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Science serves your farm and home.

A. H. VanLandingham

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Science

SERVES YOUR FARM AND HOME

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AGRICULTURAL EXPERIMENT STATION
WEST VIRGINIA UNIVERSITY

FEBRUARY 1961

BULLETIN 452

Science

SERVES YOUR FARM AND HOME

ANNUAL REPORT OF A. H. VANLANDINGHAM, DIRECTOR, WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION FOR THE PERIOD 1958-59

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on our cover

Today West Virginia has the seventh greatest volume of hardwood sawtimber in America, and has ranked as one of the nation's four top hardwood lumber producers over most of the past 50 years. Even so, our forests still represent the State's one great undeveloped resource. For example, today in West Virginia 10 million acres produce 145 million cubic feet of wood per year, which is 145 cubic feet or 75 board feet per acre of low-average grade. If placed under technical forest management, these 10 million acres could produce 450 million cubic feet of wood per year, or 45 cubic feet and 225 board feet per acre of high-average grade. This alone would increase the return from well-marketed stumpage from an average of 75 cents per acre per year to an average of \$5 per acre per year.

At present, two-thirds of our wood crop is cut into lumber and 80 per cent of our high-grade lumber is sold for manufacture outside the State. One-third goes into round or split timbers for mining, farming, fuel, or pulpwood. The annual crop includes some of the finest cabinet woods in America—oak, walnut, cherry, maple, and yellow poplar. Some way must be found to use West Virginia labor in converting these valuable woods into high-value furniture and home interiors.

The annual value of our State's forest products has been estimated to be \$101 million. If the manufacture of high-grade lumber could be added to the increased quantity and quality of wood production as gained from technical forest management, this amount could be increased to at least a half-billion dollars.

Annual Report of the AGRICULTURAL EXPERIMENT STATION

West Virginia University
Morgantown, W. Va.

Director

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SCIENCE SERVES YOUR FARM AND HOME 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, West Virginia.

on the

calendar . . .

APRIL—

7-8—Joint meeting of the Tri-State Wool Growers' and the W. Va. Purebred Sheep Breeders' associations, Morgantown

21-22—Annual W.V.U. Dairy Cattle Judging School, Morgantown

22—Little Eastern National Livestock Show and Barbecue, Morgantown

27-29—Southeastern Intercollegiate Livestock Judging Contest, Morgantown

JUNE—

13—Ohio Valley Agronomy Field Day, Point Pleasant

16—Livestock and Agronomy Field Day, Revmann Memorial Farms, Wardensville

new publications

Bulletins

426, Parts 1 and 2. Annual Report of A. H. VanLandingham, Director, Science Serves Your Farm and Home, March 1959.

427, Leonard M. Sizet, Ward E. Porter, Charles C. Anderson, Laurel Sabrosky. The Learning Experiences of Youth Groups—A Study of 4-H Clubs in Barbour County, West Virginia, May 1959.

428, Kenneth D. McIntosh. Characteristics of Livestock Slaughter Plants in North-eastern United States, June 1959.

429, James H. Clarke, Mardy Myers, J. Scott Hunter. Milk Vending—A Market-Wide Evaluation in Berkeley County, W. Va. June 1959.

430, James H. Clarke, Walter F. Thompson. Merchandising Milk Through Vending Machines, June 1959.

431, C. K. Dorsey, H. E. Kidder. Cattle-Grub Control in West Virginia, September 1959.

432, Roger W. Pease. The Balled-and-Bur-lapped Pack for Ornamental Shrubs and Trees, October 1959.

LAMB DEATHS...

High death rate during early days emphasizes importance of care, need for research

by James A. Welch, Animal Husbandman

DEATHS of lambs are often the major cause of reduced income from sheep flocks. A summarization of lamb deaths in the 82 flocks participating in the 1959 Master Shepherd Program of West Virginia reveals an average loss of 14 per cent. The top 10 flocks, rated according to gross income per ewe bred, lost only 4.7 per cent of their lambs, while the 10 flocks with the lowest income lost an average of 29 per cent. Workers in other states have reported that losses of up to 30 per cent before weaning are not uncommon.

This article reports a study of the causes of lamb deaths and the ages at which these deaths occurred. Records of the West Virginia University Agricultural Experiment Station flocks provided the data used. A total of 1,184 purebred lambs were born to the University's Southdown, Hampshire, Corriedale, and Shropshire flocks between 1947 and 1958. Sixty-seven crossbred lambs were also included in the study.

The age at death was recorded in these age groups: 0 to 3 days, including still births; 4 to 10 days; 11 to 30 days; and 31 to 140 days. Deaths were classified under the following major headings: (1) still-born, (2) accidental, (3) ewe failed to own or had insufficient milk, (4) lamb diseases, (5) killed by dogs, (6) ewe abnormalities, (7) miscellaneous, (8) frozen, and (9) undetermined causes. Percentages of death by each of the above causes were computed for single, twin, and triplet lambs. The influence of breed on lamb mortality was also explored.

Table 1 shows the percentages of all deaths which occurred in each

of the age intervals. Nearly two-thirds of all lambs dying before weaning either were born dead or died by the third day. When the first two intervals are combined, it can be noted that almost 80 per cent of the deaths occurred before the lambs were 11 days of age.

TABLE 1. PERCENTAGES OF TOTAL LAMB DEATHS WITHIN AGE INTERVALS

DAYS OF AGE	PER CENT OF TOTAL DEATHS
0-3*	66.2
4-10	13.1
11-30	7.6
31-140	13.1

* Includes stillbirths

One-half of the lambs dying after reaching 31 days of age were killed by dogs. Inasmuch as losses from this cause would not be expected in all flocks, or even in any one flock in all years, the importance of losses occurring in the early age periods is further emphasized.

SHEPHERD'S presence at lambing time will save many lambs; good management is also very important.

The total mortality up to 140 days of age from all causes over the twelve-year period was 22.59 per cent of the lambs born. The causes of death are summarized and ranked in order of importance in Table 2. Deaths from undetermined causes are high. Incomplete records and failure to autopsy all of the lambs account in part for this high figure.

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INDIVIDUAL pens for ewes and their new-born lambs will pay off in lambs saved. Flock owners will find it profitable to use all of the knowledge and skill they possess in managing their sheep prior to and during the lambing season.

* Acknowledgment is made to the Station veterinarians for diagnoses of causes of deaths; to J. L. Perkins, G. V. Hardman, and J. G. Mattern, Jr., graduate students who summarized the data included in this report; and to Animal Husbandmen of the West Virginia Agricultural Extension Service, who provided data on the 1959 Master Shepherd Program of West Virginia.

EMPLOYMENT and UNDEREMPLOYMENT

of rural people in the Upper Monongahela Valley

by W. W. Armentrout, Agricultural Economist

A continued decrease in coal mining employment has brought attention to the problem of inadequate work opportunities for rural people in the coal mining areas of West Virginia. In April 1952, 114,900 people employed in mining produced 12,368,000 tons of coal; in April 1955, 67,200 workers produced 11,794,000 tons, and in April 1957, 76,300 workers produced 13,336,000 tons. More coal is being produced by fewer workers owing to increased mechanization.

The West Virginia Agricultural Experiment Station, in cooperation with the Production Economics Branch, Agricultural Research Service, U. S. Department of Agriculture, began a study of employment and underemployment of rural people in July of 1954. This study was confined to the 10 counties comprising the Upper Monongahela Valley. In many respects, however, this area is fairly typical of the coal mining areas of the State.

A randomized sample of people living in the open country of the Valley was drawn and a field study was made of 888 households. A report of that part of the study which considered employment was published in June 1957 as West Virginia University Agricultural Experiment Station Bulletin 404.

Only one-third of the families in the open country lived on tracts that could qualify as farms, according to the Census definition of a farm in effect at that time. Only 5 per cent of the households depended on agriculture alone for their income. Forty per cent of the households in the area were those of workers in the mines, factories, stores, and other places of employment who relied solely on nonfarm work as a means of support. Fourteen per cent of the households relied for their support solely on non-work sources of income: i.e. royalties, rents, social security, retirement

funds, and public assistance. The remaining 41 per cent had income from several sources. Most frequently, nonfarm work was the major source, with farming or non-work income as supplementary.

Of the 2,287 persons in the sample households who were 14 years old or over, 59 per cent had done some work during the 12 months preceding the survey. One-third of them had worked as much as 100 days.

The average length of employment for all persons who had worked during the year was 154 days—185 for males and 92 for females. Workers whose main employment was in agriculture worked for an average of 63 days. Those whose main employment was in nonfarm work were employed for an average of 201 days. This difference in days employed is partly due to the fact that two-thirds of the nonfarm workers were males between 24 and 64 years of age, whereas two-thirds of the farm workers were women and youths.

Underemployment Evidence

Evidences of underemployment among rural people include:

1. An unusually high proportion of nonworkers among all persons 14 years old or over: 41 per cent in the Upper Monongahela Valley as compared with 36 per cent in the United States.

2. Short-term or no employment among women and youth. Only 11 per cent of the women worked as long as 100 days during the previous year, yet 28 per cent of them were neither housewives nor in school. Only 35 per cent of the males 14 to 24 years old worked as long as 100 days, yet 53 per cent of them were not in school.

3. Inadequate employment in agriculture. Males 25 to 64 years old, who worked on home farms only, worked for an average of 130 days during the previous 12 months.

4. Inadequate employment among service workers. Females 25 to 64 years old employed in service work were employed for an average of 93 days during the preceding year.

5. Some underemployment in coal mining. Males 25 to 64 years old employed in coal mining worked for an average of 177 days during the preceding year.

Income Sources

Data on sources of income are quite revealing. Only 6 per cent of the total income of people living in the open-country in the Valley came from farm operations or farm wages, while more than twice as much income, 14 per cent, came from non-work sources, principally social security payments, pensions, and public assistance. Eighty per cent of the total income came from nonfarm employment.

A total of 401 youths had left the survey homes during the previous 8 years, 197 males and 204 females. More than one-third of the young men went into the armed forces. Over one-half went into nonfarm work. Only three of the young men leaving home during this 8-year-period become farm operators; two became hired farm workers.

Sixteen per cent of the workers 14 years old and over were reported as available for employment. Approximately 90 per cent of these preferred nonfarm work.

The Upper Monongahela Valley is representative of areas in which farm people have left agriculture for more profitable employment in a developing local industry. In this case, however, the local industry—coal mining—no longer needs the services of many of the workers who depended upon it. The workers have come to depreciate farming as a source of livelihood and do not want to return to it. They prefer to

(continued on page 12)

Horticulturists seek

Blight Resistant American Chestnuts

by W. H. Childs, Horticulturist

WHEN chestnut blight destroyed the chestnut industry in the eastern United States early in the Twentieth Century, research workers of the United States Department of Agriculture and the State Experiment Stations began studies to obtain blight-resistant or blight-immune chestnuts of quality comparable to the American Chestnut.

The research workers used two methods of attacking this problem. One was to select good quality oriental chestnuts which were immune or practically immune to the blight, and crossing these with American Chestnuts in order to obtain better tree characters and nut quality. The other was the collecting and growing of nuts from American Chestnut trees (usually basal sprouts) which survived the blight.

Both methods were included in projects initiated at the West Virginia University Agricultural Experiment Station, but this report deals only with the second method. Although the first work was begun in the 1930s, it is only that progress

made since 1951 that is considered here.

Beginning in the fall of 1951, Assistant Hillculturist Roger W. Pease annually collected nuts from American Chestnut trees throughout West Virginia and elsewhere, both personally and with the help of interested individuals. These were harvested before they had dried out appreciably. At the Experiment Station, they were treated with hot water to kill worms and placed in cold storage until they could be planted in peat moss in cans in a lath house. The methods used in growing are described in detail in West Virginia Agricultural Experiment Station Circular 90, entitled *Growing Chestnuts From Seed*.

After a year's growth in the lath house, the small chestnut trees were moved to the Horticulture Farm and grown there with standard orchard practices, including fertilizing, cultivating, mowing, and rodent control. By 1955, some of the

(continued on page 8)

FIGURE 1. Diseased American chestnut tree, arrow shows blight canker.

FIGURE 2. Young chestnuts five months after planting. Seeds were placed in peat moss in lath house.

FIGURE 3. Chestnuts are transplanted to Horticulture Farm after 1 year in lath house. Here they receive standard

orchard treatments for pest control, fertilization, cultivation. These trees have been in the field for 16 months.

FIGURE 4. Healthy chestnut set out in 1952. Note vigor and size. See page 8 for photo of blight-killed tree.

FIGURE 1. Three 2-year-old Scotch pine seedlings with extreme shovel root.

DURING the past decade tree planting for reforestation and Christmas tree markets has expanded rapidly in West Virginia. As a result, foresters of the West Virginia University Agricultural Experiment Station have received many inquiries concerning the death or decline in vigor of scattered trees in young plantations. This condition is apparent in many forms—poor height, growth, off-color foliage, stunted needles, thin foliage, and dying plants. These symptoms appear in plantings of all conifers. They are most apparent in plantations of white pine, Scotch pine, shortleaf pine, and Norway spruce. In nearly every case, investigation has shown that poor root development caused by careless planting techniques is the cause.

Symptoms Can Be Spotted

These symptoms may develop gradually in seedlings formerly showing normal growth. Death may occur suddenly, however, when the

*Assistant Silviculturist and Associate Silviculturist, respectively.

Poor planting practices may cause Low Vigor, High Mortality in your plantations

by James H. Brown and Kenneth L. Carvell*

root system becomes incapable of meeting the tree's demands for moisture and nutrients. Although these conditions may be found on any site, they most commonly occur on heavy clay soils, where physical conditions for good root growth and development are less favorable. Examination of root systems of low vigor or dead trees showed that the roots were cramped, poorly-oriented, or knotted. These conditions are usually due to poor planting.

Cramped and poorly-oriented root systems are found most frequently on those areas planted with a dibble or planting bar. This condition, known as "shovel root," results because the vertical roots are bent over in the bottom of the hole, and the lateral roots are compressed into a vertical position (See Figure 1). After many years these roots still exhibit this unnatural position. Eventually the seedling is likely to die. Recovery occurs only if a new lateral root system becomes established soon enough to meet the demands of the crown (Figure 2 E).

Examinations of other seedlings show root systems which are badly knotted and cramped—the result of bunching or intertwining of roots

at the time of planting. In most cases, the longer roots were obviously folded or cramped into the planting hole, or the seedling was rotated to draw these roots into a smaller space. The tangled network, thus produced, gradually strangles itself as diameter growth takes place.

Recommendations

When planting on any soil, and particularly on heavy soils, the following practices are recommended:

1. Planting holes must be large enough to accommodate the entire root system without forcing roots into unnatural positions.

2. When planting large stock a mattock is much more desirable than a planting bar, since the mattock will produce a hole which allows a more natural arrangement of the root system.

3. Mattock planting should be used on heavy soils regardless of the size of the planting stock.

4. Unusually long roots should be cut to lengths consistent with the size of the hole. Far more damage results when long roots are bunched into the hole than from removing them.

FIGURE 2. (A) Healthy 4-year-old white pine showing well-developed root system. (B) Dead tree of same age. (C) Root system of dead seedling showing shovel root condition and vertical position forced on horizontal roots at planting.

(D) Stunted 4-year-old white pine (in circle) with thin foliage and stunted needles. (E) Same seedling showing shovel root condition and new lateral root system developing above. Follow recommendations — avoid shovel root.

MICE

Two species work to destroy hardwood seedlings; poison stops them

by Kenneth L. Carvell and E. H. Tryon*

ALTHOUGH hardwoods make up 90 per cent of West Virginia's forest area, almost all successful forest plantations presently established in this State are conifers. Repeated hardwood planting failures indicate that much must be learned about hardwood planting techniques and initial plantation care before large-scale hardwood plantings can be recommended with any assurance of success.

During the past 15 years the West Virginia University Agricultural Experiment Station has been studying factors responsible for these failures, with the hope of developing techniques to reduce hardwood seedling mortality.

Many of the reasons for hardwood planting failures are obscure. However, poor choice of planting site, heavy grass sod, frost injury, and animal damage are known to play important roles in seedling mortality. Hardwoods are more exacting in site requirements than conifers. In general, hardwoods must be planted on the best sites. Grass sod cramps and interferes drastically with root development. Late spring frosts kill or stunt many species. Finally, animals—mainly rabbits and mice—damage hardwoods seriously through browsing foliage, clipping stems and roots, and stripping bark.

Although rabbit damage is more noticeable and more readily detected than rodent damage, Figure 1, recent experiments have indicated that mice are actually more destructive than rabbits in many

areas. Therefore, it is important to be able to recognize the first signs of mouse injury, and to take immediate control measures before seedling loss from mice destroys the entire planting.

Description of Damage

During the fall seasons of 1955 and 1956 extensive rodent damage was discovered in a young northern red oak plantation (*Quercus rubra* L.) at the West Virginia University Forestry Woodlot. These seedlings had been established during the fall of 1954 under a complete overstory of 20-year-old black cherry (*Prunus serotina* Ehrh.), hawthorn (*Crataegus* spp.), and crabapple (*Malus coronaria* (L.) Mill.). The oaks had been planted by placing acorns in seed spots using an 8-by 8-foot spacing between adjacent spots. By the summer of 1955 each spot contained from one to three seedlings which averaged approximately 1 foot in height.

FIGURE 1. Oak seedlings showing typical rabbit damage. Such damage usually occurs when other food is scarce. Buds, small branches are cut within 2 feet of ground, but above litter.

In October 1955 many oak seedlings were suddenly and mysteriously missing. Closer examination revealed that many other seedlings were leaning slightly to one side, and had been cut off just beneath the surface of the ground. Leaning seedlings could be readily lifted from the seed spot (Figure 2). In a strong wind the stems of these seedlings could blow away, leaving no trace of where the seedling had

(continued on page 8)

FIGURE 2. Many oak seedlings, leaning slightly, have been cut just beneath soil surface by mice. Such seedlings can be readily lifted from the seed spot, may be blown away by winds.

FIGURE 3. The roots of many erect oak seedlings have been partially cut off by mice. This weakens the seedlings, may be important factor in causing die-back and growth stagnation.

*Associate Silviculturist and Silviculturist, respectively.

MICE

Two species work to destroy . . .

(continued from page 7)

been. This kind of damage might well explain the frequent sudden disappearance of many seedlings, a phenomenon familiar to those who have attempted to raise hardwoods.

Examination of the remaining erect seedlings showed that roots had been partially cut off or peeled just below the surface of the ground (Figure 3). A reduction in the number of main roots might well be a factor in causing leaf yellowing, stem die-back, and growth stagnation so frequently observed in many young oak plantations, as well as in areas of natural oak reproduction.

Damaged seedlings were examined by wildlife specialists who agreed that this injury was due to mice. A study of mouse damage was made during the early fall of 1955. This showed that 56 of 274 seedlings had been destroyed by rodents. The roots of nine seedlings were partially damaged. In 1956 fifty-three seedlings were lost through rodent damage. Repeated damage of this magnitude could completely wipe out a hardwood planting within a few years unless some method of rodent control was established.

Trapping

During the late winter and spring of 1957, evidence of mouse activity was present again in this plantation. Live-traps were used to attempt to discover the exact species of mouse which were destroying the seedlings. Four traps were placed in surface runways at points of known rodent activity. During a three-month period 28 white-footed mice (*Peromyscus*) were trapped.

Examination of trails and runways showed that, in addition to the more obvious tunnels at the surface of the ground, there were many deep tunnels which went down as far as 20 inches below the surface. This tunnel pattern indicated that many pine mice (*Pitymys*) were also present, although none had been caught in the traps due to their subterranean feeding habits. White-footed mice do not make tunnels of their own, but use the surface trails of other mice and moles. The white-footed mouse feeds above ground, explaining the large number caught in the traps.

Due to the difference in feeding habit the greater part of the damage of the pine mouse is inflicted below ground. This damage consists of stripping bark from larger roots and cutting smaller roots, while the white-footed mouse does its damage on the surface, eating seed, and peeling bark from small seedlings and trees.

Control Measures

In the fall of 1955 initial rodent control measures were started. Upon the recommendations of the Department of Horticulture of West Virginia University, zinc phosphide—a rodenticide—was tested. Diced apples (one-half inch cubes) were placed in a quart jar, and one tablespoonful of zinc phosphide powder was dusted over the top of the apple cubes. The container was covered and shaken until the cubes were thoroughly stained with the dark rodenticide. Due to the high toxicity of this poison the apple cubes were removed from the jar with a knife and two cubes were placed in each runway still actively used by mice. Two or three applications of diced apples should be made. Although no dead mice were found following the poisoning, the sharp decrease in rodent damage indicated that the poison had been effective. No further evidence of mouse damage was found until early in the fall of 1956. At this time another poisoning operation was carried out which effectively reduced the rodent population again.

It is important to place bait only in those runways actively used by rodents. Although it is often difficult to tell whether a runway has been abandoned or not, usually old runways will contain mold, dead leaves and fine litter, while actively-used runways will be clean and kept open for frequent travel.

Runways throughout the entire plantation and along the margin for approximately 100 feet should be poisoned. One poison station every 10 feet is effective. Care must be taken not to miss any areas within the plantation or around the margins, as any remaining colonies of mice will quickly spread over the plantation area again. Following poisoning, repeated observations must be made in hardwood plantations, as mice can again invade an area quickly and again cause heavy damage.

AMERICAN CHESTNUTS

(continued from page 5)

oldest trees in the plots had produced burrs, and these were collected and treated as the native nuts had been. The present emphasis is on this second generation of nuts, and to date 229 have been planted. Spring frosts destroyed the crop of nuts in 1957.

If one or more highly-resistant or immune trees are found in this planting, the next step will be to test for desirable nut quality and growth habits, and to develop propagation by cuttings to a practical point. Cuttings have been successfully rooted and carried through the winter by Pease.

FIGURE 5. Chestnut tree killed by the blight. Blighted trees are not removed from the planting, because it is desired that they in turn will infect all others not either immune or highly-resistant.

THE STATION STAFF

December 1, 1959

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(continued on page 11)

These station projects were active in the year 1958 - 59

(Abbreviations of funds supporting projects: H-Hatch; NE-Northeastern Regional Research; NEM-Northeastern Regional Marketing Research; S-State; SCS-Soil Conservation Service; USDA-United States Department of Agriculture.)

Administration

General Administration of Federal-Grant Fund Research (H 1)
Planning and Coordination of Cooperative Research (H 2)

Agricultural Biochemistry and

Nutrition

Undifferentiated growth factors in proteins (H 5)
Prevention of rancidity in carcass fats of turkeys and hogs (H 6; coop. Poultry Husbandry)
Broiler rations for high efficiency (H 17; coop. Poultry Husbandry)
Measuring the nutritive value of forage crops (H 46, NE-24; coop. Animal Husbandry)
The relationship of plasma protein-bound iodine to productive potential in dairy cattle (H 96, NE 30; coop. Dairy Husbandry; Animal Husbandry)
The influence of autoxidized fat in the diet on protein requirements (H 118, NE 37; coop. Home Economics)
Miscellaneous chemical investigations (S 5)
The hemicellulolytic activity of rumen bacteria (S 125)

Agricultural Economics and Rural Sociology

The diffusion of recommended farm practices in two West Virginia counties (H 25; coop. U. S. Extension Service)
Lime, fertilizer and barnyard manure used on West Virginia farms (H 41; coop. Agronomy and Genetics)
Improvement of market procedures and outlets for West Virginia livestock (H 73, NEM 7)
The production-consumption balance and efficient utilization of milk for non-fluid uses in West Virginia (H 75, NEM 13)
The economics of broiler production on West Virginia farms (H 85; coop. Poultry Husbandry, Agricultural Extension Service)
Marketing nursery crops in West Virginia (H 93, NEM 15)
Evaluation of the effects of retail vending machines on the sale of fluid milk, and cost and efficiency of distributing milk through vending machines (H 94, NEM 14; coop. AMS, USDA)
Handling methods and cost in packing apples (H 97, NEM 19; coop. Horticulture)
Improving the usefulness of livestock marketing information (H 99, SM 20; coop. Southern Region)
Effects of national production control and price support programs on incomes of farmers in the Appalachian area (H 100, IRM 1; coop. Interregional)
An economic evaluation of the use of irrigation on West Virginia farms. (H 101, NEM 33)

The influence of population change and migration upon agriculture and rural community life in West Virginia (H 102, NE 31)

The effect of advertising and promotion on milk sales (H 114, NEM 14)

Effects of market innovations on costs of and returns for poultry (H 115, NEM 21)

Manpower utilization and agricultural adjustment potentials in Fayette, Raleigh, and Summers counties, West Virginia (H 121; coop. Agricultural Extension Service, ARS, W. Va. Dept. of Employment Security, USDA)

An evaluation of the marketing information for consumers (M.I.C.) program in the Wheeling-Stebenville area (H 122; coop. Agricultural Extension Service, Federal Extension Service)

Market structure and development of floricultural products (H 124, NEM 8)
Input-output relationships of harvested forage production on dairy farms in the Appalachian valley (H 126, NE 18; coop. Agronomy and Genetics)

The marketing of limes and fertilizer in West Virginia (Title 11, ES 259; coop. Farmer Cooperative Service, USDA)

Agricultural Engineering

Determination of factors influencing the drying rates of grains (H 15; coop. Engineering Experiment Station)
Poultry house design for West Virginia (H 65, NE 8; coop. Poultry Husbandry)
The mechanization of forage crop harvesting, processing, storing, and feeding (H 69, NE 13; coop. Animal Husbandry, Dairy Husbandry, Reedsville Farm)
Factors involved in the use of supplemental irrigation under West Virginia conditions (H 92, NE 22; coop. Agronomy and Genetics)
Agricultural climatology of West Virginia (H 105, NE 35)
Curing and handling of burley tobacco (H 123; coop. Agronomy and Genetics, Ohio Valley Experimental Farm)
Hydrology of watersheds on shale soils (H 130; coop. Agronomy and Genetics)
Study of the design of operating characteristics of a grain conveyor using fluidization principles (S 63; coop. Engineering Experimental Station)
Preliminary and exploratory investigations pertaining to agricultural engineering (S 97)

Agronomy and Genetics

The phosphorus and potassium supplying and fixing power of several important West Virginia soils (H 18)
The influence of fertility and management on several ladino clover-grass mixtures (H 19)
Corn genetics and breeding (H 29; coop. Reymann Farms, N.E. Corn Conference, Ohio Valley Farm, Extension Service)
Selection and breeding of superior strains of red clover for West Virginia (H 34; coop. Plant Pathology, Extension Service, USDA)
The interrelation of soil fertility, planting rate and geometry of spacing in relation to yield of various hybrid corn varieties (H 38; coop. Ohio Valley Farm)

Crop rotation experiments (H 43; coop. Ohio Valley Farm)

Maintaining profitable stands of alfalfa (H 50; coop. Plant Pathology, Reymann Farms, Ohio Valley Farm)

Weed control in corn (H 52; coop. Reymann Farms)

Alfalfa breeding and genetic investigations (H 66)

The influence of several management practices on the performance of alfalfa and ladino clover grown alone and in association with grasses (H 68)

Factors affecting the herbicidal activity of some chemicals applied to the soil surface (H 76, NE 12)

Some chemical properties of the major soil types of West Virginia (H 81; coop. SCS, USDA)

Using nitrogen fertilizer efficiently (H 82; coop. Ohio Valley Farm)

Breeding winter barley for high yields and powdery mildew resistance (H 86, NE 23; coop. Plant Pathology)

The molybdenum status of West Virginia soils (H 104)

Nutrient availability in relation to soil structure (H 106, NE 11)

The production of burley tobacco (H 108; coop. Ohio Valley Farm)

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The growth and control of quackgrass *Agropyron repens* under various conditions (H 128, NE 42)

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Soil Survey Work in West Virginia (S 8)

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)

Animal Husbandry

The relation of birth weight within breeds to growth rate of purebred mutton-type lambs (H 12)
Nutritional requirements of swine for growth (H 22)
Breed as a factor in the production of ewes retained for flock replacement and for the production of market lambs and wool (H 23)
Nutritional requirements of the brood sow (H 40)
Methods to increase non-protein nitrogen utilization by ruminants (H 45; coop. Agricultural Biochemistry)
Control of chronic respiratory disease (CRD) (H 53, NE 5; coop. Reymann Farms)
Causes of sterility in cattle (H 55, NE 1; coop. Dairy Husbandry, Artificial Breeder's Coop.)
Avian infectious anemia-synovitis (H 88, NE 5; coop. Agricultural Biochemistry)
Reproductive efficiency of beef cattle (H 90)
The pathogenicity of infectious agents for the uterine mucosa (H 127, NE 40; coop. Dairy Husbandry)
Nutrition, soil, and herbage interrelationships in a syndrome resembling hypomagnesemia tetany in ruminants (H 131; coop. Agronomy and Genetics)

Exploratory or preliminary investigations on diseases, feeding and management of farm animals (S 89)
 Fat calf versus feeder calf production in West Virginia (S 95; coop. Reymann Farms)
 Hay versus hay and silage for ewes (S 103; coop. Agricultural Biochemistry)
 Increasing the utilization of low quality hays by wintering beef cattle in West Virginia (S 111; coop. Reymann Farms)
 Methods of feeding growing-fattening pigs for economical production of lean carcasses (S 113; coop. Agricultural Biochemistry)
 Studies on infections synovitis (S 117; coop. Agricultural Biochemistry)
 The effects of two systems of selection of breeding stock on beef cattle performance (S 118; coop. Reymann Farms, Dairy Husbandry)

Dairy Husbandry

The transmission of milk and butterfat production and body conformation of dairy sires (H 7; coop. USDA)
 The keeping quality of milk in home refrigerators (H 11)
 Comparison of young bulls with proven bulls in artificial breeding (H 27; coop. W. Va. Artificial Breeder's Coop.)
 Breeding efficiency of dairy cows (H 33; coop. Animal Husbandry)
 The use of type and production records as a basis for a dairy cattle improvement program (H 35; coop. Ayrshire Breeder's Association)
 The effects of early versus delayed breeding of dairy heifers (H 107)
 Improving the quality of cottage cheese in West Virginia plants (H 133; coop. Plant Pathology, Bacteriology and Entomology)
 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)
 Chemical inhibition as a means of preserving bovine sperm (S 114; coop. College of Arts and Sciences)
 Effects of increasing the upper limit of feeding concentrates to Holstein cows (S 120; coop. Animal Husbandry)
 The effects of continuous feeding of chlor-tetracycline to dairy cows (S 127; coop. Agricultural Biochemistry, Statistics)

Forestry

Efficient forest management practices for West Virginia cut-over and burned-over hardwood forest lands (H 36; coop. W. Va. Conservation Commission)
 Animal repellents on hardwood forest plantations (H 37)
 A survey of multiflora rose plantings in West Virginia, with special reference to growth characteristics and spreading tendencies (H 42; coop. SCS, Conservation Commission)
 Timber management for the market demands in southern West Virginia forests (H 56; coop. Island Creek Coal Company)
 Factors affecting natural regeneration in upland oak types (H 67; coop. Plant Pathology)
 Production of plantation-grown Christmas trees in West Virginia (H 119; coop. Agronomy and Genetics)

Revegetating spoil banks with forest tree species (H 120; coop. SCS)
 Marketing lumber in West Virginia (H 125, NEM 24; coop. U. S. Forest Service)
 Quality control of lumber dimensions (H 129)
 Improvement of farm game and wild life conditions on a soil conservation district (S 42)
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 Conversion of unproductive hardwood stands to desirable forest types (S 107)
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 Strength and related properties of *Ailanthus altissima* grown in West Virginia (S 110; coop. College of Engineering)
 Silvicultural management of Virginia pine in West Virginia (S 126)

Home Economics

Qualities in blouses: the relations of those considered in selection to the satisfactions found in wear (H 77, NE 19)

Horticulture

Improvement of potato varieties for West Virginia (H 4; coop. Plant Pathology)
 Nutrition of apple trees in West Virginia (H 16; coop. University Experiment Farm)
 Improvement of apple juice (H 21; coop. Agricultural Biochemistry)
 The selection, breeding and propagation of the low-bush blueberry *Vaccinium vacillans* (H 31)
 The effect of certain chemicals on color, finish and maturation of apples (H 39)
 Selection, breeding and propagation of nursery crops (H 59)
 Effects of herbicides on tree fruits and small fruits (H 116)
 Miscellaneous horticultural investigations (S 27)
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 The effect of new growth substances on the preharvest drop of apples (S 66; coop. University Experiment Farm)
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 Propagation and selection of edible nut-bearing trees suitable to West Virginia (S 98)
 Testing of azaleas (S 112; coop. Reedsville Farm)
 Turf trials for home lawns (S 116)
 The improvement of Geranium (*Pelargonium hortorum*) through breeding (S 121)

Plant Pathology, Bacteriology and Entomology

The relation of genetics and environmental factors to growth, physiology and reproduction of fungi (H 3)
 Apple measles (H 8; coop. Horticulture)
 Black rootrot of apple (H 9)
 The microbiology of strip mine spoil (H 13)
 Decay as a factor in sprout reproduction of yellow poplar (H 14; coop. Forestry)

The nutrition of fungi and bacteria with special reference to substances which induce, stimulate, or inhibit growth and reproduction (H 28)
 The fungicidal efficiency and phytotoxicity of orchard sprays as influenced by methods of application, timing, and environmental factors (H 30; coop. University Experiment Farm)
 Testing new fungicides and insecticides for values as pesticides on small fruit and vegetable crops (H 32)
 The cause of, and remedy for, red clover failures in West Virginia (H 51)
 Biology and control of tree-wilt pathogens (H 57, NE 25; coop. W. Va. Dept. of Agriculture, W. Va. Conservation Commission)
 Improvement of tomato varieties for West Virginia (H 58; coop. Horticulture)
 The symbiotic relationships between microorganisms and insect vectors of plant diseases (H 62)
 The structure and function of specialized tissues in insects (H 63)
 Biology and control of nematodes affecting fruit trees and forest seedlings (H 72, NE 34; coop. University Experiment Farm, USDA)
 Diseases of forage grasses (H 78; coop. Agronomy and Genetics, USDA)
 Arthropods affecting livestock in West Virginia—their distribution and control (H 79)
 Cereal and forage crop pests—their distribution, incidence and control in West Virginia (H 80)
 Virus diseases of sour cherry and other stone fruits (H 89; NE 14; coop. University Experiment Farm)
 The possible relationship of metallic iron toxicity to drought injury in shade and forest trees (H 109; coop. Forestry)
 The cause and control of "hemlock canker" (H 113)
 The microbiology of farm ponds (H 132)
 Miscellaneous plant disease investigations (S 19)
 Miscellaneous insect and insecticide studies (S 24)

Poultry Husbandry

 Simplified methods of improving initial interior egg quality and shell quality through selective breeding (H 44)
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 Breeding for efficient production of eggs and meats (H 74, NE 6; coop. Reymann Farms)
 The effect on hatchability, chick viability and growth rate of fortifying chick embryos (H 111)
 Broiler management investigations (S 104; coop. Reymann Farms)
 Development of satisfactory broiler rations (S 105; coop. Reymann Farms)
 Intermingled versus individual pen rearing for broiler strains (S 119; coop. Reymann Farms)
 Radionuclide mineral metabolism of chicks which differ genetically (S 124)

University Experiment Farm

 The effect of chemical spray schedules on the quality and quantity of apples produced (H 83; coop. Plant Pathology, Entomology Res. Branch of USDA)
 Apple and peach insect control (S 91; coop. Bureau of Entomology and Plant Quarantine)
 Delicious budspout evaluation tests (S 115)

Financial Statement for the Year July 1, 1958 to June 30, 1959

Classification of Receipts and Disbursements	Hatch	Regional Research Fund	Title II	Non-Federal Funds	TOTAL
RECEIPTS					
Received from the Treasurer of the U. S.	495,888.00	102,880.00	1,250.00	.....	600,018.00
State appropriations:					
Main Station .....	.....	.....	.....	349,776.00	349,776.00
Special (Oak Wilt Research) ..	.....	.....	.....	10,000.00	10,000.00
Special endowments, fellowships					
ships and grants:					
Foundations .....	.....	.....	.....	9,700.00	9,700.00
Industry .....	.....	.....	.....	7,500.00	7,500.00
Gift .....	.....	.....	.....	100.00	100.00
Sales .....	.....	.....	.....	175,253.00	175,253.00
Balances forward July 1, 1958 ..	.....	.....	1,620.64	205,859.00	207,479.64
Total Available	495,888.00	102,880.00	2,870.64	758,188.00	1,359,826.64

DISBURSEMENTS

Personal services	419,646.57	61,263.01	2,686.71	311,431.00	795,027.29
Travel	7,724.03	12,584.77	42.99	7,086.00	27,437.79
Transportation of things	160.08	143.13	.....	1,682.00	1,985.21
Communication services	654.39	32.53	.....	5,815.00	6,521.92
Rents and utility services	5,759.45	1,639.58	.....	27,163.00	37,562.03
Printing and reproduction	4,524.12	1,373.80	.....	1,020.00	6,917.92
Other contractual services	3,495.62	1,067.77	9.00	50,350.00	54,922.39
Supplies and materials	33,802.73	14,639.93	131.94	131,827.00	189,401.60
Equipment	12,348.40	6,813.14	.....	31,983.00	51,144.54
Land and structures (contr.) .....	.....	.....	.....	.....	.....
Taxes and assessments	7,772.61	.....	.....	1,696.00	9,468.61
Total Disbursements	495,888.00	102,577.66	2,870.64	570,053.00	1,171,389.30
Reverted Balances		302.34			302.34
Non-reverted Balances Available for 1959-60				188,135.00	188,135.00

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LAMB DEATHS

(continued from page 3)

Still births accounted for a large number of lamb losses. This group included all lambs which were born dead, either prematurely or at the normal time. Probably also included in this group are some lambs which were born alive but died before the shepherd saw them. Accidental deaths included such causes as crushing by the ewe, drowning, injury by other livestock, and miscellaneous accidents.

Failure of the ewe to own or to have enough milk to raise her offspring occurred most frequently in multiple births. Lamb diseases accounted for only 6.9 per cent of all deaths. This figure is probably lower than was actually the case because many of the deaths listed under "undetermined causes," "still born," and "accidental" were likely caused by disease. Pneumonia caused most of the deaths due to diseases.

TABLE 2. PERCENTAGE OF TOTAL DEATHS BY CAUSES

Undetermined causes	30.5
Stillborn	30.2
Accidental	10.2
Failure to own—insufficient milk	8.0
Lamb diseases	6.9
Killed by dogs	6.5
Ewe abnormalities	6.2
Miscellaneous	1.1
Frozen	0.4

Loss of lambs from attack by dogs was an important factor, although it occurred in only 3 of the 12 years. Difficult lambing and pregnancy disease (ketosis) were the chief components of the category called "ewe abnormalities." Miscellaneous causes, such as congenital abnormalities, and deaths from freezing were of minor importance.

Relationships between causes of death and type of birth, whether single, twin, or triplet, are presented in Table 3. The values presented in this table are the percentages of lambs born single, twin, or triplet which died from each of the various causes. It is not surprising that total mortality increased as the number of lambs born per ewe increased. Twin and triplet lambs are usually smaller and often weaker than single lambs. Deaths attributable to failure to own and

insufficient milk are particularly high in the lambs of multiple births.

As was mentioned earlier, the lambs listed as having died from undetermined causes are numerous because of incomplete records. The high incidence of death of triplet lambs in this category probably means only that a higher percentage of the triplet lambs died than was the case in single or twin births.

TABLE 3. PERCENTAGES OF MORTALITY BY CAUSES WITHIN TYPE OF BIRTH

CAUSE OF DEATH	TYPE OF BIRTH		
	SINGLE	TWIN	TRIPLET
Undetermined causes	5.6	6.4	14.8
Stillborn	5.8	6.8	8.6
Accidental	1.7	2.4	3.7
Failure to own -			
insufficient milk	0.2	2.1	6.2
Lamb diseases	0.7	2.1	0.0
Killed by dogs	1.5	1.6	0.0
Ewe abnormalities	0.0	2.2	0.0
Miscellaneous	0.0	0.3	1.2
Frozen	0.0	0.1	0.0
ALL CAUSES	15.5	24.0	34.5

Death losses from all causes in the various breeds were as follows: Shropshire, 14.3 per cent; Corriedale, 15.3 per cent; Hampshire, 27 per cent; and Southdown, 27.9 per cent. There were only 70 Shropshire lambs born during the period because the Shropshire flock was discontinued in 1952. Three to four hundred births were recorded in each of the Corriedale, Hampshire, and Southdown flocks. Although there were differences in total mortality, there were no marked differences among breeds in causes of deaths.

The most significant finding in this study is that the largest percentage of lamb deaths occur at an early age. This leads to two conclusions—research aimed at reducing lamb losses must be directed toward the causes of these early death losses, and flock owners should use all of the knowledge and skill they possess in managing their sheep prior to and during the lambing season.

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EMPLOYMENT

(continued from page 4)

remain in the Valley, but most of them stated that they are willing to go elsewhere to do nonfarm work. A return to agriculture offers no solution since farming opportunities open to them would yield a very small return in comparison to the incomes to which these people have become accustomed. Any solution must be along the line of new industries in the area or an outmigration of workers to expanding industrial areas.

The few people who remain in agriculture in the area are much less fully employed than those who have gone into industrial employment. The small farm incomes suggest that the farm units are too small and that there is a lack of capital needed to produce on the most efficient basis. More nonfarm employment opportunities are needed for these people.

Live-at-home farming, even though inefficient, does constitute a valuable supplement to the incomes of many of the nonfarm workers.

Eighty per cent of the workers have had several years of industrial or business experience. This constitutes a valuable resource in itself. They have become adjusted to regular employment and have acquired skills that are valuable for nonfarm occupations. To overcome the underemployment of farm people who have not had such nonfarm experience probably will be a larger and more difficult job than the occupational readjustment of nonfarm workers.

The development of local industries, or bringing in new ones, is much to be preferred to outmigration of the underemployed workers. The latter means reduced home markets, reduced number of workers in relation to the number of dependents, and disruption of established home and community relationships.

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