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Science serves your farm and home.

A. H. VanLandingham

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Science

SERVES YOUR FARM AND HOME



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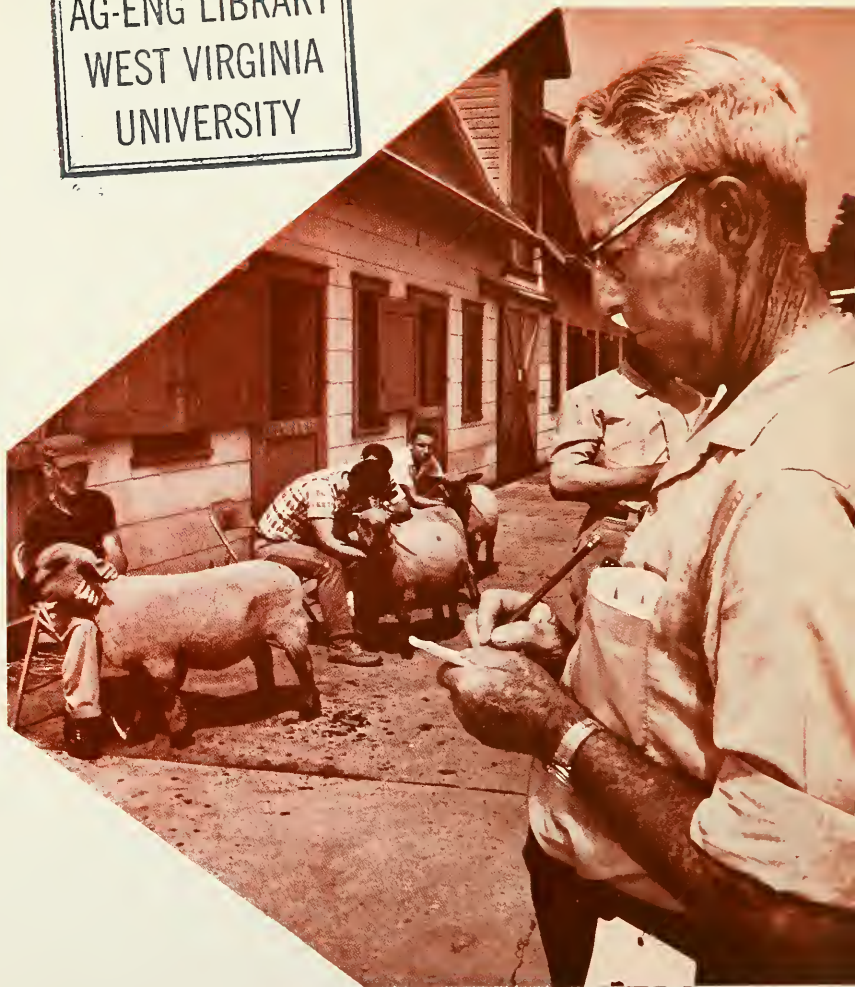
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AGRICULTURAL EXPERIMENT STATION
WEST VIRGINIA UNIVERSITY

SUMMER 1966

Bulletin 532



Science

Serves your farm and home

BULLETIN 532

SUMMER 1966

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 26506.

Editor-in-Chief JOHN LUCHOK

Managing Editor . . . JACK CAWTHON

Photographer DAVID CREEL



COVER: More than 350 farmers from throughout the State attended the Animal Industry Field Day held June 30 on the poultry, dairy, and livestock farms. Senior and junior judges rated cattle, sheep, and swine. Lewis County teams won first place in both divisions. An old-fashioned beef barbecue lunch was served in the new Forestry Building. After lunch, Louis Longo, a highly successful Connecticut dairyman, was the featured speaker. (Photo by David Creel special for SSYF & H)

COMMERCIAL EGG PRODUCTION— PARKERSBURG AREA



A. H. VanLandingham
Director

RECENTLY several of us on the staff at West Virginia University visited six farms located in Wood and Jackson counties which produce market eggs. Of the six farms visited, two had a capacity of 25,000 layers each.

According to the U. S. Census, Wood County had 53,000 chickens over four months of age in 1959, and 80,000 in 1964. There are an estimated 95,000 in Wood County at the present time. Twice as many eggs were produced in 1964 as in 1959—1,122,733 dozen as contrasted to 501,231 dozen. The roughly half-million dozen increase was accomplished with an increase of only 26,000 layers, indication that the small farm flocks are being replaced by the more efficient commercial producers.

Since the 1964 Census, eight new poultry houses have been constructed, with capacities of from 5,000 to 10,000 birds. The new houses are insulated and have forced ventilating fans, automatic feeders, and waterers. Management is about equally divided between floor plan and cage operations.

Flock size in the county averages around 5,000 birds, and ranges between 800 to 25,000. Approximately 20 producers account for about 99 per cent of production.

Most of the eggs are marketed wholesale through local stores and the Farmers' Market, and some are sold retail at the farms and on egg routes. There seems to be no great difficulty in finding markets for the eggs.

It is quite apparent that the Parkersburg area is favorably located for egg production, being adjacent to surplus feed grain production in Ohio and neighboring states. As a factory-type enterprise requiring only relatively small areas of land, and with proper management and resources available, commercial egg production in the Parkersburg area should develop into a multimillion-dollar industry—another farm enterprise well suited to West Virginia.

Relatively good quality hunting land
is not something that just naturally
occurs where there are trees
high quality hunting lands require
some management by man.

HUNTING QUALITY ON WEST VIRGINIA'S

In recent years considerable interest has been expressed in the outdoor recreational potential of West Virginia. Such interest is manifested in a multitude of written and oral reports that are flowing from various state, federal, and private agencies. In general, these reports are quite optimistic about our recreational opportunities and, either explicitly or implicitly, outdoor recreation is assigned a major role in the generation of future income and employment.

However, outdoor recreation is a phrase which encompasses a broad range of activities from the very simple act of walking, to the highly complex operations of a commercial ski resort. Each activity is relatively unique in its land, labor, and capital requirements, and in the experience and skill required by participants. It is these very basic supply and demand requirements that logically precludes an aggregation of these very different activities. Thus, it is not very meaningful to generalize about our "outdoor recreational potential" on the basis of one or two activities. Perhaps it would be best to say that among all activities there are some which offer relatively good opportunities, and there are some which appear to offer relatively poor opportunities. Regardless of one's intuition or vested interest, a certain amount of basic supply and demand information is needed for each of several activities before our total outdoor recreational potential can be adequately assessed.

Among the many recreational activities, it has been suggested quite often that hunting represents an excellent income and employment opportunity for private landowners. As an enterprise for farmers or other private owners of land, hunting has certain advantages when compared to other recreational enterprises: landowners already have the basic requirement of land; labor requirements are relatively low and few specialized talents are necessary; it fits in reasonably well with other farm enterprises; and it generally requires lower capital investments.

ALTERNATIVES

There are several alternatives from which landowners could choose to market the hunting rights on their land. They could (1) establish commercial hunting preserves, (2) lease hunting rights to hunting clubs, (3) lease hunting rights to individuals, (4) convert their homes to hunting lodges during hunting season, or (5) assess hunting fees on individual hunters. Thus, if supply and demand conditions were favorable, private landowners would be in a position to transform what has been a free service (free entry to hunt on privately owned land) into a marketable one with value.

The ability of private landowners to earn annual income from the marketing of hunting rights depends upon the interaction of both supply and demand forces. However, if we assume that there is a demand, which is unchanging over the period

of time under consideration, there are supply considerations which will affect the income potential from hunting. Chief among these factors is the hunting quality on privately owned lands, the supply of free hunting lands, and landowner attitudes about the charging of hunting fees.

Relatively good quality hunting land is not something that just naturally occurs where there are trees. High quality hunting lands in West Virginia, or elsewhere in many areas of the United States, require some management by man. In many instances, species of wildlife must be introduced into an area; there must be a physical environment that furnishes adequate food and protection; and, finally, man must take action to prevent overharvesting of the game, damage from feral dogs, harvesting out of season, and destruction of the habitat through such things as uninterrupted natural succession, forest fires, and adverse lumbering practices. Furthermore, the creation of a desirable physical environment for hunting, and the restraining of certain acts of man, is not something which can be done once and then forgotten. The maintenance of desirable game habitat is most important in providing for a future game supply.

To maintain high quality hunting lands, once established, requires consistent management of the plant-life for provision of food and cover and the proper harvesting of wildlife for optimum yields. For example,



PRIVATELY OWNED LAND

Kenneth D. McIntosh

Asst. Agricultural Economist

habitat must be managed to prevent extensive stands of sawtimber with no breaks; den trees and mast trees and bushes must be retained for certain wildlife; young sprouts, shrubs, and seedlings must be available for food for some wildlife; and for many of the small game animals the "edge" must be retained for food, nesting, cover, and protection.

If the hunting quality on our privately owned land is relatively poor, hunters will be encouraged to pursue their sport elsewhere. Further, low quality hunting land jeopardizes the ability to capture monetary benefits from the marketing of hunting rights. Hunting quality on State owned or leased public hunting areas is relatively good because of wildlife management practices that are followed on these lands. Until recently, however, we had very little information on the hunting quality of privately owned lands. In this respect it is well to remember that over 90 per cent of the land in West Virginia is privately owned. Furthermore, access to State owned or leased public hunting areas is free of charge. Private landowners who incur costs in improving the hunting quality on their lands cannot be expected to grant free hunting. Furthermore, areas which can be used free of charge compete with fee-paying areas, and an expansion in the number of free areas will undermine attempts of private landowners to establish fee-paying enterprises.

Considering the importance of quality on the potential income and employment that might be derived from hunting, a project was undertaken in the summer of 1965 by the Agricultural Experiment Station to determine hunting quality on privately owned lands. The following information is a condensation of the material from that project report.

STUDY PROJECT

An analysis of secondary sources of information suggested that hunting quality, Statewide, is relatively low because of adverse effects of changes in land use. There has been a rather drastic decline since 1950 in the amount of land used for crops, hay, small grains, and pasture. Over the same time period there has been a rather pronounced increase in the proportion of land classified as forest land. Lands which are completely stocked with poletimber and sawtimber do not provide a physical environment for high quality hunting lands for most game. Thus, the rapid abandonment of land for farming purposes that has occurred since 1950, and the subsequent reversion of these lands to forest, has led to widespread deterioration of the habitat, especially for rabbits, quail, and grouse. Further, if current land use trends continue, and the process of natural succession continues uninterrupted, the habitat on privately owned land will continue to deteriorate, even for deer.

In June 1965 an empirical assessment of hunting quality on privately owned land was made by interviewing a random sample of landowners in West Virginia and obtaining from them a quality rating on their lands for hunting various species of wildlife. Admittedly, a more objective assessment of quality might be obtained by isolating individual tracts of land around the State and by conducting on each tract a study of the number and kinds of wildlife, the available food supply, and protective covering. However, for purposes of the study it was assumed that landowners could make an adequate quality discrimination because:

1. They are familiar with the physical habitat of their land;
2. They travel over their land periodically and can observe the kinds and numbers of wildlife;
3. They control access to their lands and by virtue of such control are able to note the species and quantities of wildlife killed on their lands;
4. Many landowners hunt on their own land, as well as the land of others; by direct involvement in the hunting activity they are able to evaluate the hunting quality of their land.

Each landowner was asked to make an overall evaluation of his land on the basis of species available, their numbers, available food supply, and protective cover from weather and man. Further, each landowner was asked to rank his land as excellent, good, average, below average, poor, none, or don't

(continued on page 19)

NEMATODES

ROBERT E. ADAMS
Assoc. Plant Pathologist

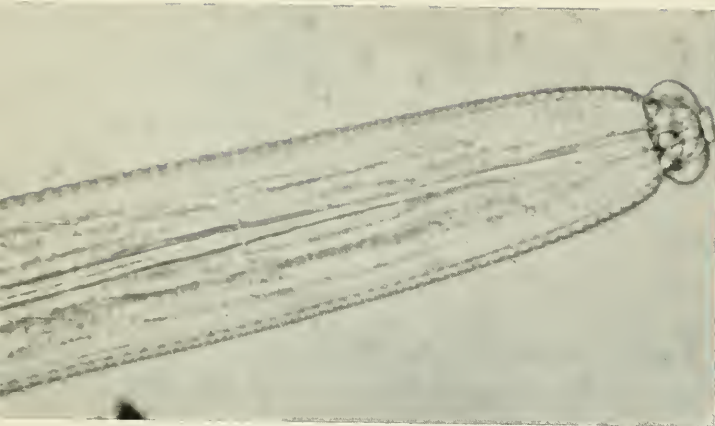
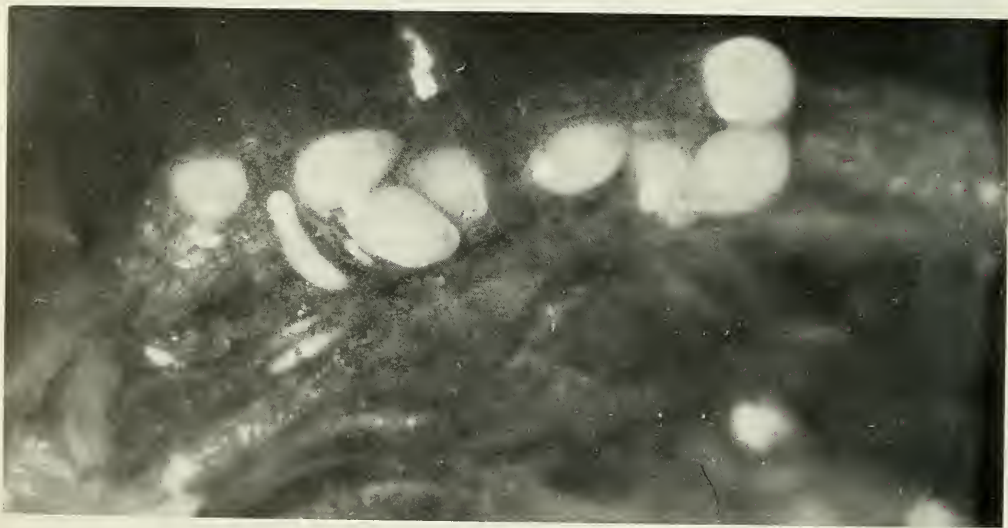


Figure 1 (above). Photomicrograph of the head of an Awl nematode showing the hollow stylet that it uses to puncture plant cells on which it feeds.

Figure 2 (below). Photomicrograph of swollen females of a cyst-forming nematode attached to a plant root.



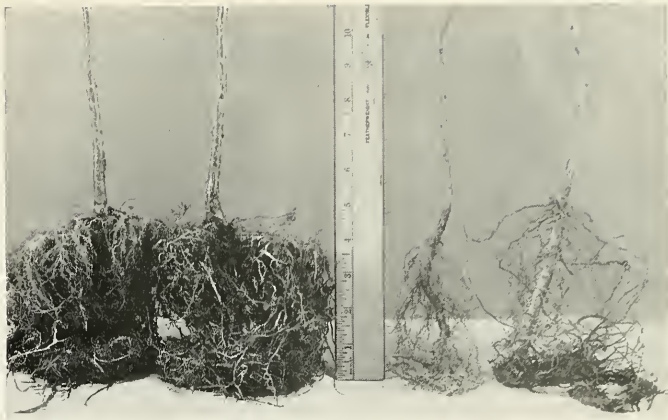
NEMATODES are microscopic worms that live in the soil, in fresh water, in the sea, and in animals. Some feed on bacteria, some on fungi, some on insects, some on domestic animals and man, and some on the roots or other parts of higher plants. Those that attack man and animals have been known and studied since Biblical times. The study of those that attack plants

is of more recent origin, and the study of those that live in our fresh waters and seas is just beginning.

Attention in the Agricultural Experiment Station has been directed towards those nematodes that live in close association with plants of economic importance (Figure 1). Plant parasitic nematodes have been found in soils planted to apples, peaches, cherries, straw-

berries, raspberries, vegetable crops, field crops, nursery and greenhouse crops, and the forest. Representatives of all of the major groups of nematodes of economic importance have been found in West Virginia (Figure 2). Species new to science have been found and described. Nematode problems exist in the production of crops in West Virginia and some damage is severe.

Figure 3. Mazzard seedlings (rootstocks for sweet and sour cherries). The two on the left were grown in nematode-free soil—the two on the right in the same soil but to which nematodes were added.



VEGETABLES

Because of the topographic nature of much of the land in this State, suitable areas for home gardens are restricted. In most instances, this means that the same areas are used year after year for gardens, a practice which creates a favorable situation for the increase of nematodes that attack vegetables. To learn whether this is actually the case, soil treatments were applied in an area in the Tygarts Valley that has been repeatedly planted to vegetable crops. Experiments using soil treatments can frequently reveal the nature and extent of nematode problems. The soil fumigant Trizone (a mixture of methyl bromide 61 per cent, propargyl bromide 6.8 per cent and chloropicrin 30 per cent, Dow Chemical Co.) was applied at the rate of 200 lb per acre to plots 4 feet wide and 25 feet long. The fumigant was applied with a soil injection machine that lays a plastic cover over the treated area as the fumigant is injected. In one treatment, the black plastic was removed 3 days after injecting the fumigant;

in the second, the black plastic was left on until harvest; in the third, the black plastic was placed on untreated soil; and the fourth was untreated and uncovered soil. Three weeks after treatment, equal numbers of beet seeds were planted in each plot. In October, the beets in each plot were harvested and weighed. At the same time, representative soil samples were collected from each plot and analyzed for plant parasitic nematodes.

The results are presented in Table 1. Statistical analysis shows that the yield of beets was significantly higher in the fumigated plots than in the non-fumigated plots. Planting through the black plastic increased yields slightly over that in the plots without the black plastic cover. Two species of plant parasitic nematodes were found, *Pratylenchus penetrans* (root-lesion nematodes) and *Paratylenchus nanus* (pin nematodes). The fumigation treatments essentially eliminated the plant parasitic nematodes. The black plastic cover on untreated soil reduced the root-lesion nema-

todes by 45 per cent and the pin nematodes by 77 per cent. The results show an inverse relation between numbers of plant parasitic nematodes and yields of beets. The reduced number of nematodes where the black plastic was placed on untreated soil was surprising and as yet unexplained. Absolute proof that these nematodes caused the low yields of beets must await carefully controlled greenhouse experiments.

The plant parasitic nematodes that are commonly found in soil samples from West Virginia gardens are: root knot nematodes (*Meloidogyne* spp), pin nematodes (*Paratylenchus* spp), lesion nematodes (*Pratylenchus* spp), dagger nematodes (*Xiphinema americanum*), and spiral nematodes (*Helicotylenchus* spp). The spiral nematodes are not known to damage vegetable plants directly, but research at this Station has shown that their presence in the soil increases the incidence and severity of southern bacterial wilt of tomato. The sugar beet nematode (*Heterodera schachtii*) which attacks many vegetables

Figure 4. Norway spruce seedlings growing in a nursery. Those in the background were growing in fumigated soil—those in the foreground in untreated soil.



has been found in the Canaan Valley.

TREE FRUITS

Apple, peach, and cherry trees are also attacked by plant parasitic nematodes. Individual trees, small groups of trees, or entire plantings may make poor growth, while adjacent trees or plantings having an identical cultural program and similar soil make satisfactory or even vigorous growth. The results of our studies provide an explanation for this commonly observed phenomenon. In essence, the vigor of the trees is correlated with the size of the nematode population on their roots. Vigorous apple trees (making 9.4 inches annual terminal growth) were associated with plant parasitic nematode populations that averaged 83 nematodes in 50 ml of soil, while weak trees (making 2 inches annual terminal growth) were associated with nematode populations that averaged 190 nematodes in 50 ml of soil, more than twice that of the vigorous trees. Greenhouse studies in which apple seedlings were inoculated with the nematodes from the orchards showed that the plant parasitic nematodes were responsible for the poor growth. Similar results were found in studies conducted in peach and cherry orchards (Figure 3).

Dagger nematodes, lance nematodes (*Hoplolaimus* spp), pin nematodes, and spiral nematodes are found most frequently in West Virginia orchards. Others found less frequently are the lesion nematodes, sheath nematodes (*Hemicycliphora* spp), and the ring nematodes (*Criconemoides* spp).

NURSERY CROPS

Nematode problems can be especially severe on nursery-grown crops. Consequently, the control of nema-

todes in plant nurseries can be very profitable, even though the value of the individual plant is low. To illustrate this point, conifer seedlings are sold by the Department of Natural Resources for 1½ cents per tree. Untreated, nematode-infested beds produce about \$8,000 worth of trees per acre. Large-scale experiments to control the nematodes (using methyl bromide at 2 lb per 100 sq ft) have produced yields of trees worth \$23,000 to \$24,000 per acre of nursery bed (Figure 4). When the cost of treatment is subtracted (\$2,000 per acre) this leaves a net return per acre which is about three times that from untreated beds. Returns to nurserymen producing ornamental plants of higher value can be expected to be even greater. In the nurseries, the principal nematodes are lance nematodes, sheath nematodes, ring nematodes, dagger nematodes, root knot nematodes, stunt nematodes (*Tylenchorhynchus claytoni*), and species of *Trichodorus*.

STRAWBERRIES—TOBACCO

Limited studies have demonstrated that strawberries and tobacco are subject to severe damage by nematodes in West Virginia. Extensive fumigation trials on strawberries have been started this spring. The main nematode pests known on these crops in the State are: root knot nematodes, root lesion nematodes, dagger nematodes, and the tobacco stunt nematode.

Growers who have experienced difficulty in obtaining high yields despite good cultural and fertility practices might find it profitable to request information from the Agricultural Experiment Station, West Virginia University. This can be done through your County Agent or by writing to the Station.

Dr. David White New Director of Forestry



Dr. White

Dr. David E. White, assistant professor of forest economics at West Virginia University, has been named to the position of director of WVU's Division of Forestry, effective July 1.

A native of Syracuse, N.Y., White is a graduate of Syracuse University, where he received his bachelor's and master's degrees in forest management in 1959 and 1960, respectively, and his doctor's degree in forest economics in 1964.

White worked for a time as forester with the Crown Zellerbach Co. in western Oregon before completing work on his doctorate. He also has served at Syracuse as an instructor in forest economics.

For the past two years, White has been at WVU in the post of assistant professor in the Division of Forestry.

Dean Robert S. Dunbar, Jr. said White's major areas of interest are natural resources policy and the economics of the forest industry. The new director also has authored a book, **THE ECONOMIC PROBLEMS OF THE LUMBER INDUSTRY IN NEW YORK STATE**. White is a member of the Society of American Foresters and the American Economic Association. He currently serves on the Official Board of Spruce Street Methodist Church in Morgantown. Dr. and Mrs. White are the parents of four children.

White's appointment fills the vacancy created by the retirement of Dr. W. Clement Percival as director, a position he held for 33 years.

TABLE 1

Yield of Table Beets in Fumigated Soil in Relation to Nematode Populations at Harvest.

Yield and Nematode Numbers	Fumigated ¹		Non-fumigated		F value
	Plastic Removed	Plastic Left on	Plastic Left on	Untreated	
Yield per 25 ft row	26.8 lb	30.7 lb	3.8 lb	0.2 lb	4.13*
Nematode numbers in 50 ml soil:					
<i>Pratylenchus</i>	4	0	60	110	
<i>Paratylenchus</i>	9	11	152	659	5.04*

¹Soil treated with Trizone (methyl bromide 61 per cent, propargyl bromide 6.8 per cent, chloropicrin 30 per cent, Dow Chemical Co.) at the rate of 200 lb per acre.

*Denotes differences at 1 per cent level of significance.

MANY poultrymen have been considering the possibility of vaccinating their birds for chronic respiratory disease (CRD). In broiler breeder flocks the primary reason for vaccination has been for the reduction of egg transmission of *Mycoplasma gallisepticum* (MG), the causative agent of CRD. Other poultrymen have considered vaccination to prevent outbreaks of CRD when the birds were in production.

West Virginia Agricultural Experiment Station and its sub-station at Reymann Memorial Farms have been working on vaccination and control programs for the past six years. The primary purpose of the experiments has been to use vaccination to reduce egg transmission as an aid in developing a flock free of CRD. Most of the information about the programs has been published as scientific articles in *Avian Diseases*. This article deals primarily with the results of the vaccination procedures.

Since it has been found necessary to use live pathogenic organisms in vaccines to produce a long-lasting immunity to CRD in chickens, the programs have been referred to as "planned" or "controlled exposure." These terms are not entirely appropriate since in most cases the infection is neither planned nor controlled.

For these experiments, chickens were vaccinated by placing one drop of a virulent *Mycoplasma gallisepticum* culture (WVU 1791) into the nostril. The chicks were usually one day old, or 14 to 16 days old, and in one instance, the birds were 14 weeks old before they were vaccinated. The weight gain of chickens and feed conversion following vaccination were calculated at 10 weeks of age. The chickens which received no vaccination weighed 0.45 lb more than the vaccinated birds. The former had a feed conversion of 2.46 as compared to 2.63 for the latter.

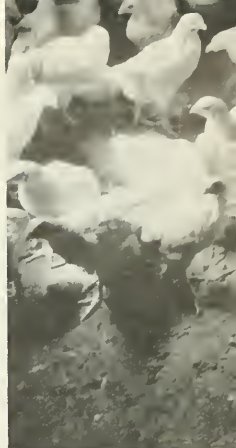
Generally the vaccination procedures did not adversely affect the livability, except one year when a mortality of 10 per cent was encountered following vaccination.

Egg production records were available from a flock of New Hampshire and Dominant white hens maintained at the Reymann Memorial Farms. Egg production figures before vaccination in 1960, after vaccination in 1961, 1962, and 1963, and a CRD negative flock in 1964 are presented in Table 1. These birds had been selected for meat production and a gradual decline in egg

VACCINATION for CRD

N. O. Olson, J. O. Heishman, and C. J. Cunningham

N. O. Olson is Animal Pathologist; J. O. Heishman is Associate Pathologist, Reymann Memorial Farms Station; and C. J. Cunningham is Animal Husbandman in Charge, Reymann Memorial Farms



production had occurred for the past ten years.

There was an increase in egg production following vaccination in 1961. The increase was not apparent in 1962 and 1963. When the CRD had been eradicated from this flock in 1964 there was an increase in production over 1962 and 1963 but not over the vaccination in 1961 and the naturally exposed year, 1960.

The Dominant white hens showed a steady decline in egg production from 1961 to 1964. The decline continued in 1964 even though the flock was free of CRD.

In 1961 and 1962, when controls were maintained, there were no significant differences in egg production between the control New Hampshire hens, which became infected by natural means, and the hens that had been vaccinated. Further work is being considered to critically evaluate the effect of CRD on egg production.

In 1960 when testing antibiotics for the elimination or control of CRD, detailed culture procedures indicated that a high degree of resistance had developed following

experimental exposure of chicks when 14 or 16 days old. It was decided to hold groups of these artificially infected (vaccinated) chicks to maturity and determine the rate of egg transmission. Two separate trials were conducted with 8 groups of approximately 100 females and 8 males per group. In trial 1 the chicks had received the following treatments: No medication, or medication of 400 grams of chlortetracycline, plus 0.5 per cent terephthalic acid for 1-14, 5-14, or 7-14 weeks. These birds were held to 35 weeks of age. A total of 4,396 cultures was taken from the yolk sac of incubated eggs and no mycoplasmas were recovered. In addition, 5,351 eggs were set in a commercial incubator. At hatching time 116 pipped embryos and cull chicks were examined for air sac lesions, and two had positive lesions but mycoplasma were not recovered.

In trial 2 approximately the same number of birds was selected from an uninoculated control, an inoculated control, and two groups that had received chlortetracycline, 1,500 grams per ton of feed, from 1-10 weeks or 7-10 weeks. These birds

TABLE 1
The Effect of Vaccination for Chronic Respiratory Disease on Subsequent Egg Production.¹

Breed	Before Vaccination ² 1960	After Vaccination			No Vaccination ³ 1964	
		Group 1 ⁴	Group 2 ⁴	1962	1963	
New Hampshire	41.27	45.0	50.12	37.73	32.0	40.0
Dominant White	—	41.79	—	39.81	38.0	37.13
New Hampshire ⁵ Control	—	44.79	—	39.23	—	—

¹Based on a nine-month period per hen housed.

²Not vaccinated, but became infected by natural means.

³These birds became infected by natural means.

⁴Group 1 and 2 kept in separate houses.

⁵These hens remained free of CRD.

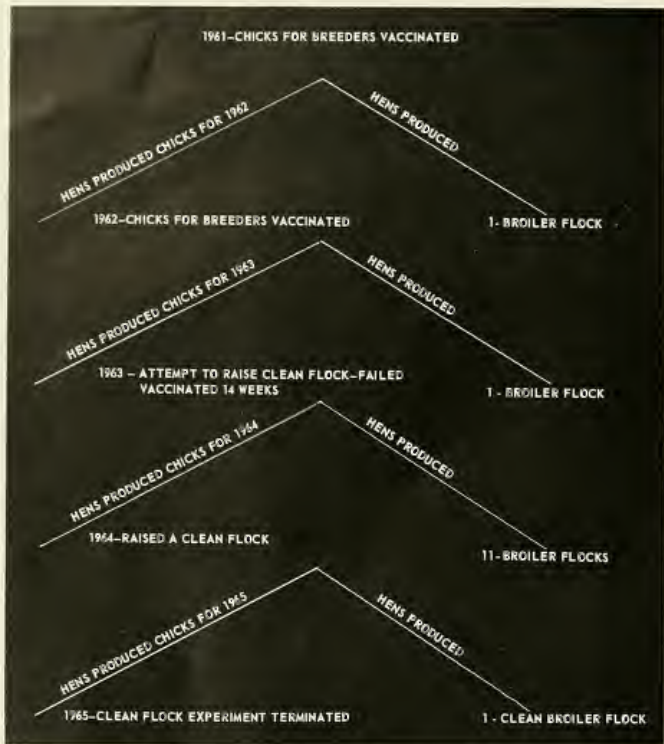


Diagram of vaccination experiment.

were observed for 38 weeks. The uninoculated control became infected between the sixth and eighth week; the others had been vaccinated when 16 days old. Eggs were collected on two different occasions for two-week intervals between October 1960 and February 1961. A total of 3,852 eggs were collected and incubated and 2,246 live and 296 dead embryos were cultured. A positive MG culture was obtained from the group that had received chlortetracycline from 1-10 weeks and from the group that became exposed by natural means between the sixth and eighth week.

The results of these preliminary trials were encouraging; therefore, a similar vaccination program was established at the Reymann Memorial Farms with the intention of establishing a flock free of *Mycoplasma gallisepticum*. For these studies a breeding flock of approximately 1,200 New Hampshire and Dominant white birds was available. Agglutination tests on serum

taken from birds prior to vaccination showed that this breeding flock had become infected by natural means. Egg transmission was confirmed, when 14 out of 351 pipped embryos or cull chicks were found positive for CRD. This was slightly less than that obtained from 26 other West Virginia flocks, when 651 out of 7,788 pipped embryos or cull chicks were positive for CRD (see diagram).

Since it was necessary to introduce eggs from an outside source as part of a breeding project in 1962, it was decided to continue vaccination for another year. Even though eggs from an outside source were introduced in 1963, an attempt was made to develop a free flock. The eggs from the outside source were dipped in an antibiotic solution in hopes of eliminating MG in them. When some of the birds in the 1963 flock were infected at 12 weeks, all were vaccinated at 14 weeks. No further hatching eggs or chicks from an outside source were added. From

hens of the 1963 vaccinated group, 11 broods of 1,200 broilers each and one brood for replacement were reared to determine if they were free of CRD. One brood of broilers was obtained from hens of the latter group.

From chicks vaccinated in 1961 and 1962, 531 pipped eggs and cull chicks were examined in 1962 and 1963 and no CRD lesions were found. During this same time, 83 pipped eggs from control hens which had been exposed by natural means were negative for CRD air sac lesions.

One flock of broilers in 1962 was free of MG but the 1963 flock of broilers revealed two isolations from the trachea and a low reactor rate when checked at 10 weeks of age. As stated previously, the attempt to raise a clean breeder flock in 1963 was abandoned at 12 weeks when 12 per cent of the birds reacted to the serum plate test for CRD and 31 per cent of the tracheal swabs were positive for MG. These birds were vaccinated at 14 weeks of age.

The inability to develop a clean flock by vaccination was discouraging, but it was suspected that the infection came from chicks obtained from hatching eggs from an outside source.

At this time a new broiler house became available at the Reymann Memorial Farms. It was decided to use this house to determine in more detail what one might expect from the progeny of birds that had been vaccinated at 14 week of age, compare these results with chicks from a commercial breeder flock that had been exposed by natural means, and chicks from a clean flock.

Eleven flocks of broilers of approximately 1,200 chicks each were obtained from the vaccinated hens. Eight flocks of approximately 1,200 chicks each were obtained from the commercial source. Also an additional group of approximately 1,500 chicks from vaccinated hens were reared to maturity to determine if a clean flock could be established. A clean breeding flock was established and one group of 1,200 chicks for broilers was obtained from this flock.

The presence of CRD in the above broiler flocks was based on the examination of pipped eggs and cull chicks for air sac lesions, culture of tracheal swabs for MG, and the serum plate test for MG agglutinins. The broilers from the clean breeding flock were negative for CRD. Two out of the 11 lots of broilers

from vaccinated hens and 5 out of the 8 lots of broilers from hens exposed by natural means were infected. The percentage of mortality in broilers was 1.1, 1.8, and 2.3; the percentage condemnations for airsacculitis was 0.0, 0.50, and 0.23; and the total percentage condemnations was 0.73, 1.13, and 1.68 in broilers from clean, vaccinated, and hens exposed to CRD by natural means, respectively.

CONCLUSION

Vaccination for CRD was effective in reducing the egg transmission rate when compared to birds exposed by natural means. No infection occurred in broilers from clean hens. There was less CRD infection in broilers from vaccinated hens than in broilers from hens exposed to CRD by natural means. Egg production was not affected by these vaccination procedures.

Uncomplicated CRD in chickens results in an asymptomatic infection and few air sac lesions. This was evident in these experiments in that no clinical signs were apparent even though the number of infected birds in some flocks was high. The condemnation for air sac disease was also low. The effect of superimposing vaccination for bronchitis and Newcastle disease is being investigated in another experiment.

The results of these experiments clearly indicate that vaccination can be used as an aid in the eradication of CRD if the progeny are reared in small groups.

Disadvantages

Certain disadvantages to using the vaccination procedure became evident in these trials. Since a virulent product must be used for vaccination, the stage is set for possible severe outbreaks of CRD. This happened one year, and a mortality of 10 per cent occurred in the vaccinated birds. The use of living MG vaccines is a potential hazard to the flocks that are free of CRD. Vaccination for CRD interferes with eradication programs for other diseases caused by mycoplasma such as infectious synovitis.

Results

The results of these experiments show that (1) it is possible to develop a CRD clean flock from an infected flock, (2) it is possible to keep flocks clean if reasonable sanitary precautions are carried out, (3) the introduction of breeding stock from an unknown source should not be permitted.

SOLAR COLLECTORS

O. R. HARMAN

Asst. Agricultural Engineer

SOLAR energy is a source of free heat which can be used to condition air for animal shelters, heat air for drying of materials, and to supply heat for many other applications.

The Department of Agricultural Engineering at West Virginia University has for the last five years conducted tests on differently designed air flow solar collectors.

Longhouse¹ investigated a flat, a curved, and a corrugated collector (Figure 1). Typical insolation rate and heat gain curves are shown in

Figure 2. The curved collector, which collects solar energy at the rate of 175 btu per square foot, is the most efficient at noon. The other two collectors are more efficient in the morning, however. The collector performance on a clear day is indicated in Table 1.

The effect of clouds on the rate of collection can be observed in Figure 3. Between 11:00 a.m. and 1:00 p.m. the sky was cloudy and a dip is seen in the energy curves. Performance is presented in Table 2.

Newer designed solar collectors are shown in Figure 4, and typical heat gain curves are shown in Figures 5 and 6. The characteristics of these collectors are given in Table 3.

Collector number 1 has two collector plates. The top plate has holes in it through which radiant energy may pass and be collected on the second or lower plate. These holes are approximately 1 inch in diameter and are located in rows 6 inches apart along the width, and 3 inches apart along the length of the plate. Both plates are corrugated aluminum with the top of the plates painted black. Air is passed over the front and back of the top plate and also over the top of the second plate. Plastic sheets were placed over the collector plates of all solar collectors permitting air to be passed over the plates and radiation to be collected.

Collector plate number 2 was also corrugated aluminum with the top painted black. Only one plate was used in this collector and the air passed in back of the plate. However, fins were placed in the air passage, perpendicular to the plate as well as the air flow. Under this arrangement it took longer for the air to travel through the collector

¹Longhouse, H. A. "Design, Construction and Testing of a Stationary Solar Collector," unpublished M.S. Thesis, W.V.U., Morgantown, W. Va.

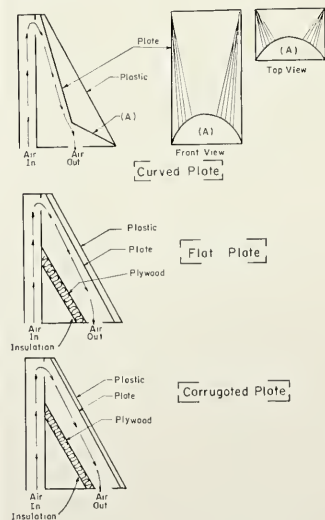


Figure 1. Cross sections of solar collectors used by Longhouse.

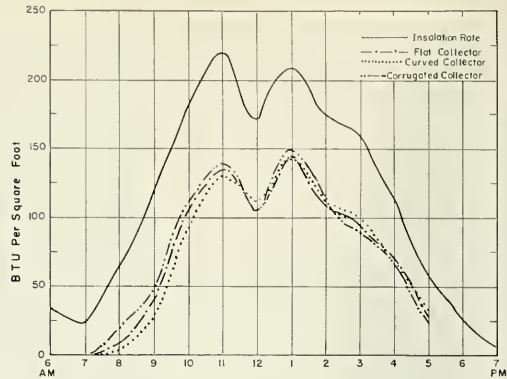
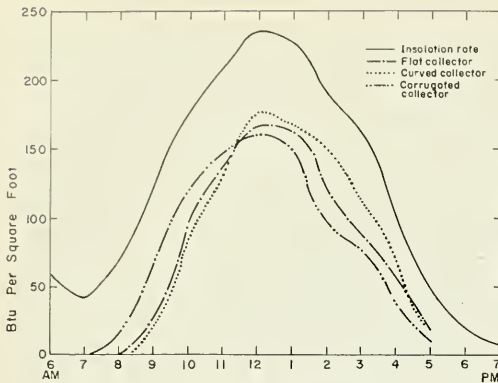


TABLE 1
Collector Performance on a Clear Day, June 17, 1961.

Description	Collectors		
	Curved Flex-O-Pane Behind Collector Surface 465	Flat 32.6 Flex-O-Pane Behind Collector Surface 645	Corrugated 32.6 Flex-O-Pane Behind Collector Surface 590
Type			
Area, sq ft	32.6	32.6	32.6
Cover Sheet	Flex-O-Pane	Flex-O-Pane	Flex-O-Pane
Air Passage	Behind Collector Surface	Behind Collector Surface	Behind Collector Surface
Air Flow (cfm)	465	645	590
Total Radiation Received, Btu/day sq ft	1689.0	1689.0	1689.0
Total Radiation Collected, Btu/day sq ft	928.2	880.0	894.0
Efficiency Per Cent	54.9	52.1	52.9
Temperature Rise (ΔT)	6.0	4.6	4.4
Radiation Loss in Plastic, Btu/day sq ft	169	169	169
Radiation Loss Absorber Plate, Btu/day sq ft	152	152	152
Conduction Loss Back and Bottom Btu/day sq ft	306.5	235.0	249.7
Convection Loss Through Front Btu/day sq ft	88.5	85.7	75.7
Loss Not Accounted For Btu/day sq ft	44.8	167.3	148.6
Loss Not Accounted For Per Cent	2.7	9.9	8.8

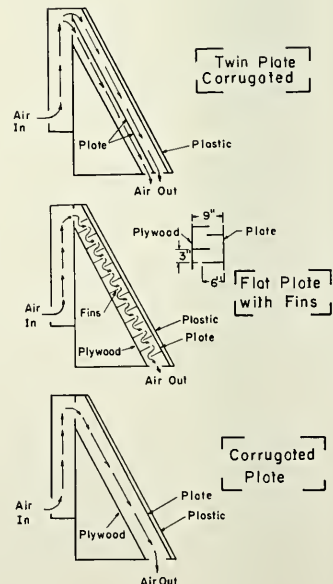
Figure 2 (above, left). Insulation rate and heat gains through collectors.

Figure 3 (above, right). Insulation rate and heat gains through collectors on a cloudy day.

Figure 4 (below). Cross sections of solar collectors used in 1965.

TABLE 2
Collector Performance on a Cloudy Day, June 18, 1961.

Description	Collectors		
	Curved Flex-O-Pane Behind Collector Surface 465	Flat 32.6 Flex-O-Pane Behind Collector Surface 645	Corrugated 32.6 Flex-O-Pane Behind Collector Surface 590
Type			
Area, sq ft	32.6	32.6	32.6
Cover Sheet	Flex-O-Pane	Flex-O-Pane	Flex-O-Pane
Air Passage	Behind Collector Surface	Behind Collector Surface	Behind Collector Surface
Air Flow (cfm)	465	645	590
Total Radiation Received, Btu/day sq ft	1562.1	1562.1	1562.1
Total Radiation Collected, Btu/day sq ft	823.7	840.1	863.7
Efficiency Per Cent	52.7	53.8	55.3
Temperature Rise (ΔT)	4.9	4.1	4.2
Radiation Loss in Plastic, Btu/day sq ft	156.2	156.2	156.2
Radiation Loss Absorber Plate, Btu/day sq ft	140.6	140.6	140.6
Conduction Loss Back and Bottom Btu/day sq ft	278.1	232.7	238.4
Convection Loss Through Front Btu/day sq ft	100.0	97.8	85.0
Loss Not Accounted For Btu/day sq ft	63.5	94.7	78.2
Loss Not Accounted For Per Cent	4.1	6.1	5.0



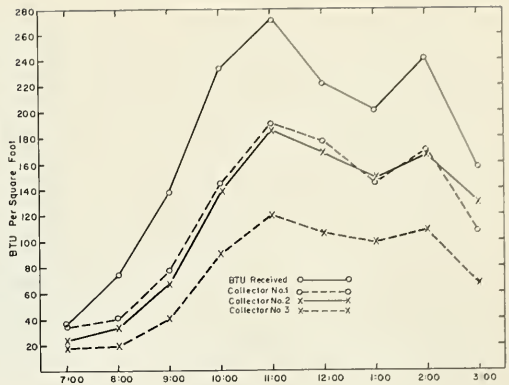
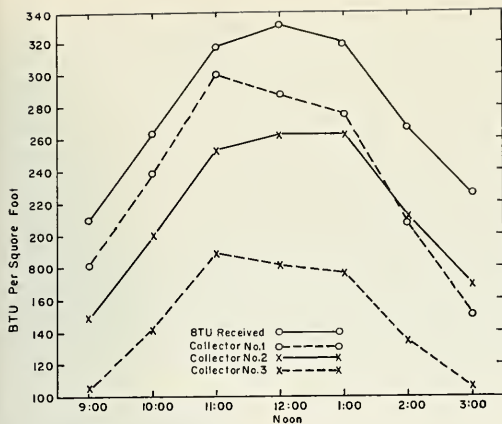


TABLE 3

Solar Collector Characteristics, October 13, 1965.

Description	Collectors		
	Double Plate	Finned	Corrugated
Type	32.6	32.6	32.6
Area, sq ft	32.6	32.6	32.6
Cover Sheet	Over and behind	Behind	Behind
Air Passage	front plate and	Collector	Collector
	over second plate	Surface	Surface
Air Flow (cfm)	473	225	440

Figure 5 (above, left). Energy collected on a sunny day (3/19/65).

Figure 6 (above, right). Energy collected on a cloudy day (10/14/65).

and the air was heated to a higher temperature than it would have been without the use of fins.

Collector number 3 was similar to number 2 but the fins were omitted. The air was passed under the plate. Therefore, it was in the collector less time than the air in collector number 2.

Figure 5 shows the energy collection curves for the three collectors. Data taken on March 19, 1965, reveals a sunny day with no clouds. The double-plated collector was

more efficient over the total period tested (9:00 a.m. to 3:00 p.m.), than the other two collectors. However, after 1:45 p.m., collector 2 seemed to be heating the air more than collector 1. This may have been due to the fins heating the air rather than solar energy collected, as the fins would be a heat sink. Tests will be conducted to determine if this is true. The third collector was far below the other two in performance.

Figure 6 shows the performance

of the collectors on sunny days with clouds in the atmosphere between 11:00 a.m. and 2:00 p.m.

SUMMARY

The first collectors tested by Longhouse collected at a rate of 175 btu per square foot of solar collector. This was the maximum rate at noon. Later versions of solar collectors collected energy at the rate of 300 btu per square foot. For this higher efficiency the cost increased due to the extra plate.

SOME DIETS MAY AFFECT NUTRITION

Thinking of dieting? Considering one of those low-carbohydrate diets that seem to be so popular these days? Before attempting any radical, crash diets of this type it might be wise to consider the results of nutrition research currently underway at West Virginia University.

Dr. Elisabeth S. Yearick, Associate Nutritionist, warns that there are many virtues to dietary carbohydrates that humans can ill-afford to do without.

Dr. Yearick explains that the consumption of carbohydrates by Americans has declined in the past

30 years, chiefly as a result of a reduction in the use of starchy foods such as potatoes and cereal grains. Because of the present accent on "staying slim," the WVU researcher says it is probable that consumption of carbohydrates will continue to decline.

"Perhaps it is time," says Dr. Yearick, "to point out some of the virtues of carbohydrates. Cereal grains, potatoes, corn, and other starchy vegetables contribute a useful variety of vitamins and minerals to the diet. All carbohydrates provide a cheap source

(continued on page 23)

A DECADE

BROILER production in West Virginia has undergone some astonishing changes during the past ten years. In 1956 the State industry began a new growth spurt. In fact, it appeared that new life had been injected into the industry since production increased steadily each year until the peak production year of 1959 when 27.5 million birds were produced. Then in 1960 a downward trend of production began that has continued through 1964 when 17.2 million birds were produced.¹ The 1965 production increased over 1964 by more than a million birds, and the broiler placements of the early months of 1966 showed a gain over the corresponding months of 1965.

During this ten-year period several attempts were made to re-vitalize the industry, to stimulate production, and to stem the downward trend of the early 1960's. Greater emphasis was placed upon efficient broiler production within the State by means of the so-called efficiency contracts. The basis for the efficiency contracts was the average liveweight of the broiler, and the pounds of feed needed to produce a pound of broiler (feed conversion ratio). By lowering the feed conversion ratio the cost of producing a pound of broiler was brought more nearly in line with the tumbling market price.

The effect of greater feed efficiency resulted in a decrease from about three pounds of feed to about two pounds of feed per pound of liveweight produced. The liveweight market price of this period reflected the ever-increasing number of birds being grown, especially in the South Liveweight prices tumbled from near a 20 cents per pound average in 1956 to less than 16 cents in 1965.²

¹U.S.D.A. *Chickens and Eggs, Farm Production*, etc. 1960 and 1965.

²Ibid., 1956 and 1965.



OF CHANGE

1956-59

In the five years preceding 1960, broiler contract terms underwent several changes. Until 1956, the basic contract called for a division of "money profit," computed as the difference between the market price and cash costs of production, on a fixed-share basis. Ninety per cent of the "profit" was paid to the grower and 10 per cent of the "profit" was retained by the contractor. When the cost-price squeeze of this period made its full effect felt, the cost of production exceeded the market price and there was no "profit" to be divided. Growers complained that they were producing broilers for the meager amounts gained from the re-sale of the feed sacks, certain unused allowances for fuel and litter, and the value of the manure.

In an effort to gain efficiency and thereby reduce the cost of production, the feed efficiency contract was introduced in several different forms. Basically, the contract settlement involved some calculations using the feed conversion ratio, average liveweight of the birds, and perhaps the selling price. Other types of contracts tried were: a fixed guarantee per chick sold, and a weekly payment per chick brooded.



IN THE STATE'S

These latter types failed to achieve wide adoption since they did not contain an incentive for efficiency. The feed conversion-ratio contract established itself as the chief contract in use. By 1960, growers were efficiency conscious but the tumbling market price still left the cost of production precariously near the market price.

During the period from 1956 through 1960 the West Virginia University Agricultural Experiment Station conducted research of economics of production. Cost of production, average weights, feed conversions, mortality, age of birds at

marketing, and various characteristics of the broiler producer and his production facilities were examined. Records on nearly 1½ million birds were obtained. These birds represented almost 5 per cent of the birds grown during the 1956-57 period. Interviews were made with over 300 producers and 25 broiler contractors.

For several years prior to 1960, West Virginia had three major areas of concentrated broiler production. These were the South Branch Valley area, the Greenbrier Valley area, and the Tygart-West Fork Valley area. Each of the areas had several broiler

contractors and a broiler slaughtering and dressing plant. Live buyers (individuals who bought broilers for resale purposes or bought according to orders, contracts or specifications) from both within and without the State did a thriving business.

1960-64

During the early 1960's there were signs that all was not well with the industry. Signs other than decreasing numbers of broilers became evident. Here and there a contractor closed his business. Occasionally a live buyer went bankrupt. One producing area lost its slaughtering plant. Meetings of contractors, buyers, growers, hatcherymen, and University personnel were held to examine the position and production trend. This resulted in some updating of technology, a few modern houses were constructed, some contract terms were changed, and a general awareness of the importance of broiler production was created. In spite of all this, the downward trend continued. Contractors blamed growers for high costs relative to the market prices. They also recognized some of the production difficulties such as: the long hauls of bagged feed to producers with small flocks; the need for bulk

feed handling and delivery; and the increased costs of too many contractors competing for producers in the area, causing needless repetition of several delivery trucks traveling the same roads. Growers blamed contractors for declining profits. Since growers were making little or no profits they failed to reinvest capital in production facilities and could not adopt some of the technology that was necessary for efficient production.

About 1960, while the Tygart-West Fork Valley area struggled for its existence, another production area began to develop—Garrett County, Maryland and Preston and Monongalia counties, West Virginia. This development was due largely to the efforts of a new firm. This firm had been producing broilers in large numbers on its own farms. Now it saw fit to build a slaughtering plant and more new houses and to mix its own feed. At the present time this firm closely approaches a completely integrated operation. It has contracted with some producers in the South Branch Valley area and a few of the survivors of the Tygart-West Fork area. Production in this area, which was not covered by the research study previously mentioned, has been fairly stable and appears to be established upon a firm competitive basis.

From 1960 through 1964 production within the State continued its downward trend. In the early 1960's production practically ceased in the Tygart-West Fork area except for a few producers that transferred production to the newly developed Maryland-West Virginia area. Contractors of the Tygart-West Fork area went out of business, and live buyers of the area ceased operating.

Beginning in late 1960, a new method of figuring the cost of production became crucial in computing "profits" and thereby the nature of the contract. The grower, the contractor, and the hatcheryman teamed up and the contractor and hatcheryman agreed to compute their contributions to the productive process as their actual costs, excluding any mark-ups. The grower's contribution to squeezing down the cost of production was reflected in the largest average liveweight of the bird and the lowest feed efficiency that he could achieve during the growing period. If the cost of production computed in the manner indicated above was less than the market selling price, the "profits" were divided as follows: 38 per cent



BROILER PRODUCTION

PAUL NESSELROAD

Asst. Agricultural Economist

to the grower, 25 per cent to the hatcheryman, and 37 per cent to the contractor. If the cost of production was in excess of the market price, there were no "profits" to be divided. Neither grower, hatcheryman, nor contractor received a return for his efforts under these conditions. This contract has been dubbed the "Miss America" contract (38-25-37) and has continued in use to the present time.

In the early 60's the slaughtering plant located in the Greenbrier Valley closed. Producers in this area quit broiler production and a few converted their houses to egg production facilities. Contractors dropped out of business in this area until only two remained active. The local hatchery also ceased production.

The hatchery located in the Greenbrier Valley was not the only hatchery that ceased operation. The number of hatcheries located throughout the State had been declining since 1955. By and large, commercial hatcheries in the State have not been the chief source of broiler chicks placed in the State. For a few hatcheries, broiler chicks were a principal part of their business. Thus, the decline in broiler production alone should not be considered as the entire reason for so many hatcheries closing. However, the decline in broiler placements, plus the age of some hatchery managers, and obsolescence of the equipment and programs were the chief reasons that hatchery numbers decreased so drastically. In 1955, there were 27 hatcheries in the State; in 1960, 14; and in 1965, 6.

In the South Branch Valley area the number of contracting firms appeared to stabilize at around six. However, one large contractor discontinued operations during 1965. The broiler auction, which started at Petersburg about 1955, has continued to function but on a more limited scale as the number of birds declined. Fewer buyers came to the auction. Sometimes buyers went out of business entirely. Another auction that started at Wardensville, West Virginia, struggled for existence from the very beginning, but by 1961 it had failed completely. The management of the dressing plant in the South Branch Valley complained about the need for more birds for efficient operation.

1966

Where does West Virginia stand in broiler production in 1966? There has been a rather startling change in the State's production

during the last 10 years. The late 1950's saw production rise; 27½ million birds were produced in 1959. Then a sudden reversal in numbers began in 1960 which continued through 1964, with a low of just over 17 million birds. This was a decrease in production of over 10 million birds in just five years. Then as suddenly as the decline started, it stopped. In 1965 production started to increase.

During the period of decline, efforts were made to induce producers, contractors, and bankers to take a "new look" at broiler production within the State. Committees have been organized, tours have been conducted to other producing areas, and hopes are again high. However, unless the adoption of the "new look" continues, interregional competition could bring about a return of the decline in production.

Analysis of the production data of 1965 and the early months of 1966 indicates that production numbers will continue upward throughout this year. Although the time interval is short, increased egg settings and broiler placements indicate that production may reach about 19½ million birds this year. Statistical analysis of the data for the past ten years indicates that production will rise slightly above 19 million birds for 1966.

Questionnaires Sent

To ascertain further what is happening in the production of broilers in West Virginia, it was decided to mail a letter to the over 300 pro-

ducers contacted during the 1956-57 study. The letter contained a card for the grower to fill out and return. Certain questions were asked that were indicative of the grower's production status. Twenty-five per cent of the growers responded. Three per cent of the letters were returned for such reasons as: moved, moved without leaving a forwarding address, forwarding address expired unknown, or deceased. A follow-up was made on all growers who did not answer the questionnaires sent to the Greenbrier and South Branch areas. This consisted of a personal visit to the producing contractors, county agricultural agents, and others closely allied with broiler production in each of the areas. The results of efforts to ascertain how many of the 312 producers contacted in the earlier study who were still producing in 1965 are presented in Table 1.

Some of the important features of this table are as follows:

1. Accounting is made for over 80 per cent of the producers of the earlier research studies.

2. Fifty-three per cent of the producers are known to have quit or died.

3. Twenty per cent of the producers could not be accounted for due to such reason as: moved; their contractor has ceased to produce; and they are unknown to present personnel of the industry or have been out of production for so long that their names are not recognizable at the present time.



Production has tended to centralize in areas . . .

4. In the South Branch Valley area the "quitters" were growers of brood sizes of less than 4,000 birds. The earlier research indicated there was a ratio of 4 to 1 for the smallest brood size over the other two group sizes. The quitting ratio is approximately the same as the ratio of the brood sizes that existed in 1956-57.

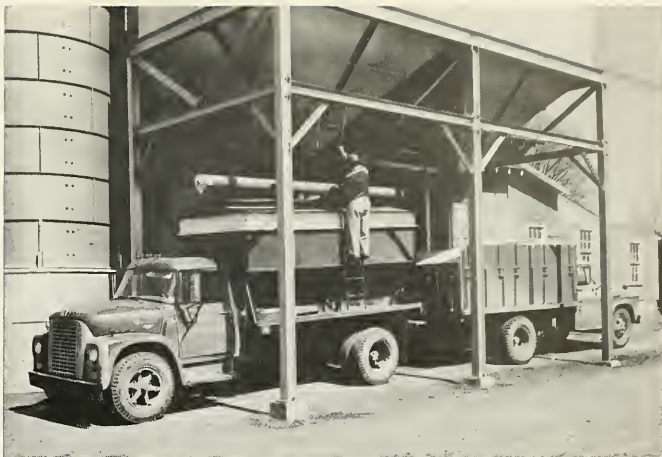
5. In the Greenbrier Valley area the earlier research revealed an almost 1 to 1 ratio between producers in the middle-size brood group (4,000 to 9,999) and those of the other two brood groups taken together. The ratio of quitters by group size indicates the quitting ratio was distributed in the same relationship as was the earlier producing ratios.

6. Approximately 25 per cent of the producers of the Tygart-West Fork Valley are accounted for but the history of the 1960's indicated production in this area was very limited.

Using the mailed response for those who ceased production during the period between 1956 through 1965, the replies indicate that these former producers were responsible for producing over 12 million birds. This figure represents a loss of 45 per cent of the peak production reached in 1959. Since actual production decreased slightly over 10 million birds during this interval and these former growers produced over 12 million birds, it is obvious some of their production facilities were operated by others who were in the business, or more likely, new and modern facilities were constructed to account for the difference in the two figures. It is hoped that new construction accounts for this difference. However, the industry should not be oblivious to the number of growers who quit production and the combined effect of their production that was withdrawn in such a short period of time. There are many out-of-date buildings still being used to produce broilers, and many older producers still growing birds. Both the building and the producer represent potential decreases in production in the not too distant future.

Current Contracts

Although the "Miss America" contract is currently in use, several other contracts are available to the grower. There does not appear to be a single contract universally adopted Statewide at this time. In fact, a single contractor may offer several different sets of contract



Some contractors have modernized their mills and delivery equipment and they no longer accept just any grower who wants to produce broilers.

terms to the growers he services. The grower selects the contract he feels will pay him the most. He may select from the 90-10 fixed shares, "Miss America," guaranteed chick

payment, or some version of the feed-conversion-ratio contract. Such freedom of choice may be a means of quelling grower dissatisfaction or
(continued on page 18)

TABLE 1
Present Production Status of 1956-57 Sample of Broiler Producers by Areas, Brood Size, and Producer Age Group.¹

Area	Brood Size	Age Group (Years)	Production Status (Numbers)				
			Producers	Quit	Dead	Unknown	Total
South Branch Valley	0 to 3,999	20-39	10	24	2	9	45
		40-59	31	45	3	13	92
		60 & over	8	12	7	7	34
		ALL	49	81	12	29	171
	4,000 to 9,999	20-39	5	6	0	1	12
		40-59	12	11	1	1	25
		60 & over	2	1	0	0	3
		ALL	19	18	1	2	40
	10,000 and over	20-39	2	0	0	0	2
		40-59	2	1	0	0	3
60 & over		0	0	0	0	0	
ALL		4	1	0	0	5	
Greenbrier Valley	0 to 3,999	20-39	0	2	1	1	4
		40-59	2	8	1	7	18
		60 & over	0	6	0	0	6
		ALL	2	16	2	8	28
	4,000 to 9,999	20-39	2	11	0	3	16
		40-59	5	10	0	3	18
		60 & over	3	4	0	2	9
		ALL	10	25	0	8	43
	10,000 and over	20-39	0	3	0	1	4
		40-59	0	2	0	0	2
60 & over		0	0	0	0	0	
ALL		0	5	0	1	6	
Tygart-West Fork Valley	ALL	ALL	0	5	0	14	19
Grand Totals			84	151	15	62	312

¹The age grouping used in 1956-57. These people are currently 9 or 10 years older than when originally classified in the groups shown.

Only when the well is
dry do we learn the
value of water

WATER INSURANCE:

FARM ponds are becoming as commonplace on farms as barns and tractors. Some were built to enhance the beauty of the farm but most have been constructed for utilitarian purposes. Water from farm ponds is used for livestock, washing around barns and milking sheds, for irrigation, and for recreational purposes, such as fishing, swimming, and ice skating. In some areas, with treatment, the water is used for domestic household purposes.

Most ponds are constructed to impound surface run-off water during periods of rainfall and snow melt. Such waters, oftentimes, also receive drainage from barns and barnlots and even effluent from the septic tank or overflow from the cesspool. This type of drainage may carry pathogenic bacteria which can enter into the farm pond and be potentially dangerous to humans and animals.

Most of the microorganisms in the run-off, and even in the farm pond water, are harmless soil forms, although some may be classed as nuisance forms. Studies from Ohio State University have shown that ponds may contain certain bacteria which can cause trouble in milk, such as off-flavors and high acidity. These are the thermophilic (heat loving) and thermoduric (survive pasteurization) bacteria. Such bacteria can easily get into milk if untreated pond water is used indiscriminately around barns and milking sheds. The coliform index is used as an indicator of fecal pollution

in domestic drinking water. Using this index, the studies at Ohio State show that farm pond water is a "lightly polluted raw water."

Farm ponds, like artificial and natural lakes, bogs, and soil, in fact all natural habitats, contain indigenous (native) microorganisms. These microbes are involved in the decomposition of organic matter, such as leaves, which blow into the ponds. This decomposition eventually results in the elements being changed from organic to inorganic forms. Similar actions take place in the soil, thereby releasing these elements to be used again by plants. This is a regular cycle in nature, the building up, tearing down, and building up again, the continual reuse of elements. Microorganisms involved in these processes are not pathogenic.

The average number of bacteria per milliliter (about 1/3 teaspoon) in the water of the West Virginia farm ponds studied was approximately 20,000. Many of the bacterial colonies were yellow, red, orange, pink, and blue. The chromogens represented about 35 per cent of the total bacteria in the water. In the bottom sediment, the number of bacteria averaged about 31 million per wet gram (about 1/30 ounce) of sediment. The chromogenic bacteria in the bottom sediment was about 17 per cent of the total bacterial count. The total number of bacteria in the soil surrounding the ponds averaged about 18 million per gram, dry weight. In the soil, the chromogenic bacteria represented about



FARM PONDS

27 per cent of the total organisms.

Algae and, oftentimes, water weeds are found in ponds, also leaves and other like organic materials, that blow or are washed into the ponds by run-off water. Studies were made to determine how rapidly such materials decomposed in the pond water. At room temperature, with gentle shaking, 29.5 per cent of red clover added to pond water decomposed in 22 days. Added straw decomposed slower; only about 9.5 per cent decomposed under the same conditions in 22 days. The decomposition rates of algae and potamogeton (a water weed) were also studied. Algae decomposed at a rate about equal to that of red clover and potamogeton about like straw.

Water-logged organic fragments settle to the bottom of a pond and become a part of the bottom sediment. The sediment not only contains large numbers of bacteria but it also ranged from 1 per cent to better than 8 per cent of organic matter. This would indicate about 0.1 to 0.8 per cent nitrogen. The sediment also contained rather high levels of exchangeable potassium and active phosphorus. The pH levels of all the pond waters and sediments were around neutral.

Dry summer months usually cause a drop in the water level of farm ponds, natural ponds, and sloughs. The high temperatures during these periods, combined with the stagnant conditions, promote the development of certain algae forming a scum on the water which

may be poisonous to livestock. Some of these algae belong to the blue-green group. All blue-green algae, however, are not poisonous, but any pond, even partially covered with scum, should be treated with suspicion. The blue-green algae implicated in livestock poisoning belong to the genera: *Aphanizomenon*, *Anabaena*, *Nodularia*, *Coclosphaerium*, and *Gloeo-trichia*.

Livestock drinking from such ponds often die mysteriously, and the ponds and their water are seldom suspected. Data have accumulated since 1878 which definitely relate the death of livestock to the blooming stage of the algae, especially in standing water.

Dangerous conditions are not too difficult to recognize. When the algae are in the dangerous "bloom stage," the water surface appears as though coated with a layer of blue-green paint. Whenever the wind blows from one direction and causes the algae to accumulate along the banks, *keep your livestock away!*

Good water is the life blood of civilization. As the water table lowers because of droughts and increased demands by industry and cities, wells and other sources of water become unable to satisfy the demands. Under such circumstances the comment by Benjamin Franklin, "Only when the well is dry do we learn the value of water" becomes fully understood. Then the farm pond becomes a valuable asset, a form of water insurance, if properly cared for.

Broiler Change

(continued from page 15)

may be indicative of an industry in a period of flux.

Current Grower Characteristics

Some insight into the future may be gained by further analysis of the mailed card responses.

South Branch Valley

1. Young men (20-39 years of age) indicated that they did not want to produce broilers in small brood sizes. Only two such respondents indicated they would grow birds in lots of less than 10,000 birds.

2. Many small broods with less than 10,000 birds are still produced. These small producers are ill-equipped and the age factor alone will prevent further expansion of their production.

3. A few young men (20-39 years of age) have enlarged their production facilities to substantial sizes (20,000 or more).

Greenbrier Valley

1. Few producers of small broods (less than 4,000 birds) remain in operation.

2. There are few producers of large broods. Several large-volume producers have chosen other alternative enterprises, such as egg production or pullet raising.

3. Present producers of this area have substantial housing and equipment to continue production for several years, provided the scattering of producers does not make the cost of feed delivery too great so that the cost of production becomes unreasonable relative to the market price.

Tygart-West Fork Valley

Little can be said about this area that has not already been said. Production will be limited and almost entirely dependent upon the decisions of one contractor. Without a change of course this area, "for all practical purposes has ceased to effectively exist."³

Decline Explained

A few observations and comments concerning the respondents of the returned questionnaires who have quit production may be in order.

South Branch Valley

1. Many of the young producers (20-39 years of age) have taken em-

ployment elsewhere. These producers indicated a definite lack of modern, labor-saving conveniences.

2. None of the producers of large broods have quit; in fact, the opposite has occurred with the number of large brood producers increasing.

3. Those who quit predominantly gave ill health, and no profit as the reasons for quitting.

4. Growers who have quit indicate that their houses are deteriorating, have been torn down, or are being used as cattle and sheep sheds. These houses could not be used for future production except at great expense. Technological advances would indicate new houses as a better investment.

Greenbrier Valley Area

1. In contrast to the South Branch Valley, most of the houses in this area were more modern. That is, many had furnace heat, mechanical feeders, and bulk bins. Despite these conveniences, producers quit production.

2. Almost the sole explanation given for the cessation of production was low liveweight prices resulting in little or no profit for the producers.

3. The distribution of producers who quit production is fairly proportionate to the distribution of producer numbers by the various group sizes. Producers of large size broods have quit as well as producers of small size broods.

4. The houses of some of the larger producers have been converted to egg production or pullet raising. Many of the houses are idle. These of course, are deteriorating and will be beyond reclaiming for broiler production.

The Future

What is the future for broiler production within the State? Without a marked change in the existing situation, the production of broilers in the Greenbrier Valley has a limited life, probably five years or less. The bases for this observation are: (1) The scarcity of producers and broiler numbers means long feed hauls for contractors, and thus high cost of production, (2) the lack of new producers entering the industry, and (3) attitude of current producers to recover as much of their investment as possible while maintaining only their buildings and equipment means that eventually they will be unable to renew their capital investment and that

they too will discontinue production.

The eventual loss of the Greenbrier Valley area will leave the oldest area of production, the South Branch Valley, and the newest, the Maryland-West Virginia area as the only two producing ones in the State. These two areas differ somewhat in their production characteristics but may become more alike in the future.

The present general trend for many of the smaller and older producers of the South Branch Valley area to quit production is expected to continue. However, there are currently some signs of a "new look" taking place. The number of contractors appears to have stabilized. These contractors have modernized their mills and delivery equipment and no longer accept just any grower who wants to produce broilers. They are more selective in awarding contracts and have also encouraged growers to modernize and up-date their broiler facilities. Production has tended to centralize in areas with one contractor feeding most of the birds in that area. This has eliminated long feed hauls for a few birds and the duplication resulting from several contractors making deliveries in the same area.

Some broiler growers have built additional houses of a modern type and installed mechanical, labor-saving equipment. These growers appear to be headed for large-scale production of at least 20,000 birds at a time or to even larger numbers of 100,000-150,000 birds at a time. Some birds are being produced by individuals, either on their own or in conjunction with some phase of the total integrated process, such as hatcheries or slaughtering plants rather than through contracts with feed mills.

Summary

In summary, it appears the total number of birds produced will be less than 10 year ago, but much larger broods will be grown, centered about some feed mill or a companion part of the industry which approaches more closely the vertically integrated industry.

The production level is not at all clear-cut at this time, but it does appear production will be concentrated in the South Branch Valley and in the Maryland-West Virginia area. The quantity of birds produced will depend (a) upon the extent of the "new look" in one area, and (b) the decisions of one firm in the other area.

³Paraphrase of written personal comments of a member of the staff of Animal Industry and Veterinary Science, 1965.

Hunting Quality

(continued from page 3)

know for each of nine species of wildlife.

The analysis of landowner evaluations reveals that, Statewide, hunting quality is relatively low for eight of nine species of wildlife (see Tables 1 and 2 for landowner evaluations of hunting quality for deer and squirrel). For instance, only 1 per cent of the landowners rank their lands as good or excellent for hunting bear. Comparable percentages are wild turkey 7; quail 15; ruffed grouse 17; deer 27; raccoon 31; rabbit 32; squirrel 36; and groundhog 69.

In spite of these overall conclusions, there are wide variations in the quality of hunting lands among regions of the State and among counties in a given region. For example, 42 per cent of the landowners in the Eastern region indicated that their lands are good or excellent for hunting deer. In comparison, only 8 per cent of the landowners in the Southern region and 16 per cent of those in the Northwestern region rank their lands as good or excellent for hunting deer. Among the counties in the Eastern region the proportion of landowners ranking their lands as above average hunting quality for deer range from a low of 18 per cent in



Map shows regions and sample counties.

Berkeley County to a high of 77 per cent in Hampshire County. In the Northwestern region above average quality ratings for deer range from a low of 8 per cent in Marshall County to a high of 30 per cent in Doddridge County. Similarly, the Southern region ranges from a low of 3 per cent in Lincoln County to 23 per cent in Fayette County.

In addition to deer and wild turkey, the Eastern region has higher quality ratings for ruffed grouse, quail, rabbit, groundhog, and bear than either the Southern or Northwestern regions. The Northwestern region has the highest quality rating for squirrel and raccoon. The Southern region has very low quality hunting lands for all species

TABLE 1
Landowners' Quality Evaluations of Their Lands for Deer Hunting, By County, Sample of West Virginia Landowners, 1965.

Region	Excellent		Good		Average		Below Average		Poor		None		Don't Know	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Berkeley	0	0	14	18	17	22	10	13	15	20	13	17	7	9
Hampshire	39	28	67	49	25	18	2	1	2	1	2	1	1	1
Monroe	2	2	18	17	17	16	11	10	10	9	43	40	6	6
Pendleton	9	8	53	50	30	28	5	5	4	4	6	6	0	0
Pocahontas	3	3	17	19	27	39	9	10	7	8	27	30	1	1
Preston	7	4	62	36	52	30	13	8	14	8	17	10	9	5
EASTERN REGION	60	9	231	33	168	24	50	7	52	8	108	16	24	3
Fayette	4	8	7	15	10	21	3	6	5	10	16	33	3	6
Lincoln	0	0	4	3	13	10	14	11	18	14	55	42	28	21
Wyoming	0	0	2	6	7	21	1	3	1	3	22	67	0	0
SOUTHERN REGION	4	2	13	6	30	14	18	8	24	11	93	44	31	15
Braxton	4	3	23	17	47	35	19	14	12	9	11	8	18	13
Doddridge	4	4	24	26	28	31	14	15	1	1	10	11	10	11
Marshall	1	1	9	7	41	31	29	22	28	21	6	5	19	14
Roane	3	2	13	9	46	31	21	14	17	12	26	18	22	15
NORTHWEST REGION	12	2	69	14	162	32	83	16	58	11	53	10	69	14
TOTAL ALL REGIONS	76	5	313	22	360	25	151	11	134	9	254	18	124	9

TABLE 2

Landowners' Quality Evaluations of Their Lands for Squirrel Hunting, By County, Sample of West Virginia Landowners, 1965.

Region	Excellent		Good		Average		Below Average		Poor		None		Don't Know	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Berkeley	0	0	17	22	19	25	6	8	18	24	10	13	6	8
Hampshire	7	5	49	36	59	43	11	8	6	4	4	3	2	1
Monroe	5	5	32	30	29	27	15	14	13	12	9	8	4	4
Pendleton	12	11	49	46	31	29	5	5	7	7	3	3	0	0
Pocahontas	2	2	26	29	26	29	14	15	15	17	7	8	1	1
Preston	5	3	52	30	49	28	21	12	22	13	16	9	9	5
EASTERN REGION	31	4	225	32	213	31	72	10	81	12	49	7	22	3
Fayette	2	4	14	29	17	35	3	6	2	4	8	17	2	4
Lincoln	0	0	24	18	52	39	25	19	13	10	0	0	18	14
Wyoming	2	6	7	21	11	33	5	15	4	12	4	12	0	0
SOUTHERN REGION	4	2	45	21	89	38	33	15	19	9	12	6	20	9
Bradford	12	9	53	40	40	30	6	5	6	5	3	2	14	10
Doddridge	11	12	27	30	33	36	4	4	3	3	4	4	9	10
Marshall	4	3	26	20	47	35	16	12	20	15	2	2	18	14
Roane	20	14	44	30	43	29	10	7	6	4	7	5	18	12
NORTHWEST REGION	47	9	150	30	163	32	36	7	35	7	16	3	59	12
TOTAL ALL REGIONS	82	6	420	30	456	32	141	10	135	10	77	5	101	7

of wildlife included in the study.

Analysis of variance tests were used to test the significance of these variations in quality ratings between regions and among counties. The results of these tests indicate that differences in quality ratings among counties are statistically significant for each of the nine species of wildlife included in the study.

SUMMARY

In summary, landowner evaluations of hunting quality are in substantial agreement with the conclusion drawn from secondary information that hunting quality on privately owned land is relatively low when considering the entire State. However, these landowner ratings also point out significant differences

in hunting quality among regions of the State. The Eastern region contains higher quality hunting lands than either the Southern or Northwestern regions. It would appear that this more favorable situation in eastern West Virginia is due to a combination of factors such as low population densities, relatively smaller landholdings, more favorable physical environment in the form of vegetation for food and cover, and a larger proportion of land in agricultural uses such as row crops, small grains, hay and pasture.

In view of its location relative to the large metropolitan areas in the eastern United States, and its higher quality hunting lands, the Eastern region currently offers the best

potential of any area in West Virginia for income and employment opportunities through the marketing of hunting rights. At the same time, it will require considerable resources to take advantage of this opportunity.

From the standpoint of private landowner interest, there are three important supply problems which need resolving before hunting can be expected to add substantially to income and employment opportunities. These are: habitat deterioration through natural succession; increasing acreage of publicly owned or leased hunting lands that can be used by hunters free of charge; and the widespread prevalence of anti-hunting fee attitudes among private landowners.

SEAL ADOPTED FOR WVU CENTENNIAL

An official emblem for West Virginia University's 100th Anniversary year, beginning Feb. 7, 1967, and a theme around which the major events of the year will be planned, have been released by the 100th Anniversary Office in Morgantown. The seal, in gold, blue, and white, is the creation of Prof. Benjamin Freedman of the Division of Art; the theme was contributed by Dr. Ruel E. Foster of the Department of English.

The seal contains the words, "West Virginia University, 100 years, 1867-1967," in blue, on a white circle. Inside this, against

a gold field, is a blue, free-hand drawing, representing historic Woodburn Circle on the University's downtown campus in the



foreground, and the new, modern towers of the Evansdale and Medical Center campuses in the distance.

The theme, "Through Changing Knowledge to Enduring Wisdom," represents a basic conviction of those who have planned the celebration thus far.

Donovan H. Bond, executive director of the observance, said the theme will be used as a basis for five symposia, six seminars, and a half-dozen convocations, beginning with a symposium on "The Lessons of History" in February, 1967.

The purpose of this article is two-fold: first, to give an overall picture of the changes which are taking place in the American rural church in general, and second, to present some empirical data which could indicate specific functions of the rural and small town church in West Virginia.

THE CHANGING RURAL CHURCH

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Assimilation and Consolidation

The United States has drawn its various and numerous brands of organized religion from as many lands as its people. There are at least one-hundred Christian groups in West Virginia. Considering this diversity, the recent improvement of means of transportation, rural migration, and the changing role of the church, one should expect that assimilation (which is an already initiated process) and consolidation of rural religious groups will continue. This is manifest in the steady decline of the number of churches, in spite of rapid increases in membership, and in the merging of the churches at all levels—local, regional, and national.

The devise of the "larger Parish" is becoming an accepted instrument. Such a notion would have been unthinkable in earlier days, when denominational competition was at its height.

Today most groups, while maintaining their denominational identity, cooperate in welfare and educational work, at both state and national levels. The grassroots of this trend should, to a large extent, be found in the increased membership and significance of the various ministerial associations and in the achievements of community-wide, church-sponsored activities.

Membership and Participation

Before one discusses membership and participation in the rural church he should first consider the function of the church in the rural society. Many define religion as a response to the need for an organized conception of the universe and to have a mechanism for allaying anxieties. However, the more societies change and become complex, the more the role of the church changes. Such changes or adjustments are necessary for success and survival. In other parts of the country the most important changes refer to the social role of both the church and the minister. Such roles are becoming increasingly important. As data from surveys conducted elsewhere indicate, churches, in rural areas primarily, are introducing more and more secular activities and are becoming more and more involved in community affairs.

One would expect that the opened horizons for the rural family will have an unfavorable effect on their attachment to the church. To a large extent, due to the social activities of the church, the opposite is true. As data presented elsewhere by this author show, the more people interact in the church group, the more they identify themselves with the group and the more they obey its overt norms, regardless of belief.

This approach to religion has allowed survival of the church in a number of rural communities which, as we know, (a) consistently lose population, and (b) their members have better means of reaching larger centers. The drain of persons who support the church, of course, is not without consequences. Adult membership in some rural churches is declining, although this is not true for youngsters of less than 18 years of age. This increase, however, will probably be temporary for areas of high out-migration. There is a considerable number of rural churches today which have only one-third of the 300 members which are considered a suitable congregation. It is obvious that such decline will continue to have influence on the budget, and in turn, the church programs. The lack of programs in turn will influence membership.

The Rural Minister

The minister is an institutional functionary who derives his authority by the position he holds. He changes his role when his position in the rural community is perceived differently. Thus, with the changing rural society the role of the minister is changing. He is more and more realizing that dissemination of the doctrine is only part of his role and that he is expected to strengthen his social role.

Recent surveys show that still most of the rural minister's time goes into preparation and participation for his traditional role. Little time is spent with county agents and other nonchurch leaders and

groups. Nevertheless, more ministers, in anticipation of changing expectations, are requesting more training in the area of human relations, primarily organization of groups.

Rural churches are experiencing a rapid turnover of ministers. Younger ministers are replacing older ministers and these younger ministers remain in their rural post shorter periods of time. However, this rapid turnover of younger ministers does not seem to unfavorably affect the organization of the church. More activities are becoming institutionalized and larger numbers of paid employees are hired to assist in these activities.

Religiosity in West Virginia

Religiosity is usually defined by the extent of the individual's church participation and the strength of his religious beliefs. Data collected from a random sample of male adults in Mineral and Hardy counties of West Virginia indicate strong identification with both these aspects of religiosity. Among the 475 respondents, 52.1 per cent indicated that they attend church frequently, 35.5 per cent occasionally, and only 12.2 per cent do not attend at all. Concerning change in church membership, 11.3 per cent of the respondents indicated that they had changed church; of these, 1.3 per cent changed from sectarian¹ to non-sectarian church membership, but a larger proportion, 2.9 per cent, changed from non-sectarian to sectarian. The remaining 6.1 per cent of those who had changed church membership had remained either sectarian or non-sectarian.

The first three statements of Table 1 indicate strength of belief. Among the 476 respondents, 84.5 per cent indicated that they believe there is a God who hears and answers prayers. Only 2.8 per cent disagreed with this statement; 1.3 per cent disagreed strongly. Similarly, 72.9 per cent believe that there is life after death; however, in comparison to the previous statement, a larger proportion, 11.3 per cent, disagreed with it, and 6.9 per cent disagreed strongly. Finally, a much smaller proportion of respondents agreed with the statement that the world is soon coming to an end; 24.4 per cent strongly agreed with the statement while 43.3 per cent strongly disagreed with it. Those who agreed with this last statement are either members of sectarian churches or members of non-sectarian churches with sectarian tendencies.

The last two questions of Table 1 refer to the function of the church in alleviating anxiety produced by the individual's inability to adjust to a rapidly changing, complex society: 85.7 per cent of

¹Sectarian churches constitute an important aspect of the Appalachian culture and emphasize separation from the world and literary interpretation of the Scriptures. Most of them are premilenarian, emphasizing imminent personal return of Christ to rule for a thousand years. Finally, relationships among members of these churches are intimate.

TABLE 1

Responses to Statements About Belief in God and Dependence on Religion.

Statement	Strong Agreement	Moderate or Slight Agreement	Moderate or Slight Disagreement	Strong Disagreement
I believe there is a God who hears and answers prayers.	84.5% (402)	12.8% (61)	1.5% (7)	1.3% (6)
I believe there is life after death.	72.9% (347)	15.7% (75)	4.4% (21)	6.9% (33)
I believe that the world is soon coming to an end.	24.4% (116)	12.8% (61)	15.9% (76)	43.3% (206)
My faith in God is the best means of forgetting my daily worries.	55.5% (264)	30.2% (134)	7.6% (36)	6.5% (31)
Religion is what actually keeps me going.	35.9% (171)	35.9% (171)	18.3% (87)	9.9% (47)

the respondents agreed with the statement that their faith in God is their best means of forgetting daily worries, and of these, 55.5 per cent agreed strongly; also, 71.8 per cent of the respondents agreed with the statement that religion is what actually keeps them going, and of these, 35.9 per cent agreed strongly.

Summary

These data then indicate that a very important function of religion today, at least in Mineral and Hardy counties, is to help alleviate anxiety which complexity and rapid societal change produce. This speculation is also supported by the data which

indicates that more non-sectarians become sectarians than vice-versa in spite of the fact that formal education, which is known to be associated negatively with the joining of sectarian churches, is increasing in the two counties where this study has been conducted. However, the joining of sectarian churches is known to be a means of alleviating anxiety, which is produced by rapid societal change. For instance, rural migrants who move into the city often reject their institutionalized church to join a sectarian one. Sectarian churches are known to have emotional doctrines and intimate relations among their members which both operate as anxiety relieving mechanisms.

Diets Affect

(continued from page 11)

of energy and many of them improve the palatability of our meals."

In explaining the physiological aspects of her research, Dr. Yearick notes that a specific function of carbohydrate is its protein-sparing action. She said it has been known for a long time that carbohydrates, fed with a minimal protein diet, permit the body to retain more of the nitrogen from the protein, thus improving utilization of the vital protein by the body.

"When eaten, protein is digested to amino acids and absorbed into the blood, which carries them to all the tissues where they are needed," Dr. Yearick said. In her laboratory studies, Dr. Yearick found that tests on young men show consumption of a high-protein meal containing liberal carbohydrates produced less accumulation of amino acids in the blood than those meals containing moderate carbohydrate content.

Dr. Yearick concludes:

"Since the liberal carbohydrate intake did not seem to reduce intestinal absorption of the amino

acids, it would appear that the amino acids were disappearing more rapidly into the tissues."

An extension of the studies at WVU indicates that not all amino acids disappear from the blood at the same rate. This confirms reports of other research workers that the amino acids most needed by the tissues are removed most rapidly from the blood.

Dr. Yearick said her data support another medical theory which states that the amino acid most limiting in a protein is that producing the least increase in the blood, relative to the body's requirement.

From all of this, Dr. Yearick comments that "evidence is accumulating from studies of the inter-relationships of nutrients that no nutrient should be excluded from the optimal diet."

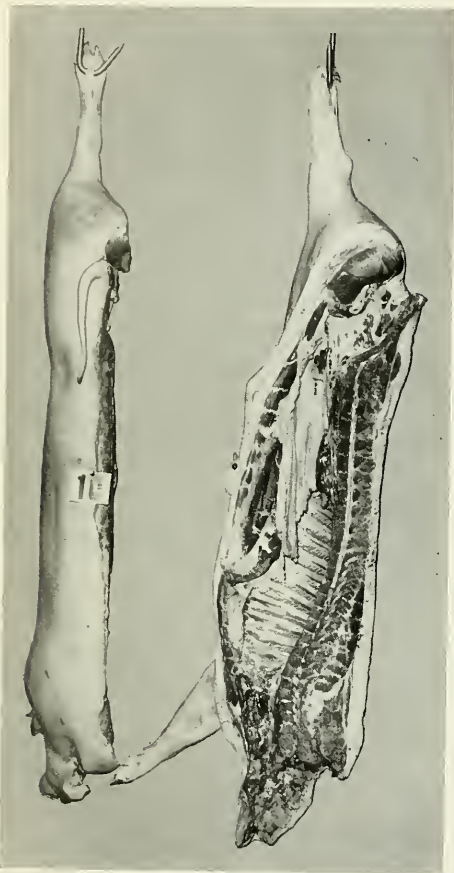
In other words, although fewer carbohydrates in an individual's diet may contribute to some weight loss, there could be a corresponding loss in nutrition that offsets the benefits of a slimmer figure.

The research is continuing, but the lesson already seems apparent. Any dieting procedure should be approved by a doctor to insure proper nutrition during the weight-losing period.

Sex Influences Carcass Characteristics of Swine

Below: This is a desirable pork carcass from a 208-pound gilt; carcass length 31 inches; dressing percentage 75.1; backfat thickness .1 inch; lean cuts 57.7 per cent; ham and loin 38.9 per cent; loin eye area 5.35 square inches.

J. L. McBee, Jr. and D. J. Horvath
Assoc. Animal Husbandmen



MUCH research in swine breeding, selection, and feeding has been conducted in an effort to produce a meatier product. The success of this effort is imperative if pork is to reclaim the share of the consumer's food dollar that its nutritive qualities warrant. Recent work at the Agricultural Experiment Station indicates that sexes may have to be managed differently in order to realize their full genetic potential for red meat production.

Three feeding and slaughter studies, using a total of 114 pigs, have been conducted in recent years to determine the effect of different feeding regimes upon rate and efficiency of gain and carcass characteristics. The animals used were Durocs, Yorkshires, and Duroc-Yorkshire crossbreds. In each trial, approximately equal numbers of barrows and gilts of similar body weight were selected from each litter and allotted to treatment randomly within sex and litter. The pigs were self-fed in concrete floored pens.

Upon reaching approximately 200-225 pounds live weight, the hogs were slaughtered and dressed packer style. The carcasses were chilled at 36° F for 48 hours, at which time weights, measurements, and complete carcass cut-out data were obtained using standardized procedures.

In all three studies, gilts had a significantly greater percentage of lean cuts (ham, loin, picnic, Boston butt) and a significantly lower percentage of fat cuts.

Gilt carcasses had larger loin eyes and less backfat than barrow carcasses. Barrow carcasses dressed out at a slightly higher percentage, due to the excess fat. Carcass length was approximately the same.

Results of the second study showed that barrow carcasses had a significantly higher percentage of ether extract, an indicator of marbling, in the *longissimus dorsi* muscle. No differences were apparent in eating quality as judged by a taste panel.

TABLE 1
The Results of Three Feeding and Slaughter Studies.

Study	Number of Animals	Lean Cuts	Fat Cuts	Longissimus Dorsi Muscle Area (Sq In)	Backfat Thickness (In)	Dressing (Per cent)
		Per cent				
First Study						
Gilts	21	53.7	33.5	4.6	1.32	---
Barrows ...	21	51.5	36.7	3.9	1.49	---
Second Study						
Gilts	18	53.0	35.5	---	---	---
Barrows ...	18	50.6	38.0	---	---	---
Third Study						
Gilts	20	54.3	33.6	4.8	1.53	76.1
Barrows ...	16	50.9	37.1	4.1	1.77	76.7



