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AGRICULTURAL EXPERIMENT STATION
WEST VIRGINIA UNIVERSITY

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Science SERVES YOUR FARM AND HOME

ANNUAL REPORT OF A. H. VANLANDINGHAM, DIRECTOR, WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

PART 1
Annual Report of the
AGRICULTURAL EXPERIMENT STATION
West Virginia University
Morgantown, W. Va.
Director
A. H. VanLandingham

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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.

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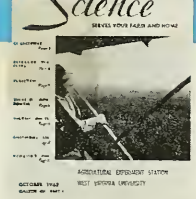
on the calendar . . .

NOVEMBER—

1, 2 Governor's Wood Utilization Conference, Charleston
4 W. Va. Veterinary Medical Association meeting, Morgantown
9 West Virginia Congress of Agriculture, Morgantown
9 Ninth Morrill Seminar, "The Development of the Social Sciences," West Virginia University, Morgantown

on our cover



In 1959, the Board of Governors of West Virginia University and officials of the Conservation Commission of the State of West Virginia entered into a cooperative agreement that will have far-reaching consequences on the welfare of the State and its citizens.

In that year, West Virginia University acquired, through a 99-year lease, 7,500 acres of the Coopers Rock State Forest. This land, now known as the West Virginia University Forest, promises to become one of the outstanding forest-teaching laboratories in the nation.

Administered by the University's Division of Forestry, the Forest makes it possible for students to achieve valuable experience that can never be obtained through textbook study alone. In a real sense, the Forest serves as the site of internship through which the student can step into the role of the professional forester.

Educational uses of the forest, however, are not limited to those students who attend classes each day on the University campus. Practicing foresters, forest-land owners, and other professional workers in the vast lumber industry visit the area to observe and discuss problems with University foresters.

Forestry research is essential if facts are to replace opinions in guiding the management of West Virginia's vast and rich forest resources. Extensive studies of forest production, wildlife, tree diseases, and other areas of forest operations have been initiated.

As the Forest matures, it should become a self-sustaining asset of the University, and at the same time serve as an example of what wise forest management can accomplish in West Virginia. In this way, it will render an unusual service to the people of our State.

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October, 1962

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A. L. Barr, Ph.D., Assoc. Agr. Econ.
J. H. Clarke, M.S., Agr. Econ.

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LUMBER PRODUCTION
In West Virginia and The United States 1929-1961

by Dr. O. C. Stine, Consultant
Agricultural Economics and Rural Sociology

LUMBER production in West Virginia has declined since the second World War, while the total production in the United States has remained at a relatively high level.

In earlier years, beginning in 1929 and continuing through the great depression and the war years, the production of the State followed rather closely the major changes in national production.

The great depression following 1929 reduced lumber production, in both the State and the nation, by more than 50 per cent. This was in response to the great changes in economic conditions.

Postwar Recovery

The wholesale price of lumber, which had dropped sharply from 1929 to 1932, returned to its predepression level by 1937. At the time of the outbreak of war in Europe, production had not entirely recovered from the depression, but war conditions increased the demand for lumber. Prices advanced and production increased in the early years of the War, until checked by controls and the diversion of resources to other pressing needs.

The demands for construction to meet deferred civilian needs following the war resulted in sharp advances in prices from 1945 through 1950. National lumber production responded to the increase in demand. West Virginia production, however, turned downward after 1947. By 1953, it had been reduced to its lowest level since 1934, and a further reduction in 1961 pushed it below the depression low of 1932.

Why was the State lumber production reduced, while the national production continued at a high level following the war?

Mines, Railroads Important

A survey, in 1953, of the State's market outlets for primary wood products provided some significant facts about the conditions of the market.[1] It showed that coal mines were the most important market outlets within the State for products of the lumber industry. Mine materials — including headers, caps, wedges, and ties — made up about two-thirds of the lumber marketed within West Virginia.

The State's coal production had been at a record level in 1947, but was reduced by 30 per cent in 1949.[2] After some recovery, production continued to decline through 1954. Again, after a temporary recovery, production declined to about two-thirds of the record level of 1947. In the meantime, the larger mechanized mines, by shifting to the use of steel roof bolts, had considerably reduced the lumber requirements per ton of coal mined.

Railroads were also an important market outlet for our lumber before and during the war.[3] The consumption of sawed ties, timber and lumber by railroads, however, was reduced by more than one-half between 1948 and 1958. Building permits in the State increased after 1948, but not sufficiently to offset to any extent the losses from reduced sales to mines and railroads.[4]

Out-of-state Competitors

The lumber industry in the State also lost ground in competition with other states. The national consumption of lumber in building and construction activities more than doubled from 1945 to 1950, and continued with a moderately downward trend through 1959.[5] The share of California redwood, western pine, and Canadian imports in the market increased substantially, replacing to some extent the use of southern pine.

Among the reasons commonly given for this shift are: (1) relatively low competitive long-haul freight rates; (2) increased mechanization of the western industry; and (3) larger tree and mill size in the West.[6] Such competition can be met only

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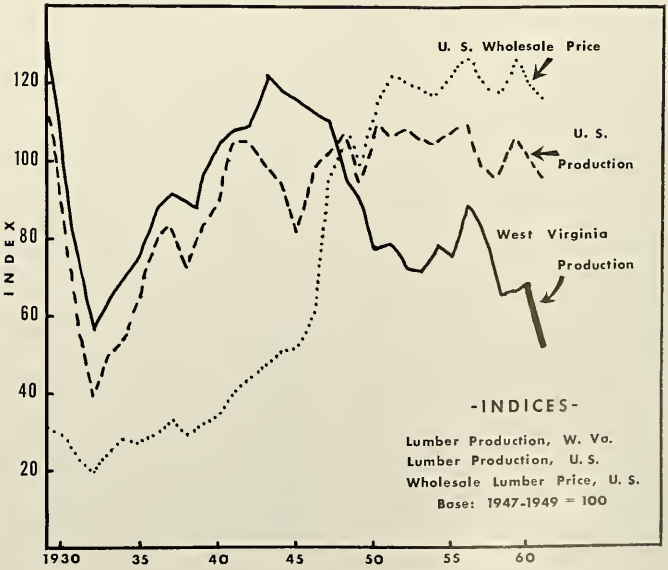


[1] "Primary Wood Industries of West Virginia," Bulletin 461, WVU Agr. Exp. Sta., June, 1961. pp 14-15.
[2] "West Virginia Business Index, Annual Review," 1961. p 4.
[3] "Lumber Industry Facts," 1960-61. p 43.
[4] "West Virginia Business Index, Annual Review," 1961. p 12.
[5] "Lumber Industry Facts," 1960-61. pp 27, 33.
[6] "The Wood Products Industry," from the "Tarheel Farm Economist," North Carolina State College of Agriculture and Engineering, Jan., 1962.

Research shows best time for CUTTING ALFALFA

by Dr. Gerald A. Jung

Associate Agronomist

SEVERAL considerations are important when deciding the proper time to cut alfalfa in the spring or summer. The stage of maturity at cutting greatly influences yields and quality of the hay. Data in Table 1 show that the yield of dry matter per acre increases as the plant progresses from the vegetative stage to the late bloom or early seed formation stage. Loss of leaves in the later stages of maturity results in a decrease in yield after the late bloom stage.

Another consideration, from the standpoint of yield, is the number of cuttings which can be taken. If alfalfa is cut in the early bloom stage rather than in the seed-forming stage, one more cutting can be taken. Therefore, mowing at the later stages of maturity means fewer cuttings and lower total seasonal yields.

While the yield of dry matter is increasing during maturation, the quality of the forage is undergoing changes in its nutritive value. One of the most important factors governing nutritive value is the content of digestible energy. Digestibility of hay is high until the plant reaches the early bloom stage, then it declines about 10 per cent by the time the plant enters the seed pod stage. This 10 per cent reduction can occur in a period of three to four weeks.

In addition to changes in digestibility, reductions occur in the protein and mineral contents of the plant as it approaches maturity. Because protein and energy supplements are expensive, farmers should try to produce as much of these in their crops as possible.

Therefore, from the standpoints of digestibility, protein content, and mineral content, it would seem wise to harvest alfalfa as early as possible. However, because of yield considerations, this is not the case.

Five or Six Harvests?!

The answer to the question "Why not 5 or 6 harvests?" becomes apparent when alfalfa is repeatedly cut or grazed during the early growth stages. The average yields of four varieties, cut 4, 5, and 6 times during the season, are presented in Table 2.

The seasonal yields are reduced when alfalfa is cut too frequently. Much of the total yield of 2.73 tons per acre in six cuttings was harvested in the first cutting. Very little was produced for the sixth cutting.

TABLE 2.
THE EFFECT OF NUMBER OF HARVESTS ON AVERAGE YIELDS AND STANDS OF FOUR VARIETIES OF ALFALFA AT MORGANTOWN IN 1960.

NUMBER OF CUTS	YIELD	STAND AFTER ONE YEAR OF HARVEST
	(TONS/ ACRE)	(PER CENT)
4	4.80	76
5	3.47	42
6	2.73	16

Persistence of stand is also influenced by frequency of cutting. Again, in Table 2, it shows that varieties harvested four times a year maintained an average stand of 76 per cent, while those harvested six times a year maintained a stand of only 16 per cent. This shows how improper gazing can hurt an alfalfa stand.

The reason why alfalfa can not persist under the five- or six-cutting systems is that it is cut at early stages of maturity. Alfalfa uses stored sugars and starch to produce new growth, and it continues to use its stored-up food reserves until about the time buds begin to form. After bud formation, the process reverses and the plant begins to store starch and sugars in its roots and crowns.

It becomes obvious, then, that if alfalfa is cut repeatedly in the bud stage, or earlier, the plants will sooner or later run out of food reserves and die.

At locations in the State where the elevation is higher than at Morgantown (1,200 to 1,300 feet), usually only three cuttings should be taken, because growing seasons are shorter and alfalfa plants grow slower at higher elevations.

Trials at Morgantown have shown that is is possible to take the first cutting in the bud stage, and other harvests during early bloom, without seriously reducing stand. This information is very important for farmers who have large acreages of alfalfa.

Where large acreages are involved, and mowing of the total acreage requires a considerable period of time, the alfalfa which is cut last will be more mature than that which was cut first. Therefore, if cutting begins while the plants are in the bud stage, the alfalfa harvested at the end of the period will still be at a desirable stage of maturity.

If this situation forms a problem, it may be overcome by growing varieties such as Du Puits or Williamsburg in short rotations. These varieties grow faster than others, and can be cut at a different time.

In order to get high yields of good quality hay, without reducing the stand, alfalfa should be mowed at the 10 per cent bloom stage.

TABLE 1. THE EFFECT OF STAGE OF MATURITY ON THE YIELD AND QUALITY OF THE FIRST CUTTING OF ALFALFA HAY*

STAGE OF MATURITY	YIELD	DRY MATTER DIGESTIBILITY	PROTEIN	MINERAL
	(TONS/ACRE)	(PER CENT)	(PER CENT)	(PER CENT)
Vegetative	1.15	72.6	32.4	11.1
Bud	1.33	69.0	23.3	8.7
5-10% Bloom	1.81	71.9	17.9	8.8
Early Seed Formation	2.19	62.5	15.8	7.8
Green Seed Pods	1.78	62.3	14.3	6.8

*Data from Research Report No. 4, Wisconsin Agricultural Experiment Station, and from Dr. R. L. Reid, West Virginia University Agricultural Experiment Station

Fall Cutting

Food reserves also play an important role in determining the best time to mow alfalfa in the fall. Generally speaking, it is desirable to have alfalfa go into the winter with a high amount of food reserves—which are needed to keep plants alive over winter, develop cold resistance, heal wounds, and support new growth in the spring.

Varieties vary considerably in how much they will grow in the fall. Generally, the more winter hardiness a variety possesses, the less it grows during the fall months. The decrease in the rate of growth is pronounced at higher elevations, because of the lower temperatures there.

If alfalfa is mowed in early September, when in bloom, food reserves will be used to produce new growth. The growth is slower as temperatures get lower and days become shorter. However, under West Virginia conditions adequate time is available for plants to store sugars and starch before winter.

If alfalfa is cut later in the fall, a point is reached where the plants produce new topgrowth, but have very little time for storing food reserves. Thus, they go into the winter with low reserves.

If the final mowing occurs late enough, temperatures will be low enough to prevent the plants from making much topgrowth. Again the plants will go into the winter with a fairly high level of reserves.

A certain amount of stubble is desirable in catching and holding snow, because snow acts as an insulator. A cover of 10 to 12 inches of snow provides enough insulation so that air temperatures will not affect soil temperatures.

Studies at Eight Locations

Since 1959, the Experiment Station has conducted studies of alfalfa at Martinsburg, Morgantown, Reedsville, Point Pleasant, Terra Alta, Union, Wardensville, and Wheeling. The purpose of these particular studies is to determine which dates are best for taking the last cutting of alfalfa.

At each location, six varieties are harvested during the first or third weeks of September and October. The results of this research should provide information that will be useful to farmers in keeping their alfalfa stands productive longer.

DR. WALTER R. LEWIS

DR. WALTER RICHARD LEWIS was born on June 4, 1917, to William A. Lewis, Sr., and Susan Allen Lewis in the Town of Union, Eau Claire County, Wisconsin. He died at Morgantown, West Virginia, on August 25, 1962.

He is survived by his wife, Mrs. Wilma Morris Lewis, and their seven children—Ralph William, Patricia Jean, Barbara Ann, Carl Richard, Thelma Jean, Robert E. Horn, and Mrs. Loretta June Wilshire.

After attending Truax Elementary School and Eau Claire Senior High School, Dr. Lewis enrolled in the Eau Claire State Teacher's College in 1935, and then transferred to the University of Wisconsin in 1939, where he earned his Bachelor of Science degree in 1941. He accepted a teaching assistantship at the University of New Hampshire the following fall, completing requirements for his Master of Science degree there in 1943. At this time, he was appointed Assistant Chemist at Purdue University, and worked and studied at this institution until he was awarded the Doctor of Philosophy degree in 1948.

Dr. Lewis joined the research staff of Kingan Company, meat packers of Indianapolis, Indiana, as Research Chemist in 1947. In 1948, he was appointed Assistant Director of Research for that Company, a position he held until joining the faculty of West Virginia University in 1951.

At West Virginia University he was Professor and Chairman of the Department of Agricultural Biochemistry and Nutrition in the College of Agriculture, Forestry, and Home Economics, and Agricultural Biochemist in the Agricultural Experiment Station.

His research activities were conducted in the fields of human nutrition, food processing, and polarography of peroxides of fats. His interest in the welfare of the people of West Virginia was reflected in his leadership in extensive studies concerning the nutritional status of wide segments of the State's population.

Dr. Lewis

He was a joint author of two bulletins of the West Virginia University Agricultural Experiment Station, *Nutritional Status Studies in Monongalia County, West Virginia*, Bulletin 375T, and *The Value of Inedible Fats in Pig Rations*, Bulletin 399. He wrote numerous technical articles for the journals of scientific societies devoted to chemistry and nutrition.

Dr. Lewis was a member of the American Chemical Society, the American Association for the Advancement of Science, the American Oil Chemists Society, the West Virginia Academy of Science, and the West Virginia State Nutrition Council. He served the latter organization as its Secretary from 1954 to 1956, as its President from 1956 to 1958, and as a member of its Executive Committee from that time until his death.

He was a member of the Society of the Sigma Xi, Gamma Sigma Delta, Alpha Zeta, and Phi Lambda Upsilon.

Dr. Lewis was intensely interested in youth and its welfare, which he expressed by serving in leadership positions in his church and the Boy Scouts of America. This service permitted him to pursue his favorite hobby of vocational counseling of youth.

AN APPRAISAL OF LIVESTOCK MARKET NEWS IN WEST VIRGINIA

by W. O. Champney
Assistant Agricultural Economist*

KNOWLEDGE of existing market conditions is an important factor in deciding when to buy or sell livestock. This knowledge is as important for producers who buy and sell animals as it is for persons engaged entirely in the marketing phases of the industry.

Most farmers are not marketing livestock on a day-to-day basis, but are concerned with market conditions when they buy or sell. Therefore, this study was made with the following objectives—to show what market news was being made available to farmers, to appraise livestock market news dissemination in terms of its reception by farmers, and to make suggestions for improvement.

Livestock market news is defined as information about conditions affecting prices, numbers, and movements of livestock through market channels. Such information tends to be classified into two categories—facts about day-to-day activities, which may be called "short run information," and data and facts that may affect marketing conditions in future periods, which may be called "long-run" or "outlook" information.

Sources of Data

Surveys were taken of three groups normally concerned with market news in West Virginia. One group consisted of farmers in the State who had sold or purchased 10 or more head of livestock during the year. The second group consisted of managers of radio and television stations, and the third group consisted of publishers of weekly and daily newspapers in the State. However, the latter was not contacted personally, as the needed information was available from newspaper files in various libraries.

*Mr. Champney is now at Kansas State University.

A library survey was conducted to determine the number of daily and weekly newspapers that report market information. No attempt was made to analyze the reports qualitatively, and only the frequency and sources of information were tabulated.

A mail survey was used to determine the livestock market information disseminated by radio and television broadcasting stations. The types of information received from this survey were: the hours during which radio and TV stations reported livestock market information, the frequencies of these broadcasts, and the source from which the information was derived. No attempt was made to obtain information on the quality of reports, although information (prices, receipts, salable animals, and gross sales) was obtained.

A survey was taken to determine what media were most frequently used by farmers, and what additional information, if any, would help them in making "marketing decisions."

Dissemination of Market News

RADIO AND TELEVISION

In 1959, 55 radio and TV broadcasting stations were located in West Virginia. Of these, 41 stations replied to a mail questionnaire. Four non-respondents were TV stations, the remainder were radio stations.

Twenty-six radio stations in West Virginia broadcast livestock market news regularly. About 62 per cent of the total broadcast such information once daily. News was given twice daily by 23 per cent of the stations that replied. Only one station gave more than two daily livestock market reports.

Programming of livestock information was tabulated for regular intervals other than daily. Some stations carry "other" programs, in addition to the scheduled market reports, which serve to enlighten farm audiences as to market happenings. These "specials" were reported by three stations.

Two stations gave market news only once a week. One station reported market news two or more times weekly, but not daily. These were broadcasts made following sales at a local auction.

The information usually reported by both radio and TV stations was prices, receipts, salable animals, gross sales, and consignors. Prices were given by all stations. Receipts and numbers of salable animals were given by 60 per cent of stations broadcasting market news. In less than half the cases, gross sales were included in the broadcasts. With one exception, gross sales information applied only to local auctions.

Source of Radio and TV Reports

Livestock market news disseminated by the West Virginia broadcasters originated from out-of-state or distant terminal markets and from in-state auction markets. News originated at four terminal markets—Chicago, Pittsburgh, Cincinnati, and Baltimore. Eighteen stations broadcast terminal market news. The majority carried the Chicago reports, although this market is probably least important in terms of number of animals marketed there by West Virginia livestock men.

Pittsburgh terminal market reports were broadcast by 10 stations, and Cincinnati and Baltimore terminal reports were broadcast by four stations. The Baltimore and Cincinnati reports were made by the stations, within the State, located nearest these cities.

Auction market news was broadcast by 16 stations, 10 of which also broadcast terminal market news. However, only three stations listed separate broadcast time for auction news reports. No one auction was reported by more than two stations. This indicates that local coverage only was given for these markets. One station in the survey included information obtained from a dealer in its livestock market reports.

How Stations Get Information

Wire services were used exclusively for obtaining terminal market news. In some cases, supplementary

information was obtained from reports printed by the United States Department of Agriculture.

Telephone and mailed reports were the methods most frequently used for acquiring local auction news. Of the 26 stations reporting market information broadcasts, about 40 per cent received some of their information from county offices of the Cooperative Extension Service.

Times for Market Newscasts

Radio and television provide one important feature which other mass media do not provide, at least to the same degree. This is timeliness of information. However, due to its nature, information received via radio or TV cannot be filed for leisurely examination or future reference. The time of day which market news broadcasts are made is important in reaching the farm audience. Therefore, the time schedules of radio and TV broadcasting were tabulated for this analysis.

Most of the radio stations in the study reported their market information in the early morning. For the purposes of the study, the morning hours were divided into two periods, with the period between 5 AM and 9 AM designated as "early morning" and the period between 9 AM and 11 AM designated as "late morning." Only one livestock market newscast was reported for the late morning period, and it occurred on a Tuesday.

The noon hours, between 11 AM and 1 PM, were of equal importance by frequency of reports. Fewer market news broadcasts were made on Saturday than on any other day of the week except Sunday. Broadcasts during the early morning and the noon periods apparently reach more farm audiences than those made during any other time.

NEWSPAPERS

In the library survey, it was found that 44 weekly and daily newspapers reported some type of livestock market news. As in radio and TV dissemination, the markets reported varied with the location of the paper. This was less so for terminal news reports than for local market news, but it was evident in both cases.

Source of Newspaper Reports

Daily newspapers printed news from the terminal markets at Chicago, Baltimore, Pittsburgh, and Cincinnati. News from the Chicago market was reported by eight dailies. News from Baltimore and Pittsburgh was reported by nine and 10 dailies, respectively, and two dailies carried reports from Cincinnati.

There were eight out-of-state papers which serve West Virginia readers. Of these, five published reports from the Chicago market, one from the Baltimore market, one from the Pittsburgh market, and one from the Lancaster market.

News of West Virginia markets was reported in both daily and weekly papers. Most auction sales were reported by more than one daily paper, and 82 per cent of the auctions held within the State were covered by weeklies. About 45 per cent of these sales were covered by more than one publication.

News Items Covered

Prices, receipts, and lists of salable animals were published by all daily and weekly newspapers, while reports of gross sales and consignors were included in some newspapers.

How Papers Get Information

Six sources were commonly used by newspapers to obtain information about the livestock markets. Generally, daily papers used the wire services and telephone reports. Weekly newspapers received market information from telephone conversations or mailed reports.

Neither the weeklies or the dailies used Crop Reporting Service reports as a source of market information, although these usually provided the same information that was available from auction managers.

Farmer-use of Media

A random-sample survey was conducted in 1957 to determine the sources used by farmers in obtaining livestock market news. Only those farmers who bought or sold ten or more head of livestock qualified for the survey.

By this stratification, 126 schedules were procured from the sample area. This sample furnished information on the use of livestock market news by farmers who produce livestock as the major farm enterprise.

Farmer-use of Radio

Radio reports were listed by 64 per cent of the 126 farmers as a source of information about livestock markets. More than this number were familiar with radio, but 81 indicated its "use" as a source of information.

Farmers in the survey were classified according to the percentage of total revenue received from livestock sales and according to the size of their farms in acres. Each of these classifications were related to the proportions of farmers that used radio as a source of market information. No significant differences were found, among the two classifications, between the proportions that used or did not use radio.

Among all farmers, radio was most frequently mentioned as a source of livestock market news. Daily newspapers ranked second, and weekly papers third.

Only those farmers who indicated that they used radio as a source were considered to be "users" in making statistical comparisons, while those indicating knowledge of its existence, but not receiving the reports, were considered to be "non-users."

The survey was not designed to ascertain why this or other media were not used by farmers. Therefore, only the number of farmers listening to the reports can be considered as a relevant measure of radio's value in aiding farmers make decisions about marketing their livestock.

Farmer-use of TV

Farmers infrequently used TV as a source of livestock market information. Few indicated that they watched a program for this type of information.

Observations from the survey were too few to analyze statistically, or to draw conclusions about the importance of television as a source of information. Various factors, such as time of broadcasing and the emphasis on programming for urban viewers, have been suggested as being responsible for this situation. However, none of these factors were checked in this study.

Farmer-use of Newspapers

Daily newspapers ranked second as a source of livestock market news, with 45 per cent of the farmers in the survey indicating that they used market reports in daily papers to estimate the value of their marketable livestock.

Farmers using or not using newspapers for market news were classified according to size of farm and

(Continued on page 11)

The West Virginia University

FOREST

A facility for teaching and research

A. W. Goodspeed, Silviculturist
and
R. C. Kellison, Forest Superintendent*

FOREST Headquarters, also home of the Forest Superintendent, permits full-time supervision of Forest workers.

SINCE 1937, West Virginia University, through its Division of Forestry, has offered a four-year curriculum leading to the degree of Bachelor of Science in Forestry. University leaders realized at the start that the development of effective programs of teaching and research would require the continuous use of a sizeable area of forest land, encompassing a wide range of forest conditions, easily accessible from Morgantown, and in stable ownership.

Attention soon turned to nearby Coopers Rock State Forest, a tract of 13,000 acres acquired by the State of West Virginia in 1936. Located in Monongalia and Preston counties, only ten miles from Morgantown, this forest was almost ideally suited to the needs of the Division of Forestry. Subsequently, negotiations between the Division and the Conservation Commission of West Virginia resulted, in 1945, in a 30-year agreement. The agreement was "for the purposes of establishing and maintaining a portion of the Coopers Rock State Forest as an area for research in the broad field of forestry, including game and fish management, and of providing for the Forestry students of West Virginia University practical training in the care and management of West Virginia forests."

The area to which this use-agreement applied was comprised of about 8,000 acres in two parcels, and consisted of that part of the Forest that lies north of State Highway 73. Responsibility for protection against fire, trespass, and tree diseases remained a responsibility of the Conservation Commission, while the Division of Forestry undertook to initiate and carry forward an active program of forest research. The program got underway in 1948.

With the way cleared for action, the use of the Forest by the University steadily increased. Experience gained during the first several years suggested that some changes were needed in the use-agreement to improve administrative operations and to protect established long-time research projects. Consequently, negotiations were again undertaken with the Conservation Commission and a very satisfactory agreement reached in 1959. Particular credit is due to the Conservation Commission, now the Department of Natural Resources, for the effective cooperation with the University in hammering out a satisfactory operational agreement.

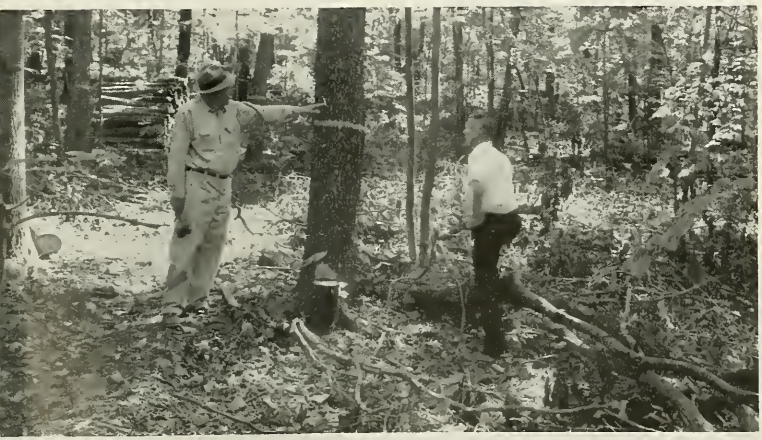
The new and current agreement is between the Board of Governors of West Virginia University and the Department of Natural Resources of West Virginia. It is a 99-year lease covering 7,500 acres of the Coopers Rock State Forest lying north of State Highway 73. This is the larger of the two parcels of land included in the original agreement. It is now known as "The West Virginia University Forest," and is operated under the administrative supervision of the University's Division of Forestry.

One provision of the lease deserves special mention, as it has apparently been the cause of some misunderstanding. Both parties to the lease have agreed "To do all in their powers to keep the laws affecting hunting and fishing on the area under lease the same as those that are generally in effect in Monongalia and Preston counties and that in every way hunting and fishing pressures shall be maintained as nearly equivalent as possible to those on other forest lands which have no special restrictions as to public hunting and fishing."

History of The Forest

The first extensive use of the forest appears to have taken place during the first half of the 19th century.

*Mr. Kellison is now a graduate student at North Carolina State College.



ONE of the production research plots on the WVU Forest. Other research includes studies of tree diseases, wildlife, establishing trees on iron-ore spoils.

At this time, iron ore was mined in and around the forest. The ore was reduced in small local furnaces, a process which required large quantities of wood to prepare the charcoal which in turn was used as a reducing agent. Much of the wood came from the forest.

This business declined during the latter half of the century, and by 1900 new second-growth stands of timber were on the area. Existing maps show that by 1911 the entire Coopers Rock State Forest area had been acquired by the Kendall Lumber Company. This concern later constructed a logging railroad from the Baltimore and Ohio railroad tracks on the north bank of the Cheat River, up through Darnell Hollow, and through the entire area of the present University Forest. In 1924 and 1925, the entire forest was logged, and this concluded major forest operations on the tract.

After acquiring the area in 1936, the Conservation Commission initiated an intensive system of fire protection. This program has been so effective that fires have been few, small, and negligible in the amount of damage done to the forest.

Prior to State ownership, however, fires were common. Ample evidence of past fires may be seen today. Many of the older trees that escaped the woodsman's axe are now of little commercial value, because of advanced decay that probably gained a start in old fire injuries.

LOCATION AND GEOLOGY

Slightly more than one-half of the 7,500-acre West Virginia University Forest lies in Monongalia County, and the remainder in Preston County. A gravel road, beginning where State Highway 73 crosses Chestnut Ridge, proceeds north along the ridge to Sand Springs. The Forest Superintendent's Headquarters is located a mile and one-half up this road. The road also branches at this point, leading to the Monongalia County Chestnut Ridge Camp three-fourths of a mile to the west. It then continues on through the Forest to Darnell Hollow on the Fairchance Road. This portion of the road is currently impassable.

The topography of the Chestnut Ridge anticline is rough. Elevations range from 1,100 feet at Darnell Hollow to 2,600 feet at the Sand Springs fire tower. The underlying rocks are sedimentary in origin. Rock outcrops are common. Soils are medium-textured, derived mainly from shales and sandstones.

Because of the variations in elevation, the growing season is not uniform over the entire forest. Available records suggest an annual growing season of 140 days, and an average rainfall of 45 inches annually.

Tree species occurring on the Forest are those indigenous to the region. Important among the hardwood species are the red and white oaks, chestnut oak, and yellow-poplar. Hemlock occurs naturally, particularly along Laurel Run at the eastern edge of the Forest. Plantations of pine are present in limited quantities. Scattered throughout the Forest are many other species of commercial value, such as cucumber, hard maple, and black cherry.

One important original species of the Forest, the chestnut, was killed by the blight in the early 1920's.

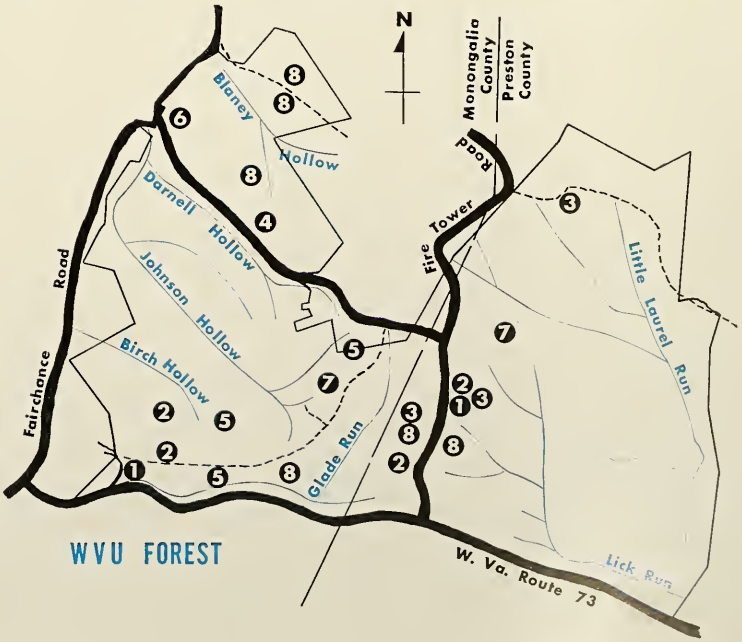
Today's tree population on the area is the resultant of the Forest's past history. Stands of mixed oaks occupy the higher and drier sites, while stands containing high proportions of yellow-poplar are found in the coves and on the cooler and not-so-dry slopes.

In general, the Forest is even-aged, about 30 to 35 years old, and originated after the commercial logging operations of 1924 and 1925. Many of the stands are two-storied in char-

(Continued on Page 10)

--KEY--

1. Yellow-poplar Sprout Decay Studies
2. Forest Production Plots
3. Block Cherry Research
4. Fish Production Study
5. Spoil Bank Study
6. Oak Wilt Research
7. Wildlife Studies
8. Oak Drought-Canker Studies



NOTE: For a report of wildlife research on the W.V.U. Forest, see Bulletin 467, *Science Serves Your Farm and Home*, January, 1962.

The W.V.U. Forest (cont'd)

acter, being composed of an understory regenerated on the area after the logging operations, and an overstory made up of much older trees that were not cut by the loggers.

In addition, small patches of older timber, missed by the loggers for one reason or another, stand as evidence of the excellent timber the Forest can produce. The hemlock stand along Laurel Run, in the eastern part of the Forest, is a good example.

PRESENT WVU ACTIVITIES

All activities of the West Virginia University Forest are under the administrative supervision of the Division of Forestry. While to some extent overlapping, these activities can be broadly classified in the following categories:

1. Forest development and operations
2. Forest, wildlife, and related research
3. Educational use

Development and Operations

Forest development and operations concerns the general management of the Forest. Everything concerned with the organization, protection, acquisition of equipment, development of facilities, and record keeping on the Forest is included. It is under this heading that the business affairs of the Forest are conducted.

In 1952, the University established the position of Forest Superintendent, so as to provide full-time supervision of work on the Forest. A number of young graduate foresters have held this office in which they gained personal, first-hand experience before moving on to more remunerative positions.

In 1959, living quarters were established in the Headquarters building, which had become available in the 1959 lease. By being able to live on the Forest, the Superintendent can more effectively oversee operations and development.

A considerable amount of operations and development work has been accomplished since 1949, the chief limiting factor being the availability of funds. The Forest Headquarters has been equipped with central heating and an automatic hot water system. Electricity is provided by a portable generator. A small crawler tractor has been acquired for road maintenance and woods work. This machine, equipped with a dozer blade and an integral logging arch, has proved extremely versatile.

Maps, based on existing and original surveys, have been prepared of boundaries, interior drainage, and the more important roads of the Forest. That portion of the Forest lying east of the Sand Springs road has been divided into 14 compartments for purposes of location and record keeping. The compartments, which average about 250 acres in size, utilize natural topographic boundaries whenever possible, and can be subdivided if future operations so require. Similar compartmenting of the western portion of the Forest is now underway.

The Forest boundary has been cleared of brush, and the boundary wire put in a fair state of repair. Some clearing of interior roads has been done, to make them of use to trucks needed in woods operations.

New roads on the Forest include one of three miles which begins near the Sand Springs road just north of the Highway, and leads to the Chestnut Ridge Camp. Much of the Forest which has been difficult to reach has thus become accessible by car. The public can use this road, but strictly at its own risk. A branch of this road now leads to Johnson Hollow.

An over-all forest inventory, showing wood volumes, growth, and locations of forest stands, is in process. Field work on some 1,400 acres in the eastern portion of the Forest has been completed. The inventory will permit the preparation of an operational management plan for the Forest, which will be the basis for controlling the harvest of timber as it matures, perhaps 50 years in the future.

A substantial timber sale was made in 1954, in cooperation with the Conservation Commission. Old overtory trees were removed from some 170 acres in order to permit younger trees to grow. About 800 thousand board feet were sold for $12,000. Under the administrative arrangements in effect at the time, income from the sale could not be applied to the development of the Forest. This situation has since been remedied.

In the past three years, sales of firewood and pulpwood have been used in disposing of wood cleared from road, research, and teaching sites. As the material is cleared from the sites it is stacked in a wood yard near the Forest Headquarters. After it seasons, it is cut up and sold locally for firewood. Students in the Division of Forestry are employed to saw and deliver this product, which amounted to some 50 face cords in the 1960-61 school year.

A car load of pulpwood, about 13 cords, has been sold to a Pennsylvania paper company. More sales of this sort can be expected as the Forest becomes increasingly productive. Tom Clark, a WVU alumnus and consulting forester, was helpful in arranging this sale.

Research

A key use of the West Virginia University Forest is for research. Forest areas need not be managed for wood production alone. Fish and wildlife, recreation, and watershed protection are examples of important uses of forested areas. These uses are neither mutually exclusive nor incompatible with the production of wood crops, yet much needs to be learned about effective forest land use. It is for this reason that an active program of research is being carried out on the Forest.

One phase of this research concerns production methods suitable for mixed oaks and yellow-poplar forest cover types. Forty small plots were established in these types when the trees were about 20 years old. Each plot will receive, as needed, a particular combination of intermediate cuttings.

On all plots, the objective will be to produce the best crop of timber that the site, type, and systems of cuttings will permit. Each plot will be measured at five-year intervals to trace its development, and the time spent and products harvested from each plot will be recorded in detail. The data will then become the basis for a comparative evaluation of production methods for even-aged hardwood stand management.

Projects such as this are time consuming, but essential, if facts are to replace opinions in guiding the management of West Virginia's forests.

Some reseach can be more quickly completed. An example is the work done on the old iron-ore spoil

banks in the Forest. These have been studied from the standpoint of vegetation and soil development as it occurs after the mining ceases. This project is significant in connection with the revegetation of modern strip mine spoil banks, presently a problem in land reclamation.

Data from this research indicates that forest stands may be successfully produced on many of the spoil banks being created today.

Other research deals with the relation between drought and oak cankers, soil moisture, natural regeneration in oak stands, economic value and wood properties of locally-produced black cherry, transmission of decay in yellow-poplar sprout clumps, and control of oak wilt. The oak wilt and the yellow-poplar decay projects are being conducted by the University's Department of Plant Pathology, Bacteriology, and Entomology.

Wildlife research has become increasingly active in the last few years. University wildlife scientists are studying small mammals of the Forest, and cooperating with the Fish and Game Division, West Virginia Department of Natural Resources, in a study of game animal habitat development. Fish production in the Forest's headwater streams is being studied by University biologists.

Collectively, a considerable amount of research has been initiated on the Forest. By its nature, such work is inconspicuous. To the layman, it may appear that little or nothing is underway, and he may conclude that research efforts have little value.

Such a conclusion would be entirely erroneous. The factual information necessary to effectively develop the State's forest resources can be obtained only through a carefully thought-out research program. For this reason, it is expected that research on the Forest will proceed at an increasing tempo in the future.

Education

The third major activity on the University Forest is that of education. It is, perhaps, its most important function. Students in the Division of Forestry make regular use of the area for this purpose.

The embryo silviculturist, under competent supervision, develops on the Forest his art and skill in timber marking. In a real sense, he receives the internship that qualifies him to step out as a professional forester. In the process he picks up a good deal of woodsmanship that can not otherwise be provided in his curriculum.

The same benefits are received in other phases of the student's education, such as forest protection. In addition, through part-time work, the student may pick up a great deal of operational experience, valuable in building self-confidence in his ability to do the job. For all of this, the University Forest is essential.

Educational functions of the Forest, however, are not limited to the students. Individuals and groups visit the Forest to observe management and research, and to discuss, on the site, particular problems in which they are interested. The resulting exchanges of ideas have been most beneficial to those responsible for managing the Forest. It is hoped that they are likewise beneficial to the visitors, as well.

THE FUTURE

As an area for teaching and research, the West Virginia University Forest has provided a facility unexcelled by that of any other forestry school. Its teaching and research potential has barely been scratched, and opportunities for such uses will undoubtedly be more fully utilized in the future.

Organization of the forest will be improved as funds become available. As the young timber matures, it is entirely reasonable to expect the Forest to become a fully self-sustaining asset of the University.

At the same time, it will demonstrate what can be achieved by proper forest management in West Virginia. In this way, it will serve the people of the State as well as the needs of the University's Division of Forestry.

MARKET NEWS

(Continued from page 7)

percentage of total income obtained from livestock sales. As with radio, no significant differences occurred between these classifications in the proportions using or not using daily newspapers.

Hence, it appears that farmers in all types of farming depend on this source, and no one group would be affected more than any other group by additions or reductions in space devoted to markets.

A comparatively small percentage of farmers availed themselves of market information in weekly newspapers. Of the farmers interviewed, 25 per cent read weekly newspapers as a source of market information to estimate the value of their livestock.

Again, no statistically significant relationships existed between either the dollar income received from livestock sales or the farm size in acres with the number of users or non-users of weeklies. Thus, no income or size group used weeklies more than any other income or size group.

Weekly newspapers were not mentioned by farmers in any one segment of the survey to a significantly greater proportion than by those of any other segment. Every weekly serving a sampled area had some market-news readers in that area.

Other Factors Involved

Farmers replying to the survey indicated that market price was not the only factor considered when they decided to sell animals. Only 27 per cent of the interviewees included market outlook information as a factor in deciding when to sell.

Condition, or fatness of the animals, was reported by 65 per cent of the farmers to be the most important factor. Market outlook information ranked second. Feed supplies, selling of culls, financial situation, and selling out were other reasons mentioned, but each of these accounted for less than five per cent of the total interviewed.

It would seem that information is needed about future market prices in relationship to animals nearing market readiness. This would give producers more complete and timely information for making production and marketing decisions. This need is further validated by the apparent adequacy of program time and newspaper space devoted to present dissemination of livestock market news.

Suggestions for the Media

Broadcasters and publishers might review basic and supplemental information needed by the livestock seller. Some presently-available information needs wider distribution, such as long- and short-run outlooks, reports of future expectations of the industry, and occasional reviews of seasonal patterns.

LUMBER PRODUCTION

(Continued from page 3)

through improvements in quality of products, efficiency in marketing, and adjusting production to meet changing market requirements.

Hardwoods, in respect to competition from the west coast, have fared better than the southern softwoods. The production of oak flooring increased from 1945 to 1950, and continued at a high level with a downward trend in recent years to 1960. Wholesale prices of the hardwood lumber also held to the higher levels in 1960. The overall consumption of hardwood lumber, however, declined from 20.8 per cent of total consumption in 1948 to 16.7 per cent in 1960.

Some significant changes in market requirements in recent years may be noted.[7] Among the most notable are the great increases in the use of veneers and plywoods. The value of shipments of these products more than d o u b l e d between 1947 and 1958. The value of prefabricated wood products increased from 103 million to 322 million dollars during the same period, and mill work values increased from 546 million to one billion, fifty million dollars. Such are adjustments to changes in patterns of residential construction.

Sales Out-of-State

The West Virginia survey of 1953 indicated that about two-thirds of the lumber then being cut was sold in out-of-state markets, with about one-half of this volume going to manufacturers to be processed for the ultimate consumer.[8] Obviously, these conditions handicap the industry in meeting competition from other areas, and limit the opportunities of producers within the State in realizing the potential value of their forest resources.

Market Recovery Predicted

The low condition of the lumber industry of the State in 1960 and 1961 may prove to be the darkest hour before the dawning of a new day. The general business revival under way, along with new housing legislation, has stimulated new residential housing starts. Building permits in West Virginia increased substantially in the latter half of 1961.[9]

Nationwide, new construction of residential buildings to be put in place in 1962 is expected to increase six percent over 1961.[10] Activity within the State is astir to develop new and higher value market outlets for the lumber industry.

Looking further ahead, through 1963 to 1965, the formation of new households is expected to begin to register with increased demands for new homes. This should bring increased demand for hardwood lumber for flooring and furniture to levels beyond recovery from the depression.[11]

In the meantime, the productive resources of West Virginia are here to be nurtured to supply the increasing requirements.

LUMBER PRODUCTION IN THE UNITED STATES AND WEST VIRGINIA AND THE WHOLESALE PRICE INDEX FOR THE UNITED STATES, 1929-1960[1]

YEAR	UNITED STATES PRODUCTION		WEST VIRGINIA PRODUCTION		PRICE INDEX[2]
	BILLION BOARD FEET	INDEX[2]	MILLION BOARD FEET	INDEX[2]	
1929	38.7	111	700	134	31.2
1930	29.4	84	550	106	28.5
1931	20.0	57	400	77	23.1
1932	13.5	39	300	58	19.4
1933	17.2	49	350	67	23.5
1934	18.8	54	380	73	28.1
1935	22.9	66	410	79	27.2
1936	27.6	79	470	90	28.9
1937	29.0	83	490	94	33.1
1938	24.8	71	400	77	29.0
1939	28.8	83	518	99	31.0
1940	31.2	89	559	107	34.2
1941	36.5	105	578	111	40.7
1942	36.3	104	588	113	44.2
1943	34.3	98	655	126	47.0
1944	32.9	94	631	121	50.9
1945	28.1	81	478	92	51.5
1946	34.1	98	548	105	59.3
1947	35.4	101	618	119	94.5
1948	37.0	106	514	99	107.3
1949	32.2	92	432	83	98.2
1950	38.0	109	411	79	114.5
1951	37.2	107	421	81	123.6
1952	37.5	107	388	74	120.5
1953	36.7	105	382	73	119.3
1954	36.4	104	377	72	117.3
1955	37.4	107	405	78	124.4
1956	38.2	109	479	92	127.2
1957	34.6	99	437	84	119.7
1958	33.4	96	353[3]	68	118.0
1959	37.0	106	351	67	127.1
1960	35.0	100	365	70	121.4
1961	32.0[4]	92	275	53	117.0[4]

[1]Data for United States production, 1929-1946, and for West Virginia production, 1929-1940, taken from "Lumber Production in the United States, 1799-1946." Data for United States production, 1947-1960, and the wholesale price index for all years, taken from "The Demand and Price Situation for Forest Products." Both are publications of the United States Forest Service. Data for West Virginia production, 1941-1961, is from "The West Virginia Business Index," a publication of the West Virginia Chamber of Commerce.

[2]1947-49 = 100.

[3]"The U.S. Manufacturing Census" of 1958 reported 346 million board feet.

[4]Preliminary indications.

[7]"1958 Census of Manufacturers, MC58(2)-24B, Millwork Plants," p 24B-3.

[8]"Primary Wood Industries of West Virginia," Bulletin 461, WVU Agr. Exp. Sta., June, 1961, pp 6, 27-28.

[9]"West Virginia Business Index," Jan., 1961, p 6.

[10]"The Demand and Price Situation," U.S. Department of Agriculture, Dec., 1961, p 9.

[11]"The Demand and Price Situation for Forest Products," U.S. Forest Service, Nov., 1961, pp 13-15.

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(Continued from page 2)

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(Continued on page 14)

These station projects were active in the year 1961-62

(Abbreviations of funds supporting projects and other abbreviations: AMS-Agricultural Marketing Service; ARS-Agricultural Research Service: CES-Cooperative Extension Service; H-Hatch Funds; NE-Northeastern Regional Research; NEM-Northeastern Regional Marketing Research; S-State Funds; 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

Prevention of rancidty in carcass fats of turkeys and hogs (H 6; coop. Animal Science)
Measuring the nutritive value of forage crops (H 46, NE-24; coop. Animal Science, Agronomy and Genetics)
Metabolic relationships among amino acids, peptides and phospholipids (H 150, NE-37; coop. Home Economics)
The mechanism of action of hemicellulases and the structure of hemicelluloses (H 157)
Miscellaneous chemical investigations (S 5)
The hemicelluoytic acidity of rumen bacteria (S 125)

Agricultural Economics and Rural Sociology

The economics of broiler production on West Virginia farms (H 85; coop. Poultry Science, CES)
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)
The effects 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)
Market structure and development of floricultural products (H 124, NEM 8)
Input-output relationships of forage production on dairy farms in West Virginia (H 134, NE-43; coop. Agronomy and Genetics)
An economic analysis of the physical and monetary costs incurred in the procuring, slaughtering and distributing of livestock, meat and meat products of local and wholesale slaughtering establishments in West Virginia (H 135, NEM 7; coop. Farmer's Cooperative Service, AMS)
An analysis of specification buying and production of livestock and meat in West Virginia (H 136, NEM 7; coop. Farmer's Cooperative Service, AMS)
Improving farm income from apple sales through changes in market organization and structure (H 137)
Economics of reducing the frequency of retail milk delivery (H 138, NEM 25)
Market development of ornamental nursery products (H 139, NEM 15)
Adjustments needed to enhance the competitive position of West Virginia in marketing broiler products (H 151, NEM-21)
Tobacco marketing in West Virginia (Title II, ES 234; coop. AMS, Kentucky Agricultural Experiment Station)

Agricultural Engineering

Poultry house design for West Virginia (H 65, NE 8; coop. Poultry Science)
The mechanization of forage crop harvesting, processing, storing, and feeding (H 69; coop. Animal Science, Dairy Science, Reedsville Farm)
Factors involved in the use of supplemental irrigation under West Virginia conditions (H 92, NE 22; coop. Agronomy and Genetics, Reymann Memorial Farms, Ohio Valley Experiment Farm)
Agricultural climatology of West Virginia (H 105, NE 35, Weather Bureau, U. S. Department of Commerce)
Curing and handling of burley tobacco (H 123; coop. Agronomy and Genetics, Ohio Valley Experiment Farm)
Hydrology of watersheds on shale soils (H 130; coop. Agronomy and Genetics)
Equipment for hillside pastures (H 156)
Effect of temperature, humidity, and drying time on hay (H 158, NE-13)
Study of the design of operating characteristics of a grain converyor using fluidization principles (S 63; coop. Engineering Experiment Station)
Preliminary and exploratory investigations pertaining to agricultural engineering (S 97)
Cost of installing and using electrical equipment (S 129; coop. Dairy Science, Animal Science, Poultry Science, Statistics, W. Va. Farm and Home Electrification Council)

Agronomy and Genetics

Corn genetics and breeding (H 29)
Selection and breeding of superior strains of red clover for West Virginia (H 34)
Crop rotation experiments (H 43; coop. Ohio Valley Experiment Farm)
Weed control in corn (H 52; coop. Reymann Memorial Farms, Ohio Valley Experiment Farm)
Alfalfa breeding and genetic investigations (H 66)
Some chemical properties of the major soil types of West Virginia (H 81)
Using nitrogen fertilizer efficiently (H 82; coop. Ohio Valley Experiment Farm)
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 Experiment Farm)
The correlation between various laboratory methods of determining available nitrogen in northeastern soils and the responses to added nitrogen to crops grown on the soils in greenhouse and field studies (H 112)
Studies of soil properties that affect establishment and growth of oak stands in West Virginia (H 117)
The growth and control of quackgrass *Agropyren repens* under various conditions (H 128, NE 42; coop. Biology)
The microclimate and soil moisture regime in forested soils as affected by topography and its effect on site productivity in mixed oak stands (H 140)
The performance of several alfalfa varieties grown under different climatic conditions with emphasis on the influence of fall cutting (H 141)
The influence of cutting and fertilization treatments on the productivity and persistence of orchardgrass and timothy (H 142, NE 29)
Biochemical studies on cold resistance of alfalfa (H 152)
Rate and time of application of K fertilizer in relation to yield and longevity of alfalfa stands (H 153; coop. Ohio Valley Experiment Farm, Reedsville Experiment Farm)
Evaluation of improved varieties, synthetics and new forage species for the Northeast (H 154, NE-28)
Physiological responses of weed and crop plants to herbicides (H 161; coop. Horticulture)
Field crop variety testing (S 6)
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)
Preliminary investigations in crop production and genetics (S 128)

Animal and Veterinary Science

The relation of birth weight within breeds to growth rate of purebred mutton-type lambs (H 12)
Breed as a factor in the production of ewes retained for flock replacement and for the production of market lambs and wool (H 23; coop. Reymann Memorial Farms)
Methods to increase non-protein nitrogen utilization by ruminants (H 45; coop. Agricultural Biochemistry)
Respiratory diseases of poultry (H 53, NE-5; coop. Reymann Memorial Farms, Agricultural Biochemistry, Poultry Science)
Avian infectious anemia-synovitis (H 88; coop. Agricultural Biochemistry)
Reproductive efficiency of beef cattle (H 90, S 10, Southern Region)
The pathogenicity of infectious agents for the uterine mucosa (H 127, NE 40; coop. Dairy Science)
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)
Increasing the utilization of low-quality hays by wintering beef cattle in West Virginia (S 111; coop. Reymann Memorial Farms)
Methods of feeding growing-fattening pigs for economical production of lean carcasses (S 113; coop. Agricultural Biochemistry)
Studies on infectious synovitis (S 117; coop. Agricultural Biochemistry)
The effects of two systems of selection of breeding stock on beef cattle perfor-

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STATION PROJECTS

(Continued from page 13)

mance (S 118; coop. Reymann Memorial Farms, Dairy Science)
The efficacy of certain anthelmintics in the control of sheep parasites (S 132)
A comparison of the wastage of feed by various types of swine self-feeders (S 135; coop. Agricultural Engineering)

Dairy Science

The influence of genetics and environment on milk and meat production in Ayrshire cattle (H 7)
The transmission of milk and butterfat production and body conformation by dairy sires (H 7)
Comparison of young bulls with proven bulls in artificial breeding (H 27; coop. W. Va. Artificial Breeder's Coop., CES)
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)
Indirect calorimetry studies with dairy cattle (H 159; coop. Agricultural Biochemistry and Nutrition)
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)
The feeding value of hay cut at various dates and stages of maturity for milk production (S 133; coop. Agricultural Biochemistry and Nutrition)
Factors that affect the solids-non-fat content of milk (S 134)

Forestry

Efficient forest management practices for West Virginia cut-over and burned-over hardwood forest lands (H 36; coop. W. Va. Conservation Commission)
Timber management for the market demands in southern West Virginia forests (H 56; coop. Island Creek Coal Co.)
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, W. Va. Conservation Commission, W. Va. Christmas Tree Grower's Association, Maryland Departments of Research and Education and Forests and Parks)
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 dimension in West Virginia hardwood sawmills (H 129)
Utilization and management of sprout black cherry (H 145)
Population studies of forest small mammals in West Virginia (H 147)
Forest fire protection through public interest in game management in southern West Virginia (H 149; coop. Island Creek Coal Co., W. Va. Conservation Commission)
Plantings of forest trees and shrubs at Greenland Gap (S 56)
Determination of optimum growth of West Virginia hardwoods (S 60)
Conversion of unproductive hardwood stands to desirable forest types (S 107)
Silvicultural management of Virginia pine in West Virginia (S 126)

Home Economics

Serum nutrient distribution following test meals of different composition (H 160; coop. Agricultural Biochemistry and Nutrition)

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)
The selection, breeding and propagation of the low-bush blueberry *Vaccinium Vacillans* (H 31)
Selection, breeding and propagation of nursery crops (H 59; coop. Reedsville Experiment Farm)
Effects of herbicides on tree fruits and small fruits (H 116)
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)
Chemical thinning of apples and peaches (S 69; coop. University Experiment Farm)
Propagation and selection of edible nut-bearing trees suitable to West Virginia (S 98)
Testing azaleas (S 112; coop. Reedsville Experiment 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)
The microbiology of strip mine spoil (H 13)
Decay as a factor in sprout reproduction of yellow poplar (H 14; coop. Forestry, USDA)
The nutrition of fungi and bacteria with especial 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)
Factors influencing losses from root rots of forage legumes (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)
Arthropods affecting livestock in West Virginia—their distribution and control (H 79; coop. Animal Science, Dairy Science)
Cereal and forage crop pests—their distribution, incidence and control in West Virginia (H 80; coop. Agronomy and Genetics)
Virus diseases of sour cherry and other stone fruits (H 89; NE 14; coop. University Experiment Farm, USDA)
The possible relationship of metallic ion 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)
Studies of psychrophilic bacteria important in the spoilage of dairy products (H 146)
Gum defects in black cherry, *Prunus serotina,* Ehrh., associated with attack by shot-hole borer, *Scolytus regulosus* (Ratz.), and similar or related defects caused by other agents (H 148; coop. USDA Forest Service)
Miscellaneous plant disease investigations (S 19)

Poultry Science

Broiler rations for high efficiency (H 17)
Improving the reproduction performance of turkeys (H 49)
Breeding for efficient production of eggs and meats (H 74; coop. Reymann Memorial Farsms)
The effects on hatchability, chick viability, and growth rate of fortifying chick embryos (H 111)
Evaluating crisscross breeding of poultry (H 144)
Increasing genetic variation in poultry for selection purposes through the use of gamma radiation (H 155, NE-6; coop. Statistics)
Radionuclide mineral metabolism of chicks which differ genetically (S 124)
Development of economical broiler rations (S 130; coop. Reymann Memorial Farms)
Nutrition of egg producers (S 131)

University Experiment Farm

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

STAFF

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C. R. Coffman, B.S., Farm Supt.
H. C. Frick, B.S., Grad. Res. Asst.
E. M. Jencks, Ph.D., Asst. Agron.
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Financial Statement for the Year July 1, 1961 to June 30, 1962

Classification of Receipts and Disbursements	Hatch	Regional Research Fund	Title II	Non-Federal Funds	TOTAL
RECEIPTS					
Received from the Treasurer of the U. S.	$551,395.00	$ 96,250.00	$ 2,000.00	....	$649,645.00
State appropriations:					
Main Station	....	....	....	$407,923.99	407,923.99
Special (Oak Wilt Research)	....	....	....	9,993.67	9,993.67
Special endowments, fellowships and grants:					
Industry:					
Private corporations	....	....	....	21,932.70	21,932.70
Farm and trade associations	....	....	....	102.00	102.00
Sales	....	....	....	216,672.71	216,672.71
Balances forwarded July 1, 1961	....	....	....	167,881.99	167,881.99
Total Available	$551,395.00	$ 96,250.00	$ 2,000.00	$824,507.06	$1,474,152.06
DISBURSEMENTS					
Personal services	$468,569.58	$ 60,265.58	$ 1,176.71	$388,667.01	$918,678.88
Travel	10,874.65	6,836.78	87.71	7,779.19	25,578.33
Capital assets	28,289.43	11,310.93	....	50,279.31	89,879.67
Other operating expenses	43,661.34	17,835.11	735.58	220,013.82	282,245.85
Total Disbursements	$551,395.00	$96,248.40	$2,000.00	$666,739.33	$1,316,382.73
Reverted Balances		1.60			1.60
Non-reverted Balances Available for 1962-63				$157,767.73	$157,767.73

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W. A. van Eck, Ph.D., Asst. Agron.
Collins Veatch, Ph.D., Agronomist

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G. D. Bengtson, B.S., Assoc. Editor
D. R. Creel, Photographer

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D. L. Nelson, M.W.T., Asst. in Wood Tech.
R. L. Smith, Ph.D., Asst. Forester
E. H. Tyron, Ph.D., Forester

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Elisabeth S. Yearick, Ph.D., Assoc. Nutritionist

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W. R. Fortney, Ph.D., Assoc. Hort.
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O. M. Neal, Jr., Ph.D., Assoc. Hort.
O. E. Schubert, Ph.D., Hort.
R. F. Sweitzer, B.S., Farm Supt.
K. C. Westover, Ph.D., Hort.

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L. A. Berg, M.S., Grad. Res. Asst.
J. W. Byler, B.S., Grad. Res. Asst.
R. B. Carroll, B.S., Grad. Res. Asst.
C. W. Clayton, M.S., Res. Tech.
T. C. Davis, M.S., Grad. Res. Asst.
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R. T. Griffey, B.S., Grad. Res. Asst.
N. T. Griffith, B.S., Grad. Res. Asst.
W. N. Harnish, B.S., Grad. Res. Asst.
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J. R. Sutherland, M.S., Grad. Res. Asst.
R. P. True, Ph.D., Plant Path.
W. J. Vail, B.S., Grad. Res. Asst.
C. J. Wenger, B.S., Grad. Res. Asst.
H. A. Wilson, Ph.D., Bacteriologist

Poultry Science

Homer Patrick, Ph.D., Poultry Sci.
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J. R. Johnson, B.S., Res. Asst.
W. G. Martin, M.S., Asst. in Poultry Sci.
H. C. Smith, B.S., Farm Supt.
R. A. Voitle, B.S., Grad. Res. Asst.

Substations

Ohio Valley Experiment Farm, (P.O. Pt. Pleasant)
C. B. Sperow, Jr., M.S., Asst. Agron. in Charge
H. F. Ross, M.S., Asst. Agron. and Tobacco Specialist

Reedsville Experiment Farm, (P.O. Reedsville)
L. P. Stevens, M.S., Farm Supt.

Reymann Memorial Farms, (P.O. Wardensville)
C. J. Cunningham, B.S., Animal Husb. in Charge
J. O. Heishman, D.V.S., Assoc. Animal Path.

University Experiment Farm, (P.O. Kearneysville)
Edwin Gould, B.S., Entomologist-in-Charge
J. G. Barrat, Ph.D., Spray Specialist

Miscellaneous

R. S. Dunbar, Jr., Ph.D., Statistician
J. G. Hall, B.S., Agriculturist
H. L. Warner, M.S., Mechanician
Mary L. Washburn, Staff Assistant
R. J. Watts, M.S., Supvr. Off. Bus. Relations and Records

West Virginia's LABOR FORCE In 1965 and 1970

by Dr. Leonard Sizer
Associate Rural Sociologist

THIS projection of West Virgina's labor force by sex and age categories, without regard to migration, was prepared so as to indicate the volume of increase in number of persons in the labor force. Table 1 contains predictions of the number of persons moving into, or passing through the sex-age categories during the time specified, keeping constant certain factors that may influence changes in the force one way or the other.

The factors regarded as remaining constant, for the purposes of the projects, were: the continued classification of unemployed as part of the labor force; death rates (based on past records) would remain constant; labor force participation rates would conform to the 1960 pattern of age-sex categories for West Virginia, and no net out-migration for each category would occur. With these factors held constant, the projections in Table 1 were prepared.

While it is believed that the above factors will not remain constant, assessment of the amount of change that may be expected cannot be handled easily. Table 1 serves to focus our attention upon the volume of employment needs, and the age-sex categories in which these needs are most likely to occur.

More People—More Jobs Needed

All persons who will be in the labor force age categories in 1965 and 1970 are alive today. Growth will not occur in each of the age categories during the periods 1960-65, 1965-70, or 1960-70.

Reference to the size of incoming age groups, compared to the size of out-going age groups, as determined in the 1960 Census, clarifies the differences. The most significant growth occurs in the age categories 18-24 and 25-34.

In order to take care of additions to our labor force, 42,000 new jobs will be needed between 1960 and 1965, and an additional 65,000 needed between 1965 and 1970, if all are to be placed. If these jobs are not forthcoming, these numbers of people—together with those dependent upon them—will perhaps find it necessary to leave the State.

It is believed that some developments—such as earlier retirements from the labor market and the prolongation of education—may decrease the pressure for employment somewhat. However, it is possible that the trend of increased rate of employment of women may offset a considerable reduction in this pressure.

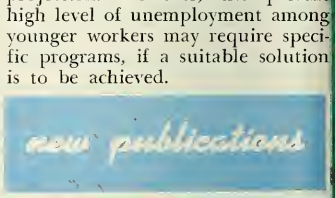
TABLE 1. THE LABOR FORCE OF WEST VIRGINIA, BY AGE AND SEX CATEGORIES, WITH PROJECTED ESTIMATES FOR 1965 AND 1970.

AGE CATEGORY	1960 CENSUS	1965 PROJECTION*	1970 PROJECTION*
(MALES)			
14-17	10,042	15,800	11,300
18-24	49,243	76,600	93,200
25-34	92,670	86,300	113,800
35-44	104,330	102,800	103,000
45-64	150,876	157,000	165,200
65 on	18,473	19,100	20,900
Total Males	425,634	453,600	507,400
(FEMALES)			
14-17	4,668	5,500	5,200
18-24	27,302	38,300	45,400
25-34	29,012	28,700	33,200
35-44	38,299	38,000	34,400
45-64	56,731	59,800	63,300
65 on	6,434	6,800	7,200
Total Females	162,446	177,100	188,700
Total Persons	588,180	630,700	696,100

*No allowance for out-migration.

The increasing amounts of training required by changes in the structure of employment—that is, greater numbers of professional and highly-skilled persons—will continue to maintain pressure for longer periods in school and other training.

Fewer numbers of women in the child-bearing years, evidenced in the 1960 Census, appears to be an influencing factor in the drop of number of persons in the youngest age categories in the 1970 labor force projection. However, the present high level of unemployment among younger workers may require specific programs, if a suitable solution is to be achieved.



Bulletins

467. Part 2. Science Serves Your Farm and Home, April 1962.
472. E. H. Tryon, H. G. Woodrum. Growing Christmas Trees from Seed, April 1962
473. James H. Brown. Success of Tree Planting on Strip-Mine Areas in W. Va., April 1962.
474. Ross A. Phillips, K. C. Elliott, Using Flail Forage Harvesters, May 1962.
475. A. D. Longhouse, Homer Patrick. Eight Years of Experience with Windowless Housing for Poultry, May 1962.
476. T. B. Clark, J. K. Bletner, C. J. Cunningham. Restricted and Full-Feeding of Growing Pullets, June 1962.
477. Roger Pease. Expanding the Demand For Floricultural Products Sold By Florists, June 1962.
478. Wallace W. Christensen, Henry H. Webster, Gregory Baker, Newell A. Norton, William H. Reid. Marketing of Lumber Produced by Sawmills in the Northeast — Phase 1, June 1962.
479. H. M. Hyre, C. J. Cunningham, R. S. Dunbar, T. B. Clark. Breeding for Efficient Production of Eggs and Poultry Meat, June 1962.
480. Kenneth D. McIntosh, Clarence E. Trotter. Labor Utilization in Slaughtering Operations of Plants in Northeastern United States, June 1962.

Current Reports

35. A. H. Rakes, R. L. Reid, I. D. Porterfield. The Feeding Value For Milk Production of Hays Cut at Various Dates, June 1962.
36. E. H. Tryon, K. L. Carvell. Comparison of Acorn Production and Damage on Sites With Abundant and With Sparse Oak. June 1962.

Scientific Articles

616. W. G. Martin, Homer Patrick. Radionuclide Mineral Studies. 3. The Effect of Breed and Dietary Zinc, Calcium, and Vitamin D_3 on the Retention of $Zinc^{65}$ in Chicks. *Poultry Science*, Vol. 40, No. 4:1004-1009, July 1961.
618. Anthony Ferrise, Homer Patrick. The Water Requirements of Broilers. *Poultry Science*, Vol. 41, No. 5:1363-1367, September 1962.

Science

SERVES YOUR FARM AND HOME

AGRICULTURAL EXPERIMENT STATION
WEST VIRGINIA UNIVERSITY

APRIL 1963
BULLETIN 481
(Parts 2 and 3)

Bulletin 481, Parts 2 and 3 April 1963

Science SERVES YOUR FARM AND HOME

ANNUAL REPORT OF A. H. VANLANDINGHAM, DIRECTOR, WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

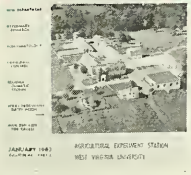
PARTS 2 and 3
Annual Report of the
AGRICULTURAL EXPERIMENT STATION
West Virginia University
Morgantown, W. Va.
Director
A. H. VanLandingham

LEIGHTON G. WATSON ..... Editor
GLENN D. BENGTSON ..... Associate Editor
DAVID R. CREEL ..... Photographer

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.

IN THIS ISSUE

Science on our cover



THE West Virginia University Dairy Farm, one of five teaching and research farms located near the University campus, is the home of some of the State's finest dairy cattle. The herd, consisting of cows of the Ayrshire, Guernsey, Holstein, and Jersey breeds, has earned as many Progressive Breeders' and Constructive Breeders' awards as has any other college herd in the nation.

Production records, both individual and for the herd, were set at the Farm during the past year. Star performers were Reymann Country Nancy, who produced 19,300 pounds of milk to become the highest-producing Ayrshire in the University's long history of outstanding Ayrshire cows, and WVU Lucifer Dora, who produced 21,375 pounds of milk to become West Virginia's highest-producing Holstein. Average production for both the Ayrshire and Holstein herds was highest in University history.

In addition to being the training ground for all WVU students majoring in dairy production, the Farm serves as a teaching laboratory for every dairyman in the State. WVU Dairy Day, a field day held every two years, attracts hundreds of dairymen who come to see the herd and the facilities and to hear reports of research and the current recommendations on feeding, breeding, and management. A number of short courses and judging schools are carried on at the Farm for Extension workers and other agricultural leaders who are in daily contact with dairy farmers.

Nearly a dozen research projects are underway at the Farm. Each of the cows in the herd is being used in one or more of these projects. Thus, the individual and collective records of the cows become more outstanding, when it is remembered that each cow is doing two jobs —the traditional role of manufacturing one of nature's most perfect foods, plus that of contributing to the scientific knowledge of dairying.

on the calendar . . .

APRIL—

27 Thirteenth Annual Little Eastern National Livestock show and Barbecue, Morgantown

MAY—

3-5 West Virginia Home Economics Association, Annual Meeting, Jackson's Mill

10 Honors Convocation, College of Agriculture, Forestry, and Home Economics, Morgantown

JUNE—

3 University Commencement, Morgantown

JULY—

15-17 Joint meeting of the Eastern Section, American Dairy Science Association, and North Atlantic Section, American Society of Animal Science, Morgantown

25-28 West Virginia Association of the Future Farmers of America, Annual Convention, Jackson's Mill

AUGUST—

18-21 Northeast Section of the American Society of Agronomy, Annual Meeting, Morgantown

new publications

Bulletins

482T. R. L. Smith. *Acorn Consumption by White-Footed Mice (Peromyscus leucopus).* Dec., 1962.

Current Reports

37. M. W. Johnson. *Hybrid Corn Performance Trials in West Virginia,* 1962. Feb., 1963.

(continued on page 9)

Reorganization creates

DEPARTMENT OF

Animal Industry

AND

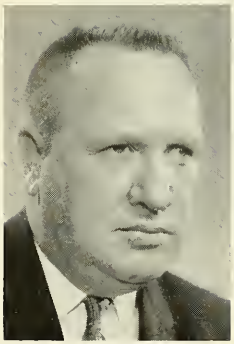
Veterinary Science

by Director A. H. VanLandingham

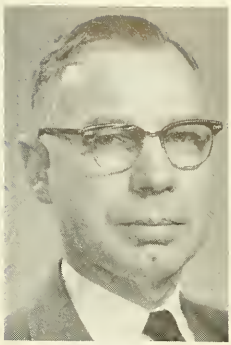
THE University's College of Agriculture, Forestry, and Home Economics has created a new Department of Animal Industry and Veterinary Science. This was accomplished by combining the old departments of Animal and Veterinary Science, Dairy Science, Poultry Science, and the nutrition work in the Department of Agricultural Biochemistry and Nutrition.

Dr. Robert S. Dunbar, Jr., formerly Professor of Statistics and Station Statistician, heads the new department. Dr. Dunbar, a graduate of the University of Rhode Island and Cornell University, joined the West Virginia University staff as Associate Dairy Husbandman and Associate Professor of Dairy Husbandry in 1952. In 1957 he was appointed to the position of Associate Professor of Statistics and Associate Station Statistician. He became Professor of Statistics and Station Statistician in 1960.

Dr. Dunbar, trained as an agricultural scientist with major work in animal breeding and genetics and minor work in statistics, is well qualified for this important new position. As Station Statistician he has kept in close contact with research and instructional programs of the animal industries.



Dr. Dunbar



Dr. Patrick

The Department of Agricultural Biochemistry and Nutrition has been renamed the Department of Agricultural Biochemistry and is headed by Dr. Homer Patrick. Dr. Patrick, a graduate of the University of Missouri and Pennsylvania State University, joined the staff of West Virginia University in 1957 as head of the Department of Poultry Husbandry. Before coming to West Virginia University, Dr. Patrick was the Director of the University of Tennessee's agricultural research program at the Oak Ridge Nuclear Institute. His research specialty is radionuclide metabolism.

It is believed this reorganization will permit the use of facilities and personnel in a more effective manner. From the standpoint of teaching, research, and extension the College should be better prepared to serve the livestock and poultry industries of West Virginia.

Special emphasis will be devoted to animal breeding and genetics; animal physiology; biochemistry and nutrition; and veterinary science in the production of animal, dairy, and poultry products.

Progress Report . . .

VETERINARY RESEARCH

by N. O. Olson and L. Dozsa

IN 1955, the West Virginia University Agricultural Experiment Station initiated studies on Chronic Respiratory Disease of poultry in cooperation with several experiment stations in the Northeast region. This disease has caused severe economic losses among West Virginia poultrymen and poultrymen in other states.

The studies were designed to obtain basic information as to how the disease is transmitted, the effect of antibiotics on the disease, and practical methods of control.

In cooperation with T. R. Hash and Byron Moore of the Cooperative Extension Service, Dr. J. O. Heishman of the Reymann Memorial Experimental Farms, and Ralph Hitt of the West Virginia Department of Agriculture, more than 50 breeder flocks in the State were tested or partially tested for CRD. The percentage of reactors found in these flocks varied from less than 5 to the maximum of 100 per cent.

Pipped embryos from these flocks were checked for air sac lesions and 100 per cent of the flocks transmitted CRD. The infection in pipped embryos was found in from 1 to 35 per cent of these embryos from the various flocks. The flocks with the lower percentages of reactors revealed the lower transmission rates in embryos.

It was clearly established that *Mycoplasma gallisepticum*, the pleuropneumonia-like organism (PPLO) that causes CRD, was transmitted through the egg. When broilers from hens with a high CRD transmission rate were compared with broilers from hens with a low transmission rate, there was considerably less infection in the latter groups.

(continued on page 10)

Dr. Norman Olson, Station Veterinarian, wrote the report on Chronic Respiratory Disease. Dr. Leslie Dozsa, Associate Veterinarian, wrote the report on Vibriosis research.

N. O. Olson

L. Dozsa

Ecoclimatology

Temperature, humidity measurements near soil surface show climate of plant zone varies more than standard weather data has indicated

by W. A. van Eck

AGRICULTURE is the science and practice of efficient energy fixation and conversion into edible and useable forms of plants and animals. The green plant is our basic factory, because it alone can fix the sun's energy. The amount and distribution of this energy on earth should thus be of basic importance to agriculture. In addition, the availability of water is essential to plant growth and survival.

Energy and water are fundamentals of climate, and the study of the principles and effects of climate is called climatology.

Although climatology has presented us with information on the general regional climate pattern, it is in several respects inadequate to explain or predict the climatic conditions to which agricultural plants are subjected. This applies particularly to the temperature and moisture in the plant environment.

As all plants germinate in the soil and emerge from the soil surface, the thin layer of air immediately above the soil is of primary importance in conditioning plant growth. Moreover, it is in this layer that incoming solar radiation is distributed between soil and atmosphere. Due to a minimal degree of air circulation, temperature and humidity vary to their widest extremes in this particular zone. The climate in this zone has been referred to as microclimate, bioclimate, or ecoclimate.

These extreme conditions subject crop plants to a much different climate than can be measured at standard weather stations. Especially on clear days, temperature and evapotranspiration are much higher while humidity and air movement are much lower nearer the ground. For level fields and specific crops it is, however, possible to develop correlations between the macroclimate as observed at the standard 5-foot height, and the ecoclimate around the plant. This relationship can serve as a basis for crop yield predictions for certain crops on certain soils.

Where the land is not flat, as is the case in the Appalachians, the plant-zone climate varies with the angle at which the sun's rays strike the ground. South-facing slopes receive the most solar energy, which is maximal when the slope grade equals the sun's angle from the zenith point. North-facing slopes receive the least energy, especially when the slope grade equals or exceeds the angle of sunray inflection.

(continued on page 8)

— Key —

W:	Standard weather station on ridge
N_{fo} :	Microclimate station on forested north-facing slope
N_{ex} :	Microclimate station on exposed north-facing slope
S_{fo} :	Microclimate station on forested south-facing slope
S_{ex} :	Microclimate station on exposed south-facing slope

Dr. Willem A. van Eck is Assistant Agronomist, Agricultural Experiment Station.

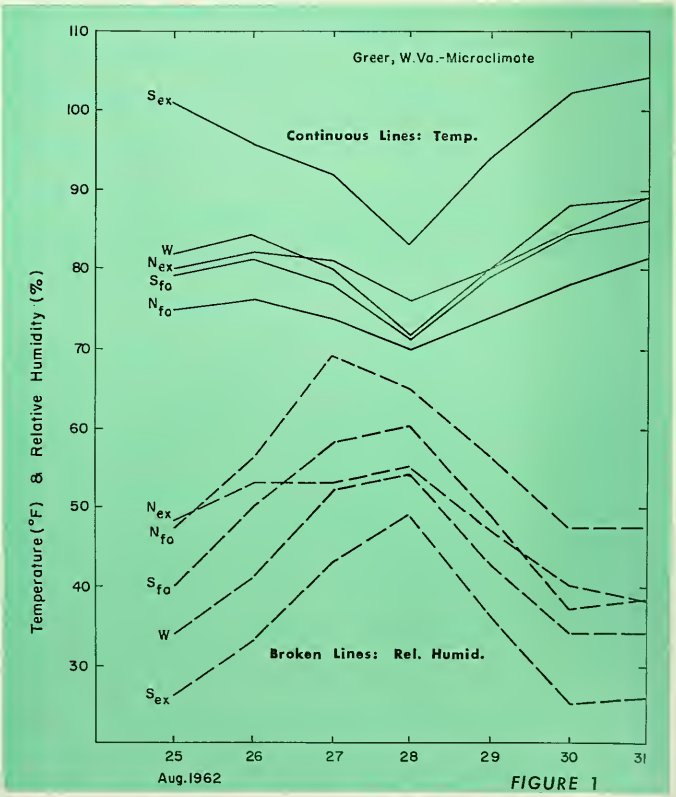


FIGURE 1

DAILY maximum temperature, minimum relative humidity as recorded by four weather stations measuring microclimate and a single standard weather station during an August week in 1962. Note extremes recorded at exposed site on south-facing slope, differences in readings of microclimate stations, standard station.

Horticulturists conduct

CRABGRASS

Control Studies

by W. R. Fortney and A. P. Dye

Turf experiment plots at WVU

CRABGRASS, a common weed in most West Virginia lawns, has occupied the attention of gardeners for years. Although temporary control of this pest can be achieved through applications of certain herbicides, recent WVU research indicates that a combination of management practices and wise selection of species might provide more satisfactory control, without the expense of purchasing and applying chemicals.

The investigation of natural resistance of turf grasses to invasion by crabgrass, *Digitaria sanguinalis* (L.) Scop., and the effect of mowing heights was conducted on a series of 14 plots of various grass species, varieties, and mixtures at the West Virginia University Horticulture Farm near Morgantown.

These plots were originally established as turf trials in the fall of 1955 and spring of 1956. They are on a southern slope, at an elevation of about 1,160 feet. The plots were fertilized with a complete fertilizer in April and September of each year, mowed at regular intervals, and treated with 2,4-D to control broadleaf weeds.

During the summer of 1958, from May 28 until August 18, two replications of 14 plots of turf grasses were mowed at seven- to nine-day intervals with a rotary lawn mower. Mowing was done at four clipping heights—½, 1, 1½, and 2 inches.

Crabgrass populations on the plots were measured by pulling and counting the plants. Removing the plants from the turf was necessary in order to eliminate errors in subsequent counts. It is difficult to distinguish between single crabgrass plants and groups of plants growing in turf, because of the tendency of the species to put out adventitious roots from the nodes.

The smallest number of crabgrass plants were found in the plots that were mowed with the mower set to cut at 2 inches. The number of plants increased progressively as mowing height decreased. This relationship, shown in Figure 1, was found to exist in all plots, regardless of species, varieties, or mixtures growing there.

These experiments also revealed that certain species, varieties, and mixtures of turf grasses have more natural resistance to crabgrass infestation than do others. The bents, Kentucky 31 fescue, and a mixture of Kentucky and Merion bluegrasses showed pronounced resistance. In Table 1, it may be noted that the mixture of one-half Kentucky bluegrass and one-half Merion bluegrass was more resistant than either grass growing alone. On the other hand, mixtures containing combinations of Creeping Red and Illahee fescues, bluegrasses, and redtop were less resistant to crabgrass than were pure stands of these species.

TABLE 1. CRABGRASS PLANTS PER SQUARE FOOT IN 14 GRASSES AND GRASS MIXTURES.

PLOT	NUMBER OF PLANTS*
Astoria Bentgrass	0.80
Colonial Bentgrass	0.85
Kentucky Bluegrass and Merion Bluegrass	1.00
Kentucky 31 Fescue	1.13
Creeping Red Fescue	2.22
Illahee Fescue	5.07
Redtop	5.03
Merion Bluegrass	5.03
Kentucky Bluegrass	5.55
Kentucky Bluegrass, Redtop, and Creeping Fescue	6.95
Kentucky Bluegrass and Ryegrass	7.75
Commercial Mixture No. 1	8.55
Commercial Mixture No. 2	9.07
Kentucky Bluegrass, Redtop, and Illahee Fescue	10.67

*Mean of four subplots.

Even though the bent grasses are the most resistant to crabgrass infestation, these grasses are not suitable for home lawns. The care that

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½ in. 1 in. 1 ½ in. 2 in.

FIGURE 1. Crabgrass plants pulled from experimental plots reflect influence of mowing height on crabgrass infestation. Plots mowed at one-half inch yielded greatest number of plants, while plots mowed at two inches had minimum number of plants. This was true in all plots, regardless of species growing there.

William R. Fortney and Arthur P. Dye are Associate Horticulturists of the Agricultural Experiment Station.

W. R. Fortney

A. P. Dye

WEST VIRGINIA'S

Climate . . .

Extensive studies of climate in the northeastern U.S. will be valuable to both agriculture and industry

by W. H. Dickerson

AN understanding of climate is important in agriculture, especially in problems relating to crop response, yield, or damage by extremes of the weather. It is equally important in engineering applications which are concerned with erosion, drainage, irrigation, runoff, and flood control.

In all such problems, the weather experienced during any one year, or even a period of several years, does not usually provide a sound basis for making decisions. Rather, such decisions should be based on a knowledge of climatic probability, derived from weather conditions observed over an extended period of time.

Some examples of how climatic data can be used include the analysis of the amount, distribution, and effectiveness of rainfall for determining the need for supplemental irrigation; frequency analysis of rainfall to serve as a basis for estimating the cost-benefit ratio of flood protection measures; and determination of the functional requirements of equipment for producing, processing, and storing agricultural products when these are influenced by the weather. The reader can doubtless think of applications in his own field of interest.

In a project entitled "Agricultural Climatology of West Virginia," the Agricultural Experiment Station is cooperating with the United States Weather Bureau and experiment stations of 10 northeastern states in climatological research. The over-all project is entitled "Northeast Regional Research Project No. 35," and is supervised by the Northeast Regional Technical Committee on Climatology.

Walter H. Dickerson is Agricultural Engineer, Agricultural Experiment Station.

The work has been concerned with the application of computer methods in analyzing existing data from cooperating Weather Bureau stations, and with the collection of new and more detailed climatic data at two University substation farms.

Phases of the Study

The basic electronic computer analysis of the daily weather records has been accomplished. This has provided the following tabulations:

1. Weekly mean maximum, mean minimum, and mean temperatures; and the mean and variance of these for a 30-year period.

2. The mean and variance of the first fall and the last spring occurrences of the following daily minimum temperatures: 0, 16, 20, 24, and 32° F.

3. The frequency of 1, 2, —, n consecutive days with daily maximum temperatures of 90° and above, 95° and above, and of 100° and above. Also, similar runs of consecutive days with minimum temperatures equal to or less than 32, 28, 20, 16, and 0°.

4. For selected temperature ranges, the frequency of rapid reductions in the minimum temperature of as much as 20° and 10° in a 24-hour period.

5. Heating degree-days totals by four-week periods, as well as the mean and variance for each period. Also, weekly totals, mean, and variance for growing degree-days above 40° and 50°.

6. Total weekly rainfall and the frequency of occurrence of rainfall, according to selected class intervals.

7. For each 4-week period, the frequency of three or more consecutive days with less than .01 inch of daily precipitation, less than .10 inch, and less than .20 inch.

8. Corresponding tabulations of three or more consecutive days with daily precipitation of .01 inch or more, .10 inch or more, and .20 inch or more.

9. Weekly precipitation sums, with the mean and variance of these.

New Stations

Two fairly complete weather stations have been maintained at widely separated substation farms, the the Reymann Memorial Experiment Farms at Wardensville and the Ohio Valley Experiment Farm at Pt. Pleasant. These stations are members of the Weather Bureau Cooperative Network, and report regular air temperature and precipitation observations.

In addition, they record solar radiation, relative humidity, soil temperature, and wind movement. Pan evaporation is measured on a daily basis.

The farms are also providing data on elements of the weather that have not been studied extensively. For example, no measurements of solar radiation had been made in the State until pyrheliometric observations were initiated at Wardensville and Pt. Pleasant.

Accomplishments to Date

Tangible results include the acquisition of daily and of weekly and four-weekly summary cards which are of great potential value. However, such machine summaries and listings usually require much additional work in order to put the results in a form from which inter-

pretations, conclusions, and applications to specific problems can be made.

For instance, weekly rainfall totals must be fitted into a mathematical model before useful estimates of weekly rainfall probability can be made. Methods for handling rainfall data have been reported, with sample applications, by J. C. Burchinal and W. H. Dickerson of West Virginia University. The procedure is described in Station Bulletin 454T, entitled *Rainfall Probability and Its Applications.*

The initial efforts of our Station have been directed toward producing information that can be published in a "climatological atlas" of the northeastern United States. The "atlas" is a long-range project, conducted under the supervision of the NE-35 Technical Committee.

Two bulletins have already been released by the Committee. *Spring and Fall Low Temperature Probability* was written by A. V. Havens of the New Jersey Agricultural Experiment Station and J. K. McGuire of the U.S. Weather Bureau. The other, *Probability of Selected Weekly Precipitation Amounts in the Northeastern Region of the U.S.,* was written by McGuire and B. E. Dethier of the agricultural experiment station at Cornell University.

It is suggested that persons who are interested in the climate of West Virginia refer to the Weather Bureau publication entitled *Climatography of the United States, No.* 60-46, *Climate of West Virginia.* This is an excellent general review and summary, and might well be studied for background information.

Freeze Probability, Weekly Precipitation

Freeze probability and weekly precipitation are examples of the type of information which can be developed from machine analysis.

The computation of the mean and variance of the last occurrence of freezing temperatures in the spring and the first occurrence in the fall provides a method of estimating the chance that this event will occur a specified number of days before or after the mean date. This is based on the assumption that the freeze dates follow the normal frequency distribution.

The relationship provided the basis for calculating the dates in the work by Havens and McGuire. It should be noted that no periodicity is implied in this method of analysis. Also, freezing temperature has been taken as the occurrence of a temperature of 32° F. or lower in a standard weather shelter.

The data in Table 1, which lists six West Virginia stations, was extracted from the publication of Havens and McGuire, which lists similar information for all stations in West Virginia and throughout the northeast.

Rainfall data are frequently reported as monthly or annual totals. While this is useful for many applications, weekly totals of rainfall are much superior when estimates over a short period are needed. Such totals were ascertained from the punch card study and published in the Cornell bulletin by Dethier and McGuire.

Estimates over a short period are needed in many crop production and soil and water conservation problems. An adaptation of the tabular data, Figure 2, is a plot of the weekly sums (on the basis of the climatological year which begins March 1) for the 30-year period at the Wardensville Weather Station. The general trend of the lines is important, but little significance should be attached to the zig-zag pattern between adjacent weeks.

The upper curve of Figure 2 is a plot of the extreme high for the 30-year period, and the lower curve shows the percentage of years in which a particular week of the climatological year had zero or only a trace of rainfall.

Although Wardensville is within the "rain shadow" of the Allegheny Front, and is among the stations recording the lowest annual precipitation in the State, the number of weeks without measurable rainfall appears to be quite high. This feature should be the subject of a future investigation.

Other points of interest are the extreme fluctuation in weekly sums (from 0 to about 9 inches), and the fact that the median rainfall is always below the mean (or average) rainfall. A limited examination of the historical weather rec-

(continued on page 8)

FIGURE 1. Map showing locations of the 21 weather stations that contributed West Virginia data to the study. More than 150 stations are included in the regional study. Stations at Wardensville and Point Pleasant are on WVU research farms.

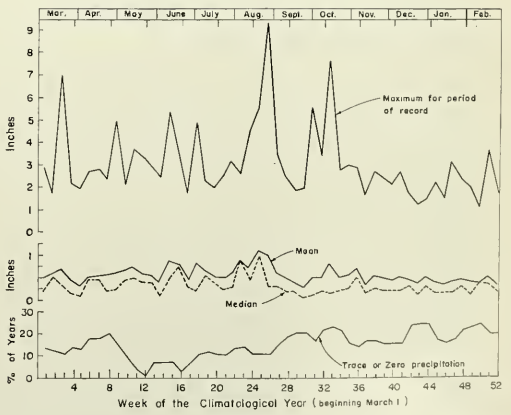


FIGURE 2. Weekly precipitation at Wardensville, based on 30-year record. Maximum rainfall of nine inches (upper curve) occurred in 26th week. In about 12 per cent of the years, little or no rainfall occurred during this period (lower curve).

CLIMATE STUDIES

(continued from page 7)

ords would seem to indicate that the extreme weekly amounts were usually caused by tropical cyclones (hurricanes) as was the case with the storm of June 17 and 18, 1949. This storm caused a destructive flood in the Moorefield-Petersburg area.

The extreme highs in weekly rainfall tend to pull the average above the median and thus give a false impression of the amount of moisture that is available on a 50-50 basis. It would seem to be more realistic to think in terms of median weekly or monthly rainfall than to consider the average values.

For a complete tabulation of precipitation probability by weeks for West Virginia and other northeastern stations, refer again to the Cornell University publication of Dethier and McGuire.

Future Studies

The Regional Committee has a number of additional studies in progress at the various experiment stations in the Northeast. The West Virginia University Agricultural Experiment Station will soon publish a study of heating degree-days. It has also been instructed to develop procedures and investigate the feasibility of carrying out an analysis of extreme precipitation amounts for the Northeast Region.

Table 1. Probability Data for Last Spring Occurrence of 32° F.

Station	Spring Dates on Which Chance of Last Occurrence of Temperatures of 32° or Lower Decreases to:						
	90% (9 in 10)	75% (3 in 4)	67% (2 in 3)	50% (1 in 2)	33% (1 in 3)	25% (1 in 4)	10% (1 in 10)
Elkins	Apr 24	May 1	May 4	May 9	May 14	May 17	May 24
Glenville	Apr 17	Apr 22	Apr 24	Apr 28	May 2	May 5	May 10
Martinsburg	Apr 8	Apr 15	Apr 18	Apr 23	Apr 28	Apr 30	May 7
Point Pleasant	Apr 8	Apr 15	Apr 18	Apr 23	Apr 28	May 1	May 9
Wardensville	Apr 20	Apr 29	May 3	May 10	May 16	May 20	May 29
White Sulphur Springs	Apr 19	Apr 28	May 2	May 8	May 14	May 18	May 27

ECOCLIMATE

(continued from page 4)

The energy differences are reflected in temperature, humidity, and evapotranspiration levels. Complex landforms defy predictions of these values from standard weather station data. Yet, these climatic data are of utmost importance in explaining biological and soil phenomena in a landscape such as that of West Virginia.

Effect on Moisture, Heat

It appears that it is not solar radiation that affects plant growth, but rather its indirect effect upon the moisture and heat budget of the plant site. High temperatures and associated low vapor pressures induce evapotranspiration of moisture from soil and plant, and it is this moisture stress that directly or indirectly has a pronounced effect upon plant growth and survival.

Wind velocity, rate and frequency of rainfall, and water storage capacity and retention characteristics of the soil and the nature and degree of exposure of the soil surface will modify or accentuate this effect.

In recent years, agronomists of the West Virginia University Agricultural Experiment Station have undertaken to study the contrasting climates associated with valleys and valley slopes. Microclimate under forest canopies varies little on opposite slopes, but considerable differences may be found in open fields and in areas where trees are not in foilage.

Figure 1 shows data recorded at 5 weather stations, 4 of which measured climate 6 inches above the ground. The fifth measured climate at the standard height of 5 feet. This latter station was situated on an exposed level ridge, while the others were placed on adjacent steep north and south slopes. Each slope had one station under forest canopy and one in an open field. The experiment was conducted in a mountain valley near Morgantown, W. Va.

Continuous data were collected throughout the growing season. The data in Figure 1 were collected during the week of August 25, 1962. The solid lines indicate daily maximum temperature, while the broken lines indicate minimum daytime relative humidity. Figures 2 and 3 show how these factors vary during a typical day with sunshine.

Forest Cover Makes Difference

It is interesting to note the modifying effect of forest cover on ground level climate, especially on the south slope; the similarity between forested south slopes and exposed north-facing slopes; and the essentially tropical climate, during summer, of the exposed south-facing slopes. Data obtained from the standard weather station are unlike those of the other stations and would be a poor measure of the climatic conditions of the sites where plants are growing, even within a distance of a few hundred feet. The climatic differences are probably even greater when measured on the soil surface proper.

In forest stands, the resulting effect of moisture stress is slower growth and lower quality timber on south-facing slopes. Natural selection favors those species best adapted to water deficiency or associated soil characteristics, and this shows up most in the lower vegetation strata which are more permanently exposed to climatic extremes.

Ecoclimate's Role Overlooked

Similar contrasts in yields and stand composition have been observed in forages and other crops grown on sloping land, but the significant role played by ecoclimate in crop production has not been fully appreciated because experimental plots are usually laid out on level terrain.

It can be demonstrated that West Virginia crop establishment and yields may, under some conditions, be more limited by macroclimate and microclimate than by either soil conditions or management. This would most likely occur on sloping land.

The research findings from one ecoclimate cannot be applied to plants grown in another ecoclimate. Thus each experiment should be clearly documented as to its particular site characteristics, so that

the effect of climate may be properly evaluated. This also demonstrates the value of having students in agriculture and forestry take a course in climatology.

Systematic studies of typical cross sections of the Appalachian landscape, such as those now being initiated at the Experiment Station, may give us a better understanding of how the various landforms modify the effect of the incoming sunlight, as well as of wind movement. This research may eventually enable us to predict the ecoclimate for different sites more precisely.

More Information Needed

In view of the large investments in effort and funds, and the desire to know the range of applicability of research findings, it appears justified that each major research station be equipped with a complete and well-supervised weather station, where information on the vertical profiles of climate above and below the soil surface can be obtained for representative crops and soils. A project needs to be devised so that data can be frequently tabulated and analyzed, and then published regularly for the benefit of other research workers.

The unusual combination of topography and land use in the Appalachian area makes West Virginia an especially suitable location for the study of the relationships between complex landforms and climate, and their effect on agricultural production.

NEW PUBLICATIONS

(continued from page 2)

Scientific Articles

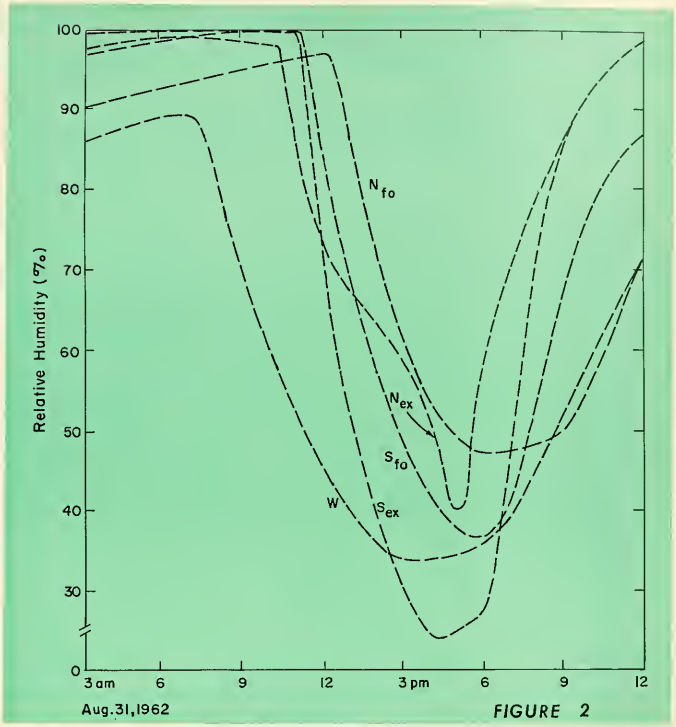
961. C. C. Dowler, N. M. Baughman, C. Veatch. The Effect of Soil Type, Soil pH, and Simulated Rainfall on the Distribution of DNPB in the Soil. *Weeds*, Vol. 6, No. 3:281-288, Jul., 1958.

936. Leslie Doza, N. O. Olson. Atresia of the Anus and of the Rectum in a Pig Repaired by Colostomy. *Journal of the American Veterinary Medical Association*, Vol. 138, pp. 20-21, 1961.

941. K. E. Nestor, H. M. Hyre. A Comparison of Various Treatments of Fowl Semen. *Poultry Science*, Vol. 40, No. 3:772-777, May, 1961.

951. V. G. Lilly, H. L. Barnett. Acetate as a Carbon Source for Fungi. *Proceedings of the W. Va. Academy of Science*, Vol. 33, pp 5-10, 1961.

954. G. A. Jung. The Effect of Uracil, Thiouracil, and Guanine on the Cold Resistance and Nitrogen Metabolism of Alfalfa. *Plant Physiology*, Vol. 37, No. 6:768-744, Nov., 1962.



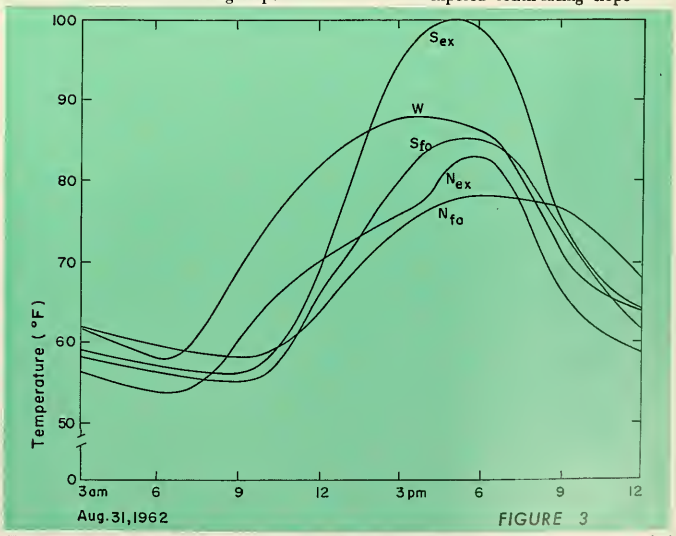
W: Standard weather station on ridge

N_{fo} : Microclimate station on forested north-facing slope

N_{ex} : Microclimate station on exposed north-facing slope

S_{fo} : Microclimate station on forested south-facing slope

S_{ex} : Microclimate station on exposed south-facing slope



FIGURES 2 and 3. Fig. 2 shows relative humidity, Fig. 3 temperatures recorded by the five stations during a sunny day in August. Microclimate recorded at an exposed site on a south-facing slope showed greatest variation; that recorded at a forested site on a north-facing slope varied, but not to such a great extent.

CHRONIC RESPIRATORY DISEASE

(continued from page 3)

This was further substantiated by dipping hatching eggs in erythromycin, which further reduced the egg transmission rate. Much better performance was found in the chicks from the dipped eggs, as compared to chicks from the undipped eggs. However, it was also apparent that other factors were responsible for the severe outbreaks of CRD *accompanied by air sac infection.*

Initial Infection Mild

Briefly, the disease caused by *Mycoplasma gallisepticum* is a mild respiratory infection which may even go undetected. But when the Mycoplasma infection is present and the birds become infected with bronchitis or Newcastle disease or both, a severe respiratory infection results. If this condition then becomes complicated by a pathogenic *Escherica coli,* a more severe respiratory infection develops and is frequently accompanied by "air sac" infection resulting in high mortality and high condemnations at the time of slaughter. The duration of CRD is approximately 6 weeks.

Good ventilation, sound sanitary practices, and proper care have helped considerably in reducing the incidence of CRD. However, when the combination of Mycoplasma plus pathogenic *E. coli* plus a virus respiratory disease—especially bronchitis—develops, a severe disease outbreak will occur.

Try to Break Chain

West Virginia workers have attempted to "break the disease chain" by giving high levels of antibiotics to control Mycoplasma. This has been partially successful, but the levels of antibiotics needed are excessively high. However, the weight loss caused by uncomplicated CRD was controlled by continuous medication with 50 grams of chlortetracycline per ton of feed.

Elimination of vaccination for infection bronchitis or Newcastle disease has been used by some West Virginia poultrymen in reasonably isolated areas. This has reduced the incidence of CRD and air sac infection.

West Virginia poultry veterinarians are now investigating vaccines for the control of CRD. They have been using a virulent culture of Mycoplasma to vaccinate chicks from day-old to 4 weeks of age. This has been effective in reducing the egg transmission rate. Refinements in this program are definitely needed, however, since the combination of Mycoplasma and pathogenic *E. coli* and bronchitis still produces a severe respiratory disease. This has occurred in some of the experiments to date.

In all diseases, elimination of the infectious agent is desirable. This has been accomplished, to a limited extent, by workers in other states. If it is possible to extend this method further, a practical approach to the control of this disease may be at hand.

Extensive work with egg dipping and vaccination is very desirable at the present time, in hopes that such research will lead to the establishing of methods that will help in the eventual eradication of this severe and costly disease.

BOVINE vibriosis is a specific disease of the genital tract of cattle. Its presence causes infertility and abortions, and is believed to cause more than 40 per cent of the cases of bovine infertility.

The disease represents losses to the dairy herd owner through decreased reproductive capacity, abortions, decreased milk production, and the costs of providing replacements for infected animals. Annual losses to the disease are estimated to exceed 137 million dollars.

The presence of bovine vibriosis in West Virginia has been proven by laboratory diagnosis. It is generally widespread, having been reported in most of the 50 states of the United States.

Disease Under Study

A project now being conducted at the West Virginia University Agricultural Experiment Station is designed specifically to obtain information about how vibriosis affects the genital tract and uterus of the cow. The work is being done in the recently-constructed isolation barn at the WVU Dairy Farm, using animals provided for this purpose by the Department of Animal Industry and Veterinary Science.

The general procedure in the conduct of this project has been to observe the changes occurring in the mucosa of cows inoculated with *Vibrio fetus.* In the first phase of the experiment, dairy cows are inoculated with *V. fetus* cultures. Uterine biopsies were conducted at regular intervals during the entire course of the disease, so as to establish the pattern of pathological changes occurring in the lining of the uterus.

Infection Lengthy

This experiment revealed that some cows carried the infection as long as 410 days. In every case, a period of two months elapsed following the termination of the infection before the cows were again ready for conception.

The second phase of the experiment was conducted to determine the length of the period of immunity caused by vibriosis. It turned out that, contrary to general belief, the previously infected and recovered cows were immune for only 3 to 4 months. These cows were easily reinfected 6 months later, although the resulting vibriosis was milder and lasted for a shorter time.

The most recent phase of this research is devoted to an evaluation of various antibiotics in the treatment of vibriosis. This phase is not as yet complete, but evidence to date indicates that intrauterine applications of certain antibiotics hastens recovery.

CRABGRASS

(continued from page 5)

is required for a lawn of bent grasses restricts its use to golf courses and other areas where full-time professional care is available.

These findings show the importance of selecting proper species and mixtures and the importance of proper mowing practices in developing a turf that resists crabgrass infestation. Although chemicals may give temporary control of this weed, resistant grass species or mixtures of species, mowed at the proper height, will provide dense turfs without the additional labor and expense associated with herbicides.

ABOUT PAGE 12...

The author of our Page 12 article, "Milk Replacer for Raising Dairy Calves," is Richard A. Ackerman, Assistant Dairy Scientist, Agricultural Experiment Station.

WVU Dairy Herds

are Champion Producers!

by R. G. Mitchell

OUR West Virginia University dairy herds enjoyed another good year in 1961 under the management of Clark Taylor and Edward Smith. Few college herds have received as many Progressive and Constructive Breeders' awards as has our herd here at West Virginia University

Two of the University's four dairy breeds reached an all-time high in production in 1961. In addition, after several years of non-competition, animals from three of the herds were exhibited at the State Dairy Show and at the State Fair. In the two shows, WVU dairy animals won a total of 13 first or second place awards, as well as junior champion and reserve grand champion awards. In the 1962 State Fair and the State Dairy Show, WVU dairy animals won 14 first or second place awards, and again included junior and reserve champion awards.

Ayrshire Herd — Thirty-two cows averaged 11,687 pounds of milk, 4.1 per cent test, and 484 pounds of butterfat. This is an all time high for the Reymann Memorial herd in milk production. The cows averaged 85.9 in classification and qualified for the 18th Consecutive Breeders' Award. This award is presented to purebred herds meeting high production, type, and health standards. In show ring competition, the University received several blue ribbons with its Ayrshires, and exhibited both Grand and Junior champions at the State Dairy Show.

Guernsey Herd—In 1956, Shawnee Farm at Lewisburg presented the University with 15 females and one bull, Quincy King John (at the Maryland-West Virginia Bull Stud). The West Virginia Guernsey Cattle Club presented a Guernsey heifer. Nine animals produced an average of 9,220 pounds of milk, 5 per cent test, and 464 pounds of butterfat. The average classification was 82.7.

Three heifers received two first-place awards and one second-place award at the 1961 State Dairy Show. The senior yearling was also the Junior and the Grand Champion at the 1961 State Dairy Show. First prize was also awarded to the WVU Guernseys in the Junior Get and the Best Three Female classes.

Dr. Ralph G. Mitchell is Associate Dairy Scientist, Agricultural Experiment Station.

Holstein Herd — Twenty-three cows averaged 15,107 pounds of milk, 3.9 per cent test, and 583 pounds of butterfat. This is the first time that the herd has exceeded the 15,000-pound level of production. Our top Holstein also reached an individual high—21,375 pounds of milk and 744 pounds of fat in 305 days. This is the largest single lactation recorded by a University cow. The average type classification score was 83.6 and the herd received its 15th Progressive Breeders' Award.

Three Holsteins exhibited at the 1961 State Dairy Show received one first-place award and two second-place awards in their respective classes.

Jersey Herd—Mr. and Mrs. C. Albert Woodworth of Hurricane presented three heifers to the University in 1961. One of the heifers is milking with her first calf and producing at the rate of 30 pounds daily, having freshened at 1 year and 10 months of age. Nine cows averaged 8,138 pounds of milk and 420 pounds of butterfat. The average type classification was 85.8.

WVU LUCIFER DORA became West Virginia's highest-producing Holstein last year with 21,375 pounds of milk and 744 pounds of butterfat. Herd-wise, it was also a record year for WVU Holsteins, who averaged 15,107 pounds of milk.

REYMANN COUNTRY NANCY, a WVU Ayrshire, last year set the record for University Ayrshires with 19,677 pounds of milk and 708 pounds of fat. The Ayrshire herd, like the Holstein herd, set a record, averaging 11,687 pounds of milk.

MILK REPLACER
for raising dairy calves

R. A. Ackerman, Assistant Dairy Scientist

THE most practical way for the dairyman to improve his herd is to raise the calves which result from the mating of outstanding sires, such as those used in the artificial breeding studs, with his better cows. The commercial dairyman often fails to raise his replacements because of the loss of saleable milk required to start the calves. The use of a satisfactory milk replacer can reduce the cost of raising replacements without using any saleable milk.

Man started his search for products which might be used in place of milk for starting calves many years ago. Early attempts were unsuccessful, due to the lack of knowledge regarding nutrition and the requirements of the young calf. Much research was done at the time of the first World War and some replacers were placed on the market. However, these did not prove satisfactory, and calves raised on them made poor growth or died. The knowledge of the nutritional needs of the calf has steadily increased, and by World War II fairly satisfactory substitutes for milk were available. Today, replacers provide for satisfactory growth of dairy calves and make it possible for the dairyman to reduce the cost of raising them.

Composition of Replacers

All of the modern replacers contain a large percentage of milk by-products such as dried skim milk, buttermilk, or whey. These ingredients seem necessary if the replacers are to be successful. Some replacers contain little else than added vitamins, minerals and antibiotics and, in some cases, animal or vegetable fats. Other replacers may contain as much as 40 per cent or more grain by-products. These materials would seem to offer little advantage, except perhaps to reduce the cost of feeding.

During the past several years, the University's Department of Dairy Science has been doing considerable research with a milk replacer containing 10 per cent added animal fat, lecithin, trace minerals, vitamins, and antibiotics added to an otherwise all-milk, by-product replacer.

No statistically significant difference has been found in the growth or health between calves started with milk replacer and those started by the limited whole milk method.

During the past three years, we have started all of our calves for herd replacements on milk replacer instead of the limited whole milk method we had used for many year We feel that the calves grew as we had no scours or other ailments, a were equal in all ways to calves grown in former years.

Feed Extra Replacer

Milk replacers should be used according to the directions on the tag or bag. We feel, however, that perhaps it is good insurance to feed the replacer somewhat longer, and at a slightly higher rate for the older calves, so that a total of about 35 pounds of the dry material is consumed by each calf rather than the 25 pounds usually suggested by the manufacturer. The extra 10 pounds helps to get the calf off to a good start and growing at a good rate, so that if satisfactory feeding and management practices are continued, the animal will be well-grown and can be bred to calve at a younger age.

Replacer May Save Money

Calves should be encouraged to eat a good dry starter ration as soon as possible after the first week. Early-cut, green, high-quality hay, containing less than 50 per cent legumes should be supplied at that time.

Sanitation and good ventilation are of utmost importance in the successful rearing of dairy calves. Be sure to clean and sterilize all milk buckets after every feeding.

The savings in the cost of raising a calf by replacer will, of course, depend on the price a dairyman receives for his milk, as well as the cost of the replacer. Under most conditions, there will be a saving of $10 to $15 or more for each calf raised.

Circular Available

West Virginia University Experiment Station Circular 111, now available at your County Agent's office, gives details on the use of replacers. It contains a simple way for you to determine how much you will save per calf. If more convenient, you may secure a free copy of the circular by writing the W.V.U. Mailing Room, Oglebay Hall, Morgantown, W. Va.

THESE fine heifers at the West Virginia University Dairy Farm were raised on milk replacer. Research conducted at the Farm has shown that the use of replacer may enable dairymen to save from 10 to 15 dollars per calf raised.