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Science Serves Your Farm

H. R. Varney

H. R. Varney

Science

SERVES YOUR FARM

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WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Bulletin 382, Part 1 Fall 1955

Science SERVES YOUR FARM

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

For the Period 1955-1956

IN THIS ISSUE

on our cover

Research in dairy technology is an important phase of the work done at the West Virginia University Agricultural Experiment Station for the advancement of dairying in West Virginia. Consumers benefit, too, because it is through progress in dairy technology that milk and milk products reach the dining table fresher and tastier than ever before.

Research in dairy technology takes many forms. On page 6 an article deals with the problems of selecting detergents for cleaning milk utensils with water supplies of various hardnesses. A discussion of factors to be considered when selling more milk through the use of vending machines appears on page. 3

A glance through the history of dairy technology research at West Virginia University reveals that WVU scientists were the first to associate oxidized flavor of milk with the fat globule membrane. This knowledge helped bring about the change from copper to stainless steel and glass utensils throughout the dairy industry, thus removing much of the causes of oxidation. Other investigations have dealt with the manufacture of sweet curd cottage cheese, the keeping qualities of milk delivered every other day and kept in the family refrigerator, and the keeping qualities and consumer preferences of "one-plus-two" milk.

on the calendar . . .

JANUARY—

3-6—Dairy Short Course, Jackson's Mill
12-13—Sheepmen's Short Course, Morgantown
23-27—West Virginia University Farm and Home Pest Control Workshop, Morgantown
30-31—Joint Staff Conference of Teacher Trainers and Supervisors of Agricultural Education, Morgantown

FEBRUARY—

1-24—West Virginia University In-service Training Course for Extension Workers, Morgantown
10-11—Agricultural Education Program and Policy Committee Meeting, FFA-FHA Camp, Ripley
10-11-12—West Virginia State Horticultural Society Annual Meeting, Martinsburg
1-Mar 15—County Extension Garden Schools
6-Mar 2—West Virginia University Farm and Home School in Agriculture and Home Economics, Morgantown.

MARCH—

17-19—State FFA Ham, Bacon and Egg Show, Charleston
21-22—State 4-H Ham and Bacon Show and Sale, Clarksburg

new publications

Bulletins

369, Part 4. Annual Report of H. R. Varney, Director, Science Serves Your Farm, Summer, 1955.

Circulars

98. K. L. Carvell and H. P. Berthy. A Guide to Killing Woody Plants in West Virginia. August, 1955.

Current Reports

11. R. P. True, T. M. Judy, and Eldon Ross. The Absorption of Solutions Through the Tops of Freshly Cut Oak Stumps. October, 1955.

Can vending machines sell MORE MILK?

by S. J. Weese, Associate Dairy Husbandman

CAN vending machines help sell the surplus milk available in West Virginia?

Much material has been published recently on the vending of milk by machines. West Virginia distributors have been slow to promote the idea of selling milk in vending machines and today very few milk vending machines can be found within the State. Available evidence indicates that milk sold by vending machines does not decrease milk sales on routes and in stores.

Can vending machines do for the milk industry what they have done for the candy, soft drink, and cigarette industries? Machines sell 15 per cent of all candy and cigarettes and 25 per cent of all soft drinks consumed. Of course, vending of milk by machines presents problems that the aforementioned commodities do not. Because of its perishable nature, milk must be kept under refrigeration, and even then must be sold within a relatively short time. The sale of milk offers only modest profit margins. Despite these obstacles, the records of some concerns show milk vending machines to be a potentially profitable enterprise.

National Study

The secret of increasing consumption of milk is to make it more readily available in schools, factories, and business houses, and to encourage present milk drinkers to drink more milk. A study conducted for the American Dairy Association by Alfred Politz Research, Inc., showed that 88.3 per cent of the milk sold is consumed at home. According to the Politz report, 79 per cent of the people in the United States drink milk irregularly, but 20.4 per cent of the milk drinkers drink 46.6 per cent of the volume consumed.

Vending milk by machine is still in its infancy. Dairies are advancing cautiously in this field to sell their products. Indoor vending machines cost approximately $300 to $900 apiece, so considerable capital is needed to make even a moderate start. Desirable locations must be found where a large sales volume per machine can be realized. This is important in all types of machine vending operations. The interest on money in vending machines is a large overhead expense. Also, the machines must be serviced at frequent intervals regardless of the perishability of the product.

In every vending operation there is a "break-even" point for each machine. This is a certain average number of units that must be sold each day to cover fixed costs. Below this point a machine loses money. Profits are proportional to the number of sales over the "break-even" point. The "break-even" point varies with the type of machine, location, and other factors involved.

Types of Machines

There are many different types of vending machines on the market. They can be classed into manually operated, completely automatic, and bulk-type machines. Most locations prefer a paper packaged product.

One of the manually-operated type of machines has been in use on the West Virginia University Campus since 1951. It has been generally satisfactory from the mechanical standpoint, requiring only a new refrigeration motor (which was relatively inexpensive) and a new rubber gasket around the lid. Several improvements have been made by the manufacturer since the production of this machine. Probably the same

(continued on page 8)

Vending machines in office buildings, factories, schools, gymnasiums, and other places where people gather to work and play will provide many more retail outlets for the sale of milk. To measure the influence of vending machines on total milk sales in industrial areas, marketing specialists of the West Virginia University Agricultural Experiment Station and the United States Department of Agriculture have initiated a city-wide study in Martinsburg, West Virginia. Milk distributors, factories, and other institutions are cooperating in this study. Milk distributors will operate the machines and keep detailed records of sales and other factors involved in selling milk by machine.

This 274-half-pint automatic machine is easily serviced, can sell $27.40 worth of white or chocolate milk unattended.

Oak, yellowpoplar, walnut, hard maple, and cherry are among species of logs purchased from farm woodlands, then stored at mill until needed. As logs are sawed, boards move to sorting shed by conveyor, where they are sorted and stacked according to grade, size, and species. Next stop is drying, either by air or kiln, and so as to dry r nationwide to

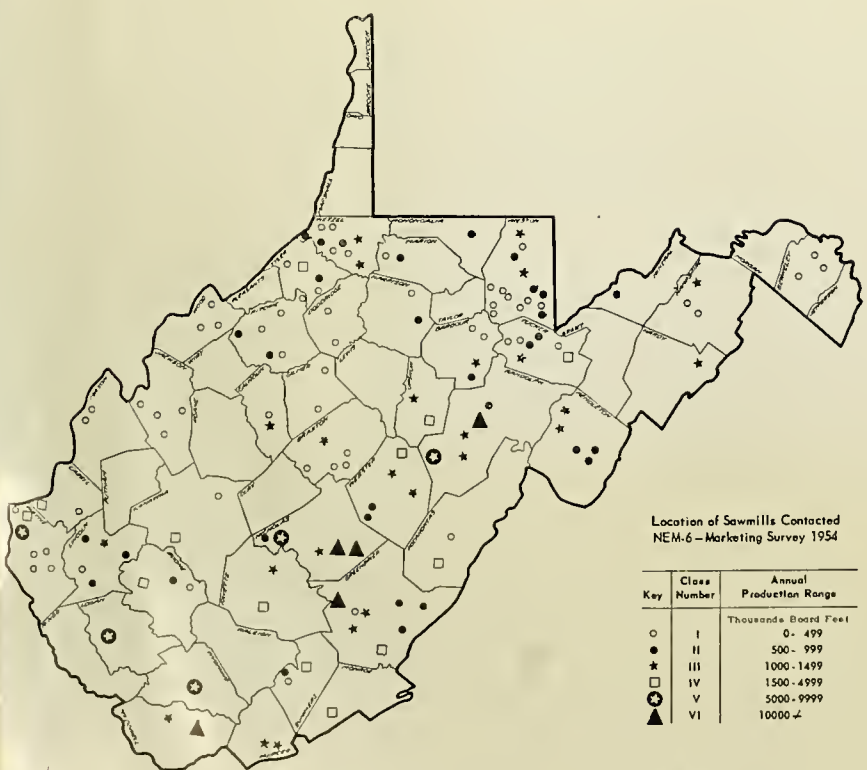
Sawmills - -

MARKETS FOR FARM WOODLAND PRODUC

by W. H. Reid, Associate Forester

THE farm woodland owner is sometimes confronted with a problem in disposing of the production from his woodlands. Obtaining the best market for these products is important and often receives the least attention. Frequently, more value is lost as a result of indifferent marketing practices than through mismanagement of logging or manufacturing operations.

In order to learn more about the marketing of wood products, a Northeast regional research project (NEM-6) is in progress. The West Virginia University Agricultural Experiment Station is participating in this study. Approximately 200 primary wood-using industries in West Virginia have cooperated in giving information concerning their operations. These industries consist of sawmills, flooring mills, veneer and plywood mills, stave mills, rustic fence mills, insulator pin mills, tanning mills, handle mills, and charcoal plants. All of these industries are possible markets for the farm woodland owner's products. Whether or not the woodland owner will be able to utilize an individual wood industry market will depend on several factors, such as transportation costs, size and species available from woodlands, and market demand.



Six Mill Classes

For purposes of analysis, the 144 sawmills contacted in this study were divided into six mill classes, based on annual production in 1953. A total of 193,241,000 board feet was produced by these mills. Of this amount, 78 per cent was purchased as stumpage* and 22 per cent as logs.

Mill class, number of mills, production by mill class and percentage of total production are given in the table at bottom page 5.

Source

The source of raw material by class of forest ownership was investigated. Approximately 40 per cent of the logs or stumpage used was from land owned by the sawmill operators included in the study, and 60 per cent was from privately owned lands as follows: 40 per cent from

*Stumpage—standing merchantable timber products.

oards to be air dried should be carefully stacked dly and properly. West Virginia lumber is sold nufacturers of fine furniture and wood products.

land owned by the sawmill operators, 40 per cent from privately owned woodlands in blocks of less than 500 acres and 16 per cent from privately owned woodlands in blocks of more than 500 acres.

Class I mills obtained 74 per cent of their raw material from private lands of less than 500 acres in size. Classes II, III, and IV mills each obtained approximately 62 per cent from private lands of less than 500 acres. Class V mills obtained 28 per cent of their raw material and Class VI mills 12 per cent of their raw material from private lands of less than 500 acres.

It is evident from these findings that sawmills producing up to 5,000,000 board feet per year purchase more than half of their raw material requirements in the form of logs and stumpage from private woodland ownerships of less than 500 acres in size.

Type of Purchase Agreement

The most commonly used type of purchase agreement for stumpage on privately owned lands of less than 500 acres in size was a buyers written contract. Approximately 39 per cent of all sawmill operators bought by this method. Verbal log purchase was done by 29 per cent of the mills obtaining raw material from this class of land ownership, and verbal stumpage purchase was used by 20 per cent of the sawmills.

The use of written specifications for species and log sizes and the use of log grades in purchasing were limited to a few of the larger mills. These quality requirements were not applied to stumpage purchases; therefore, approximately three-fourths of this raw material was not purchased by specification or grade.

Prices

The prices paid for mixed hardwood stumpage for all mills averaged $10.00 per thousand board feet. The stumpage price varied from $4.00 MBM** to $15.00 MBM for mixed hardwoods depending on species, condition of stand, accessibility, demand, and comparative ability of seller or buyer to negotiate.

Mixed oak stumpage brought $12.50 per MBM on an average. Stands of almost pure white oak or red oak with timber capable of producing prime and #1 logs sold for $25.00 per MBM on the stump. Stands of yellowpoplar brought an average of $16.00 per MBM. Hard maple sold for as high as $25.00 per MBM on the stump, but the average for maple stumpage was $12.00 per MBM. By contrast white pine stumpage averaged $27.00 per MBM.

The average price for mixed hardwood logs delivered to the mill was $38.00 per MBM. This figure was lowest in Mill Class I at $33.00 per MBM and increased with increasing mill class size to an average maximum of $45.00 per MBM paid by Mill Class VI. Prime white and red oak logs brought approximately $70.00 per MBM at mill yard. No. 1 oak logs ranged from $40.00 to $52.00 per MBM. Mixed oak, which includes chestnut oak, sold for $56.00 per MBM for top grade logs. Yellowpoplar averaged $94.00 per MBM for prime logs delivered to mill. No. 1 and No. 2 logs brought $66.00 and $42.00, respectively. Top grade maple logs brought $82.00 per MBM at mill yard with lower grades averaging $63.00 and $40.00 per MBM. Prime basswood logs sold for $86.00 per MBM at mill yard with lower grades bringing $59.00 MBM and $40.00 per MBM. The average top price for cherry logs at mill yard was $87.00 per MBM with lower grades bringing $61.00 per MBM and $38.00 per MBM. Wood-run grade of hickory, beech, gum and sycamore sold for an average of $20.00 per MBM at mill yard.

**MBM—Tbousand board feet measure.

The majority of the sawmill owners reported no change in average prices paid for stumpage and logs purchased in 1951 and 1954 as compared with the above prices which were reported for the year 1953.

Summary

Sawmills are the most numerous of the wood-using plants and along with their wide distribution, provide a most convenient market for the woodland owner. They use a greater volume of timber than all the other wood-using industries combined.

Woodland owners often are advised to sell their timber on a selective basis by which the trees are sold for specified markets, such as veneer, cooperage, and lumber. It is important for the woodland owner to know what he has available for the market and then select the best market or markets for his product. In selecting such market or markets the owner should consider the results from sales that allow high-grading (removing only the high quality trees). Repeated high-grading of a woodland results in a stand made up of low quality, hard to sell trees. Although the sawmill operator may not pay the highest price for individual trees, he usually buys the greatest volume from a given woodland and may be the best over-all market.

Editor's Note: "A Mobile Circular Sawmill For Farm Woodlots in West Virginia," Experiment Station Bulletin 377, contains information about an experimental mill designed to saw timber at logging sites remote from established mills. Bulletin contains data on cost of initial construction, and operating and production data obtained during a year's testing in the field. This bulletin may be obtained at the County Extension office, or by writing to the Experiment Station in Morgantown.

Table 1. Annual Production of 144 Sawmills in 1953

Mill Class		No. Mills	Annual Production	Percentage Total Annual Prod.
Class No.	Annual Prod. Range			
	Thousand Bd. Ft.		*Thousand Bd. Ft.*	
I	0-499	63	11,348	6
II	500-999	32	20,777	11
III	1000-1499	25	27,110	13
IV	1500-4999	13	31,641	17
V	5000-9999	6	36,455	19
VI	10,000-	5	65,910	34
TOTAL		144	193,241	100

STARTER RATION

helps dairy calves GROW

by R. A. Ackerman, Assistant Dairy Husbandman

With starter, calves grow faster.

THE West Virginia University Dairy Department has started young dairy calves on different amounts of hay and starter ration. More than 70 calves, including Ayrshires, Holsteins, and Jerseys, were removed from their dams shortly after birth, fed colostrum from their dams the first four days and then each was fed a limited amount of whole milk amounting to a total of 315 pounds during the first 8 weeks. The calves were placed at random, by breed, into one of three groups. They were kept in individual solid-walled wooden pens. Weights of feed consumed were recorded daily, and weight and measurements of the calves were made at weekly intervals.

The calves were fed according to the schedule in the table at right.

The calves in the first two groups made about equal gains in weight and body measurements, and the cost of feed per pound of gain was about the same. The calves in the second group ate a total of about 10 pounds more starter ration on the average than those in group one but consumed some 57 pounds less hay. Calves in the third group grew only about three-fourths as fast as those in the other groups, and although their total feed cost was a few dollars less, the cost of feed per pound gain was the highest of any of the groups.

During the final weeks of the trial most of the calves would have consumed more starter ration than was offered.

The study shows that under the management conditions at the West Virginia University Dairy Farm a supply of good starter ration must be fed daily to maintain satisfactory growth in young dairy calves raised on a limited amount of whole milk.

Feeding Schedule	Group I	Group II	Group III
	Pounds Per Calf	Pounds Per Calf	Pounds Per Calf
1st 8 Weeks			
Whole Milk	315	315	315
Calf Starter*	Free Choice	Free Choice	None
Mixed Hay**	Free Choice	None	Free Choice
2nd 8 Weeks			
Calf Starter	Free Choice to 4 lbs. daily	Free Choice to 4 lbs. daily	½ Amount consumed by Group I
Mixed Hay	Free Choice	½ Amount consumed by Group I	Free Choice

*The calf starter used was a nationally-known, commercially-mixed ration containing no antibiotic.

**Hay was early cut, mixed-hay containing about one-third legumes.

Effect of Water Hardness Upon the Performance of Detergents Used in Cleaning Dairy Utensils

by J. E. Fike, Assistant in Dairy Husbandry

MANY dairymen are not using the detergent which is best adapted to their water supply. Too often they use the detergent which is most readily available or one provided by their milk plant. Some milk plants provide the same detergent for all their producers, with no consideration of the wide variation in the water supplies in any particular area.

Researchers at the West Virginia University Agricultural Experiment Station have just completed a study of the water supplies of all Grade A milk producers in Monongalia County. Water hardnesses, the amount of calcium and magnesium salts present in the water, were determined in all water supplies. A comparison of the effectiveness of ten different dairy detergents was made. Detergents were tested for wetting ability, cleansing action, solubility at two different concentrations, and ease of rinsing. An effective detergent will (1) dissolve completely without formation of troublesome precipitates (scum), (2) result in a solution which will rapidly wet all surfaces of soil or equipment, and (3) rinse easily from the equipment.

Water hardness on the Monongalia County farms tested varied from 5 (very soft) to 320 (very hard) parts per million of calcium carbonate. These two supplies were located on farms which were only one-half mile apart.

Although the data has not been completely analyzed, it appears as though water hardness has little

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BACTERIA on the farm

by H. A. Wilson, Associate Bacteriologist

THE term bacteria to many people means "germs," and germs are reminders of disease. Yet the number of bacteria helpful to man, and particularly the farmer, far outnumber the harmful kind.

Although some bacteria and their rather close relatives, the fungi, do cause diseases of man, plants, and animals, the majority are beneficial. Bacteria and the fungi, for example, are responsible for the decomposition of organic matter and sewage. Certain dairy products and manufactured foods would not be possible without them. Some of the fungi, though chiefly responsible for the spoilage of fruits and vegetables, and for many plant diseases, also are important as producers of certain antibiotics, such as penicillin.

Soil microorganisms, particularly bacteria and fungi, are mainly beneficial. Many are engaged in the decomposition of plant and animal materials and the breakdown of mineral matter to simpler substances again to be used by plants. Plant growth is dependent upon these breakdowns and man, therefore, is dependent upon these soil microorganisms for his food.

Some bacteria in the soil are able to take nitrogen from the atmosphere and add it to the soil in a form that plants can use. Some of these bacteria do this by themselves and others, like the legume bacteria, live on the roots of legume plants. These bacteria "fix" the free nitrogen of the air and exchange it for food from the plant.

The disposal of human excreta and industrial wastes is an ever-present major problem of civilization. In rural areas the septic tank is perhaps the best method, if water is available in the house for the disposal of this domestic waste. Bacteria, both those which "work" in the absence of atmospheric oxygen and those which require such oxygen, break down the waste materials in the tank. The materials in the liquid portion which is discharged from the tank into the soil are reduced to simple compounds available to plant grow by soil microbes.

Microorganisms found in milk are responsible for both good and bad changes in the milk. Ropy milk, bitter milk, and colored milk are examples of bad changes. Certain disease producing bacteria will live in milk and these, unfortunately, do not produce any changes in appearance, taste or smell of the milk and consequently are not easily detected. The disease bacteria which cause tuberculosis, undulant fever, and some types of septic sore throat may come from the cows. Diseases originating with human handlers of the milk and which may be milk-borne are intestinal diseases, typhoid and paratyphoid fevers, cholera, dysentery, diarrhoea, scarlet fever and diphtheria. All these bacteria which cause unwanted changes in the milk or diseases of humans can be eliminated by herd inspection, clean and sanitary conditions in the stable, milk house and dairy, permitting only healthy and clean individuals to handle the milk, proper sanitizing of cans and utensils and pasteurization of milk.

Many products, such as sour cream butter, cheeses, acidophilus and bulgaricus milk are products of controlled milk fermentation by bacteria or fungi. Silage, a product usually made of corn, is preserved in a silo as a result of microbial fermentation. Sauerkraut is preserved by organic acids produced by certain beneficial bacteria. Vinegar is produced by yeasts and certain bacteria. The yeasts change the sugar solutions in apple cider to alcohol and then the alcohol is changed to acetic acid by certain bacteria.

These helpful bacteria are ever-ready to help the farmer. All they require is more favorable conditions for their growth and they will do the work for free.

STRETCHING farm protein supplies

THERE is not enough high-protein feed produced in the United States to properly feed our livestock and poultry. A recent estimate has put this shortage at 1,369,000 tons per year. This deficit probably will become more serious as the country's population continues to increase. It seems important, then, that the supply of protein feeds be increased or used more efficiently.

Scientists have known for more than sixty years that ruminants, cattle and sheep, can utilize urea to supply part of their protein requirements. Urea is a simple and relatively inexpensive chemical compound. Not much use was made of this knowledge until the shortage of high-protein feeds became critical during World War II. Since that time it has been found that cattle and sheep can be fed urea to supply *up to* 30 per cent of their total protein needs.

Ruminants are able to use urea because of the presence of billions of microorganisms in the paunch. The microorganisms convert this simple compound into more complex substances which the animal subsequently digests and uses. Investigators in recent years have learned much about these microorganisms and their requirements. This new knowledge leads us to believe that it should be possible to furnish *more than* 30 per cent of the ruminant's protein needs in the form of urea or some other cheap, simple compound.

Cattle and sheep consume about 6,508,690 tons of high-protein feed each year. The substitution of a simple chemical for a large part of the natural feeding stuffs used by ruminants would release much high-protein for hogs and poultry. These animals cannot utilize urea.

Workers in the Departments of Animal Husbandry and Agricultural Biochemistry of the West Virginia

(continued on page 8)

*Authors are G. C. Anderson, Animal Husbandman; J. A. Welch, Associate Animal Husbandman; D. S. Shelton, Associate Agricultural Biochemist; and G. A. McLaren, Assistant Agricultural Biochemist.

VENDING MACHINES

(continued from page 3)

is true of all types of vending machines, as the manufacturers have been alert to the defects that have arisen in the past.

Vending Machine Use

A recent report from the Dairy Cattle Show held at Jackson's Mill, August 15-19, showed that of the 3,250 one-half pints of chocolate and white milk consumed, vending machines sold 1,325. Eleven hundred one-half pints were sold at sandwich stands, and 825 one-half pints were served in the dining room.

In January, 1951, a hand-operated vending machine was placed in the Field House at West Virginia University for the use of day and evening classes. This machine sold 13,240 one-half pints of milk in 1951; 14,925 one-half pints in 1952; 13,087 one-half pints in 1953; and 9,826 one-half pints in 1954. The decrease in sales for 1954 was to a great extent caused by the moving of the United States Bureau of Mines Experiment Station to its new location in Morgantown. From 50 to 75 persons were involved in this move. Nearly all of this was chocolate milk. In January, 1952, a second vending machine was placed in Terrace Hall (freshman women's dormitory). This machine sold only 5,852 one-half pints of milk in the nine school months of 1952 and 2,838 one-half pints in seven school months of 1953. The machine was taken out at the end of the seventh month because of insufficient use.

More Tests Needed

Why was the vending machine successful at the Field House and not at the dormitory? The milk at the Field House was consumed mostly by boys after an hour's strenuous exercise in a physical education class. The girls in the dormitory were served milk three times a day with their meals and the milk from the vending machine was consumed largely during the late evening hours when the girls were restricted to the dormitory. More milk outlets on the campus must be tried before any conclusions can be made.

To estimate the success of vending machines in increasing the consumption of milk in a given locality, a thorough study of a particular town is needed. Machines can be placed in filling stations, offices, schools, and industrial plants. Such a study is being undertaken by the Department of Agricultural Economics at West Virginia University in cooperation with the U.S. Department of Agriculture.

WATER HARDNESS

(continued from page 6)

effect upon wetting ability. However, there is a marked difference in wetting ability of different detergents. Water hardness does affect solubility and ease of rinsing to a great extent, and some detergents are better adapted to hard water supplies than others.

Station workers recommend that dairymen should have their water supplies tested for water hardness and attempt to use the detergent which will give them the best possible results.

PROTEIN SUPPLIES

(continued from page 7)

University Agricultural Experiment Station have begun a series of experiments to find ways of using urea or other simple compounds to supply nitrogen to rumen microorganisms so they may synthesize protein in excess of 50 per cent of the total amount required by sheep. Many different types of compounds will be used alone and in combination with urea. Ample minerals, vitamins, and carbohydrates will be fed so that the microorganisms will be able to grow more rapidly and thereby convert more simple compounds into protein which the sheep can use.

These experiments will be of two general types. In the first group of tests, now underway, the amount of protein stored by a sheep is measured. To do this the sheep is put into a stall or crate so that the feed it eats can be accurately weighed and the feces and urine it voids can be collected and measured. Chemical analyses of the feed, feces, and urine permit calculation of the amount of protein retained by the sheep. Various feeding levels of many simple chemical compounds will be evaluated in this manner.

If the laboratory tests show certain compounds to be good sources from which the rumen microorganisms can make protein, these compounds will be tested under feed lot conditions. In the feed lot tests the simple compounds will be compared with a natural feed-stuff, such as soybean oil meal. Comparisons will be based on the ability of the substances tested to support growth of the body and wool.

Compounds found to be satisfactory for sheep will be tested for cattle under feed conditions.

DAIRY PRODUCTION

It is with pride that we can report that the three University dairy herds have again won the Constructive Breeders' Award and the Progressive Breeders' Award. These awards are presented to purebred herds meeting high production, type, and health standards.

Holstein Herd—The fifteen cows in this herd produced during the past year an average of 13,730 lbs. of milk testing 4.1 per cent and 557 lbs. of butterfat. They had an average type score of 84.2. The herd qualified for its ninth consecutive Progressive Breeders' Award. This herd has an average production of 12,707 lbs. of milk and 515 lbs. of butterfat over the last five years.

Jersey Herd—The ten cows in this herd produced more milk and butterfat than in any year since they were put on the twice-a-day milking schedule. They produced 8,003 lbs. of milk and 439 lbs. of butterfat. The average butterfat test was 5.5 per cent, and the type score averaged 86.5, thus earning the herd its eighth Constructive Breeders Award. Herd average over the past five years has been 7,612 lbs. of milk and 418 lbs. of butterfat.

Ayrshire Herd—The twenty-nine cows in the Reymann Memorial Ayrshire herd produced during the past year an average of 10,198 lbs. of 4.1 milk and 422 lbs. of butterfat. Since many of the animals were first-calf heifers, the records were converted to a mature basis. When this was done they equaled 10,996 lbs. of milk and 456 lbs. of butterfat. There are only seven other herds of the Ayrshire breed which have won as many Constructive Breeders' Awards as has the Reymann herd, with eleven such awards. The average classification of this herd is 86.5, which was surpassed by only ten herds in the United States this past year. The mature equivalent five-year average for the Reymann herd is 10,545 lbs. of milk and 449 lbs. of butterfat.

Many of the cows in the University Herds are daughters of bulls used by the West Virginia Artificial Breeders' Cooperative.—*H. O. Henderson, Dairy Husbandman.*

Science

SERVES YOUR FARM

Bulletin 382, Part 2

Winter 1955

WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

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ANNUAL REPORT OF H. R. VARNEY, DIRECTOR, WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

FOR THE PERIOD 1955-1956

IN THIS ISSUE

on the cover

Plans for the 1956 County Hybrid Corn Trials are now complete. Experiment Station agronomists are preparing samples of the recommended and experimental hybrids for mailing to county agents and cooperating farmers. Selection of the hybrids to be planted in any particular county depends upon information collected during previous trials, as well as rigorous testing in Experiment Station plots.

Cooperating farmers and county agents in 22 counties will receive seed, plot stakes, and uniform planting guides in April. These test hybrids are to be planted at the same time and in the same field as the farmer's regular corn crop, and will receive identical fertilization, tillage, and weed control treatments.

At harvest time, Extension and Experiment Station agronomists set a date for a harvest demonstration. Farmers and other interested persons visit the trial plot and assist in the harvest. Thus they are able to observe first hand the growth and yield performance of hybrids which later may be recommended for planting in their area.

The results of the 1955 trials and the 1956 list of recommended hybrids are contained in Current Report 12, which is now ready for distribution. Copies may be obtained at County Extension Offices, or by writing to the Experiment Station in Morgantown.

on the calendar . . .

MARCH

17-19—State FFA Ham, Bacon and Egg Show, Charleston
21-22—State 4-H Ham and Bacon Show and Sale, Clarksburg

new publications

Bulletins

382, Part 1. Annual Report of H. R. Varney, Director, Science Serves Your Farm, Fall, 1955.
383T. W. H. Reid and C. B. Koch. A Laboratory Method for Testing Wood Mine Pins in Tension. November, 1955.
384. W. S. Hutson. Livestock Marketing Practices of West Virginia Farmers. December, 1955.
385. Norman Nybroten. Pricing Piece Chicken for Kept-up Displays. January, 1956.
386T. R. S. Dunbar, Jr., and G. Heebink. Locating Outstanding Bulls in Artificial Breeding. January, 1956.

Circulars

84 (Revised). R. F. Dugan. Farm Fish Ponds in West Virginia. January, 1956.

Current Reports

11. R. P. True, T. M. Judy, and Eldon Ross. The Absorption of Solutions Through the Tops of Freshly Cut Oak Stumps. October, 1955.

Scientific Articles

483. R. P. True, E. H. Tryon, J. F. King, Cankers and Decays of Birch Associated with Two Poria Species. Journal of Forestry, Vol. 53, No. 6: 412-415, June 1955.

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Frozen Semen

FOR PLANNED MATINGS

by R. S. Dunbar, Jr., Associate Dairy Husbandman

Chest used for storage, transportation of frozen semen. Picture shows arrangement of flasks, and bag of dry ice which is placed over the semen.

IN recent years it has been shown (1,2) that progeny testing of young bulls provides the best opportunity for improving the average genetic merit of a stud of bulls in artificial breeding. One of the best sources of such young bulls is the mating of outstanding A.B. proven bulls[1] to selected cows which are superior to their herd mates and, when possible, daughters of other outstanding A.B. proven bulls. In certain of the larger populations of artificially bred cattle such matings may occur as a matter of chance, but in general, chance matings will not provide a sufficient number of young bulls in most populations.

During the past year the Dairy Department has worked with the sire selection committees of the West Virginia Artificial Breeders' Cooperative, Inc., in the initiation of a planned mating program. The objective of this program is to obtain outstanding young bulls to be progeny tested in artificial breeding. This work consists of essentially three phases; namely, the selection of the cows, selection of the sires, and distribution of the semen.

Selection of the Cows

The cows were selected from registered and Dairy Herd Improvement Association tested herds which had an average production exceeding the average of all registered and tested herds of that breed in the State. The individual cows were chosen according to results of an indexing procedure, a modification of a selection index derived and published by Legates and Lush (3). It is an objective method for combining production records on the cow, her dam, granddams, progeny, and sisters.

A list of the selected cows was compiled by the Dairy Department of the Experiment Station and submitted to the appropriate sire selection committee. The committee then arranged for a contract between the owners of the cows and the West Virginia Artificial Breeders' Cooperative.

Under the terms of this contract, a cow is to be mated to one of the selected bulls and, if the resulting calf is a male, the Cooperative has an option to purchase the calf for a specified sum. No option is held on female calves and there is no charge to the herd owner for breeding the cow.

Selection of the Sires

The most promising young bulls in artificial breeding are those sired by bulls proven, in artificial breeding, to be truly superior sires. These sires must have large numbers of artificially sired daughters which have been tested for production. In order for a bull to be considered a desirable sire for planned mating, his daughters must be superior to the average of all the artificially sired daughters of the bulls of that breed in the same stud, providing their records were made at approximately the same time.

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[1] A.B. proven bulls are bulls which have been used in artificial breeding and have a number of artificially sired daughters which have been tested for milk and butterfat production.

Planned matings are still being made today with frozen semen from Seely Brook Pebble Beach 831870, dead since July, 1954. His 291 artificially sired daughters averaged 12,730 lbs. 3.6% milk, on a 305 twice-a-day test, Mature Equivalent Basis.

Radiant temperature under this infra-red brooder, as measured at the black ball (1), was found to be considerably higher than air temperature at edge of hover (2). Chicks gather at edge of hover, then move into center when desiring extra heat.

Radiant Temperatures Under INFRA-RED brooders

by A. D. Longhouse, Agricultural Engineer

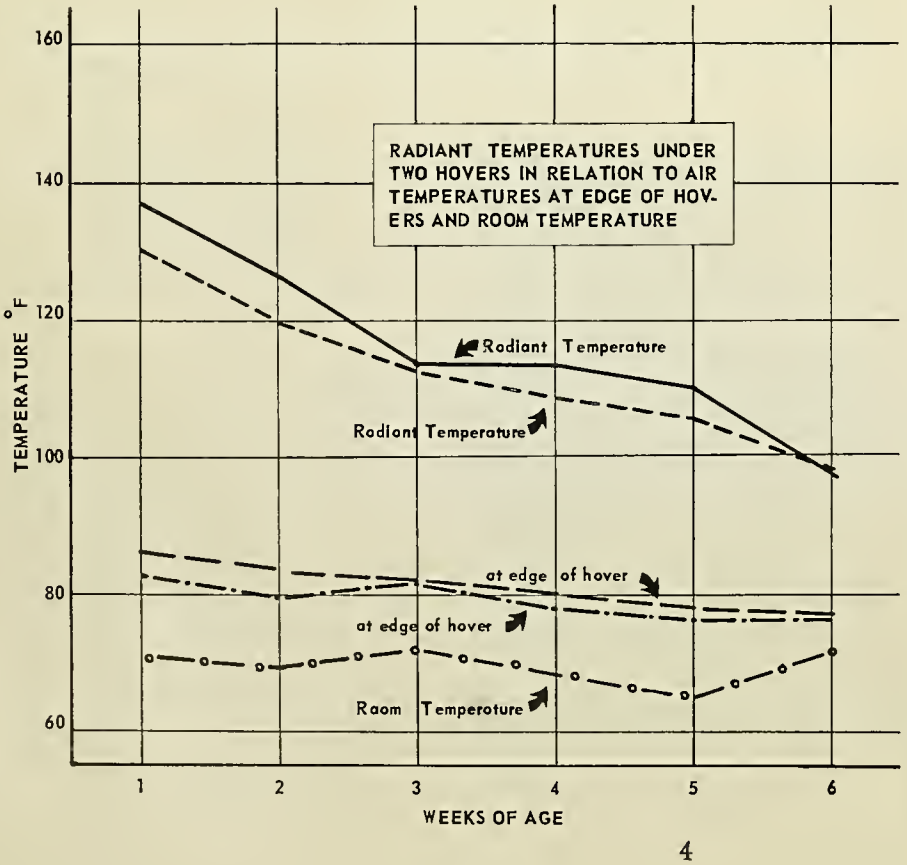
THE temperature as measured by thermometer at chick height at the edge of a brooder hover is not necessarily a measure of chick comfort. Recent studies by agricultural engineers and poultry husbandmen of the West Virginia University Agricultural Experiment Station indicate that much higher temperatures may exist under hovers than are indicated when these temperatures are measured with an ordinary thermometer.

During a two-year study, radiant temperatures were measured at chick-height under the center of an infra-red brooder (photograph). This brooder used industrial-type clear glass heat lamps and an aluminum hover. The total wattage used was 1,750.

Temperature Measured

The radiant temperature under the hover was measured by inserting a thermocouple into the center of a 4-inch copper globe painted black. (1, photograph). A second thermocouple was placed in a glass tube at chick height at the edge of the hover (2, photograph). This thermocouple measured the temperature that would be recorded on an ordinary thermometer. The glass tube prevented damage to the thermocouple by chickens, and provided a mount to hold it in place.

As was expected, radiant temperatures were highest when all of the lamps were lighted, and the full wattage was being consumed under the hover. The radiant temperature curve in the accompanying chart shows that an average heat of nearly 140° F. was reached when the birds were young and the hover was near the floor. Some single readings taken during the coldest part of the brooding period showed radiant temperatures of 155° F.



Hover Raised

The hover was raised to accommodate the chicks as they grew larger. As the distance between floor and hover increased, the radiant temperature under the hover showed a steady decline, while the temperature at the edge of the hover fell less than expected, (chart). Room temperature did not exceed 70° F. during either of the brooding periods.

Temperatures under an infra-red type electric hover should be kept high enough to make the center uncomfortably warm for the chicks. This will cause them to form a doughnut-shaped circle near the edge of the hover, leaving a bare space in the center. Thus additional

(continued on page 9)

Artificial Insemination

IN BROAD BREASTED BRONZE TURKEYS

by T. B. Clark, Associate Animal Husbandman and R. E. Cook, Research Assistant in Poultry

LOW fertility is perhaps the most common and the most costly problem in turkey breeding flocks. Low embryo viability is sometimes associated with low fertility in Broad Breasted Bronze strains. The two factors together can be very costly.

Some think there is a genetic basis for fertility, and this is being studied in pedigree matings in the University flock. There are differences between strains in the Broad Breasted Bronze or any other variety of turkey, but to select for high fertility is a difficult problem. Without the use of trapnests one can only choose well-balanced, up-standing toms with a natural walk.

Low fertility may arise from some management factors, such as immature toms and lack of pre-season lighting for early eggs, and exceeding the tom-hen ratio of 1 to 10. Environmental stresses such as slat floors and extreme temperatures seem to depress fertility, especially in the Broad Breasted Bronze variety.

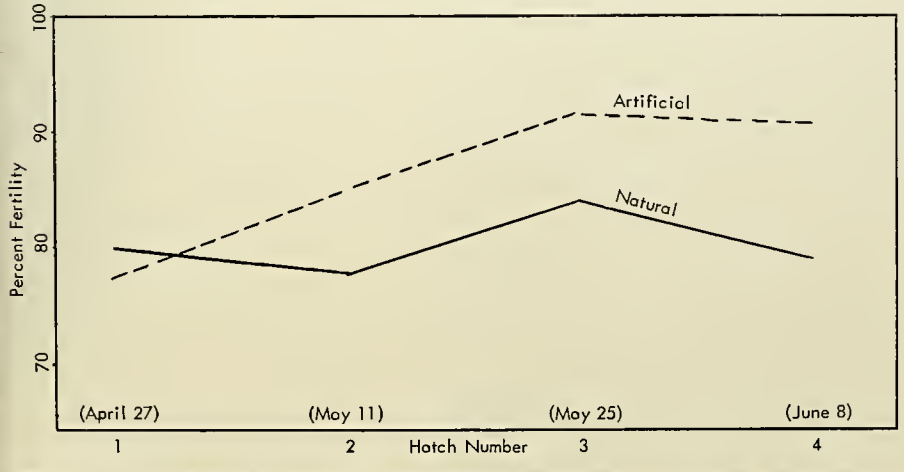
Popular Method

Artificial insemination is becoming increasingly popular where low fertility is a problem. When used as the sole means of producing fertile eggs, this method reduces the number of toms required. Also, it does away with saddles because the toms are maintained in separate pens from the hens. A new version of the method has become popular on the west coast. It is the use of artificial insemination as a supplement to natural mating.

The supplementary method is being studied at the University Poultry Farm in Broad Breased Bronze single-tom matings. The breeding flock is maintained on slat floors which seem to discourage mating and consequently lower fertility. To test the efficiency of the technique on slat floors, six of the twelve hens in each of the eight pens were inseminated artificially at the beginning of the breeding season in 1955 and every two weeks thereafter. The other six hens in each pen were allowed to mate naturally. At first the toms were separated from the hens for one or two days but this was found unnecessary. Good semen producers could be picked up and milked while running with the hens.

Results

The results for the eight pens are shown in Graph 1. The hens producing eggs in each hatch were grouped according to method of mating. Even though the fertility did not drop very low in the hens naturally mated, the artificially mated hens exceeded them in the percentage of fertile eggs produced after the first hatch. High fertility was maintained through the other three hatches when a seasonal drop would be expected as shown by the lower line. In the June hatch, the eggs from the artificially mated hens were 90 per cent fertile or about 12 per cent above those from the natural matings. This difference occurred even though both groups of hens were running with the tom in each pen.



GRAPH 1. Comparison of fertility from natural matings and artificial insemination.

Fertility Not Always Improved

Naturally, the fertility was not improved in all pens. Several hens in two pens had a low fertility all season. In the beginning, the toms had to be tested to find those that yielded appreciable amounts of semen. California workers have found that about 3 to 5 per cent of the toms were sterile at all times of the year.

Some turkey breeder flock owners consider the technique too expensive and the turkey too small an animal on which to practice artificial insemination. Considering the price of turkey eggs, low fertility in the Broad Breasted Bronze variety is more expensive than the cost of artificial insemination.

Technique Easily Acquired

The technique of artificial insemination can be quickly acquired after watching an experienced operator. Experience will be obtained while checking the toms for good semen production. The number will be reduced automatically by the many low producers and the few non-producers of semen. It is advisable to still keep twice as many toms as will be required.

Turkey breeders that have had trouble with low fertility in their flocks in past seasons should examine their management practices and other conditions in their flocks before the new breeding season. Supplementary artificial insemination is not a cure-all for all fertility problems. It has the greatest beneficial effect in very low fertility flocks where the condition is not caused by disease.

Birdsfoot Trefoil--

A Promising Legume for PASTURE AND HAY

by O. J. Burger, Associate Agronomist

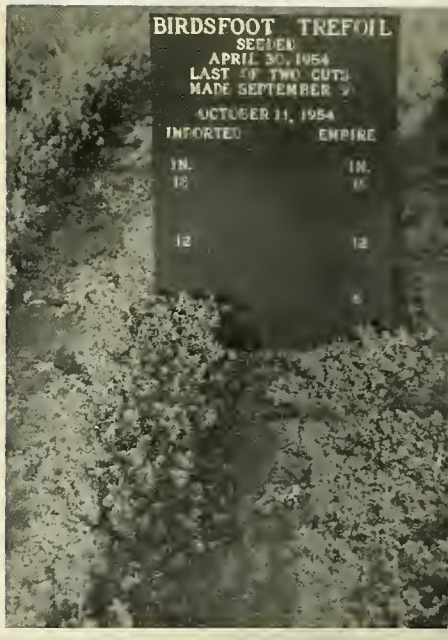


FIGURE 1. Growth habit of birdsfoot trefoil. On the left is the upright growth of the hay type such as the Viking variety; on the right is the low-spreading habit of the pasture type such as the Empire variety.

WEST VIRGINIA farmers will do well to watch birdsfoot trefoil. It may become our best pasture legume. It is now being grown on a few West Virginia farms with good success but on others, difficulty in its establishment and management has been encountered.

The trefoils can be divided into two main groups, the annuals and perennials. The two annual species are of little value in this country. Within the perennials, there are two types; namely, broadleaf and narrowleaf.

The broadleaf birdsfoot trefoil is of greater importance to West Virginia farmers than the narrowleaf. Empire is a variety of broadleaf birdsfoot trefoil which has a low growth habit. A more erect growth is produced in the other varieties such as Viking and European seed stocks. The difference in growth habit between Empire and a variety of European seed stocks is shown in Figure 1. Varieties such as Empire, because of their characteristic growth habit, are used for pasture, while Viking, Cascade, Granger, and Italian varieties are generally used for hay.

Long-Lived Legume

Birdsfoot trefoil will not replace other legumes where they are well adapted to climate and soil conditions but it has many characteristics required for use where other legumes fail. It is long-lived and may be the legume needed for hay or pasture on land not well adapted to alfalfa. It is drouth-resistant and makes much more growth in midsummer than does wild white clover. Once birdsfoot trefoil is well established it will withstand severe competition and drouth longer than Ladino clover.

The Empire variety is of special interest in West Virginia. This variety is primarily a pasture legume for land that is to remain in sod for long periods. It performs best on good soil, but it will also grow and persist on poorly-drained, as well as shallow, dry soils. Birdsfoot trefoil is well suited for the hill land of West Virginia. Once established, birdsfoot trefoil should persist for many years. Some stands of 15 years and older are still producing very well.

Similar to Alfalfa

Birdsfoot trefoil is similar to alfalfa in some respects. It is a perennial legume with a taproot much like that of alfalfa, although the taproot of birdsfoot is much more branched. The fine stems, growing 20 to 40 inches from a crown, much like that of alfalfa, Figure 2, tend to lodge considerably, but if this is a problem, it can be solved to some extent by growing birdsfoot with a supporting grass such as timothy. The leaves have five leaflets in contrast to alfalfa and clovers which have three. The flowers are in groups of two to eight, each like a tiny yellow sweet pea about one-half inch long. The seed pods are characteristically brown when ripe and extend outward at an angle from the flower stem tip to give the appearance of a bird's foot, hence its name. Each seed pod contains about 10 seeds. When ripe and dry it snaps open and scatters the seed a distance of several feet. Grazing animals seldom will consume the entire top-growth of birdsfoot, particularly the pasture type, such as Empire, because of excessive lodging. This fact, coupled with the natural scattering of seed, is conducive to spreading of the stand of birdsfoot trefoil.

Birdsfoot will grow better with some grasses than with others. Kentucky bluegrass, timothy, and tall fescue grown with birdsfoot make good mixtures, Figures 3 and 4. Fairly good yields have been obtained from a mixture of birdsfoot trefoil and Kentucky 31 fescue seeded at six and eight pounds per acre, respectively, Figure 5. Some yields from various mixtures are reported in Table 1.

TABLE 1. YIELD IN TONS DRY MATTER PER ACRE OF BIRDSFOOT TREFOIL GROWN ALONE AND WITH GRASSES DURING 1952 AND 1953. AVERAGE OF 3 REPLICATIONS, MORGANTOWN, WEST VIRGINIA

MIXTURE	SEEDING PER ACRE		DRY MATTER YIELD THREE CUTTINGS EACH YEAR		
	BIRDSFOOT	GRASS	1952	1953	AVERAGE
	Lbs.	*Lbs.*	*Tons*	*Tons*	*Tons*
Birdsfoot alone	6	—	3.01	1.98	2.50
with—Kentucky 31 fescue	6	8	2.59	1.84	2.22
with—Kentucky bluegrass	6	6	2.50	1.82	2.16
with—Timothy	6	4	3.23	2.24	2.74
with—Smooth bromegrass	6	10	2.85	1.72	2.28
Average			2.84	1.92	2.38

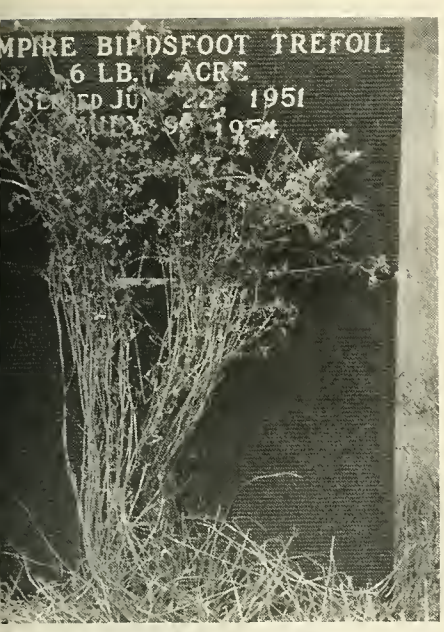


FIGURE 2. Empire birdsfoot trefoil. Because of the low, spreading growth habit, this plant remained after hay cutting was made. Note the many fine stems and numerous leaves, as well as the number of characteristic blossoms and seed pods resembling birds' feet.

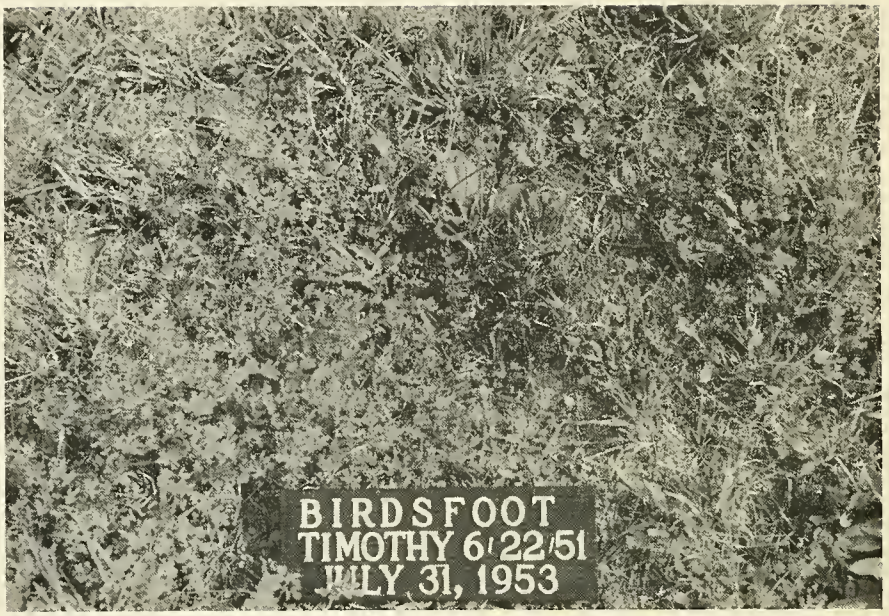


FIGURE 3. Empire birdsfoot trefoil with Timothy. Even though mixture was just cut, there is good evidence of a stand of trefoil on soil of below average fertility.

About two years ago some exploratory work on establishment of birdsfoot trefoil was initiated at the West Virginia Station. Some of the work was conducted in cooperation with Soil Conservation Service.

Planting Hints

Best conditions for securing successful establishment and maintenance of birdsfoot trefoil were as follows:

1. Test the soil. Lime soil to pH 6.5.
2. Apply 80-100 pounds P_2O_5 and 80-100 pounds K_2O per acre, depending on soil test, during tillage operation or at seeding time. This is equivalent to 400 to 500 pounds of 0-20-20 fertilizer per acre.
3. Disk soil in early April and once or twice before seeding to reduce weed competition.
4. Seed about corn planting time for most locations. This probably would be during the first two weeks of May.
5. Good cover and high forage yields can be obtained when seeded with tall fescue, Kentucky bluegrass or timothy. Suggested seeding rates per acre are as follows:

Birdsfoot trefoil	5-8 pounds
Tall fescue	5 pounds
or	
Kentucky bluegrass	3 pounds
or	
Timothy	4 pounds

6. Inoculate with the special birdsfoot trefoil inoculant.
7. Seed in bands. This may be done by adapting a grain drill with tubing (garden hose) so that the seed is dropped above the fertilizer band in the row behind the drill shoe. Seeding may also be done by using a cyclone seeder or cultipacker seeder.
8. Use cultipacker to firm seed bed. The seed must not be placed deeper than one-fourth inch.
9. New seeding should be clipped when necessary during the first season to reduce competition. Controlled grazing *must* be practiced to avoid over-grazing.

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FIGURE 4. Empire birdsfoot trefoil with Kentucky 31 fescue. Of particular interest is this combination because it has been a highly compatible mixture on soils of poor to medium fertility.

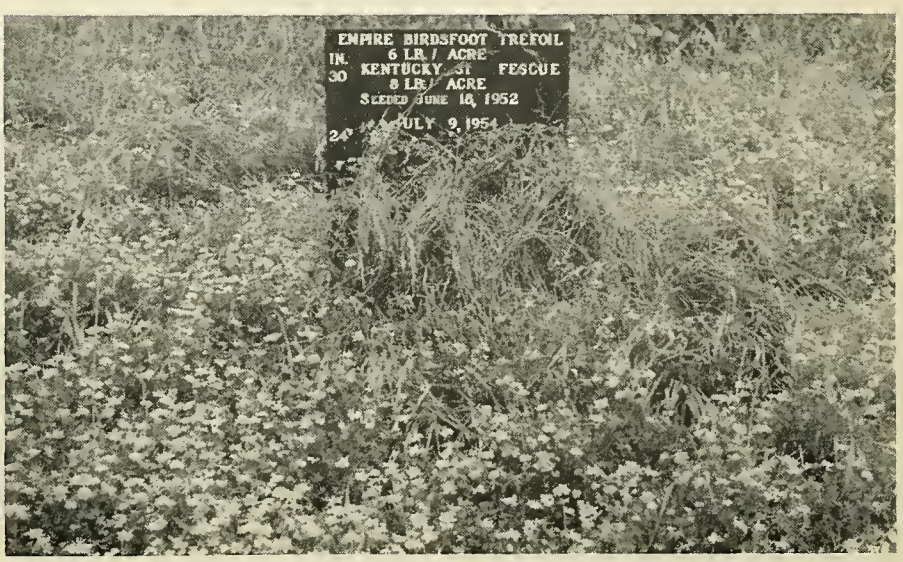

FIGURE 5. Shown here are Empire birdsfoot trefoil and Kentucky 31 fescue. High yields of fine, high quality forage can be produced on land not suited to alfalfa.

WEST VIRGINIA SOILS NEED MORE *Lime*

by P. E. Nesselroad, Assistant in Agricultural Economics

and

G. E. Toben, Associate in Farm Management

MORE than one-half of the full-time and part-time farmers in West Virginia did not apply any liming material to their soil from 1949 through 1953. They did not apply it even though most West Virginia soils are lime deficient. Only one farmer out of ten applied some lime in each of the five years. One-third of the farmers reported using lime only once during the five years.

This and other information about lime materials was obtained from a research project carried out by the Department of Agronomy and Genetics of West Virginia University. The research showed that ground limestone is the most important lime material. In terms of neutralizing value, limestone accounted for more than 70 per cent of the material used in 1953. Burnt lime was second in importance and marl was the third most important. The use of marl was almost completely confined to the counties along the eastern border of the State.

Lime materials showed a wide range in price throughout the State. Limestone varied in price from less than a dollar to as much as twenty-two dollars per ton. Hydrated lime was usually twice the price of ground limestone in the same area. Marl generally was cheaper than limestone where both were available.

Price Is Sometimes Misleading

Price does not always indicate the best buy. Some materials are not ground fine enough. Others are made from substandard or superior materials. Waste and by-products may prove good buys to farmers in some localities. Sometimes farmers may substitute the purchase of one material for another and gain. For instance, on the basis of average ability to neutralize acid soil, marl at $6.00 per ton and hydrated lime at $8.75 are equal in value to limestone at $5.00 per ton. In making substitutions, or purchasing materials of unknown quality, farmers need to know the neutralizing value as well as the price.

It was found that the common rate of application used by farmers was two tons per acre regardless of the kind of material, crop need, or method of spreading. Only one-third of the farmers had their soil tested prior to applying lime and less than one-third of those testing before application tested the following year.

The five-year average price reported for custom spreading was 66 cents per ton. Based on average labor and machine costs, custom spreading was cheaper than farm spreading. However, custom spreading is not available over the entire State and is limited in some areas by the terrain. Even if custom spreading is available, farmers should consider if they have alternate use for their own labor which is more profitable before changing to custom spreading.

Lime Use Is Low

Since 1944 the quantity of lime materials used annually by West Virginia farmers has decreased almost continuously. The 171,931 tons of lime used in 1954 is less than one-fifth of the quantity estimated to be necessary for annual maintenance. It is generally necessary for maintenance purposes to lime crop-rotation land once each four to six years and pasture land once in ten years. If farmers continue applying lime in the future at the rate they did in 1953, it would take 25 years to lime all the crop-rotation land once, and 100 years to lime all the pasture land once. Previous amounts of lime materials applied have always been far short of maintenance.

NEW PUBLICATIONS

(continued from page 2)

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FROZEN SEMEN

(continued from page 3)

Several suitable sires were found among the A.B. proven bulls owned by the New York Artificial Breeders' Cooperative, Inc. The West Virginia Artificial Breeders' Cooperative, Inc., was able to obtain frozen semen from them.

Distribution of the Semen

The most difficult aspect of a planned mating program is the problem of having semen of a selected bull available when a selected cow is to be bred. This difficulty arises because A.B. proven bulls satisfactory for planned matings are few in number and usually are located hundreds of miles from the cows to be bred. Because of their advanced age these bulls have a very short life expectancy. The technique of freezing bovine semen and successfully storing it for long periods has greatly reduced this difficulty.

In this instance, the semen was processed at the laboratory of the New York Artificial Breeders' Cooperative. Raw semen was diluted in an egg yolk extender to which certain antibiotics had been added. Glycerol was then added and the extended semen-glycerol mixture was measured into glass vials which were then sealed. Each vial contained enough semen to bred a single cow. Dry ice was used to reduce the temperature to −110° F., thus freezing the semen.

The vials of semen used in planned matings throughout the Mountain State are stored in an alcohol bath surrounded by dry ice in a large thermos flask. The flask is insulated by glass wool within a smaller wooden chest used both for storage and for carrying the semen to farms where the cows are located. Immediately before a cow is to be bred, a vial of semen is removed from the chest and placed in ice water to thaw. After thawing, the vial is opened and the semen used as in routine artificial insemination. The semen chest was originally kept at West Virginia University between inseminations.

On the average, the transportation of the frozen semen used in the State has required a round trip of approximately 85 miles. Such a distance would be impractical for routine artificial breeding, but not so for a planned mating program. Another additional expense is the cost of dry ice for storage of the semen at −110° F. But the important point to be remembered is that the objective of the planned mating program is not to obtain bulls at a lower cost, but rather to obtain the most promising bulls possible for progeny testing in artificial breeding.

Results to Date

Approximately 14 Holstein and 9 Guernsey cows have been selected and bred. The conception rate has been satisfactory. Two calves have been born, both are females.

During the early stages of this work, the Dairy Department was responsible for the storage and distribution of the frozen semen, as well as assisting the West Virginia Artifical Breeders' Cooperative in the selection of cows and bulls to be mated. Now the Cooperative has full responsibility for storage and distribution of the semen and the Dairy Department, under the terms of a cooperative research project, assists with the selection of cows and bulls to be used in the planned mating program.

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BIRDSFOOT TREFOIL

(continued from page 7)

10. Apply fertilizer annually. Apply about 400 pounds 0-20-20 per acre or equivalent.
11. Control grazing so that the birdsfoot plants may produce seed which should result in thicker stands.

More Research Needed

In conclusion, a great deal of research is necessary to establish the best methods for birdsfoot trefoil culture in West Virginia. Birdsfoot will not replace alfalfa and is of greatest value for hay and pasture in areas where alfalfa is not successful and where a long-lived legume is needed. It appears very promising as a legume to be incorporated into permanent bluegrass pastures because of its tolerance to dry as well as wet conditions.

Farmers should determine the value of this legume by actual trial seeding on areas where it is difficult or not desirable to plow often. Great care must be taken in seeding and management to secure a successful stand. Once this legume is established it will offer many years of grazing and cover.

INFRA-RED BROODERS

(continued from page 4)

heat is available if there is a sudden drop in temperature, and sickly chicks and others that need additional heat can move into the center and absorb as much heat energy as they can stand. Information as to radiant temperatures under other types of hovers, such as hot water, coal, wood, and oil burning, is unavailable.

staff of station

December 1, 1955

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Damon Shelton, Ph.D., Assoc. Bio.

DAIRY HUSBANDRY

H. O. Henderson, Ph.D., Dairy Husb.
R. A. Ackerman, M.S., Asst. Dairy Husb.
A. Bortoff, B.S., Grad. Asst.

(continued on page 12)

These station projects were active in the year 1954-55

(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 (A 13)
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)
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)
(Title changed) Segregating and Pricing Poultry Meat and Egg Quality. (RM 36, NEM-11; Coop. USDA)
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)
The Physical and Economic Input-Output Relationships of Forage and Other Feed Production in the Appalachian Valley. (RM 49, NE-18; coop. Agronomy and Genetics)
Rural Population Dynamics. (RM 50, NE-17; coop. Home Economics, ARS, Monongahela Power Company)
Improvement of Market Procedures and Outlets for West Virginia Livestock. (RM 52, NEM-7)
The Production-Consumption Balance and Efficient Utilization of Milk for Non-fluid Uses in West Virginia. (RM 54, NEM-13)
The Marketing of Lime and Fertilizer in West Virginia. (RM:c-701, AES259; coop. Farmer's Coop. Service)

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)
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)
The Mechanization of Forage Crop Harvesting, Processing, Storing and Feeding. (RM 48, NE-13; coop. Animal Husbandry, Dairy Husbandry and Reedsville Farm)

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)
The Influence of Several Management Practices on the Performance of Alfalfa and Ladino Clover Grown Alone and in Association with Grasses. (RM 47, NE-21)
Factors Affecting the Herbicidal Activity of Some Chemicals Applied to the Soil Surface (RM 55, NE-12)
Some Chemical Properties of the Major Soil Types of West Virginia (RM 60; coop. SCS and USDA)
Using Nitrogen Fertilizer Efficiently (RM 61; coop. Ohio Valley Experiment Farm and University Experiment Farm)

Animal Husbandry

Improving marketing value of turkeys by cross breeding (BJ 5)
The effects of thyroid stimulants and depressants on growth and fattening of swine (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)
Simplified Methods of Improving Initial Interior Egg Quality and Shell Quality Through Selective Breeding (BJ 68)
Methods to Increase Non-protein Nitrogen Utilization by Ruminants (BJ 69; coop. Agricultural Biochemistry)
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 silage 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)
Increasing the Utilization of Low Quality Hays by Wintering Beef Cattle in West Virginia (S 111, coop. Reymann Memorial Farms)
Silages for cattle and sheep (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)

Financial Statement for the Year July 1, 1954, to June 30, 1955

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	$165,723.72	$49,210.00	$2,500.00		$373,228.00
State appropriations:									
Main station	....	....	....	....	....	....	....	$152,703.00	152,703.00
Substations	....	....	....	....	....	....	....	62,130.00	62,130.00
Special	....	....	....	....	....	....	....	28,000.00	28,000.00
Special grants, etc.	....	....	....	....	....	....	....	10,500.00	10,500.00
Sales	....	....	....	....	....	....	....	188,016.94	188,016.94
Miscellaneous	....	....	....	....	....	....	....	1,124.88	1,124.88
Balances forward July 1, 1954	....	....	....	....	....	....	....	141,443.84	141,443.84
Total Receipts	$15,000.00	$15,000.00	$60,000.00	$65,794.28	$165,723.72	$49,210.00	$2,500.00	$583,918.66	$957,146.66
DISBURSEMENTS									
Personal services	$ 9,756.14	$12,843.91	$50,783.83	$54,444.78	$138,125.52	$30,714.13	$ 1,466.67	$208,982.53	$507,117.51
Travel	1,027.40	7.14	482.50	2,559.41	6,428.43	7,295.03	970.76	3,585.46	22,356.13
Transportation of things	....	16.90	52.31	17.50	216.11	26.51	....	653.96	983.29
Communication service	....	....	....	....	27.00	45.00	....	3,270.20	3,342.20
Rents and utility services	21.30	....	31.21	10.86	183.30	1.80	....	15,493.81	15,742.28
Printing and binding	2,438.22	....	815.20	1,106.12	775.74	375.84	....	944.71	6,455.83
Other contractual services	847.98	....	189.00	410.21	137.26	470.13	....	24,908.84	26,963.42
Supplies and materials	908.88	899.56	5,551.01	6,554.31	12,858.46	6,371.35	62.57	112,193.13	145,399.27
Equipment	....	1,232.49	2,091.21	691.09	6,869.70	1,964.89	....	25,028.86	37,878.24
Lands and structures (contr.)	....	....	....	....	98.57	1,547.83	....	27,965.00	29,611.40
Total Disbursements	$14,999.92	$15,000.00	$59,996.27	$65,794.28	$165,720.09	$48,812.51	$ 2,500.00	$423,026.50	$795,849.57
Reverted Balances	.08		3.73		3.63	397.49		1,742.68	2,147.61
Non-reverted Balances Available for 1955-56								$159,149.48	$159,149.48

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)

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.)

Breeding for Efficient Production of Eggs and Meat (RM 53, NE 6, coop. Reymann Memorial Farms and Dairy Husbandry)

Dairy Husbandry

Breeding efficiency of dairy cows. (BJ 42; coop. Animal Husbandry)

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

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)

Conversion of Unproductive Hardwood Stands to Desirable Forest Types (S 107)

Planting Forest Trees in West Virginia (S 108)

Logging Methods for the Farm Woods (S 109)

Strength and Related Properties of *Ailanthus altissima* Grown in West Virginia (S 110, coop. College of Engineering)

Test specimens for wood adhesives (RM 16)

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

Factors Affecting Natural Regeneration in Upland Oak Types (RM 46; coop. Plant Pathology)

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)

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PROJECTS

(continued from page 11)

Qualities in Blouses: The Relations of those Considered in Selection to the Satisfactions Found in Wear (RM 56, NE 19)

Horticulture

Improvement of potato varieties for W.Va. (A 11; coop. Plant Pathology)
Selection, breeding, and propagation of the lowbush blueberry vaccinium vaccillans (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. (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)
On-the-farm production 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.)
Testing of Azaleas (S 112; coop. Reedsville Farm)
Improvement of apple juice (P 61; coop. Agricultural Biochemistry)
Selection, Breeding, and Propagation of Nursery Crops (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 24)
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)
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 symbolic relationships between microorganisms and insect vectors of plant diseases (RM 40)
The structure and function of specialized tissues in insects (RM 41)
Nematodes Injurious to Fruit Trees (RM 51; coop. University Experiment Farm and USDA)
Diseases of Forage Grasses (RM 57; coop. Agronomy and Genetics and USDA)
Arthropods Affecting Livestock in West Virginia—Their Distribution and Control (RM 58)
Cereal and Forage Crop Pests—Their Distribution, Incidence and Control in West Virginia (RM 59)
The Effect of Chemical Spray Schedules on the Quality and Quantity of Apples Produced (RM 62; coop. USDA)

STAFF OF STATION

(continued from page 9)

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

FIELD DAYS

A new growing season always means a new series of Field Days for the research farms of the West Virginia University Agricultural Experiment Station. Field days are very important in the activities of the Experiment Station, because it is here that scientist meets farmer. Then new farming techniques are explained, questions asked and answered, agricultural problems listed, and needs for additional research discussed.

Field Day events planned for 1956 include Agronomy Day at the Reymann Memorial Experimental Farms at Wardensville on June 22; Dairy Day at the University Dairy Farm in Morgantown on June 28; and Agronomy Day at the Ohio Valley Substation at Point Pleasant August 16. Events are also being planned by the Departments of Animal Husbandry and Horticulture. Detailed plans will be announced preceding each event.

FARM FISH PONDS

Farm Fish Ponds in West Virginia, Circular 84, has been revised and is now being printed. This popular publication, written by Assistant Forester R. Franklin Dugan, describes the important role played by farm fish ponds in soil conservation systems, the construction techniques and costs for a farm fish pond, and management of bass and bluegill fish populations. Copies of Circular 84 (Revised) may be obtained at your County Extension office.

Science

SERVES YOUR FARM

Bulletin 382, Part 3

Spring 1956

SEE
Hardwood Plantations
PAGE 6

WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Bulletin 382 Part 3 Spring 1956

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 1955-1956

IN THIS ISSUE

on our cover

The earliest settlers were quick to note the value and beauty of West Virginia's bountiful forests. By 1775 there were more than fifty water-powered mills sawing lumber for local use, and export to distant markets began shortly after 1800 when timbermen started floating logs down the Ohio River.

Unwise and wasteful cutting was characteristic of these early logging operations. Many of the beautiful stands of red spruce and white pine, along with comparable stands of hardwoods, were ruined by this wasteful cutting. As a continual supply of timber depends upon wise management, the current production of West Virginia's forests was greatly reduced. Much cut-over land grew up in scrub timber and undesirable species, thus reducing the supply of hardwood lumber for home and market use.

There is still a hungry market for quality hardwoods grown in West Virginia. Foresters estimate that nearly a million acres of land in the State would be better employed if they were producing hardwood timber. But many hardwood plantings fail. More reliable methods of reforestation and management of these trees are needed.

That is why much of the research conducted by foresters of the West Virginia University Agricultural Experiment Station is devoted to hardwoods. In the experimental black locust-red oak plantation pictured here, the 9-year-old oaks averaged only 3.8 feet in height. Growth was stunted by rabbit damage. The tall oak growing near the locust is 15 feet in height.

new publications

Bulletins

382, Part 2. Annual Report of H. R. Varney, Director, Science Serves Your Farm, Winter, 1955.
387T. Francis J. Gough and Edward S. Elliott. Blackpatch of Red Clover and Other Legumes Caused by *Rhizoctonia leguminicola* sp. nov. January, 1956.
388T. H. A. Wilson and Gwendolyn Stewart. The Numbers of Bacteria, Fungi, and Actinomycetes in Some Strip-Mine Spoils. February, 1956.
389. N. Nybroten. Consumer Preferences for Poultry Meat. May, 1956.
390. N. Nybroten and J. H. Clarke. Lime and Fertilizer Distribution Practices in the Eastern Panhandle of West Virginia. June, 1956.
391. W. D. Porter and W. H. Metzler. Availability for Employment of Rural People in the Upper Monongahela Valley, West Virginia. June, 1956.

Circulars

99. N. Nybroten. Pricing Chicken Fryer Parts by Style of Cutting. May, 1956.

Current Reports

12. W. L. Haltiwanger, R. J. Friant, and V. L. Bolyard. Results of Hybrid Corn Yield Trials in West Virginia, 1955. February, 1956.
13. Collins Veatch. Weed Control—1956 Suggestions. April, 1956.
14. Poultry Staff. Results of the Second West Virginia Random Sample Broiler Test. April, 1956.
15. T. B. Clark, J. O. Heishman, and C. J. Cunningham. Effect of Vigofac, Aureomycin, NFZ + nf-180 and Lipamone in Broiler Rations. May, 1956.

Editor's Note: Publications listed above, and other Agricultural Experiment Station publications are usually available from the office of your County Agricultural Extension Agent. You may also obtain copies by writing to: Director, Agricultural Experiment Station, West Virginia University, Morgantown.

BACTERIA AND MILK

by H. A. Wilson, Associate Bacteriologist

• Not all bacteria are harmful, but those that are can spoil your milk . . .

THE excellence of milk as a food for humans and mammals is well known. It is less well known that milk is an ideal substance for the development of many bacteria, yeasts, and fungi.

Milk is seldom free of bacteria as it comes from the cow. These bacteria, unless they are pathogenic, are not as dangerous as those which may find their way into milk from other sources. These sources may be the coat of the cow, bits of hay and straw, manure, dust, milking machines, hands and clothing of milkers and milk handlers, and utensils.

In general, bacteria found in milk can be classified into three important groups: those which bring about desirable fermentation, those which bring about undesirable fermentation, and disease-producing bacteria.

Desirable Changes

Certain bacteria in milk bring about the production of lactic acid from the lactose in the milk, causing coagulation of the casein. This change is so common it is spoken of as the normal fermentation or souring of milk Under controlled conditions these organisms make up the lactic acid starters which are used for butter, cheese, and cultured buttermilk manufacture.

Other desirable changes in milk result in the production of Bulgarian milk, acidophilus milk, and yogurt, to name a few. These fermented drinks are usually, and most successfully, produced under controlled conditions, using either pasteurized or sterile milk and pure cultures. Such conditions are almost necessary for the production of Bulgarian and acidophilus milk.

Undesirable Changes

Gassy Milk is the result of certain bacteria growing in the milk and producing gas, usually carbon dioxide. They are generally intestinal bacteria, and get into the milk from manure, unclean utensils, or handling by unsanitary persons.

Bitter Milk is caused by certain bacteria, and at least one yeast. Such a flavor is often produced in milk held at relatively low temperatures.

Ropy Milk is milk in which the fluid condition is changed to a somewhat viscid or slimy nature and forms threads or viscid masses when poured or dipped. The bacteria responsible often come from surface water, cistern water, and cooling tanks. If this trouble appears, all utensils should be immediately sterilized, and the milking area thoroughly cleaned and disinfected.

Red, blue, and yellow milk may result from the action of certain organisms, the color depending on the type of organism causing the action. This is not a common trouble.

Disease Bacteria

Many of the present-day practices in milk and milk product handling are the direct result of attempts to prevent the dissemination of diseases by the products. Pathogenic bacteria, unlike those which cause certain fermentations, cannot usually be detected by taste, odor, or the appearance of the milk or dairy product.

Pathogenic bacteria come from two sources: cows and people. Numerous diseases originating from humans may be spread through milk. Such intestinal pathogens as typhoid and paratyphoid, cholera, diarrhoea, and dysentery gain entrance into milk from infected handlers with unsanitary habits. Such workers should not be permitted to handle milk, milk products, or milk utensils. Once these pathogenic bacteria enter the milk, they multiply to great numbers rapidly.

Other disease bacteria, such as those which cause nose and throat disturbances, may gain entrance into milk as a result of coughing and sneezing by milkers and handlers with such infections.

These diseases, along with many others, may be prevented by permitting only healthy and sanitary persons to handle milk and its products, and permit such handling only in sanitary surroundings.

Tuberculosis, mastitis, and contagious abortion are among those

(continued on page 8)

HERE'S HOW TO PRODUCE GOOD, CLEAN MILK

1. Develop and follow a milking routine . . . this will mean faster, quieter milking, more profit.
2. Keep cows clipped and clean. Wash udders and teats with towel soaked in warm water.
3. If hand milking, use covered-top milk pails. This reduces "fall-in" from cow's coat, ceiling, etc.
4. Wear clean, neat-fitting clothes while milking. Dirt can fall into pail from clothing.
5. Keep milking area clean and free of manure.
6. Do not feed roughage or spread bedding immediately before or during milking. This keeps down dust.
7. Keep utensils clean and rinsed in sterilizing solution. Care of utensils is very, very important.
8. Employ only healthy, sanitary persons.
9. Prompt and rapid cooling of the milk, immediately after each cow is milked, keeps out dirt, reduces bacteria count.

SOME RESULTS OF *Soil Testing*

by G. G. Pohlman, Agronomist
and
E. C. Flesher, Formerly Graduate Assistant in Agronomy

TESTING soil samples as an aid in making recommendations for lime and fertilizer has been carried out by the Department of Agronomy and Genetics for more than 30 years. For a long time this service was on a "bring or send it in and we'll test it" basis. Starting in September, 1953, the service was reorganized with the West Virginia University Agricultural Extension Service cooperating in securing samples and in interpreting results.

County Agent Aids Program

Your County Agricultural Agent has a supply of bags to be used in sending samples to the testing laboratory. He also has sample information sheets on which the field characteristics and past management are recorded. Soil samples, taken according to directions furnished by the County Agent, and the information sheets are mailed to the Soil Testing Service, West Virginia University Agricultural Experiment Station, Morgantown, West Virginia. The soils are then tested and the results returned to the County Agricultural Agent for recommendations for treatment.

Speeds Testing

The new system has speeded up and expanded the testing program. In the last four months of 1953, 818 samples were tested. In 1954, the first full year of operation, about 2,640 samples were tested, and in 1955, 3,008 samples were tested.

The results for 1953 and 1954 are being summarized. They show a number of interesting facts:

1. Farmers in certain areas are more interested in having their soils tested than farmers in other sections.

2. Soil reaction (need for lime) varied greatly. Table 1 gives the percentage in various groups according to their reaction.

This shows that a large majority (about 70 per cent) of the soils need lime for our most valuable crops.

3. Our soils are generally low in available phosphorus. The results of the tests are shown in Table 2.

Soils Low in Phosphorus

In spite of the fact that most mixed fertilizers used in West Virginia are high in phosphorus and considerable superphosphate has been used, about two-thirds of the soils tested are low in available phosphorus. Of those testing very high in available phosphorus, a large majority were from lawns and gardens.

4. Available potassium supply is low on many soils. The results of the tests for available potassium are shown in Table 3.

TABLE 1. SOIL REACTION

pH RANGE	RELATIVE ACIDITY	PERCENTAGE OF SAMPLES TESTED
Above 6.75	None	13.5
6.25-6.74	Slightly Acid	16.5
5.75-6.24	Slightly to Moderately Acid	19.5
5.25-5.74	Moderately to Strongly Acid	21.6
4.75-5.24	Strongly to Very Strongly Acid	20.9
Below 4.75	Very Strongly Acid	8.0

TABLE 2. AVAILABLE PHOSPHORUS

AMOUNT SHOWN BY SOIL TEST	PERCENTAGE OF SAMPLES TESTED
Very Low	55.3
Low	12.0
Medium	8.5
High	7.3
Very High	16.4

SOIL SAMPLING can be properly done with soil tube, auger, or shovel. Sample must be clean, representative of the field. County agent can supply instructions.

SEVERAL SAMPLES, taken over the field, are thoroughly mixed, screened to remove roots and pebbles, then dried to provide composite sample for soil test.

rival at the lab, samples are placed red trays. A small portion of each s measured for extraction process.

A WEAK acid solution extracts the plant nutrients, and is filtered to provide clear solution for phosphorus and potash analysis.

MODERN laboratory instruments measure the exact phosphorus and potash content of sample, as well as the soil acidity.

About one-fourth of the soils are in the low or very low range. These will respond to potash fertilizers under most farming systems. Those showing a medium supply will probably need potash for a crop like alfalfa.

All Samples Included

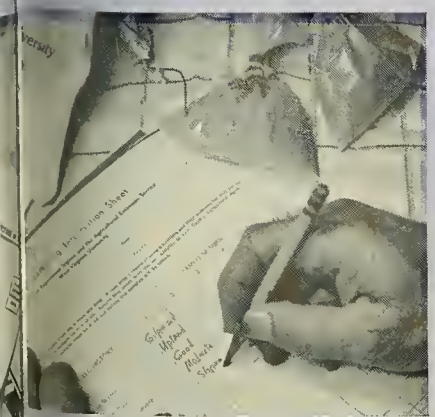
These results are for all the samples received and include samples from lawn and gardens as well as from crop and pasture fields. Inasmuch as lawns and gardens have often been well limed and fertilized, the results show more samples not needing lime and having high available phosphorus and potash than would be the case if only samples from pasture and crop land were considered.

A more complete summary of the results by counties, by crops, and by soils is being prepared to serve as an aid in evaluating West Virginia soils.

TABLE 3. AVAILABLE POTASSIUM

AMOUNT SHOWN BY SOIL TEST	PERCENTAGE OF SAMPLES TESTED
Very Low	3.2
Low	20.7
Medium	40.4
High	16.1
Very High	19.6

HIGHER YIELDS and better quality are obtained when soil fertility is not the limiting factor. Fertilization practices based on soil testing, proper management, and use of improved varieties will bring more profitable farming to this area.



HARACTERISTICS, cropping and r history, and intended use must n in order to make sound recom- ons. Mail information with sample.

Hardwood Plantations

by E. H. Tryon, Silviculturist
and Kenneth Carvell, Assistant Forester

APPROXIMATELY two-thirds of West Virginia's area is forest land. Of this proportionately large forest acreage, about 90 per cent is composed of hardwood timber. Yet nearly all forest plantings are of coniferous species such as the pines and spruces!

Why is this? Would you not expect that we should be planting more hardwoods such as the red and white oaks, yellow-poplar, and white ash instead of conifers? An answer to this question, complete with reasons, is not easily given. However, the poor results of hardwood plantings, possibly excepting black locust, have resulted in the present trend—conifierous species, not hardwoods—even in this hardwood state. (Figure 1).

Why have hardwood plantings failed so often in a region where high quality hardwood timber grows so well? Several reasons for failures are known, but often plantations fail due to unknown causes.

First of all, a good site is necessary. No successful plantations of hardwoods are known to exist on poor sites in the entire State. Sod is another factor which is harmful to hardwood seedlings. Before field planting is attempted, heavy sod must be removed. Browsing by deer, cutting by rabbits, and stem girdling by mice can completely ruin a plantation. Spring frosts do serious damage to hardwood seedlings by producing multiple stems and reducing height growth.

During the past 15 years a limited amount of work has been done on hardwood plantings by the West Virginia University Agricultural Experiment Station to test both species and site. Some of the results are presented here and summarized in Table 1 on page 8.

The 9-year-old planting of green ash on a poor site has very poor height growth, although the survival is satisfactory. Plantings of catalpa and yellow-poplar, the same age and on the same site, are failures from the standpoint of both survival and growth. Rabbits, mice, and heavy sod, as well as the poor, dry soil, are known to have contributed to the failure of these three species. The height growth of the 9-year-old red oak growing on a favorable spoil bank was greatly reduced because of rabbit damage.

The plantings of 2-year-old yellow-poplar growing on a good site appear successful, although they are too young to predict results with any degree of certainty. They have not been damaged by animals or frost, and only little sod is present. Two-year-old white ash planting stock also appears to do well on a similar site.

Perhaps the most notable fact con-

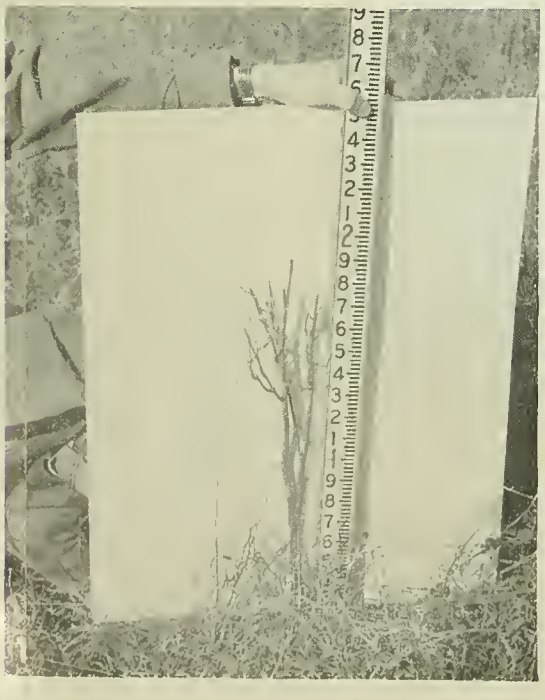


FIGURE 2. Photo 1, nine-year-old catalpa growing in an open field having poor soil and a heavy sod. This seedling, about two feet tall, is representative of the average open-grown catalpa seedling. Damage from rabbits, deer is principal cause of such poor growth. Photo 2, nine-year-old catalpa growing under conditions similar to those in Photo 1, except for protection at the base by a surrounding growth of two-foot-high hawthorns. The five-foot height exceeds by two feet the average height of seedlings with some sort of protection. These protected seedlings average over one foot taller than those catalpas growing with no protction. Photo 3, nine-year-old catalpa, growing under conditions similar to those in Photo 1, except for the protection of an isolated Virginia pine. The catalpa beside the measuring stick is 5½ feet tall; the one near the man, tallest in the plot, is 11 feet.

IGURE 1. A pine and hardwood planting. he nine-year-old green ash planting (fore- ound) is a failure. At the left stands a ccessful eleven-year-old red pine planting eraging ten feet tall. Hardwood plantings ten fail, especially in poor soil, heavy sod.

cerning these plantings is that better growth was obtained where the seedlings grew beside, or were protected by woody vegetation. Table 1 shows that the average height of protected seedlings of green ash and catalpa was greater than that of the unprotected seedlings by 50 per cent or more. These differences may be observed in Figure 2.

The best average height growth of red oak occurred where they grew next to a protective border of black locust. Unprotected red oak seedlings showed poorer growth than those protected by the black locust mixture. Red oaks growing under these three conditions were all heavily damaged by rabbits, with those in the black locust mixture suffering the greatest damage. If there had been no rabbit damage, the average height of the oaks in the black locust mixture would be expected to exceed the average height of the oaks along the border, as shown by the heights of the tallest oaks. The best height growth occurred in the mixture and the poorest in the open (see Figure 3 and cover page). Although the seedlings which were protected were taller that the unprotected ones, the

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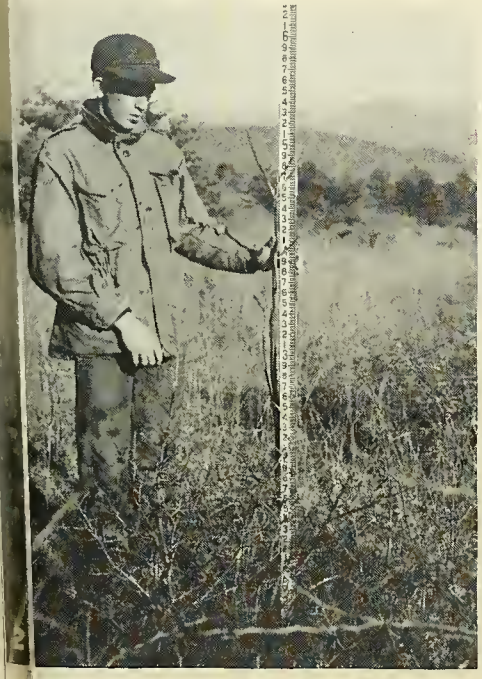
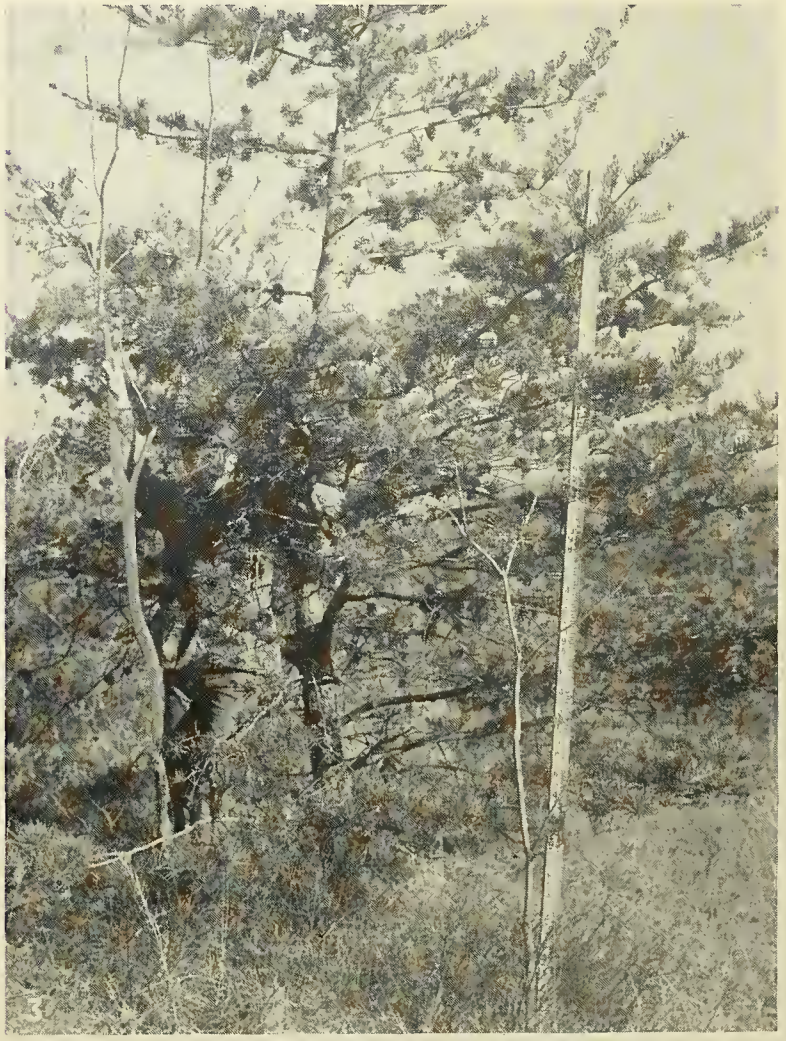


FIGURE 3. At left is a nine-year-old mixed planting of black locust and red oak. At right is a pure planting of nine-year-old red oak. The red oak on the border, near the man, is over eight feet tall. Rabbit damage is probably main cause of poor growth.



HARDWOODS

(continued from page 7)

effectiveness of the protection is difficult to evaluate because of the heavy amount of animal damage which has occurred yearly. Likewise, the young yellow-poplars growing among dead saplings which had been killed by poisoning before planting were slightly taller than those in the open.

The belief that the presence of a certain amount of woody vegetation may be beneficial to hardwood plantings is not new to the Station workers. Foresters M. G. Brooks and K. L. Carvell have reported this situation in newspaper releases, and the red oak-black locust plot has been used in student laboratory work to illustrate this beneficial effect.

Eliminate Competing Vegetation

Work in coniferous plantings throughout the United States has indicated clearly the need of eliminating competing woody vegetation, and this practice has carried over into work with hardwoods. Perhaps the beneficial effect of some protection to hardwood seedlings is one step of many which we must learn to apply in order to grow better hardwoods from plantings.

Heavy shade, however, is *not* desirable and should not be confused with a light protection by woody plants. Hardwoods, like conifers, will fail if planted in a forest stand under heavy shade from tree crowns.

BACTERIA

(continued from page 3)

diseases of cows that may infect man. Tuberculosis can be transmitted from a diseased cow to a person, particularly a child, by drinking raw milk from the cow. Periodic herd inspection and the destruction of tuberculosis reactors in dairy herds has almost completely controlled infections from this source in the United States.

Man can become infected with brucellosis organism (contagious abortion) by contact with diseased animals, their tissues or discharges, or through the drinking of raw milk from these animals. In man the disease is known as undulant fever.

Mastitis is a disease of the udder. Freshly-drawn milk from an infected animal sometimes contains enormous numbers of bacteria that are pathogenic, some of which are capable of causing septic sore throat in humans.

Prevention of Bacterial Contamination

Undesirable fermentations and colors in milk and the spread of disease-causing bacteria through milk can be controlled by following well-known simple and important practices. Periodic inspection of herds and the elimination of diseased cows has been one of the major factors in preventing the spread of tuberculosis and undulant fever from cows to humans.

Permit only healthy and sanitary persons to milk your cows and handle the milk and its utensils. Public health laws in many areas require health certificates for dairy workers.

Clean and sterilize all utensils after each usage. Dirty cans and utensils harbor many microorganisms which contaminate clean milk when it is poured into them. All utensils should be free of open seams and rust. For recommendations as to proper cleaning and sterilizing techniques, see your county extension agent, your high-school vo-ag teacher, your agricultural experiment station, or the field man of a dairy that buys milk and bottles or manufactures it into dairy products.

Milking technique, especially cleaning the cow before milking, is important. The "managed milking" recomendations of your extension dairyman or county agricultural agent will include suggestions for cleaning the udder prior to milking. Also, don't spread bedding or move hay and straw just before or during milking. This stirs up dust and dirt, and increases chances of contamination. Conduct a good fly control program, and keep the barns clean, and your milk will be cleaner and will have a lower bacteria count.

Clean, wholesome milk is a wonderful food. But it can be produced only under ideal conditions . . . conditions created by cleanliness and sanitation in the dairy barn.

Table 1. Average Height and Survival of Planted Hardwood Seedlings

Plot	Species	Age (years)	Site Quality	Condition of Land	Ave. Height (feet)	Height of Tallest Tree (feet)	Per cent Survival
1	Green ash	9	Poor	Open, heavy sod	1.9	6.5	77
				Protected, sod[1]	3.0	6.2	
2	Catalpa	9	Poor	Open, heavy sod	2.0	6.0	25
				Protected, sod[1]	3.1	10.0	
3	Yellow-poplar	9	Poor	Open, heavy sod	—	—	0
4	Red Oak	9	Favorable spoil bank	Open, no sod	2.5	5.0	60
				On bordor of black locust block, no sod	6.3	10.2	60
				Mixed planting with black locust, no sod	3.8	15.0	72
5	Yellow-poplar	2	Good	Open, light sod	1.4	2.2	94
6	Yellow-poplar	2	Good	Killed saplings no sod	1.9	2.9	87

[1]Hardwood seedlings protected by woody vegetation, however, no sod was present.

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Morgantown