MINNESOTA
FARM AND HOME
SCIENCE
Published by the Minnesota Agricultural Experiment Station

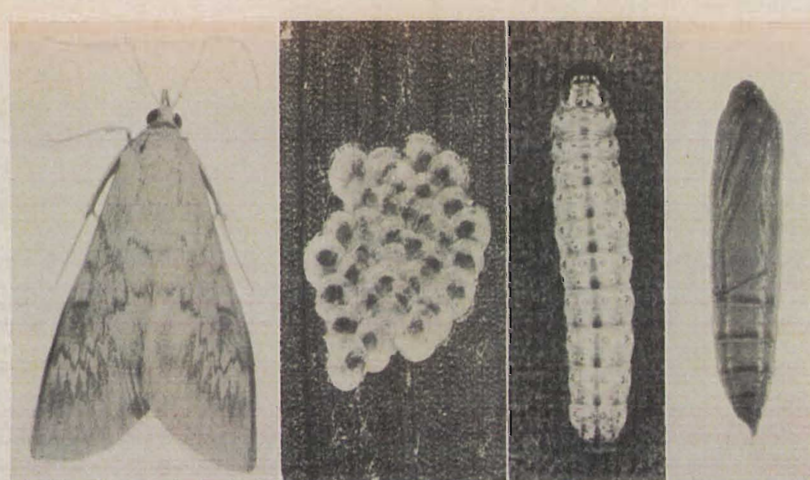
Vol. II, No. 2 | University Farm, St. Paul 8 | February 15, 1945

European *Corn Borer* Comes to Minnesota

T. L. AAMODT

RECENT swift movement of the European corn borer into and across the corn-belt states, including Minnesota, has brought a new challenge to our farmers. Every possible means of combating it through research and practical application of all known means of control must be employed.

Since this native pest of the old world was first found in the United States in 1917 near Boston, Massachusetts, it has spread across several eastern states, reached Wisconsin in 1931, and today can be found in practically every county of Wisconsin, Illinois, and Iowa.



Four stages of the corn borer: the adult moth, egg cluster, full-grown larva or borer, and pupa—three times enlarged except the eggs which are almost 10 times life size.

Although European corn borer scouting has been carried on in Minnesota since 1940, the first specimen was collected in Houston County near Eitzen in September, 1943. Now the borer has spread to the north as far as Ramsey County and as far west as Martin County. Other counties known to be infested include: Fillmore, Wabasha, Olmsted, Goodhue, Mower, Dodge, Dakota, Rice, Winona, Steele, Freeborn, Faribault, Waseca, Le Sueur, and Washington.

Corn borer damage. Left—larva tunneling through cornstalks. Pupa, shown on outside of cornstalk at left, was lifted out of cavity. Right—broken cornstalks typical of corn-borer injury.

Weather conditions have a very important bearing on the increase, decrease, and spread of the European corn borer. The effects of such conditions as temperature, moisture, and other factors under Minnesota conditions are still to be investigated. It is hoped that the extremely cold winters may reduce the overwintering population; however, winter mortality in itself is not accepted as an explanation of seasonal fluctuations.

So far, only two Minnesota counties, Houston and Fillmore, have been heavily enough infested to warrant surveys of abundance. Examination of representative fields in 1944 showed that in Houston County 12.8 per cent of the corn plants were infested, averaging 1.4 borers per infested plant; while in Fillmore County 5.6 per cent of the plants were infested, averaging 1.1 borers per infested plant. Ordinarily no noticeable damage occurs, except possibly in sweet corn, until about five borers per plant are present.

While no visible economic damage has yet occurred to corn in Minnesota, the

(Continued on Page 14)

Home-grown Timber for Farm Buildings

Above—selecting logs in farm woodlot; logs ready for sawing. Right—portable sawmill in operation.

C. H. CHRISTOPHERSON and L. W. REES

MANY Minnesota farmers are reviving an old industry, that of harvesting the timber from their farm woodlands and processing it into lumber for urgently needed buildings and farmstead equipment. The acute shortage of commercial lumber for civilian use has practically stopped farm building construction and has seriously curtailed repair and maintenance work.

For several years the Division of Agricultural Engineering, the Division of Forestry, the Lake States Forest Experiment Station, the Agricultural Extension Service, and the Soil Conservation Service have cooperated in making studies and offering assistance to farmers, sawmill operators, carpenters, and others engaged in the production, processing, and use of lumber from the farm woodlands. This work has shown the value of certain methods and practices in the production and use of lumber on the farm.

Planning Precedes Selection

Prior to construction, any new building should be carefully planned to best meet the specific requirements of the farm. From this plan a bill of materials should be formulated which will determine the approximate number of 2 x 4's, 2 x 6's, and other dimension stock, and the amount of 1-inch material required. Some decision should also be made as to the kinds of available woods to be used, and whether the material is to be surfaced or used in the rough. Framing members, sheathing, and roof boards can be used in the rough to decrease the cost.

The next step is to select the trees in the woodland from which to cut the lumber. To leave the woodland in good condition for future use, the older and more mature trees should be selected. Care should be exercised in cutting so as not to damage the surrounding timber.

The choice of species from which lumber can be sawed varies considerably in different parts of the state. In southern Minnesota the main species include oak, elm, cottonwood, basswood, soft maple, butternut, green ash, black ash, and willow. The northern species include white, red (Norway), and jack pine, and aspen (popple), tamarack, spruce, balsam fir, black ash, and paper birch.

Different woods vary considerably in density, strength, shrinkage, warping, resistance to decay, ease of working, paint-holding qualities, and ability to hold nails. Thus the available wood best suited for a specific use should be chosen.

The logs should be cut into lengths that will use as much as possible of the tree and still produce lumber of the desired length, keeping in mind that odd-length lumber may be required for some of the framing. The logs should be cut 3 inches longer than the required lumber to allow for squaring and trimming.

The logs can be cut at any time during the year, but logging in the farm woodland is usually carried on during the slack season. Logs cut in summer should be immediately placed on a skidway built well off the ground, and the lumber sawed as soon as possible. Winter-cut logs can be piled on the ground provided they are sawed early in the spring.

Processing the Timber

Most of the lumber from farm woodlands is sawed by portable mills. Such lumber is not always as uniform in size as that from the larger sawmills, so that more hours of labor are required on construction jobs. One should select a mill operator with the ability and equipment to do accurate sawing.

All lumber that is to be surfaced must be cut full dimension to allow for shrinkage during seasoning, and for planing. If the lumber is to be used in the rough, it is advisable to saw dimension stock about ¼ inch less than full dimension unless the extra thickness and width are required for additional strength. One-inch lumber should be sawed about ⅞ inch in thickness when used in the rough. When material is cut in these sizes the final dimensions, after seasoning, will approximate the standard dimensions of yard lumber.

Finish lumber and siding should be surfaced to improve the appearance and be smooth for painting. Lumber for flooring should be dressed and matched or made into shiplap. Joists and studding can be surfaced on one edge for uniform width, while sheathing, sills, and plates are sometimes surfaced on one face to provide uniform thickness. Lumber should be seasoned before it is surfaced.

Seasoning the Lumber

All lumber shrinks as it dries below a moisture content of about 30 per cent. Most of the shrinkage takes place in the width and thickness; very little in length. Thus green lumber can be used for framing, but if used for vertical siding, wide cracks will develop. Later these wide cracks can be covered with seasoned battens, but it is generally not advisable to use green lumber for sheathing or roof boards because the shrinkage will set up stresses in the siding or shingles.

Best results are obtained if all lumber is air seasoned prior to use. Thoroughly air-dried lumber in this region will contain about 12-15 per cent of moisture. It is better to use the heavier hardwoods such as oak, ash, and elm for framing when the moisture content has been reduced to about 20 per cent, as when drier, these woods become difficult to work and nail. All matched lumber should be thoroughly air dried. For interior finish in the home the lumber must be kiln dried to about 8 per cent.

The length of the air seasoning period varies with the season, kind of wood, thickness of lumber, size of pile, and method of piling. It requires about 2 to 3 months of good seasoning weather to dry lumber sufficiently for most farm building purposes. The best seasoning period extends from about May 15 to November 15. Thus, lumber cut and properly piled prior to June 1 should be in good condition by late summer.

The lumber should be well piled to prevent deterioration and speed up seasoning. Pile as follows:

- Select an open, well-drained site.
- Build a solid foundation with a slope from front to rear of 1 inch per foot of length. The top of the foundation should be at least 12 inches above the ground at its lowest point to allow free air circulation beneath.
- The lumber in each layer should be of the same thickness with a space of 2 to 3 inches between the boards to allow for downward movement of cold, wet air. The layers of boards should be separated by stickers, each placed directly over the one below and in turn directly over a beam or cross piece in the foundation. For best results the stickers should be about 1 inch thick and placed not more than 3 feet apart. If lumber of different lengths is to be put in the same pile, put the longest boards on the outside of each layer and place the shorter boards alternately flush with the front and the rear of the pile. Do not leave long unsupported lengths of stickers, or allow the boards to project beyond the stickers at the rear. To keep out rain water, give the front end of the pile a forward pitch of about 1 inch per foot of height by having each layer of boards project slightly beyond the ends of the layer beneath.
- Place the dimension stock, especially the heavier hardwoods, near the bottom so it will not dry too rapidly and will be kept straight by the lumber above. 2 x 4's are often kept straight by piling on edge.
- The pile should be provided with a good roof to shed rain and melting snow.
- Remove all weeds and debris from around the pile.

Planning Durable Buildings

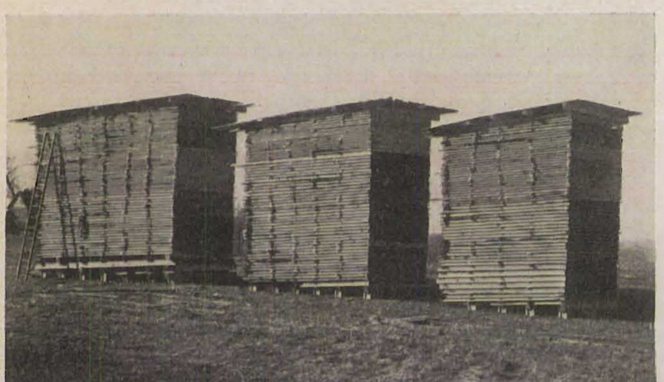
Most farm buildings are expected to last 40 to 50 years. They could be designed for longer life, but in many cases would become obsolete before they are worn out. Many of the species of trees available in the farm woodlands are subject to early decay caused by microscopic plants known as fungi. Fungi will not grow in wood when it is below 20 per cent in moisture; thus, air-dry material will not decay. If the wood is infected prior to seasoning, the fungus will simply remain dormant and will begin growth as soon as conditions become favorable.

The most durable woods growing in Minnesota and used for building construction are northern white cedar and white oak. Woods intermediate in durability include tamarack and rock elm. All other woods commonly used in building construction are not durable and should have preservative treatment when used in places conducive to decay.

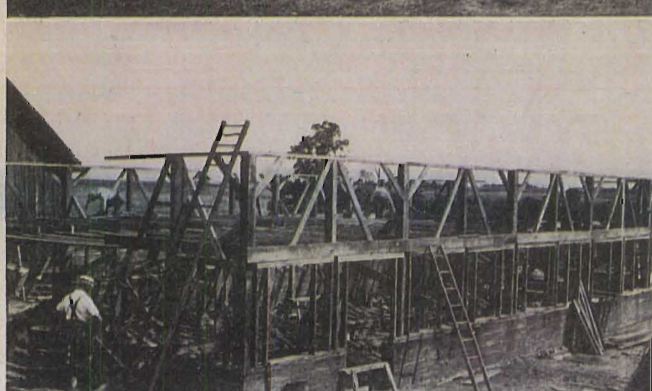
The following construction precautions will prolong the life of farm buildings:

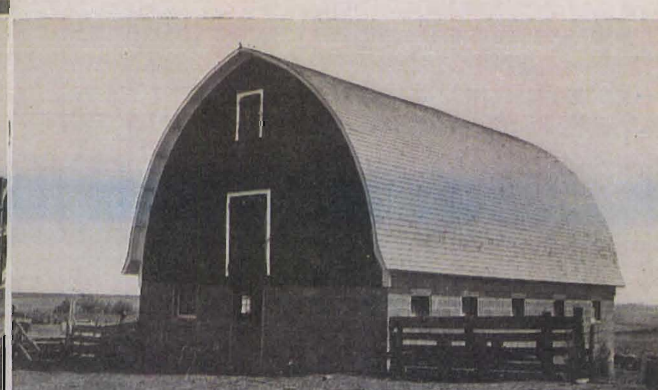
1. Build on a well-drained site. On flat ground, grade the soil so that it slopes away from the building.
2. Use dry lumber or if green lumber is used see that there is free circulation of air around it so that it can properly season in the building.
3. For sills and other parts likely to be in contact with moisture, use the most durable woods. If nondurable woods must be used, treat with a wood preservative.
4. Foundation walls should extend high enough to keep the lumber dry. One foot is usually considered as minimum.

(Continued on Page 13)



Left—lumber properly piled for seasoning. Below—framing a barn with home-sawed lumber; completed hoghouse from home-grown lumber.





Pullorum, Paratyphoid in Chicks, Poults

Testing for pullorum by the rapid whole blood test. Dr. Pomeroy, standing, mixes the test fluid with blood samples and watches for clumps to form, sign of a reactor. Seated at right is Dr. Fenstermacher. Culling birds in background is T. H. Canfield of the University Farm poultry staff.

B. S. POMEROY and
R. FENSTERMACHER

HEALTHY CHICKS make healthy hens. But it also takes healthy hens to get healthy chicks. The two most common killers of baby chicks and turkey poults are pullorum disease and its closely related kin, paratyphoid infection. How can the loss from pullorum disease in chicks and poults be reduced and eliminated? What is meant by paratyphoid infection in poults and how can it be controlled? What should a prospective buyer of chicks and poults consider in order to avoid pullorum disease? Before we can answer these questions, we must understand the essential facts about pullorum disease and the relationship of paratyphoid infections to pullorum disease.

Pullorum Disease in Chicks

Pullorum disease has been called many names, some good, some bad, but the most common ones are B.W.D. or Bacillary White Diarrhea or white diarrhea. It is caused by a germ, *Salmonella pullorum*, and the cycle of infection is well understood. In the adult bird the disease may produce no outward symptoms but may localize in the egg-making organs so that some of the eggs laid by infected or "carrier" hens contain the organism *Salmonella pullorum*. Infected eggs hatch infected chicks which contaminate the incubator through chick excretions, egg shells, and chick down, and the disease spreads to the healthy chicks.

Healthy chicks may contract disease from infected chicks in the shipping box. In the brooder house, the droppings from the infected chicks contaminate the feed, water, and litter.

The diseased chicks may show evidence of the infection during the first week. They act as if cold or chilled, have ruffled feathers, appear listless, and stand around with closed eyes. The droppings may be whitish and sticky and sometimes may stick to the down about the vent. This is described as "pasting up behind." Diagnosis cannot be made from these symptoms alone but should be confirmed by laboratory examination. The loss from the disease may be severe, varying from less than 5 per cent to 10 per cent of the group during the first few weeks. Unfortunately, not all infected chicks die and those birds that survive may have the infection localized in the internal organs, particularly the reproductive organs such as the ovary and oviduct in the female and the testes in the male.

How then can this cycle of infection be broken? Can the carrier birds be detected by some sort of test? Methods have been developed to detect carriers of pullorum disease, and ridding the flock of these carriers is the only practicable means of controlling pullorum disease. Because of an urgent need of a national poultry program for disease control and breeding improvement, the National Poultry Improvement Program was inaugurated in 1935, as a cooperative program under the auspices of the United States Department of Agriculture and cooperating official state agencies. In Minnesota the plan is under the supervision of the Poultry Improvement Board and the Minnesota State Live Stock Sanitary Board.

No terminology is more misinterpreted than the designation "pullorum tested" as applied either to individual flocks or to hatchery supply-flocks as a group. "Pullorum tested" means little unless certain other facts are known. Certainly it does not imply that no pullorum disease exists in the breeding flocks unless such is known to be a fact. To unify and clarify the terminology, the National Poultry Improvement Plan has set up minimum standards and each state can raise its own standards as much higher as it desires. The plan recognizes four classes of flocks and hatcheries as related to pullorum disease. Only flocks and hatcheries operating under the National Plan can use the seal, symbols, and terminology. The four classes and the minimum requirements in Minnesota are given elsewhere. (See box.)

Hatcheries that operate under the National Poultry Improvement Plan receive ratings based on the supply-flock tests. The hatchery is assigned a rating equal to that of its most-infected flock. For example, if one flock was classed as U. S. Pullorum Tested, the hatchery rating would be U. S. Pullorum Tested, even though all its other flocks were classed as U. S. Pullorum Clean. In practice, of course, hatcheries try to discard the low-rating flocks so as to qualify for higher hatchery ratings.

When the pullorum testing program started in Minnesota several years ago, the average amount of infection was over 12 per cent. This year, over a million and a half tested birds are under state supervision, and about one third of the hatcheries are operating under the National Poultry Improvement Plan. The average amount of infection was about 2 per cent. Minnesota has made great strides in reducing the loss from pullorum disease. Some states have done better in that they have eliminated from their program the two lowest classes and recognize only the U. S. Pullorum Clean and Passed classes. The prospective chick buyer must be mindful that in order to eliminate pullorum disease, it must be eradicated from the breeding flocks.

Pullorum Disease in Turkeys

Only during the last 10 years has pullorum disease in turkeys become serious. In all probability the disease was introduced to turkeys through contact with infected chicks and has now become widely established. The cycle of infection is the same as in chickens. The loss from the disease may vary from 5 per cent to 100 per cent of a brood.

Another disease that is closely associated with pullorum disease in turkeys is paratyphoid infection. Paratyphoid is of little or of no importance to baby chicks so far, but in poults the loss from paratyphoid infection in Minnesota during the past season was as high as from pullorum disease.

Paratyphoid in Turkeys—What is meant by paratyphoid and what is the relationship to pullorum disease? The germ that causes pullorum disease was given the name *Salmonella pullorum*. Now, belonging to the same genus or family of *Salmonella* are many other bacteria that have individual differences from *Salmonella pullorum*. These organisms or germs are known as the paratyphoid group which includes many species of bacteria—each with a definite name. In poults that have died from paratyphoid infection, about 30 types have been found. Several types of paratyphoid organisms may be encountered in a single outbreak.

Usually paratyphoid hits a brood of poults during the same period of life as pullorum disease, and it is impossible to differentiate the two diseases by the symptoms. This must be done by laboratory examination. It is important to know what type of paratyphoid is involved in an outbreak if the turkey raiser desires to eliminate this infection from the breeding stock, because it would be impossible to test the flock for all the types that have been encountered in turkeys.

Testing for Pullorum and Paratyphoid in Turkeys—Can the carriers of pullorum disease and paratyphoid infections be detected by a blood test? At present, only the laboratory tests are recognized as official tests for pullorum disease or paratyphoid infections. The whole blood test used for the detection of pullorum disease carriers in chickens is not used in the official pullorum testing program for turkeys. This necessitates the drawing of blood samples and testing them in a laboratory by the tube or the serum plate methods. Since the pullorum and paratyphoid control programs in turkeys have been in operation for a very few years, much confusion exists in the use of certain terms, and the prospective poult buyer should remember certain important facts. The term "pullorum tested" should be qualified. One should know whether the birds were tested by the whole blood or laboratory test, the status of the flock as determined by the laboratory test, and whether it is free of pullorum disease or the amount of infection present.

Many of the states have a pullorum disease control program for turkeys. In 1943, a National Turkey Improvement Program was adopted to improve the production and market quality of turkeys and to reduce losses from disease. Minnesota has not adopted the plan as yet; but in 1943, the Minnesota State Live Stock Sanitary Board formulated a pullorum disease control program for turkeys patterned after the National Plan. The terminology of both the State and National plans for turkeys are similar to that of the National Poultry Plan. Following are the specifications for the four Minnesota classes, all based on the laboratory test:

Minnesota pullorum tested permits less than 5 per cent of reactors in the flocks and all reactors must be removed from the premises.

Minnesota pullorum controlled permits less than 2 per cent of reactors in the flocks, and all reactors must be removed from the premises.

Minnesota pullorum passed permits no reactors on last retest of previously infected flock from which reactors were removed.

Minnesota pullorum clean permits no reactors on any test during the breeding season.

The elimination of pullorum and paratyphoid infection from turkey poults will depend on the achievement of pullorum and paratyphoid free breeding flocks.

The prospective chick or poult buyer should remember that health and good management are the foundations of successful poultry husbandry.

NEW BULLETINS

Minnesota farmers had so much soft and near-soft corn in 1944 that they are going to buy their 1945 seed with sharper attention to its ability to ripen well ahead of frost. Accordingly there is more interest than usual in the report of the Minnesota Agricultural Experiment Station on its tests to determine maturity ratings of hybrid corn varieties offered for sale in this state in 1944. This report is given in Station Bulletin 383, "Maturity Ratings of Corn Hybrids Registered for Sale in Minnesota in 1944."

Free single copies of this bulletin and the other new publications listed below may be obtained from your county agent or from the Bulletin Room, University Farm, St. Paul 8, Minnesota.

SB 378—Managing the Dairy Herd for Greater Returns

SB 379—Managing Hogs for Greater Returns

SB 381—Pesky Plants

S (Postwar Series)—Progress in Development of a Land and Timber Management Program in Northeastern Minnesota

EP 140—1945 Farm Outlook

EF 128—Your Flax Crop

EB 245—Some Legal Requirements for Cooperative Associations

EB—Extension Bulletin. EP—Extension Pamphlet. EF—Extension Folder. SB—Station Bulletin.

EVERY CHICK BUYER SHOULD KNOW THESE SYMBOLS

Below are the symbols authorized for use by hatcheries by the National Poultry Improvement Plan to help buyers of chicks guard against pullorum disease. Each term has a specific meaning. All classes shown are based on rapid whole blood tests.

Flock tested and found to have less than 5 per cent, but more than 2 per cent, of reactors. Reactors removed and premises cleaned and disinfected.

Flock tested and reactors found but less than 2 per cent. Reactors removed, premises cleaned and disinfected.

Flock showed no reactors on last retest, although on an earlier test reactors were found, removed, and premises cleaned and disinfected.

Flock tested and no reactors found. Considered free of pullorum disease.

Turkey Classes Are Similar

Symbols, terms, and specifications similar to those shown are used for poults under the National Turkey Improvement Plan, but classes are based on laboratory blood tests instead of the rapid whole blood test approved for chicks. Minnesota is not cooperating in the National Turkey Plan, but has set up similar classes of its own.

True *Soil Conservation* Is Many-Sided

Poor drainage causes loss of crop on thousands of our richest acres.

PAUL M. BURSON and C. O. ROST

KEEPING a farm permanently productive necessitates a program of true soil conservation. In recent years, the term "soil conservation" has been widely used in connection with the physical control of soil erosion by wind and water. Much emphasis has been placed on this phase of soil conservation through the encouragement of such practices as contouring, strip cropping, and terracing. Valuable as these practices are they do not correct the basic causes which make soil erosive. An adequate concept of soil conservation must include the conservation of plant food nutrients without which productivity cannot be maintained. Only by proper land use and intelligent management of the soil can economic levels of fertility be safeguarded and unnecessary wastage from erosion be avoided. Such a system is the six-point Minnesota Soil Fertility and Conservation Program presented below.

Drainage and Cultivation

Although much Minnesota land that was originally poorly drained has now been drained, there are still many thousands of acres of underdrained land which could be made much more productive with adequate drainage systems. This was demonstrated during 1944 when a large amount of land produced no crop or a greatly reduced one. The removal of surplus water encourages granulation of the soil and lets in air. The presence of water near the surface excludes air and thus restricts the feeding area of plant roots which will not develop without air. Under good drainage, plant roots grow down as much as 5 feet, while poor drainage may limit root growth to a foot or less.

Like drainage, cultivation encourages soil granulation and aeration. Cultivation incorporates crop residues and manure in the soil, thus maintaining the organic matter. Proper cultivation conserves moisture by increasing the infiltration of rain water and reducing runoff, thus preventing the loss of both water and soil. The preparation of a proper seedbed is insurance against crop failure. This is especially true when legumes and grasses are sown. Many failures to obtain stands of these crops are due to faulty seedbed preparation.

MINNESOTA SOIL FERTILITY AND CONSERVATION PROGRAM

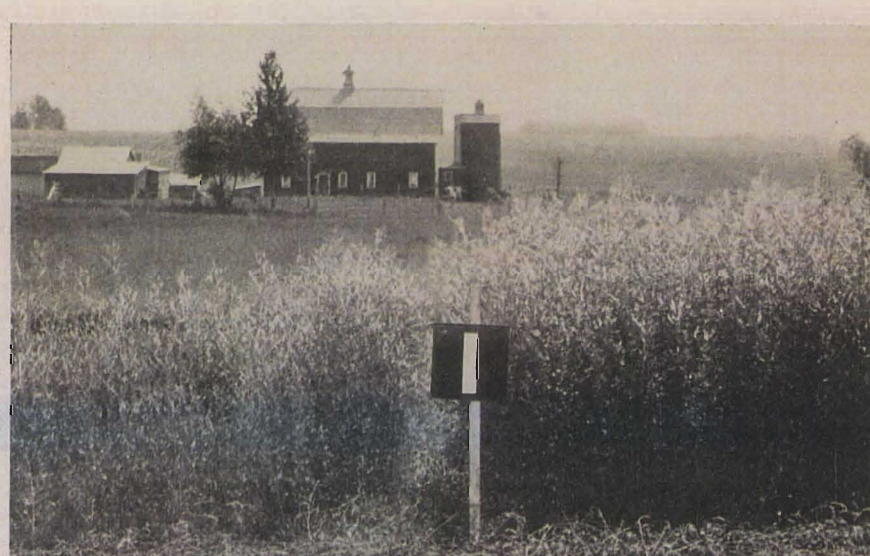
I. Drainage and Cultivation
II. Liming Acid Soils
III. Crop Rotations
IV. Organic Matter
V. Commercial Fertilizers
VI. Erosion Control Practices

Liming Acid Soils

Liming of acid soils is the foundation of soil conservation. Since not all Minnesota soils are acid, soil tests should be made before liming to determine actual need. The main areas of lime-deficient soils include the well-drained uplands of the southeastern part of the state and the sandy soils of the upper Mississippi Valley and of north central and northeastern Minnesota. In these areas liming has been essential to the successful production of alfalfa and sweet clover but less so for the common clovers. Through the successful production of a legume crop to maintain the crop rotation, liming indirectly helps the other crops in the rotation by increasing nitrogen and by improving the availability of other plant nutrients such as phosphorus.

Proper Crop Rotations Essential

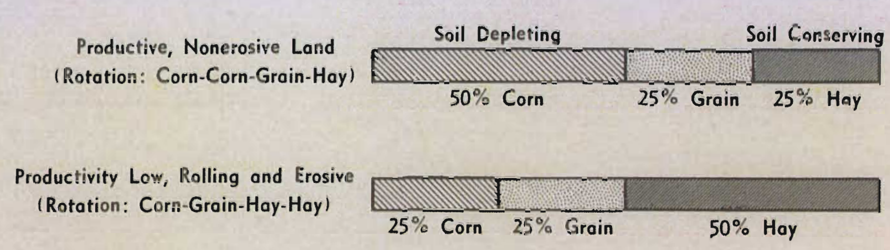
A crop rotation is the basis of any planned soil fertility and conservation program. Its purpose is to maintain and improve the fertility of the soil and



A striking demonstration of the benefits of liming acid soils for alfalfa and sweet clover production. The plot at the right was limed; at left, not limed.

ADJUSTING CROP ROTATIONS TO SOIL CHARACTERISTICS

A sample 4-year rotation



control erosion. Crop rotations should provide a balance between the soil-depleting crops (corn, potatoes, grain, etc.) and the soil-conserving crops (legume and grass mixtures) based on the characteristics of the soil (type, slope, and degree of erosion) and past management practices.

The balance between soil-depleting and soil-conserving crops will determine the fertility level of the soil and the extent to which erosion will be controlled. How the balance between soil-depleting crops and soil-conserving crops may be adjusted to soil characteristics is illustrated in the accompanying figure.

Growing the maximum amount of soil-depleting crops while looking out for soil fertility and conservation by balancing soil-depleting acres with the proper acreage of soil-conserving crops is conservation for use.

Plowing under organic matter, such as this field of sweet clover, builds fertility and reduces erosion.

To be most beneficial to the soil, soil-conserving crops must include inoculated legumes. Inoculation of the legume at time of seeding will help to improve stand, increase the fertility of the soil, and promote better growth and yield.

Maintain Soil Organic Matter

Organic matter is the life of the soil and the storehouse of fertility. High crop yields have always been associated with soils high in organic matter. The quality as well as the quantity of organic matter is important. Crop residues and manure derived from legumes decompose more rapidly than straw or cornstalks and furnish relatively larger amounts of nutrients to the soil.

The effects of organic matter in the soil are: (a) it contains reserve supplies of plant food nutrients, (b) it feeds the vast population of microorganisms in the soil, (c) it maintains the physical condition of the soil, (d) it increases the intake and movement of water in the soil, and (e) it prevents erosion.

Organic matter may be maintained and increased by (a) addition of barnyard manure, (b) the growing of green manures, and (c) the return of crop residues. All of these practices are important, and each should be used when it best fits into the rotation system.

Commercial Fertilizers

Although Minnesota soils are naturally fertile, they are losing fertility more rapidly than realized. Many of our soils are producing lower yields than they once did and fertilizer trials show increased responses. Nutrients are removed from the farm most rapidly by cash crops. All livestock and livestock products also remove nutrients but less rapidly, since a part is returned in the manure. The removal of phosphorus and potash is the most serious, since they can be returned only in the form of commercial fertilizers. The use of such fertilizers will increase the yield of crops, improve their quality, and hasten maturity. A soil conservation program must include the use of fertilizers to replace the mineral nutrients sold from the farm.

Erosion Control Practices

Proper land use and good soil fertility and management practices supplemented by simple erosion control practices will maintain yields and reduce soil and water losses to a minimum. Among these simple erosion control practices are grassed waterways, contour cultivation, and strip cropping.

On some slopes such practices as terracing may be employed, although their need may often be reduced by the use of long crop rotations or by adjust-

Commercial fertilizers often give such marked responses as did phosphorus in the case pictured here.

Grassed waterways are one of the most effective means of preventing gullies. This one did double duty by also yielding a crop of hay.

ments in land use such as seeding to permanent hay or pasture. In general, the protection of sloping land against erosion can be accomplished by good soil fertility and management supported by adaptable erosion control practices.

The manner of application of the Minnesota Soil Fertility and Conservation Program depends upon the emphasis which must be placed upon one or more of the six principles, depending on the particular soil problems. Sometimes one principle will be most important, sometimes another, and sometimes several. If this program is followed, the soils of Minnesota may be kept permanently productive.

DDT in Minnesota Tests Shows Promise as Farm *Insecticide*

A. A. GRANOVSKY

AMONG the many new chemicals discovered by scientists in their constant search for more efficient weapons against our insect enemies, one of the most promising for the control of a wide variety of insects is DDT. It has, doubtless, been more extensively tested than any other new insecticide during the last two years. Preliminary studies definitely indicate that it is an extremely effective material against many chewing and sucking insects which damage agricultural crops and those that threaten the health of human and animal life.

DDT has attracted widespread attention in this country on account of its remarkable control of flies, mosquitoes in the adult and larval stages, body lice, fleas, bedbugs, and other external parasites. It has proved to be almost miraculous in stamping out the malarial mosquitoes in their breeding grounds and pools, and thus reduced malaria to the minimum in the Anzio beachhead, in the South Pacific, and wherever it has been used. Through American efforts, DDT has checked without delay the most dreaded typhus epidemic in Africa and in Italy. The dramatic control of the typhus louse in Naples in 1943 and consequent prevention of a typhus epidemic in Italy is very vivid.

DDT is indeed a magic powder. In less than two years it has already saved millions of lives and is acclaimed to be one of the most important factors in recent victories in the most difficult theaters of war, where malaria and typhus are rampant. Surely, it represents the most outstanding contribution of American entomologists to the war effort in protecting the health of our manhood. By its versatile usefulness, DDT has already demonstrated profound possibilities for promoting the future welfare of the world. It measures to, if not surpasses, the ultimate values of the sulfa drugs and penicillin.

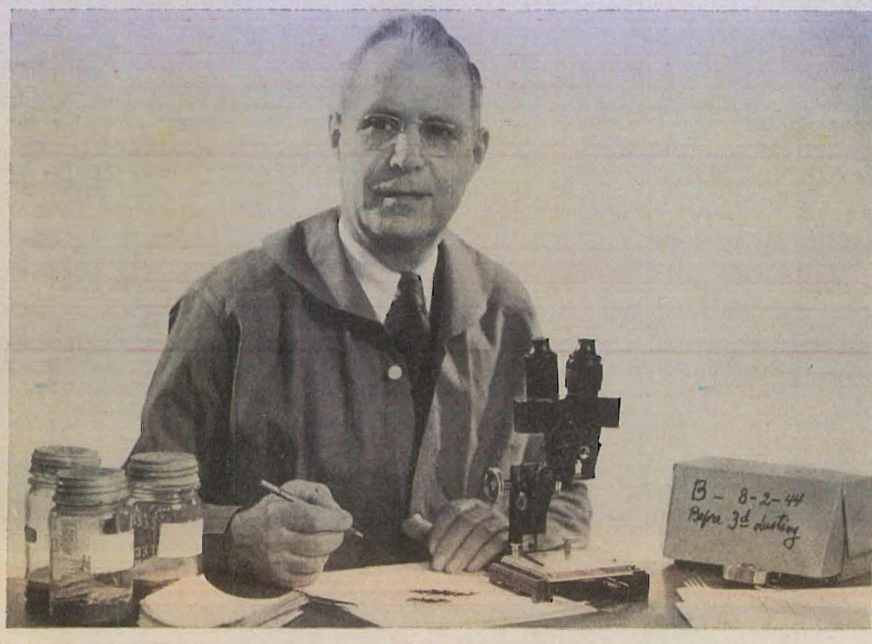
DDT's insecticidal usefulness is not limited to the external parasites of man and animals. It has been found to give equally striking control of many insect pests of the growing agricultural crops, fruits, and vegetables, as well as of stored products.

DDT is a chemical known as "Dichloro-diphenyl-trichloroethane." In pure form it is a somewhat lumpy, whitish, almost odorless powder. Being only slightly soluble in water it must first be made into an oily stock solution. Its solubility in various organic solvents varies greatly.

As early as 1874, this chemical was prepared by a German chemist. Too insoluble for any immediate practical use, it remained hidden in a dusty volume until 1939, when it was tried as an insecticide by the Swiss Geigy Chemical Company. It was found very effective against several insects, especially the house fly. But it was not until the end of 1942 that it was developed in the United States as the greatest insecticide of all time. Several companies now manufacture large quantities of DDT in various forms for different purposes—emulsions, solutions, suspensions, dusts, aerosols, and smokes. Almost the entire output is being used by the American armed forces, with the exception of limited quantities for research by the Agricultural Experiment Stations and other research institutions. Much experimental work is now being done to discover agricultural uses and it may not be too long before DDT will be released for general use.

The Minnesota Agricultural Experiment Station has had an opportunity to use DDT for the last two years. The Division of Entomology and Economic Zoology was the first in this country to make extensive field experiments with

The disease which ruined the carrot on the right is spread by leafhoppers which can be controlled by DDT as proved by the healthy carrot at the left.



Dr. Granovsky identifying and counting insects swept with net from potato plots dusted with DDT in last summer's experiments.

DDT aimed at the control of various insects pests of potatoes, truck crops, and apple nursery stock. It is the only Station having at this time two years' field experience with DDT, especially against potato insects. Preliminary tests in the early summer of 1943 proved DDT harmless to potato foliage and it was immediately used in three large commercial potato fields located near Princeton, Harris, and in the Red River Valley near East Grand Forks. During 1944 the studies with DDT for potato insects in Minnesota were further extended and it was extensively tested with truck crops.

During these two years, DDT was used against the potato insects in comparison with about 30 other combinations of insecticides, in five commercial potato fields in various sections of the state, and in two series of experimental plots at the Northwest Experiment Station at Crookston. It was used as a dust in Pyrax carrier at the concentrations of 1, 2½, 3, and 5 per cent, either alone or in combinations with fungicides such as yellow cuprocide or tribasic copper sulfate. All experiments were conducted in triplicate on plots chosen at random, the majority of the plots measuring about half an acre each.

Throughout the experiments a careful record was kept of the trend of population of various insects in each field. This was accomplished by periodic uniform sweeping with insect nets over each plot (1) before each application of DDT and other insecticides, (2) usually within 24 hours after each treatment, (3) about 4 or 6 days after each dusting, and (4) again about 10 to 14 days after each treatment. The last insect count for each application also served as the survey of insects preceding the next application. These periodic insect counts afforded a comparison between DDT and other insecticides in controlling populations of various insect pests injurious to the potato crop. Other measures used for comparison were the amount of typical injury produced by potato leafhoppers and fleabeetles, and, finally, the yield of potatoes under each treatment.

DDT proved to be one of the most outstanding insecticides for the control of most potato insects. It is extremely efficient against fleabeetles, one of the most serious pests of potatoes in the Red River Valley, even in concentrations as low as 1 per cent. It also gave strikingly good results against leafhoppers, perhaps better, on the whole, than any other known insecticide, especially at the 5 per cent level. Although the knockdown of leafhoppers right after treatment is less conspicuous than with pyrethrum, DDT gave better long-run results and almost complete control of the leafhopper nymphs for a long time after each application. Control of leafhoppers, tarnished plant bugs, Colorado potato beetles, and fleabeetles depends both on the insecticides hitting the insects when being applied and on its remaining toxic while the insects are feeding and moving about and when new insects hatch from the eggs on sprayed plants.

In this connection it is well to mention that as a rule the combination of DDT with 5 per cent of yellow cuprocide gave much better control of most of the potato insects than the same concentrations of DDT alone. Preliminary trials combining the slow, but long-acting DDT with fast-acting pyrethrum gave remarkable kill of potato insects and holds promise of commercial possibilities.

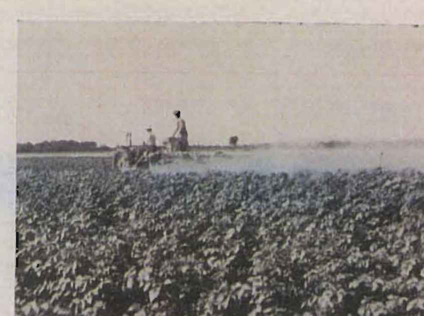
On July 17, 1944, a small field of potatoes at the Northwest Experiment Station was dusted by DDT, 25 pounds per acre, using an airplane duster. The results of this demonstration were fairly comparable to those obtained from the regular experiments.

In 1944, DDT was extensively tested against various truck crop insects. The most extensive tests were those conducted against leafhoppers, mainly *Macrosteles divisus*, feeding on carrots. Six different combinations of dusts, two of which contained DDT, were used in a series of randomized and replicated plots, of about a half acre each. This species of leafhopper is apparently associated with the viruslike disease of carrots which has become so common in Minnesota in the last few years, often causing losses of from 60 to 90 per cent. DDT at the 5 per cent level proved to be unusually effective in the control of these leafhoppers, resulting in a high percentage of disease-free carrots.

DDT was also used in Minnesota against cabbage insects. It is far more effective than any of several other insecticides tried against imported cabbage worms, cabbage loopers, and the larvae of the diamond back moth, and even against cabbage aphids.

Such insects as the squash bug, striped and spotted cucumber beetles, onion thrips, corn earworm, Colorado potato beetle, and several species of sucking bugs, as well as leafhoppers feeding on the leaves of apple nursery stock, are all quite effectively controlled by two or three DDT applications per season.

From these experiments it is apparent that DDT, as an agricultural insecticide, has very high toxic properties but is slow in its action, much slower than pyrethrum. DDT acts primarily on the nervous system of insects and is also toxic when taken into the digestive system. Thus it is a remarkable insecticide, having the properties of a contact and a stomach poison, able to



Dusting potatoes with DDT in Minnesota field trials in the Red River Valley.

control both sucking and chewing insects.

DDT's most remarkable property is its residual value when applied as a spray or dust, especially indoors. Once applied, it remains poisonous to some insects for weeks or even months. On foliage outdoors its lasting quality apparently is not as great, but even under field conditions it readily kills many common insect pests for two weeks or longer.

According to the available information, DDT in common insecticidal preparations as a dust and water spray is not absorbed by the skin of humans. The oil spray preparations are slowly absorbed through the skin and as such are dangerous to use. It is also poisonous to man and animals when ingested with food. It is believed that it is a slowly cumulative poison deleterious to the liver and kidneys. However, in the forms and concentrations designed for the control of agricultural insect pests it is just as safe as other insecticidal poisons now commonly used, if handled with reasonable care.

In this country DDT is already being known under a confusing variety of trade names, marking the materials for various uses. The most common name for DDT intended to control insect pests on plants is *Gesarol*, which is further subdivided by symbols as to dust and spray form in various concentrations. The name *Gesapon* designates the DDT specially manufactured for the control of certain soil insects. The combination of insecticide and fungicide compounds containing DDT is known as *Gesarex*. There are several other names.

While the work performed with DDT must be considered preliminary, the results definitely show a wide range of possibilities in the control of some of the most important insects of agricultural crops. Many of these insects are quite difficult to control with any other known insecticides, and DDT promises to give significantly more positive results. It is certainly one of the best materials for potato insects, carrot leafhoppers, and others.

DDT must be further investigated as a poison to man and animals, either during its application or by eating the treated vegetables and fruits. Its possible health hazards offer certain limitations upon its general use. Another serious limitation against the promiscuous use of DDT is that its long-lasting residual properties are not only effective against harmful insects, but are equally effective against bees and beneficial insects, such as many predators and parasites that help combat the injurious ones.

Considering all of the phases involved in its use, this newest remarkable insecticide is bound to revolutionize the control of at least certain economic insects. It can be readily manufactured at low cost. Its lasting insecticidal value against a wide variety of insects will reduce the need of frequent applications, thus reducing operating cost of insect control. Whether it will be used alone or in combination with other insecticides and fungicides, DDT is one of the most promising agricultural insecticides of the future.

Canada Honors University Farm Horticulture Chief

RECENT bestowal of Canada's highly prized Stevenson Memorial Medal for "conspicuous achievement in horticulture" upon Professor W. H. Alderman is not only an outstanding personal tribute to a great horticulturist, but also a significant recognition of the entire horticultural staff and program at the Minnesota Agricultural Experiment Station and Fruit Breeding Farm.

The award was made at Winnipeg in November at a joint banquet of the Western Canadian Society of Horticulture and the Canadian Society of Technical Agriculturists. In addition to the impressive gold medal, Professor Alderman was presented a handsomely leather bound, hand-decorated certificate which particularly emphasized the value to Canada of many of the 50-odd Minnesota fruit, vegetable, and flower introductions. Both sides of the medal and a page from the certificate are pictured herewith. Professor Alderman, photographed with a basket of Haralson apples, has been at the University of Minnesota 26 years, where he is chief of the division of horticulture at University Farm and superintendent of the Minnesota Fruit Breeding Farm at Excelsior.

Passage by congress of the first Morrill Act in 1862, donating public lands for colleges of agriculture, made possible the Minnesota Agricultural Experiment Station. In 1863 the Minnesota legislature accepted the federal land donation and authorized purchase of a site near the University and under its direction.

First land for the present Minnesota Fruit Breeding Farm was purchased in 1907—77 acres near Lake Minnetonka.

Minnesota *Butter* Is Rich in Vitamin A

ROBERT JENNESS and L. S. PALMER[1]

Summer grazing floods Minnesota milk with vitamin A. Good green alfalfa keeps up the supply in winter.

TO WHAT EXTENT may Minnesota butter be depended upon as a source of vitamin A in the human diet? Obviously this question is of importance to the consumer, and certainly it should be of interest to the producer in view of the competition from other products that butter is facing. Indeed, it is of such great importance, that a statewide 18 months' survey, designed to secure an answer to it, has recently been conducted at the Minnesota Agricultural Experiment Station. The information obtained indicates that approximately 90 per cent of Minnesota's butter has vitamin A potencies above the generally accepted minimum of 9,000 International Units per pound.

Although the fundamental factors affecting the vitamin A potency of butter have long been recognized, no data have been available relative to the actual potency of butter produced under various conditions throughout the country. In an attempt to secure such data, the Committee on Food and Nutrition of the National Research Council instigated, in 1941, a national cooperative project for the determination of vitamin A in butter. Most of the important butter-producing states have been or are participating in this survey. As befitted its rank as the nation's leading butter-producing state, Minnesota's project was by far the most extensive of any in the country.

Organization of the Survey

Eighty-six of the 87 counties in Minnesota produce creamery butter. On the basis of 1940 production figures, 10 regions were established, each consisting of a block of adjacent counties and each producing approximately 10 per cent of the state's butter. Four creameries in each region, each located in a different county, agreed to submit samples during 1943. For the most part these were cooperative organizations drawing cream exclusively from surrounding territory.

The samples, consisting of one-pound prints selected at random, were mailed to the laboratory where they were analyzed by chemical methods agreed upon after collaborative work by several experiment stations. In general, samples from a given creamery were analyzed at biweekly intervals only, but during the transition period from winter feeding to pasture conditions when the potency was changing rapidly, analyses were made every week.

The roughage available in Minnesota during the winter 1942-43 was considered to be exceptionally low in carotene content as the result of severe weathering during harvest. For this reason the project was extended, on a greatly reduced scale, through the first six months of 1944 to ascertain whether the low vitamin A potencies observed in 1943 winter samples would be duplicated when roughage quality was more nearly normal.

In 1943, 1,019 samples were analyzed and 126 in 1944.

Source of Vitamin A in Butter

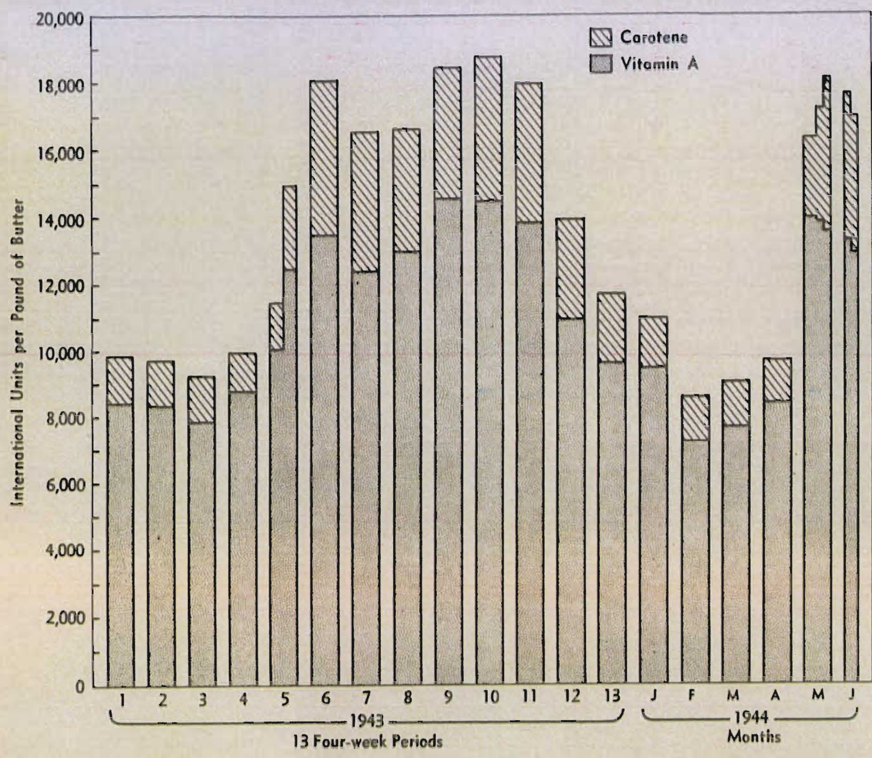
Under ordinary conditions, the vitamin A potency of butter arises from carotene in the plant material consumed by the dairy cow. Pasture grass, silage, and early-cut, leafy alfalfa hay are the best sources of carotene available under ordinary conditions. A portion of the ingested carotene, which is yellow, is transmitted unchanged into the milk fat. Another portion is transformed by the cow to colorless vitamin A of which she utilizes part for her own vitamin A requirement and transmits part into the milk fat. The vitamin A and carotene of milk, being dissolved in the fat, are transferred almost entirely to the cream upon separation and to the butter upon churning.

Since animals, including humans, can utilize both carotene and vitamin A itself to satisfy their vitamin A requirements, the amounts of each present are combined in arriving at the total vitamin A potency of a food product such as butter. The unit of potency is the International Unit which is defined as equivalent to six tenths of a microgram (a microgram equals one-millionth of a gram) of β-carotene and tentatively is considered equal to one fourth of a microgram of vitamin A.

Results of the Survey

The survey brought out strikingly the contribution of Minnesota butter to the nation's supply of vitamin A. Our calculations indicate that the 294 million pounds of butter produced in this state in 1943 contained 826,333 grams of vitamin A and 495,632 grams of carotene. These amounts correspond to 4,109,037,000,000 I.U., enough to supply two and a quarter million people their full requirements of vitamin A for an entire year. At current retail prices for vitamin A concentrates this quantity would cost over four million dollars—a sizable bonus to consumers of Minnesota butter.

[1] Dr. L. S. Palmer, chief of the Division of Biochemistry, University Farm, died in 1944 while this survey was in progress.



Carotene and vitamin A in Minnesota butter. The average vitamin A potency is consistently up to the accepted standard of 9,000 International Units per pound and in summer goes up to twice that amount.

The data failed to reveal any large differences in average total potency among the 10 regions. For the state as a whole the average potency for 1943 butters was 13,958 I.U. per pound.

The average annual vitamin A potency of Minnesota butter is alone relatively meaningless, however, because of marked seasonal fluctuations in potency. The accompanying diagram indicates something of the magnitude and characteristics of these fluctuations which are similar to those observed in similar latitudes in other parts of the world. The following points should be emphasized in regard to these fluctuations:

● Marked changes in total potency occurred during the year. From January 1 to April 22, 1943, the samples averaged 9,000 to 10,000 I.U. per pound. With the beginning of pasturing, a rapid rise occurred until the summer level of 16,500 to 18,500 I.U. per pound was attained. This level persisted until early October, whereupon the potency gradually declined during the remainder of the year. The picture for the first half of the year was corroborated by the results secured in 1944.

The implications of these seasonal fluctuations with regard to the dependability of butter as a source of vitamin A in the human diet are obvious. The average per capita consumption of butter in the United States is approximately ¾ ounce per day. This amount of winter butter supplies about 400 I.U. of vitamin A or about 8 per cent of the 5,000 I.U. daily requirement recommended by the Committee on Food and Nutrition of the National Research Council. On the other hand, ¾ ounce of the best summer butter supplies 800 I.U. or about 16 per cent of the daily requirement.

● The distribution of samples among several ranges of potency is interesting. For 1943 it was calculated that nearly 90 per cent of Minnesota's butter had potencies over 9,000 I.U. per pound, while nearly 45 per cent had potencies over 15,000 I.U. per pound. However, it is not encouraging to note that considerable proportions of the samples fell below the 9,000 I.U. level in the winter. This was particularly true of the third four-week period (February 26 to March 25, 1943) when 44 per cent of the samples were below 9,000 I.U. per pound.

● The distribution of total potency between carotene and vitamin A varied. In winter butter, carotene furnished only 11 to 15 per cent of the potency, while in summer butter it furnished 21 to 25 per cent of it.

● Butters from region 2, which comprised the northeastern quarter of the state, were consistently higher in carotene throughout the year and lower in vitamin A in the summer than those produced in the remainder of the state. The reason for this divergence became apparent when, upon consulting dairy extension officials, it was found that Guernseys represent a greater proportion of the cattle population of region 2 than of that of the rest of the state. Elsewhere in the state Holsteins predominate. It is well known that Guernseys and Jerseys convert less of the carotene that they consume into vitamin A than do Holsteins and Ayrshires. This accords with the common observation that butter from Guernseys and Jerseys is of a deeper yellow color than that from Holsteins and Ayrshires; more unchanged carotene is transmitted into it. It is important to note that deep yellow color alone, contrary to popular belief, is not an index of total vitamin A potency. Actually the paler butter of Holsteins or Ayrshires may be equal in total potency to that of Guernseys or Jerseys, since one microgram of the *colorless* vitamin A is equivalent to 4.00 I.U., while one microgram of *yellow* carotene is equivalent to only 1.67 I.U.

The differences between region 2 and the remainder of the state are of no practical importance in so far as total potency (both carotene and vitamin A) is concerned. Thus for the entire year 1943 the butters from region 2 averaged 13,971 I.U. per pound, while those from the other nine regions averaged 13,932 I.U. per pound.

Recommendations

It has been shown, both in this country and abroad, that the vitamin A potency of butter in winter can be maintained nearly at summer levels by feeding high-quality roughage. In Minnesota the logical step to be made in increasing the dependability of butter as a source of vitamin A appears to be more extensive use of early-cut, leafy, unweathered alfalfa hay and high-quality silages as winter roughages.

At best, considerable losses of carotene occur in haymaking. The very best grades of sun-cured alfalfa hay may contain no more than 30 per cent of the carotene present at the time of cutting. If weathering occurs, the carotene may be almost completely destroyed. Both artificial drying and ensiling offer distinct advantages in the preservation of carotene in alfalfa.

Since the carotene content of leaves is much higher than that of stems, obviously there is an advantage in cutting early when leaves constitute a larger proportion of the crop. It should be noted also that early-cut hay has other nutritional advantages, notably higher protein content, over late-cut hay.

Demand for an agricultural experiment station in Minnesota was pushed by the Territorial Agricultural Society, organized in 1854, and an act to establish a state agricultural college with an experimental farm was passed by the first legislature in 1858.

Home-grown Timber

(Continued from Page 3)

6 All buildings housing livestock or farm produce should be adequately ventilated to carry out moist air.

6 Insulated livestock shelters should have a vapor barrier between the insulating material and the interior of the building. This will keep the insulating material dry and prevent moisture from condensing in the walls and causing decay.

7 All construction joints should be made tight enough to keep moisture out. Flashings should be used over doors and windows, at roof intersections, and at roof openings.

Designing Buildings for Strength

Care should be exercised in the selection of home-grown lumber for such members as joists, girders, braces, rafters, and other members which must carry a considerable load. When possible, one should select the stronger woods such as the oaks, hickory, rock elm, sugar maple, and green ash. Tamarack and red pine are the strongest of Minnesota softwoods.

The spans of joists, rafters, and girders should be kept short when either low-strength or low-grade lumber is used. The best way to increase the strength of a joist is to increase its depth. A 2" x 12" joist is four times as strong as a 2" x 6" joist.

Stock for joists, girders, and rafters should be free of defects which would reduce strength. Defects on the upper edge of these members will not lower the strength as much as if on the lower edge. The lower grades of lumber can be used for roof boards and for other parts of the building where their defects will not impair the strength.

Additional strength for a floor can be gained by a closer spacing of the floor joists, or by using rough lumber instead of surfaced lumber. A joist which is full 2" x 10" in size is 36 per cent stronger than one surfaced to 1⅝" x 9½".

In making built-up girders, at least one member should be as long as the span between girder posts. The other members should be spliced so as to stagger the joints properly.

Adequate braces and ties should be used in all building construction, particularly when low-strength or low-grade lumber is used.

Nailing Dense Hardwoods

The nailing of dry oak, elm, hickory, maple, and other dense hardwoods is difficult. When these woods are green or only partially dry, the nails are easily driven and there is not the danger of splitting that exists with the nailing of dry hardwoods. However, there are difficulties in using green lumber, because of warp, shrinkage, extra weight, loss of nail holding power, and a temporary loss of strength.

The blunting of the nail point is of some help in preventing the splitting of lumber. However, it is more effective to use smaller diameter nails if they can be driven without bending. Of course it will be necessary to use more of them. Additional nails are also required with green lumber to prevent warp, and in some cases to compensate for the loss of holding power of the nails as the lumber dries out. Because dense hardwoods hold nails so much better than softwoods, they can usually be nailed when green and when dry still have the equivalent nail holding power of the softwoods.

A lubricant, such as beeswax, oil, or paraffin, will aid somewhat in driving nails. Drilling small diameter holes for nails would solve the driving problem, but in most cases would take too much time. The clinching of nails and the use of cement-coated nails is of considerable help when nailing into the less dense woods. Where power is available for making holes and grooves, the use of bolts and timber connectors would eliminate many of the nailing problems.

Painting Native Lumber

A considerable number of the early farm buildings of native lumber were never painted, and except for signs of considerable weathering many of these buildings are still in fair condition. Paints and stains, however, may be used to improve the appearance of farm buildings. Paints are most attractive if applied to surfaced lumber, while stains are more effective on rough lumber. Both paint and stain can be more easily applied to rough lumber by spraying than by brushing.

The softwoods and such hardwoods as aspen, basswood, and cottonwood hold paint quite well. The hardwoods such as oak, ash, elm, and hickory are more difficult to paint. The best results will be obtained on these woods if a soft paint such as white lead and oil is used. Some of the hardwoods, particularly the oaks, cause uncoated nails to corrode and stain the wood as well as the paint. This difficulty can be partially overcome by using nails with corrosion resistant coatings.

Cash Savings

Cash savings possible from use of home-grown timber are indicated by the records of Winona County farmers who have cooperated with the Soil Conservation Service in the management of their farm woodlands. The average cost to produce a thousand board feet of rough lumber on five farms was $27.15 plus $8.75 for milling, making the average cost of milled lumber $35.90 per thousand, approximately one half the price of commercial lumber.

Records were also kept of the lumber costs on a number of farm buildings. The savings from using farm instead of commercial lumber were $140 on a 16' x 30' poultry house, $207 on a 24' x 32' double corn crib, $433 on a 26' x 40' hog house, and $816 on a 34' x 60' dairy barn. Since the home-sawed lumber was not graded, some allowances must be made for differences in the quality of the lumber and for extra labor involved in construction with home-sawed lumber.

Creameries Need Added Capital For Postwar Use

E. FRED KOLLER

PROVIDING adequate financial resources to meet the rising volume of postwar needs is one of the urgent problems confronting Minnesota creamery managers and directors at this time. When the war is over, more funds than usual will be required to replace worn-out equipment, modernize the plant, provide for expansion, and meet contingencies.

Analysis of the balance sheets of 75 Minnesota cooperative creameries over the 10-year period 1934 to 1943 indicates that their current financial position is relatively weaker now than in the years immediately before the war and the difficult years of the middle thirties. This is in sharp contrast with the current financing in most industrial and commercial firms. Current assets of these creameries, including cash and the items readily convertible to cash, increased 59 per cent from $12,000 per association in 1940 to $19,064 in 1943. In the same period, current liabilities (short-term debts) increased 67 per cent. Although net working capital (the amount by which current assets exceed current liabilities) increased as a result of these changes from an average of $2,601 to $3,361, it did not keep pace with the growing needs of these plants.

The current ratio (current assets to current liabilities) shows the relative changes in working capital of these creameries and is a common measure of their ability to meet current debts. At the close of 1943, the current ratio of these creameries averaged 1.21 to 1 ($1.21 of current assets to each $1 of current debt) as compared with 1.28 to 1 in 1940 and 1.34 to 1 in 1934. A 2.00 to 1 ratio is considered a desirable mini-

Comparison of Average Working Capital of 75 Minnesota Creameries as of December 31, 1940 and 1943

	1940	1943
Current assets:		
Cash and U. S. bonds	$ 4,129	$ 5,979
Receivables (net)	4,462	8,309
Inventories	3,267	4,608
Prepaid expenses, etc.	142	168
Total current assets	$12,000	$19,064
Current liabilities:		
Notes payable (short-term)	907	1,212
Accounts payable—general	803	826
Accounts payable—patrons	6,860	12,387
Accruals, etc., payable	829	1,278
Total current liabilities	$ 9,399	$15,703
Net working capital	$ 2,601	$ 3,361
Current ratio	1.28 to 1	1.21 to 1

mum. In 1943, 56 of the 75 creameries studied showed ratios below the very low level of 1.50 to 1 as compared with 47 plants in 1940 and only 40 in 1934.

The working capital of many of these creameries and of a large proportion of creameries over the state is too small for sound financing. The slightest adversity may result in financial embarrassment. Furthermore, the shortage of working capital gives rise to such undesirable and costly financial practices as bank overdrafts, short-term borrowing at high rates to cover milk or butterfat payments, delayed payment of bills with loss of discounts, and inability to buy supplies economically.

More working capital than usual should be available after the war to finance repairs and to make replacements of depreciated equipment which were delayed because of wartime restrictions. Analysis of the depreciation reserves of these creameries shows that average replacements of about $3,000 per association (at prewar equipment prices) will be needed to restore facilities to their approximate prewar service capacity. This includes nothing for the improvement of facilities or business expansion. Possible price declines and other business uncertainties following the war make it desirable to provide an additional cushion of working capital now.

To strengthen their current financial position and provide adequate funds for postwar needs, creameries not only must halt further reductions of their limited working capital but also must obtain additional capital from their patron members. The loss of working capital of many creameries is attributable to severe competition between plants which causes them to pay more than is warranted for butterfat. In recent years, many creameries have diverted large amounts of working capital into fixed assets, particularly whole milk equipment, and large amounts have been invested in central milk drying plants and other federated cooperative enterprises. From 1940 to 1943 these creameries increased their average investment in the equities of other cooperatives from $2,701 to $7,822 per plant. As far as possible capital for these purposes should be provided by members through deductions or earnings retained in the business in the form of stock credits, patronage equity reserves, or other patron credits, but not from working capital. It is also advisable that funds being accumulated for postwar uses be segregated in special savings deposits or invested in government bonds to help assure that they will be retained in the business and not used in payments for products, dividends, or other current uses.

Corn Borer

(Continued from Page 1)

Worm eats worm as Nature aids corn borer control. The larva shown emerging from a corn borer which it has destroyed belongs to a family of wasplike parasites which lay their eggs on newly hatched borers.

possible extent of future losses may be judged from U. S. Department of Agriculture estimates of damage to corn by European corn borer in 1943. These estimates indicate a loss of about $33,363,518 to a corn crop valued at approximately $774,000,000 grown in the infested areas. Of this total, 83.3 per cent or $27,800,740 occurred in corn harvested for grain and 16.7 per cent or $5,562,778 to sweet corn. Losses in nearby states were: Indiana, 78 counties, $11,510,883; Illinois, 41 counties, $6,599,531; Iowa, 20 counties, $607,200; Michigan, 14 counties, $563,017; and Wisconsin, 9 counties, $90,613.

Description

The full-grown European corn borer larva is nearly an inch long and one-eighth of an inch thick, with a dark brown or black head—the color of the body ranging from light to dark brown to pink. The upper surface of each division of the body bears a row of small dark brown spots, while the underside of the body is flesh colored and free of markings. The moths have a wing expansion of about an inch and their general color is variable, ranging from pale yellow to light brown.

Several species of caterpillars are found attacking corn and are often mistaken for the European corn borer. Three most commonly confused with the European corn borer are the corn earworm, common stalkborer, and smartweed borer.

Life History

During its life the European corn borer passes through four distinct stages: the egg, larva or caterpillar, pupa, and the adult. The full-grown larvae overwinter mainly in cornstalks, corncobs, and in weeds. Only fully matured caterpillars are sufficiently hardy to survive and overwinter in the northern areas. In May and early July these caterpillars transform to pupae or the resting stage, and in about two weeks the moths emerge. When the weather is cool with frequent light rainfalls, the moths may live for many weeks; however, the span of life of this stage usually varies from one to three weeks. Although close to 2,000 eggs have been laid by individuals, it is estimated that approximately 400 eggs is the average for a female. Eggs hatch in about a week, and after the young caterpillars have fed externally a short while they burrow into various parts of the plant, making tunnels as they feed and grow. What happens when these larvae become full grown depends on whether they belong to the single-generation or multiple-generation strain of borers. In a single-generation strain these larvae lie over winter in their tunnels. However, if the larvae belong to a multiple-generation strain they will pupate immediately, producing a second generation of moths in late July and August. These will bring forth a new batch of larvae, most of which will mature in September and October and hibernate until the next spring. It is known that a fair percentage of the multiple-generation strain is present in Minnesota and this complicates and intensifies the whole problem. A knowledge of the physiological relationship between the different strains of this species is extremely important and is yet to be determined under our conditions.

Corn is the most common host plant of the European corn borer. The insect attacks field corn, both dent and flint, popcorn, sweet corn, and corn planted for silage and fodder. In some parts of the country it will attack and do considerable damage to potato vines. Numerous weeds are also hosts, as well as many other field crops, vegetables, flowers, and shrubs.

Damage to corn by the European corn borer may appear in any part of the plant above the ground. The borer may tunnel in the cob and in the grain, often resulting in crooked or deformed ears. Feeding by the larva is often followed by molds. The main damage to corn is the tunneling of the stalks and earshanks. Heavily infested stalks sometimes are reduced to a mere shell. An Indiana study indicates that the average grower will not notice reduced yields in corn until upwards of five borers per plant are present. It is well known, however, that some damage is caused by relatively lower populations. Sweet corn may be damaged much more severely by considerably lower populations than dent corn because of the much smaller size of the stalk and because the direct feeding of the borers in the ears usually renders such ears unusable. Heavy deposits of frass in the axils of the leaves or in any of the feeding areas is good evidence of the presence of the borers. Looking over the top of the field for broken tassels is also a good first means of detecting the borer.

Control

No single practice is known at this time that will control the European corn borer. Corn growers for the time being are urged to adopt as many of the measures recommended as possible and to cooperate in community control efforts. Study of important methods of attack are continually being made including biological, mechanical, chemical, and cultural phases of control and legislation. Of the immediate control measures to be effected by the farmers in Minnesota, cultural and mechanical are the most important.

Destruction of Overwintering Larvae —The borers survive the winter as larvae in the stalks of field or sweet corn, and coarse-stemmed weeds. These borers must be completely destroyed before moths emerge in the spring (May 1 to June 1 depending on locality).

Feed stalks to livestock direct as silage or as finely cut or finely shredded stover.

Plow stalks under cleanly, using attachments such as trash shields, wires or chains, to a depth that will prevent their being again brought to surface by later cultivation. Low-cutting attachments for most corn binders are now on the market. When stalks are left standing for cattle feed, a railroad rail, heavy pole, or a planker should be dragged over the field on a frosty day in winter to break off all stalk remnants close to the ground. These should then be raked up and burned in the spring before the moths are ready to emerge and the field should be plowed deeply to bury all remaining refuse. New, specially built 16-inch plows now on the market enable clean plowing on corn stubble fields.

Avoid sowing fall wheat or other small grains for harvest in standing corn or corn stubble. Corn ground intended for sowing small grains in the spring should be plowed cleanly instead of being disked, unless the corn has been cut low and the stalks removed.

Plant as late as practicable, but only within the normal planting period adapted to the locality. This is especially desirable on the more productive soils, as the moths prefer the tallest and most vigorous corn on which to deposit eggs. Where only one generation of the borer occurs, extremely early planting is likely to be most badly infested. On the other hand, where a large second-generation strain occurs, later plantings may be severely infested.

Trap crops may assist in the control of the European corn borer as the moths seek better-growing and larger corn in which to lay eggs. Farmers in adjoining states have found it advisable to plant several rows of corn in advance of the regular crop, then to cut these extra rows early in August for livestock fodder.

Corn hybrids now commercially available differ in their resistance or tolerance to the European corn borer. No strains so far tested have proven immune to borer attack nor are any of them sufficiently resistant to be depended upon as a method of complete borer control. Resistant hybrids, when available for Minnesota, however, will help materially in reducing the losses from borer attack.

Farmers should consult county agents or state experiment stations regarding the best hybrids for their locality and insist on types that will mature when planted moderately late.

Control by insecticides is adapted at present only to early market or home garden sweet corn since it is not profitable to apply insecticides to field corn. New chemicals such as DDT and others are being tested against European corn borer and results have been very encouraging, particularly in sweet corn.

Introduction and establishment of parasites is another promising method of combating the corn borer, but cannot be depended upon for some time yet. Minnesota entomologists have already made arrangements with the U. S. Bureau of Entomology and Plant Quarantine for obtaining and releasing of parasites in the very near future, but farmers must not be misled into neglecting cleanup and other practices of immediate value. It cannot be assured that parasites will do the job for them.

Quarantines

Because of the natural spread of the European corn borer from the East into the corn belt of the United States, most of the European corn borer quarantines are being or have been revoked. Minnesota has no such quarantine, but growers wishing to ship other than cleaned, shelled corn into uninfested areas outside of the state should familiarize themselves with the regulations governing such shipments into the state concerned.

Research

Four general lines of research must be considered as most likely to produce maximum results with respect to the corn borer problem and, with varying degrees of emphasis on each, should be utilized as the basis of attack.

First, a detailed study of the seasonal history of the borer is essential to provide information for more definite clean-up recommendations.

Second, investigations are needed of varieties of corn resistant to the borer. These involve cooperation with plant breeders and agronomists.

Third, research into the introduction and establishment of parasites should be conducted.

Fourth, recommendations on use of insecticides should be tested to determine their applicability to Minnesota conditions.

Original research will also be necessary to determine the value and application of other known control measures to Minnesota conditions. For the present we have no alternative than to practice those measures found favorable and now recommended by surrounding states and the U. S. Bureau of Entomology and Plant Quarantine.

Facing the Problem

Farmers living in the heavily infested corn borer areas of the United States and who have had many years' experience with the pest have learned to live with it and produce good crops of corn despite its presence. Farmers in Ohio who have consistently followed the practices outlined for control have commonly produced 60 to 80 bushels of corn per acre.

We do not know as yet how heavily Minnesota may eventually become infested, but since an environment favoring the crop usually favors its principal insect pests it would not be wise to assume that damage will be negligible.

When farmers neglect control measures, corn yields are cut seriously—many times by over half. But by the use of resistant hybrids, timely planting, clean farming, and community effort it should be possible for Minnesota farmers to continue harvesting good corn crops in spite of the European corn borer.

European corn borer meeting schedules for all infested counties are now being planned in cooperation with the Extension Service.

MINNESOTA FARM AND HOME SCIENCE

Published by the Minnesota Agricultural Experiment Station, University Farm, St. Paul 8, Minnesota

C. H. BAILEY, Director
F. R. IMMER, Associate Director

Editorial committee—H. L. Harris, chairman, J. J. Christensen, Eva Donelson, E. Fred Koller, W. E. Morris, M. H. Roepke.

FEBRUARY 15, 1945

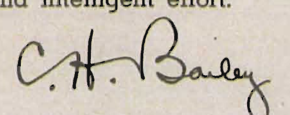
The Quiet Soil

OF ALL the components of an active farm enterprise the soil appears, at first thought, to be the most static. New varieties of crops emerge from the work of plant breeders, new breeds of livestock and poultry make their appearance, new buildings are erected, new tools and equipment flow from our shops to occupy and adorn our farms. Amid these visible and measurable changes the soil appears to be with us always, immutable, unchanged. Yet this is far from the fact. Soil has been produced for our use in agriculture through long geological ages. It came into being gradually and slowly. The virgin soil that greeted the pioneer settlers a century ago contained a record, if it could have been read, of its history. It supplied a composite picture of the rocks from which came certain of its mineral constituents; of the plants which grew on it in ages past; of animal life which flourished on it; of the forces of wind and weather, glaciers, streams, and lakes.

Just as it evolved in consequence of these physical and biological associations, so it responded to the new conditions imposed by human manipulations. One great difference in the new situation, however, was the accelerated rate at which soil changes occurred when the farmer began to till it. Changes that would have required centuries or millenniums in the gradual processes of nature now occurred in a decade or two. Just the simple acts of plowing and sowing induced relatively violent changes in its physical structure as well as in the biological associations thus imposed. Some of these changes were advantageous to the crops and to the husbandman. Others were hazardous, to say the least, and have not been conducive to the preservation of the soil.

Thus, the removal of the original plant cover exposed the soil on slopes to the forces of erosion, often resulting in a terrific loss of the fertile top soil. In dry seasons wind also shifted the top soil, and left "blowouts" of reduced fertility. Continuous cropping to grain crops progressively removed nitrogen, phosphorus, and other elements of fertility. Losses of humus or organic matter changed the bacteriological make-up of the soil. The soil often became the depository of weed seeds, which sprouted to vex the careful husbandman. It also became a medium for the transmission of plant and animal diseases.

The very complexity and degree of these rapid changes in soil point to the difficulties of their control and correction. There is no simple way to restore soils that have been abused. Soil fertility and conservation practices that reduce erosion should be applied where needed. Application of commercial fertilizers is often useful and profitable; but, on the average farm, it should be accompanied by the use of manure, the appropriate seedings of legumes and grasses, adequate rotation of crops, and attention to weed control and general soil sanitation. The heritage that we wasted cannot be regained cheaply. It will require investment of funds and time; above all, it will require diligent consideration and intelligent effort.



Dean and Director
Department of Agriculture, U. of M.

Evermore is Newest Minnesota Strawberry

A. N. WILCOX

A NEW variety of everbearing strawberry, developed at the University of Minnesota Fruit Breeding Farm and recently named Evermore, has made a good record in a number of localities. It is being sold by nurseries in Minnesota, North and South Dakota, Michigan, Indiana, and New York.

This variety, which has been known as Minnesota No. 1166, is a selection from a cross between the Duluth everbearing strawberry, an earlier introduction from this station, and the old favorite, June-bearing variety Senator Dunlap. At the Fruit Breeding Farm, where it has been observed for 15 years, it has been the most generally satisfactory everbearing variety. For about 10 years it has been under trial in other localities, in some of which it has been very good.

The Evermore seems to be unusually hardy and to produce runner plants more freely than most everbearing varieties. When grown under suitable conditions it is very productive. The fruit is long, smooth, and attractive and holds its large size uniformly through the season. It ships well. The dessert quality is good but not outstanding. The flavor is distinct but slightly acid.

Very few varieties of fruit are consistently superior under a wide range of conditions. This is especially true of everbearing strawberries. The Evermore strawberry is introduced, not as an all-round superior sort, but as one capable of profitable production when grown under suitable conditions.

Perhaps the greatest value of the Evermore may lie in its performance under conditions less favorable for most varieties. Reports from western Minnesota, the Dakotas, and Montana indicate that the Evermore may have a particular value for those drier regions where most strawberries do not thrive.

In This Issue