a place to return when industrial work is slack. Much of the poor farming seen in West Virginia is the result of a lack of genuine interest in agriculture on the part of many who live on the land and are called farmers.

We are constantly seeking information which will enable us to call attention to improvements in management of farms. For this purpose we have been studying the economic factors which cause seasonality of milk production on farms, the use of lime and fertilizer on farms, custom rates for farm jobs, and hay making practices.

4-H Clubs Being Studied

Our research has hardly touched the sociological problems of the rural people. For some time we have been studying the organization of 4-H clubs to learn what type of organization holds promise of best results. We are getting some answers.

Recommended and proven farm practices are superior to many that are carried on at the farm level. In two counties we tried to learn how and to what extent recommended farm practices have become diffused among the farmers. The project has not yet been completed.

Most of the research discussed above has not been completed. We will continue to work next year on certain phases of the marketing of our major agricultural commodities. As new work, we have underway a study of the utilization of rural manpower in the ten counties comprising the Upper Monongahela Valley and a study of the economies of forage production in the Eastern Panhandle of the State.

BIOCHEMISTRY

(continued from page 4)

tation of animals, improving the flavor of apple juice, preventing rancidity in carcass fats, and peptide growth factors.

Two Types of Research

Some of the projects mentioned are examples of what we call applied research. By that we mean that if we are successful in attaining the objectives of the project, the results may immediately be used in ways that will be of obvious value. Other projects represent more fundamental work. The application of this type of work is not always immediately apparent, but usually the results lead to developments of far greater value than anyone could have foreseen. Both applied and fundamental research are needed if farmers are to continue to improve their welfare and increase their productivity as they have in the past fifty years. Applied research cannot long continue to be productive unless additional basic information is developed by fundamental research.

Needs Explained

To be most effective in serving West Virginia agriculture, this department needs to expand its research program both in cooperation with other departments and in the fundamental studies which are often carried on by this department alone. One of the urgent needs is for a better laboratory building. The building in which the department is now located is one of the oldest on the University campus. It was originally built for another purpose and is not designed in such a manner that it can be converted into an efficient biochemistry laboratory.

A second need of the department is to expand its program of training graduate students. Graduate students not only do a great deal of work on research problems at very reasonable cost, but in the process become more proficient research workers and increase the number and quality of workers in the field. The importance of this phase of our work cannot be overestimated.

HOME ECONOMICS

(continued from page 11)

undertakings have the "know-how" which home economics does not have.

Home economics research is concerned with whatever problems are home-centered. Since the focus of modern agriculture is to fulfill the material needs of families, it follows that agricultural research will be supplemented and strengthened as research in home economics develops.

It will be clear to any reader of this issue of *Science Serves Your Farm* that research in home economics at West Virginia University is in its earliest stages. It needs greater expansion if West Virginia families are to receive the consideration they deserve.

These station projects were active in the year 1953-54

(Abbreviations for funds supporting projects: A—Adams; BJ—Bankhead-Jones; NE—Northeastern Region Research and Marketing; NEM—Northeastern Region (marketing). Research and Marketing; RM—Research and Marketing; P—Purnell; SCS—Soil Conservation Service; S—State; USDA—United States Department of Agriculture.

Administration

Planning Cooperative Research under Title I of the Research and Marketing Act (RM 11)

Statistical characteristics of biological variables (Hatch 3)

Agricultural Biochemistry

Unidentified growth factors in proteins (A13)

Prevention of rancidity in carcass fats of turkeys and hogs. (A 14; coop. Animal Husbandry)

Ascorbic acid metabolism (PUBLICATION ONLY) (BJ 48; coop. Home Economics)

Factors needed to supplement rations for satisfactory growth, reproduction and lactation (BJ 51)

Miscellaneous chemical investigations (S 5)

Glycine content of poultry feeds (S 68)

Broiler rations for high efficiency (P 57; coop. Animal Husbandry)

Relationship of nutrient intake to nutritional status in human subjects (RM 39, NE 16; coop. Home Economics, University Health Service)

Agricultural Economics

Custom rates for farm jobs (BJ 60)

Lime, fertilizer and barnyard manure used on W. Va. farms. (BJ 65; coop. Agronomy)

Effect of consumer choice on egg marketing (S 62; coop. USDA)

A survey of a stranded town: Elk Garden, W.Va. (S 67)

Public library service in W.Va. (S 101)

Seasonal milk production on W.Va. farms (P 48; coop. Dairy Husbandry)

Organization as a factor affecting 4-H club work (P 64; coop. Extension Service)

The diffusion of recommended farm practices in two W.Va. counties (P 65)

Inter-market price relationships for milk and dairy products in W.Va. (RM 17, NEM 1)

Marketing livestock in W.Va. (RM 28, SM 7)

Lowering milk marketing costs in W.Va. (RM 32, NEM 13)

Consumer preferences and demands for poultry and poultry products (RM 36, NEM-11)

Marketing forest products in W.Va. (RM 38; NEM-16; coop. Forestry)

Marketing peaches. (RM 42)

The rate of movement of apples and factors affecting rate. (RM 43, NEM 9)

Livestock feed marketing and purchasing in W.Va. (RM-C-703 ES194, Title II, also S 99; coop. Bureau of Agricultural Economics)

Agricultural Engineering

Design and construction of a pasteurizer of commercial capacity for nut meats (S 57; coop. Horticulture)

Study of the design and operating characteristics of a grain conveyor using fluidization principles (S 63; coop. Engineering Experiment Station)

Preliminary and exploratory investigations pertaining to agricultural engineering (S 97)

Determination of factors influencing the drying rates of grains (P 55; coop. Engineering Experiment Station)

Investigations to determine the optimum stall for dairy cows (RM 5; coop. Dairy Husbandry)

To determine the most efficient and economical methods of removing manure and litter from dairy barns (RM 6; coop. Dairy Husbandry)

Design, construction, and testing long hay blowers (RM 15)

Study of the design and operating characteristics of a barn baled hay drier using supplemental heat (RM 21)

Factors involved in the use of supplemental irrigation under W.Va. conditions. (RM 24; coop. Agronomy, Reymann Memorial Farms)

Poultry house design for W.Va. (RM 44, NE-8; coop. Animal Husbandry)

Agronomy and Genetics

Corn genetics and breeding (BJ 3; Reymann Farms, Ohio Valley Farm. University Experiment Farm, N. E. Corn Conference, W.Va. Extension Service)

The effect of fertilizer treatments and cropping systems on the yield and quality of tobacco (BJ 19; coop. Ohio Valley Farm, USDA)

Selection and breeding of superior strains of red clover for W.Va. (BJ 43; coop. Plant Pathology, Extension Service, USDA)

Barley breeding and testing (BJ 54)

The interrelation of soil fertility, planting rate and geometry of spacing in relation to yield of various hybrid corn varieties (BJ 58)

Crop rotation experiments. (BJ 67; coop. Ohio Valley Experiment Farm. Agricultural Economics)

Field crop variety testing (S 6)

Soil survey work in W.Va. (S 8)

Alfalfa Investigation (PUBLICATION ONLY) (S 10)

Crop rotation experiments (S 11)

Crop responses to various fertilizers (S 14)

Changes in condition following a mine sealing, tile draining and surface treatment in soil acidized by run-off mine water (PUBLICATION ONLY) (S 40)

Road-bank stabilization (PUBLICATION ONLY) (S 50)

Killifer furrows in eroded black shale for run-off (S 58; coop. Reymann Farms)

Characteristics of flow from a large spring (S 59; coop. Reymann Farms)

The establishment and testing of grass and legume species and strains for soil conservation (S 87; coop. Nursery Division, SCS)

Preliminary investigations in soil science (S 94)

Studies on W.Va. pastures (PUBLICATION ONLY) (P 30-1; coop. USDA)

The phosphorus and potassium supplying and fixing power of several important W.Va. soils (P 58)

The influence of fertility and management on several Ladino clover-grass mixtures (P 59)

The lime requirements of a number of W.Va. soil types (P 60)

Maintaining profitable stands of alfalfa (RM 10; coop. Plant Pathology)

Weed control in corn (RM 22; coop. Reymann Farms)

Forage crops varieties, strains, and species for W.Va. (RM 26, NE 10)

Alfalfa breeding and Genetic investigations. (RM 45)

Animal Husbandry

Effect of selection in cross breeding on broilers within certain heavy breeds of chickens (A 7; coop. Reymann Farms)

Improving marketing value of turkeys by cross breeding (PUBLICATION ONLY) (BJ 5)

The effects of thyroid stimulants and depressants on growth and fattening of swine (PUBLICATION ONLY) (BJ 47)

Effect of heredity and environment on keel deformities in White Leghorns (BJ 53)

Effect of prophylactics and therapeutics for controlling coccidia in chickens (BJ 55; coop. Reymann Memorial Farms)

Nutritional requirements of the brood sow (BJ 64)

Legume grass silage vs. corn silage for wintering beef cows (S 53; coop. Agricultural Biochemistry, Reymann Farms)

Coccidiosis and Newcastle disease (S 88)

Exploratory or preliminary investigations on diseases, feeding, and management of farm animals (S 89)

Floor space requirements of broilers in a centrally heated house (S 93; coop. Reymann Memorial Farms)

Fat calf vs. feeder calf production in W.Va. (S 95; coop. Reymann Memorial Farms)

Hay versus hay and silages for ewes (S 103; coop. Agricultural Biochemistry)

Broiler management investigations (S 104; coop. Reymann Memorial Farms)

Development of satisfactory broiler rations (S 105; coop. Reymann Memorial Farms)

Silages for cattle and sheep (PUBLICATION ONLY) (P 34; coop. Agricultural Biochemistry)

Methods of feeding growing pullets (P 39; coop. Reymann Farms)

Comparison of native and western ewes for production and longevity (P 41; coop. Reymann Farms)

The relation of birth weight within breeds to growth rate of purebred mutton type lambs (P 50)

Nutritional requirements of swine for growth (P 62)

Breed as a factor in the production of ewes retained for flock reproduction and for the production of market lambs and wool (P 63; coop. Reymann Memorial Farms)

Some chemical and physical analyses of the blood of dairy cows (RM 8; NE 1; coop. Dairy Husbandry)

Improving the reproduction performance of turkeys (RM 9)

Transmission and immunity of vaccine strains of Newcastle disease in chicks following adult vaccination (RM 23, NE 5)

Causes of sterility in cattle (RM 30, NE 1; coop. Dairy Husbandry, W.Va. Artificial Breeders' Coop.)

Dairy Husbandry

Breeding efficiency of dairy cows. (BJ 45; coop. Animal Husbandry)

The use of type and production records as a basis for a dairy cattle improvement program (BJ 45; coop. Agricultural Economics, Ayrshire Breeders Assoc.)

Financial Statement for the Year July 1, 1953, to June 30, 1954

Classification of Receipts and Disbursements	Hatch	Adams	Purnell	Bankhead-Jones	Bankhead-Jones Sec. 9 Research & Marketing			Non-Federal Funds	Total
					9b1-2	9b3	Title II		
RECEIPTS									
Received from the Treasurer of the U.S.	$15,000.00	$15,000.00	$60,000.00	$65,794.28	$86,464.55	$31,550.00	$2,500.00		$276,308.83
State appropriations:									
Main station	....	....	....	....	....	....	....	$160,740.00	160,740.00
Substations	....	....	....	....	....	....	....	65,400.00	65,400.00
Special	....	....	....	....	....	....	....	....	....
Special grants, etc.	....	....	....	....	....	....	....	8,980.00	8,980.00
Sales	....	....	....	....	....	....	....	222,557.47	222,557.47
Miscellaneous	....	....	....	....	....	....	....	270.00	270.00
Balances forward July 1, 1953	....	....	....	....	....	....	....	125,823.69	125,823.69
Total Receipts	$15,000.00	$15,000.00	$60,000.00	$65,794.28	$86,464.55	$31,550.00	$2,500.00	$583,771.16	$860,079.99
DISBURSEMENTS									
Personal services	$ 9,653.13	$13,729.50	$52,080.76	$57,798.57	$72,351.70	$19,420.67	$1,315.28	$205,674.30	$432,023.91
Travel	400.54	27.65	1,064.34	1,888.85	5,163.80	2,464.80	1,167.91	3,332.43	15,510.32
Transportation of things	....	....	3.00	4.55	4.53	3.00	....	505.41	520.49
Communication service	....	....	....	....	14.70	....	....	3,586.03	3,600.73
Rents and utility services	526.25	....	43.96	4.53	152.78	....	....	16,059.09	16,786.61
Printing and binding	2,151.14	....	....	893.72	692.52	915.00	....	520.85	5,173.23
Other contractural services	301.14	....	330.40	219.40	169.61	335.10	....	34,883.78	36,239.43
Supplies and materials	1,967.80	903.00	3,390.22	4,133.04	5,724.33	1,862.18	16.81	139,885.55	157,882.93
Equipment	....	339.85	3,087.32	851.62	2,190.58	4,999.17	....	37,225.25	48,693.79
Lands and structures (contr.)	....	....	....	....	....	....	....	....	....
Total Disbursements	$15,000.00	$15,000.00	$60,000.00	$65,794.28	$86,464.55	$29,999.92	$2,500.00	$441,672.69	$716,431.44
Reverted Balances						1,550.08		654.63	2,204.71
Non-Reverted Balances Available for 1954-55								$141,443.84	$141,443.84

Methods of feeding and rumen inoculation as they affect the growth and development of young dairy calves (BJ 62; coop. Animal Husbandry)

Preliminary or exploratory investigations on diseases, feeding, and management of dairy cattle (S 86)

Miscellaneous investigations of dairy products (S 90)

Selecting for milk production in Jersey cattle. (S 106)

The transmission of milk and butterfat production and body conformation by dairy sires (P 14; coop. USDA)

The keeping quality of milk in home refrigerators (P 49)

Prepartum milking of dairy heifers (P 51; coop. Agricultural Biochemistry)

The effect of water hardness on cleaners for dairy utensils (P 66)

Comparison of young bulls with proven bulls in artificial breeding. (P 67; coop. W.Va. Artificial Breeders Coop., W.Va. Extension Service)

Some chemical and physical analyses of the blood of dairy cows (RM 8, NE 1: coop. Animal Husbandry)

Forestry

Mobile circular sawmill for farm woodlots in W.Va. (BJ 44)

Efficient forest management practices for W.Va. cut-over and burned-over hardwood forest lands (BJ 49; coop. Conserv. Comm.)

Animal repellents on hardwood forest trees (BJ 56)

Growth of vegetation and rate of soil development on old iron-ore spoil banks (BJ 59)

A survey of multiflora rose plantings in W.Va., with special reference to growth characteristics and spreading tendencies. (BJ 66; coop. Soil Conservation Service; Conservation Commission)

Improvements of farm game and wild-life conditions of the soil conservation district (S 42)

Planting of forest trees and shrubs at Greenland Gap (S 56)

Determination of optimum growth of W. Va. hardwoods (S 60)

Wood pins for mine roof support (S 102)

Test specimens for wood adhesives (RM 16)

Timber management for the market demands in southern W.Va. forests (RM 31)

Home Economics

Space, facilities, and structural requirements for activities relating to the business of the farm and home in W.Va. (RM 27, NE 7; coop. Agricultural Engineering, Extension Service)

Horticulture

Improvement of potato varieties for W.Va. (A 11; coop. Plant Pathology)

Selection, breeding, and propagation of the lowbush blueberry vaccinium vacillans (BJ 12)

Effect of certain chemicals on color, finish and maturation of apples (BJ 61)

Miscellaneous horticultural investigations (S 27)

Variety tests of tree and small fruits (S 29)

Variety and strain studies of vegetables (S 31)

Lily bulb production trials (S 61; coop. USDA)

Nutrition of apple trees in W.Va. (S 65, also P 56; coop. University Experiment Farm, Entomology, Plant Pathology)

Effect of new growth substances on the preharvest drop of apples (S 66; coop. University Experiment Farm, Entomology, Plant Pathology)

Chemical thinning of apples and peaches (S 69; coop. University Experiment Farm)

Apple and peach insect control (S 91; coop. University Experiment Farm, USDA, Bureau of Entomology and Plant Quarantine)

(continued on page 26)

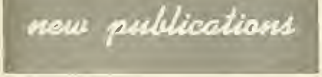
PROJECTS

(continued from page 25)

Improvement and selection of ornamentals suitable to W.Va. (S 96)
Propagation and selection of edible nut-bearing trees suitable to W.Va. (S 98)
Harvesting, handling, and packaging of peaches (S 100; coop. University Experiment Farm, Mt. Fruit Sales, Inc.)
Improvement of apple juice (P 61; coop. Agricultural Biochemistry)
Selection of nursery crops and propagation methods (RM 35)

Plant Pathology, Bacteriology, and Entomology

The relation of genetics and environmental factors to growth, physiology and reproduction of fungi (A 6, revised, 1952)
Anatomical and histological changes in diseased plants (A 10)
Nutrition of fungi and bacteria with especial reference to substances which induce, stimulate, or inhibit growth and reproduction (BJ 2)
Spray injury and fungicidal efficiency of orchard spray as influenced by the weather (BJ 6)
Testing new fungicides and insecticides for value as pesticides on small fruit and vegetable crops. (BJ 32) Revised 1954
Forest tree diseases, Sub-2, chestnut blight (S 18; coop. Forestry, Horticulture)
Miscellaneous plant disease investigation (S 19)
Miscellaneous insect and insecticide studies (S 21)
Apple measles (P 19)
Black rootrot of apples (P 21)
Microbiology of strip mine seepage water in relation to plant growth and soil conditions (P 53; coop. Agronomy)
Decay as a factor in sprout reproduction of yellowpoplar (P 54; coop. Forestry)
Storage and market disease of tree fruits 13; coop. Agricultural Economics)
Cause and remedy for red clover failures in W.Va. (RM 14; coop. Agronomy)
The toxicity of cumulative spray residues in soil (RM 18; coop. University Experiment Farm, Bureau of Entomology and Plant Quarantine)
Oak Wilt (RM 33; coop. SCS)
Improvement of tomato varieties for W.Va. (RM 34; coop. Horticulture)
The symbiotic relationships between microorganisms and insects vectors of plant diseases. (RM 40)
The structure and function of specialized tissues in insects. (RM 41)

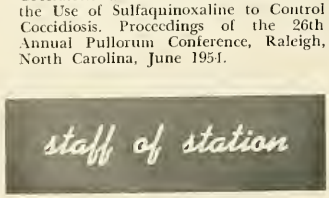


Bulletins

369. Part I. Annual Report of H. R. Varney, Director, Science Serves Your Farm. Fall, 1954.

Scientific Articles

481. Collins Veatch. Effect of Some Chemicals on Weed Growth and Corn Production. Proceedings of the Northeastern Weed Control Conference, January 1954.
482. H. L. Barnett, Federick F. Jewell. Recovery of Isolates of Endoconidiophora Fagacearum Isolates from Oak Trees Following Mixed Culture Inoculations. Plant Disease Reporter. Vol. 38: 359-361, May 1954.
484. H. L. Barnett, R. P. True, F. L. Brown. Fertile Albino Mutants of the Oak Wilt Fungus. Plant Disease Reporter, Vol. 38: 121, February 1954.
486. Edward S. Elliott. Notes on Forage Plant Diseases Observed in Northern West Virginia During 1953. Plant Disease Reporter, Vol. 38: 279-281. April 1954.
487. Norman Nybroten. What Price Egg Quality? Poultry Processing & Marketing Journal, Vol. 60: 12-32, May 1954.
489. N. O. Olson, T. B. Clark. Concurrent Coccidiosis and Newcastle Disease and the Use of Sulfaquinoxaline to Control Coccidiosis. Proceedings of the 26th Annual Pullorum Conference, Raleigh, North Carolina, June 1954.



November 1, 1954

Administration
Irvin Stewart, LL.B., Ph.D., LL.D., President of the University
H. R. Varney, Ph.D., Director
A. H. VanLandingham, Ph.D., Assistant Director

Agronomy & Genetics
G. G. Pohlman, Ph.D., Agron.
N. M. Baughman, M. A., Asst. Agron.
V. L. Bolyard, B.S., Asst. in Agron.
D. R. Browning, M.A., Asst. Agron.
O. J. Burger, Ph.D., Assoc. Agron.
Maria H. Cartledge, A.B., Technician
B. L. Coffindaffer, B.S., Grad. Asst.
Clyde Cecil Dowler, B.S., Grad. Asst.
Henry W. Fairchild, Ph.D., Assoc. Agron. (on leave until July 1, 1955).
Everett C. Flesher, Jr., B.S., Grad. Asst.
S. L. Galpin, Ph.D., Hydrol.
William L. Haltiwanger, Ph.D., Asst. Agron.
Thomas R. McCarroll, B.S., Grad. Asst.
Dale A. Ray, Ph.D., Asst. Geneticist
Charles B. Sperow, Jr., B.S., Asst. in Agron.
Collins Veatch, Ph.D., Assoc. Agron.

Animal Husbandry
E. A. Livesay, D.Sc., An. Husb.
G. C. Anderson, Ph.D., Assoc. An. Husb.
J. K. Bletner, M.S., Asst. Poult. Husb.
T. B. Clark, M.S., Assoc. Poult. Husb.
Robert E. Cook, B.S., Asst. in Poult.
C. J. Cunningham, B.S., Assoc. An. Husb.
J. O. Heishman, D.V.S., Assoc. An. Path.
H. M. Hyre, M.S., Assoc. Poult. Husb.
Robert H. Ingram, Ph.D., Asst. An. Husb.
Harold E. Kidder, Ph.D., Asst. An. Husb.
D. A. Munro, D.V.S., Asst. An. Path.
Norman O. Olson, D.V.S., An. Path.
J. A. Welch, Ph.D., Asst. An. Husb.

Biochemistry (Agricultural)
W. R. Lewis, Ph.D., Biochem.
Cyril D. Anderson, B.S., Grad. Asst.
Padma Rag Datta, M.S., Grad. Asst.
Damon C. Shelton, Ph.D., Assoc. Biochem.
Willa Mae Short, B.S., Technician
William E. Nutter, B.S., Grad. Asst.
Orville L. Voth, M.S., Asst. Biochem.
C. E. Weakley, Jr., M.A., Assoc. Biochem.

Dairy Husbandry
H. O. Henderson, Ph.D., Dairy Husb.
R. A. Ackerman, M.S., Asst. Dairy Husb.
R. S. Dunbar, Jr., Ph.D., Assoc. Dairy Husb.
James E. Fike, M.S., Asst. in Dairy Husb.
Donald A. Hutchinson, B.S., Asst. in Dairy
I. D. Porterfield, M.S., Assoc. Dairy Husb. (on leave until July 1, 1955).
S. J. Weese, M.A., Assoc. Dairy Husb.

Economics (Agricultural) and Rural Sociology
W. W. Armentrout, Ph.D., Agr. Econ.
J. H. Clarke, M.S., Assoc. Agr. Econ.
Homer C. Evans, M.S., Asst. Agr. Econ.
Justine M. Foglesong, M.A., Asst. in Agr. Econ.
W. S. Hutson, B.S., Asst. Agr. Econ.
Paul E. Nesselroad, B.S., Asst. in Farm Mgt.
Norman Nybroten, Ph.D., Agr. Econ.
W. F. Porter, Jr., Ph.D., Assoc. Rural Sociol.
G. E. Toben, M.S., Assoc. in Farm. Mgt.

Engineering (Agricultural)
A. D. Longhouse, Ph.D., Agr. Engr.
W. H. Dickerson, M.S., Assoc. Agr. Engr.
Kendall C. Elliott, B.S., Asst. in Agr. Engr.
Roy E. Emerson, M.S., Asst. Agr. Engr.
J. T. Reid, M.S.A.E., Asst. in Agr Engr.

Forestry
W. C. Percival, Ph.D., For.
John F. L. Bell, BSF, Asst. For.
Maurice Brooks, M.S., For.
J. B. Byers, BSF, Asst. For.
Kenneth L. Carvell, DF, Asst. For.
R. F. Dugan, M.F., Asst. For.
A. W. Goodspeed, M.F., For.
Norman D. Jackson, BSF, For. Supt.
Christian B. Koch, MSF, Asst. in For.
C. A. Myers, Jr., M.F., Asst. in For. (on leave until July 1, 1955).
W. H. Reid, MSF, Assoc. For.
E. H. Tryon, Ph.D., Silviculturist

Home Economics
Lillie Louise Chapman, M.A., Asst. Nutr.
Montelle Dietrich, M.S., Asst. in Home Ec.
John Joel Moss, Ph.D., Assoc. Home Ec.

Horticulture
R. S. Marsh, M.A., Hort.
D. C. Alderman, Ph.D., Assoc. Hort.
W. H. Childs, Ph.D., Hort.
A. P. Dye, M.S., Asst. Hort.
Mason E. Marvel, M.S., Asst. in Hort.
Edward Lee Mattson, M.S., Asst. Hort.
O. M. Neal, Jr., B.S., Asst. Hort.
Roger W. Pease, M.S., Asst. Hort.
O. E. Schubert, Ph.D., Assoc. Hort
K. C. Westover, Ph.D., Hort.

Plant Pathology, Bacteriology, and Entomology
J. G. Leach, Ph.D., Plant Path.
Robert E. Adams, Ph.D., Asst. Plant Path.
H. L. Barnett, Ph.D., Mycol.
Charles R. Berry, A.B., Grad. Asst.
Foster L. Brown, Grad. Asst.
C. K. Dorsey, Ph.D., Entom.
John J. Eichenmuller, M.S., Asst. in Plant Path.
Edward S. Elliott, Ph.D., Asst. Plant Path.
M. E. Gallegly, Jr., Ph.D., Asst. Plant Path.
Francis J. Gough, B.S., Grad. Asst.
Edwin Gould, B.S., Entom.
Harry L. Hansen, Ph.D., Asst. Entom.
Harold G. Hedrick, M.A., Grad. Asst.
Frederick F. Jewell, M.S., Grad. Asst.
V. G. Lilly, Ph.D., Physiol.
C. R. Orton, Ph.D., Plant Path.
Robert Pristou, B.S., Asst. in Plant Path.
David O. Quinn, A.B., Grad. Asst.
Gwendolyn Stewart, M.S., Asst. in Bact.
R. P. True, Ph.D., Assoc. Plant Path.
Charles L. Wilson, B.A., Grad. Asst.
H. A. Wilson, Ph.D., Assoc. Bact.
Jack B. Wilson, M.S., Grad. Asst.

Miscellaneous
Glenn D. Bengtson, B.S., Asst. Editor
D. R. Creel, Photog.
John Luchok, B.S.J., Editor
Martha R. Traxler, Chief Clerk

ANIMAL HUSBANDRY

(continued from page 18)

Substation. Extensive studies showed that in this house at least, allowing broilers only ¼ square foot of floor space per bird did reduce growth slightly but had little or no other bad effects.

A simplified corn-soybean broiler ration is lower in cost than the complex commercial-type rations and the results obtained, except for slower growth, are almost as good.

Doubling the number of feedings has indicated that little is gained, provided precautions are taken to keep feed before the broilers at all times. Likewise, when the water space was doubled there was no increase in growth at broiler age.

Studies comparing old built-up with new litters for the control of coccidiosis have shown no benefits from changing the litter after each brood of broilers.

ANIMAL PATHOLOGY

The marked increase in poultry population the past few years has greatly increased the disease problems. The virus diseases of the respiratory organs have caused the most concern. These are Newcastle disease, infectious bronchitis, and chronic respiratory disease. Better methods of diagnosis have made it possible to separate these diseases by laboratory procedures, but it is not always possible to do so in the field.

In 1954, a new disease condition in poultry has been encountered. The disease is characterized by anemia, pale and shriveled combs, general weakness, emaciation, and enlargements about the joints. The disease has been reported from other states.

The causative agent has been isolated and is thought to be a large particle virus or small bacteria. Chickens and turkeys have been infected experimentally.

Work is in progress to determine the mode of spread, nature, and general measures to control this new disease.

Breeding efficiency of dairy cattle was not increased by the routine use of hormones and certain mechanical treatments. Hormones in the case of inactive ovaries were worthwhile.

No correlation was found between shy breeding and the incidence of granular vaginitis in the University dairy herd.

Emphasis is being placed on viruses and pleuropneumonia-like organisms as causes of shy breeding.

All sections of the department are in urgent need of more office and laboratory space.

The Animal Husbandry section is in need of a slaughter house, and an experimental cattle shed.

The Poultry Husbandry section is in need of additonal mating and laying pens for both chicken and turkey work.

The Animal Pathology section is in need of isolation equipment. This equipment can be provided for in the proposed new Animal Science Building or in a separate isolation building.

AGRICULTURAL ENGINEERING

(continued from page 6)

means from the top of a conventional silo, and by mechanical means from the bottom of an upright silo. Additional information will be obtained next year concerning the performance of a horizontal above ground silo filled with uncut grass silage. This is sometimes called long-grass silage. Different methods of covering the horizontal silo will be used to determine the waste that occurs under each.

Future engineering research must surely expand to include farm structures. This is a field that has had very little attention from most research workers. Barns are being built or remodeled and new ones constructed which do not take into account or allow for many of the known labor-saving devices available today. It is hoped that much will be gained from the mechanization process towards the reduction of chore labor about the farmstead. When this is done it is believed that new and more simplified structures will be built around the mechanized chore-saving facilities. Not only is there a need for new designs in farm structures to include labor-saving equipment, but also to eliminate high-cost materials and labor, and provide for greater use of native material.

Building requirements for tobacco curing is another branch of farm structures that needs serious attention in West Virginia in order to maintain the high quality of tobacco West Virginia farmers are able to grow. Research work now proposed may bring about tobacco housing research in the next few months.

Attention should be given to the design of equipment for the application of lime and fertilizer on the hillside pasture of West Virginia. Many of the problems of maintaining productive hillside pastures can be attributed to the lack of the proper equipment for economical distribution of lime and fertilizer.

The employment of one additional staff member specializing in rural electrification research will aid materially in the over-all application of electricity to agriculture—the best hired man a farmer can have. With this addition to the staff, the department will have achieved its goal of one specialist in each of its major fields.

DAIRY HUSBANDRY

(continued from page 9)

The projects now in progress, with revisions as found necessary, will be continued until they have been completed. Other new projects are being planned and will be developed just as rapidly as funds, personnel, and facilities are provided.

The completion of a new calf barn and the remodeling of the old calf barn into a heifer barn, making it possible to have all of the heifers together in one barn, gives an excellent opportunity for a study on heifer feeding and management, and such a study is being planned. Additional calf nutritional studies are also being planned. Some of these will involve rumen studies on the effect of rations on the rumen flora. Such studies will require additional buildings and a trained physiologist.

A study on the best methods of harvesting and storing hays and silages is being planned in cooperation with the Agricultural Engineering Department, and a study of the best way to feed forage to dairy cattle is being considered. Such questions as—Is it better to harvest the forage and haul it to the cow or to allow the cows to pasture it? Should pasturing be rotated or continuous? How is it best to store silage, in trench, horizontal or upright silos? Can silage be successfully made and fed as long hay?—these and other questions on forage harvesting, storing and feeding will be studied as funds, facilities, and man power are available.

In the manufacturing field, the projects now in progress will be carried to completion. New projects on the marketing of milk by means of milk venders; the cause of variations in fat and other milk solids; and studies on the use of pipeline milkers and cold-wall coolers will be started when funds and equipment are available.

REEDSVILLE FARM, in Preston County, boasts fine roads of rock, cleared from fields, crushed at roadside

REYMANN Memorial Experimental Farms, Hardy County, occupy 987.5 acres devoted to crops, beef cattle, sheep, and poultry.

substations

IN ADDITION to the Animal Husbandry, Poultry Husbandry, Dairy Husbandry, Horticulture and Agronomy Farms at Morgantown which are used for both instructional and research purposes, the Experiment Station operates four substations located in strategic agricultural areas of the State. Substations differ from the farms at Morgantown in that usually several departments have experimental work located on a substation; whereas, the farms at Morgantown are operated by the several production departments in their particular field. Substations are used for experimental and demonstrational purposes.

The Reymann Memorial Farms at Wardensville, a gift received in 1917 from the estate of Lawrence A. Reymann, occupy 987.5 acres of land on the Capon River in Hardy County. The farm is devoted primarily to work with beef cattle, sheep and poultry. Work with small grains, forage and pasture improvement, water conservation, and soil erosion is also emphasized.

The Ohio Valley Substation of 150 acres at Point Pleasant on the Ohio River, which was acquired in 1945 from the War Assets Administration, is devoted to work with tobacco and field crops of special interest to the farmers of the Ohio and Kanawha valleys.

The University Experiment Farm, a tract of 158 acres near Kearneysville in the eastern fruit growers section, is devoted to work related to fruit production, including insect and disease control. Much of the insect and disease control work is in cooperation with the United States Department of Agriculture.

The Reedsville Experiment Farm in Preston County, acquired through transfer of the Arthurdale Association, consisting of 457 acres, is devoted to experimental work with potatoes, vegetables, ornamentals and small grains. Legumes and grasses are grown extensively in rotation with the above crops.

KEARNEYSVILLE farm, in Jefferson County, is devoted to research in fruit production and general farming in eastern W. Va.

OHIO VALLEY branch station, in Pleasants County, serves research needs of Ohio Valley field crop, truck, tobacco farmers.

Science

SERVES YOUR FARM

Bulletin 369, Part 4

Summer 1955

WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Bulletin 369, Part 4 Summer 1955

Science SERVES YOUR FARM

Annual Report, Parts Published Quarterly by
AGRICULTURAL EXPERIMENT STATION
West Virginia University
Morgantown, W. Va.
Director
H. R. Varney

Editor ..... John Luchok
Assistant Editor ..... Glenn D. Bengtson
Photographer ..... David R. Creel

Publications Committee: O. J. Burger, V. G. Lilly, W. W. Armentrout. Science Serves Your Farm will be sent free to any resident of West Virginia in response to a written request to the Director, Agricultural Experiment Station, West Virginia University, Morgantown, W. Va.

Annual Report of H. R. Varney, Director West Virginia University Agricultural Experiment Station For the Period 1954-1955

IN THIS ISSUE

on our cover

The rolling hills and neat buildings of the West Virginia University Animal Husbandry Farm are a favorite view for folks touring northern West Virginia. Although worn out and unproductive when acquired 38 years ago, the pastures and meadows now show livestock farming at its best.

Although primarily devoted to livestock research and teaching animal husbandry, the Farm, with its pastures and meadows, produces all of the roughage needed to feed the animals. Silos, barns, a granary, and a machine shed provide working and storage space. Modern soil and water conservation practices, which were so instrumental in rebuilding the soil, still pay off in improved yields and lasting soil fertility.

The most important product of the farm is information. Current problems facing West Virginia livestock men are studied and methods developed to combat these problems. Improved feeding and breeding programs are developed and tested.

Many breeding and fat animals are produced and sold at the Farm each year. Improved breeding stock is always in demand by West Virginia farmers, and many of the Aberdeen-Angus herds and several Hereford herds in the State were started with foundation stock purchased from the Farm. Sheep and hog breeders come to the Farm to buy excellent stud rams and boars.

Berkshire and Duroc-Jersey hogs, Corriedale, Hampshire, and Southdown sheep, and Aberdeen-Angus and Hereford cattle make up the Farm's animal population.

on the calendar . . .

AUGUST—
16—State 4-H Dairy Cattle Judging Contest, Jackson's Mill
16-19—Annual State Dairy Show
17—State 4-H Health Program and Coronation, Jackson's Mill
18—State 4-H Tractor Operator's Contest, Jackson's Mill
22-27—Entomology-Fire Control Demonstration at State Fair, Lewisburg
31-Sept. 1—State Purebred Ram and Ewe Show and Sale, Jackson's Mill

SEPTEMBER—
3—Regional Purebred Ram Sale, Petersburg
12-15—Annual Program Planning Meeting for Farm Women, Jackson's Mill
13-15—State Dairy Cattle Sales, Jackson's Mill
14—Regional 4-H Sheep Shearing Contest
19—State 4-H Sheep Shearing Contest
19-22—State 4-H Livestock Round-Up
22-23-24—W.Va. Chapter of the Society of American Foresters, Camp Caesar
23-25—West Virginia 4-H All Star Conference, Jackson's Mill
28-Oct. 2—R.Y.U.S.A. Conference, Jackson's Mill
30—Demonstrational Feeder Calf Sale, Petersburg

OCTOBER—
17-21—Annual Extension Workers' Conference, Jackson's Mill
25—4-H Wool Dress Show, Jackson's Mill

new publications

Bulletins

369, Part 3. Annual Report of H. R. Varney, Director, Science Serves Your Farm, Spring, 1955.
371. G. E. Toben and P. E. Nesselroad. Custom Rates for Farm Jobs in West Virginia. March, 1955.

(Continued on page 8)

PAPER PROTECTS strawberries

by W. H. Childs, Horticulturist

STANDARD recommendations in text books and circulars for Northeastern United States with regards to preventing frost injury to blooming strawberry plants is to recover, when frost threatens, with the straw that had been tramped down between the rows when the winter mulch was removed. In 1952 the author re-covered a one-fifth-acre planting in this manner. It required five hours of constant labor to cover the plants, and an equal time to uncover the next day. In addition, the straw available was insufficient to give complete protection.

In casting about for an easier and more efficient method of protecting from frost injury, the possibility of using water-resistant paper was considered. (This had been done in Florida.) Three rolls of "whale-hide" paper 3 feet wide were obtained.* All were moisture-resistant and had considerable wet strength. One roll was waxed on one side only, one on both sides, and the third was an unwaxed crinkled paper. There were no frosts during the strawberry bloom period in 1953, so tests had to wait until 1954.

Frost was predicted for the night of May 4, 1954. A field containing twenty-five 100-foot matted rows set 3½ feet apart was available. Rows 1 to 14 inclusive were Premier, and 15 to 25 inclusive were Catskill. Rows 1, 2, and 24 were covered with straw in the usual manner. Rows 3, 4, 6, 7, 9, 10, and 12 were covered with paper waxed on one side only; rows 13, 14, 15, 16, 17, 18, 19, 20, and 21, were covered with paper waxed on both sides; and rows 5, 8, 11, 22, 23, and 25 were covered with the crinkled paper.

The rolls were suspended from a broom handle stretched between two sawhorses at the end of the row, and the paper was rolled out the length of the row. The air was quiet, as is usually true when frost threatens, and the paper was applied without difficulty. Eight-foot stakes were laid across two rows of paper at 20- to 25-foot intervals to hold them in place. It took a little more than half as long per row to apply the paper as to cover with straw.

A moderately heavy frost that night killed grape shoots and potato plants and caused severe injury to unprotected strawberries. Possible frost was predicted almost every night for the next week, but none other occurred. Starting May 14, ten random sections were taken in one row for each treatment for each variety, and the number of total blooms and of frost-killed blooms was recorded. Each section provided from 200 to 400 blooms. The data obtained are summarized in Table 1.

Paper Superior to Straw

Almost all of the loss for the paper-covered rows was along the edges, whereas there was considerable loss thoughout the row when straw was used. Fewer blooms were open for Catskill than for Premier.

The results obtained indicated that the paper used was superior to straw in protecting from frost injury. Although the counts suggested that the paper waxed on two sides was best for Premier, the apparent superiority over the other papers may have been largely due to the position of the row, since the other two gave very similar results for Premier, while the crinkled paper was better for Catskill. Hence, a definite conclusion that one type of paper was best is not justified.

In addition to the better protection afforded by the paper, other advantages were the decreased "mauling" of the plants, and the elimination of burying of blooms and small fruits which occurred when straw was removed and placed between the rows a second time.

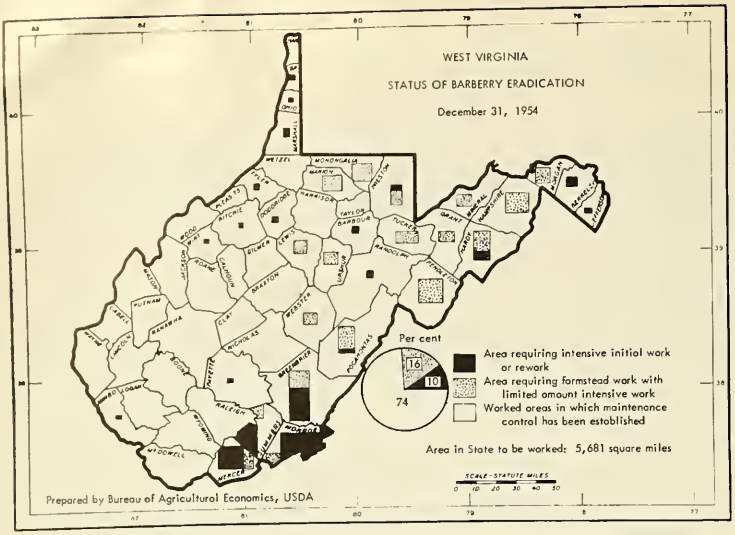
Several weaknesses with regards to the use of paper showed up in this study. First, a better method of anchoring the paper than that used needs to be worked out. A gusty wind arose the morning after the frost, and the paper was blown about considerably. Second, rain while the paper is in place complicates the procedure. Since frost was predicted for several nights, the paper was removed and replaced several times. Rain occurred twice during the period, and the puddles that formed had to be "poured" off before the paper would dry enough so it could be rolled up. Third, rolling up the paper took about as long as removing straw. Finally, the cost of paper—about 1½ cents per running foot—would be a factor to consider. If securely anchored, it should be useable for several applications, but it requires considerable storage space when re-rolled. In this regard, it should be mentioned that the crinkled paper was most resistant to tearing.

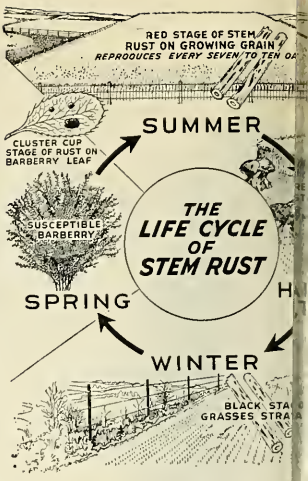
It is planned to continue this study using paper 4 feet wide so there will be some overlapping. This should decrease, or eliminate frost injury along the edges of the rows, and may decrease the difficulty resulting from wind getting underneath and blowing the paper about.

Table 1. Frost Injury to Strawberry Blooms Protected by Several Materials

Variety and Protectant	Total Blooms Counted	Killed Blooms	Per cent Killed
Premier			
Straw	2937	746	25.4
Paper waxed on 1 side	2962	455	15.4
Paper waxed on 2 sides	2655	244	9.2
Crinkled paper	2845	417	14.7
Catskill			
Straw	3378	307	9.1
Paper waxed on 1 side	3129	267	8.5
Crinkled paper	3141	188	6.0

*Donated by the Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich.





(1)

The Barberry - -

OUR UNWANTED CROP!

by Edward S. Elliott and W. M. Watson *

DO WE have a grain rust problem in West Virginia? Or is the grain rust problem important only in the Midwest where most of the nation's grain crop is grown? The answers to these questions may be of interest to many Mountain State citizens.

This nation experienced an 88 million bushel loss of wheat and a 90 million bushel oat loss from stem rust in 1953. The loss to wheat was equally as great in 1954.

When the rust disease develops on barberry bushes in West Virginia there exists a potential danger of spread to grain and subsequent loss of crops in this State and in other states. Although total grain production in West Virginia is but a small part of the United States' total yield, our "crop" of barberry plants is among the *biggest* and *best*. Therefore, West Virginia does have a stem rust problem which is important to this State as well as to other states.

*Edward S. Elliott is Assistant Plant Pathologist. W. M. Watson is Agriculturist, Plant Pest Control Branch, USDA, in charge of barberry eradication in the West Virginia-Virginia area.

Breeds New Rust Races

Here are the facts. Certain kinds of barberries are the alternate host for the stem rust disease of wheat, oats, barley, rye, and several grasses; that is, the rust lives first on grain, then on barberry, then back to grain and so on. On the barberry host, it is possible for the rust fungus to hybridize and produce new races of stem rust which never existed before. These new races may be capable of attacking grain varieties commonly resistant to the older races of rust. Excellent examples of this race are 15B of wheat rust and race 7 of oat rust. They were the major causes of the huge grain losses in 1953 and 1954. We know that some of the new races of rust which develop on our native barberry can cause havoc with this nation's grain crop.

Important Job

An area in southeastern West Virginia and neighboring Virginia contains probably the greatest concentration of barberry plants in the United States. This is a native American barberry (*Berberis canadensis*). A second kind of susceptible barberry, the common barberry (*Berberis vulgaris*), which was brought from Europe by early settlers, now can be found growing wild in many parts of the country including certain areas in West Virginia. The Japanese barberry (*Berberis thunbergii*), which is not susceptible to stem rust, can safely be used in hedges and other ornamental plantings. Federal and State quarantines prohibit the propagation and sale of rust susceptible species of barberry.

Eradication of many of the barberries and the use of rust resistant varieties of grain have provided stem rust control that can be measured in terms of hundreds of millions of dollars. But it is a job that cannot stop. As long as susceptible barberries grow in grain-producing areas, we are faced with the recurrence of disease epidemics such as those in 1953 and 1954. This program depends for its success upon the combined efforts of State and Federal agencies and farm operators. West Virginia is one of 18 states included in the Federal-State cooperative program.

Progress and Prospects

Here is our situation in West Virginia. Initial appraisal of the stem-rust problem revealed that within the 24,282-square-mile land area in the State, barberry bushes were known to be growing and causing rust spreads to small grain within an approximate area of 5,581 square

(2)

(3)

miles. Windborne spores originating on barberry in these areas could also be carried many miles to adjoining barberry-free areas and into bordering states. The greatest number of barberry bushes were found in an area which included Berkeley, Greenbrier, Mercer, Monroe, Pocahontas, and Summers counties.

Since inception of the project, 4,760 square miles have been covered by an inspection for planted and wild barberry bushes. Within 4,211 square miles of that area all rust-susceptible bushes have been cleared and no further work is believed to be necessary. Of the remaining 1,470 square miles requiring future work, an initial survey has been completed on 548 square miles. Since barberry regrowth results from seed which may remain in the soil for several years before germinating, it will be necessary to rework areas until there is no longer danger of regrowth. There are 922 square miles of territory that still require initial inspection.

Our mountainous terrain and the spreading habit of the native barberry makes the problem in West Virginia and Virginia doubly difficult. New brush-killing chemicals and power-driven spray equipment have, however, greatly eased the task.

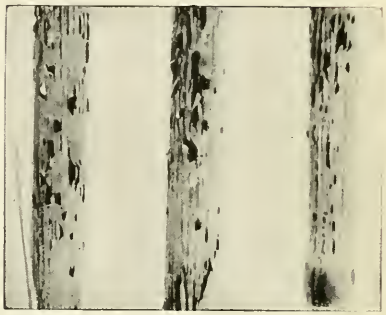
Report for 1954

The West Virginia barberry eradication report for 1954 reveals that 6,363,643 bushes were eradicated from 89 properties, involving 537 square miles in 12 counties. These figures include bushes treated on 23 old properties and 15 properties inspected where no bushes were found. On a rework survey 66 square miles were covered.

Stem-rust control has been demonstrated in many local areas where observations of rust development and losses were recorded over the years before and after barberry eradication. For example, records reveal that yields of wheat were increased by an average of 68 per cent in the West Virginia-Virginia barberry area. Thus it appears that the cooperative efforts of State, Federal, and local agricultural agencies and farm operators are accomplishing the objectives of the program.

Eradication of the barberry will not completely eliminate stem rust since the rust spores can be blown north each year where they winter over on growing grains and grasses. But, even so, eradication will completely eliminate destructive local

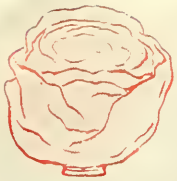
(Continued on page 8)



(4)

(5)

(1) Life cycle of stem rust. (2) A barberry eradication worker in West Virginia spraying native barberrry (Berberis canadensis) with hormone-type brush-killing chemicals. (3) Rusted barberry leaves. (4) Rusted grain stems. (5) Plump and rust-shriveled wheat.



Cover Your Head

LETTUCE

by W. H. Childs, Horticulturist

IN *Science Serves Your Farm*, Part 2, December, 1952, the author described a method of protecting newly-set head lettuce plants from cold injury in early spring by covering them with parchment paper.* The paper (2 feet wide) was rolled out in strips the length of the rows to be covered, and supported by wickets of No. 11 wire at eighteen-inch intervals. The edges were then covered with earth to hold the paper in place.

In the original study the plants were set on March 26 and protected until April 28. Protected plants formed heads three or four days sooner than non-protected ones, but this was still not early enough to take advantage of the excellent May market, since the first heads were harvested on May 31.

In 1953, plants were set at a much earlier date in the hope of having salable heads by mid-May. Seed was sown in the greenhouse in early January, and 1,220 plants were set in the field on February 27. Nine hundred and seventy of these were covered with paper and the rest left unprotected. March and April were mild in 1953, the temperature never falling below 28° F. after March 10. There were a few cold days during the first ten days in March, but a light covering of snow protected the uncovered plants when the temperature dropped to 14° on March 9. Unprotected plants came through without injury from cold.

*Donated by the Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich.

Early Harvest

The paper was removed on April 24, and the first heads harvested on May 19. This was a week sooner than the first head was cut from the unprotected plants. All but 18 of 752 heads had been harvested from the protected plants by June 1, whereas only 38 of 186 heads, or 20.4 per cent, were cut from the non-protected plants after this date. The total harvested was 77.5 per cent for the protected plants and 74.4 per cent for the non-protected.

In 1954 a still earlier planting was made. Seed was sown in the greenhouse the last week in December, and 2,500 plants were set in the field on February 19 and 20. All but 250 plants were covered with paper. In contrast to 1953, March and early April were very cold. There were temperatures of 12°, 14°, and 16° F. on March 4, 5, and 6 without snow protection, and twenty-five other days with temperatures below 30° between February 20 and April 15. The unprotected plants were severely injured, 175 of 250 being killed completely and the rest set back seriously.

Heat Injures Plants

The protected plants looked very good when examined on April 15. Since a cold period was predicted for around April 21, it was planned to uncover after that. However, unseasonably high temperatures of 85°, 86°, 88°, and 83° F. occurred on April 19, 20, 21, and 22. When the plants were uncovered on April 23, it was found they had been severely injured by the high temperatures (with little or no ventilation). The outer leaves were distorted, and only 750 salable heads were obtained from 2,250 protected plants. However, in comparison, only twenty salable heads were harvested from the 250 unprotected plants, and they were of poor quality.

(Continued on page 8)

HEAD LETTUCE plants get a head start when they are covered with paper in early spring. Plants in covered-ventilated row, left, and those in covered row, right, dwarf uncovered plants, center. Covered plants produce earlier

Dr. C. R. ORTON

DR. C. R. Orton, Professor of Plant Pathology, died on June 16, 1955. He was to retire on June 30, with 26 years service to West Virginia University.

Dr. Orton was born in East Hardwick, Vermont in 1885. He received the B.S. Degree at the University of Vermont in 1909, the M.S. degree at Purdue University in 1915, and the Ph.D. degree from Columbia University in 1924. In 1942, the University of Vermont conferred upon him the honorary degree of Doctor of Science.

Dr. Orton began his professional career in 1909, as a Special Agent with the U.S.D.A. The following year he was Assistant Plant Pathologist at the University of Wisconsin, followed by three years as Assistant Botanist at the Purdue Agricultural Experiment Station. In 1913, he transferred to Pennsylvania State College where he served successively as Assistant Professor, Associate Professor, and Professor.

Dr. Orton came to West Virginia in 1929 after serving for 4½ years as Plant Pathologist for the Bayer Semesan Company. At West Virginia University, he served successively as Head of the Department of Plant Pathology, Head of the Department of Biology, and Head of the Department of Plant Pathology and Forestry. In 1938 he was made Dean of the College of Agriculture and Director of the Agricultural Experiment Station. While serving as Dean and Director, he was instrumental in many progressive developments. The Division of Forestry was developed under his guidance in 1938, and became a fully accredited school in 1948. The department of Agricultural Engineering was also established during this time.

Served in Liberia

In 1949, Dr. Orton relinquished his administrative duties and returned to the Department of Plant Pathology as a Research Professor. While on leave from 1950 to 1953, he served as Director of Research and Extension in Agriculture for the Technical Cooperation Administration in Monrovia, Liberia. While there he set up the first full-scale Point 4 Agricultural Program and organized and put into operation a staff of 16 technical workers.

Dr. Orton's services to West Virginia went beyond his duties as Department Head and Dean and Director. He was deeply interested in all aspects of West Virginia agriculture and especially in the conservation of soil and water. For 15 years he was a member of the West Virginia State Planning Board, and served as its chairman from 1941. He served as a member of the Technical Advisory Committee and alternate delegate to the Potomac River Basin Commission. For eight years he was Secretary of the Experiment Station Section of the Association of Land Grant Colleges and Universities and was chairman of the Section in 1948.

Active in Recreation

Dr. Orton was a charter member of the Chestnut Ridge Camp Association and chairman of the Board of Directors. He did much to keep this popular recreation area available to the community.

Active in numerous professional societies, Dr. Orton was elected President of the American Phytopathological Society in 1939. He also was a member of several scientific organizations, including Sigma Xi, Alpha Zeta, and Phi Epsilon Phi.

C. E. WEAKLEY, JR. RETIRES

ON June 30th, Mr. Charles E. Weakley, Jr. retired after forty-eight years of service to the University. Mr. Weakley was born in Towson, Maryland on February 7, 1885. He attended public school and Franklin University Preparatory School from 1892 to 1902. After having completed preparatory work, he attended Johns Hopkins University and the University of Virginia. His first job was as chemist with the Eastern Dynamite Company (Du Pont), Barksdale, Wisconsin. After about a year with the company, Mr. Weakley began his service with the University in the spring of 1907 as a research chemist. He later received a Bachelor's and Master's Degree from the University. Over this period of years, he has contributed materially to many research projects in the field of Agriculture, particularly Agricultural Chemistry and Nutrition.

He is a member of the American Chemical Society, Sigma Xi (National Honorary Scientific Society), Phi Lambda Upsilon (Honorary Chemical Fraternity), and the West Virginia Academy of Science.

During Mr. Weakley's period of service, the University has made

(Continued on page 8)

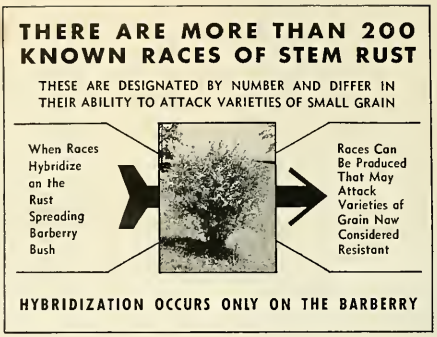
C. E. WEAKLEY

BARBERRIES

(continued from page 5)

epidemics and immeasurably simplify the task of the plant breeder who will not be forced to keep pace with ever newer, more destructive races which are constantly originating on the barberry host.

The barberry eradication program in West Virginia is a cooperative effort of the West Virginia Department of Agriculture, the West Virginia University Agricultural Experiment Station and Extension Service, and the Plant Pest Control Branch of the U.S. Department of Agriculture.



C. E. WEAKLEY

(continued from page 7)

phenomenal growth. The year he came to the University, seventy-five persons were granted Bachelor's Degrees, no Master's Degrees were granted and only one Degree of Doctor of Philosophy as compared with the current year when 738 received Bachelor's Degrees, 346 Master's Degrees and 10 received Doctor of Philosophy Degrees.

Mr. Weakley's services will be missed around the Department of Agricultural Biochemistry where he has served faithfully for so many years. We all wish him much happiness in the years to come.

LETTUCE

(continued from page 6)

The first heads were harvested from the protected plants on May 16, while it was June 8 before any heads were cut from the non-protected ones. Had the paper been removed from the covered plants ten days sooner, a very good crop would have resulted, while the plants set in the open as late as March 20 were severely injured by cold in 1954.

Conclusions

Use of parchment paper for three years has brought out several points of interest regarding its good and bad points. Some of these are listed below:

1. When plants are set early (before March 1 at Morgantown) the harvesting season can be expected to be at least a week earlier for covered plants than for unprotected ones set at the same time. As compared to plants set at the usual time (March 15 to April 1), the early-set protected plants should be at least two weeks earlier.

2. Covered plants very probably will not be injured by any low temperatures encountered during March and April in most of West Virginia if the paper remains intact.

3. One can expect to spend about twice as long covering plants as setting them, and it is hard to cover without tearing of the paper if there is an appreciable amount of wind, especially if it is gusty.

4. Tears in the paper after it is in place, by dogs, other animals, children, or any other cause will give winds an opportunity to whip strips loose. The author found it advisable to fence in the head lettuce area with chicken wire in 1954 after the difficulty encountered in keeping the paper in place in 1953.

5. The grower should watch carefully after about April 10, and punch numerous holes in the paper if unseasonably hot weather is encountered. Removal of the paper during such a hot period might be as injurious as leaving the plants covered with little or no ventilation.

6. Ground badly infested with quack grass or other weeds should be avoided if lettuce is to be covered. Clumps of grass and weeds will grow vigorously under the paper and smother out the lettuce.

NEW PUBLICATIONS

(continued from page 2)

372. Homer C. Evans and W. S. Hutson. Marketing Appalachian Apples. March, 1955.
373. Norman Nybroten and James M. Kesecker. Some Features of Feed Marketing in West Virginia. April, 1955.
374. Collins Veatch. Winter Wheat Variety Trials in West Virginia, 1949-1954. May, 1955.
375T. Faith Wolfe Chalmers, L. Louise Chapman, John J. Lawless, Walter R. Lewis, Sam Stregevsky, Orville L. Voth, and A. H. VanLandingham. Nutritional Status Studies in Monongalia County, West Virginia. June, 1955.
376. J. O. Heishman, C. J. Cunningham, and T. B. Clark. Drugs for Controlling Coccidiosis in Chickens. June, 1955.
377. Jack B. Byers. A Mobile Circular Sawmill for Farm Woodlots in West Virginia. June, 1955.
378T. R. A. Ackerman, A. H. VanLandingham, H. O. Henderson, and C. E. Weakley, Jr. Prepartum Milking of Dairy Cows. June, 1955.
379T. H. A. Wilson and Gwendolyn Stewart. Ammonification and Nitrification in a Strip Mine Spoil. June, 1955.
380. F. W. Schaller and G. G. Pohlman. The Effect of Rate and Frequency of Phosphate Application on Pasture Production. June, 1955.

Circulars

95. Homer C. Evans and Ray S. Marsh. Consumers' Reaction to Price of Tree-Ripe Peaches. May, 1955.
96. Mason E. Marvel. Results of Vegetable Variety Trials in West Virginia, 1954. May, 1955.
97. Roger W. Pease. Rooting Holly Cuttings in a Window Box. June, 1955.

Current Reports

10. Poultry Staff. Results of the First West Virginia Broiler Grower Test, August 4 to August 12, 1954. June, 1955.

Editor's Note: All publications available from the West Virginia University Agricultural Experiment Station are included in a list of publications recently released. This list may be obtained by writing to the Director, West Virginia University Agricultural Experiment Station, Morgantown.

Science

SERVES YOUR FARM

Bulletin 369, Part 3

Spring 1955

WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Bulletin 369, Part 3 Spring 1955

Science SERVES YOUR FARM

Annual Report, Parts Published Quarterly
by
AGRICULTURAL EXPERIMENT STATION
West Virginia University
Morgantown, W. Va.
Director
H. R. Varney

Editor ..... John Luchok
Assistant Editor ..... Glenn D. Bengtson
Photographer ..... David R. Creel

Publications Committee: G. C. Anderson, O. J. Burger, V. G. Lilly. Science Serves Your Farm will be sent free to any resident of West Virginia in response to a written request to the Director, Agricultural Experiment Station, West Virginia University, Morgantown, W. Va.

Annual Report of H. R. Varney, Director West Virginia University Agricultural Experiment Station

For the Period 1954-1955

IN THIS ISSUE

on the calendar . . .

MAY—

13-15—State Home Economics Association Conference, Jackson's Mill.

30-June 4—Volunteer 4-H Leaders Conference, Jackson's Mill.

JUNE—

1—Animal Husbandry Field Day, Animal Husbandry Farm, Morgantown.

8-9—Central West Virginia Strawberry Festival, Buckhannon.

16—Agronomy Field Day, Ohio Valley Substation, Point Pleasant.

20-26—Older 4-H Club Members Conference, Jackson's Mill.

on our cover

Oglebay Hall is headquarters for the West Virginia University Agricultural Experiment Station. It also houses the main offices of the Agricultural Extension Service and is the main classroom and laboratory building for students in the College of Agriculture and the Division of Home Economics.

The main offices of the departments of Animal Husbandry, Horticulture, Agricultural Education, Home Economics, and the crops and genetics sections of Agronomy are located in Oglebay Hall, as are research laboratories for animal pathology, crops and genetics, horticulture, meats, dairy technology, and home economics.

A dairy manufacturing plant, where milk from the University Dairy Farm is pasteurized and bottled for delivery to student dining halls, is located in the basement. There is a lounge for students who wish to study or read the latest agricultural magazines. In the mailing rooms clerks address and mail the many agricultural publications which are distributed to farmers each year.

Even though Oglebay Hall is large, it does not have adequate space for all the departments of the College of Agriculture and the Experiment Station. Agricultural Engineering, Forestry, Agricultural Economics, Agricultural Biochemistry, Dairy Husbandry, Publications, and Plant Pathology, Bacteriology, and Entomology are housed in other buildings.

new publications

Bulletins

369, Part 2. Annual Report of H. R. Varney, Director, Science Serves Your Farm, Winter, 1954.

370. Collins Veatch. Soybean Variety Trials in West Virginia, 1947-1953. February, 1955.

Current Reports

8. R. P. True, F. Waldo Craig, and Donald Cuppett. Control of Oak Wilt Disease in 1954. January, 1955.

9. W. L. Haltiwanger, R. J. Friant, and V. L. Bolyard. Results of Hybrid Corn Yield Trials in West Virginia, 1954. March, 1955.

wild grape vines–

THEY CAN BE CONTROLLED

By R. L. Carvell, Assistant Forester
and E. H. Tryon, Silviculturist

GRAPE VINES smothering foliage and deforming trunks of large trees. Basal spray of 2,4,5-T will eradicate the vines.

WILD grape vines present an important problem to woodland owners in West Virginia. In young stands and open areas dense impenetrable tangles often cover the ground to a depth of ten feet or more, completely smothering valuable tree seedlings. In older stands large vines climb into the tree tops and shade the crowns with their thick foliage. In time their weight deforms and breaks even the sturdiest stems. Many potential timber trees have been so distorted that they are completely worthless for lumber production.

To cut or burn these vines are only temporary remedies, since grape sprouts vigorously and vines regrow quickly. Recent experiments show that chemical sprays can be used to eradicate these vines at small cost. Moreover, these chemicals are non-poisonous to man and livestock and are easy to apply.

In this experiment a 1 per cent mixture of 2,4,5-T in a water carrier was applied to the foliage of grape during May. In August the same concentration was applied to the grape of an adjacent area. The leaf surface was wetted to the point of run-off.

Sprays Used

Observations the following spring indicate that grape tangles can be killed by spraying the foliage with a 1 per cent mixture of 2,4,5-T and water. The chemical is easily applied to the foliage with a knapsack-type garden sprayer equipped with an adjustable nozzle which permits selection of a fine or medium spray as desired.

Foliage sprays produce the highest mortality when applied in the spring, and are effective when applied any time after the foliage is fully developed. Effective control may be obtained during the late spring and early summer, but spraying in late summer and autumn, just prior to leaf fall, will not produce particularly heavy kill.

After grape is sprayed the foliage gradually shrivels, turns brown, and falls (see photograph). Often a second spraying, a month or so later, is needed to "touch up" patches missed the first time.

A WILD GRAPE tangle two months after the initial spraying treatment. A second spraying will be applied to those patches that were missed in the first operation.

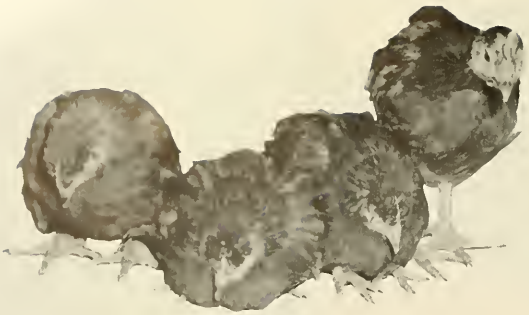
Control of Large Vines

In older stands the foliage of grape often climbs into the crown of larger trees, frequently reaching a height of 80 or 100 feet. Foliage sprays cannot be used in controlling these vines due to the difficulty of applying the spray to the leaves.

Two different treatments were applied to these large vines to determine the most effective method of control. In the late summer twenty vines were cut three feet above the ground. The following spring a foliage spray of 1 per cent 2,4,5-T in a water carrier was applied to the sprouts from these stumps. In the same stand twenty uncut vines were treated with a basal spray. In this treatment, a band of bark, one foot in height, encircling the base of the vine, was thoroughly saturated with a 4 per cent solution of 2,4,5-T in an organic carrier.

Observations made one year after treatment showed that the vines that had been cut and sprayed later had resprouted. Basal spraying had produced almost complete kill.

(continued on page 8)



Infectious A

(THE STORY OF

A NEWLY RECOGNIZED disease has caused considerable losses in broiler flocks and to a lesser extent in replacement flocks during 1951 in West Virginia. The disease has been called enlarged joint condition, hock disease, and arthritis. Infectious anemia-synovitis is more descriptive of the disease and is being suggested as the name by which it should be identified.

The disease has been seen principally in broiler flocks in birds six to eight weeks of age. However, birds as young as five weeks and more than eight weeks of age have become infected. Symptoms vary with the stage of infection. The first observable symptoms in birds usually are pale combs, leg weakness or lameness, and retarded growth. An infected bird may show one or all of these symptoms.

Many times the condition has been mistaken for coccidiosis. As the disease progresses, the feathers become ruffled, weakness is more pronounced, and the birds assume a sitting position. The combs of the males shrink and are usually pale, although some may become bluish-red in color. Swellings usually occur around the joints, and breast blisters are common. The hock joints are most commonly involved, but in some birds all joints become infected. The birds become extremely thin, and in the latter stages of the disease, dehydrated. Even though birds may be severely affected, they will eat and drink but have difficulty doing so because of the sore joints. Greenish discoloration of the droppings, which contain an unusual amount of white uric acid and urates, is common. Many birds are apparently killed by being trampled by other birds.

Substance in Joints

When the swollen joints are opened they reveal a viscous creamy material. This material becomes cheese-like as the disease progresses. In extremely dehydrated birds no fluid can be seen about the joints, but the cheese-like material remains. Many times there is no apparent swelling about the joints, but when the joints are opened the creamy material is found. In some cases only one joint may be involved. Joint involvement may be absent in the early stages of the disease. More study is needed to determine the symptoms in all stages of the infection.

The internal lesions vary. The most striking feature is their absence in many birds that are severely affected. The most consistent internal lesion is enlargement of the spleen (two to three times). This occurs in about 50 per cent of the cases. This enlargement is more commonly seen in the early stages of the disease. Enlargement and greenish discoloration of the liver are occasionally seen. Small hemorrhages are occasionally seen on the liver, and in some cases hemorrhagic liver blisters occur. These blisters vary in diameter from one to three centimeters.

Birds Examined

Microscopic examination of tissues from severely affected birds revealed numerous foci of reticuloendothelia cells in the liver, an inflammation of the arteries, and infiltration of heart muscles by white blood cells.

The hemoglobin content in the blood from affected birds is reduced as well as the number of red blood cells. The reduction in hemoglobin is responsible for the pale comb in affected birds. The white blood cell counts are usually increased and there is usually more monocytes and heterophils present than is normally found.

The causative agent is thought to be a large particle virus or a small bacterium. No bacteria were found when the fluid around the joints was cultured on bacteriological media; however, the agent did grow when inoculated into the yolk sac of fertile chicken eggs. Further work is in progress to determine the exact cause of the disease.

Disease Spread

How the disease spreads in farm flocks is not known. In the laboratory, chickens have been experimentally infected by inoculation of joint fluid and egg-embryo-grown material by the following routes: pad, joint, air-sac, vein, and sinus. Infection has not resulted from nostril or trachea inoculation. Eye inoculation has resulted in infection when joint fluid was used. The incubation period in experimentally infected birds has been generally four to ten days. Birds placed in contact with experimentally infected birds usually have an incubation period of twenty-five to thirty days or longer. Only a small number of these birds have become infected. The feeding of ground livers and spleens from infected birds has not resulted in infection. These studies indicate that infection in the field probably takes place at an early age.

Turkeys have been experimentally infected by pad and vein inoculation with joint fluid and egg-embryo-grown material, but not by sinus inoculation. Attempts to isolate the causative agent from field cases of turkeys with swollen joints have not as yet been successful.

---

* Authors of *Infectious Anemia-Synovitis—The Story of Enlarged-hock Disease* are N. O. Olson, Animal Pathologist; J. K. Bletner, Assistant Poultry Husbandman; D. C. Shelton, Associate Agricultural Biochemist; D. G. Munro, Assistant Animal Pathologist and G. C. Anderson, Associate Animal Husbandman.

emia-Synovitis

ARGED-HOCK DISEASE)*

Diagnosis Not Difficult

The diagnosis of synovitis is not difficult if infection is typical. Other infections and nutritional deficiencies may cause enlarged joints. Many times other diseases present in the bird complicate diagnosis. For this reason birds suspected of having synovitis should be examined by a veterinarian or submitted to a diagnostic laboratory.

Synovitis has been found in many parts of the country. Workers in Texas reported the disease present in Texas, Arkansas, and the Delmarva area. West Virginia workers have found the disease in Maryland and Pennsylvania, as well as West Virginia. Workers from other states have reported its presence. The disease has affected from 1 to 75 per cent of the birds in affected flocks. It is quite likely that the disease goes unnoticed in many flocks.

In some flocks the disease has caused major economic loss. One broiler contractor reported a loss in excess of $15,000 in an approximate six-month period from synovitis. This did not include losses sustained by the growers themselves. The disease was diagnosed in fifty-five flocks in West Virginia during 1954. The flocks varied in size from 1,000 to 20,000 birds. In twenty-one flocks there were 154,000 birds with an approximate loss of 7,700. This does not include the total loss, since many birds were culled and others were graded down at the time of slaughter. An over-all estimate of a 10 per cent loss in affected flocks seems conservative. The loss from this disease in West Virginia probably exceeds $50,000 per year.

More Research Needed

Synovitis has caused severe losses to some growers in a few concentrated broiler growing areas. The number of flocks involved represent only a small proportion of the total flocks in West Virginia. However, there is a pressing need for research as to the spread, prevention, and treatment of synovitis in case the infection should become more widespread.

Preliminary experimental work, however, points to a temporary means of controlling the infection. In laboratory experiments the causative agent was killed by penicillin and streptomycin. Penicillin alone apparently had no effect, but streptomycin alone killed the agent. When severely affected birds from commercial flocks were brought to the laboratory and treated with aureomycin or terramycin, improvement was noted. When the antibiotics were given to infected flocks in the field, the results were variable; some flock owners reported improvement in their birds, whereas others reported no effect.

Control of Disease

Preliminary laboratory work with aureomycin and terramycin indicates that these drugs, administered at the rate of 200 grams per ton of feed, is an effective control measure. These drugs were given before exposure to synovitis. When these drugs were given after the symptoms appeared, the disease was suppressed but not completely cured in all birds. The aureomycin was apparently more effective than the terramycin.

Results of these experiments suggest that aureomycin or terramycin, used continuously, may control synovitis. Treatment may be of some value in flocks that are affected at an early age in that it should prevent the development of the disease in birds not yet infected. However, little control can be expected unless the drug is used early and continuously. These drugs will need thorough testing in the field to prove their value in the control of synovitis.

An over-all project for the study of synovitis, which includes a study of various treatments in commercial flocks, has been initiated at this Station.

THESE TURKEYS are eight weeks old. The birds on the left were inoculated with the synovitis agent when three weeks old, and weigh only 1½ pounds. The healthy turkey at right weighs 3½ pounds. Infected birds tend to sit.

THE BIRD on the right shows how infected birds tend to "sit." Ruffled feathers, pale combs, and swollen joints are other symptoms of synovitis. Bird on the left is normal and healthy. Synovitis is frequently misdiagnosed as coccidiosis.

the cultivation of

Fringed Gentians

By Roger W. Pease
Assistant Horticulturist

PLANTS blooming at end of 2nd year.

"THERE are several fringed gentians, but ours is perhaps the most beautiful of gentians, and one of the choicest and most delicate of American wild flowers. It has been proposed as our national wild flower, and, while sought after less than the trailing arbutus, it is in even greater danger of extermination in certain states because it is a biennial, and because it has never been successfully cultivated. Seeds of *G. crinita* have long been advertised, but they are difficult to germinate and the plant is not seen in American gardens."[1] These comments are pertinent to West Virginia. Here the closed, or bottle, gentian (*Gentiana andrewsii*) is common, but *G. crinita* is rare. Only in Greenbrier County has its presence been reported to the Herbarium at the University's Department of Biology.[2] The plants tend to disappear from recorded localities, and *G. crinita* seems to be nearing extinction in the State.

In 1951 small-scale investigations were undertaken at the West Virginia University Agricultural Experiment Station to discover possible methods for preserving the species in arboretums or in flower gardens whose owners might be especially interested in the species. It was hoped that methods might be devised for producing fringed gentians on a commercial basis.

Late in September, seed was collected from wild plants located in New Jersey and stored in moist refrigeration at about 41° F. until mid-October. Then a greenhouse flat was equipped with a hardware cloth bottom and divided into two compartments. Half an inch of wet sphagnum moss was spread over the hardware cloth. One compartment was filled with a mixture of half sand and half garden soil. Moist sphagnum moss, which had been shredded through three-eighths-inch hardware cloth was used to fill the other compartment. After the seed had been scattered over both media, dry sphagnum moss, shredded through quarter-inch hardware cloth, was sprinkled over the surface. To prevent damage by rodents, a sheet of three-eighths-inch hardware cloth was placed over the flat. Then two moist, folded, burlap bags were placed on the hardware cloth. The prepared flat was stored during the winter under the floor of a porch in order to prevent rain from washing the tiny gentian seed into the growth media. No water was applied directly, but whenever the surface of the burlap was dry, the folded bags were removed, thoroughly soaked with water, wrung out, and replaced.

Germination was excellent the following spring. The burlap bags were removed and the flat placed under open shade. The gentian seedlings were slow-growing, and weeds sprouting from the garden soil used in one compartment soon choked out the gentians. When the weeds were pulled, the tiny gentian plants were destroyed. In the compartment filled with sphagnum moss weeds were not a problem, but when soluble plant food was applied according to directions, the young plants were killed.

In the fall of 1952, the process of planting the seed was repeated, except that only one growth medium was used—equal parts of sterilized greenhouse potting soil and peat moss. When germination occurred the following spring, no plant nutrients were added. Weeds in this instance were not a problem. The flat of gentian seedlings was placed in an unheated cold frame from which approximately half of open sunlight had been excluded. All watering was done by a mist spray with the jet-and-baffle-type nozzle capable of operating under sashes. By frequent use of the mist spray, the air was kept humid and the

(continued on page 8)

FRINGED GENTIAN SEEDLINGS at the end of their first year's growth.

1Bailey, L. H., *The Standard Cyclopedia of Horticulture*. Macmillan, New York, 1935. Vol. II, p. 1324.

2Core, E. L., Head Department of Biology, West Virginia University. Verbal Report.

Broiler Feeding and Management

By T. B. Clark, J. O. Heishman, C. J. Cunningham and J. K. Bletner*

BROILER producers in West Virginia are interested in factors which will provide rapid and efficient growth. Experimental work was conducted at the Reymann Memorial Farms Substation in 1954 to study the effects of some factors such as feed supplements and management practices. The growers are particularly interested in management practices. Such practices can effect economies along this line easier than any others. For this reason much of the work was in the management field.

The experimental broiler house at the substation is heated by forced hot air and is designed so that all pens are heated and lighted alike. About 460 broilers were placed in each pen so as to allow about ¾-square foot of floor space per bird. Duplicate pens were placed on each treatment. Each experiment lasted 10 weeks.

Ration Content

The basal ration used in these experiments consisted of 60 per cent ground yellow corn, 35 per cent soybean oil meal, 2.5 per cent steamed bone meal, 1.5 per cent pulverized limestone, 1.0 per cent iodized salt, and .03 per cent manganese sulphate. The ration was supplemented by a premix on a per pound basis as follows: 1816 I.U. vitamin A; 340 I.C.U. vitamin D_3; 1.5 mg. riboflavin; 10 mg. niacin; 125 mg. choline chloride; .0075 mg. vitamin B_{12}; and 2 mg. procaine penicillin. The ration was calculated to contain 21 per cent protein.

The average body weights and the average feathering grades are from pen samples. The feed conversion values are calculated from the pounds of feed consumed and the pounds of broilers sold after correcting for the birds that died. All birds that died were autopsied.

The supplements methionine and calcium pantothenate, tested in Experiment 1, did not give conclusive results, although the pens receiving methionine alone had a slightly better average body weight than the control pens. This experiment was conducted in the winter months, starting January 23. Good growth was obtained for all treatments, and the feed conversion values were less than the average body weights. This relationship of average body weight to feed consumed is considered satisfactory under average broiler producing conditions.

Management Practices Studied

Experiment 2 was conducted to study the effect of the following management practices: (1) Debeaking the chicks at day-old with an electric debeaker; (2) Wire guards made of one-inch mesh wire and placed on top of the feed in the hoppers to prevent feed wastage; and (3) Double-watering space as provided by two, 4-foot troughs in each pen.

This experiment was conducted during the warm months, starting May 20. The sexes were grown separately, but the treatments seemed to affect both sexes alike. Growth and feed conversion were not as good as that obtained in the previous experiment. The debeaked birds showed about the best performance. Feathering was almost normal, although very little feather picking occurred among the lots which were not debeaked. The wire guards did not improve feed consumption enough to warrant their use. The one-inch mesh wire used here may have been too large to effect a feed saving. Doubling the watering space produced better results than the wire guards. This management practice seemed to have a beneficial effect on both growth and feed conversion. From these results, at least two 4-foot automatic watering troughs seem to be necessary for 460 broilers during the hot summer months.

Debeaking Studied

Experiment 3 was conducted during cooler weather, starting October 18. Two of the treatments tested under Experiment 2, debeaking and increased watering space, were repeated. New Hampshires were used in the previous experiments, but in this experiment one-half of the pens were filled with dominant white crossbred broilers and listed as D.W. in the table summarizing Experiment 3. The chicks in this experiment were debeaked at one week of age.

The various treatments used in Experiment 3 had no consistent effect on the two kinds of broilers. It was expected that feather picking would be severe among the white-feathered crosses and that debeaking would be necessary as a control measure. In addition, it was expected that debeaking would have a beneficial effect on growth and feed conversion as found in Experiment 2. However, as shown by the average feathering grades, very little feather picking occurred regardless of treatment or breed. With regard to watering space, the results suggest that more than one 4-foot watering trough per pen seemed to have no beneficial effect during the cooler months. Doubling both the feeding and watering space had not been tested here before. However, these additions did not give consistent results. The additions gave slightly better growth, but the feed conversion values were higher as compared with the controls.

The only consistent effect noted in these treatments is the lower mortality of the crossbreds as compared with that of the New Hampshires. This, of course, had little relation to the treatments. The lowest mortality was also noted among the crossbreds in the broiler growing test here at the University Poultry Farm in 1954 where all pens were fed alike.

Hoppers Being Studied

To keep feed and water before the broilers continuously is important. More hopper space than used here does reduce the number of daily feedings required to keep feed in the hoppers. In a previous trial additional growth was not obtained when the daily feedings were increased from one to three. The common practice is to use more feeding space than the maximum tested here. This was provided by two 4-foot feed hoppers per 100 birds. However, as more hoppers are used, more floor space for the broilers must be provided to maintain the same floor space per bird ratio.

The most efficient method found in all of our studies for reducing the feed consumed per pound of gain was to fill the present type of feed hoppers only about half full. This increases labor cost by having to feed more often, or else the hopper space has to be increased. For these reasons different types of hoppers are being studied to determine if feed loss can be reduced without increasing labor for feeding and keeping floor space utilized by the hoppers at a minimum.

(continued on page 8)

*T. B. Clark is Associate Poultry Husbandman, J. O. Heishman is Associate Animal Husbandman, C. J. Cunningham is Associate Animal Pathologist, and J. K. Bletner is Assistant Poultry Husbandman.

BROILERS

(continued from page 7)

Experiment 1. Results from Addition of Methionine and Calcium Pantothenate

Treatment	Performance of Broilers to 10 Weeks of Age			
	Average Weight (lbs.)	Feed Conversion (lbs.)	Mortality (%)	Feathering Grade (3-best)
Control	3.11	3.00	6.08	2.90
Methionine (1)	3.16	2.90	5.86	2.90
Calcium pantothenate (2)	3.12	2.76	10.30	2.84
Methionine (1) and Calcium pantothenate (2)	3.12	2.84	11.46	2.76

(1)Each ton was supplemented with 1 pound of methionine and (2) 4 grams of calcium pantothenate.

Acknowledgment: The methionine was furnished by The Dow Chemical Company.

Experiment 2. Effect of Debeaking, Wire Guards and Increased Watering Space

Treatment	Performance to 10 Weeks of Age			
	Average Weight (lbs.)	Feed Conversion (lbs.)	Mortality (%)	Feathering Grade (3-best)
Control	2.55	2.91	12.26	2.82
Debeaked (day-old)	2.64	2.89	8.74	2.99
Wire guards	2.60	2.81	13.56	2.88
Double-watering space	2.64	2.79	10.53	2.94

Experiment 3. Effect of Debeaking, Increased Watering and Feeding Space

Treatment		Performance of Broilers to 10 Weeks of Age			
		Average Weight (lbs.)	Feed Conversion (lbs.)	Mortality (%)	Feathering Grade (3-best)
Control	-N.H.-	2.86	2.98	4.58	2.87
	-D.W.-	2.80	3.04	2.65	2.94
Debeaked (week-old)	-N.H.-	2.85	3.01	9.08	2.91
	-D.W.-	2.87	2.98	3.87	2.98
Double-Watering Space	-N.H.-	2.79	2.95	3.75	2.96
	-D.W.-	2.86	2.97	2.79	2.95
Double-Watering and Double-Feeding Space	-N.H.-	2.96	3.02	3.86	2.87
	-D.W.-	2.87	3.13	3.54	2.95

N.H. = New Hampshires. D.W. = Dominant white crossbred broilers.

GENTIANS

(continued from page 6)

growth medium moist at all times. The seedlings were thinned to about three-fourths-inch spacing in late spring. At this time top growth was less than one-fourth inch, but the branched taproots were sometimes three inches long. By late August the seedlings were approximately one-half inch in height.

During the winter of 1953-54 the flat of gentians was stored in an unheated cold frame under glass sashes and watered occasionally from a garden sprinkling can. The sashes gave protection from extremes of cold, but occasionally the surface of the growth medium froze.

The gentians grew rapidly during the spring of their second season, and were transplanted to plant bands in late May. In June they were shifted from the bands to a shaded peat moss bed on the edge of a flower garden. "Fritted Trace Elements" were added to the peat at the recommended concentration, and a complete soluble plant food was applied once every two weeks. The peat moss was watered thoroughly at least once a week.

Red Spiders Controlled

During August and September severe infestations of red spiders killed many of the plants, but spraying with Malathion every three days controlled the red spiders. The plants bloomed profusely in late September, but bees and other insects seldom visited the blossoms. Therefore, approximately half of the plants were cross-pollinated by hand. It was a quick and simple procedure to scrape the pollen from the blossoms of one plant with a dissecting needle and to deposit it on the pistils of the blossoms on another plant. All hand-pollinated plants and some of the others produced an abundance of seeds.

Before definite recommendations are made for the cultivation of *G. crinita* on a commercial basis further investigations in the simplification of techniques should be conducted.

GRAPE VINES

(continued from page 3)

Water Carriers Used

Bark sprays produce the highest mortality when applied in the spring or summer. Spraying during the fall and winter is less effective. One application of herbicide, if carefully applied, will be sufficient to obtain a high percentage of kill. No "touch up" spraying should be necessary.

Before applying, 2,4,5-T is always mixed with a water carrier or an organic solvent such as diesel oil, fuel oil, or kerosene. Water carriers are used when the chemical is applied to leaves. Organic solvents are necessary only when the herbicide is applied to the bark. Directions for mixing poisons of various concentrations are given in the following chart.

Concentration (volume basis)	Amount of 2,4,5-T Needed to Make 1 Gallon of Solution	
Per cent	*Tablespoonfuls*	*Milliliters*
1	3	40
4	12	160

Caution

Care must be taken not to apply foliage or bark sprays to brush or vines located close to gardens, as drops of these herbicides may be carried by the wind to the succulent garden plants and cause extensive damage. Even on days when there is no wind movement, vapor may contaminate the atmosphere for a radius of 100 feet or more, and damage crops.

After spraying, the pump must be washed thoroughly with water before using the sprayer for garden purposes, since small amounts of poison left in the pump may be sufficiently strong to kill garden plants. Two tablespoonfuls of ammonia should be added to wash water to help neutralize the herbicide.