RESEARCH IN REVIEW

JANUARY
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UNIVERSITY OF MASSACHUSETTS

VOLUME 1, NUMBER 1. AMHERST, MASS.

From the Director . . .

For the past 70 years the Massachusetts Agricultural Experiment Station has been constantly striving to improve your standard of living.

Since agricultural research is primarily concerned with the solution of problems related to farming and farm living, those of you in the towns and cities may not be aware that these new advances eventually lead to a more healthy and comfortable life for you.

This report from the School of Agriculture and Horticulture of your university is intended to give you a factual and up-to-date story of some of our most outstanding recent research findings in a form that is readily understood.

I am sure that you will find these articles informative and helpful.

Dale H. Sieling

In This Issue

Research In Review

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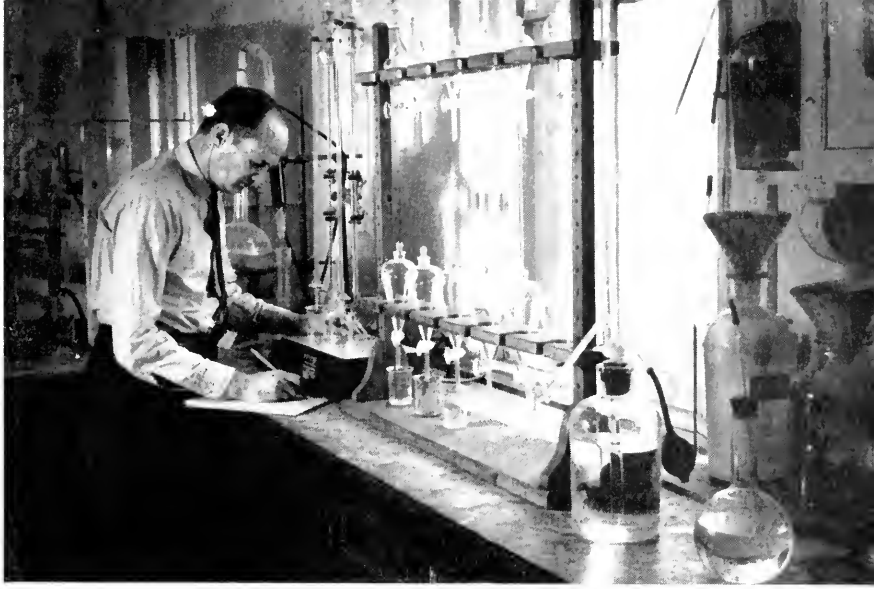
Director—DALE H. SIELING
Editor — PORTIA A. IERARDI

The Cover — School of Agriculture and Horticulture, University of Massachusetts. (Lower left): Stockbridge Hall. (Lower right): State Agricultural Experiment Station, administration building, on campus. (Upper left): Waltham Field Station, substation, Waltham. (Upper right): The Cranberry Station, substation, East Wareham.

Photography by John H. Vondell. Cover Design by Jeane Shreve Kenworthy.

PUBLICATION OF THIS DOCUMENT APPROVED BY GEORGE J. CRONIN, STATE PURCHASING AGENT



The Control Service makes many analyses to protect animal feedstuffs. Here the chemist determines the amount of trace elements in a feed.

MASSACHUSETTS FIRST TO PASS FEED ACT

JOHN W. KUZMESKI ★

IN the early days when farmers raised their own grain for their livestock, there was little need to question the quality of feed. Toward the latter part of the nineteenth century, however, great quantities of various feeds were being shipped into Massachusetts from other states. Among these feeds were by-products from the flour milling, starch, glucose, and linseed and cottonseed oil industries. The products included wheat bran and middlings, corn gluten feed and meal, and cottonseed and linseed oil meals. By 1895, several brands of mixed feed were being manufactured and sold.

The wide differences in the appearance and health of animals eating different lots of supposedly similar feed made it apparent that the nutritive value of the feeds varied even though the labels proclaimed the feeds to be the same. Analysis of some of the feeds at the New England experiment stations indicated considerable variation in composition. For example, in some instances coffee hulls were being added to wheat bran, and ground corn cobs were being blended with wheat middlings. Cottonseed meal, which normally contains over 36 percent protein, often contained only 19 percent protein and was mixed with ground cotton hulls. There were many other instances of similar activities on the part of unscrupulous feed manufacturers.

This problem was thoroughly discussed at a meeting of the New Eng-

★ Head of Feed and Fertilizer Control Services.

land experiment station directors in 1896, and, as a result, in the following year, Massachusetts passed the first feed control law in the country. Other states soon followed suit, until now almost every state has a feed control law.

The first Massachusetts law merely authorized the collection and analysis of feed samples with subsequent publication of results. Inasmuch as no provision was made for a penalty for misbranded feed and the manufacturer was not required to state guarantees, the law was ineffective in restraining the practices of unscrupulous manufacturers.

Chemical analysis and microscopic examination of samples collected from all parts of the state by the feed inspector are now made to determine whether the feeds are correctly labelled.

From Simple to Complex

Until a comparatively few years ago the inspection and analysis of feeds was a relatively simple matter. The manufacturer guaranteed protein, fat, fiber, and carbohydrate or nitrogen-free extract. Before the recognition of the importance of vitamins, trace minerals, drugs, and antibiotics in animal nutrition, the control official had no particular difficulty in substantiating or refuting the manufacturer's claims.

A list of the determinations made by the Control Service now indicates how much times have changed. The list includes tests for moisture, protein, fat, fiber, ash, calcium, cobalt, copper, fluorine, iodine, iron, magnesium, manganese, nickel, phosphorus, salt, sand, zinc, vitamin A, vitamin D, carotene, choline, riboflavin, enheptin, nitrophenide, nitrosal, sulfaquinoxaline, and urea. Microscopic examination includes the identification of feed ingredients and the identification and count of whole noxious weed seeds.

Minerals Vital in Nutrition

You may be wondering about the importance of these factors in animal nutrition and the necessity for making all these determinations. A few examples may explain this.

There are extensive areas in the Northeast known to have soils deficient in cobalt. Other such areas probably will be discovered. Ruminants, such as cattle and sheep, grazing upon the forage in these areas develop loss of appetite and anemia; in extreme cases, the animals die. An unbelievably small amount of cobalt is sufficient to remedy this. It is calculated that one ounce of cobalt distributed daily among 280,000 sheep will maintain good health. At present almost all dairy and sheep rations contain small amounts of added cobalt.

Many of the other minerals mentioned are necessary in larger quantities and play a role in animal nutrition that is just as vital as that of cobalt. Claims are made for the presence of all these minerals in

Obtaining a feed sample. Feeds must be labelled and registered before sold.

The microscope is invaluable for identifying ingredients and harmful weed seeds in feeds.

mixed feeds, mineral supplements, and animal tonics. To prevent the use of exaggerated claims, analysis of the products is necessary.

Animal Diet Superior

We all know that vitamins are necessary in the human diet. Vitamins in animal feeds are just as important. Commercial feeds provide animals with a far more adequate and a far better balanced diet than the diet of most humans. No stone is left unturned by research workers in their zeal to produce a feed composed of ingredients so scientifically blended that not a single nutritional factor is lacking. By comparison, the human diet is usually a haphazard collection of food items that may or may not provide the required amounts of vitamins and minerals. Of course, a daily fare of dairy ration or poultry mash would hardly be an attractive dish for humans.

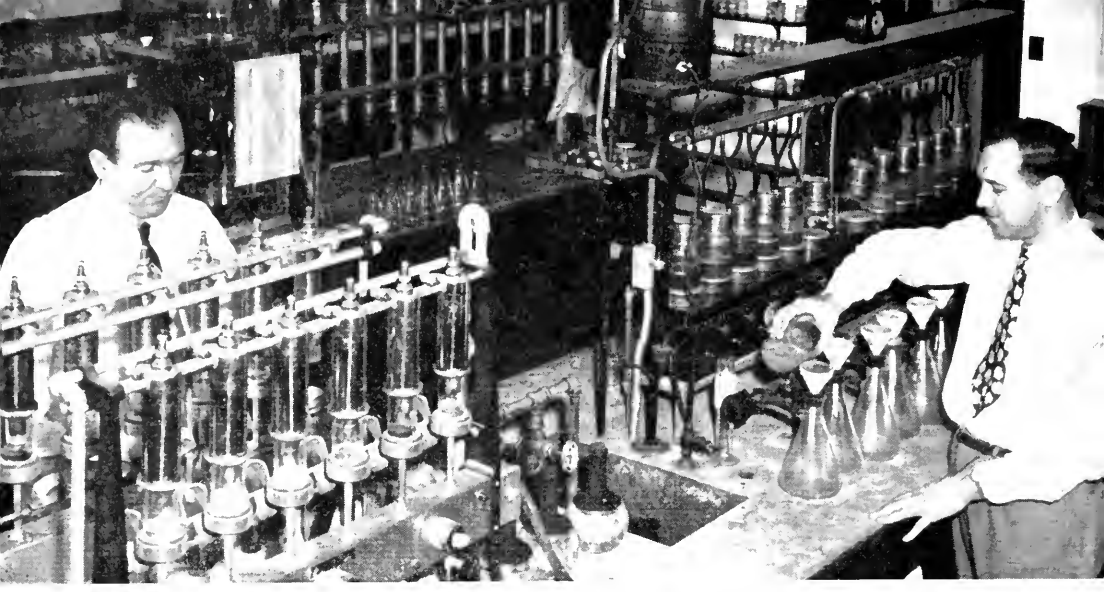
Many Samples Analyzed

Drugs, including nitrophenide and sulfaquinoxaline, are used in poultry rations to prevent such diseases as coccidiosis. Enheptin, for example, is added to turkey feeds to prevent blackhead disease. Other drugs such as nitrosal act as growth stimulants as well.

Most of these drugs are effective only when present in concentrations that can vary only slightly. If too little of the drug is present, it does not produce the desired effect. On the other hand, if present in only a moderate excess over the guaranteed amount, the drugs may be toxic. Since some of the drugs are present in amounts of only .0125 percent, it is a difficult task to mix the drug into the feed so that it is uniformly distributed. Some of the drugs deteriorate if the feed is stored for a considerable time. Therefore, it is frequently necessary to analyze feeds containing drugs to make certain that neither too little nor too much of the drug is present.

Each year the Control Service receives many samples of feed suspected of being deficient in vitamins or some other nutritional factor or of causing the death of livestock because of the presence of toxic ingredients. Sometimes the stomach contents and viscera of dead animals are submitted for analysis in cases of suspected poisoning. These samples necessitate tests for such chemicals as arsenic, lead, cyanide, DDT, and parathion.

The state institutions that have poultry or livestock buy feeds that must be mixed by contractors according to specifications given by the state purchasing agent. The Control Service receives over 1000 feed samples a year from the lots delivered to these institutions. These feeds are examined microscopically and tested chemically whenever necessary. They are accepted or re-



Analyzing feed for fat, fiber, and protein content. Less than a cent for each 100-pound bag of feed sold pays for an analysis.

jected on the recommendation of the Control Service.

It is fortunate that the manufacturers of laboratory equipment have kept pace with the requirements of the analytical chemists. If it were not for some of the modern analytical tools that the Control Service has, it would not be possible to furnish the service now rendered without greatly increasing the number of chemists. Considered invaluable is such equipment as the Beckman Quartz Spectrophotometer which has an ultraviolet light attachment for the determination of vitamin A, a fluorescence attachment for riboflavin determination, and a flame photometer attachment for the determination of minerals in feeds and fertilizers. Other equipment, such as the electrometers and stereoscopic microscopes, enable the control chemist to obtain not only quicker results but also more accurate determinations. The Control Service is constantly seeking better analytical methods that can be adapted to feed and fertilizer control work.

Advances Bring More Problems

We have mentioned some of the problems with which the control official is confronted as the result of advances in the field of animal nutrition. Although the appearance of the new drugs, vitamins, and other dietary factors has presented the control official with analytical problems, the feed manufacturer is faced with perhaps even greater problems involving mixing and keeping qualities and handling of some of these materials. Unless the manufacturer of mixed feeds buys accurately pre-mixed supplements or concentrates, he will have the problem of properly blending the minerals, vitamins, and drugs with the usual feed ingredients. To obtain a uniform feed mixture requires not only costly equipment but also the technical "know-how" to operate such equipment efficiently.

(continued on page 15)

OK TO STORE CLEANED EGGS

JAMES E. FULLER AND WALTER C. FLANDERS ★

SINCE Mr. and Mrs. Consumer are insisting more and more on neat, attractive food displays, eggs are not acceptable for market until they have been cleaned. The use of germicides for cleaning eggs is prohibited by law in many states; therefore most of the cleaning is done by washing, with or without soap, or by sanding. The wash water cannot be very warm because too much heat might partially cook the egg. For sanding, a type of sand-blasting is used.

Egg shells contain pores filled with a mucilaginous substance that allows air to pass into the egg but resists the passage of microorganisms. Washing or sanding will remove this protective substance.

To find out the extent to which microorganisms will penetrate through cleaned shells, eggs from the University poultry flocks were examined after their removal from nests. Only an occasional egg was found to contain bacteria. Both uncleaned eggs and eggs cleaned by the methods mentioned were stored dry for several weeks under normal cold-storage conditions. No bacteria were found inside the eggs. Other eggs were immersed in nutrient broth and held at room temperature to allow bacteria on their shells to grow and to penetrate the egg if possible.

Bacteria penetrated cleaned egg shells to a greater extent than the uncleaned shells; however, bacteria invaded all eggs in substantial numbers. From the results of the investigation, then, it would seem that eggs in dry storage would be in little danger of contamination from bacteria on the shells, whether the eggs were uncleaned or were cleaned by washing or sanding.

Eggs are washed by placing them loosely in wire baskets which are then immersed in warm water and soap.

★ Dr. Fuller, Research Professor, Bacteriology, assisted by W. C. Flanders, graduate student.

NEW HORMONE FOR APPLE DROP

F. W. SOUTHWICK ★

McINTOSH apple trees have graced the rugged hillsides of New England for many years, lending a natural beauty to their surroundings. Unfortunately, this succulent variety is very apt to drop one-fifth or more of its crop just before harvesttime. Since the McIntosh makes up 70 percent of the present commercial apple crop, it is easy to understand, then, how economically important it is to avoid as much loss as possible.

2,4,5-TCPPA Superior

With a view towards solving the apple drop problem, the Station has been carrying on tests for the past year to compare the effectiveness of a new hormone with that of NAA (naphthaleneacetic acid) in the control of apple drop. This new hormone goes by the impressive name of trichlorophenoxypropionic acid, better known as 2,4,5-TCPPA. It seems that 2,4,5-TCPPA will control drop for a longer period and can be applied slightly earlier than NAA materials.

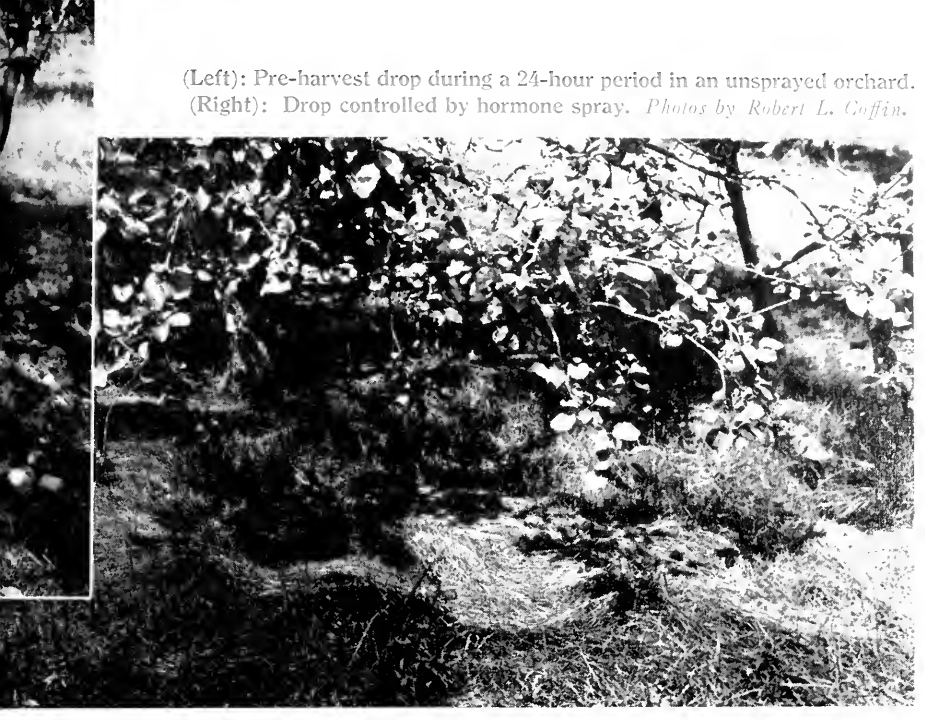
According to tests with McIntosh apples, if the new hormone is applied at the same time or up to a week before NAA materials are normally applied, it will give the best drop control. If applied two weeks ahead of NAA (usually about the last day in August in Massachusetts), it tends to "run out" at about the same time as NAA applied about two weeks later. These results definitely point to the superiority of 20 parts per million of 2,4,5-TCPPA over NAA, if it is applied at the same time or four to seven days ahead of the sound fruit drop.

Hormone Reaction Varies

When applied three weeks or more before harvest, the new hormone may improve surface red color and hasten fruit maturity. Late treatments of 2,4,5-TCPPA (at the time or less than a week ahead of

★ Research Professor, Pomology.

(Left): Pre-harvest drop during a 24-hour period in an unsprayed orchard. (Right): Drop controlled by hormone spray. *Photos by Robert L. Coffin.*



NAA applications) did not hasten maturity as much as the earlier treatments and had little or no effect on red color development. Where late August treatments of 2,4,5-TCPPA were made on McIntosh, it was possible to find apples fully red and ripe on the trees three weeks later. Such apples often contained water core and were obviously unfit for storage. In Gravenstein and in Golden Delicious treated three and five weeks before harvest, respectively, the ripening effect of 2,4,5-TCPPA was not uniform on the sprayed trees. Some fruits were well colored and overmature, whereas others were still green and immature on the same tree. Also, the same variety in different orchards did not always respond to this hormone in the same way for color and maturity.

Time Element Important

It would seem, then, that we should consider carefully the wisdom of using 2,4,5-TCPPA on large acreages of McIntosh, even though it may be the best drop control material available. If the fruits sprayed with this hormone are not harvested within approximately two weeks after treatment, especially if temperatures are high during the harvesting season, growers may find themselves with some highly colored but soft fruit with a short marketable life. Since NAA materials can also hasten maturity to a lesser extent, fruit sprayed with either material should not be allowed to hang too long.

If satisfactory results are being attained with NAA materials, there would be no reason to discontinue their use for the control of apple drop. If not, however, 2,4,5-TCPPA is a superior substitute for drop control when properly timed. We should, of course, recognize its potential effect on maturity and harvest the crop accordingly. If hastened maturity is the aim, then this new material offers some interesting possibilities along this line, especially with early varieties.

WEATHER-HAY AND STORAGE

JOHN G. ARCHIBALD ★

THREE years of hay curing studies have brought out the interesting fact that weather during the growing season before the crop is cut has little influence on the chemical composition of the crop.

The picture changes when we consider weather during the curing process, that is, between cutting time and storage. A moderate amount of rainfall (one inch or less) apparently has little, if any, adverse effect on the nutrients in hay, especially if it rains before the hay has dried out to any extent. Too much rainfall, however, will cause great losses of sugar, and overexposure to bright sunlight will destroy the carotene. Protein content is not greatly affected by weather.

The losses taking place after the hay has been stored are possibly of greater significance than the changes and losses during curing. In storage, carotene losses are greatest and most marked during the first week, continuing at a somewhat slower rate until the hay is fed out several months later. Losses of sugar are also high, taking place entirely during the first month of storage. Here again protein content of the hay is not materially affected.

Studies were made to compare barn-dried hay (dried over a forced draft of air) with field-dried hay. Although barn-dried hay was slightly higher in protein, sugar, and carotene at the time of storage, by the time the hay was fed out, these differences had disappeared almost completely. Eight cows fed both barn-dried and field-dried hay from the same field for four months during two winter seasons produced the same amount of milk.

Critical Stage in Barn-drying

Although barn-drying does have certain definite advantages, farmers are warned against expecting too much of it. It is very easy to ruin good hay by storing it too damp or by faulty operation of an air blower. For example, a lot of alfalfa was baled for barn-drying but left on a wagon for a week before putting it over the drier. A second lot from the same field was baled and put over the drier at once. A few weeks later the sugar content of the first lot was 2.1 percent, whereas that of the second was 7.1; the carotene content was 6 and 65 parts per million, respectively. In another instance some excellent quality legume hay was baled and placed over a drier, and it was later discovered that only a fraction of the amount of air was being delivered by the blower because of belt slippage. Meanwhile sugar content dropped 6.5 to 2.6, and carotene dropped from 75 to 13 parts per million.

★ Research Professor, Animal Husbandry.

The first few days or maybe hours in the barn-drying process are critical. Hay not kept cool at this time will ferment greatly and lose most of its sugar and carotene.

Losses of valuable constituents in storage, especially of carotene and sugar, are higher, even under relatively favorable conditions. If hay has been stored too damp or if the blower does not supply sufficient air to do the job in a reasonable length of time, losses are high.

Even in ordinary storage when drying has been completed in the field, losses are inevitable under present day conditions.

First Cutting for Silage

Because no methods of hay storage have as yet been developed on a practical scale, farmers would do well to look into the possibilities of storing a maximum tonnage of their first cutting of grass as silage. Such a procedure has several advantages.

1. Losses of valuable nutrients are kept at a minimum in well-made silage.

2. Grass for silage is removed from the field almost as soon as cut, allowing growth of the second crop to begin sooner. This assures more tonnage of second cutting and the possibility of a third cutting, especially with a crop such as alfalfa.

3. If some dry hay is desired to feed along with the first crop silage, the weather is usually much better for haymaking when the second crop is ready than it is for the first crop.

4. Second and third cuttings of any hay crop are much more palatable and nutritious than the first cutting. The coarse, rank growth of the first cutting, especially if the crop has been well fertilized, makes much better silage than hay.

Trench Silo Good Substitute

For those farmers who do not have silo capacity enough for such a system of storage or who do not have a silo at all, the trench silo is being successfully used in this state.

If a considerable acreage of first cutting is still left to be made into hay, the process may be speeded up by using a barn drier. Both ensiling and barn drying make it possible to harvest all the first crop of hay by the end of June regardless of the weather, with the further advantage that a minimum of overripe, fibrous, unpalatable hay will be left to be discarded.

The trench silo on the left, built in 1944, is the first of the 160 trench silos in the state. On the right, a tractor helps to pack down silage in a recently constructed trench silo. A removable aluminum roof will be used as a cover. *Photos by Ralph W. Donaldson.*

Broodiness In Rhode

Though no different in appearance from other Rhode Island Reds, this one can be depended upon not to sit.

BROODINESS in hens (sitting on eggs for the purpose of hatching) is of great economic concern to poultry men because each broody period means a loss of about 15 days of egg laying. The instinct to sit is almost universal in the American breeds. This depressing effect on egg production results in extra labor and equipment to "break up" broody hens. To discourage this tendency to sit, hens are removed for three or four days to slatted-floored coops.

Since the beginning of this century, research has been directed towards reducing the incidence of broodiness in most flocks. In 1913 the breeding of Rhode Island Reds for high egg production was begun at this Station. The first generation of pullets laid an average of 114 eggs in the first year; 90 percent of all the birds went broody one or more times in that year.

Breeding Procedure

Complete families of pullets were trapnested for a full laying year without culling, that is, without discarding inferior or defective birds. (Trapnesting is an effective method of obtaining an accurate egg record of each bird.) Each generation was produced by mating birds within the line, but close inbreeding was avoided. From 90 to 100 pedigreed pullets were trapnested each year for a complete record. This method of breeding reduced the incidence of broodiness to as low as one percent but never completely eliminated the instinct.

Hormones Injected

Since the hormone prolactin increases in concentration during broody periods and has been made to induce broody behavior, all females in our nonbroody line were tested by prolactin injections. It was assumed that prolactin would induce broody behavior in those females carrying the inherited tendency for broodiness.

Tests began in the summer of 1947. Hens usually reacted by not laying for about 15 days. None of the birds actually became broody, and many did not react at all. Those females showing little or no reaction were used as breeders the next year.

Tests were repeated the following summer, and breeders selected in the same manner as in the previous year. The complete absence of broodiness in the last three generations is sufficient evidence that the hormone test was satisfactory in helping to eliminate completely the

★ Research Professor, Poultry Husbandry

Eradicated Island Reds

F. A. HAYS ★

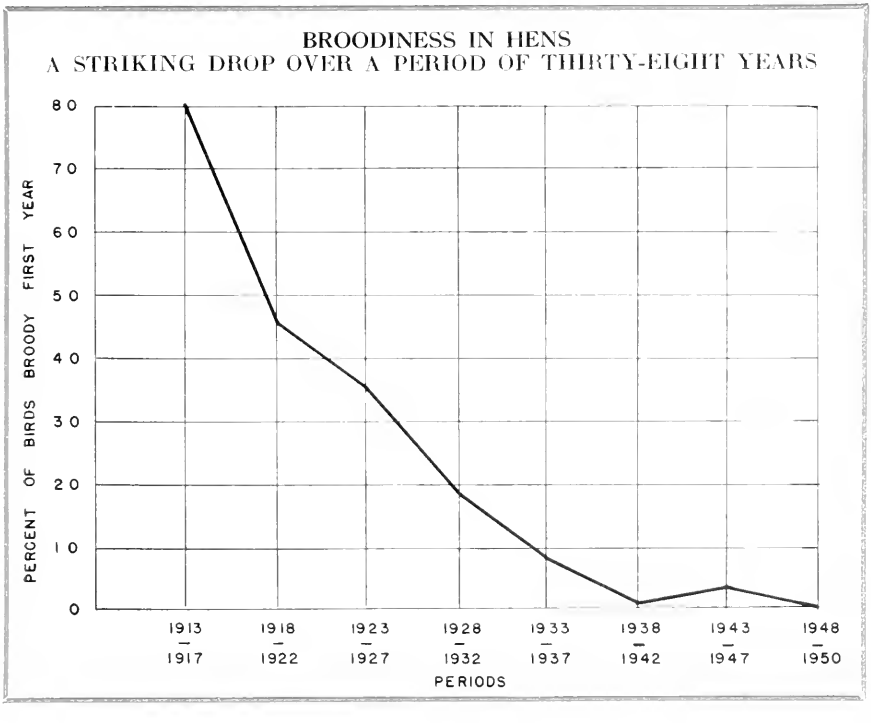
broody instinct in Rhode Island Reds.

Crossing No Problem

The crossing of two breeds or strains that are relatively low in broodiness may give excessive broodiness in the cross. Many good strains, therefore, cannot be profitably crossed for egg and meat production. This problem has led to the expensive procedure of testing many crosses to discover a cross that will give the best results.

A genetically nonbroody breed or line may now be safely crossed with any other line without the danger of increasing the incidence of broodiness. Such a nonbroody line can be improved to such a high degree that it will contribute the best characters to any cross.

This hen is being injected with prolactin which will reveal whether or not she has broody instincts.



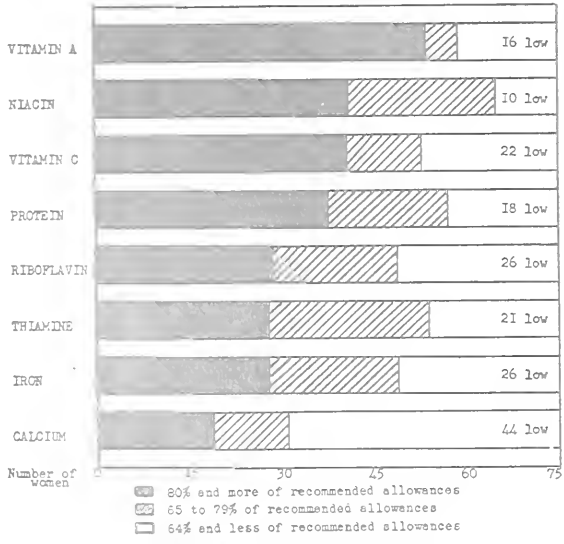
DIET OF EXPECTANT MOTHERS *not up to par*

ANNE WERTZ ★

GOOD nutrition is more essential and nutritional deficiencies are more serious in times of physiologic stress. Pregnancy is a period of special interest because the mother must now place more emphasis on the high quality of her diet in order to have the proper building materials for the growth of her child.

The methods followed to study the nutritional status of expectant mothers and its relationship to the health of the mother and child involve dietary studies, biochemical analyses of blood and urine, and medical examinations of both mother and child. Although this study has not yet been completed, several interesting facts have already become evident in the course of the work.

Amounts of nutrients received by mothers, according to the Recommended Daily Allowances.



Just what an individual eats, and how much, is not easily determined. If the food intake of a homemaker is obtained by an interview between the homemaker and a dietitian, the homemaker usually overestimates the amount of food that she eats in comparison with an actual record of the food eaten. Since the daily amount of nutrients consumed by an individual varies, the food records must be kept for several days to obtain a more accurate picture of the food intake.

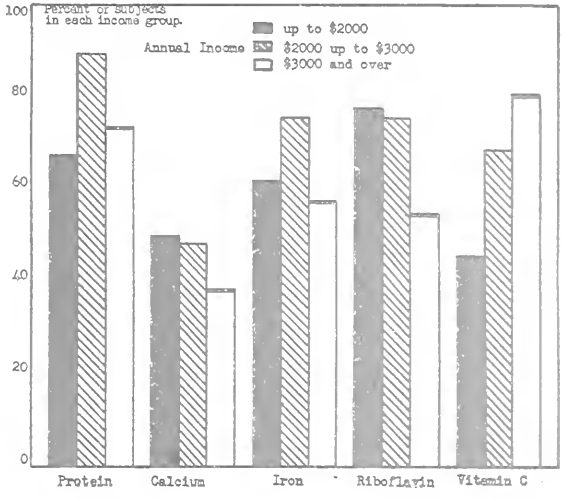
Many Diets Low

Dietary habits of 75 expectant mothers have been studied at least for two, and usually for three, seven-day periods. The allowances for nutrients by the National Research Council as ideal levels at which to aim should not be interpreted to mean that failure to attain these levels indicates a state of malnutrition. These allowances were arbitrarily divided into three groups merely for the purpose of comparison and do not represent a definite standard. Only one woman of the 75 studied consumed a diet that contained the recommended amount of nutrients for women in the latter half of pregnancy. Two other women met the recommended daily allowance in all nutrients except calcium. Many of the diets were low in several of the eight nutrients

★ Research Professor, Home Economics.

studied but were more adequate in niacin and vitamins A and C than in any of the other nutrients. Less than half the number of women studied consumed 80 percent or more of the recommended allowances of calcium, iron, thiamine, and riboflavin.

Many diets could have been brought up to the adequate level by the addition of milk and meat or other foods in small amounts; however, some of the diets were so grossly inadequate that quite drastic changes should have been made.



The graph is based on the number in each income group receiving 65 percent or more of recommended allowances.

Income and Diet Not Related

With the idea in mind that the adequacy of the mother's diet might be directly dependent upon the income of the family, or more closely upon the amount spent for food for each person in the family, a study was made of the mother's diet in relation to the amount of money spent for food. About 25 percent of the families had an annual income of less than $2000; about 40 percent, an income of $2000 to $3000; and about 35 percent, an income of $3000 to $5000 and over. A study of food intakes for each of these groups indicated adequate as well as inadequate diets at all levels of income. Ascorbic acid was the only nutrient that seemed to be more adequate in the higher income group — a possible reflection on the amount of citrus fruit or fruit juice purchased. The education and interest of the homemaker in nutrition rather than the amount of money available for food seem to determine what she buys.

Slight Clinical Signs Apparent

Laboratory studies on blood samples during pregnancy indicate that high hemoglobin values are less prevalent, probably because of a low dietary intake of protein and iron.

Although this study has not been completed, it is evident that several of the women studied showed some clinical signs (usually to a slight degree) during pregnancy that might be attributed to an insufficient amount of some of the food nutrients in their diets.

(continued from page 6)

Manufacturers Do Good Job

The manufacturer's concern does not end with the knowledge that the feed has been properly mixed. Some of the ingredients used would deteriorate comparatively quickly during storage if precautions were not taken to prevent this. By the use of anti-oxidants and other means, the manufacturer prolongs the keeping qualities of the less stable ingredients so that the mixed feed, even after a reasonable period of storage, still contains all nutritional factors in adequate amounts. The fact that so few guarantees are found seriously out of line is a tribute to the ability and resourcefulness of those engaged in the production of feeds.

THE SPIRIT OF RESEARCH

"Research means different things to people in different walks of life. American industry does not need to be convinced of the importance of research. On every hand we see what patient fact-finding has done to improve everyday existence. The laborer of today enjoys luxuries denied kings less than 50 years ago, largely through contributions of science to the conveniences of life, which most of us already regard as necessities. The skeptic may tell you that research consists of proving the obvious in a most thorough manner by laborious means. The most fundamental requisite of a research project is the *idea*. A disciplined imagination is at the bottom of every great discovery. The researcher must be looking for something. He may not know exactly what he is looking for, but he knows enough about the situation to recognize the presence of an unsolved problem. A person with an idea and who also possesses a capacity for critical analysis is at least partially equipped to solve the problem. If, in addition, he is a master of a method or procedure which can be used in the investigation, the chances of success are even more promising. Frequently, however, these two abilities are not associated in the same person. The obvious conclusion, therefore, is that for the most successful prosecution of research, it is necessary to combine the talents of two or more scientists or technologists, so that a fusion of effort may more speedily yield success to the research project.

Research is still an open field with opportunity for all—both the brilliant scholar and the industrious plugger. Research builds on foundations already constructed by others who have gone before. Sir Isaac Newton paid a lasting tribute to his predecessors when he said that if he saw a little farther than others it was because he stood on giant shoulders. The challenge is ours to provide the shoulders on which the future investigator will stand and from which he, in turn, will peer beyond the present horizons of knowledge into the great unknown. That is the spirit of research."

—Carl R. Fellers

Part of an address delivered by Dr. Carl R. Fellers, Head of the Food Technology Department, when he was presented the Stephen Babcock Award in 1950 for his notable contributions in the field of food technology.

RESEARCH IN REVIEW

Vol. 1 University of Massachusetts Amherst No. 2

From the Director . . .

Information obtained through research today becomes the foundation for better living tomorrow. Present discoveries may have practical application or offer fundamental information upon which even greater discoveries are based. Many commodities that we take for granted were born in the research of yesterday.

The articles in this issue reflect some of the work carried on by the School of Agriculture and Horticulture in the research program at your state university.

Dale H. Sieling

In This Issue

Research In Review

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Director—DALE H. SIELING
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COVER: A microscopic view of diseased lung tissue taken from a chicken infected with chronic respiratory disease. Magnification 240 diameters.—*Photo by Jack E. Gray.*

Photography, John H. Vondell. Drawings, pp. 10-11, courtesy National Dairy Council, Chicago, Ill.

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Fig. 1. Veterinary research is constantly in the fight against diseases that affect animals. Here the chronic respiratory disease agent is being isolated and propagated in embryonating eggs.

CHRONIC RESPIRATORY DISEASE

a serious problem in poultry health

By H. VAN ROEKEL and O. M. OLESIUK *

RESPIRATORY infections in poultry have become a major threat to the poultry industry during the past twenty years. Even though these infections have the same symptoms and lesions, laboratory investigations have now identified them as distinct and specific diseases, thus making possible the development of effective control methods.

Within recent years a new respiratory disease has been identified among poultry in Massachusetts. It differs from infectious bronchitis and Newcastle disease in that its rate of spread through a flock is slow and its course is of long standing. Because of these features it has been called "chronic respiratory disease."

Viral-like Agent

The identification of the disease is economically important to the poultry industry. At present, it has been identified in widely scattered areas in the United States but its distribution and prevalence are not known.

The disease is caused by a viral-like agent, the nature of which is not fully understood. It is difficult to study the behavior and characteristics of this agent because it is not readily isolated in embryonating eggs or in special culture media.

* Dr. Van Roekel, Research Professor, Veterinary Science, assisted by O. M. Olesiuk, Assistant Research Professor.

In Massachusetts the disease seems to be frequent in growing and mature chickens and has not as yet been identified in chick flocks. The predominating symptoms were respiratory râles (wheezing), nasal discharge, decreased feed consumption, loss in body weight, and a decline of 10 to 40 percent in egg production. The severity and persistence of these symptoms varied markedly. The resumption of normal egg production was very slow, and sometimes did not return to normal. Sexual maturity was delayed somewhat in birds affected before they had begun to lay. Later, the initial production rate was low for a prolonged period. Egg quality in affected birds was usually normal, but sometimes changed slightly in color and texture. In some instances fertility was affected, especially if the breeding males were infected. Sometimes hatchability and survival of the chicks were lowered, and feed consumption declined 10 to 20 percent. Climatic conditions seemed to influence the severity of the symptoms.

Spread of Disease Not General

The disease may appear on the same premises from year to year. Sometimes the disease did not appear to spread to the mature birds that had been on the premises for one or more years, but was common in birds that had been exposed to either Newcastle disease or infectious bronchitis vaccines. In many cases the infection spread slowly and appeared to be confined to certain pens of birds in the flock. Few deaths, however, among mature chickens seemed to be caused directly by the disease. In growing birds, four weeks or older, mortality as high as 35 percent has been observed.

In several flocks of chickens and turkeys on the same premises, infectious sinusitis was diagnosed in the turkeys, and chronic respiratory disease in the chickens. Since the agents causing chronic respiratory disease and infectious sinusitis have many characteristics in common, further investigation is necessary to determine whether both diseases are caused by the same agent.

During the past year the disease has been identified in approximately 70 flocks. A critical study of the birds from these flocks revealed that 90 percent manifested respiratory symptoms. Tracheal râles were observed most frequently. On post-mortem, most birds revealed a tracheitis (infection of the windpipe) and an aerosacculitis (infection of the air sacs) manifested, usually, by thick, opaque air sac membranes, which might be coated with a yellowish creamy exudate (discharge).

More recently, the chronic respiratory disease agent has been identi-

Fig. 2. Distended sinuses, partly closed eyelids, and nasal discharge add up to chronic respiratory disease and one sick poult.

Photo by Robert L. Coffin.

Fig. 3. The frothy mucus in the eye of this Rhode Island Red is another sign of chronic respiratory disease.

Photo by Robert L. Coffin.

fied in dead and live embryos and cull chicks (four days or less in age) obtained from commercial breeding flocks affected with the disease. These findings may appear significant from the standpoint of the dissemination of the disease, if infected breeding flocks are used to supply flock replacements or fertile eggs for the production of live vaccines for poultry. More evidence must be obtained to establish the fact that this disease can be spread through the egg.

Identification Difficult

A positive identification of the disease is difficult. An accurate diagnosis can be approached by obtaining an adequate flock history, isolating the agent in embryos, and reproducing the disease in chickens.

It has been found that infectious exudates from the tracheae and air sacs of affected birds, when inoculated into embryonating eggs, will produce embryo mortality and embryo lesions. The fact that the lesions, in some instances, appear specific for this agent is an aid in its identification.

When the infectious agent is inoculated into chickens or turkeys by way of the sinus or trachea, a sinusitis usually follows, and frequently a tracheitis is observed. Extensive air sac infection is usually found in inoculated chickens. These symptoms and lesions do not become evident for several days (7 to 14) after inoculation with the agent. When infectious material is inoculated into birds immune to infectious bronchitis and Newcastle disease, it has been found that a definite diagnosis of this disease can be obtained generally within two weeks. Since these methods and observations have helped greatly in the identification of the disease in commercial flocks, the flock owner is able to deal with this problem more intelligently.

Streptomycin Effective

During the past year it has also been observed that the chronic respiratory disease agent is inhibited by some of the antibiotics. Streptomycin has been effective in reducing sinusitis in turkeys, whether the infection was caused by the turkey sinusitis or chronic respiratory disease agents. Further investigation is necessary to determine the true value of the various antibiotics in practical control of chronic respiratory disease outbreaks. At the present time, disposal of affected flocks appears to be the only means of controlling the disease.

POTATO *Consumption*

hits 40,000,000 mark

By ROBERT A. FITZPATRICK *

FORTY MILLION POUNDS of potatoes a month — this is the unbelievable amount demanded by the people of Massachusetts. Thus is created the potato market, the broad outline of which is easily seen, but the fine details are not only often obscure but always changeful. One state alone cannot supply this need, because potato production in the United States is widely scattered and seasonal. Consequently, in some years, as many as thirty-five states and four Canadian provinces may ship potatoes to Massachusetts. Competition among these areas for a share in the market establishes a pattern of marketing, and when supply and demand are free to operate, each area can estimate its position in the market relative to other areas.

What happens, however, when the market is neither wholly competitive nor wholly controlled, as in a period of price supports? And what happens when freight rates are changed frequently in a short time? How are the details in the marketing pattern changed? The final answers to these questions, at this stage of the research, are not drawn up, but results to date are highly provocative.

In following the course of these will-o'-the-wisp changes in marketing patterns, studies of potatoes unloaded at Boston from 1939 to 1950 have been made. In the early years of the period, ruling competitive forces set up a typical marketing scheme. This pattern, described in terms of percents of total carlot unloads each month at Boston, is illustrated in the accompanying graph.

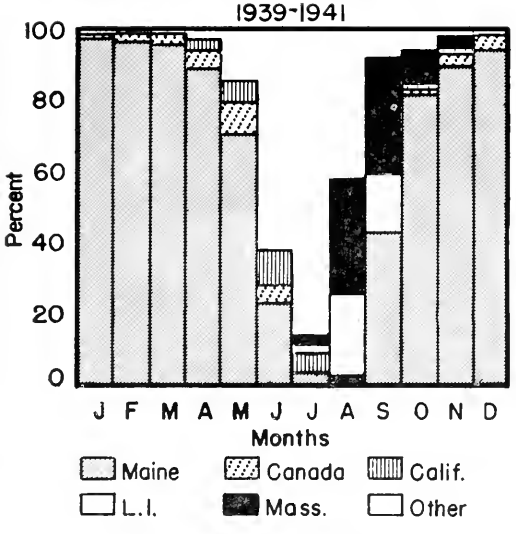
Massachusetts Ideally Located

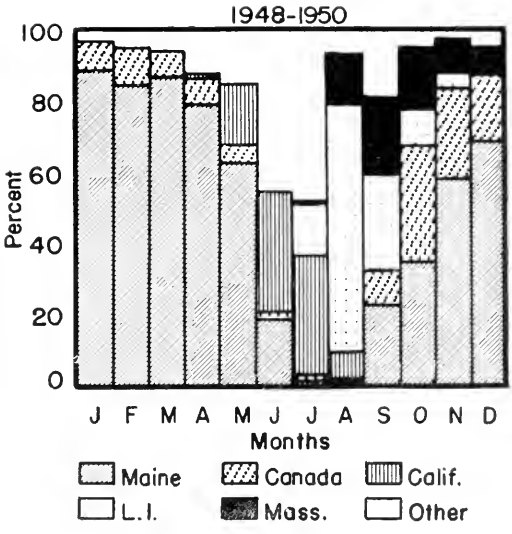
It can be seen that each state, or groups of similar producing states had a place in the market for a well-defined period. Maine was the leading supplier from October to the following May. Then, as the old crop supplies petered out, the new crop from Florida and the Carolinas (included in "Other" in the graph) helped to meet the demand. As harvest moved northward, these states were superseded by Virginia, Maryland, and New Jersey (also included in "Other"). With the decline of receipts from these states, the new crop shipments from Maine and the other late areas began. Massachusetts, by virtue of its location, had a definite place in the market, between the southern states and other late states, and marketed the bulk of its crop in a few months. Canada, California, and Long Island were of minor importance, although new land was being brought into production in Long Island.

Legislation Affects Production

Between 1943 and 1950, striking changes occurred in the production and marketing of potatoes in the country. The war promoted the

* Assistant Research Professor, Agricultural Economics





enactment of price support legislation to assure adequate potato supplies, and soon the Government came into the national market as an important buyer. Later, growers enrolled in the price support program were assigned acreage allotments. In this way, the Government sought to reduce surplus production, and the growers were assured of price support. In addition, several changes were made in transportation rates of potatoes.

The effects of these influences on the market are being analyzed, and it is not yet possible to evaluate their economic importance. It is obvious by the comparison of the two graphs that something has happened to the typical pattern of potato marketing in Massachusetts.

Competitive Market Returns

The modification of the 1939 to 1941 pattern is evident. Maine lost some of its share of the market to Canada. The southern states gave way in large measure to California and Long Island. Massachusetts lost ground to Long Island and Canada, with the result that the local crop marketings were moved farther along into the season and into more direct competition with Maine.

The influences that were changing the marketing pattern did not cease to operate in 1951, but one important variable, price supports, was removed. The 1951 crop year marked a return to competitive marketing, but there is no evidence that the pattern of 1939 to 1941 will be restored intact.

For the present, we are reminded that the location advantage of Massachusetts farmers is subject to radical change, and our potato marketing structure is constantly receiving the impacts of changing economic conditions.

CLUBROOT

Still a Cabbage Pest

By WILLIAM L. DORAN *

CLUBROOT, a serious disease of cabbage, broccoli, cauliflower, and other crucifers, markedly lessens production. With more than 3000 acres given over to the raising of these plants in Massachusetts, it is easy to see how economically important it is for the vegetable gardening industry of the State to keep such crops free from the havoc of fungi and insects. The well-known author, Samuel Hopkins Adams, must have been familiar with this agricultural problem when he wrote in *Holiday*, June 1951, "No other product of the soil is so buffeted by the winds of chance as the humble cabbage leaf. Compared to the risks of raising it, the double zero on a roulette wheel is a conservative investment."

Soil-borne Disease

The cause of clubroot is a fungus, with the formidable name *Plasmodiophora brassicae* Wor., which lives in the soil, entering the plant through the roots. The infected roots become deformed, swollen, and finally decay; meanwhile, growth is stunted, and the plant wilts and dies.

If clubroot becomes severe, the home gardener usually stops planting cabbage and related plants; the commercial grower sometimes resorts to a long rotation, which is not always effective, probably partly because of the presence of cruciferous weeds, at least thirteen species of which are known to be hosts to this disease fungus; or, the farmer may apply lime to the soil. This procedure, however, does not always prevent clubroot.

* Research Professor, Botany

Fig. 4. Cabbage plants grown in clubroot-infested soils. Left: No treatment. Right: Soil treated with hydrated lime and mercurous chloride.

Photos by Robert L. Coffin.

Effective Killer Sought

Many soil fungicides and chemicals will kill disease organisms. The problem is to find some that are not costly to apply and, most important of all, not injurious to the plant. In its search for a solution to this problem, the Station has conducted experiments to determine the effectiveness of applying fertilizers containing soil fungicides to combat clubroot and other diseases.

More Control with Lime and Mercurous Chloride

Several soils were collected, and their pH values, water-holding capacities, and other measurable characteristics were determined. These test soils were inoculated with a small quantity of a soil known to be infested with clubroot fungus. Some form of lime was worked into the soil at various rates of application. Mercurous chloride or other fungicide was then mixed with a commercial fertilizer, usually a 5:8:7 fertilizer. Untreated soil received fertilizer alone at the same rate of application as the test soils. Seeds were sowed at intervals after soils were treated. At several intervals after seeding, the plants were inspected for presence of clubroot and for growth.

It was interesting to note that the less acid soils (soils with a high pH value) had the least clubroot. None of the organic fungicides gave as good control of clubroot as the combination of lime and mercurous chloride. In several soils, this combination completely controlled clubroot. Many new fungicides still remain to be tested before definite conclusions can be drawn regarding control of this cabbage pest.

STORE *vs.* DELIVERED MILK

By A. D. HOLMES *

WE CANNOT LIVE healthy, normal lives if vitamin C is absent from our daily diet. This valuable vitamin must be constantly present to protect us from scurvy, a disease causing spongy gums, loose teeth, anemia, and general weakness.

When milk, one of the principal products of our Massachusetts farms, is freshly drawn from the cow, it is a rich source of reduced ascorbic acid or vitamin C, but, unfortunately, by the time the milk is on the consumer's table, it has lost a serious amount of the vitamin.

Home-delivered Milk Superior

Milk for household use is now obtained by the dealer-retail house-to-house delivery system or from the near-by grocery store. The house delivery plan was changed during the earlier years of World War II to an alternate day delivery. In addition, milk sold in stores is now frequently kept in a refrigerated, illuminated, glass display cabinet.

Previous studies indicating that commercial milk purchased by the consumer contained only a small amount of vitamin C prompted a study at this Station to determine the amount of vitamin C in average store and home-delivered milk distributed in the Amherst area. One hundred twenty-six samples of commercial retail milk were obtained from local stores and typical households supplied by the house-to-house delivery system. Fourteen samples were obtained from each store or home at intervals during a period of 10 to 11 months. The average amount of vitamin C for all samples of store milk was 3.8 mg. per liter; for all samples of milk delivered to homes, 6.8 mg. per liter (one liter is approximately one quart). It would seem, then, that home-delivered milk is superior to store milk as a source of vitamin C.

These low values, 3.8 and 6.3 mg., are conclusive enough evidence that the commercial milk distributed in the Amherst area is very low in vitamin C. Furthermore, they indicate that almost 66 to 80 percent of the 20 to 25 mg. per liter of vitamin C in the freshly drawn milk is lost before it reaches the consumer.

Information Urgently Needed

The loss of such a nutritionally important vitamin can be avoided only if urgently needed information is obtained concerning procedures for processing, storing, and distributing commercial milk.

* Research Professor, Chemistry

Frozen ORANGE CONCENTRATE

UNDERGOES LABORATORY TEST

By E. E. ANDERSON and I. S. FAGERSON *

FOR MOST AMERICANS, breakfast would not be complete without fruit or fruit juice which is expected to provide a major portion of the daily requirement of vitamin C.

Attractive advertising themes strongly proclaim that the vitamin C content of frozen concentrate is equal to that of the juice from freshly squeezed oranges. The advertisements, however, do not state the source of the frozen orange juice being compared. Such information is important because poor transportation and storage facilities on the part of the producer, wholesaler, and the retailer may cause a reduction in the vitamin C content of the frozen orange concentrate from the level originally present in the freshly concentrated juice.

Vitamin C Content Varies

To determine how much the vitamin C content varied between the same and different brands of frozen orange concentrates available to consumers on the retail markets, twenty of the most popular brands of frozen orange concentrate were selected. One six ounce can of each brand was purchased in each of six or more cities so that there was a total of at least six samples for each brand. The cans were packed in dry ice immediately after purchase and shipped air express to the laboratory for analysis.

Of the twenty brands examined, only five had average values of less than 40 mg. of reduced ascorbic acid per 100 ml. of reconstituted juice, that is, concentrate added to three volumes of water. Only one of the nationally advertised brands fell in this category, the remaining four were less widely known brands.

Extreme Differences Found

Within the same brand, the amount of vitamin C varied from 30.3 to 49.6 mg. per 100 ml. of reconstituted juice to an over-all difference of 28.7 to 51.5 mg., representing the extreme differences between the 20 different brands examined.

According to the National Research Council, a recommended allowance of vitamin C for adults should be from 70 to 75 mg. a day. To meet these recommended levels, then, 9½ ounces of the reconstituted sample with the lowest vitamin C value or five ounces of the sample with the highest, would be required.

* Assistant Research Professors, Food Technology

Flower Growers!

PROTECT AZALEAS IN THE FALL

By

C. J. GILGUT *

Fig. 5. Cracked and shredding bark of an azalea killed by November frost. *Photo by Norman Butterfield.*

"WINTER INJURY" is a common expression used by amateur and professional horticultural "experts" to explain why presumably hardy plants alive and vigorous in the summer are dead in the spring. The reasons given for nonsurvival are as varied and numerous as the experts themselves. Each has his own explanation: "Didn't have enough water before the ground froze last fall," say some. "Too much," say others. "Overfertilized." "Not enough fertilizer—plants undernourished and starved." "Plants did not mature as they should have before winter set in." And so it goes.

* Extension Professor, Plant Pathology

Plants Killed in the Fall

Few people realize that, although the dead plants are first noticed in the spring, many of them are actually killed by frosts in the fall, particularly young plants of azaleas and rhododendrons.

This type of injury was first brought to the attention of the Staff at the Waltham Field Station by a nurseryman in the Fall of 1948. The previous spring he had planted out several hundred thousand young azaleas and rhododendrons, considered hardy in our climate and satisfactory and desirable for local planting needs. On October 22, which had been preceded by below-freezing tem-

peratures, a large number of his plants were so badly damaged that they died—a serious loss to him. Damage consisted of splitting and cracking of the bark, exposing the wood beneath; in some instances, the bark hung in shreds from the branches and twigs. Attempts to explain what predisposed the plants to injury were mere guesses and unsatisfactory. The root systems were well-developed and in good condition; soil tests indicated no poisonous materials or excessive amounts of plant nutrients; the plants had not suffered for lack of water, nor did it seem they had received too much. One possible explanation was that fertilizer heavily applied in the spring to prepare the soil for planting caused the plants to produce soft growth, which did not harden sufficiently before the frost.

Fertilizers Do Not Cause Frost Injury

To obtain more information on predisposing causes, young plants of several kinds of azaleas and rhododendrons susceptible to frost injury were planted in the Spring of 1949 in blocks, some of which were fertilized with organic materials, such as manure, castor pomace, and commercial dried hen manure; others, with commercial chemical fertilizers. The rates of application were made on the basis of 500 to 2,000 pounds per acre. That fall there was no injury, although temperatures as low as 26 degrees prevailed.

In the Spring of 1950, fertilizers were applied again, and although some blocks showed considerably better growth than others because of the beneficial effects of fertilizer, no frost injury occurred even though many nights the temperatures dropped below freezing.

Another application of fertilizer was made in the Spring of 1951, and by fall some of the plants were two and a half to three feet high. On November 7, after several nights of below-freezing temperatures, there was serious frost injury to such hardy azaleas as Torch Azalea, Korean Azalea, Korean Rhododendron and Carolina Rhododendron, but not to Ghent Azalea, in all the blocks regardless of the kind or amount of fertilizer used.

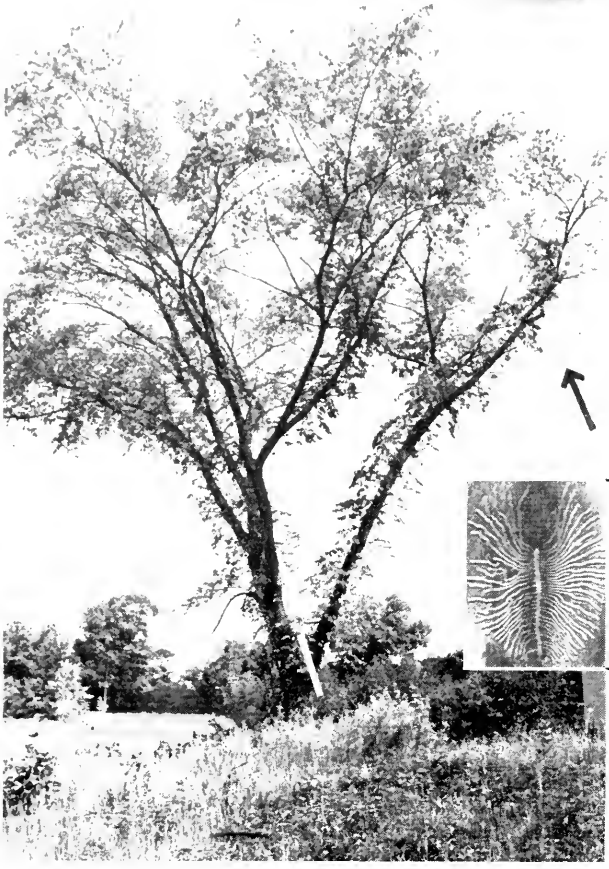
Apparently, fertilizer is not a factor in predisposing azaleas and rhododendrons to frost injury. This conclusion is further supported by the frost killing of 114 named varieties of hybrid azaleas in another field planted in the Spring of 1951 in soil prepared with only a moderate amount of fertilizer.

Rainfall Is One Cause

An analysis of the records of rainfall for each month of the growing season for 1948 through 1951 indicated that rainfall in October is related to frost injury. In 1948 and 1951, when injury occurred, October rainfall was 4.3 and 4.7 inches, respectively; whereas, in 1949 and 1950, when there was no injury, although fall temperatures were often as low or lower than in the injury years, the rainfall was 1.2 and 1.5 inches, respectively.

This relationship indicates that frost injury can be reduced, and even prevented, by (1) withholding water from azaleas and rhododendrons in October and (2) root-pruning in rainy seasons, at least two weeks before expected frosts. Both operations will slow up growth and harden the plants against frost damage.

QUICK ACTION *may save* ELMS



Bark stripped from a dying elm exposing curious design of larval galleries made by Dutch Elm disease carrier beetles.
Photo by Robert L. Coffin

By DAVID H. MARSDEN *

Fig. 6. Elm tree affected by Dutch Elm disease. Arrow points to wilted foliage and other symptoms. Pruning the limb at the main trunk indicated by white marker might save the rest of the tree.

UNCEASING VIGILANCE and quick action with a saw may save many desirable elms from the deadly, quick-spreading Dutch elm disease. The chances of saving affected elm trees by pruning out diseased parts were tested by the Shade Tree Laboratories in small scale trials during the summers of 1950 and 1951.

In Amherst and vicinity, 31 elms were discovered with symptoms typical of those appearing during the early stages of Dutch elm disease. Each tree was operated on promptly to remove the affected parts, thus preventing further spread of the disease in the sap stream; in most instances, the pruning was done within 24 hours of the discovery of discolored and wilting foliage. Samples of wood from the cut branches were tested for the presence of disease organisms. Of the 31 trees suspected of Dutch elm disease, 24 were harboring the disease fungus, and the other seven were affected with lesser diseases. Of the 24 trees that had Dutch elm disease, 15 were healthy by the end of the 1951 growing season, apparently because of the prompt removal of the affected parts.

* Assistant Research Professor, Shade Tree Laboratories

Failure to save some of the affected trees by pruning could be attributed to (1) excessive infection of the crown, (2) spread of infection into the trunk, (3) too long delay in the pruning operation, or (4) insufficient amount of pruning.

It is obvious, then, that pruning cannot be effective unless disease symptoms are detected early, for example, when foliage symptoms are restricted to one major branch and when no discoloration of the sapwood extends into the trunk. An affected branch must not only be removed promptly to prevent spread of the contagion throughout the tree but must also be removed back to the trunk to insure complete elimination of the fungus.

Dutch elm disease is so deadly that it may reasonably be assumed that trees affected with the fungus will decline quickly unless pruning is done promptly.

Advantages In Pruning

1. Prompt action may save irreplaceable trees.

2. Cost of operations may be substantially less than cost of removing entire tree.

3. Incentive created to watch and protect special trees of commons and parks.

4. Threat to near-by elms lessened by reducing material suitable for breeding of elm bark beetles, carriers of the disease.

5. Danger of accidents from falling parts of weakened trees minimized.

6. Inconvenience and hazards in removing trees greatly curtailed.

7. General program for detection of disease materially aided even if the restrictive pruning is not successful.

Disadvantages In Pruning

1. Pruning cannot be delayed to establish certain identity of disease.

2. Disease may not be completely eliminated.

3. Value of pruning may be discredited because of misuse as cure-all or panacea.

4. Its probable success, extent, and relative merits can be evaluated only by trained and experienced operators.

Errata: Vol. 1, No. 1, p. 11, par. entitled "First Cutting for Silage." First sentence should read:

"Because no methods of hay storage that will eliminate or at least minimize these losses (of valuable constituents, especially carotene and sugar) have as yet been developed on a practical scale, farmers would do well to look into the possibilities of storing a maximum tonnage of their first cutting of grass as silage."

Page 11, last line, "discarded" should read "fed out."

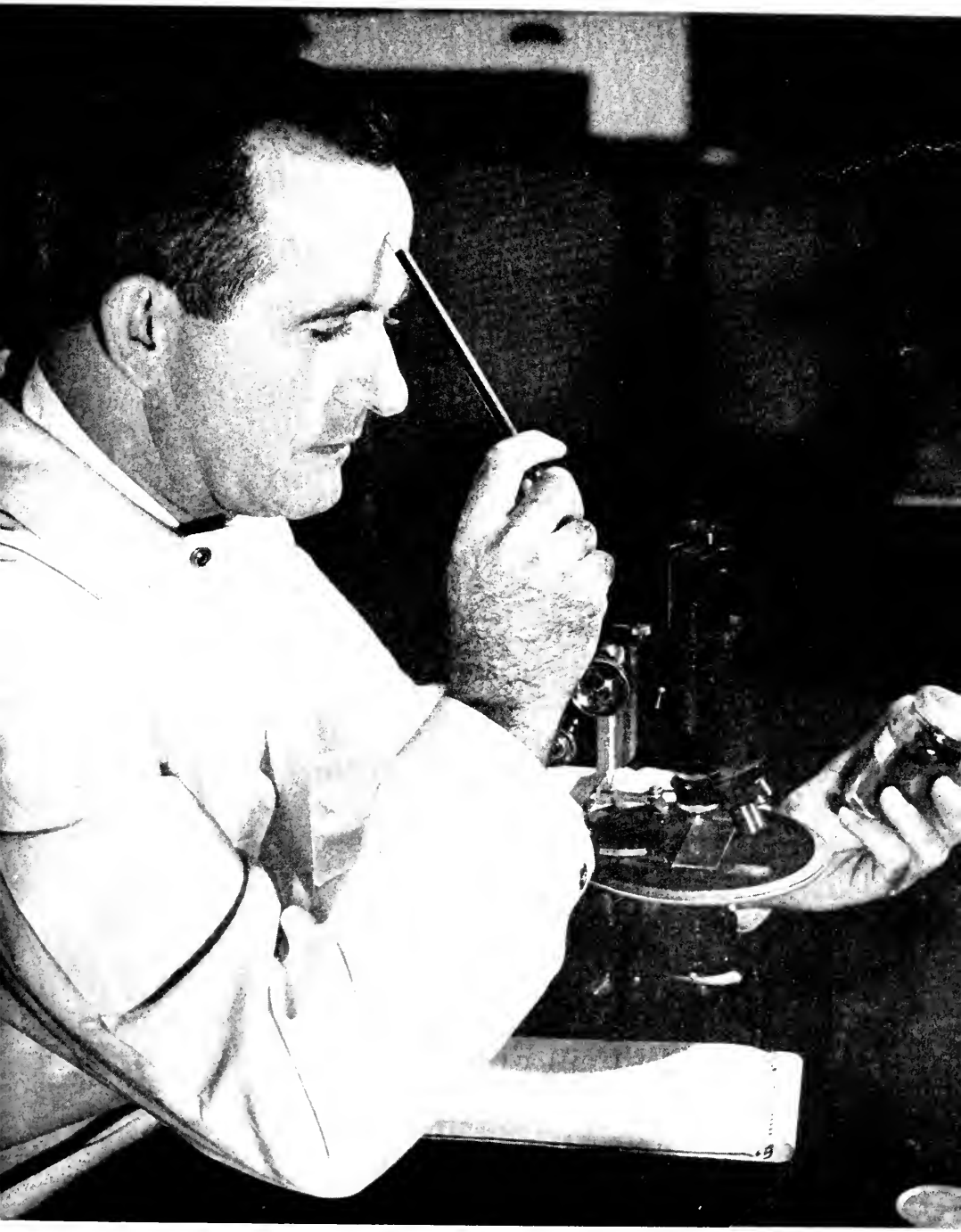
GOVERNMENT TO HELP POULTRY RESEARCH

The Department of Veterinary Science has been awarded a grant of $25,000 by the Bureau of Animal Industry, United States Department of Agriculture, to investigate chronic respiratory disease, more generally known as "air sac infection," in poultry.

The grant, part of a cooperative research program between the Bureau of Animal Industry and several state experiment stations, will extend over a two-year period. Here at the Massachusetts Experiment Station under the direction of Dr. Henry Van Roekel efforts will be directed toward simplifying and speeding up diagnosis and developing means of prevention and control. Transmission of the disease with special emphasis on egg-borne route will also be studied.

Complete flock histories together with a study of the incidence and distribution of the disease will be combined with other information and procedures to develop improved methods for diagnosis. Another plan in this vast research program will be the determination of the value of antibiotics in the treatment of chronic respiratory disease.

The award comes at an opportune time when this poultry menace is on the increase, particularly in the East. The solution of the major problems of the disease will be of great economic benefit to the poultry industry.



From the Director . . .

Research in an agricultural experiment station is not conducted exclusively for the benefit of farmers but is intended to be of value to all people. For example, I would like to call your attention particularly to the articles appearing in this issue on Warfarin and Newcastle disease. Warfarin was discovered at the University of Wisconsin in a study to determine the cause of hemorrhage in cattle that had consumed sweet clover. This research led not only to the use of Warfarin as a poison for rodents but also to the discovery of a similar chemical in the treatment of embolism in humans.

Although our study of Newcastle disease is directed toward the solution of problems related to the poultry industry, the fundamental information gained from this study may eventually lead to the formulation of a cure for such important virus diseases as the common cold and influenza.

For the average person, the secondary benefits derived from agricultural research are, in many instances, of greater interest and more practical importance than the primary information.

Dale H. Sieling

In This Issue

Research In Review

VOL. 2, NO. 1 JANUARY 1953

A free semi-annual periodical published as part of the annual report of the Massachusetts Agricultural Experiment Station.

All requests for *Research in Review* should be addressed to the Mailing Room, South College, University of Massachusetts, Amherst, Massachusetts.

Director—DALE H. SIELING
Editor — PORTIA A. IERARDI

Cover: Professor John W. Kuzmeski, Head of Feed and Fertilizer Control Services, in characteristic pose at his desk in the laboratory. See story on page 14. *Photo by John H. Vondell.*

PUBLICATION OF THIS DOCUMENT APPROVED BY GEORGE J. CRONIN, STATE PURCHASING AGENT.
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Of TREES and WIRES

By MALCOLM A. McKENZIE*

IN RECENT YEARS, wire-using public utilities have realized the need for research in the problems of trees and wires. Thousands of dollars are spent annually in Massachusetts in routine line clearance operations, and storms of varying intensities add to the mounting costs of maintaining the outside plant when trees and wires tangle.

From various conferences on this subject, it is apparent that the perfect stormproof wire has not yet been invented. If and when this wire is made, it will be a most unusual product, even in this age of miracles. For, it must defy the physical laws by enduring beyond its own breaking point. So, there may be quite a wait. In the meantime, the wires we have must suffice, and all phases of the intricate problem of storm damage should be studied.

Electrical storms, ordinarily, cause damage to individual trees and wires in the immediate vicinity within a rather restricted territory. This is a fortunate circumstance, since no reliable means of predicting tree victims of lightning are available. However, valuable trees, or those in especially critical locations in relation to key outside electric plants, may be equipped with suitable protectors. Accordingly, the principal concern here is with damage from sleet and snow.

*Director, Shade Tree Laboratories.

Investigation has revealed that trees and wires do not always live together in harmony in the crowded quarters where circumstances often make it unavoidable to confine them. It may well be that here as in other experiences, familiarity breeds contempt. In the crowded spaces, wind, rain, snow, and ice give added spread, volume, and weight for which adequate allowance cannot be provided ordinarily within the already cramped quarters. Thus we have conflict.

It is doubtful whether more laws or regulations can resolve the issue of trees and wires or whether any one fixed pattern can be established to abate the conflict. Rather, it would seem that fundamentally the problem is not between wires and trees, but between individuals and personalities, that is, human relations of persons served by wires and trees.

Needless Damage Caused

Moreover, in a recent survey* it was found that many trees that fall on wires preceding service interruption were defective often at critical points in support of limbs. For the most part, the defects, including damages by fungus and insect pests, could have been detected before tree breakage and damage to wires.

In the so-called good old days we anticipated loss of service from utilities during and after storms by providing alternative devices. Usually, the kerosene lamps were still on hand, and the telephone was not the universal, dependable means of communication but merely the luxury of the big house on the corner. However, new generations have almost lost self-reliance in preparation to meet emergencies, and luxuries have become necessities in an increasingly complex world of buttons, bells, and bulbs. Accordingly, the demand for continuity of service requires critical review of interruptions.

Tragedy and Tradition

It would be interesting to compare data over a period of years in an effort to determine whether there are communities that keep abreast of tree maintenance problems so effectively that every storm does not bring also a shower of limbs and branches. Let us hasten the day when such showers shall be sufficiently rare that they will be worthy of the same note now given the rare showers of fish.

*Marsden, D. H. *Shade Tree Survey*. Mar. 9, 1951.

A decaying elm and a sleet storm interrupted wire services in this town, endangering the near-by house as well as police and fire equipment.

In some areas the danger of falling trees will be accelerated presently, since the trees have reached maturity, and being somewhat less than human they will fall apart in old age rather than fade away in the absence of braces, crutches, and fillings. Surveys would determine hazardous and diseased trees that require timely pruning or removal, and at the same time offer opportunity for appropriate tree planting.

This relatively simple suggestion is not so simple to execute in the tradition of New England towns. In fact, the complications can become legion in number when one treads ever so softly near the tree of romantic or sentimental attraction, real or imagined.

For the immediate present, the survey work to discover and remedy tree defects before they become tree tragedies offers the best hope for storm-proofing lines.

A Job For Research

For the future, which is sure to be here before most people are ready for it, the planting of street trees should be subjected to the same research treatment already accorded the wires. No one could deny that the outside plant of utilities has undergone continual progressive development. Yet, the setting onto which this plant has been superimposed has remained fundamentally the same. In critically evaluating the place of street trees in the future, one should not overlook all features of the site. In addition to wires and poles, highway construction, curbing, snow plows, trucks, pleasure cars, underground services, and tree diseases complicate the satisfactory maintenance of trees. The problem is a challenging one, the more so because it is often disposed of so readily, if innocently and expensively.

Only completely objective studies can do justice to the problem. Otherwise, the elimination of street trees may be threatened. Some alternatives are careful selection of suitable trees, planting trees on adjacent private property, and judicious tree maintenance. Operation of the many experiments now in progress throughout the Commonwealth in this relatively new field necessarily leaves one at times in the quandary of the artist who wished he knew as much about anything as his critics knew about everything.

This broken limb, hanging like the sword of Damocles, is another striking example of damage caused by weakened trees and storms.

"Booster" SPRAY

INCREASES IMMUNITY AGAINST NEWCASTLE

By STEPHEN B. HITCHNER and GILBERT REISING, JR.

IN ITS INCESSANT struggle to conquer the forces of respiratory infection, Veterinary Science continues to pound at the still impregnable line of Newcastle disease —an ever-present threat to the poultry industry. This respiratory and nervous infection of poultry is caused by a virus that may produce a high mortality in young chickens and a complete cessation of egg production in laying flocks. It has become so firmly established in the United States that the development of a method of immunization to keep the disease under control is urgently needed.

Vaccines now available are the killed virus, and two live-virus vaccines (the intranasal and wing-web). Each type has its advantages and disadvantages, and to date no one vaccine gives complete control of the disease. That differences of opinion do exist regarding the type of vaccine to be used is an indication that knowledge of the respective merits of the vaccines is lacking and that additional improvements are needed in vaccines or vaccination procedures.

B_1 Strain Safe for Chicks

Vaccination studies at this Station have been devoted primarily to the strain of virus used in the intranasal vaccine, frequently referred to as the B_1 strain. Since this strain causes such a mild reaction, it can be used with safety in chicks of any age without producing any nervous symptoms. The immunity induced in day-old chicks is not 100 percent effective, but does provide most broiler flocks with approximately 80 to 85 percent protection up to market age.

Recent tests have demonstrated that to get protection each chick must receive an adequate dose of live-virus particles. Because of the mild nature of this strain of virus, the virus must reach the susceptible tissues to be effective. Poultrymen should not rely on contact exposure to take care of the birds that are poorly vaccinated. Therefore, to get the greatest protection from the intranasal vaccine, a vaccine containing sufficient live-virus particles must be administered to each chick, with care, without stretching the dosage.

It has been recognized that during the past season a few flocks have experienced severe outbreaks of Newcastle a few weeks after vaccination. The exact cause of lack of protection in these cases is not known but may be explained, in part, by failure to observe the precautions previously mentioned. Regardless of the cause, during certain seasons of extreme exposure to Newcastle, a higher degree of immunity may be needed to give

*S. B. Hitchner, Research Professor, assisted by G. Reising, Jr., Research Instructor, Veterinary Science.

A compressor from an ordinary paint sprayer and a nasal atomizer comprise the equipment for vaccinating this flock of chicks against Newcastle disease. *Photo by John H. Vondell.*

adequate protection. Tests have been carried on to see whether increased protection could be accomplished by revaccinating the birds at approximately four weeks of age by spraying the flock with the B_1 strain of virus. This method has proved beneficial in "boosting" immunity after day-old vaccination; such revaccination in broiler flocks may be justified in heavily infected areas during the winter season. To be effective, however, the vaccine sprayed must have a high concentration of live-virus particles. Since the present commercial intranasal vaccines are not satisfactory for this method of administration, work is under way to develop a product that can be applied by the spray method.

Increased Immunity Sought

The spray method of administration, considered during the early studies on the intranasal type of vaccine, was rejected because of the severe reaction it induced in susceptible baby chicks. More recent trials at the Virginia Experiment Station have revealed that the vaccine can be sprayed for vaccinating baby chicks under controlled conditions. Studies directed here in Amherst towards the application of the vaccine in birds three to four weeks of age or older have revealed that spraying will give good immunity response without serious reaction. This method of application is being studied in field flocks as a method of initial vaccination as well as a method of revaccination to increase the immunity of previously vaccinated flocks. The results to date have been very encouraging and open new possibilities for an easy method of flock vaccination against Newcastle disease.

Introducing the weed series -

Research WAGES

By
WILLIAM H. LACHMAN
Associate Research Professor, Olericulture

Professor L and a half r on weeds -

APPROXIMATELY THIRTY percent of the cost of raising crops is forfeited in the endless war to control weeds—a serious enemy of the market gardener. By depriving crops of water and nutrients and harboring insects and diseases, weeds reduce yields and increase the cost of production.

Recently developed control methods, which are generally more effective, quicker, and less costly than hand labor, are fast supplanting the expensive hand-weeding and hoeing sometimes required in weedy fields of vegetables.

Stoddard Solvent Cuts Costs

A few of the newly discovered chemicals are selective in nature. That is, they may be applied directly to a field, killing the weeds promptly without harming the crop. Just such a material is Stoddard Solvent, an oil long used as a solvent or cleaning fluid. When Stoddard Solvent is sprayed on fields of young carrots and parsnips, it literally erases the weeds but does not harm these particular crops. Farmers have been unanimous in their praise for this method and indicate that one treatment is worth about $90.00 per acre, the price of hand-weeding, but costs only about $25.00.

2,4-D Varies in Toxicity

Another very similar procedure is the use of the widely heralded 2,4-D weedkiller in fields of sweet corn. Here 2,4-D is sprayed on the field of young corn to kill broad-leafed weeds. (Grassy weeds are not harmed by this treatment.) One curious feature of this method, however, is the fact that 2,4-D is quite toxic to certain varieties of sweet corn and harmless to others.

Test plot of spinach at right sprayed with chloro-IPC immediately after planting. The plot at left received no treatment.

Photo by Robert L. Coffin.

CHEMICAL WARFARE ON WEEDS

n's method of weeding carrots has been estimated to save six dollars annually. This article is the first of a series of four reports nation's second highest cause of annual crop loss.

Pre-emergence Spraying Successful

Many chemicals that kill crops on contact may be useful for killing weeds in pre-emergence applications. This involves spraying the soil before the crop comes up. Weeds near the surface are killed by the chemical residue; crops are thus weed-free for five to six weeks.

Sweet corn may also be weeded with 2,4-D in pre-emergence applications. By this method, the growth of almost all annual grassy and broad-leafed weeds except smartweed is prevented for five to six weeks. Several other chemicals, such as the di-nitros and sodium pentachlorophenate, may also be applied in this manner. The di-nitros are particularly useful for weeding fields of beans.

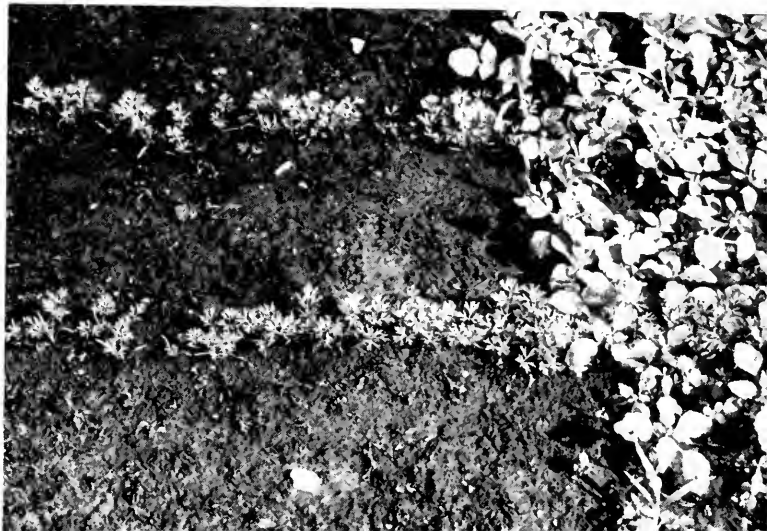
Moisture Conditions Important

Proper moisture conditions are necessary in the soil for these weedkillers to work efficiently in pre-emergence applications. Under very dry conditions, they may not kill any weeds. Moreover, in very light soils, heavy rains soon after treatment may leach the chemical and kill the germinating seedlings.

Two More New Chemicals

Many unsuccessful experiments were tried in weeding small seeded crops, such as spinach, beets, and lettuce, with little hope. Now, however, a chemical called chloro-IPC has been found apparently fairly dependable in killing most weeds without harming the crop.

Chemicals are even eliminating the need for hand-weeding onions. Potassium cyanate, another new chemical, is selective in killing all small annual weeds in this crop. The strength of this chemical must be adjusted to the weather conditions prevailing before and at the time of treatment. (cont. on page 15)



One week before this photograph was taken the carrot plot at the left was sprayed with Stod ard Solvent.

Photo by Robert L. Coffin.

BHC* *an effective weapon against pine borers*

*Benzene hexachloride.

Spraying a test pile of logs. *Photo by Robert L.Coffin.*

By WILLIAM B. BECKER

Assistant Professor, Entomology

HOW OFTEN have we seen new lumber with holes in it? How did they get there? Can they be avoided? These holes are commonly left by insect pests that attack recently cut trees and unseasoned logs left out of doors during the late spring and summer. Although these pests desert the wood sooner or later and will not be able to reinfest it, they have already damaged the logs, either permanently ruining them for use as lumber or considerably reducing their value. When lumber from such logs is used in home construction, some of these insects may still be in it, causing annoyance when they desert the wood, leaving holes in roofing paper, plaster, paint, or wall paper.

Injury to unseasoned logs by borers is ordinarily avoided when living trees are cut in the late fall and winter and sawed into lumber before spring. When this cannot be completed on time, or when trees felled during the spring and summer cannot be promptly converted into lumber, much injury is avoided by placing the logs immediately into available ponds until ready to be sawed. (Of course, a suitable pond is not always conveniently located.) Round-headed borers, ambrosia beetles, bark beetles, and bark weevils, are some of the insect pests responsible for damage to logs and lumber. The most serious pests, the round-headed borers and ambrosia beetles, actually bore through the wood,

whereas the bark beetles and bark weevils only burrow in the bark or just under it, but help to introduce the fungi that cause decay or staining.

After the New England hurricane of September 1938, lumbermen searched in vain for a possible spray material to protect the many fallen trees and unseasoned logs against boring insects. Those logs that could not be sawed into lumber or dumped into ponds before the next spring were ruined by the borers. Since then, however, experiments with new synthetic organic insecticides have revealed that benzene hexachloride, a name commonly reduced to BHC, is effective in preventing attack by these insects. Excellent results have been obtained with liquid BHC concentrates diluted in water or in fuel oil.

BHC is a complex organic chemical composed of several forms called isomers. Only one of the isomers, named the gamma isomer, is effective against insects. The strength of a BHC insecticide is therefore measured by its gamma isomer content.

Spraying Individual Logs

In tests, individual pine logs were sprayed on all surfaces until they were well soaked and the insecticide began to run off. The logs, cut the size of cordwood because of convenience in handling, were turned over in the process to achieve complete spray coverage. Garden-type sprayers (three-gallon, compressed air) equipped with adjustable spray nozzles were used. Logs cut from live trees during the winter were sprayed *only once* in the early spring before the insects' flight period. Log surfaces were examined periodically during the spring and summer for signs of insect activity, and in the fall and winter the bark was removed to count the insect tunnels.

Of the materials tested, almost complete protection of pine logs has been obtained with BHC emulsion sprays diluted with water to as little as 0.2 percent gamma isomer content (by volume) and to half that strength (0.1 percent) with a concentrate dissolved in kerosene. The water-diluted spray cost about seven cents a gallon, at late 1951 prices. Two gallons, fourteen cents worth, were needed to spray ten logs individually.

Larger logs, such as those actually used for lumber, should require less spray per board foot of potential lumber, and the use of different spray nozzles may further

The heap of sawdust is an outward sign of work of the round-headed borers within. The sawdust fell from the hole just above the heap.

Photo by Robert L. Coffin.

cut expenses by reducing the amount of spray wasted.

Liquid BHC concentrates diluted in fuel oil or kerosene gave slightly better results in these tests than those diluted in water. Oils, of course, would add to the cost of the insecticide, be more of a problem to transport in the woods, add to the fire hazard, and be very injurious to living vegetation.

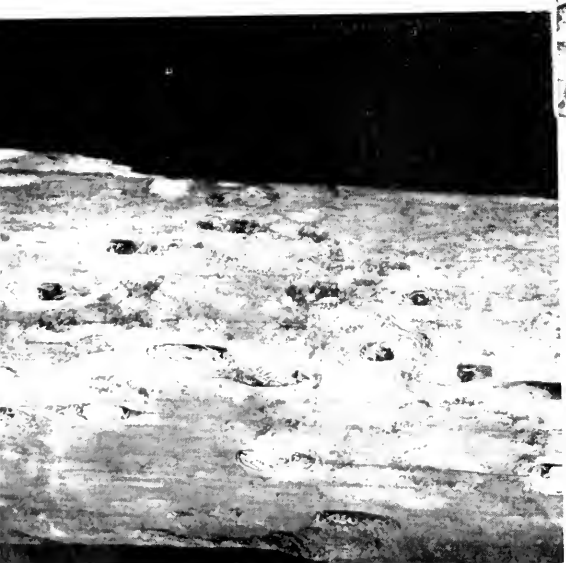
Spraying Log Piles

Logs that are sprayed incompletely or too lightly will be poorly protected. However, a BHC emulsion diluted in water and carefully applied to the entire surface of piles of insect-free cordwood stacked in the usual manner, gave very promising results.

Spraying a half cord pile of pine logs with two gallons of an emulsion (diluted with water) containing 0.4 percent (by volume) of the gamma isomer of BHC gave 97 to 100 percent reduction of infestation by round-headed borers, ambrosia beetles, and bark weevils, and the area of bark infested by bark beetle galleries 91 percent. At a cost of thirty cents for the spray to protect this half cord, it is a considerable saving from the cost of fourteen cents for protecting only ten logs when individually sprayed.

One gallon at the same concentration gave 91 to 95 percent reduction of round-headed borers, ambrosia beetles, and bark weevils but reduced the bark beetle infested area by only 46 percent.

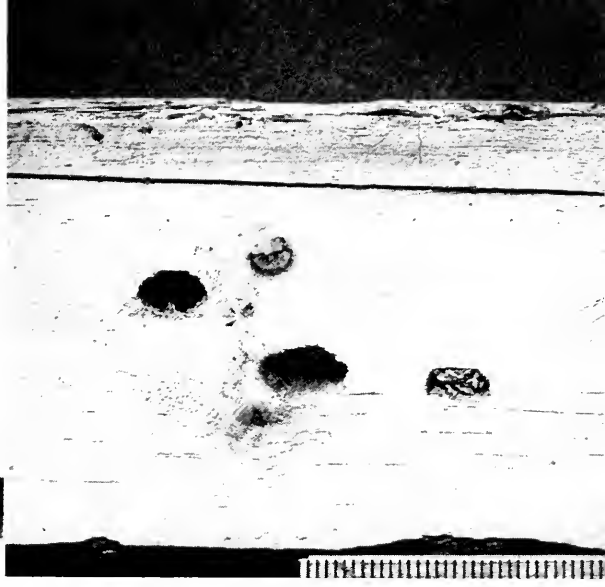
At a 0.2 percent gamma isomer content, two gallons gave 87 to 88 percent reduction of the first three types of insects, and 77 percent re-



Above: Galleries formed by bark beetles in the underside of bark.

Left: Pupal cells of the bark weevil at the surface of sapwood.

Photos by Robert L. Coffin.



Right: Lumber obviously reduced in value by round-headed borers.

Below: Holes and staining in this lumber indicate the destructive work of ambrosia beetles.

Photos by Robert L. Coffin.

duction of the last one. One gallon gave 87, 50, 90, and 78 percent reduction, respectively. Lower concentrations were less effective.

Proper Handling Advised

Because BHC, like all insecticides, is poisonous, it must be handled with whatever caution the manufacturers advise. It also has a musty odor, which some may find objectionable. Properly handled, it should be of value when wintercut logs cannot be converted into lumber before spring. It might also be useful in cutting operations in the summer. Some lumbermen have already shown interest in the possibilities of protecting sawlogs by spraying. In all instances, the insecticide must be applied *before* the insects attack the logs, but should not be applied when the logs are frozen.

More Experimentation Needed

Tests have been most promising, but more experimentation is needed to determine the lowest concentration of insecticide to apply in different situations against borers of these and other kinds of logs. More information is also needed regarding the possibility of spraying piled logs effectively, because if proved successful in different situations it would lower costs by reducing the amount of insecticide needed and would save extra handling of the logs.

The above project was carried on by the Entomology Department with the cooperation of the Forestry Department who provided the logs and facilities and permitted the experimental work in its forest reservations.

Warfarin POISON CASE

Solved by Control Service

By JOHN W. KUZMESKI

A DETECTIVE AGENCY is hardly what we should expect to find behind the ivy-covered walls of the West Experiment Station that houses the Control Service. But with so many cases of suspected animal poisoning brought to the attention of the Service, solving mysteries seems to be the order of the day for the analysts. At any rate, some of the cases make absorbing reading for those who love a mystery.

At the request of a veterinarian, the Control Service analyzes samples of feed and vital organs of animals. Whenever the outbreak of disease coincides with the delivery of a new lot of feed, it is natural for an animal owner to suspect the feed.

It is almost impossible to state positively from chemical analysis alone that a feed contains no injurious material. Therefore, when an animal feed is received. it is fed to a test group of rats. A poultry feed is fed to a test group of chicks. If the chicks or rats are affected, the feed is analyzed chemically unless the symptoms are so characteristic of a particular poison that chemical analysis is not necessary.

Recently two veterinarians reported to the Control Service that several dogs in three towns had died with symptoms similar to those seen in rats poisoned by Warfarin. All the dogs had been fed the same brand of dog meal. Samples of feed bought by three of the dog owners were collected by the feed manufacturer and submitted for analysis. A fourth sample from a new lot of feed mixed at a different time was also submitted.

Four test groups containing three rats in each group were fed each of the samples received. All the rats that ate the feeds collected from the dog owners became sick, and five died with characteristic symptoms of Warfarin poisoning. The rats receiving the new feed remained healthy.

The feed manufacturer could not explain how Warfarin got into the dog meal, since Warfarin was not used as a rat poison at the plant. Furthermore, the dog meal was mixed in 2000-pound lots, and the owners reporting death of dogs accounted for only about 400 pounds of feed. No reports were received from the buyers of the other 1600 pounds of feed. Despite the puzzling circumstances, the feed manufacturer has settled all claims to the entire satisfaction of the dog owners.

This case is unique in the history of Massachusetts Feed Control. It is the only one in which an actual poison has been found in the feed as it left the manufacturer's plant.

In another case, two cows in a herd of fourteen in the same pasture died on successive days. The veterinarian suspected poisoning and submitted the stomach contents for analysis.

A large amount of Paris green, a copper arsenite compound, was found. After receiving the report

*Head of Feed and Fertilizer Control Services.

Bleeding nose of this test rat indicates Warfarin poisoning. *Photo by John H. Vondell.*

from the Control Service, the farmer inspected the pasture carefully and found a package containing some Paris green near a woodchuck hole. Apparently someone had thrown the package into the hole to dispose of it and perhaps had covered it with dirt. Some time later Mr. Chuck dug himself out again and left the package accessible to the cows.

This illustrates the point that most poisoning cases are the result of someone's carelessness in handling or disposing of poisonous materials. The instances of poisoning from ashes containing supposedly burned toxic materials are many, because inorganic poisons are not destroyed by fire.

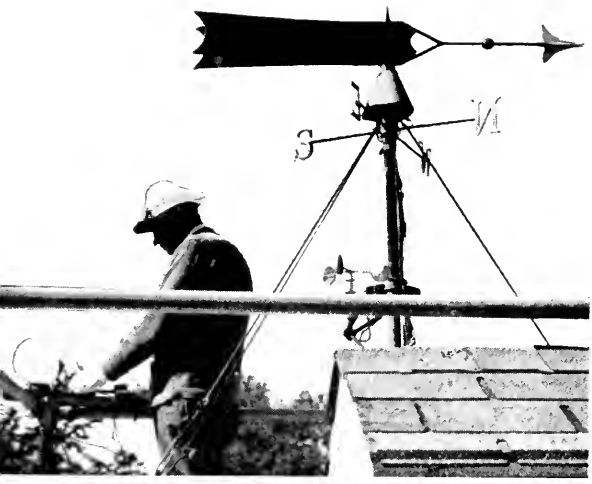
Both cases describe the circumstances under which the Control Service undertakes analytical work on submitted samples. In the first case, responsibility for the poisoning was established; in the second, other animals were saved because of the analysis report. No work is done in isolated cases of poisoning of single pets or other animals when such work will serve only to satisfy the owner's curiosity regarding the cause of death.

(continued from page 9)

Cultivation Still Necessary

Even though weeds may be eliminated by chemicals, it is too soon to think about discarding the cultivator because experiments have shown that the soil surface must be kept broken up at critical periods during the growing season to provide for soil aeration.

Although some of these methods are relatively simple, directions must be followed closely. Chemical weeding is new, and even under the best conditions some hand-weeding and cultivation may be necessary, but not so often as formerly. Chemicals are not equally effective in killing weeds under all conditions, but where directions are followed, these methods are less costly and faster than cultivation alone.



Wind northwest, sky clear, as Dr. Henry J. Franklin looks over the instruments atop the Cranberry Station prior to figuring the frost hazard.

AVE ATQUE VALE

After forty-three years of exemplary devotion to duty, Dr. Henry J. Franklin, director of research on insect problems at The Cranberry Station, East Wareham, has retired in his seventieth year.

From the time of his appointment in 1909 to the present day, the life histories of twenty of the serious bog insects have been made known, and at least one satisfactory control measure has been found for each.

When heavy frost destroyed almost half the annual crop in 1917 and 1918, Entomologist Franklin bent the oars of meteorological study and developed a series of formulae for calculating during the day the minimum bog temperatures for the coming night. Now, in cooperation with the Cape Cod Cranberry Growers' Association and the U. S. Weather Bureau at Boston, frost hazards are figured daily at noon and in the evening in April, May, June, September, and October. Warning of dangerous frosts is telephoned and radioed to the cranberry growers.

The thoroughness of Dr. Franklin's study on the relation of weather to the size of crops and to the keeping quality of cranberries has made it possible to adjust the management of the bogs to produce a maximum of choice berries and a minimum of poor ones. Under Dr. Franklin, the cranberry crop has increased more than twofold, and is now the largest export crop of Massachusetts. In the past fifteen years, the staff at The Cranberry Station has likewise increased, rounding out the State's services to the cranberry industry.

As a living tribute to this grand old man of cranberry culture, the cranberry growers have constructed and furnished an office and study at The Cranberry Station. They are hopeful that he will not only enjoy using the study for his particular interest, the bumblebees, but that he will also remain available to them at the scene of his life's work.

God bless him with many happy years of retirement.

CHESTER E. CROSS

Dr. Cross worked for many years as weed specialist under the direction of Dr. Franklin whom he succeeded on September 1, 1952.

From the Director . . .

In the continuous pageant of Massachusetts Agricultural Experiment Station history since 1882, the names of

C. A. Goessmann	*1882-1895*
H. H. Goodell	*1895-1906*
W. P. Brooks	*1906-1918*
F. W. Morse	*1918-1920*
S. B. Haskell	*1920-1927*

will always be remembered for the service each gave as director.

With the recent passing of former Director Fred J. Sievers (1928-1952), the curtain has fallen again on an outstanding performance by a great leader. It is to his memory that this issue of Research in Review is dedicated.

Dale H. Sieling

In This Issue

Research In Review

VOL. 2, NO. 2 JUNE 1953

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All requests for *Research in Review* should be addressed to the Mailing Room, South College, University of Massachusetts, Amherst, Massachusetts.

Director—DALE H. SIELING

Editor—PORTIA A. IERARDI

Cover: Fred J. Sievers, former director of the Massachusetts Agricultural Experiment Station. (See opposite page for story.) ***Photo by Kinsman's Studio***

Cartoon on page 5 adapted from cover of *National Fertilizer Review*, Jan.-Mar. 1953, a publication of National Fertilizer Association, Washington, D.C.

Photography, Robert L. Coffin

PUBLICATION OF THIS DOCUMENT APPROVED BY GEORGE J. CRONIN, STATE PURCHASING AGENT
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FRED J. SIEVERS

1880 Scientist—Philosopher—Friend 1952

A native of North Milwaukee, Wisconsin, Fred J. Sievers was graduated from the University of Wisconsin in 1910 and received the degree of Master of Science twelve years later. A former instructor of soils at his alma mater from 1909 to 1912, professor of agronomy and later superintendent of the Milwaukee County School of Agricultural and Domestic Economy until 1917, and professor of soils at the State College of Washington until 1928, he left the West to become director of the Massachusetts Experiment Station, a position he held until his retirement in 1950.

FRED SIEVERS played a significant role in the development of agricultural teaching and research and spent most of his professional life carrying on research of his own or directing research of others. A brilliant investigator, he has been characterized as "having one of the best research minds in the country." Sievers was one of the first to recognize the importance of applying basic scientific principles in the solution of practical problems in agriculture. It was through his findings that soil nitrogen and soil organic matter were recognized as being intimately related — a fundamental truth now accepted in all practical efforts to maintain the organic matter of our soils.

Director Sievers was also credited with producing convincing evidence that soil nitrogen and not moisture was the immediate limiting factor in crop production in the great wheat-producing areas — a belief now universally adopted.

Never too busy to give constructive aid and advice to anyone who sought his help, the stimulation and encouragement that Sievers has given to others through his writing, talks, critical comments, and personal conversations stand out above his own contributions. As director of the Station and the Graduate School, he found many opportunities to break with tradition, and this he was especially eager and ready to do when, in his judgment, tradition came in conflict with progress. It was his firm belief that education stopped when complacency or smugness appeared; that a teacher is recognized and interesting not for what he knows, but rather for what he thinks; and that a sense of humor is the best evidence that the teacher or investigator possesses the imagination necessary for effective service.

Those of us who were fortunate enough to come in contact with this philosopher-scientist were indeed privileged.

Weed Story No. 2

Time and Weed

By JOHN S. BAILEY*

KEEPING THE WEEDS out of a strawberry bed by hand-hoeing is a time-consuming and costly job. This is especially true after the runner plants have started to root. At this time the space that can be weeded with the cultivator narrows, and the part that must be hoed by hand increases. On many farms where strawberries are grown, there is not enough time to keep the strawberries free of weeds. What is needed is something that will greatly reduce the amount of hand-weeding. The use of herbicidal chemicals offers considerable hope of accomplishing this.

One of the most effective of the new materials for general weed control in strawberries was first released to research workers as C. H. No. 1 and placed on the market as Crag Herbicide No. 1 or C. H. No. 1. This chemical, with the formidable name of sodium 2,4-dichlorophenoxy ethyl sulfate, is related to 2,4-D; however, unlike its toxic relative, it does not cause the leaves and stems of plants to curl and twist.

* Associate Research Professor, Pomology, The Cranberry Station

Large Weeds Not Affected

Unlike 2,4-D, C. H. No. 1 is not absorbed by the tops of the plants and has little effect on plants until it comes in contact with the soil *where it is changed into an active form by the soil microorganisms.* When this active form is present in the soil, it can be absorbed by the rootlets of germinating weed seeds and kill them. After the weeds have reached a height of one-quarter of an inch, C. H. No. 1 is no longer effective. Inasmuch as C. H. No. 1 affects only germinating seeds or very small weeds, the field should be thoroughly cultivated and hoed before this weed killer is applied to assure the destruction of any large weeds. The application should be made far enough in advance of weed seed germination so that the C. H. No. 1 will be in its active form ready to go to work as soon as the weed seeds germinate. C. H. No. 1 acts as a pre-emergence weed killer on both broad-leaved weeds and grasses.

This strawberry patch overrun with weeds has not been treated with a herbicide.

Await No Man

Several Applications Tolerated

Strawberries are very tolerant of C. H. No. 1 after the plants have become well established. It is important to wait five to seven days after planting to make the first application. Usually an application will hold the weeds in check for about four weeks. Treatment can then be repeated after another cultivation and hoeing. Although it has been reported that two applications have held the weeds for an entire season, it is probable that more will be needed under Massachusetts conditions. Strawberries will tolerate five to seven applications a year.

The most efficient rate of application is two to three pounds of C. H. No. 1 to an acre. The slight increase in effectiveness at higher rates does not justify the additional cost of material. C. H. No. 1 is applied as a water solution, but the amount of water is not particularly important, 40 to 100 gallons to an acre or whatever amount is necessary to give even distribution with the equipment available.

Cultivation Still Important

Since strawberries need occasional cultivation, some growers may prefer to apply C. H. No. 1 to the rows to save hoeing and continue to cultivate between the rows. Where this is done, calculations for dosage should be based on the area actually sprayed.

Results Satisfactory

All the common varieties appear to be equally tolerant of C. H. No. 1, which can be used on all types of soils with equal safety. Neither runner formation nor yield has been reduced by its use. No off-flavor, off-color, nor malformation of berries has been reported. Moreover, the number of hoeings necessary and the time required for each hoeing have been reduced. The performance of C. H. No. 1 has been so satisfactory that many growers plan to use it again this year.

Photograph taken one month after strawberry patch was treated with Crag Herbicide No. 1.

Frenching

Ragged margins and narrow, swordlike leaves mean frenched tobacco. It is possible that one frenched plant in a field may be enough to raise the suspicions of prospective buyers, and the price of healthy plants is lowered.

By LINUS H. JONES*

"FRENCHING" is a word spoken in low tones, hardly above a whisper, among tobacco growers who try to keep this unknown plague well hidden from the public. Why does the word "frenching" provoke such fear and create a state of unrest among tobacco men? One look at the picture on this page and you will have the answer. *Crop loss and a poor price at harvesttime.*

Frenching—A Peculiar Disease

The frenching of tobacco is a peculiar disease that stunts the plant and causes it to produce a profusion of worthless, very narrow leaves, more or less yellow in color. Sucker growth is stimulated to develop in every leaf axil. Even the internal structure of the leaves is quite abnormal because the cells are prevented from organizing proper tissue formation and development.

No Disease Organism Found

According to past records, frenching has been recognized in the United States since 1688 and in Europe since 1857. It is now known to be world-wide in occurrence. No disease organism has ever been found in the plant to indicate that the disease is due to bacteria or fungi, and neither has it been possible to classify the malady as of virus origin.

Not until it was demonstrated that frenching could be induced or dispelled at will by altering the soil temperature had it been possible to subject the problem to a thorough laboratory investigation. Through this soil temperature technique many facts have been added to our store of knowledge, which may lead to a solution of this complex problem.

* Assistant Research Professor, Botany

the tabu of tobacco men

Not Present in All Soils

The term "frenching factor" is a convenient and desirable name for the cause until a correct answer is obtained. Not found in all soils, the presence of the frenching factor can be determined by growing tobacco at a relatively high soil temperature close to 90°F. If frenching is present, the new leaves on the tobacco plant will show a pinhead mottling usually within a fifteen-day or sometimes within a four-day period. Succeeding leaves are less green, and progressively each leaf is narrower than the preceding one.

New Land Not Immune

If a soil containing the frenching factor is air-dried, steam-sterilized, or treated with a soil fumigant capable of killing weed seeds, the frenching factor is destroyed, and the succeeding planting of tobacco will develop normally. Not much is known about the general distribution of the frenching factor except that it can be found in soils that have a tendency to be moist in drought periods. Soils tested from such areas and on which tobacco has never been grown showed the presence of the frenching factor. Thus, breaking in new land for tobacco culture is no protection against frenching.

Drainage May Help

The combination of high soil moisture and a relatively high soil temperature is apparently necessary to activate the frenching factor. Liming the soil intensifies the symptoms. If adequate drainage is possible, such installations might be of some aid in protecting the tobacco from this particular disease.

Above: Frenched tobacco plant grown in high soil temperature, 95°F. Below: Normal plant grown in low soil temperature, 70°F.

Shade Tree Laboratories

on constant guard to preserve our trees

By DAVID H. MARSDEN*

ONE HUNDRED NINETY thousand chips of wood planted in more than 24,000 culture dishes — this is what testing 8,000 elm specimens meant to the Shade Tree Laboratories at the University of Massachusetts in 1952. Testing disease-suspect elms is a major service of the laboratories — service that is free to Massachusetts residents. The Labs are believed to be the only state-supported laboratories in the United States devoted to the care of trees or the science of arboriculture. A testimony to the progressive spirit of Massachusetts, the laboratories are the result of a growing realization of the value of shade trees and the obvious need for improved shade tree management based on scientifically sound and proved practices.

Forty-six Year Record

If we were to write a history of the Shade Tree Laboratories, we would look back forty-six years and record the name of Dr. George E. Stone, the first man in America to give a comprehensive course on shade tree care. His publication on shade trees was a pioneer work of high merit and wide acclaim. Later in our history we would note that the College served for several years as headquarters for the Northeastern Forest Experiment Station, a federal unit concerned with shade and forest tree problems.

With the deadly Dutch elm disease threatening to encroach on the beautiful elms of the State, Professor A. Vincent Osmun, then head of the Department of Botany, fully appreciating the potential disaster, took action by instituting a shade tree disease laboratory in his department in 1935. That year Dr. Malcolm A. McKenzie was appointed Plant Pathologist in charge of shade tree research — a function which he performs to this day.

Within thirteen years it was necessary to build a small wooden frame structure to house the offices and laboratories, and by 1950 the Shade Tree Laboratories, with Dr. McKenzie as director, began functioning as an independent unit of the Experiment Station with a branch laboratory at the Waltham Field Station.

Many Problems to Be Solved

The work of the Shade Tree Laboratories includes investigating shade tree management problems and answering hundreds of inquiries each year concerning specific tree troubles. During recent years investigations have encompassed such common problems as parasitic fungal diseases of trees; injuries resulting from floods, hail, wind, leaking gases, and construction work; the proper selection of tree wound paints; the deterioration of wood products; conflicts between trees and overhead wires; and the operation of tree

* Assistant Research Professor, Shade Tree Laboratories

management programs by towns and municipalities.

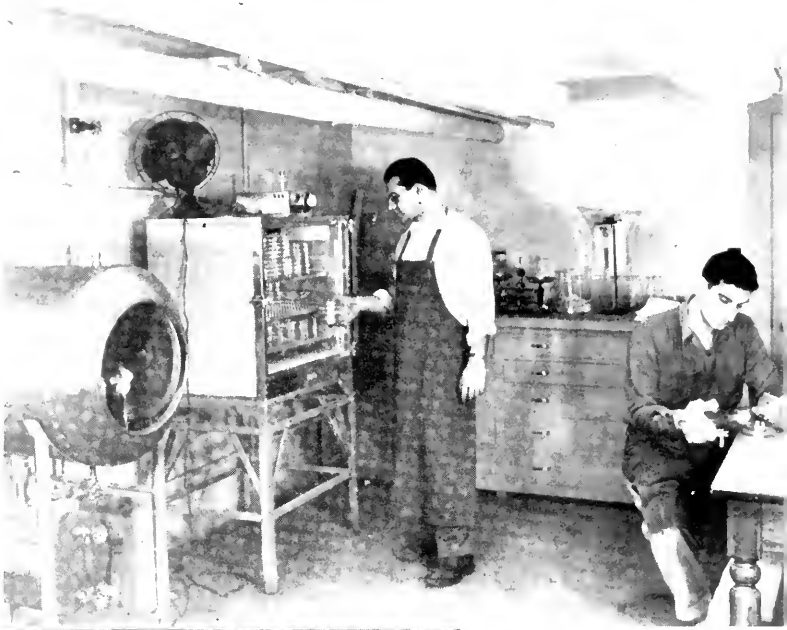
Elm Disease Major Threat

The one tree trouble that has overshadowed all others in the State since 1941 is the Dutch elm disease. Caused by a fungus and spread from tree to tree chiefly by tiny elm bark beetles, this scourge attacks the American elm with nearly always fatal results. Other elm species may be affected too, but the primary threat is to the American elm — the traditional street tree of New England since earliest colonial days. In twelve years the disease has spread to at least 286 cities and towns in twelve counties of the State, with a total of 17,776 cases confirmed as of January 1953. The only method of diagnosing Dutch elm disease involves growing the disease fungus from the wood of a sick tree onto a sterile, nutrient medium where the organism may be identified by observing its growth characteristics. Wood samples for testing are sent in by local tree and park departments, conservation officers, arborists, public works departments, and private tree owners.

Along with the testing service, the Laboratories place timely information before the public through news releases, radio talks, circulars, scientific articles, and talks at group meetings. The success of such a program depends on the cooperation of tree wardens, moth superintendents, and arborists' associations. These sustained efforts to combat the elm scourge are paying off as more and more cities and towns utilize all available knowledge to lessen the toll of the disease on their prized elms.

Present plans of the Shade Tree Laboratories envisage not only a continued attack on Dutch elm disease but also a broadened program of research on the nature and control of other important shade tree pests and the improvement of shade tree management practices in general.

The ever-increasing work of the Shade Tree Laboratories is evidence of the many demands of the public for research and services in arboriculture.

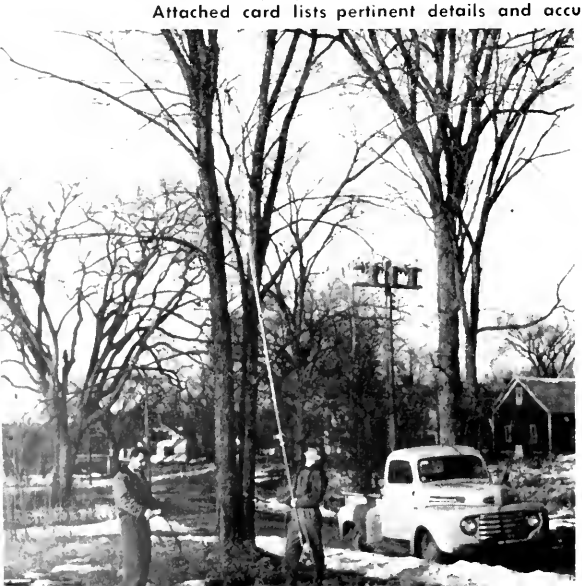


3. In the Laboratory: Preparing for culture tests on elm samples.

2. Branch samples, six to eight inches long, ready for laboratory test. Attached card lists pertinent details and accurate location of trees.

The Story of

The story of a wood so tree. In the photograp struck suddenly causin the leaves to wilt, turn story on these pages t a tree is discovered.



1. Branch samples are cut from affected parts of tree for laboratory diagnosis.

4. Testing: Chips of wood are placed on special fungus food in culture dishes.

ood Sample

egins with a diseased
w, Dutch elm disease
ranch tips to curl and
, and fall. The picture
it happens when such

U. S. D. A. Photo

5. Diagnosing and Recording Results: After a few days fungus in the wood may be identified by its growth in the culture dishes.

6. Under the Microscope: Dutch elm disease fungus growing around chips of elm wood.

ARE EGGS Priced Correctly
on the Boston Market?

By ALFRED A. BROWN*

AS MOST POULTRY MEN know, the *Boston Herald* "quotation" is the peg on which much of the industry hangs its hat. The methods used in developing this basic figure on the so-called Boston Wholesale Market, or more appropriately for New England, have not kept pace with the changes that have taken place in marketing. Except for a change in arrangements in 1938, the methods have gone through no significant change during the past 25 years, a period in which the entire distributing system has been transformed. The place of the *Herald* as a particularly important factor in price-making dates from 1938. At that time the Boston Fruit and Produce Exchange decided to discontinue the activities of its Egg-Pricing Committee. After a short period in which reporting was on a temporary basis, the arrangements now in effect were evolved.

Price Established by Herald

Formerly, the *Herald* reporter covering the markets stopped by the Exchange rooms daily for a copy of the Produce Report. Today he contacts the trade directly and provides the Exchange with a report on the egg market. The Exchange provides him with desk space and telephone facilities. The information so developed appears in the daily "Produce Report" of the Boston Fruit and Produce Exchange under the caption:

"BOSTON EGGS TODAY"
The Boston Herald reports:-
Sales: Brown, Specials, Large
200 Cases, 56c

The Boston Fruit and Produce Exchange makes this information available to the trade, to other Boston newspaper reporters who may call in, and to other markets. The Exchange Report also includes data on egg receipts and storage holdings in Boston as well as similar information for New York and Chicago. For this additional coverage, the *Herald* depends, as the others do, on the Exchange which in turn relies on the Market News Service of the U.S.D.A. and teletype reports from the New York and Chicago Exchanges.

U. S. D. A. Also Reports

The Market News Service of the U. S. D. A. also issues a daily report on egg prices. The information available to the Market News Service, however, is the product of a system operating on the Exchange or *Herald* price. The chief difficulty in present egg-pricing arrangements is the limited amount of wholesale trading available for reporting.

The altered status of the so-called Boston Wholesale Market is due to a number of simultaneous developments which are familiar to most poultrymen, egg-handlers, and others acquainted with the industry.

* Research Professor, Agricultural Economics and Farm Management

Influence of New York Market

The net effect of these developments has been a by-passing of the established market. Price-wise it meant withholding from trading activity a significant volume of sales and a substantial number of operators. Trading at the wholesale level was increasingly concentrated at fewer points, many of which only indirectly participated in price-making. The progressively limited amount of active trading that remained, nonetheless, continued to be relied upon as a suitable basis for arriving at the "quotation." That the trading and the method of reporting have continued to serve as well as they have is due to certain restraining influences, especially the New York Market.

Opportunity for Improvement

One need may be an appropriate legal framework. Both the U.S.D.A. and the trade shy away from any practices that might openly be described as price-making. This obstacle is not insuperable.

Another need is more adequate statistics. Data on receipts should be reported on a size basis when medium or small eggs make up a substantial portion of the total. They should be further classified according to receiver groups so that receipts normally not available for trading (those at plants of large-volume retailers) are properly accounted for. Changes in those receipts reported by wholesale handlers might then give a more meaningful clue regarding the extent or absence of pressures on the stocks to be traded. Data should also be available on the movement into retail channels.

A third need, and this is perhaps the most crucial, is a more definable responsibility for price-reporting and price-making.

The responsibility of the *Herald* reporter is quite definitely to his paper and through it to the Exchange. The obligation of the Boston Fruit and Produce Exchange is to its membership. Its egg price-reporting activities are, however, rigorously limited. The interest of the Market News Service is general but has been somewhat indecisive.

Anti-Trust Decree Inadequate

Since December 1949, except for the activities of the Department of Agriculture, egg-pricing and price-reporting in Boston have been subject to a consent decree of the Anti-Trust Division of the Department of Justice. The provisions of the decree, although correcting some defects, have introduced others, particularly impediments to the free flow of market information.

Need for a Gideon

The impasse resulting from this multiplicity of interests might be resolved if some Gideon stepped forth to cut through the confusion, held out a program, and said, "This is it!" The egg industry, however, is still a system of private enterprise. Much of these basic data consequently can be had only by voluntary participation in a program. It should be possible for the affected groups to meet together for discussion, and without fear of legal action, to develop the necessary arrangements. The thinking should be in New England terms: the data, meaningful; and the responsibility, accountable.

Damping-Off can be controlled

By WILLIAM L. DORAN*

DAMPING-OFF is a kind of juvenile plant disease, one of the most common causes of the death of young plants. Later, as plants grow older, they are less susceptible to this disease and finally relatively immune.

Seedlings that damp off decay and shrivel near the base, topple over, and die. This type of damping-off, after seedlings emerge from the soil, is called post-emergence damping-off.

Damping-off may also kill seeds or seedlings before germination or before emergence of the seedlings from the soil. This type of damping-off is known as pre-emergence damping-off and is controllable by the same methods that are effective against the post-emergence phase of the disease.

Fungi to Blame

Damping-off is usually more severe on plants in soil that is too wet and in air that is too moist. But water is not the real or first cause of the disease. Plants damp off because they have been attacked by any one of several parasitic fungi that live in the soil, and these fungi do more damage and cause more injury in a soil too heavily watered.

It is easier to prevent damping-off than it is to cure it; for the disease is not readily controllable if no protection is attempted until after symptoms of the disease have appeared, that is, after seedlings have begun to damp off. Under such circumstances, watering lightly, keeping the soil somewhat dry, helps some but often not enough.

Fungicide Gives Good Control

The severity of damping-off, especially of the pre-emergence type, will be lessened if seeds are sowed in moderately dry soil containing water to the extent of not more than 30 percent of its water-holding capacity and if such soil is not watered for the first time until three to five days after seeding. It appears from this and other evidence that some seeds can germinate in soil too dry for infection by some fungi. More complete control, however, is accomplished by applying a fungicide to the soil, usually before seeding or, in the case of formaldehyde, immediately after seeding.

Common Vinegar Effective

Vinegar contains about 4.0 percent acetic acid, which may be used as a soil fungicide. One-half pint of vinegar, undiluted, applied to one square foot of soil a few hours before seeding, with soils well watered immediately after seeding, gives satisfactory control of damping-off in most soils. This treatment is usually safe with cabbage, lettuce, tomato, and several annuals including China aster and Calendula; and, of course, vinegar is often available when other fungicides are not.

Formaldehyde Also Protects

Perhaps as easy a way as any to improve germination of seeds and stands of seedlings by protecting them against damping-off is to wa-

* Research Professor, Botany

ter the soil, three or four inches deep in flats or pots, with a very dilute solution of formaldehyde, one teaspoonful of 40 percent formaldehyde in one gallon of water or one tablespoonful in three gallons of water, immediately after seeding. If applied too long after seeding, there is more danger of chemical injury to seeds and seedlings.

Since the soil is usually watered at this time, anyway, no additional operations are involved. The formaldehyde solution is applied at the rate of one pint to one quart per square foot of soil and is harmless to most seeds except some of those of plants in the cabbage family. Soil so treated should not be covered with glass or paper because the escape of the formaldehyde from the soil may be prevented.

Advisers in the field of plant protection do not always practice what they preach; it may be of interest, therefore, to know that the writer uses this method frequently in his own gardening and greenhouse operations.

New organic fungicides, mostly intended for spraying or dusting the above-ground parts of plants or for the treatment of seeds, are increasing in number. Some of these added to soil fertilizers protect seeds and seedlings against damping-off. There is probably no best fungicide for use in this way with all kinds of plants; it will depend somewhat on the crop. Materials that gave good results against damping-off of several common vegetables were Phygon, Arasan, Dithane D-14, Orthocide, and Vancide. Rates of applications are different with different fungicides and for different crops.

There are plant diseases with which we must live, with which we must put up, because no easy and practical methods of preventing them or controlling them have yet been found. But damping-off of seedlings is not one of them. This disease is controllable, and there is no reason for poor stands of seedlings or no seedlings at all because of attack by damping-off.

The same number of cucumber seeds was planted in each pot. The seedlings at the left have damped off, but those at the right were protected by early sterilization of the soil with formaldehyde.

Tomato plants showing contrast between complete susceptibility and high resistance to Cladosporium leaf mold disease. Inset: Tomato leaflet showing nature of disease.

New Tomatoes . . . result of twenty years of research

By EMIL F. GUBA*

TOMATO LEAF MOLD, *(Cladosporium fulvum)* still hovers like an obstinate ghost to haunt Massachusetts greenhouse tomato growers. Unquestionably the leading destructive disease of greenhouse tomatoes, leaf mold has been a long-standing problem of study because of its importance in tomato culture under glass.

The loss of foliage caused by this disease yields an inferior grade of tomato and results in significant production losses. The disease is destructive in June and July toward the end of the spring cropping season, when returns are high, and throughout the fall cropping season, when returns are low.

Control Through Breeding

When customary disease-control measures fail or prove impractical, then breeding for resistance and immunity can be the answer to practical and successful control. Of course, the effort required in breeding is long and persevering.

During breeding work at Waltham, relating to the control of tomato leaf mold, the varieties Bay State and Improved Bay State were successively introduced to the trade. Improved Bay State is immune to all except one strain of the fungus and resistant to that one. Recently, another acceptable red tomato, the Waltham Mold-Proof Forcing, has been developed totally immune to the disease.

South American Ancestry

The high resistance of Improved Bay State is derived from a strain of the currant tomato native to Ecuador, South America. The fruits are round, red, about one-half inch

* Research Professor, Botany, Waltham Field Station

in diameter. The plant is an annual, slender, and weak-stemmed, with no economic value, although casually it may be cultivated as an oddity. The species is quite variable in its reaction to infection and plant characters. A type obtained from the U.S.D.A. Plant Introduction Program provided the source of high resistance to the disease in our breeding program.

The immunity of the variety Waltham Mold-Proof Forcing to the leaf mold pathogen is derived from the Andean tomato, *Lycopersicon peruvianum*, a perennial, decumbent plant with slender, weak stems, and greenish-white fruits about one-half inch in diameter. The species is native to the Peruvian Andes Mountains and has no economic value.

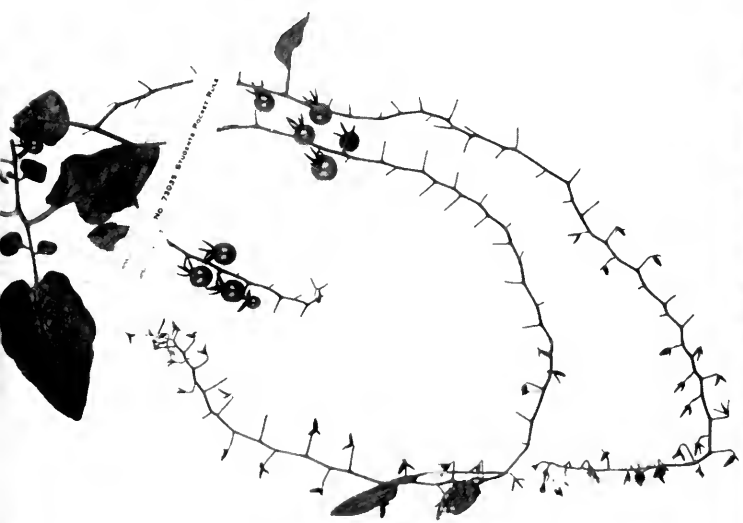
The fruits of these resistant and immune ancestors, although small and of insignificant weight, remain but a memory as larger fruit size, desirable horticultural plant type, and resistance or immunity to disease were linked by progressive hybridization and selection for successive generations to develop the acceptable edible commercial tomato botanically known as *Lycopersicon esculentum*.

Improved Bay State, in commercial production for several years, has improved yields significantly. Our Mansfield, Massachusetts, tomato growers have jocosely called it a "mortgage lifter." Waltham Mold-Proof Forcing, introduced in 1952, is considered commercially acceptable and is being grown rather widely. The fruits of both varieties number three to five to the pound, whereas those of the wild resistant and immune ancestors number about 450 to the pound.

Control Simplified

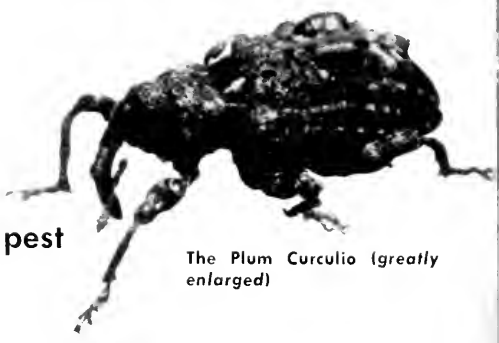
Research has simplified the control of the disease. The customary method of controlling tomato leaf mold in practice has always been uncertain and costly. Now, it is old and something of the past. The need for heating, careful greenhouse management, and cultural practices for controlling the disease as in the past is no longer so important. Induced resistance and immunity to tomato leaf mold by breeding have offered the grower security against loss and less investment in costs of culture. Thus the new concept of disease control in tomato culture under glass has replaced the old to improve the grower's income. It is hoped that no new strains of the fungus will appear to upset the results of our long history of effort.

Inflorescence and fruits of highly resistant currant tomato, *Lycopersicon pimpinellifolium*, ancestor of the Improved Bay State tomato at right.



Timing ESSENTIAL

to control persistent apple pest



The Plum Curculio (*greatly enlarged*)

By ARTHUR I. BOURNE*

THE PLUM CURCULIO is no new pest to apple growers, neither are recommendations to combat it a novelty. Massachusetts growers have been fighting the pest for many years with different degrees of success. Nevertheless, this species is still persistent, pernicious, and resourceful enough to take quick advantage of any loophole in the control program or carelessness on the part of the grower.

From the results of research and demonstrations by growers, it is evident that thorough and timely spraying with proper materials offers an effective and practical means of control. The matter of timing is one of the most decisive factors, especially in regard to the early growth of the fruit.

Experiments carried on by Professor Whitcomb of the Department of Entomology have indicated that fruits less than $\frac{5}{16}$ of an inch in diameter are seldom attacked by the Curculio and that injury does not usually occur until apples reach that size.

Left: Egg-laying and feeding scars on maturing apple. Right: Young apple showing fresh egg-laying scars.

No Universal Spray

Growers who have mixed varieties in their orchards discover not only the above fact to be true but also that different varieties have different rates of growth. Thus, the young fruit of some varieties become susceptible to Curculio injury earlier than others, and a spray application that gives excellent protection to one variety may be only partially effective on another whose fruits increase in size more rapidly.

Tests of different spray materials for Curculio control were made in one of the University orchards. Since the main variety in all the plots was Rhode Island Greening, the schedule of applications was based on that variety following the standard recommendations on timing based on temperature conditions and rate of growth. A few trees of Gravenstein, however, were present in each plot and were sprayed at the same time.

Control Schedule Recommended

In the first collection of June drops, counts indicated, in general, that more Gravenstein apples were damaged and more scars per fruit

* Head, Department of Entomology

were present on Gravenstein apples. Such damage is sufficient indication that growers should follow the recommendation of the Pest Control Schedule for the special Curculio sprays: "Spray first those varieties which grow most rapidly . . . Proper timing just ahead of or at the beginning of a hot period is essential to control Curculio irrespective of the materials used."

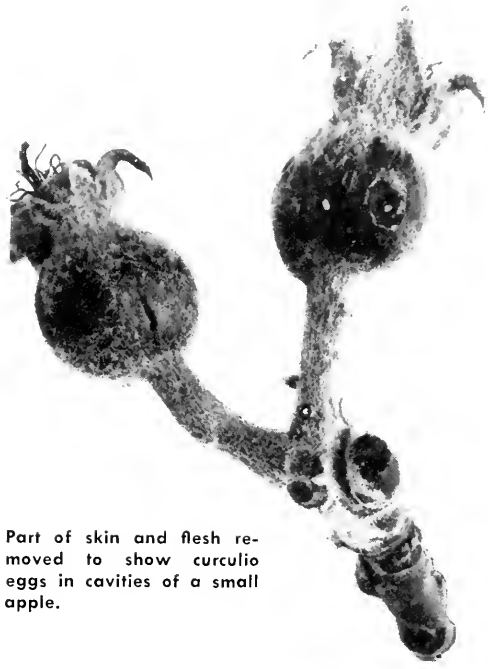
Environment Affects Control

The effect of orchard environment also has an important bearing upon Curculio attack and may largely determine the success or failure of the control program. Plum Curculio adults pass the winter in sheltered places in and around the orchard. Studies in life history and habits of the insect have revealed that stone walls, hedge rows, woods, and brushy areas offer excellent protection for these hibernating beetles. Many growers, however, still do not fully appreciate the serious threat such conditions offer.

The factors of environment were studied, and all materials tested were applied in triplicate to compensate for different types of exposure. One series adjoined woodland, a second series was placed along the margin of the orchard next to an open field in a cultivated area, and the third series ran through the center of the block.

According to the record of fruit at harvest from trees adjoining woodland, the Curculio damaged 90 percent of the fruit in the check plots compared to 53 percent from plots in the center of the orchard or along grassland and a cultivated area.

In the plots where insecticides were applied, Curculio damage averaged 2 percent of the fruit in the less exposed areas and a minimum of 0.9 percent in the center of the orchard. In places adjoining woodland, from 4 to 6 percent of the fruit were damaged in spite of equally good spraying and timing—clear indication that trees thus exposed to woods and brushland are subject to early and heavy attack by the beetles.



Part of skin and flesh removed to show curculio eggs in cavities of a small apple.

Since successful control of this pest requires carefully timed and thorough application of the most effective materials available even under the best of orchard conditions, growers should be constantly reminded that failure to eliminate dangerous environmental conditions may largely neutralize their best efforts at control and that they should supplement their spray program by removing such hazards as stone walls, hedge rows, woods, and brushy growth within and along the margins of their orchards.

A cooperative experiment with Professor Warren D. Whitcomb, Waltham Field Station, and workers in other New England States.

THIRTY-EIGHT YEARS OF PROGRESS IN PULLORUM ERADICATION

Pullorum disease, once a serious economic problem to the poultry industry, is now being held at bay after thirty-eight years of research and control efforts. Only hard cold statistics can record the story of this winning battle. In 1920-21, 12.5 percent of 24,718 birds tested were found to be reactors. In 1951-52, of 1,370,430 birds, reactors numbered less than one percent (.016).

Similar progress in pullorum eradication has been made in other areas. This progress may be credited in large measure to the accomplishments of the Conference of Laboratory Workers in Pullorum Disease Control. The objective of the Conference, which includes representatives from fourteen Northeastern states and two Canadian provinces, is to establish uniform methods and requirements in the eradication and control of pullorum disease.

On June 16 and 17 of this year, observing the twenty-fifth anniversary of its founding, the Conference has selected Amherst, its original meeting place, to hold its annual meeting.

UNIVERSITY AWARDED GRANT TO STUDY MILK

The National Institute of Health, U. S. Public Health Service, has awarded to the University of Massachusetts a grant of $5500 as part of a two-year research project to study new methods of pasteurizing milk as well as the effect of pasteurization upon certain properties of milk.

Dr. Warren Litsky of the Department of Bacteriology and Public Health will direct work on a pasteurization process based on a minimum temperature standard. A variety of pathogenic bacteria, as well as bacteria commonly found in milk, will be utilized to determine the effectiveness of the proposed process. The success of the project will mean that the sanitarian will be able to determine more easily the effectiveness of pasteurization and to eliminate some of the difficulties in establishing holding time in high temperature, short-time pasteurization equipment.

Dr. Denzel J. Hankinson, Head of the Dairy Industry Department, will direct parallel studies to measure the effect of the new treatment on flavor, creaming ability, vitamin stability, and curd-forming characteristics of milk.

This study is indicative of the concern in this State to make the best milk available, and to make that milk safer for the consumers.

From the Director . . .

Agricultural teacher, extension specialist, and research worker. In these capacities, Dr. Ralph A. Van Meter, our president since 1948, has worked in the three "atmospheres" of the University. With this opportunity to catch the spirit of each sphere, he has come to understand and appreciate the aims, ambitions, and problems of each significant part of the all-important whole—the University.

The experiment station is indeed fortunate to be a part of a university which is governed by a man whose interest in agriculture has been of long standing. Aware of the vital importance of research, President Van Meter in one of his annual reports to the trustees has pointed out that "although Massachusetts is an industrial state, agriculture is a $200,000,000 industry," and that "the value of the agricultural output is greater in Massachusetts than in any other New England state."

With President Van Meter's encouragement, research is bound to flourish at the University.

Dale H. Sieling

In This Issue

Research In Review

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Cover: President Ralph A. Van Meter. (See letter from the Director.) *Rollin H. Barrett.* Drawings on pages 3 and 5 by Roger A. Wolcatt.

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With small package fertilizers 10 ÷ 2 does not equal 5

BY JOHN W. KUZMESKI*

LONG before the increasing warmth of the sun has melted the winter snow, ardent gardeners may be seen poring over numerous colorfully illustrated seed catalogs.

What ethereal visions are conjured up of brilliantly hued flowers and sun-ripened vegetables that are to be his, only the true gardener can know. It is at this time that his sales resistance to advertisements of gardening supplies is at a low ebb. At this time, too, he is subjected to various forms of high pressure advertising by radio and by full-page spreads in newspapers and garden magazines extolling the alleged *magical*, *wonder*, *miracle*, or *enchanted* virtues of this or that plant food.

Claims are made for the presence of a multitude of trace minerals, vitamins, hormones, and organic compounds; and the average prices of plant food range from 25 cents to $26.60 a pound in products recently sold in Massachusetts.

What are the Facts?

1. Fertilizers by law must show guarantees of nitrogen, available phosphoric acid, and potash.
2. Despite any claims to the contrary, the effectiveness of these elements in promoting plant growth, provided the guaranteed amounts agree, is the same regardless of the name of the fertilizer in which they are contained.
3. Ordinary garden fertilizers sold for farm use contain all elements necessary to grow good crops of vegetables and flowers in soil.
4. Liquid and hydroponic plant foods have no advantage over the regular dry fertilizers, except ease of application.
5. So far as vitamins, hormones, and similar other factors are concerned, their inclusion in fertilizers has no value for ordinary garden use.
6. It is more economical to buy larger-sized packages. For example, one manufacturer sells a 100-pound bag of a 5-10-5 garden fertilizer for about $3.00. This means a cost of 15 cents a pound for guaranteed plant food. The cost per pound of plant food in a 5-pound package sold by the same manufacturer is 53 cents, and the cost of a pound of plant food in 3-ounce packages is $14.40.
7. Do not be misled by claims that one pound of a certain fertilizer will make so many gallons of liquid fertilizer. Remember that one pound of sugar will make several gallons of sweetened water but the nutritive value of the solution will still be equivalent to that of one pound of sugar.

* Head of Feed and Fertilizer Control Services.

Weed Story No. 3

Even Shakespeare

By JONAS VENGRIS, WILLIAM G. COLBY and MACK DRAKE*

THERE'S MORE THAN MEETS the eye in a cornfield overrun with weeds. We see and understand only the obvious — a field cluttered with undesirable plants.

Beneath the soil, however, in quiet persistent underground manoeuvers, robber barons of the soil—the lowly weeds are stealing precious minerals from the cultural plants, robbing them of healthy growth.

Competition Great

It is a common sight to see weeds between cultural plants on grassland as well as on cultivated land. With the weeds sometimes constituting 30 to 50 percent of the total yield, the competition for nutrients, light, and moisture is great.

Since not too much is known of the amount of minerals actually taken by the weeds, a study has been carried on to determine the extent to which weeds compete with cultural plants.

Weeds with extensive succulent, leafy growth, such as dandelions, plantain, milkweed, and ferns, contain more nitrogen than the cultivated plants with which they grow.

According to data accumulated for two years, weeds contained as much or more nitrogen than their associated forage crop grasses. Since grasses need nitrogen for optimum growth, they must compete strongly against their weed neighbors.

Some Weeds Thrive on Poor Soil

Whether grown on grassland or cultivated land, some weeds contained more phosphorus than their neighboring cultural plants. This was true for wormseed mustard on grassland and for pigweed on tilled land, which means that certain weeds are winning competitors for phosphorus. The struggle is less for the weeds but greater for cultivated plants when available soil phosphorus is inadequate.

Many weeds can utilize soil phosphorus in "fixed" (not readily available) forms.

* Assistant Research Professor; Head, Agronomy; and Research Professor, Chemistry, respectively.

In the clean field, at left, corn has no competition for nutrients and moisture. In the field at right, weeds are competing so strongly that the corn is suppressed, and yield is decreased. *John H. Vondell*

Had a Word For It!

"The noisome weeds that without profit suck
The soil's fertility from wholesome flowers."

Many of us have seen a field depleted in fertility and displaying an abundant weedy growth—evidence to the ability of weeds to grow and reproduce under conditions intolerable to domesticated cultural crops.

Weeds Underestimated?

It has been said that the weed is a plant whose virtues have not yet been discovered. There is already some indication that weeds may improve soil fertility. When weeds die and subsequently decompose, the soil phosphorus and other nutrient elements originally taken up by them are released during the decomposition process. Many organic decomposition products also act chemically to increase the availability of soil phosphorus. Thus, weeds may play a leading role in releasing fixed phosphorus and other soil elements.

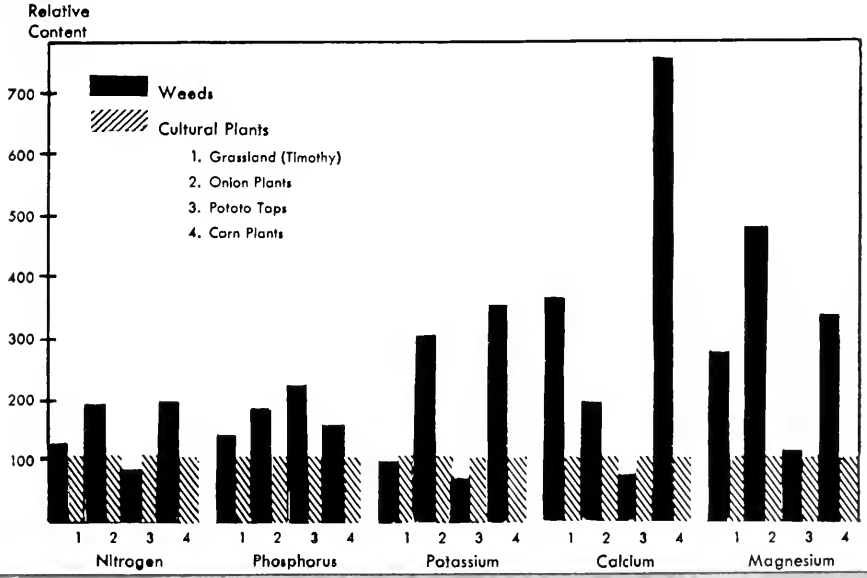
Potassium is an essential plant nutrient, particularly important in grass-legume mixtures. Grasses and weeds are so efficient in their uptake of soil potassium that they can grow normally when the level of soil potassium is too low to support legume growth. Weeds, then, place the potash supply for the legume in double jeopardy.

Under fertile soil conditions, common cultivated-land weeds, such as pigweed, chickweed, and purslane, may accumulate large amounts of potassium. For example, purslane was found to contain 8.43 percent potassium, whereas near-by onion plants had only 2.23 percent.

Weed Control Only Solution

The weed problem is as great as the number of weeds allowed to grow unhindered. The only way to stop weeds from impeding plant growth is, obviously, to keep them under control.

In the borgraph below, weeds are represented as having a greater mineral content than their associated cultural plants, except in potatoes where nitrogen, potassium, and calcium were found in lesser quantities. The cultural plants have been given the value 100.



Food Technology . . .

from pots to potentiometers

By WILLIAM B. ESSELEN*

POTS, PANS, AND A LONE GAS plate in a basement storage room of Wilder Hall—here in the Summer of 1913 was the meager beginning of a "laboratory" with Professor W. W. Chenoweth of the Pomology Department the pioneer spirit in a project on the preparation of jams, jellies, and canned foods.

With the enthusiasm stimulated by this preliminary work came more gas plates, more pots, more of the necessary equipment, and even a three-week laboratory course on the conservation of fruits.

Five years later the "laboratory" was christened "Department of Horticultural Manufactures" headed by Professor Chenoweth. By 1929 Chenoweth Laboratory, the present food technology building, took its place on the University campus.

One-Man Staff

The outstanding research program that has since developed in the food laboratory is due to the enthusiastic leadership of Dr. Carl R. Fellers, the original one-man research staff, who came to the University twenty-eight years ago.

Today, this world-known department, more appropriately named Department of Food Technology, has harbored scores of graduate students from many faraway places throughout the world.

The expansion of the one-man staff to six full-time research men and approximately 30 graduate students has been supported by innumerable research grants from government agencies and private industry.

Wide Variety of Food Problems

The original research in the department was concerned with the processing and utilization of Massachusetts fruits, such as apples and cranberries. This work has been continued throughout the life of the department and is still one of its important activities.

Research has not been confined to fruit products but has branched out and encompassed a wide variety of problems in the food field.

During World War II the department shared in the war effort by conducting work on home-canning and home-dehydration and cooperated in a project on safe home-canning process times.

Research Today

At present a number of research activities, which should be of benefit to agriculture in Massachusetts and the nation, as well as to Mr. and Mrs. Consumer, are being carried on. The use of nonsugar sweetening agents in canned and frozen fruits for diabetics and other persons on a restricted caloric intake is being investigated.

For the younger generation a major project on glass-packed baby foods is in progress.

To add spice and zest to our meals, research on the pasteurization and

* Research Professor, Food Technology.

processing of pickles is being continued, and the use of monosodium glutamate to enhance the flavor of foods is under study.

Development work on the packaging and freezing of turkeys and chickens, in cooperation with the Department of Agricultural Engineering, and work on the factors that influence the keeping quality and composition of cranberries may help to make a turkey dinner a more frequent occasion.

In cooperation with the Department of Agricultural Engineering, an apparatus has been developed for studying the thermal resistance of bacterial spores in the temperature range of 250° to 300°F. Data so obtained are important in the successful use of new canning methods.

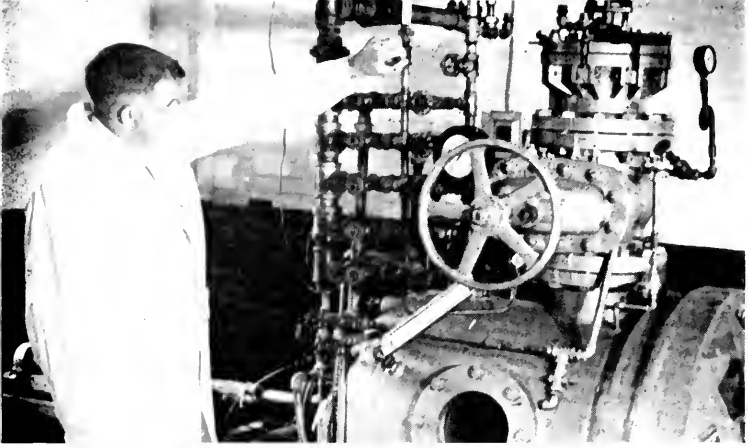
Work is also in progress on the stability of fruit colors and pigments in jams and preserves. The loss of fresh red color in such products during storage has been an important problem for many years.

Prepeeled potatoes and sliced apples for hotels and institutions are being investigated, and fundamental work is being carried out on the freezing of eggs and seafoods.

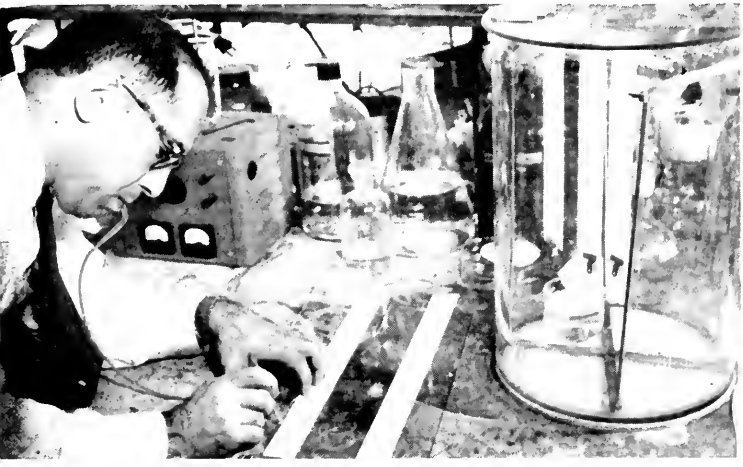
Agriculture and Industry Cooperate

The research activities of the Department of Food Technology would not be complete without the cooperation of agriculture and industry. Through the years and at present, cooperative work has been and is being carried on with Massachusetts groups and individuals, such as apple and vinegar processors, pickle packers, and cranberry and seafood canners. In many cases the research work is expedited and expanded, and by conducting tests and experimental work under commercial conditions in the plant, the food processor is better served.

A typical taste panel in the Department of Food Technology. Diabetics and those desiring a non-caloric fruit pack can take their sugar with a smile now. From studies carried on here and from opinions taken from a taste panel, synthetically sweetened packs were judged as "preferred" over the unpalatable water-packed fruit—the standard diabetic pack. *John H. Vondel*



CANNED FOODS are agitated in this experimental retart to speed up their heating rates to improve quality. Spoilage bacteria are killed more rapidly in such a pressure cooker and with less damage to food quality.



CRANBERRY JUICE contains several acids among which is quinic. Placing a drop of the juice on special paper is part of an improved method for determining the presence of quinic acid in cranberries.

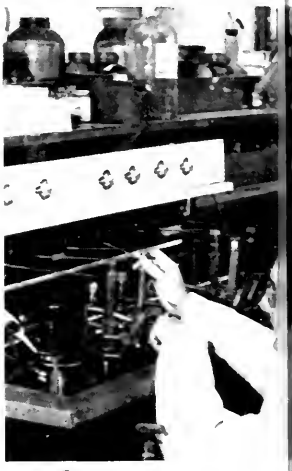
Food Research in Action

So much is being said today about the force of food in the world peace program. We are constantly charged with the commission to feed the world and teach its hungry peoples to produce more, or we leave them to fall into a wretched pit of starvation to become an easy prey to false ideologies.

The amount of food a nation can produce, however, is no better than the techniques it has developed for processing, storing, and preserving that food for future consumption. On these pages the Department of Food Technology is pictured at work to improve quality of processed foods and to develop better processing methods.

Photos by John H. Vondell

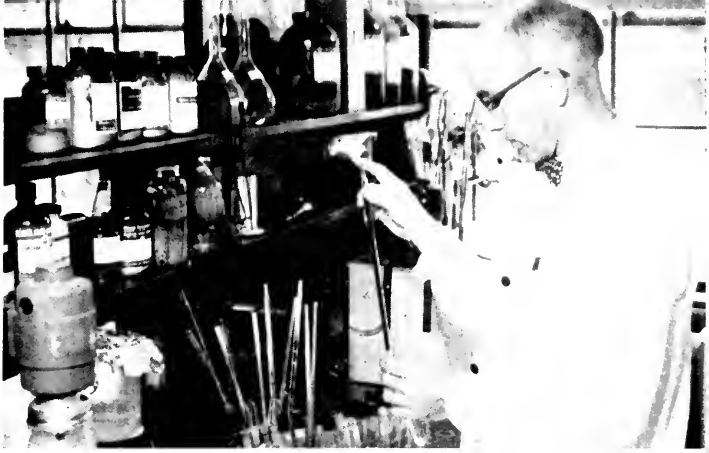
FRUIT PRESERVES such as stra storage. The causes of pigm vestigated. Here the spect preserves.



OILS AND FAT-CONTAINING fried potatoes, may some da termine the ability of antioxic

A TWELVE-POUND VACUUM- in -20° F. brine, a method whic left measures rate of freezing

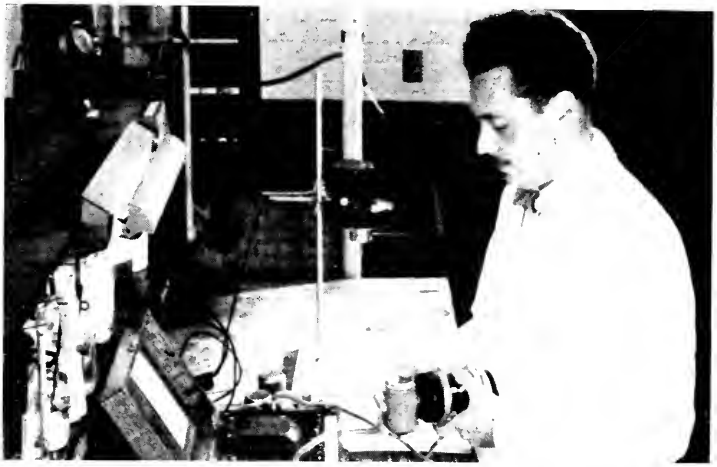
e their fresh red color rapidly during
methods to retard it are being in-
r records changes in the color of



PICKLES THAT APPEAL are a great concern to a ten million dollar pickle industry. Pasteurization of fresh pack pickles destroys spoilage microorganisms and the enzyme that causes off-flavor. Here the presence of the enzyme is detected by laboratory test.

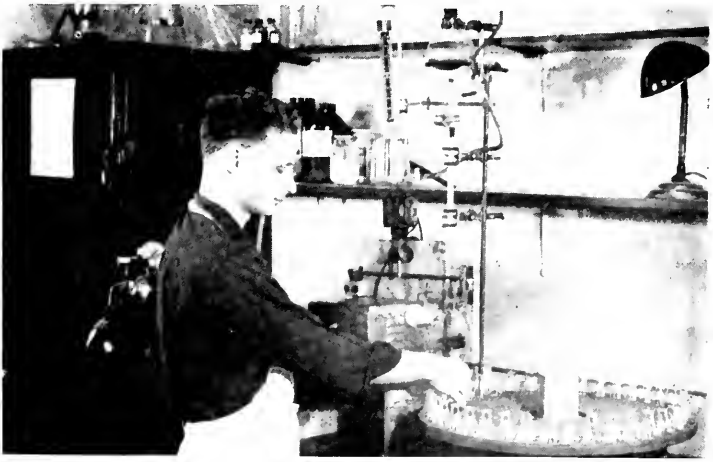
as potato chips and frozen French
ed by tests carried on here to de-
rd development of rancidity.

RKEY will freeze solid in five hours
dy heat rapidly. Potentiometer on



STRAINED BABY FOODS when stored under adverse conditions may undergo some changes in color. Such changes are measured by holding a photoelectric cell against a glass jar. The more light reflected from the contents, the less darkening present.

STRAINED CARROTS are being tested for the presence of acids. This automatic fractionating apparatus facilitates the determination.



Wilted Carnation Plant. *Norman Butterfield*

Massachusetts' 30,000,000 CARNATIONS

By

EUGENE C. GASIORKIEWICZ*

THE MAYFLOWER may be our state flower, but it is the carnation, America's second ranking flower, that is the leading cut flower produced in the State. No mean industry, this flower crop was valued at about three million dollars in 1950. Eighty-five percent of the thirty million carnations produced here are shipped to the South and westward to the Mississippi River.

Massachusetts is in sixth place in the United States (following New York, Illinois, Pennsylvania, California, and New Jersey) with 6.1 percent of the total value of cut flowers grown under glass. Recognizing this fact, the University initiated a full-time research program at the Waltham Field Station for the study of flower diseases.

* Assistant Research Professor, Botany, Waltham Field Station.

The Big Three

The "Big Three" in flower diseases —Fusarium Wilt, Bacterial Wilt, and Carnation Mosaic—account for the greatest losses in carnation production.

Fusarium Wilt is caused by a fungus that finds its way from the soil to the plant's vascular system (the system by which water and food are conveyed through the plant). Because more plants become diseased during the vegetative propagation of carnations by cuttings, the disease is a perennial problem.

Bacterial Wilt, the second of the triumvirate, is caused by a bacterium. Similar in living habits to Fusarium Wilt, it is faster acting in the amount of loss it causes. Since the bacterium is readily translocated during watering, it is easily and quickly spread through the plants.

Carnation Mosaic, the least known of the three, is caused by a virus. Highly contagious, it attacks newly introduced varieties so that most of them are infected within three years after their release. Its destructiveness to production has not been fully established.

Threefold Program

The floriculture crop pathology research program was launched with a three-way attack on these carnation diseases. First, it was aimed to obtain fundamental information on virus diseases of carnations. The extent of fungous and bacterial pathogens in commercial plantings was to be determined. The third phase of the program was concerned with an effective chemical control for these diseases.

Virus Properties

Carnation mosaic virus is inactivated by extremes of pH—below 4 (acidic) and above 9 (alkaline). The most effective pH for securing uniform and consistent infection in host plants is neutrality (pH 7).

The virus may be transmitted easily during various cultural procedures. If carnation leaf virus-infected sap is diluted beyond 1:1000 and flower juice above 1:500, the virus concentration is almost lost.

Heating carnation virus-infected sap between 145.4° and 154.4°F. for fifteen minutes inactivated the virus. Since carnation cuttings will not tolerate this amount of heat, carnation virus must be controlled by some other method.

Culturing

Culturing of carnations, that is, placing surface-sterilized pieces of carnation stems into dishes containing a suitable growing medium, has become the ideal indexing procedure for determining infection. The method is so efficient that bacteria or fungi can be detected in carrier hosts that show no symptoms under normal growing conditions. Cultured plants from the clean areas of the greenhouse become the source of supply for disease-free cuttings.

Chemicals Give Promise

Most fungicides are developed for fiber and food crops. Adaptation of these materials for control of floriculture and woody ornamental plants, however, is arrived at by trial and error. Since 1950, thirteen commercial preparations have been tested, and those giving promise have been retested. Of these, only three materials have survived to the retest stage.

These materials are evaluated for their effectiveness in the control of the disease organisms involved; their effect on the pH of the soil, on the soil fertilization program, on soluble salts in the soil, on plant growth, and on production and quality of flower. The rates of applications suitable for the crop are being determined.

Continued research in this floriculture crop as well as other crops is the only answer to the practical control of disease, the outstanding limiting factor in production.

Left: Virus infected carnation with characteristic mottling.

Right: Healthy plant.

Norman Butterfield

Ozone - a substitute for chlorine?

By J. E. FULLER, J. C DICKERMAN
and A. O. CASTRABERTI*

LOUIS PASTEUR, the great French scientist, made the first of his discoveries in the field of microbiology about the time that our Civil War was coming to an end. The development of modern microbiology may be said to date from that time.

Beginning with Pasteur's discoveries, scientific research has produced much valuable information on microbes that cause human and animal diseases. Control of these microorganisms to safeguard the public health has done much to make people healthier and their lives happier.

Water-borne Bacteria

The public-health practice of controlling and treating public water supplies has prevented the spread of infectious diseases, particularly typhoid fever, dysentery, and cholera, by this medium. In 1857, before anything specific was known about bacteria, a cholera epidemic occurred in Philadelphia among people using water that came from a particular town pump. Fifteen years later, a water-borne epidemic of typhoid fever was studied and described in Switzerland. The bacteria causing these diseases were discovered not long after.

Once the relation of bacteria to water-borne diseases was known, the next step was to find a way to destroy these bacteria and other dangerous microorganisms in public water supplies. Water was first treated with chlorine in Germany about 1894, and in England three years later. The first successful use of chlorine in the United States was in Chicago in 1908. Since that time, the chlorination of public water supplies has become general and successful throughout the United States and in the more progressive countries of the world.

Chlorination Not Perfect

Although chlorination is effective, it has certain disadvantages. In particular, it combines with organic matter in water to cause disagreeable tastes and sometimes odors. To avoid these faults, ozone, a form of oxygen, has been considered as a possible substitute for chlorine.

Ozone, employed somewhat in Europe for treatment of water, is used in the United States principally for the elimination of tastes and odors. Ozone has germicidal properties, but because of the types of generators available, the ozonation of water costs much more than chlorination.

New Generator

Recently, a simple type of ozonator that eliminates several complicated steps previously required in ozone production was made available to the University laboratory

* Research Professor, former Assistant Professor, graduate student, respectively, Bacteriology.

Preliminary experiments have demonstrated that ozone generated by this new apparatus can be added to water satisfactorily and that objectionable quantities of hydrogen peroxide and nitrous oxides are not detected.

In a second series of experiments, pure cultures of bacteria likely to be present in natural water were suspended in sterile water, and ozone was bubbled through the suspensions. Plate counts made from the suspensions before and after they were treated with ozone determined the amount of ozone and the time of application required to kill the bacteria. A very moderate amount of ozone (two parts per million) applied for one minute, killed all bacteria except those that produce spores. Fortunately, bacteria causing intestinal diseases are not spore producers.

Disinfectants

In a third set of experiments, two parts per million of ozone, applied for five minutes to raw water from streams that contained bacteria from natural sources, killed the bacteria. A longer exposure time was required because some of the bacteria were spore-producers and because organic matter in raw water combined with and inactivated some of the ozone. (Inactivation of disinfectants by organic matter is a recognized fact; chlorine is inactivated in the same way.)

Ozone More Effective

In a final experiment, 15 parts per million of ozone, applied for three minutes, destroyed a culture of protozoa that resisted the application of 250 parts per million of chlorine applied for a much longer time. Ozone could be important in eliminating from water supplies pathogenic (disease-producing) protozoa such as those causing amoebic dysentery.

An inexpensive ozonating generator could be developed for the practical treatment of public water supplies. Ozonation not only would prevent tastes and odors so often produced by chlorination, but would effectively remove any tastes and odors already in water before treatment.

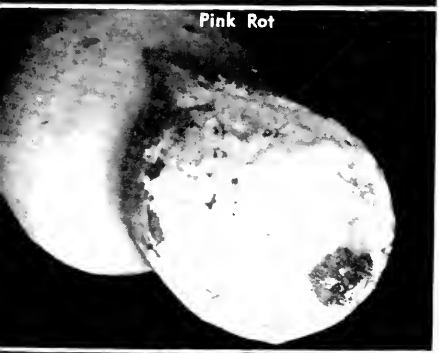
The old order may change, then, in water purification to give way to the new in a more satisfactory and effective substitute—ozone.

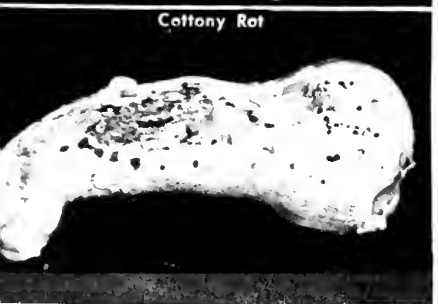
This new type ozonator, unlike earlier models, can be installed and operated at a low cost.

John H. Vondell

Rot, Scab, and Shrinkage

By EMIL F. GUBA, Research Professor





MARK TWAIN, once trying his hand at editing an agricultural paper created quite a furor, so he claimed, by describing the squash as a favorite New England *berry*!

His humor, however, was not appreciated by rugged New Englanders, and his agricultural editing was soon ended.

The squash, of course, is far from being a berry, but Mark Twain was quite right in classifying it as "New England" and "favorite," because Massachusetts now leads in the production and consumption of this blue ribbon vegetable.

Causes of Spoilage Numerous

New Englanders not only want to eat their squash, but to have it, too. And they can have it, long after harvest time, if care is taken to store the crop properly. The chief varieties for winter market are Blue Hubbard and Butternut. These are harvested in September and stored in farm buildings. Although sound and healthy when harvested, squash can be so spoiled by bacteria and molds in storage that the grower's investment is greatly depreciated. The many types of molds attacking squash during storage are illustrated on these pages.

Squash cannot be stored anywhere. They require cool, dry moving air and an even temperature. An overhead storage is better than a

The marked wilting of these squash vines has been caused by bacterial wilt. Although prevalent in the field, this vine disease ordinarily exhibits no symptoms until the squash is stored.
J. C. Richardson

CAN BE PREVENTED IN STORED SQUASH

Department of Botany, Waltham Field Station

ground floor basement storage. When temperatures rise and relative humidity declines, squash lose weight, and chemical changes and food value losses are accelerated.

As the weather becomes cooler, the storage temperature should be lowered gradually to 45° to 50°F., and air moisture should approach 70 to 75 percent relative humidity during the winter season.

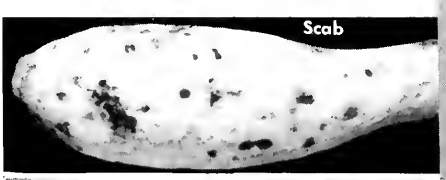
Many Precautions Necessary

According to studies, the following practices are recommended to control spoilage and shrinkage of squash in storage:

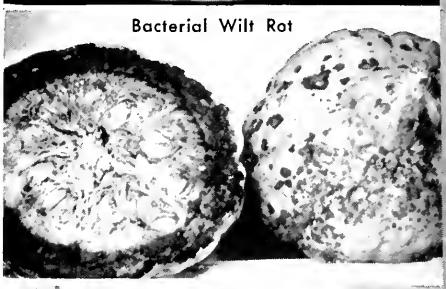
1. Select seed from mature healthy squash.
2. Treat seed with fungicides.
3. Grow squash on land that has proper drainage.
4. Rotate crops (squash should be planted not oftener than once in three years).
5. Control insects, notably striped cucumber beetle, squash vine borer, and aphis.
6. Store squash promptly after cutting.
7. Handle squash carefully to avoid injuries.
8. Fill storage room to its full capacity.
9. Heat storage and ventilate with forced air to maintain squash and atmosphere at an even temperature.

Inside Beaver Brook Farm squash storage, Dracut, Massachusetts. Visiting the many squash storages in the State would help anyone interested in improving storage practices.

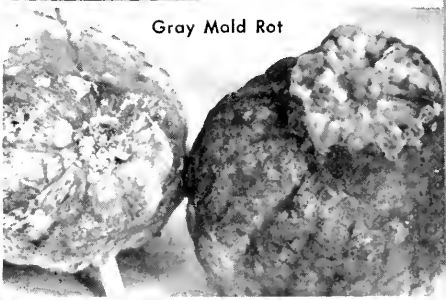
J. C. Richardson



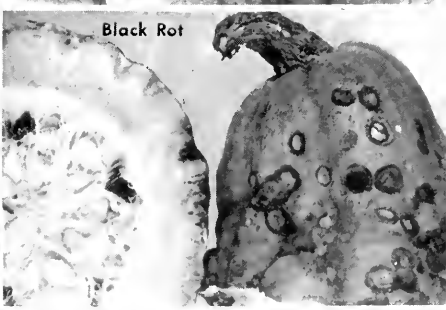
Scab



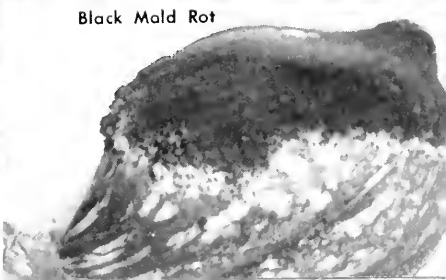
Bacterial Wilt Rot



Gray Mald Rot



Black Rot



Black Mald Rot

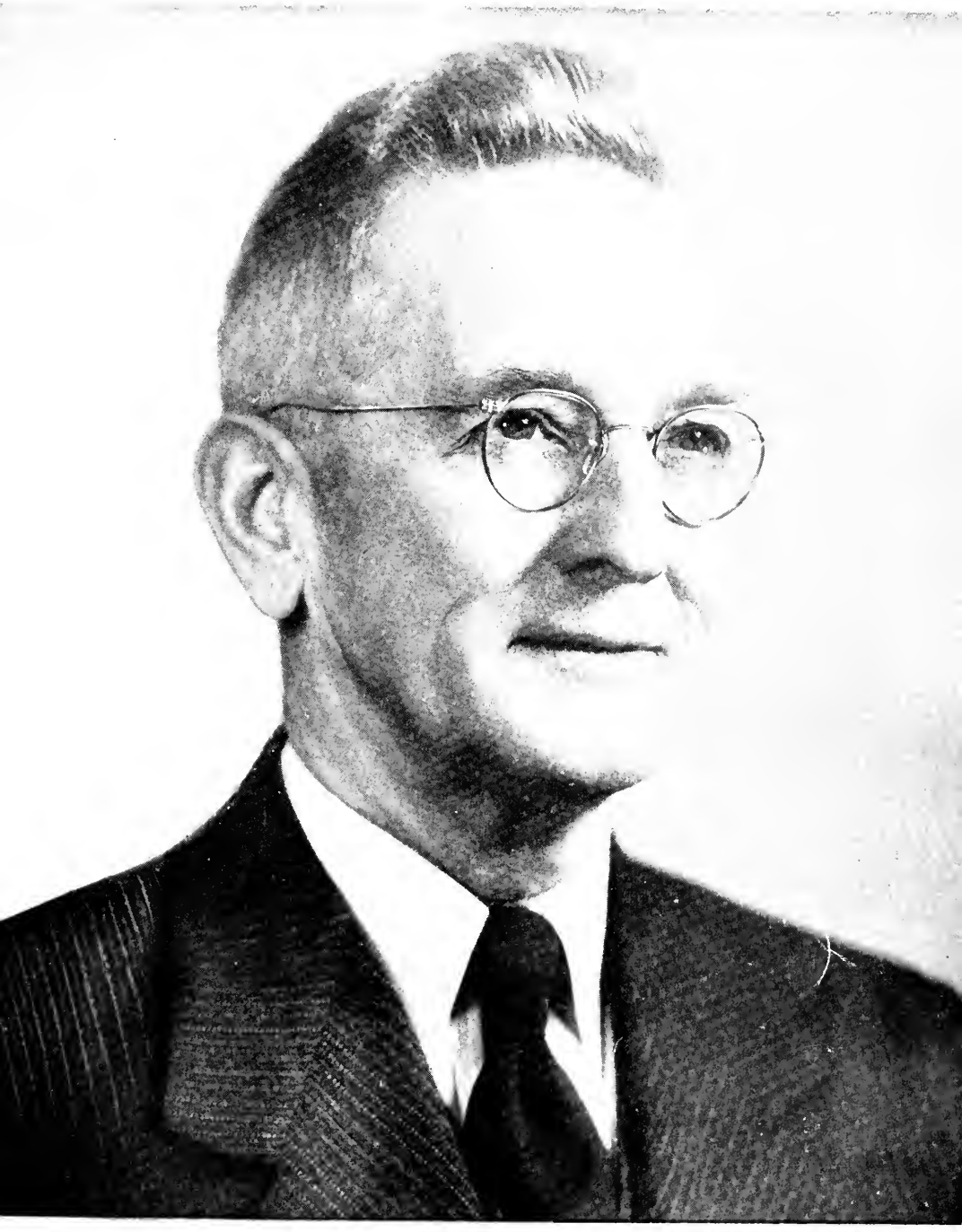
TWENTY THOUSAND DOLLARS AWARDED FOR POULTRY STUDY

With more than $300,000,000 tied up in the Northeastern States broiler industry, $40,000,000 worth in Massachusetts alone, the problems of the poultry industry become more acute and the need for improvement more urgent.

Recognizing the economic importance of such an industry, the directors of the Experiment Stations of the twelve Northeastern States have allocated $20,000 for a regional project to study several aspects of the poultry problem.

One of the problems, poultry house ventilation, has become the subject of countless articles and research studies. It is an established fact that litter moisture and the composition of the air within a poultry house seriously affect the quality of the product as well as the efficiency and health of the birds. High temperature litter and inadequate ventilation are directly responsible for blindness in young birds. Control of respiratory disease, which is becoming increasingly prevalent, may also depend upon proper environment.

Eight thousand dollars of this government grant has been earmarked for the Department of Agricultural Engineering of the University. Under the leadership of Professor Herbert N. Stapleton, the engineering staff hopes to construct a suitable low-cost high-strength poultry house, convenient for poultry workers and useful as a hurricane and rain shelter.



Research In Review

VOL. 3 NO. 2 JUNE 1954

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All requests for *Research in Review* should be addressed to the Mailing Room, South College, University of Massachusetts, Amherst, Massachusetts.

Director—Dale H. Sieling

Editor—Portia A. Ierardi

In This Issue

Cover: Ray M. Koon, former head of The Waltham Field Station. See story on back cover.

Photo by Zitso Studio

Massachusetts Joins Nation in Celebration of Entomology Centennial

(See story, pages 14-15.)

From the Director

Everyone likes a success story. The progress made by entomologists in the past century in Massachusetts in the control of harmful insects has been a notable success story. Massachusetts has a national reputation for producing leaders in the field of entomology. We are proud of that reputation and the contributions that have been made by these scientists for the betterment of our nation.

It was also in Massachusetts that one of the great entomological mistakes was made, for it was here that the Gypsy Moth was allowed to escape in 1869 after having been imported for the purpose of improving silk production.

To add to the irony of this unfortunate scientific adventure that backfired, no silk was ever produced, and since 1900 the insect pest has cost the Commonwealth $55,000,000 in direct expenditures as well as other damages.

Eradication of the Gypsy Moth in our state would be a scientific triumph that would compensate for the great faux pas made by one entomologist long ago.

Dale H. Sieling

Publication of This Document Approved by George J. Cronin, State Purchasing Agent, 5M-11-53—910953

Chicks of the Year

Twin chicks, 19 days old, hatched from a double-yolked egg. Since double-yolkers are rarely twice as large as ordinary eggs, the twins did not have enough room to develop, as evidenced by the badly crippled female, left; the male, right, though otherwise normal, had crooked outer toes. The mother of the chicks was a dominant White Plymouth Rock; the father, a New Hampshire. *Photo by John H. Vondell*

By F. P. JEFFREY, T. W. FOX, and J. R. SMYTH, JR.
Department of Poultry Husbandry

TWIN CHICKS hatching from a double-yolked egg broke the dull routine of an experiment conducted here last year in a study to determine how long fertility lasts during the early period of the laying year in hens.

Of the 208 eggs set, only one produced the famous twins that are supposed to be, undeniably, the first chicken twins to survive hatching. The remainder of the eggs did not hatch. (Only one in every 500 eggs laid by hens is a double-yolker.)

Not since 1850, when Bernard in Paris, France, reported the successful hatching of double-yolked eggs has there been any reference to such an occurrence.

Chicks of Different Sex

Proof that the twins did not originate from a single yolk was evidenced in the different sexes and different down colors. The male was pure white; the female, clear red, that is, red without any black in the primary and secondary wing feathers.

Double-Yolked Eggs Infertile

Double-yolked eggs were found to be two-and-one-half times less fertile than single-yolked eggs — a good reason why commercial hatcheries avoid setting double-yolked eggs. Moreover, embryos from such eggs died during the first seven days of incubation (a mortality rate that was four times as heavy as that found in ordinary eggs).

In spite of the high mortality, however, 30 percent of the embryos in double-yolked eggs survived at least for 14 days or longer, and many were fully developed before dying.

Double-yolked eggs are laid in greatest numbers during the early production period. In the flocks studied, the incidence of double-yolked eggs during the first seven weeks of egg production was 2.8 percent.

Weed Story No. 4

Even *Hercules*

By
CHESTER E. CROSS
Head of the Cranberry Station, East Wareham

In this last weed artic
task of hand-pulling t
seded by modern metho

EIGHTEEN HUNDRED weeds to a square foot! Multiply this by 43,560, the number of square feet in an acre, and even Hercules would have balked at the task of pulling weeds by hand on our cranberry bogs. Yet, as recent as twenty years ago, this hopeless procedure and mowing were the only methods employed in ridding the bogs of weeds.

Kerosene — An Effective Killer

Today, cranberry growers rarely pull any grass on their bogs. A year's work of time-consuming hand labor has been replaced by a million gallons of kerosene, an effective weed killer but harmless to the cranberry plants.

The vines can tolerate very heavy sprayings of kerosene oil, at least in their dormant condition, but the weeds cannot. The leaves of such cranberry weeds as the grasses, sedges, and rushes are so constructed that the kerosene spreads to the base of the leaves where the oil lodges and kills the tissues.

Kerosene, at the rate of 5000 to 7000 gallons a day, is sprayed on cranberry bogs direct from tank trucks.

Photo by J. Richard Beattie

Spraying Not Expensive

If, therefore, a grassy bog is sprayed with kerosene at the rate of 300 to 400 gallons to an acre, all the weed tops die and no measurable injury occurs to the cranberry vines. If 800 to 1000 gallons of kerosene are sprayed to an acre, the weed roots as well as the weed tops will die.

It is possible with a spray costing less than $150 an acre to treat a bog so overgrown with weeds that no cranberry vines are visible. Such a spraying will insure the bogs from all grassy weeds the following season and, with proper care, for many more seasons.

Control Difficult

In several ways, weed control in cranberries is more difficult than in other crops. First, cranberry vines are perennial and evergreen. As they grow, they cover the whole surface of the bog, usually with 200 to 600 leafy stems a square foot. Once the vines are planted and fully grown, the ground is never again plowed or harrowed, and, if well cared for, will produce annually for 90 years or more.

It is easy to see, then, how weeds can become established with heavy and sometimes very extensive root systems. Moreover, in order to re-

Would Have Balked!

f a series of four, Dr. C. E. Cross tells how the arduous eeds that invade our cranberry bogs has been super- nd chemical sprays.

move the weeds, the vines must be trampled, equipment rolled over them, and their roots disturbed.

Weeds Thrive on Bogs

Weeds, like the crop plants with which they compete, need moisture, nutrients, and sunlight to thrive. In a cranberry bog, there is usually plenty of moisture for the various weeds growing there. The bogs, usually flooded during the winter, are frequently reflooded in the spring and fall to protect them from frost (and occasionally to drown insects), and in the summer to provide irrigation.

Such wet conditions prevailing on the bogs are ideal for weed growth. The grasses, sedges, and rushes, which constitute the major weed problem, grow up through the vines, spread their leaves above, and take advantage of their height to intercept the sunlight and shade the cranberries.

Sanding Necessary

Cranberry bogs must be covered with a layer of sand one-half to one inch thick every three to five years. PDB (paradichlorobenzene), used for killing peach borers and keeping moths out of closets, is scattered at the rate of 7½ pounds to a square rod and covered immediately with an inch of sand. This kills nearly all the poison ivy and wild bean present.

Yet, the vines are unaffected and, surprisingly, show greatly increased vigor. This method of eliminating two troublesome perennial weeds is a greatly improved one over the old system of pulling or grubbing out.

Iron Sulfate Still Valuable

One of the oldest of weed killers, iron sulfate (sugar of iron or green vitriol), is still of great value in weed control — several hundred tons of it being used annually. Again, it is the great tolerance of cranberry vines that makes it possible to use this chemical. At the rate of two to three tons scattered evenly to an acre, it will kill several species of ferns, sand spurrey, tearthumb, and others. With this chemical the grower can eliminate at least twenty ferns for every one he could dig out by hand.

Here is another example of man-hours saved and production increased in a modern world of new chemical knowledge directed through proper channels for the ultimate good.

Spike rushes are common weeds on wet cranberry bogs. Here effective kill by Stoddard Solvent spray is illustrated.

Photo by J. Richard Beattie

"Service — our keynote."
Photo by Robert Young

Ray Koon and his staff
THE WALTHAM

THE NEED for a field station near Boston was first recognized in 1911, when the ravages of insects and diseases in the greenhouses and fields of eastern Massachusetts had increased to a point that threatened to put the vegetable growers out of business.

The next year, Professor Harold F. Tompson, then head of the Department of Vegetable Gardening at the State Agricultural College, as the University was then known, assisted a committee of the Boston Market Gardeners Association in filing a bill with the General Court "to establish a Market Garden Field Station for practical demonstrations."

Money Appropriated

In 1916, $8000 was granted to purchase twelve acres of land in Lexington. After another appropriation of $35,000 for buildings and maintenance, active work began with Professor Tompson in charge and Paul W. Dempsey acting as foreman.

The next seven years were spent studying the insects and diseases that beset market garden crops.

By 1923, Professor Tompson had resigned, and Professor Ray Koon was appointed his successor. Under the new head, the Station was transferred to the 55-acre Cedar Hill estate of the late Cornelia Warren in Waltham, its present home.

Flower Growers Help

With the appointment of Professor Warren D. Whitcomb, entomologist, the demands for more service began to skyrocket, and, by 1929, through the efforts of an insistent group of flower growers, legislative appropriation was obtained to enlarge the building, erect another greenhouse, and add a floriculturist to the staff. With this new look, the Market Garden Field Station changed its name to The Waltham Field Station.

Hybridizing greenhouse tomatoes. It is anticipated that the Waltham hybrid tomato may increase yields and surpass the Waltham Forcing tomato, which now makes up 90 percent of the greenhouse spring crop.
Photo by Zitso Studio

ell the story of
IELD STATION

Flower Garden Created

At this time an extensive garden of perennial flowers and a collection of rock plants were laid out. Here plants are tested under average garden conditions, and their value in a home garden is determined.

The garden, which holds 4500 plants and 130 different spring flowering bulbs, has created wide public interest and attracts thousands each year.

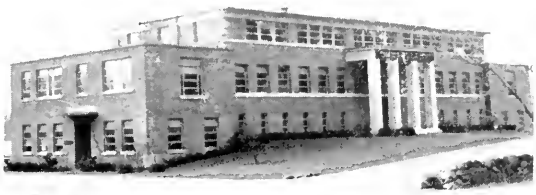
Apple Orchard Added

When it became evident that an experimental apple orchard was necessary, 200 trees were planted. Later, the Massachusetts Nurserymen's Association was instrumental in obtaining space, more greenhouse equipment, and the appointment of a specialist in nurseryculture.

New Look

Finally, when the Station was literally bursting at the seams, the Legislature again granted $275,000 in 1950 for a modern spacious building.

With the extra space, the Field Station was able to extend its service to include poultry diagnostic work to study diseases affecting poultry in the area.



"a story of constant growth"
Photo by Robert Young

The most recent addition has been the branch of the University Shade Tree Laboratory. In its field testing program, many new insecticides and other chemical killers for the control of such tree ailments as leaf miner, cankerworm, spider mites, and fire blight are tested.

Future Growth

From a pioneer staff of two to an actively expanding staff of 19, the Field Station has contributed its share of new discoveries. Its keynote is service, and its future growth depends entirely upon its capacity to meet the continually increasing needs and demands of the public.

Aerosol "bombs" are modern equipment for combatting insect pests in the greenhouse. The operator must wear a gas mask and special clothing to protect him from the poisonous vapors.

Photo by Zitso Studio

BREEDING FOR BETTER STRAINS is always going on to obtain improved vegetables that are better adapted for marketing purposes. Here Professor Guba studies the highly resistant currant tomato from which he developed the New Improved Bay State Tomato resistant to leaf mold. Professor Guba is also the foremost authority on carnation diseases. *Photo by Tupper*

Research at Waltham

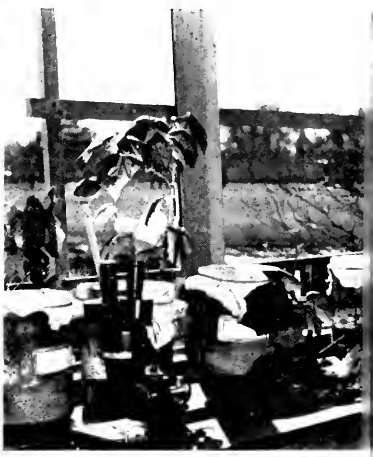
serves you

Ever mindful of its initial purpose to serve the vegetable and flower growers as well as the people of the eastern part of the State, the Waltham Field Station has carved an admirable way of research and service . . . doomed peach orchards rehabilitated . . . flowers and vegetables that are disease resistant . . . vegetable strains improved . . . more healthy birds in the poultry yard.

On these pages are illustrated some of the many facets of research at Waltham, a truly strong arm of the University.

Photos by Zitso Studio

FRUIT DISEASES are constantly being
materials and methods. Stationary
ally replaced the hose and spray ro
their orders for pesticides on studie
performance and tree tolerance.



INSECT WORK is carried on in the i
insects are reared and studied under
such as cabbage maggots, carrot ru
apple curculio beetles, grape girdlers

FLOWER CULTURE is concentrated on
portance in the flower industry. Her
to determine how various conditio
humidity, cool air, and preservatives

eans of newly discovered spray
banks of nozzles have gener-
d spraying. Fruit growers base
Waltham to determine spray

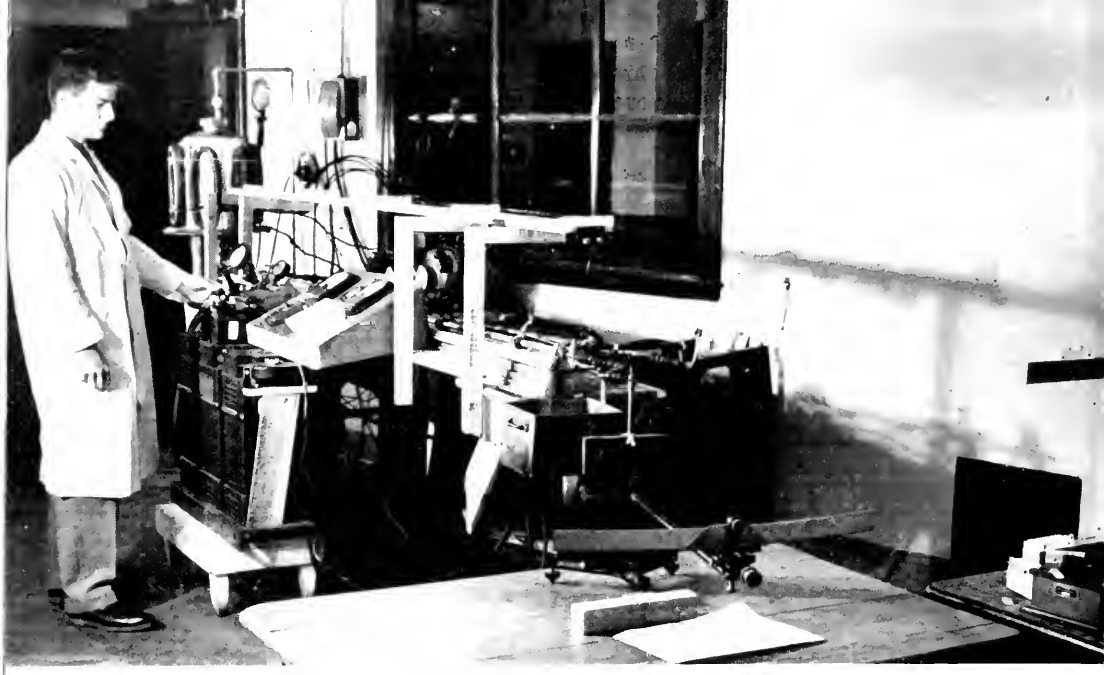
NURSERYCULTURE experts help nurserymen produce better plants at less expense. Here rooted cuttings of Hick's Yew are being removed from the propagating bed as results are recorded. Other projects include the propagation of Mountain Laurel and American Holly, weed control, and hardiness of commercially available evergreen azaleas and rhododendrons.

outdoor screened shelter where
al conditions. Many crop pests,
ash borers, celery plant bugs,
flower pests are being studied.

POULTRY DIAGNOSTIC WORK to prevent the spread of communicable diseases and thus reduce future losses is a relatively recent service well patronized by the poultrymen of the area. Last year, 9943 specimens were submitted for examination.

because of their economic im-
rs receive their daily weighing
hem. Water at 100 F, high
e life of cut flowers.

FLOWER DISEASES are always under study in a perpetual program to develop effective control measures. Here samples of flower plants are indexed by culturing to give the percentage of infection by disease organisms. Carnation and gardenia growers have benefited greatly by the findings in this field.



Experimental Apparatus for Testing the Effect of Short-Time Milk Pasteurization.
Photo by John H. Vondell

NEW PASTEURIZATION STUDIES
may lead to safer milk supply

By WARREN LITSKY, R. B. READ, JR.,
D. J. HANKINSON, and R. R. BROWN*

THE TRIUMPH of pasteurization is the dominant theme in the statistical picture of milk-borne diseases in Massachusetts. During 16 milk-borne outbreaks, between 1911 and 1915, 1,255 cases of diphtheria, scarlet fever, septic sore throat, and typhoid fever were diagnosed.

How swiftly the scene changes when we look at the picture between 1946 and 1948, when no cases of the above diseases originating in milk were reported.

* Dr. Litsky and Mr. Read are members of the Bacteriology Department; Prof. Hankinson is head of the Dairy Department; and Prof. Brown is head of the Electrical Engineering Department.

Many Factors Responsible

Healthy cows, inspection of dairy farms and milk plants, and pasteurization have been the more important causes for this marked decrease in disease. For example, from 1905 to 1909, nonpulmonary tuberculosis caused 57.7 deaths, on the average, in 100,000 population. The majority of the cases were caused by organisms known as bovine tubercule bacilli found in raw milk. It was only after 1910, when pasteurization began to be introduced on a large scale in the State that there was a precipitous decline that amounted to nearly a 75 percent drop in deaths by 1923.

Two Methods of Pasteurization

Pasteurization is a process of heating milk to a moderate temperature for a definite period of time to kill disease germs. In most states two methods of pasteurization are employed: The "holding" method requires the milk to be heated to at least 143°F (142°F in Mass.) for not less than 30 minutes, whereas the "short-time" method requires a temperature of 161°F for 15 seconds. The U. S. Public Health Service Milk Ordinance specifically states, however, that other methods may be used if they have been demonstrated "to be equally efficient and . . . approved by the State health authority."

Short-Time Method Economical

The short-time method of pasteurization is more economical for large-volume operations, and for this reason is employed by most of the large producers. However, this method is not completely satisfactory because it is difficult to establish and maintain the 15-second holding period.

Time-Temperature Relationship

The time-temperature relationship is governed by the rate of flow of milk through a heating tube. Unfortunately, since the milk flow varies as the speed of the pump varies, the time-temperature relationship necessary for proper pasteurization may be easily upset.

Higher Temperatures Established

Inasmuch as more time is required to kill bacteria at a lower temperature than at a higher temperature, it is logical, then, to assume that disease-producing bacteria may be destroyed in an even shorter time by using temperatures that are higher than currently established pasteurization temperatures. Killing temperatures may now be established by a special apparatus that heats milk in a fraction of a second to temperatures between 160° and 211° F. Once the effectiveness of these temperatures is determined, the heating time will no longer be of major importance.

New Pasteurization Process in Sight

The data obtained in these experiments will provide a basis for continuous pasteurization in which temperature will be the only standard that will require enforcement. Because commercial machines are not able to heat the milk to the required temperatures and cool it as rapidly as the experimental apparatus, the extended period of heating and cooling will provide additional killing of bacteria. This will be an added safety factor. A pasteurization process based only on a temperature standard will require fewer controls on the part of the health officer. At present, the holding-time is very difficult to check and requires special equipment. With only a temperature standard to enforce, the job of the public health inspector is simplified, and a safer milk supply is guaranteed.

This is a cooperative study under a grant from the U. S. Public Health Service, Department of Health, Education, and Welfare.

Antibiotics Score Again

in swine feeding tests

By DONALD M. KINSMAN
Assistant to the Superintendent of Farms

THE PAYROLL of the Commonwealth does not show it, but antibiotics are working for the State. A number of studies are now being conducted on the University Farm to check work performed at other stations and to test various levels of feeding. New substances are being tested in the hope of gaining additional experience and information concerning these "miracle drugs."

Since World War II, much research work on the animal nutritional value of many antibiotics has been carried on. The antibiotics primarily studied were penicillin, aureomycin, streptomycin, terramycin, and bacitracin. A decided growth stimulus and increased thriftiness were demonstrated when nonruminants (poultry and swine in particular) were fed antibiotic-reinforced feeds compared with a control group fed the same ration without the antibiotic. Further research was concerned with feeding ruminants (cattle and

Miss Marilea Papalia, University senior honor student in Animal Husbandry, implants a bacitracin pellet in a suckling pig held by Mr. Philip James. This is one of several antibiotic trials and experiments being conducted at the University. *Photo by John H. Vondell*

A newly farrowed litter of Chester White pigs gets an excellent start in life from its mother's milk. In two or three weeks, however, the pigs may be entirely weaned and placed on a sow milk replacer reinforced with antibiotics. *Photo by John H. Vondell*

sheep). Here an additional "boost" was evidenced in the young just before the development of the paunch, which is dependent upon rumen bacteria for its effective functioning.

Claims of 10 to 15 percent increase in growth and weight attributable to antibiotics were made by many workers in the field of animal nutrition. This additional growth stimulus has tremendous commercial significance and is being widely accepted throughout the livestock world.

Best Response from Runt Pigs

In January, 1953, nineteen Chester White weaned pigs from the University swine herd were divided into three groups: Group 1 included seven normal pigs, averaging 49 pounds each; Group 2 was made up of six runt pigs, averaging 31 pounds each; and Group 3, six normal pigs, averaging 46 pounds each. All groups received the same ration, but Groups 2 and 3 each had terramycin (TM5) added at the rate of 2 pounds to a ton of feed. In six weeks the runts in Group 2 had outgained the other two groups and had required less feed for every pound of grain. Group 3 was the second best to gain and made the second most efficient utilization of feed.

Other Tests Under Way

Other tests in progress concern a sow milk replacer with antibiotic incorporated to permit weaning of pigs at two weeks or less, a foal feeding trial in the raising of Morgan horses, and a calf feeding experiment to test the effectiveness of an antibiotic-reinforced calf starter.

The application of antibiotics to fight or ward off disease organisms is known almost universally. But the strange power of these newly discovered substances to stimulate growth will not be understood until more evidence is brought to the fore.

MASSACHUSETTS *Celebrates*
100 years of entomology

By F. R. SHAW and A. I. BOURNE
Department of Entomology

SIXTY-FIVE hundred of the eighty-five thousand insects in the United States are considered public enemies. Their annual damage, estimated at four billion dollars, would keep a million men working each year.

It is the old story of survival as man and insect contend for the same needs at the same time. In spite of improved pesticide materials and techniques in controlling insect life, the pests are so prolific and adaptable that they still constitute an ever-present menace.

Federal Commission Established

When migratory grasshoppers threatened western agriculture in 1877, C. V. Riley, State Entomologist of Missouri, took up the challenge by helping to form the U. S. Entomological Commission, which was so successful that the next year the U. S. Department of Agriculture established the Division of Entomology with C. V. Riley as its head. With him was J. H. Comstock, one of the outstanding entomologists of all time, and L. O. Howard, who was credited as the man most responsible for making the American people "insect conscious."

Entomology in Massachusetts

Massachusetts could very easily fill her Hall of Fame with the names of notable entomologists. T. H. Harris, author and Harvard librarian, credited by many as "The Father of Economic Entomology," was probably the first to teach entomology at college level in North America.

L. L. Langstroth, the "Father of Modern Beekeeping," discovered the "bee space" in 1851 and revolutionized the whole beekeeping industry.

A. S. Packard, State Entomologist in 1871, contributed a monograph of "Insects Affecting Forest and Shade Trees" and a *Text Book of Entomology*.

The Fernalds

Professor Charles Henry Fernald, his wife Maria, and his son, Henry

Fernald Hall on the University campus houses the Entomology Department.
Photo by Kinsman's Studio

Torsey Fernald, undoubtedly contributed more to entomology than any other one family in the history of the world.

Under Professor Fernald, the Department of Entomology at the University was organized in 1886. Within the next five years he had established the first modern insectary and had organized a campaign against the Gypsy Moth, which was first introduced into the state in 1869. It was in this campaign that he and F. C. Moulton developed lead arsenate, one of the most important insecticides ever formulated.

His efforts were so successful that within a comparatively few years, the extermination of the insect was in sight; however, in 1900, funds were cut off, and the work had to be dropped until the spread and ravages of the pest called for resumption of the work in 1905. Since that time, it has cost the taxpayers more than $50,000,000 to combat the insect. In 1954, Massachusetts alone is planning a $600,000 campaign to check the Gypsy Moth in some of the most seriously infested areas of the State.

Mrs. Maria Fernald, a notable entomologist in her own right, compiled the *Catalogue of the Coccidae of the World*, which will always be the standard reference on scale insects.

Dr. Henry T. Fernald was for many years an outstanding teacher in the field. Associated with him in Massachusetts were Professors Alexander, Bourne, Crampton, Franklin, and Whitcomb, all of whom have made substantial contributions in entomology.

Many of the men trained by the Fernalds rose to positions of prominence and responsibility in America and throughout the world.

Professor Charles Henry Fernald.
Copy by Kinsman's Studio

Celebration Planned

The year 1954 marks the centennial of the establishment of professional entomology in North America. In 1854, Asa Fitch was appointed the first state entomologist in New York, and in the same year, Townend Glover was made the first federal entomologist.

The purpose of celebrating this centennial is to acquaint the general public with the scope and importance of the insect problem and with the contributions made by entomology to the national economy as well as to the health and welfare of the American people.

Open House

Under the chairmanship of Dr. Frank R. Shaw, Massachusetts has joined the Nation in planning appropriate recognition of the centennial. It is with a sense of great accomplishment in past work and with greater hope in future progress that the University opens its doors this fall in a proud salute to one hundred years of entomological research.

At farewell party in Boston, Professor Ray Koon accepts gift from his friends as Director Sieling and Mrs. Koon look on.

Photo by Everett M. Smith

RAY KOON RETIRES

after thirty years of service

IN THIRTY VALUABLE YEARS of public service, Ray Koon as head of the Waltham Field Station has charted a praiseworthy course marked by estimable research accomplishments and expert public relations. Through the years he has seen a small wooden two-story boxlike laboratory and office building with a 200-foot greenhouse give way in 1950 to a new modern plant with many fine laboratories, offices, and a greatly enlarged staff — a tribute to his recognition of the wisdom in combining research and service for the area of suburban Boston concentrated to agriculture and horticulture.

Under his leadership he has woven a pattern of good will and understanding among vegetable and fruit growers, nurserymen, arborists, florists, and home gardeners. The success of the original Market Garden Field Station in the early years with the vegetable industry is essentially the basis of the Waltham Field Station today with its many specialized services.

Ray Koon's policy of freedom of operation has been a stimulus to his research staff and has placed the Field Station in a rather unique position among agricultural field stations in the United States.

As Ray Koon relinquishes the helm as head of The Waltham Field Station, the University staff members at Amherst, East Wareham, and Waltham extend their congratulations and best wishes for his continued good health and happiness.

Record

ANUARY
1955

COMMISSIONER HAWES
Stockbridge '20

Volume 4
Number 1

UNIVERSITY OF MASSACHUSETTS
Amherst

Research In Review

VOL. 4 NO. 1 JANUARY 1955

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All requests for *Research in Review* should be addressed to the Mailing Room, South College, University of Massachusetts, Amherst, Massachusetts.

Director—DALE H. SIELING
Editor—PORTIA A. IERARDI
Photographer—JOHN H. VONDELL

In This Issue

Cover: L. Roy Hawes, Commissioner of Agriculture in Massachusetts and New England representative to the resource conservation advisory group to Secretary of Agriculture, Ezra Benson. Mr. Hawes has also held many important posts in foreign agriculture in Italy and South America.

A firm advocate of conservation, Commissioner Hawes has applied conservation practices to his own 127-acre farm in North Sudbury where he has 700 feet of diversion terrace, 4 acres drained, and three ponds constructed for irrigation, stock water, and fire protection.

Since this issue is featuring The Stockbridge School of Agriculture and some of its outstanding graduates, it is fitting that the spotlight fall on Commissioner Hawes, a member of the first class to be graduated from Stockbridge. See pages 6-10 for story.

From the Director . . .

Levi Stockbridge was a man who loved agriculture and contributed much to teaching, research, and the agricultural industry. As a practical educator, it was through his leadership that the research program of the Massachusetts Agricultural Experiment Station was started. He worked out formulas that revolutionized the fertilizer industry, and the money received in royalties was used in experimental work that helped to lay the foundation of the Experiment Station movement in this country. Because knowledge of scientific agriculture was very limited at the time, Stockbridge had to blaze his own way without books or charts into the unknown field of agricultural education. His contribution to that field, locally and nationally, was significant. It is, therefore, appropriate that the specialized two-year course in practical agriculture at the University of Massachusetts should bear his name . . . a fine tribute to a great man.

Dale H. Sieling

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MSG*

Enhances frozen foods

**monosodium glutamate*

By IRVING S. FAGERSON

Department of Food Technology

THE BOOK of Chau Lai written before 1000 B.C. mentions 120 jars of sauces used by the royal cook. Assuming that some of these sauces included soy sauce or its equivalent, we might conclude that the Chinese have been using soy sauces for more than 3000 years!

In China, the preparation of soy sauce is largely a household art, but in Japan and the United States it is a commercial process.

One of the amino acids in soy sauce (glutamic acid) is essential in all soy sauces. More specifically, the sodium salt (monosodium glutamate), more popularly known as MSG, appears to possess the unique property of stimulating the nerve endings of the taste buds to accentuate many natural flavors. Its pronounced effect on many foods is not duplicated by any other seasoning.

MSG is now prepared in the United States from such sources as wheat gluten, corn gluten, and a by-product of beet sugar manufacturing called Steffan's waste. Using a more rapid method rather than the ancient method of slow fermentation, the United States produced 12,000,000 pounds of MSG in 1948.

Although the unique properties of MSG have led to its wide use, it is not universally applicable to such foods as fruits, fruit juices, sweet baked goods, some dairy products and cooked cereals, and some products with relatively large amounts of fat.

The Department of Food Technology has recently completed a study to determine whether MSG added to certain frozen foods would maintain or improve the flavor of these products over a continued storage period.

MSG in amounts from 2 to 5 ounces per 100 pounds of various food products was added during preparation or at the time of packaging. Control samples without added MSG were also prepared as a basis for comparison. Samples from each pack were withdrawn from frozen storage at approximately three-month intervals during the year, and flavor differences were tested by a taste panel.

The most effective amounts of MSG (to 100 pounds of food product) were: clam chowder, 2 ounces; codfish cakes, 2½ ounces; haddock fillets, 3 ounces; chicken-à-la king, 3 ounces; rosefish fillets, 3 ounces; and beef stew, 4 ounces. The flavor of those foods with MSG added was preferred over the controls, and this flavor was still preferred during the 12-month storage period.

Needle Blight . . .

mystery disease of eastern white pine

By MALCOLM A. McKENZIE, Director of Shade Tree Laboratories

NEEDLE BLIGHT, a disease responsible for the reddening of new needles of white pine trees, is still a puzzle to medical men of the forest. Known since 1900, the disease has killed relatively few white pines. Although present almost every year to a limited extent, it appears suddenly, as during the past summer, to cause great alarm among tree men.

Countless Causes Cited

Needle blight has been attributed to a variety of physiological conditions: too wet, too dry, too hot, too cold. In 1954, it was first noticed during a short period of hot dry weather after a record-breaking wet spring that had favored lush foliage development.

The disease is quite distinct from the white pine blister rust, the familiar rust fungus disease. In fact, no fungus or insect has been found consistently on affected trees.

Appropriately Named

From its appearance, the disease is appropriately called needle blight, but the primary cause of the injury is more likely associated with a damaged or inadequate root system and with the surrounding area.

In acute cases, the needles may be of normal size; in chronic cases, shorter.

Individual Trees Involved

The disease is not dramatic in its attack, for it does not sweep through a stand leaving its devastating mark but singles out one tree as its victim and goes on to a second in another group.

Any conditions that damage or retard rootlets might explain the fact

Reddish-brown needles (white in photo) on affected tree in foreground contrast sharply with the normal dark-green pine (black in photo). The brown or straw color of older needles is sometimes confused with needle blight. Evergreens near the coast may be damaged by salt spray carried by high winds. This damage resembles needle blight somewhat. The conspicuous difference is the consistent damage to all trees directly exposed to the spray.

Photo by Robert L. Coffin.

that individual trees of various ages are attacked rather than entire stands. For example, extended drought during the Summer of 1953 may have damaged pine rootlets on individual trees in relatively unfavorable sites.

During the rainy period in the Spring of 1954, even damaged roots could have furnished enough water temporarily to the tree crown if the rainy period had not been followed suddenly by hot dry days. Then the poor balance between the injured or restricted roots and the lush foliage could not maintain the water necessary for the extensive needle growth during a hot dry period. Accordingly, typical pines affected would be individual trees of a group growing on cleared land with no pine needle mulch, where drought effects or injury to roots might be severe.

Trees commonly affected are pines in stands opened recently or pines in fields and pastures rather than trees in areas of typical pine forest stands.

Fertilizer May Help

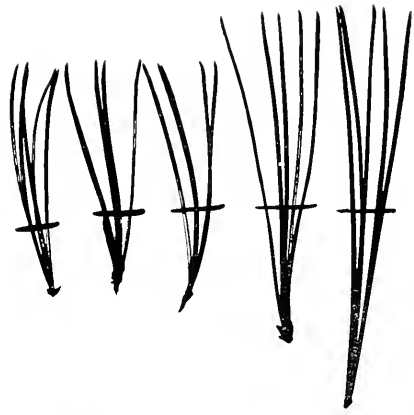
Fertilizer applied while trees are dormant may help develop feeding rootlets. The mulch of fallen pine needles may be retained as a protection against further damage to the development of feeding rootlets near the surface of the soil.

Watering ornamental pines, especially during hot dry weather in early summer, may aid unaffected trees, but watering is not a cure for damage already done.

Except in small trees, pruning is of limited value because ornamental pines are distorted when the uppermost branches are removed.

Hasty Action Not Advised

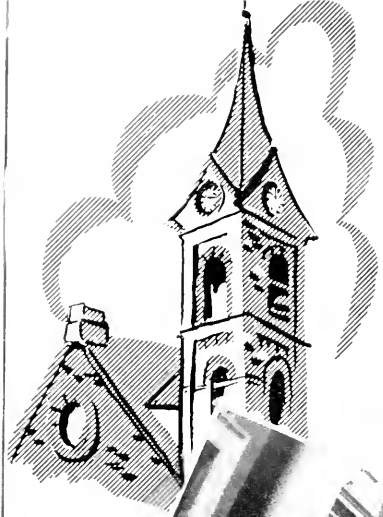
If the record of similar previous years is borne out, many trees will recover slowly or even completely without treatment in a year or several years. Comparatively few trees with extensive root injury or relatively unfavorable sites may show needle blight in successive years and fail to produce normal growth. In any event, hasty action in removing affected trees is not advisable since it is not evident that the trouble is contagious.



The lines across the needles indicate the distance from needle tip affected by reddening. *Photo by Robert L. Coffin*

Research Opportunity

Obviously, the development of needle blight of white pine is at best imperfectly understood. More recently, studies to determine the possible relationship of fungus infection of pine roots failed to give positive results. So, once again the familiar theme—a problem that looks so easy to solve on the surface may actually be rather involved. Perhaps there is no single explanation. And maybe some of the answers suggested may fit some of the conditions observed. At any rate, after 50 years, outbreaks of needle blight of eastern white pine still occur with irregularity but annoying frequency in the list of partly unresolved experiences of forest pathologists.



The University of Massachusetts

THE STOCKBRIDGE SCHOOL

"a distinctive and highly

STOCKBRIDGE is more than a name for the two-year course in vocational agriculture at our university . . . it represents a radical thought in the philosophy of education.

When our state legislators on May 14, 1918, passed a resolution to establish a two-year course in practical agriculture at "Mass. Aggie," they were looking further ahead than they realized.

This unique course is "open to any student who is seventeen years old or over and who has completed a secondary school course or its equivalent."

Specific Need in Education

What caused the Legislature to enact this fortunate piece of legislation? At the time of the resolution the first World War was coming to an end, and agriculture was booming. The war, of course, had created a need for trained men, but most of the graduates of agricultural colleges, although in fields related to agriculture, were not interested in becoming "dirt farmers." With few high schools offering courses in agriculture, many country boys lacking the opportunity for agricultural training and interested in returning to their home farms welcomed the two-year course that would open to them new vistas in scientific farming. It was for such people as these in particular that The Stockbridge School was founded.

After the college faculty survived the initial shock of having to absorb two or three hundred veterans, the two-year program was well underway.

City Boys Attracted

More than 75 percent of the students have come from larger cities and towns of the State, not the farms. They are generally high school graduates with a general course diploma, and are not prepared for the four-year degree program.

Levi Stockbridge Honored

When the program, called the Two-Year Short Course in Practical

presents . . .

OF AGRICULTURE

specialized two-year course"

"But the great success . . . when nature and art combine and work in harmony for the same grand result."

LEVI STOCKBRIDGE—First professor of agriculture and fifth president of the University. Farm born with only a common school education, Levi Stockbridge had the foresight to recognize that science and not just sweat and stubbornness would save the farms. In his study of scientific works and through patient experimenting, he worked out the first balanced formulas for crop fertilizers in the East.

Agriculture, was ten years old, its name was changed to The Stockbridge School of Agriculture in honor of Professor Levi Stockbridge, a farmer from Hadley, adjacent town to Amherst.

Practical Objectives

During two years of concentrated technical schooling, the Stockbridge student earns while he learns: for part of his six months' training includes a practical job related to his chosen field. This job may be on a dairy farm, fruit orchard, truck farm, ice cream plant, florist shop or greenhouse.

Positions for the students are obtained by the school through contacts with leading farmers in poultry, dairy farming, orcharding, vegetable gardening, milk plant operation, commercial floriculture, and ornamental horticulture, including nursery work, landscape gardening,

"The Old Naturalist"

CHARLES HIRAM THAYER—sympathetic and effective teacher for thirty-five years at The Stockbridge School, Prof. Thayer has shown sincere interest in his students, particularly those who "love the doing, but find the theory a bit difficult." Popularly known as "The Old Naturalist," Prof. Thayer, now recently retired, will be remembered with fond affection by all who were fortunate enough to have come under his influence.

DAVID L. PHELPS, Dairy Industry '42, member of the executive staff of the Ice Cream Merchandising Institute, Washington, D. C., in charge of sales personnel and merchandising training, and sales promotion. He also acts as liaison between the Dairy Industries Supply Association and the International Association of Ice Cream Manufacturers. Mr. Phelps is shown here instructing salesmen how to pack bulk ice cream.
Photo by Davis Studio, Washington, D. C.

HOWARD WHELAN, Poultry Husbandry '29, manager of the Brockton Cooperative Poultry Producers, Inc., Avon, Massachusetts, a modern processing plant and the largest cooperative of its type in New England, grossing six million dollars a year. Mr. Whelan works closely with the state extension service and state poultry associations.

Stockbridge MEN IN AGRICULTURE

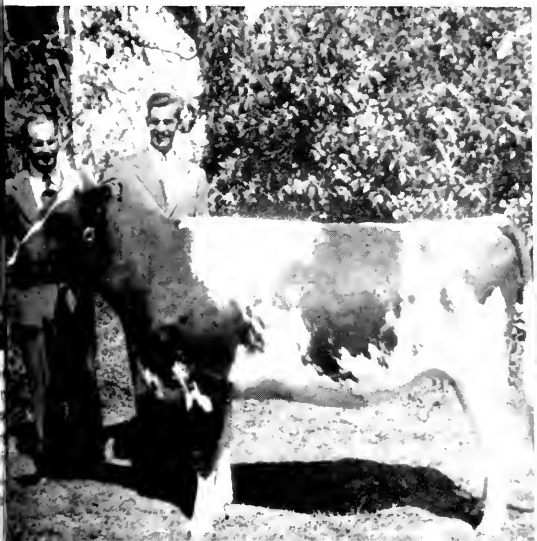
The phenomenal growth of The Stockbridge School of Agriculture in a highly industrialized state like Massachusetts is admirably reflected in the 3000 men and women who have contributed to the agricultural program of the state and have helped to maintain New England crop production. How right "The Old Naturalist" was when he said "Now when one meets an outstanding farmer in Massachusetts, it is better than half a chance that he is a Stockbridge man."

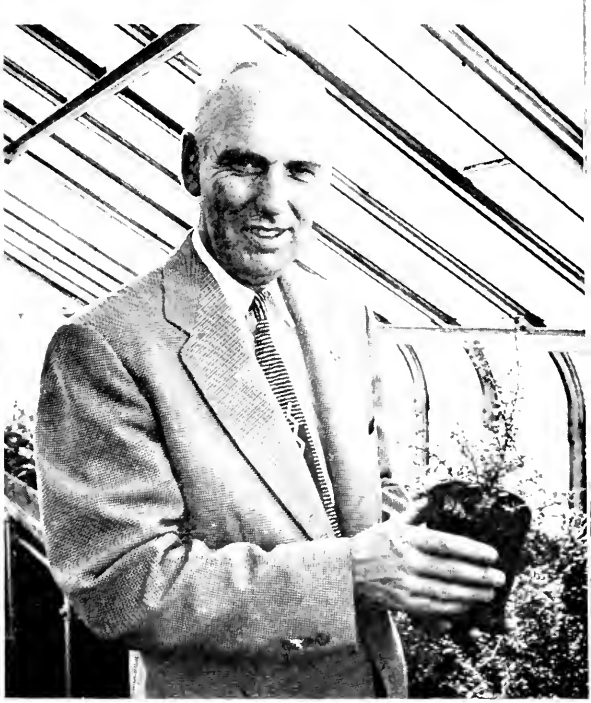
JOHN BROX, Animal Husbandry '31, has completed two years as representative from Middlesex County to the State Legislature where he is House Chairman of the Committee on Agriculture. Endowed with a strong sense of social and civic responsibility, Mr. Brox is Chairman of the Board of Selectmen of Dracut, Mass., and member of the Board of Health and Board of Public Welfare.

KENNETH B. KIRK, Arboriculture '50, salesman and assistant manager for Shield Shade Tree Specialists, a leading arborist concern in St. Louis, Missouri. Mr. Kirk is pointing out to a client that the large black oak has heartwood rot.

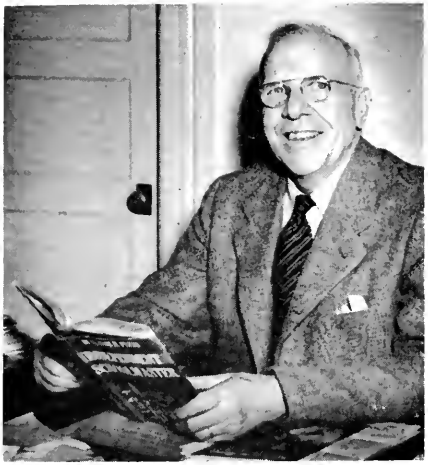
FRANCIS DE VOS, Floriculture '42, secretary of the American Horticultural Society in Washington, D. C, and assistant to the director of the National Arboretum. Mr. De Vos, one of the many Stockbridge men to continue his studies, holds a Ph. D. from Cornell. He is shown here (foreground) examining azalea plants. *Photo by Washington Star*

DOUGLAS W. FORREST, Animal Husbandry '35, successful Ayrshire breeder and dairy farm owner in partnership with his father in Litchfield, Connecticut. Member of the Farm Bureau and past president of the Dairy Herd Improvement Association, he is also the official judge for the Ayrshire breed and contributes a monthly column entitled, "Notes from the Old Timer" to the Ayrshire Digest. Mr. Forrest is photographed with his father on Anchor Mere Farm and with a prize heifer recently sold to South America.





CHARLES A. GODIN, Ornamental Horticulture '34, vice president of Adams Nursery, Westfield, Massachusetts, in charge of retail sales. As a member of the Board of Governors of the American Association of Nurserymen, as well as an officer in other organizations, Mr. Godin has done much to further the development of horticulture.



"a Stockbridge tradition of character and sportsmanship"

ROLAND H. VERBECK—recently retired director of The Stockbridge School. In the 1936 "Shorthorn", official yearbook of The Stockbridge School, student editors complimented Mr. Verbeck for developing and upholding a Stockbridge tradition of character and sportsmanship. His unwavering faith through thirty years of splendid leadership and his genuine enthusiasm for "his boys" have earned for the school the reputation of being one of the finest two-year courses in vocational agriculture in the country.

public park maintenance, and private estate work. All these major programs were organized on the basis of existing agricultural operations in the State, and New England in general.

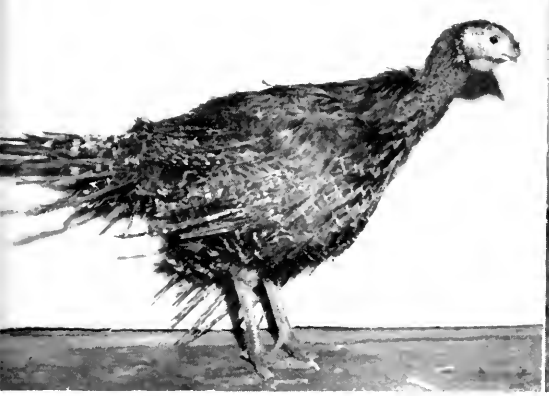
According to Mr. Emory Grayson, placement director, placing students for their six months' training required at one time a considerable selling job. Says Mr. Grayson, "I used to write literally hundreds of letters to possible employers, farmers principally, throughout the state, but during the past ten years I have had to do very little selling. The training students did such a good job that the word got around among the farmers so that now I have many more applicants for training students than I have students available."

FRED P. JEFFREY, newly elected Director of The Stockbridge School, Associate Dean of Agriculture, and former head of the Department of Poultry Husbandry. Popular with the students and faculty, Dean Jeffrey combines proficiency in Teaching, Extension, Research, Administration, and leadership in Community life.

The value of The Stockbridge School was expressed at one time by the former President Conant of Harvard University when he complimented our university on its "successful development of a two-year terminal college . . . that focuses on the practical educational needs of its community."

No greater tribute, however, could be paid The Stockbridge School than to read of the accomplishments of its graduates through the years. On the preceding pages are featured some of the many outstanding graduates who have helped keep the name of "Stockbridge" an honored one in the annals of Massachusetts agriculture.

"a five-letter man"



Left: Adult "hairy" female. Right: A "hairy" and a normal poult. A hairy, easily identified at hatching time, has wiry down which shows no fluffiness. The skin on its back is frequently visible, as if the down were pasted on unevenly.

Hairy Turkeys CAN BE ELIMINATED

By ROBERT SMYTH, JR. Department of Poultry Husbandry

IF YOU HAVE ever seen turkeys with coarse, hairy or ragged plumage and upon closer examination of their individual feathers you could not find any normal webbing, then you were looking at what the turkeymen call "hairys." This abnormal feather condition has appeared in recent years in a number of Broadbreasted Bronze turkey breeding flocks.

How do hairys get along with their normal brothers and sisters? If left to compete with normal poults, as young turkeys are called, hairys have a mortality rate four times greater than that of the normal poults up to 12 weeks of age, partly because hairys are frequently victims of cannibalism. Generally, they survive and develop satisfactorily after moving to a range, providing that the climate is good. Heavy rains or cold rainy spells add to the losses in this group.

Hairy Poults Loss to Producer

Hairy poults are culls and are a loss to the producer. Because these poults have a high mortality it costs the growers more to produce a pound of turkey meat. It is easy to see, then, why turkeymen want to eliminate this hairy characteristic from commercial strains of turkeys.

Hairy Plumage Inherited

Hairy plumage, like many of the feather-color patterns has a simple, clear-cut type of inheritance. Since the condition is due to a single recessive gene that is not sex-linked, normal birds may produce hairy offspring.

When two carriers mate, one-quarter of their offspring are hairy. The only way, then, to eliminate this condition from a flock would be to eliminate all carriers by test-mating the normals with hairys. Those individuals that produce only normal poults from the test mating do not carry the hairy gene. By using only noncarriers to produce the next generation, the hairy condition will be eliminated in a single season.

Diet of Expectant

significant health

By ANNE W. WERTZ, Department of Home Economics Nutrition

and EUGENE M. HOLDEN, M. D., cooperating physician

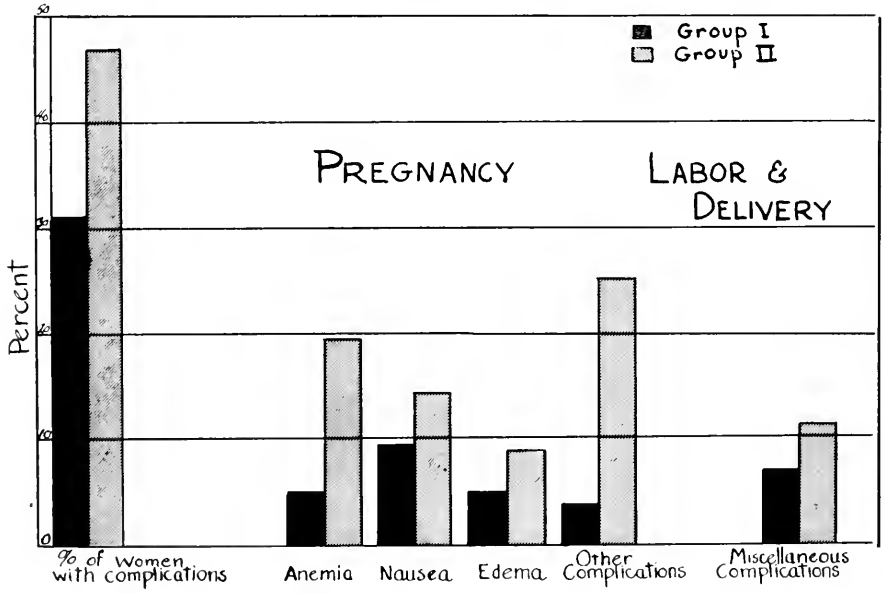
THE WRONG DIET during pregnancy may mean trouble for an expectant mother. It may mean a sick mother or child or a difficult delivery. In the January 1952 issue of *Research in Review*, it was emphasized that many women did not eat adequate diets during pregnancy.

Additional work has been conducted on this subject, and clinical records have been kept on 77 women throughout pregnancy and during delivery. Any condition that deviated from a normal healthy prenatal course was considered a complication.

Sixty-one Percent Normal

The most common difficulties during pregnancy were anemia, edema (swelling of the extremities), severe nausea, and vomiting. Other compli-

Comparison of percentage of women on adequate (group I) and inadequate (group II) diets in which complications occurred during pregnancy, labor, and delivery.



Mothers

factor

There's no doubt here of the happy, healthy outlook of little Barbara, daughter of Mrs. Donald E. Moser of Amherst.

cations were high blood pressure, toxemia (presence of poisonous substances in the bloodstream), premature birth, and pneumonia. Some complications at delivery were excessive blood loss and breech or version extraction. Sixty-one percent of the women studied had normal, uncomplicated pregnancies and deliveries.

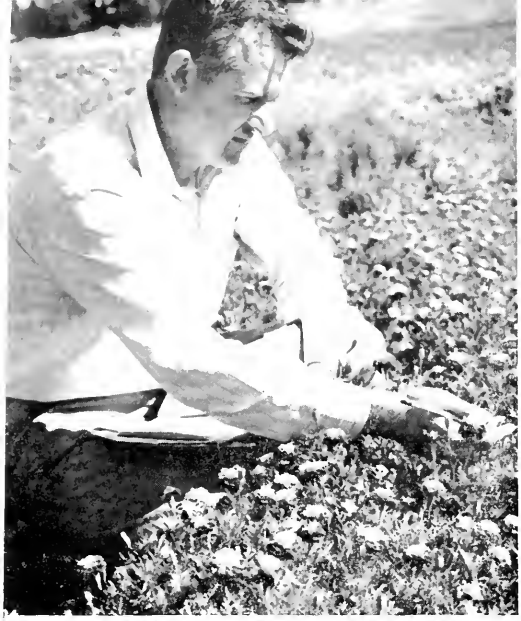
Diets Evaluated

A diet was considered adequate if it met at least 66 percent of the recommended allowances for certain nutrients (protein, calcium, iron, thiamine, riboflavin, niacin, vitamin A, and ascorbic acid). Forty-one women were included in this group. Any diet that fell below 66 percent of the recommended allowances in at least one nutrient was considered inadequate. Thirty-six women were in this group. Moreover, a little more than half of this second group had diets that fell below the allowances in two or more nutrients.

Complications Tripled

Complications were experienced by women who ate adequate diets as well as inadequate diets. But the group with inadequate diets had almost *three times* more complications than the group with adequate diets. This difference is also apparent when each type of complication is considered separately.

More care in selecting the right diet during pregnancy cannot be overemphasized: for by protecting the mother's health, the child's health is also protected, and the chances of complications at time of birth may be lessened considerably.



Mr. Lincoln taking notes on the dwarf marigolds in the field trials.

Seeds Get Third

at seed testing

By WALDO C. LINCOLN, Jr.
Seed Control Laboratory

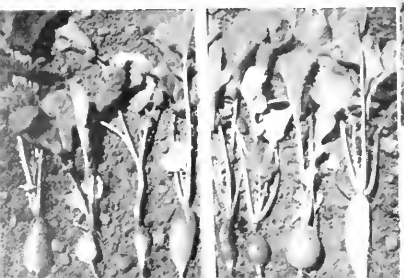
THE YEAR 1927 marked a new chapter in seed control. In November of that year the Massachusetts Seed Law was created for the "improvement in the quality of seed which are bought and sold in the Commonwealth . . . "

Under the Law, certain regulations must be met in the sale of seeds in the State. For example, vegetable and flower seed packages must be properly labeled to indicate the name and variety of seed.

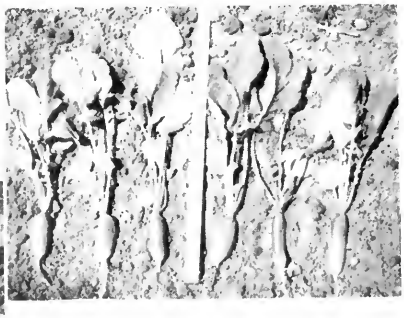
One of the functions of the Seed Testing Laboratory is to determine whether or not the variety claims on the seed packages are true. These claims are checked by conducting field trials. Samples of seeds are actually planted in the field to determine whether they will produce the plant indicated on the label of the seed package.

Seed Trials Invaluable

How important is this work? Perhaps not too much harm is done, you may argue, if you plant white Petunias and get pink or violet. The market gardener, however, knows only too well. He knows that he cannot make a financial success of his work if he plants late sweet corn only to find that his seed was mis-



Sample labeled French Breakfast found to be 80% off-type with 10% White Icicle type, 12% globe-shaped, 26% olive-shaped, 30% tapered, and 2% purple color.



Check sample of the radish variety French Breakfast.

Degree

aboratory

Check sample of the beet variety Detroit Dark Red.

Sample labeled Detroit Dark Red found to have no shape or color uniformity. Only 18% showed the typical characteristics of a Detroit Dark Red beet.

labeled and he gets a crop of early sweet. That same gardener with a field of Golden Acre cabbage would not want 30 or 40 percent Danish Ball Head. The home gardener also likes to be assured of the truth of the printed matter on a packet of seeds.

Hundreds of Seeds Tested

For the past five years field trials have been made on about 600 samples of seed each year. Half the acreage used for the trials is also devoted to testing annual flower seeds. Samples are submitted by the State Seed Inspector who thoroughly covers all retail stores in the State. Results of the tests are published in the annual control bulletins.

Varieties Often Mixed

The genus and species of flowers are not usually mixed, but the varieties often are. For example, if you planted a Fantasy Zinnia, you may get a California Giant or a Lilliput type. A color mixture should contain more than two colors; stated doubles should not harbor any singles; and dwarf plants should not be of the giant type.

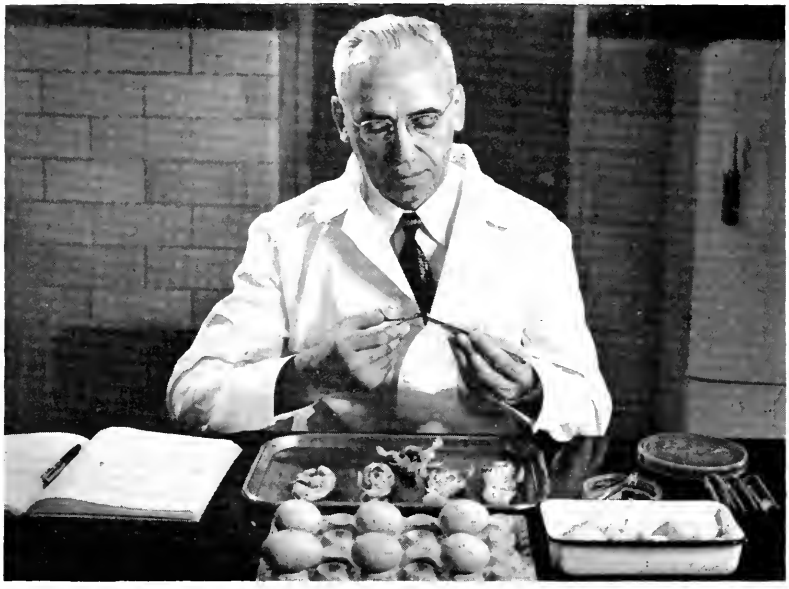
According to the 1953 trials, 20 percent of the flower seed packets were not satisfactory for one or more of the above reasons.

Constant Vigilance Necessary

The negative angle of the Seed Laboratory field work is also important. As long as the work is being carried out, seedsmen will try to be careful about proper labeling. If the work were stopped, there might be a few seedsmen who would become careless.

Although the work of the Seed Laboratory is not of a startling nature, that is, it is not concerned with developing new varieties or techniques, it nevertheless is a necessary phase of a good agricultural program in our State.

Left: An irregularly shaped unsatisfactory lot of Butternut squash.
Right: Sample lot of good squash. Note uniform shape and size.



DR. VAN ROEKEL RECIPIENT OF INTERNATIONAL AWARD

DR. HENRY VAN ROEKEL of the Department of Veterinary Science holds the Tom Newman International Award for the most outstanding contribution to poultry husbandry research published in the preceding year.

With only one exception, research workers in the United States have walked off with the Tom Newman prize each year since its establishment in 1948 by the Poultry Association of Great Britain. The award consists of a medal and 50 pounds sterling.

The research published by Dr. Van Roekel in 1952 included: A report of pullorum disease eradication in Massachusetts, a survey of the incidence of antigenic forms of *Salmonella pullorum* in the United States, chronic respiratory disease of chickens, an egg-propagated immunizing agent for the control of infectious bronchitis of chickens, and cultural attributes of the chronic respiratory agent.

Dr. Van Roekel came to the University in 1926 by way of Iowa State College, Virginia Polytechnic Institute, and Yale University. We are indeed proud of the distinction that he has brought upon himself and the University of Massachusetts.

EL SALVADOR WATER GIRL

SEE STORY OF BACTERIOLOGY AND PUBLIC HEALTH, PAGE 6

Volume 4
Number 2

UNIVERSITY OF MASSACHUSETTS
Amherst

Research In Review

VOL. 4 NO. 2 JUNE 1955

A free semiannual periodical published as part of the annual report of the Massachusetts Agricultural Experiment Station.

All requests for *Research in Review* should be addressed to the Mailing Room, South College, University of Massachusetts, Amherst, Massachusetts.

Director — Dale H. Sieling
Editor — Portia A. Ierardi
Photographer — John H. Vondell

In This Issue

Cover: Native girl from El Salvador in Central America carrying water jug. Water is so vital throughout the world that the World Health Organization of the United Nations selected the theme "Clean Water for Better Health" to celebrate its seventh anniversary this year.

It is estimated that by 1960 six billion dollars will be necessary for water systems, and nine billion for new sewers and waste facilities in the United States.

See pages 6-9 for the story of the Department of Bacteriology and Public Health at the University of Massachusetts.

Photo courtesy of United Nations

Drawings on pages 10-11 by Elaine W. Abbe.

From the Director . . .

Bacteria, microorganisms with a bad reputation, are too often associated only with disease. Not enough emphasis has been placed on their value in fermentation, medicine, food processing, and agriculture.

Most bacteria accomplish specific biological actions not accomplished by more complicated green plants or by animals. In nature, for example, bacteria help the weathering processes to convert rocks into soil; produce humus to prevent soil from becoming a nonproductive mass; degrade plant and animal residues to produce available plant nutrients; manufacture antibiotics to fight plant disease; and fix air nitrogen to enrich the soil.

Industry and medicine now depend on bacteria for some substances not yet synthesized chemically. Microorganisms can be reliable manufacturing units for vitamins, antibiotics, and pharmaceuticals.

By expanding our knowledge of bacteria, we extend the range of uses to which these organisms can be put — from improving the growth of a shrub to producing an exquisite strip of leather.

Dale H. Sieling

Publication of This Document Approved by George J. Cronin, State Purchasing Agent
5M-7-55-915441

Grass Silage ODORS

— no longer a problem

By JOHN G. ARCHIBALD, Department of Dairy and Animal Science

FARMERS can no longer offer excuses for foul-smelling silage. Thanks to agricultural research, the odor of grass or legume silage can be as mild as, or even milder than, the best grade of corn silage.

Control Water Content

Although early cut crops are of high nutritional value, they contain too much water to make good quality silage. High water content favors the development of bad odors.

One way to control the water content is to allow the freshly cut crop to wilt for several hours in the swath. For success with the wilting method, water content should be reduced to less than approximately 72 percent but not less than 58 percent; 65 percent is ideal.

Wilting is not practicable with a field chopper because it involves going over the ground twice. Moreover, weather conditions sometimes are not favorable for wilting.

Conditioners Effective

When wilting is not practicable, the water content can be lowered by mixing a dry conditioner with the grass. One hundred and fifty to 200 pounds of a material containing 10- to 12-percent water added to a ton of green grass containing 75-percent water will reduce the water content of the entire mixture to 70 percent or less, giving a silage of satisfactory odor and texture.

If the water-absorbing conditioner contains sufficient sugar, starch, or other readily fermentable carbohydrate, the quality of silage will be excellent because fermentation gets under way rapidly. These conditions are unfavorable to the formation of butyric acid and to the breakdown of protein to ammonia and other volatile products responsible for bad odors in silage.

Old hay, straw, or oat feed absorb moisture, but they lower feed value and are recommended only in emergencies when grass is very succulent, and when more effective materials are not available.

Conditioners that assist in starting the proper lactic acid fermentation as well as in absorbing moisture are corn-and-cob meal, corn or hominy meal, ground wheat, and to a lesser extent citrus pulp or citrus meal. This method is especially recommended if a farmer has his own ear corn.

Recent Developments

Two recently tested mild antiseptics, less expensive than corn meal or other meal, are sodium metabisulfite and Kylage (a mixture of calcium formate and sodium nitrite).

These fine white powders are easily applied to the top of the grass load as it comes to the silo. Eight pounds of the bisulfite or five pounds of Kylage are sufficient for a ton of grass.

Please turn to page 15

Strawberries CAN BE VIRUS-FREE

By JOHN S. BAILEY, Department of Pomology, The Cranberry Station, East Wareham

NINETY-EIGHT percent of all strawberry plants are infected by virus. Since it is not selective, the virus attacks wild plants as well as cultivated ones. It weakens plants considerably, stunts their growth, and decreases yields. To strawberry growers, this means severe financial losses.

Through the efforts of research men of the U. S. Department of Agriculture at the Beltsville Station in Maryland, several million virus-free strawberry plants are now available.

Virus Carried by Aphids

Where do the viruses come from? Can we get rid of them? The viruses are carried from diseased plants to healthy ones by aphids or plant lice (mostly of the genus *Capitophorus*). Although present all year round, aphids are active only during the time between the first bloom and the first hard frost.

Chemical Dust Effective

A good aphid killer, such as parathion or malathion dust, will keep a strawberry bed aphid-free and almost virus-free. To protect newly set beds, it is necessary to dust every 10 to 14 days from the time growth starts in April until July 1, and again during September and October. During July and August, dusting is sufficient every three or four weeks. Parathion and malathion should never be used on bearing beds during bloom nor within two weeks of harvest. Placing the bed at least 3000 feet from other strawberries helps to keep it virus-free.

Virus Tested by Grafting

How will the nurseryman who is trying to sell his plants protect them from aphids? The researchers at Beltsville obtained vigorous, healthy strawberry plants from all over the

A typical screenhouse used for producing virus-free and nematode-free plants.

United States. They tested them for virus by grafting a runner of each to a runner of a plant of the little wood strawberry (*Fragaria vesca*). The little wood variety was chosen because it shows virus symptoms clearly.

A few virus-free plants from each of 40 to 50 varieties were found by this method. These were multiplied and distributed to nurserymen for further increase and sale. Great care was taken to prevent reinfection.

Screenhouse Protects Plants

Massachusetts growers received the first virus-free plants in the Spring of 1953. Tests were immediately underway in several places in the state to compare the plants with ordinary nonvirus-free plants. They found that runner formation in virus-free plants is two to five or more times that of ordinary plants. If a grower cares for the new plants properly, they will not degenerate or, as the growers express it, "run out."

The best way to produce virus-free foundation stocks of high quality is to grow the plants in a screenhouse. This frame structure can be of any convenient size, high enough to walk in. It is covered with a fine screen to keep out aphids.

Soil in the screenhouse must be thoroughly fumigated before plants are set. Later, some of the foundation stock is set in the nurserymen's fields for further increase. The rest of the foundation stock remains in the screenhouse to be a nucleus for more virus-free stock.

Three Massachusetts nurserymen have already built screenhouses and are producing virus-free foundation stock. It may take two or three years, however, before the nursery stock has increased sufficiently so that enough plants are available to meet the ever-increasing demand. Strict control measures in the field keep the nursery stock free of virus-carrying insects.

Nematode Control Possible

A screenhouse will also assure nematode-free as well as virus-free plants. Meadow nematodes are microscopic worms that burrow into and feed on the roots of the strawberry. They are related to black-root rot, a wide-spread disease which is very serious in southern Massachusetts.

Through this protective measure, the aim of researchers to control, and perhaps eliminate, some of the more serious strawberry diseases may be realized.

Virus-free stock really pays off. Right: superior vigor and runner development of selected Sparkle strawberries. Left: regular stock. *Photo courtesy of* New York State Agricultural Experiment Station, *Farm Research*, January, 1954.

Research in

Bacteriology and Publi

of national significanc

By JAMES E. FULLER and WARREN LITSKY
Department of Bacteriology and Public Health

THE mere mention of bacteria suggests germs that cause infectious diseases. Many bacteria, however, are necessary in agriculture, industry, and medicine. It is bacteria that help digest plant and animal refuse and return it to the soil as humus and nitrogen. It is bacteria, the silent partners of industry, that make cheese, vinegar, and other fermentation products possible. It is bacteria and microorganisms that produce the antibiotics of which we are all so conscious today.

Dr. Charles Edward Marshall (1866-1927), first head of the Department of Microbiology. Product of Jörgensen's Laboratory and the Pasteur Institute, Dr. Marshall distinguished himself as a successful editor, college administrator, and reeearch director.

Research in bacteriology was begun at the University in 1912 by the late Dr. Charles E. Marshall, who organized the Department of Microbiology, now the Department of Bacteriology and Public Health.

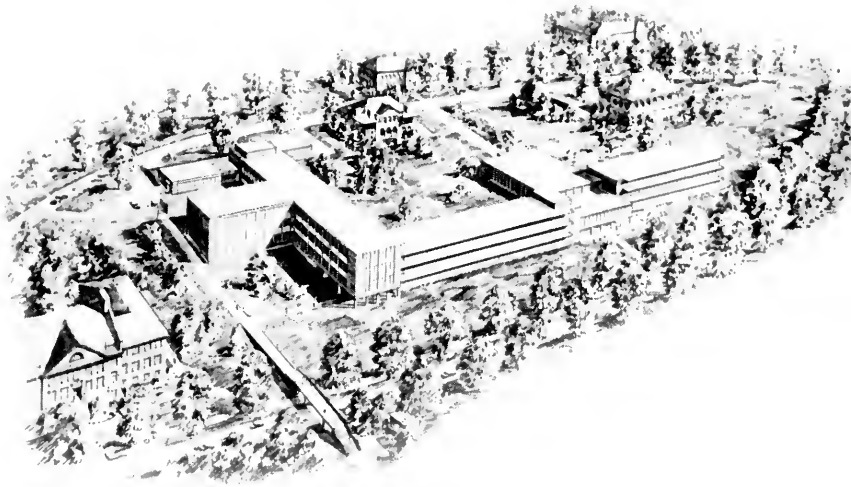
Other department heads have been the late Dr. George E. Gage, Dr. Leon A. Bradley, and now Professor Ralph L. France.

Maintaining pure water supplies has been a problem since the beginning of time. A new method has been perfected here to indicate recent fecal pollution of water by using a bacteria of the enterococci group (fecal streptococci) found only in feces.

Unlike the older test, which employed coliform bacteria, the new test positively identifies *recent* fecal pollution. This test prevents the condemnation of water that may be considered as questionable by older tests.

Swimming pools have increased the burden of the sanitarians. Bacteriologists here were among the first

Health



Architect's drawing of the proposed Public Health Center and General Sciences Center to be erected at the University.

to use oral streptococci as test organisms to determine whether or not a pool is safe for swimming. These bacteria, advocated 16 years ago, are still employed to test swimming waters.

The usual method of testing water takes about four days. A rapid method, which employs the Millipore Filter, has been recently introduced in Germany. The old method ordinarily limits the volume of water to be tested to not more than 10 cc. (about one-third of an ounce). This means that bacteria in very small amounts may escape detection. The Millipore Filter, however, has no such limit. The entire test can be completed within 24 hours, and small numbers of bacteria can be detected by filtering large quantities of water. Results from both methods are now being compared here.

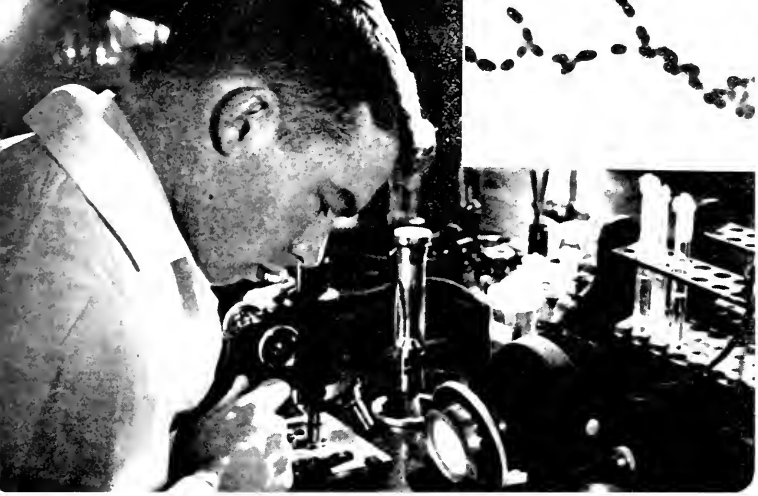
Milk pasteurization is always under study. Improved methods would reduce cost, save time, and produce safer milk with good keeping qualities without impairing the natural properties of the milk.

A project now under way with the Department of Dairy and Animal Science aims to develop an almost instantaneous method for pasteurizing milk at a high temperature. Results have been promising, and the procedure may undoubtedly be developed for other uses.

In community health, sanitation of eating and drinking utensils in public eating places is a problem that bacteriologists cannot overlook. Utensils are examined by rubbing swabs on them and transferring the bacteria to culture media. It is difficult, however, to keep the bacteria alive when too much time elapses before the swabs reach the laboratory. The research staff is trying to eliminate this problem by developing a suspending fluid that effectively preserves bacterial life for several hours.

Frozen foods have become an important part in the pattern of modern living and in the economy of the farmer. The assistance of bacteriologists has been called upon even in this industry, for improperly handled frozen foods can be carriers of

Please turn to page 15



The microscope, an indispensable tool in the laboratory, helps identify and classify bacteria and other microorganisms. Inset: Streptococci as seen under the microscope.

Various aspects of nutrition c
impressive drumlike instrument
and other living material in sm

Vinegar producers are always looking for better methods to improve their product. Here the pH meter measures the amount of acid in a product during fermentation.

Nitrates and phosphates are ne
chemicals are measured by the

The new Millipore Filter, the lo
used here to test water.

Research in Bacteriology

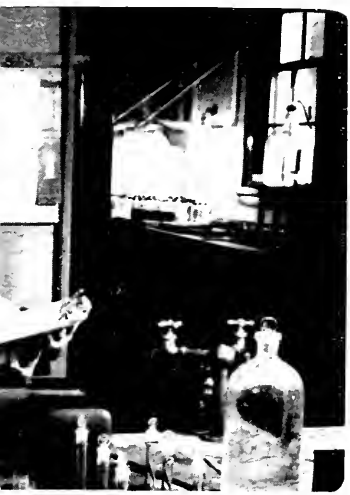
means better living for you

Almost three hundred years ago, Antony van Leeuwenhoek, a Dutch haberdasher, with the unusual hobby of grinding lenses, first observed through one of his simple lenses, a group of tiny, independent, living organisms in stagnant water and body fluids. It was not until the last century, however, that bacteriology was taken out of the "realm of purely philosophic speculations" and made a modern, specialized branch of the science world.

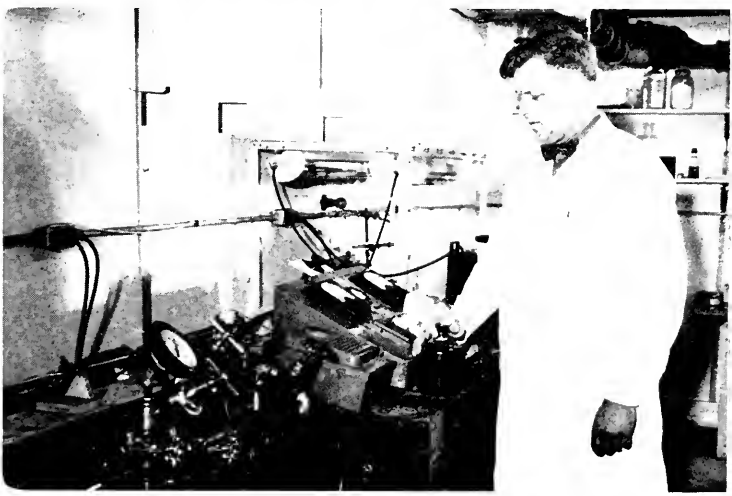
On these pages the camera has given us an admirable record of research in bacteriology and public health at your state university.

by the Warburg apparatus. This easures the respiratian of bacteria periments.

Bacteria are responsible for certain vital chemical changes, but industry must be alert to control the physical changes. Here the viscometer measures the degree of physical change that a product undergoes.



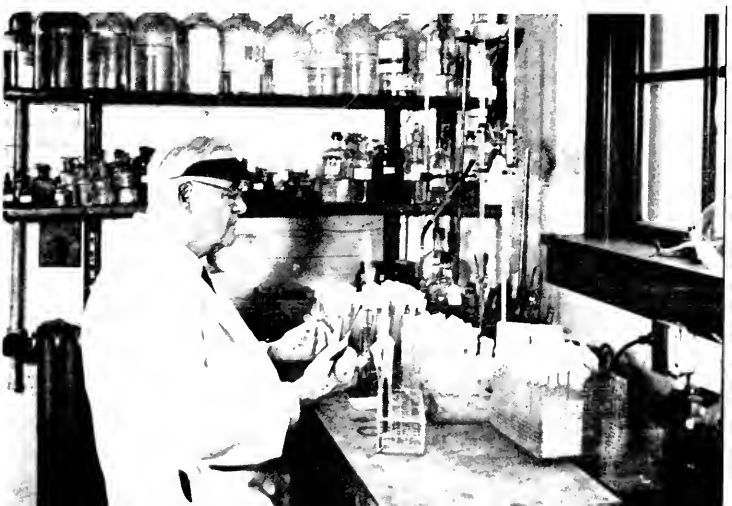
soil fertility. The amounts of these ic calorimeter.



Milk pasteurization may be safer when the principles af this high-speed pasteurizer have been fully explored and developed.

ue for testing pallution, is being

Ta keep bacteria alive and growing, special kinds of food known as culture media are usually prepared in test tubes.



Aztec corn god.

Buried Treasure

By NORTON NICKERSON
Department of Botany

ZEA MAYS, maize, Indian corn, or just plain corn — whatever the name — corn is the most important crop in America today, valued at one and a half billion dollars.

Gift of the Great Spirit

In spite of our great dependence upon corn plants, we know surprisingly little of their history. Long before Columbus touched our shores, this grass was the staple food crop of Indian tribes from Canada to Cape Horn. It was not merely their food supply; it was a prominent part of village life as well, becoming intimately related to religious ceremonials and priestcraft.

Maize was looked upon almost universally as a gift, either directly from the Great Spirit or indirectly from some neighboring area.

Not a Wild Plant

"Wild" maize does not exist in the world. Not one tribe has the tradition of its maize ever being a native or "wild" plant. Its origin becomes even more of a mystery when we realize that maize is completely dependent upon man for its cultivation.

Somehow, somewhere, an unknown Indian or tribe of Indians rescued what must have been a wild maizelike grass from what was probably its last stages before complete extinction. And, from this modest beginning, a seemingly endless variety of forms has developed, all equally capable of being interbred.

Archeological Wonder

Just how this near-miracle came about is a mystery that is currently

Dr. Norton Nickerson points to a reconstruction of a probable maize ancestor. The two corn cobs, to the left, found in Lower California, date back to 1200 A.D. The charred corn fragments above, from Cherokee County, Texas, date back to 400 A.D. The tassel in the background, known as *club*, was grown from seeds exposed to irradiation in the Bikini atomic tests.

N CORN COBS

Flute-playing nomad of Andean highlands. One of his ancestors, perhaps the legendary flute player Kocopelli, may have brought pod corn to North America. This Indian still carries on ear of pod corn in his pack.
Courtesy of *Journal of Heredity*

occupying much attention in botanical and archeological circles.

Since maize is a thoroughly domesticated plant, its movements from the areas of its suspected origin — in either Central or South America — over all the Western Hemisphere are actually a record of the movements of the tribes who carried it.

Thus, the archeologist sees in the remains of ancient maize at camp sites a fairly accurate record of the maize that the inhabitants had or brought with them into the area.

Academic Question

It is, of course, from the fragments of corn cobs, oftentimes thoroughly charred, that reliable evidence is uncovered.

The botanist has a much greater stake in such finds. He asks the purely academic question of the origin of maize. Where and when, and on what did this first domestication take place? The last question is of such commercial importance that hybrid-corn seed companies spend thousands of dollars for archaeological studies.

Haphazard Mixture

The present source of commercial inbred lines for the hybrid feed corns of commerce is a haphazard mixture of two main races of maize known as Northern Flint and Southern Dent.

A program to combine these two races in a more deliberate way is already showing promise of further increasing our yields in the Corn Belt. But both races are of unknown ancestry, and at least one of them, Southern Dent, is itself a mixture of two or possibly three other races.

Now it can be appreciated that this mixing took place in time to allow our early explorers to find a rather well adapted corn being grown by Indian tribes throughout the territories they visited.

Please turn to next page

Teosinte, the closest wild relative of corn. Beneath the tassel on the right side of the stalk is a small ear.
Courtesy of *Scientific American*

Pod Corn, an early form of our modern corn. The kernels are enclosed in separate glumes, or chaff.
Courtesy of *Scientific American*

Continued from page 11

Southwest a Rich Source

Almost any records before 1500 A.D. must be mostly archaeological in nature, and because of climatic conditions, the dry Southwest is by far the richest source of such material.

Thus, old caves, cliff dwellings, and other Indian camp sites have become "treasure islands" where modern corn breeders can uncover hidden corn cobs that may harbor the secret of the first corn.

Stakes High

Corn remains are yielding some potentially useful facts on the historical development of our present maize races. The work is relatively slow, but the stakes involved give this otherwise purely scientific endeavor the fascinating aspects of an exciting treasure-hunt.

80,000,000

The rose may bloom for Engla
The lily for France unfold:
Ireland may honor the shamro
Scotland her thistle bold;

By HRANT YEGIA

Ed. Note: This article is concerned mainly with field corn for animal consumption.

ENOUGH corn is grown in the United States today to cover the six New England States, New York, New Jersey, and Delaware.

This No. 1 crop covers more acres than any other crop, supplies more food for animal and human consumption, and brings more money to the farmers.

Early Corn Quite Similar

Our corn plant or maize is quite like that found by the first settlers. All the main types of corn known today — flint, pop, dent, and sweet corn — were grown by the early Indians. Modern varieties differ mainly in their greater uniformity.

In four and a half centuries we have developed an outstanding open-pollinated variety. (In open-pollination, the source of pollen is unknown.) Despite this accomplishment, corn production was not substantially improved until the very recent introduction of modern hybrid corn, which has increased yields about 20 percent.

It was from the open-pollinated varieties that scientists obtained foundation stock to develop modern corn.

Acres of Corn

ut the shield of the great Republic,
The glory of the West,
hall bear a stalk of the tasselled corn —
The sun's supreme bequest!
Edna Dean Proctor, *Columbia's Emblem*

artment of Agronomy

Rigid Selection

Dr. W. J. Beal of Michigan Agricultural College (precursor of Michigan State University) was the first to hybridize corn in 1876 by crossing two varieties.

Twenty-nine years later, Dr. George H. Shull discovered that he could control heredity by inbreeding and thus isolate valuable pure lines in corn. By placing the pollen from a desirable strain of corn onto the silks of another, he discovered a new strain. By this system of rigid selection, poor lines were eliminated, and a hybrid corn superior to even the best open-pollinated varieties was born.

Still Not Perfect

Hybrid corn is regarded by many agricultural historians as the most important development in food-bearing plants of the last 500 years.

All the sweet corn and field corn hybrids grown today are produced by crossing specially selected strains. There is an adapted commercial strain of hybrid corn for every corn-growing section of the country.

Unfortunately, no single hybrid has all the desirable features of a good strain of corn.

Synthetic "Wild" Corn is an earless variety produced from pop corn and pod corn. Heat caused the kernels to pop.
Courtesy of *Scientific American*

Possible Clue in Early Corn

In this concentrated project to discover a desirable hybrid corn, thousands of types of aboriginal corn in parts of the American tropics are being collected and brought to breeding centers for intensive study. It is quite possible that the clue to the new hybrid corn of tomorrow may be locked up in one of the queer, multicolored, nubby maizes of the aborigines.

Tomorrow's Corn to be Tailor-made With

> strong root systems to resist lodging . . . greater drought tolerance . . . resistance to diseases, especially to stalk and ear rot . . . resistance to insect pests . . . high protein content in grain . . . adaptation to climate and soil . . . maximum yield of good quality grain and fodder.

Silver Medal

for Massachusetts Research

on SWEET CORN

Prof. Lachman and his prize-winning *Golden Beauty*. This corn is 6 to 7½ inches depending on location and season in which it is grown. Its golden yellow kernels of medium depth cover 12 to 14 rows. Seed is produced by crossing inbreds, Conn. 13 by Ma. 21547-1-1. For a good set, 21547-1-1 must be planted about seven days before Conn. 13.

THE SILVER MEDAL for Achievement in Horticulture was awarded this year by the All-American Selections Committee to Prof. William L. Lachman of the Department of Olericulture. Since 1936, Prof. Lachman has chalked up to the credit of Massachusetts research five new varieties of hybrid sweet corn: *Pilgrim*, *Golden Jewel*, *Gold Mine*, *Barbecue*, and finally his prize-winning *Golden Beauty*.

Golden Beauty was tested for four years in 22 trial grounds throughout the United States and Canada. Each location had a resident judge in charge.

Since *Golden Beauty* is an early sweet corn, it can grow in short-season areas. It is a sturdy plant with dark green husks that clasp the ears tightly. This is important in resisting bird and insect damage. It is also resistant to both bacterial wilt and northern leaf blight. Because it matures early and is of exceptionally high quality, it is most adaptable for home and market garden use.

GRASS SILAGE (cont. from page 3)

These materials have been successfully applied to large lots of silage (120 tons) on the University farm. The treated silage was excellent, with good color and texture. It did not leave any objectionable odor on hands and clothing or in the barn after feeding. Above all, it was palatable to a herd of 70 cows, and milk production was well maintained.

The average moisture content of the green crop preserved with bisulfite was 76.7 percent, and with Kylage 77.4 percent. These compounds overcame the disadvantage of high water content, which would have caused an inferior silage.

Of course, silage made with corn meal or other ground grains has a higher feeding value than that made with chemicals because the grains add nutrients to the silage.

Determining volatile acids and bases as a measure of quality in silage.

BACTERIOLOGY AND PUBLIC HEALTH – continued from page 7

disease. Workers in the laboratory have found another use for fecal streptococci — this time, to detect contamination in frozen foods.

Detergents are newcomers to the modern kitchen. In large concentrations, some of them can kill bacteria. Because of this killing action, bacteriologists have tried to determine whether detergents also kill the bacteria necessary to digest sewage in septic tanks. In our work, we have found that detergents did not harm the efficiency of the tanks.

Animal manure shortage has created an interest in dried sewage sludge as an inexpensive substitute. Studies here have indicated that this addition would not endanger health.

In surgery, the department has recently cooperated with the Springfield Hospital to test the effect of a new form of the antibiotic terramycin, in combination with other antibiotics, on fecal flora (intestinal bacteria). This could have an outstanding effect in surgery of the large intestine, and will probably decrease the possibility of generalized peritonitis after radical operations.

With increased enrollment at the University, a larger budget, and additional outside research grants, the future of bacteriological research appears to be a bright one.

"And the old order changeth..."

Dr. Dale H. Sieling, Dean of the College of Agriculture

When the Board of Trustees of the University announced in June that the School of Agriculture and Horticulture would henceforth be known as the College of Agriculture, the efforts of Dean Sieling to strengthen the position of the college in the expanding university orbit were finally realized. This change was a high point in a long-range reorganization plan envisioned by the dean.

The thirteen departments of the college are built around a tri-level structure: a four-year course leading to the degree of Bachelor of Science, a two-year vocational course in the Stockbridge School of Agriculture, and graduate studies. Within this framework are placed the Experiment Station, which is the research branch, the Control or Regulatory Service, and the Cooperative Extension Service, an agency specializing in agricultural, home economics, and youth education.

Dr. D. J. Hankinson

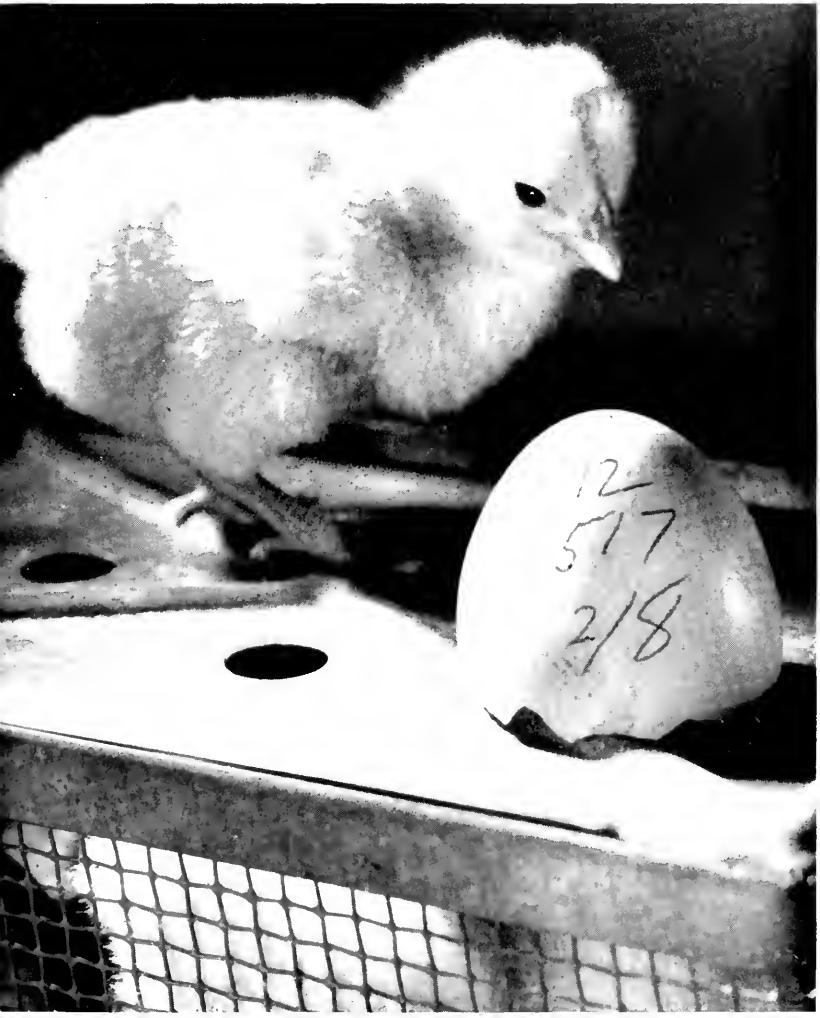
Dr. Denzel J. Hankinson, former head of the Department of Dairy Industry, has been named head of a newly-formed Department of Dairy and Animal Science, the result of a merger between the Department of Dairy Industry and the Department of Animal Husbandry.

The Department of Agricultural Engineering, formerly part of the School of Engineering, has now been incorporated within the new College.

Mr. Gilbert E. Mottla

The birth of a new Department of Agricultural Communications has brought extension communications personnel and the experiment station editor under one roof in Munson Hall. Mr. Gilbert E. Mottla, newly-appointed department head, has been charged with the challenging task of coordinating all phases of communications activities in the College of Agriculture.

Photos by Mitchell Koldy Studio.



● SEE STORY OF POULTRY RESEARCH, PAGE 4.

ANOTHER GENERATION

Volume 5
Number 1

UNIVERSITY OF MASSACHUSETTS
Amherst

Research In Review

VOL. 5 NO. 1 JANUARY 1956

A free semiannual periodical published as part of the annual report of the Massachusetts Agricultural Experiment Station.

All requests for *Research in Review* should be addressed to the Mailing Room, Munson Hall University of Massachusetts, Amherst, Massachusetts.

Director — DALE H. SIELING
Editor — PORTIA A. IERARDI
Photographer — JOHN H. VONDELL

In This Issue

COVER This bright-eyed chick is about to be recorded as a progeny of hen #512 and be assigned a numbered band of his own to be worn on his wing throughout his lifetime. In the wire basket, yet to appear, are several brothers and sisters.

The pedigree process begins in the laying pen where the mother hen trips a door as she enters the nest, locking herself in. Later, when the attendant lets her out, he marks her newly laid egg with the pen number, her own number, and the date. Each week her eggs are placed in an incubator, and just before hatching time (the 18th day of incubation) all her fertile eggs are placed in an individual wire basket to be sure that her progeny will not be mixed with others.

This detailed, careful work is the key to the great strides made in flock improvement in Massachusetts and the nation.

From the Director . . .

Genetics, nutrition, medicine, management, and marketing have contributed to the remarkable growth of the poultry industry. The application of basic information to the practical improvement of poultry raising has developed some outstanding records. Since 1911, when this industry was given recognition through the establishment of a subject matter department at this University, the average annual production of eggs per hen has increased 50%; meat production per pound of feed has increased 100%, and mortality from various diseases has decreased significantly. The hen of 1911 and the methods used in her husbandry would hardly be recognized by the modern poultryman. Could the application of new knowledge, yet undiscovered, lead to comparable changes and improvements in the future? I believe the progress may be just as outstanding in the future as it has been in the past.

Dale H. Sieling

PUBLICATION OF THIS DOCUMENT APPROVED BY GEORGE J. CRONIN, STATE PURCHASING AGENT
5M-1-56-717205

Seed Laboratory

a service to tobacco growers

By WENDELL P. DITMER and WALDO C. LINCOLN, JR.
Seed Control Laboratory

FROM CANADA to the tropics—tobacco can grow almost anywhere, depending on the type of soil and climatic conditions.

Grown at first only on a small scale in this country, the plant did not become a valuable commercial crop until the early eighteen hundreds. Today the Connecticut Valley's special shade-grown cigar wrapper tobacco is worth thousands of dollars.

What is the place of the Massachusetts State Seed Laboratory in production of this valuable crop? For many years the Laboratory has cooperated with tobacco growers by cleaning and testing their tobacco seed for a small fee.

Years ago when the need for such a service was recognized, a cleaning apparatus was devised that would properly separate the chaff, dirt, and immature seed from the good mature seed. The importance of removing immature seed is immeasurable because weak seedlings may be a source of seedbed infection.

After the seeds have been cleaned, they are tested for germination to determine the number of seeds that will produce normal plants. With this information the grower will then know how thickly he should sow the seed in his cold frame.

The value of such a service is reflected in the 73 requests made by growers last year to have samples of their seed processed.

Tobacco seeds before and after cleaning.

Poultry Research

— LIFE LINE OF THE POULTRY INDUSTRY

By THOMAS W. FOX
Head, Department of Poultry Science

In breeding for high fecundity, fast-maturing full brothers are compared carefully for physical development before prospective breeders are chosen.

FROM a backyard project to the largest agricultural enterprise in the state, as well as in New England —this is the story of the phenomenal growth of the poultry industry.

Part of this growth can be credited to the research programs established at our state university. From small beginnings in 1911 under Professor John C. Graham, the department has grown to include six staff members and two graduate students.

By anticipating problems, the department has benefited the poultry industry by supplying valuable information when it is most needed.

worldwide acclaim

Our experiment station was one of the first in the United States to study inheritance of egg production. It is easy to see, then, why our poultry breeders have won worldwide acclaim for the excellence of their breeding stock. The story of forty years of research to increase egg production through genetics is told in the pages of numerous scientific journals and in our university experiment station and extension bulletins.

Genetic improvement and improved nutrition mean that chickens begin to lay at an earlier age and lay continuously at a high rate. To the poultryman this is translated into a simple well-understood phrase — greater profits.

demanding public

Knowledge accumulated and disseminated by the University has helped to meet public demands. You have only to take a trip around the countryside to see that white chickens now far outrank the colored birds. How does this happen? How did it come about? We can probably blame it on our modern prepackaging age and a demanding public.

Dark pin feathers magnified by transparent film wrappers do not make an appealing food package. The rapid change to white-feathered birds was possible because poultry research men had already tackled the problem of inheritance of white feathers.

fertility — a major problem

Fertility studies are an important phase of current research in turkeys and chickens. Turkey poults are sold for $1.00 a poult. Each infertile egg laid by a turkey hen, therefore, markedly increases the production costs of a turkey breeding operation and prevents reduction of the high poult price.

It is well known that artificial insemination improves fertility in turkeys. Research men are still trying to find the best way to use this "trump card" with natural matings. How often should hens be inseminated? What product can best be used diluted with turkey semen? These are some of the still unanswered questions.

long range objective

The long range objective in chicken and turkey fertility studies is to eliminate the need for artificial insemination. This is hoped to be accomplished by improving fertility through genetics. To this end, therefore, birds have been selected according to their mating frequency and their duration of fertility after mating.

hormones helpful

Turkey broilers have improved in growth rate and fat content by the use of synthetic hormones three to four weeks before being dressed.

Other quality improvement projects are concerned with improving conditions for holding market eggs and improving internal and external egg quality through genetics.

housing studied

Our poultry research men and our agricultural engineers have been studying low cost poultry housing. Of particular interest have been ventilation systems and housing facilities to protect Massachusetts poultry from the rigors of New England weather The researchers have solved many problems at the college plant and on commercial poultry farms throughout the state.

results encouraging

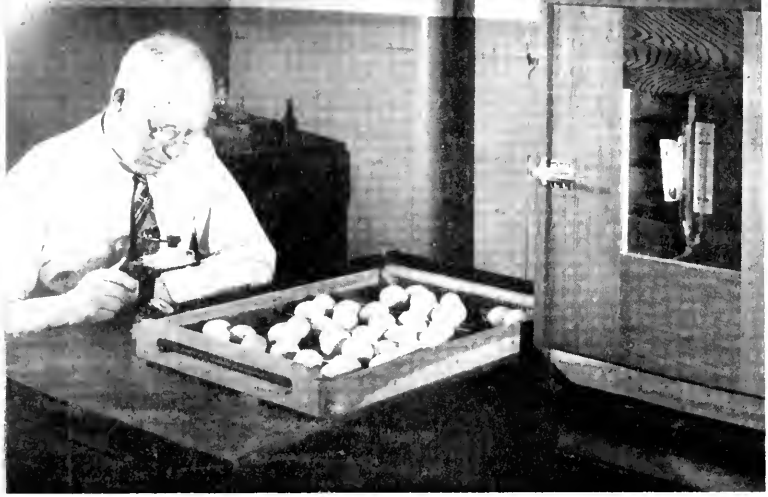
The more recent example of industry cooperation was the forming of a Random Sample Broiler and Turkey Test. Though established and incorporated by Massachusetts poultry and turkey breeders on property adjoining the University, the test is supervised by department personnel.

Three annual chicken tests and one turkey test give the twenty participating breeders an opportunity to see how their stock compares with others in growth rate, feed efficiency, and mortality.

In addition to aiding poultry breeders and broiler producers, these tests provide valuable material for department studies.

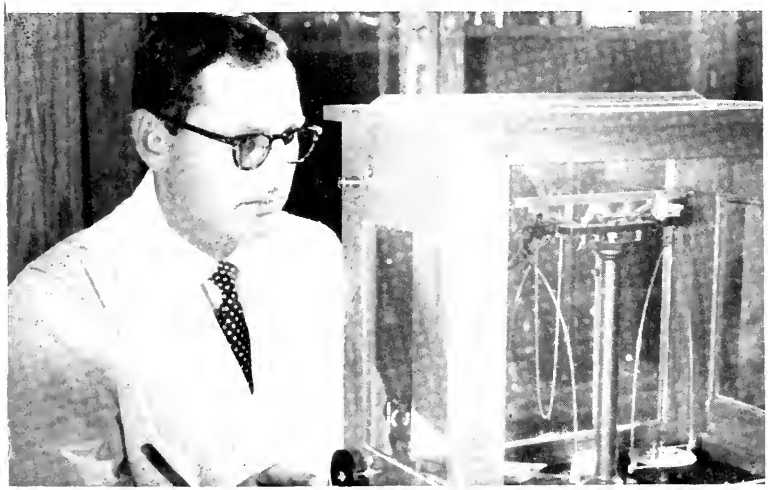
Thus far, results have been encouraging, and with greater anticipation of the needs of industry, still greater discoveries will be made.

Although members of the same family photographed above, these cockerels, unlike their full brothers, are slow-maturing.



DEVELOPMENT OF UNFERTILIZED EGGS. Eggs from virgin pullets are incubated for eight days and then opened to see whether they are fertilized. This phenomenon is known as parthenogenesis.

PEDIGREE HATCHING. Genetic
attention to maintain accurate re



PREPARING SEMEN DILUENTS. Since poultry semen is very sensitive, only precise amounts of materials must be added to make satisfactory artificial semen diluents.

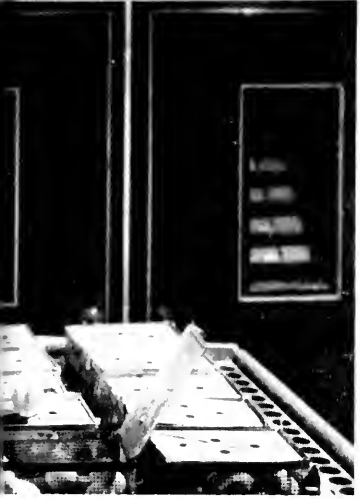
PRODUCTION OF PHENOCOPIES
with vitamin analogs just before
their abnormalities often resemb

Forty Years of Research

benefit poultry industry

Research in Poultry Science has been responsible for an ever-increasing economy of production. Consumers are able to procure poultry meat and eggs of better quality produced with smaller amounts of feed. The current efficiency of production of chicken broilers is approaching two pounds of feed per pound of meat—a record unsurpassed in animal agriculture. The fact that one man can produce 15 tons of meat with 30 tons of feed in an eight-week production period is the result of research in poultry genetics, nutrition, and management.

BROILER TESTING. Before chicks
weighed.



experiments demand meticulous
borentage.

QUALITY IMPROVEMENT. Skin quality of hormone-fed chickens is examined in a hormone administration experiment.

chicks produced by injecting eggs
are called phenocopies because
caused by known lethal genes.

SEXUAL DEVELOPMENT. Gonad tissue is examined under the microscope to study the sexual development of male turkeys.

ed to test pens, they are carefully

VENTILATION STUDIES. The University has recently developed a new ventilation system that provides a uniform and controlled flow of air in animal pens. Here the rate of air movement is checked with a velometer.

Native Plant Collection

living tribute to Bay State botanists

By NORTON H. NICKERSON
Department of Botany

WHY have plants endeared their study to a small group of scientists—the botanists? Is it perhaps that plants do not, as a rule, talk back, squeal and squirm when handled, or voice loud disgust over inadequacies of water, minerals or sunshine? Or is it their great diversity in size and form that excites the curiosities of men?

Most of us, in the halcyon days of our youth, have pressed a particular memorable flower or a "four-leaf clover" between the pages of a book. This same activity of pressing small plants and portions of larger ones, when coupled with the human instinct to collect, soon results in an accumulation of a sizeable quantity of "baled hay," which the botanists dignify by referring to it as an herbarium.

unvarying record

The beauty of such a plant collection is that it serves as an unvarying record of plant appearances.

The Herbarium of the University of Massachusetts housed in Clark Hall, consists of about 150,000 specimens of pressed plants collected from all parts of the globe: Europe, Alaska, New Zealand, India, and Argentina are a few of the places represented. About 20 percent of these plants were collected in our own state. This fraction, which is housed separately, is known as the Massachusetts State Herbarium.

Responsibility for the upkeep of these collections under the department head is vested in Miss Gladys Miner, the Curator, who has a full-time job keeping up with changes, repairs, and additions. The collection includes specimens of slime molds, lichens, algae, fungi, mosses, and ferns in addition to those of flowering plants. The assembly of this vast collection has required the work of many people over the years. All but the lichens and a few fungi have been put into workable order.

In 1869, the Hon. William Knowlton of Upton, Mass., an early trustee of the University, gave $2000 for herbarium specimens and storage cases.

About 12,000 specimens were purchased from W. W. Denslow, an amateur botanist; it was this collection that was called the Knowlton Herbarium.

The largest accession to the herbarium has been a "permanent loan" of about 85,000 specimens that previously formed the Amherst College herbarium. Many valuable collections of fungi were added through the efforts of the late Professor A. Vincent Osmun.

state plants organized

The diligent work of the late Dr. Ray Ethan Torrey resulted in separating the plants collected within the state from the main collection. Virtually all plants native to Massachusetts are represented here: 612 genera are grouped into 135 families.

Dr. Torrey's unusual ability to identify plants from fragments made

Dr. Nickerson compares specimens of the native lady-slipper orchid. Orderly files in the background make up only part of the vast collection of native plants.

hsi office a clearing-house for the many inquiries sent in by people throughout the state. Frequently, the sample submitted was merely a single leaf, twig, or shrivelled berry.

Dr. Torrey used the herbarium as a source of verification, for rarely is a plant submitted which is not duplicated in the state collection. The herbarium is also used for instructional purposes—its other important function.

"State Cabinet"

One of the oldest parts of the state collection has been described by Dr. Torrey and Mr. Edward L. Davis in volume 55 of *Rhodora*. This assemblage, part of an early natural history record called the "State Cabinet" embodied some of the oldest collecting done for a state herbarium, some sheets dating back to 1824. The "Cabinet" had originally been kept in the State House, but after founding of the University in 1863, it was sent to Amherst.

Collectors who contributed to the present State Herbarium are numerous. Many are not botanists at all: doctors, lawyers, ministers, and homemakers have all derived pleasure from the plant-collecting hobby.

The names of Dr. George E. Stone and of Professor A. Vincent Osmun, former heads of the Department of Botany, appear with great frequency. The amount of work devoted to the herbarium by these men is an indication of their keen interest in making as complete a record as possible of the state plants.

Locations that were visited vary from salt-marshes long since buried in Boston to the shores of Provincetown and the hills of West Stockbridge.

living record

The special collection of state plants is in its present useful form largely because of the efforts of Dr. Torrey. Yet, without the work of his predecessors and contemporaries in collecting, observing, and integrating the knowledge obtained from basic research on these plants, his task could not have been done.

An herbarium, then, far from appearing as a rotting collection of dried plants, becomes for the seriously interested man a living tribute to the work of others and a challenge ing way to seek deeper understanding of the plant world.

Today's Chickens

VACCINATE THEMSELVES

By ROLAND W. WINTERFIELD and
EDWARD H. SEADALE
Department of Veterinary Science

THE "Do It Yourself" trend so popular today has apparently taken hold in the chicken yard. Chickens are doing a successful job of vaccinating themselves against Newcastle disease, a respiratory and nervous infection of poultry.

old method tedious

Before the poultry industry increased in size and became more and more mechanized, the old method of vaccinating birds individually by administering vaccine through the eye was adequate, but today this process is tedious and time-consuming.

Searching for a more efficient procedure, research men explored the possibility of mass application of vaccines. Experiments under controlled conditions have proved that mass vaccination of birds through drinking water, dust, or spray with mild strains of Newcastle disease virus is as satisfactory a method as the vaccination of individual birds.

Thus far, commercial poultrymen have been enthusiastic about this mass method.

dosage important

A vaccine may contain enough virus particles to immunize chickens when it is administered through the eye. However, when the same vaccine is diluted in drinking water, immunity may not be satisfactory, unless the vaccine is very potent.

A white, powdery protein-stabilizer is mixed with the vaccine before adding to the drinking water.

Adding the vaccine mixture to the drinking water. It is important to administer a high vaccine dosage by the drinking-water raute.

What about the danger of overdosage? It is often more likely that the dosage may be insufficient or not potent enough.

Uniform, adequate dosage levels are easily provided in water vaccination procedures, regardless of whether chickens are housed or are on the range.

timing protects vaccine

The preferred way to administer Newcastle vaccine in drinking water is to remove all drinking water from the birds a few hours before vaccination. In this way the birds will build up a thirst, take in more water, and thus consume a greater dosage of vaccine.

Furthermore, by allowing the water containing the vaccine to remain only a limited time (from one to three hours) in the chicken yard, there will be less danger of adverse effects by high temperatures, by chlorination, or by litter, feed, or fecal contamination.

stabilizer also protects

The addition of a protein-type stabilizer to the water also protects the vaccine against these effects and other unfavorable conditions.

Wherever various managemental errors and hidden infections such as CRD exist, water vaccination reduces severe reactions because it lessens physiological stress.

revaccination before maturity

If flocks are vaccinated at an early age, they should be revaccinated just before sexual maturity. Here again, the water vaccination provides the necessary "booster." This method is particularly advantageous if the birds are still in range shelters, and if it is desirable to administer a uniform dosage.

economical and effective

Although no one vaccination program can be selected as ideally suited for every farm, area, or individual situation, drinking-water vaccination stands out as an economical and effective means of mass immunization. Progressive poultrymen with large, efficient farms can very well integrate this new method in their management operations.

Don't second-guess with PESTICIDES

With the passing of the Pesticide Residue Amendment to the Federal Food, Drug and Cosmetic Act, commonly known as the Miller Bill, some of our spray recommendations became passé. An excellent example is Professor Bailey's article, "Strawberries Can Be Virus-free," that appeared in the last issue of *Research in Review*. The recommendation that *Parathion and Malathion should never be used on strawberry-bearing beds during bloom nor within two weeks of harvest* is now revised, according to the provisions of the Miller Bill, to read *Do not use parathion during bloom or after fruit sets nor malathion during bloom or within three days of harvest.*

This new legislation places in your hands the entire responsibility for avoiding the misapplication of pesticides and for knowing the answers to any questions concerning these chemicals. On what crops, on or around what animals, at what concentrations, in how many applications, and how close to harvest or pasturing may each particular pesticide be used safely and legally? These questions concern everyone using insecticides, fungicides, herbicides, or rodenticides—any economic poison—in the production of high quality fruits, vegetables, nuts, grains, forage, meat, milk, and eggs.

The answers are readily available: they come to you on labels; in pest control charts; in state, federal, and county bulletins; circulars, leaflets, and letters; in conversation with state, federal, county, and commercial representatives; and during extension meetings.

This important information is not the result of guesswork. It represents extensive field and laboratory work by pesticide manufacturers. Data on toxicology, residues, and effectiveness are presented in support of the claims printed on pesticide packages. These data are then studied by competent officials of the U. S. Department of Agriculture and the Federal Food and Drug Administration, who establish safe limits for the residues. Directions for use are examined and modified when necessary to insure at harvesttime residues that fall within the established tolerances (amounts of pesticide residue that can legally remain in or on a crop).

Tolerances have not been established as yet for all pesticides on all crops. We must be ready to expect changes and to be on the alert for them. It is important to compare with newest labels any directions for pesticide usage published before or even during 1956.

Research discovers the pesticides and develops the signposts leading to their safe and effective use. It is up to you to follow them.

DR. ELLSWORTH WHEELER
Department of Entomology

"*Mature* scholars working together for the development and utilization of knowledge form the foundations of our civilization. Few things can be more important than to enhance and maintain the dignity of the investigator's profession so as to attract into its ranks and to hold men of highest ability, of sound learning, and of strong independent character. Such men have special obligations to one another, to their institution, and to the public."

SEE STORY OF
VETERINARY SCIENCE,
PAGE FOUR

Volume 5
Number 2

UNIVERSITY OF MASSACHUSETTS
Amherst

Research in Review

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In This Issue

Cover:

Excerpt from "Advice to Newcomers — a report on releosing the results of research to the public." By A. J. Riker, M. R. Irwin, R. J. Muckenhirn, Helen Parsons, ond M. A. Schoars (a committee of the College of Agriculture of the University of Wisconsin.) THE SCIENTIFIC MONTHLY, Vol. LXVI, No. 6, June, 1948.

From the Director...

The laws of the Commonwealth place an obligation on the Massachusetts Experiment Station to study the diseases of domestic animals, plants, and trees, and to test poultry for the elimination of disease.

Undoubtedly, this requirement has been a substantial stimulus to the development of extensive programs in these subject matter areas. However, without the interest of the scientists who determine the quality of the program, the notable research results that have meant so much to producers and consumers could not have been achieved.

Controlling domestic animal diseases contributes in a large part to the control of many human diseases and to the improvement of meat and meat products. This contribution alone has justified the cost of the program through the years, and is a good example of the application of agricultural research to problems that have a direct bearing on the consumer.

The control of plant and tree diseases makes our world a better place in which to live because the flowers and shrubs and trees maintain a vigor and beauty that enhance the over-all well-being of the community. We are happy that the Massachusetts Agricultural Experiment Station can contribute so much to the general welfare.

Dale H. Sieling

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Statistics

—a tool for the research man

By SARGENT RUSSELL, Department of Agricultural Economics

THE startling conclusion that men have more children than women is an example of the gross misuse of statistics. Yet this obvious inaccuracy grew out of the fact that Yale men were recorded as having more children than Smith women.

Although statistics is now an accepted research tool in all fields of science, its proper use is still the big question.

Statistics Is a Tool

Like any tool, statistics should be used intelligently, and like some beverages, with moderation. The intelligent user of statistics knows the capacity and limitations of his tool. Too often a research worker, looking for the royal road to statistics, mechanically grinds out some results. Then, without understanding his method or the significance of the results, publishes them with no interpretation or, worse still, an incorrect one.

One statistical procedure, correlation, has resulted in some classic bungles because of improper interpretation. Jevon's theory of business cycles based on sunspots is outstanding. Another worker made a similar discovery by relating the height of water in the Great Lakes to the rate of business activity.

When seeking a method of analysis for gathered data, intelligent research men can prevent another frequent blunder by looking to statistics before collecting any of their data.

On the other side of the pendulum, however, we have such tendencies as the insistence that all research be set up so that it can be treated statistically; that all results be subject to statistical tests; that a complicated technique be used when a simpler one would suffice; and that statistics be relied upon for thinking and devising questions that can come only from the research worker. Such excessive use of statistics is like using a lamppost for support rather than for illumination.

You Don't Have to Be an Expert

There is no reason why one who does not read a foreign language should have to forego using the contents of an article written in that language, although the translator may well be handicapped by a lack of technical knowledge in the field involved.

Similarly, you need not forego the use of statistics simply because the time and effort required to gain an intelligent understanding of them is more than you wish to invest. But it is true that the statistician you consult may also be handicapped by a lack of background in your field. He will appreciate it if you consult him before you collect your data and reach your conclusions, rather than decide to analyze statistically data that are neither suited for nor capable of analysis or to use your own interpretation regardless of the statistical analysis. You may be right, but you should not give the statistician credit for it.

Veterinary Science

PROTECTS ANIMAL HEALTH

By K. L. BULLIS, Head, Department of Veterinary Science

FOOD-PRODUCING animals are healthier and are growing faster than their forbears. The day may come when they will be even healthier than men because researchers in veterinary science have learned to adopt and adapt the techniques that medical men use in treating human ailments.

The first courses in veterinary science at the university were given in 1867, but it was not until 1893 that a separate department was created and the work separated from other related sciences.

Dr. Paige — a Leader

Dr. James B. Paige, graduate of the class of 1882, served as head of the department until 1922. It was under his leadership that buildings which were to house the department for more than half a century were occupied in 1899. This was the first time that facilities and equipment for the study of animal diseases were available at the university, and persons were invited to send in specimens of diseased animals for examination.

Instruction in veterinary science was more extensive during the first quarter of the present century than during the second, after courses in histology, bacteriology, physiology, and serology were transferred to other departments. Today, instruction is designed for students specializing in animal or poultry science, wildlife, and public health.

Demand for Service

Research in poultry health problems began in the early part of the century. Since then, the department has grown in personnel and facilities, as the demands for service increased and the needs for research became more urgent.

The income of the poultry industry increased from about 12 million in the early Thirties to more than 88 million dollars. With an accompanying increase in animal health problems, requests from animal industries for research, service, and information resulted in an increase in the university veterinary research staff. There were five on the professional staff in 1923, and only six at the close of the war. This changed rapidly to 19, with a total staff of 65 later.

From research in poultry health problems a method of controlling pullorum disease developed. This has helped to place New England in the forefront as a source of hatching eggs and chicks. Samples of blood are now taken from approximately one and one-fourth million chickens annually and sent to the laboratory for testing.

Diagnoses Complicated

An accurate diagnosis is the first step in setting up a program for handling an outbreak of disease. Because of the expansion of the poultry industry, a branch of the poultry diagnostic laboratory was established at the Waltham Field Station in 1950. Poultrymen can submit birds to the laboratories in either Amherst or Waltham. Laboratory diagnoses and procedures have been complicated by the increasing prevalence of virus infections. For instance, a respiratory nervous disorder known as

This new laborotory building occupied in 1951 was built to provide needed facilities and space for increased services and research requested by the livestock industry.

Newcastle disease was first recognized on the Eastern Seaboard in 1945. Infectious bronchitis, which is quite similar, was an important respiratory infection at the time, and the recognition of the importance of chronic respiratory disease, still another similar disease, about 1950 added to the diagnostic problems. Microscopic examination of tissues is also being used with increased effectiveness.

Bronchitis Control

A control program for infectious bronchitis was initiated in 1941 after many years of failure to eradicate the disease and to develop a satisfactory vaccine. After 1955 when it appeared that a suitable vaccine was available, continuation of the program was unnecessary. Up to 1,193 flocks, including 3,136,588 birds were involved each year under this program.

A laboratory testing service for mastitis—probably the Number One health disturbance of dairy cattle—began in 1946 at the request of the dairy industry.

Economically and scientifically significant research results have been forthcoming, particularly in the fields of pullorum disease, the avian leukosis complex, Newcastle disease, infectious bronchitis, and chronic respiratory disease.

Major emphasis during the past 15 years has been on respiratory infections. The control program for infectious bronchitis in use from 1941 to 1956 was an outgrowth of research.

Newcastle Program — a Success

The first successful immunization program for Newcastle disease using a live virus was introduced in 1948. Since then, mass methods of applying Newcastle and infectious bronchitis vaccines have received particular attention. This was done by applying vaccines as a spray to flocks. Current efforts are being directed towards dusts and water methods. Research men are also trying to develop more effective vaccine preparations.

The department has contributed greatly to the increased knowledge of chronic respiratory disease, particularly in relation to its nature, causative agent, transmission via the egg, and means of handling. Today animal research is concerned with unusual types of mastitis in dairy cows and with leptospirosis, a newly recognized disease of considerable economic significance.

The future of veterinary science rests in the cooperation of the poultry and animal industries, a necessary part of any organized effort to eradicate or control animal disease.

Research in Veterinary Science

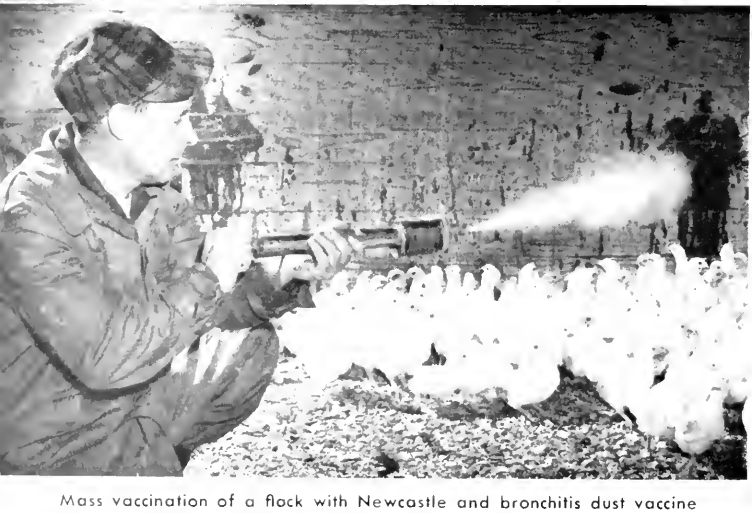
More Food and Better Profits Through Veterinary Science Research

Research and service in veterinary science vitally affect the health of the animal and poultry population. Healthy herds and flocks mean more food on our tables and better profits for the industry.

The Department of Veterinary Science at your state university has been especially active in the search to make poultry raising succeed by lessening the hazards in farming and making possible a greater economy in production. The wide variety of scientific techniques illustrated on these pages are brought into play to accomplish these purposes.

Antibiotics and other medicines are tested for effectiveness by giving measured dosages to individual birds.

Chicken embryos are an impor
and in the production of vacci



Mass vaccination of a flock with Newcastle and bronchitis dust vaccine has saved much labar far the poultry industry.

Improved vaccines and less c
from this method of growing li

Postmortem examinations are required to diagnose the cause of death in many poultry diseases.

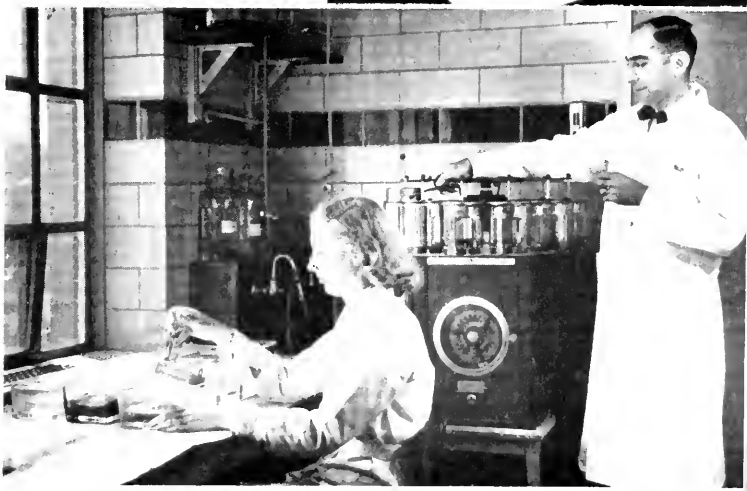
Testing milk samples in the control of mastitis in cattle. Film is being prepared to detect streptococcus germs (inset), an important cause of the disease.

l in the study of various diseases

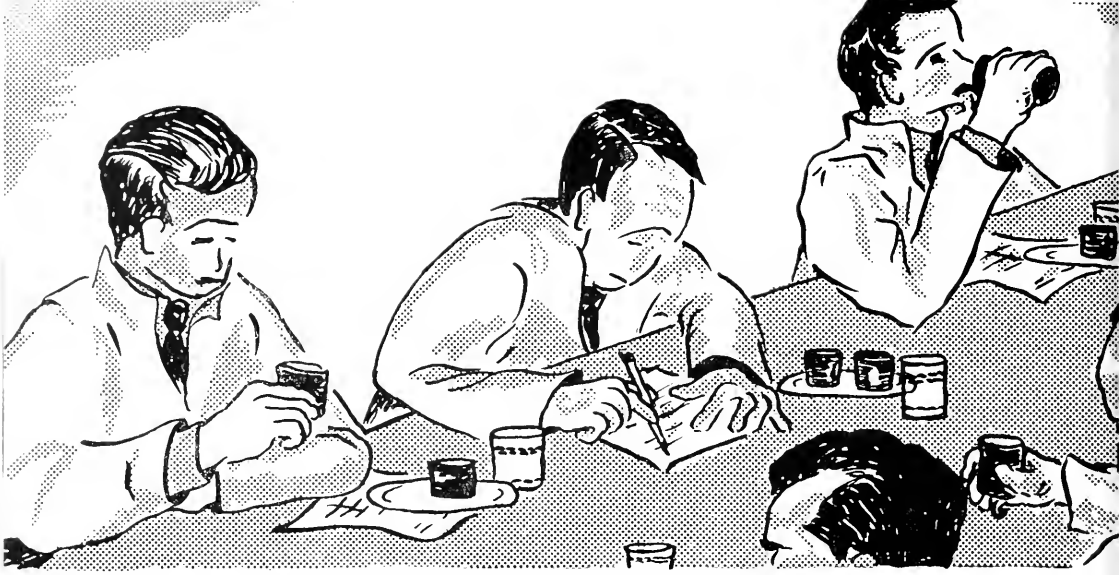
The rapid serum agglutination test, which detects chranic respiratory disease, may prove useful in establishing flocks free of the disease.

Inset: negative test, above; positive, below.

oduction methods may develop e in tubes and bottles.



Machine at right automatically gets tissues ready to be placed on slides. At left, tissues on slides are being stained for final examination.



In testing foods an "open appraisal" method may be used, such as this informal panel of taste testers.

The proof of the pudding...

By IRVING S. FAGERSON, Department of Food Technology

"THE proof of the pudding is in the eating." Food technologists have reverted in their studies to this old saying, despite their recognition of the tremendous strides in the field of analytical chemical techniques.

Until recently, food researchers have applied physical, chemical, and mechanical methods in obtaining purely objective evaluations of the food being tested. The personal reactions of the food analysts were entirely discounted until the researchers recognized that, in the final analysis, it is whether or not a person "likes" a food that makes him decide to buy it again.

Man's Senses Are Keen

Even with the finest modern analytical techniques, man has a keen sense of smell and taste. He can taste a substance in a dilution of one part in two million, and can detect one molecule of a substance in fifty thousand molecules of air.

Difficulties arise, however, when we realize that the senses of taste, odor, sight, and touch are called upon in judging flavors. Man holds second place when compared to chemical and physical analyses in his ability to obtain consistent results.

Sense Varies

Moreover, people are not equally sensitive to all flavor differences. Different days—in fact different *times* of day—may find a person more or less sensitive to a particular flavor. These inconsistencies, due to physiological and psychological differences in individuals, make man inferior to certain chemicals for taste-testing.

Men, unlike chemical tests, have the psychological barrier of bias,

This formal method may be more effective in evaluating certain products.

which lessens their effectiveness as objective taste testers.

Food technologists have devised methods of overcoming these prejudices. For example, coding the samples so that the testers cannot identify them; presenting the samples in random order; having the tasters present their results in writing without consultation with other judges; and presenting the samples in containers that are alike and free of taste and odor.

Data Must Be Significant

After obtaining the data from the various tests, researchers must analyze them to learn whether or not the taste differences recorded are significant. For example, suppose we had presented a series of judges with two samples of tomato juice, each with a different amount of salt added; the samples are coded and the judges are asked to select the sample they prefer. Suppose there are ten judges and each judge tastes each sample four times. We now have 40 judgments. Suppose 12 of these indicate a preference for sample A, and 28 for sample B. Our statistical analysis indicates that such a distribution of preference would occur by chance alone about once in 20 times. This probability is generally taken as the dividing line, and we can say that there is a statistically significant preference for sample B.

Results Not Always Useful

Now suppose that our results showed 16 for sample A and 24 for sample B. This distribution would occur by chance alone about one out of four times. Since such a result could occur so frequently by chance alone, in this case, it would be stated that no statistically significant preference was observed.

Panels Differ

There are two types of panels to measure the two taste-testing reactions. To determine the difference among samples, an "expert" panel is used. This group is usually made up of less than ten people, and is concerned with determining small differences in flavor.

To determine preference, a much larger "consumer" panel is used. As in choosing a group for an election straw vote, the testers must be sure that the people on this panel are truly representative of such factors as family size, economic background, and occupation.

Before undertaking such a project, previous study with the smaller panel is carried out to determine whether differences exist. If such differences cannot be detected by the smaller panel, preference tests are of little value.

Mapping the trail

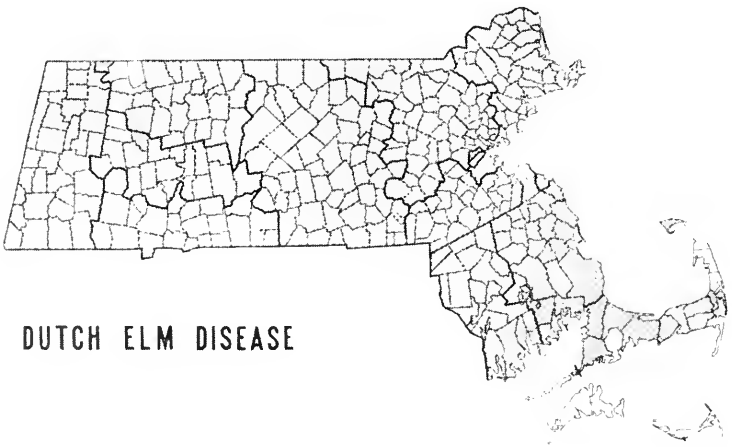
OF ELM DISEASES IN MASSACHUSETTS

By FRANCIS W. HOLMES, Shade Tree Laboratories

WILTED foliage on an elm tree in summer may mean Dutch elm disease. To find out why his elm is dying, the homeowner or town tree officer sends twigs clipped from the wilted part of the tree to the University Shade Tree Laboratories.

Laboratory cultures are then carefully prepared from the samples. Usually Dutch elm disease is confirmed, but sometimes another disease is found responsible for the wilting.

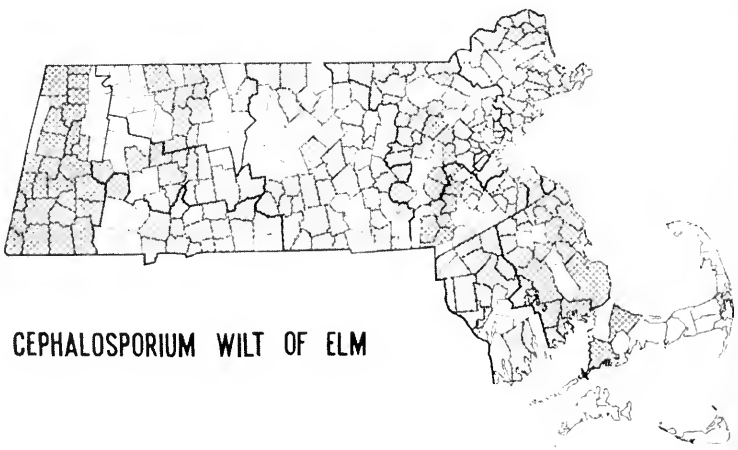
Shaded areas on the outline maps on these pages represent towns in which the most common elm diseases have been rampant during the last twenty years in our state.



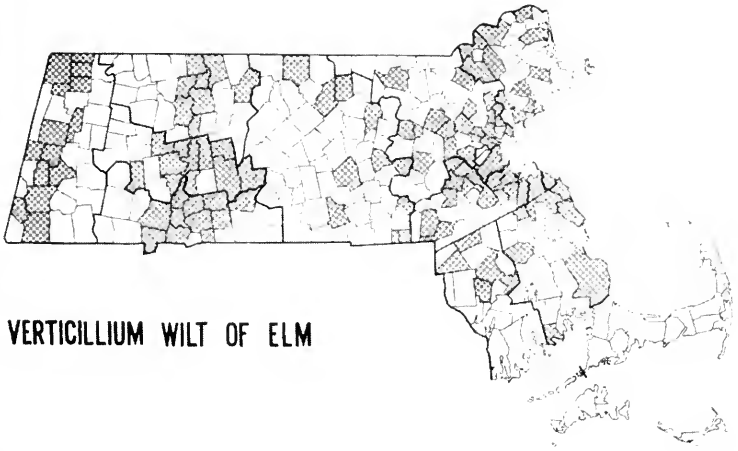
DUTCH ELM DISEASE

Dutch Elm Disease. First discovered in Massachusetts in 1941, this disease is now found in 334 of our 351 towns. It attacks only the elm trees. Unless the wilted branch can be cut off before the fungus spreads, the infected tree is almost sure to die. We can protect our elms by destroying the breeding places of the elm bark beetles that carry the disease to healthy trees. Any dead elm wood with rough bark should be burned promptly to prevent beetles from laying eggs.

Cephalosporium Wilt. Similar in appearance to Dutch elm disease, cephalosporium wilt can be identified only through laboratory tests. Some elms recover from this wilt disease, but others die slowly over a period of years. Such trees may become dangerous breeding places for the bark beetles that carry the Dutch elm disease.

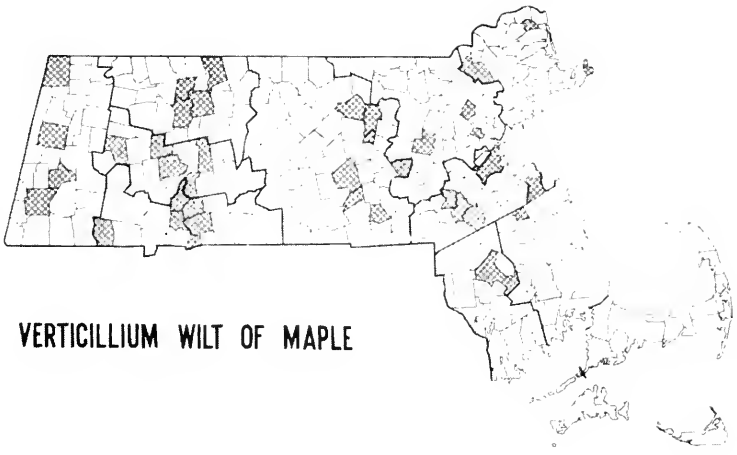


CEPHALOSPORIUM WILT OF ELM

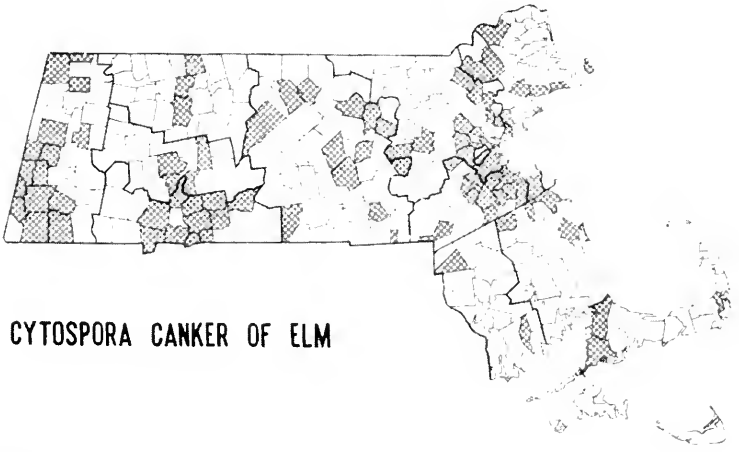


VERTICILLIUM WILT OF ELM

Verticillium Wilt. Again, only laboratory cultures can distinguish this diseose from other elm wilts. Although it may recur in later years, Verticillium wilt is not considered serious because elms often recover. However, the disease affects many plants other than elms. It often kills maple trees, and has been found in maple twig samples sent to the Shade Tree Laboratories from the towns marked on the map at right.



VERTICILLIUM WILT OF MAPLE



CYTOSPORA CANKER OF ELM

Cytospora Canker. Although this disease is not a wilt disease, it may be found when elm twigs are cultured for wilts. Small cankers on twigs and branches do not cause the tree to wilt but may spread from one branch to another and cause the tree to die back over a period of years. This disease also affects other tree species. It is one of the most common diseases of spruce trees in our state.

Professor Arthur I. Bourne

Professor Bourne Retires

AFTER 46 YEARS OF SERVICE

DURING the past 46 years Arthur Israel Bourne has served the Massachusetts Agricultural Experiment Station and the people of Massachusetts as Assistant Entomologist, Investigator, Assistant Research Professor, and Professor of Entomology. He is retiring now from his work which has been entirely in the economic field, dealing largely with fruit, cereal, and field crop pests. For many years, in the absence of an extension entomologist, Prof. Bourne has had contact with and made recommendations for pest control in all economic fields of entomology.

Professor Bourne was born on October 29, 1886, in Kennebunkport, Maine, and later lived in Hillsboro, and in Pembroke, New Hampshire. Graduated from Dartmouth in 1907 with an A.B. degree, he was first employed spraying orchards on a farm. About the same time he became involved in the control of the gypsy and brown-tail moths in southern New Hampshire.

The next year he entered Massachusetts Agricultural College as a graduate student in entomology under Dr. C. H. Fernald, with a minor in botany under Dr. George E. Stone. His entomological interest at this time dealt with the biology of aphids or plant lice.

After a summer as assistant entomologist at the Connecticut Agricultural Experiment Station at New Haven he was offered a position with the U. S. Bureau of Entomology. He resigned the next year to accept a full-time position with the Experiment Station at the then Massachusetts Agricultural College.

Prof. Bourne has published numerous articles on entomology in scientific journals and Experiment Station bulletins. He is a member of several national entomological and scientific organizations including the Entomological Society of America, the American Association for the Advancement of Science, the American Association of Economic Entomologists, and the scientific honor society of Sigma Xi.

DR. HARVEY L. SWEETMAN
Department of Entomology