Seed Verification Continued

We want to correct a statement in the article “Alfalfa That Lives,” which was in the January issue. That article, by C. P. Wilkie and H. D. Hughes, contained this statement: “with the new Federal Seed Law, which has become effective within the past few months, the records of production are dependable and the Seed Verification Service has been discontinued.

After that issue was in the mails, then came an announcement through the Agricultural Marketing Service of the United States Department of Agriculture that the regular Federal Seed Verification Service for alfalfa and red clover will be continued. A questionnaire circulated among the seedsmen who had been handling U. S. verified origin seed brought replies indicating a desire to have the service continued, even though it appeared certain at an earlier date that the new Federal Seed Law would entirely replace the Seed Verification Service.

Your Harvesting Is Done?

"Why give us a story now on when to harvest small grain, since the grain has been harvested long ago and is in the bin?" you may wonder. When we asked for the story we expected to have it in your hands before harvest time. Various interferences made this impossible.

But—perhaps you will harvest next year, we reasoned, and you probably are still thinking about the recent harvest. Some of the facts in our lead article are not new; part of them were published several years ago in a research bulletin. To those facts, however, new ones have been added here and at other stations. L. C. Burnett has brought these results together so that you can get a glimpse of what has been found at other Midwest Stations as well as at Ames.

The Leukosis Problem

Most of the poultry flocks in Iowa—and in other states—have some leukosis, Dr. Lee, one of the authors in this issue, tells us.

In the scientists’ many trials to find a solution to the problem, the only satisfactory one has been through breeding resistance into the flock. This method is a great saving of the poultrymen, too. Any kind of vaccination—if a satisfactory one could be found—would be expensive. A satisfactory one never has been found.

When chickens are inoculated with the virus of this disease, they usually do not show any effects of it for several months. The organism causing the disease has never been separated out so that it could be examined—it’s so small that it passes through any filter available.

A Raccoon Story Coming

We were all set to give you a raccoon story in this issue and then it turned out that there wasn’t room for it. Perhaps in October or January—nearer to “coon” hunting time—we shall publish it.

Much interest has been shown in the stories about wildlife that we have had. Others planned for some time in the future are on quail, pheasants, cottontail rabbits.

About the Authors

L. C. Burnett, author of the lead article in this issue, has been carrying on research with small grain at the Iowa Station longer than many of us can remember—about 35 years. He carries the dignified title of Research Professor of Agronomy, but to many of you he is “L.C.” He not only has been somewhat of a pioneer in introducing new, superior small grain varieties, but he has been judge and speaker at many corn shows, institutes and other agricultural events throughout Iowa.

A few of the varieties which L.C. is responsible for giving us are Iowa 103, Iowa 105 and Iogold oats; Iobred and Iotuck wheat. He has worked with all of the common small grain crops.

C. D. Lee is one of the few veterinarians who has concentrated on studying poultry diseases. Dr. Lee has the title of Research Associate Professor of Veterinary Research. He thoroughly knows poultry and their diseases. Under his supervision at the Veterinary Research Farm of Iowa State College, he has several flocks of chickens that are used in the study of Fowl Leukosis.

Joint author of the article on leukosis is Dr. A. J. G. Maw who is research assistant professor of poultry husbandry, in charge of the poultry breeding program of Iowa State College.

T. J. Maney (probably “Tom” to many of you) is research professor and head of the Poultry Science Section of the Iowa State College. For nearly 30 years, Tom Maney has been conducting research and breeding work with all kinds of fruit. An interesting sidelight of Tom’s activities is his work with rose breeding at the Iowa Station.

Margaret Tiffany does research work in consumption economics for the Iowa Station. In this issue she tells some of the things she found about canning on Iowa farms.

Louise J. Peet is research professor of household equipment and head of the Household Equipment Subsection of the Iowa Station. Dr. Peet is married, has one son, and so can sense the problems of the homemaker.

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Editor: FRED E. FERGUSON
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A FEW YEARS BACK, harvesting small grain was done just one way—when we thought the grain was ready to cut, or should be harvested to save it, we cut it with a binder, dried it in the shock and then threshed it.

Today, with combines scattered throughout Iowa, we have, in general, three choices: (1) We can allow the grain to stand in the field until it is mature and dry enough so that it may be combined—"direct" from the standing crop; (2) we can windrow the grain, leaving it lie until it is dry enough, pick it up from the windrow and run it through a combine ready for the bin; or (3) we can still cut the grain with a binder, shock it up and thresh it out with a threshing machine as we have been doing for years.

And so small grain harvesting in Iowa now days isn’t done just one way. Which way is best? That’s the question. If the grain is allowed to stand in the field until it is ready to combine and send to the bin, what are the probable gains in yield as compared with possible losses if it should have to be left in the field longer than had been planned?

We have been trying to get the answers to these questions here at the Iowa Station, as have agronomists at the Michigan, Illinois and Minnesota Stations.

We know that wheat, oats and barley produce maximum yields when allowed to stand in the field until fully mature. We know that the length of time that mature grain can be left standing without serious loss or damage depends largely on the weather, but it also depends on the crop and variety grown. On the average, we find that wheat and early oats have the longest safe period; for barley and late oats this period is short, when it exists at all.

From various tests at the Iowa Station we have concluded that, on the average, increases in growth will be greater than field losses until the moisture content of wheat and early oats is down to about 15 percent and of midseason oats and barley to about 20 percent. If the grain is to be harvested with a binder, the yield will be higher if it is not cut until it is fully ripe. If the crop is to be combined, the length of time after maturity that it must stand will determine whether or not windrowing will be beneficial.

But how is the farmer to tell when his oats or his wheat is down to 15 or 20 percent moisture? An old custom that seems to work rather well is to crush a kernel on a steel wheel or the frame of the machine. If it breaks up into a “meal,” it is...
YIELDS OF DIFFERENT VARIETIES OF WINTER WHEAT AND OATS AT THE IOWA STATION WHEN HARVESTED AT DIFFERENT DATES.

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<th>Variety</th>
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<th>Acre yield</th>
<th>Days delay</th>
<th>Date</th>
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Threshing machines probably will be on the Iowa horizon for some time despite inroads of combine.

1927 and 1928 showed that while these losses were small they were continuous after the moisture content of the grain dropped below 15 to 20 percent (in 1927, 15 percent; in 1928, which had more rain during harvest, the wheat losses started at 20 percent moisture).

Our Iowa investigations with oats show a pronounced difference between varieties. Most of the early maturing varieties like Iowa 105 and Iogold behaved somewhat similar to the wheat. The losses started around the 15 percent moisture content but were much heavier than those of the wheat varieties studied. With the later maturing oat varieties, Silvermine and Green Russian, the losses started before the moisture content had reached 20 percent and were increasingly heavy the longer the crop was left in the field.

In the Iowa experiments we harvested the grains twice a week from the early milk stage until after they were dead ripe. The moisture content and yield were determined at each harvest date. The weather conditions of the two seasons during which the studies were in progress were very different. In 1927 harvest conditions were ideal throughout the summer. The grain ripened normally and dried rapidly. The 1928 harvest period had two heavy rainstorms, one with some hail, and a week of cloudy weather. The accompanying table shows the date upon which the peak yields were obtained. Considering the length of time between the date of these peak yields and the date when the moisture in the grain was down to 15 percent, and therefore safe to put in storage, apparently most of the varieties could have been combined direct in 1927, but in 1928 all the midseason varieties of oats, and all the barley except Minsturdi, should have been windrowed if serious loss was to be avoided. Considering the length of time the grain had to stand before it

down at least to 15 percent; if the kernel is gummy, the moisture is above 20 percent. Some "old timers" chew the kernels and use the same system of judging—if the kernels snap between the teeth into small pieces, the moisture content is 15 percent or lower; if the kernel chews up gummy, it is over 20 percent in moisture.

One of the small grain harvesting experiments that is still considered classic was performed by Dr. Kedzie at the Michigan Station in the early eighties. He harvested wheat every day from flowering time to 2 weeks past maturity and showed that the kernel developed and the yield increased at a comparatively even rate for about 4 weeks from the date of flowering. This period he broke up into the water stage of 10 days, the milk stage of 8 days and the dough stage of 8 days. After this, through the next 2 weeks, which he designates as the hard and flinty stage, he found practically no change in yield.

Later experiments at Michigan, Minnesota and Iowa indicate that in many seasons cracking and shattering losses begin about a week after the flinty stage is reached. Our experiments at the Iowa Station in 1927 and 1928 showed that while these losses were small they were continuous after the moisture content of the grain dropped below 15 to 20 percent (in 1927, 15 percent; in 1928, which had more rain during harvest, the wheat losses started at 20 percent moisture).
Wheat, oats and barley produce largest yields if allowed to stand in the field until fully mature. Length of time that mature grain can be left standing without serious loss or damage depends on the weather, crop and variety that is being grown.

was safe to store, it would have been much safer to have windrowed all the varieties in 1928.

The coming of the combine as a more-or-less common method of harvesting small grain has stimulated interest in several research projects dealing with the optimum degree of maturity, considering both yield and quality. These investigations have led to some modification in our ideas as to what takes place while the grains are ripening, both before and after they are harvested. Most of the earlier investigation and observation was conducted under much more humid conditions than we have in Iowa; many of the notions that arose from them have been found to be inaccurate when the conditions are modified to fit the climate of our dry prairie summers.

One of these notions was that when grain had reached the late milk or dough stage, it might as well be cut and allowed to "fill-out" in the shock. Some of the early experiments tended to confirm this idea, especially if the drying process took place sufficiently slowly, covering 2 or 3 days.

In a 4-year series of experiments in Illinois, wheat was harvested at five stages of maturity. One sample was dried in the sun, a second in the shade and from a third the heads were cut and dried in the shade. The wheat harvested in the watery, the milk, the dough and the ripened stages increased in yields when cured on the straw. This increase was greatest when the curing was slowed by shade. At the fully ripe stage there was no increase during the curing process. In a later experiment at Minnesota the period of translocation in barley was prolonged up to 8 days by keeping the straw moist. Somehow different results were obtained from experiments in Canada, Michigan and Minnesota under conditions which perhaps more nearly fit our midwest harvest conditions. These investigators conclude that there is little or no transfer of material from the stalk to the grain after it is cut.

These differences in conclusions would doubtless disappear if all the samples had been dried rapidly—a condition we all want in a normal harvest.

Another notion that once had considerable standing was that the quality of wheat was much improved by being cut "full-green." This may have grown out of the fact that most of the protein and the other nitrogenous materials are deposited in the grain early in the filling period while the starch deposition increases almost to maturity. By cutting green a higher protein content might be obtained than when the material is allowed to become fully ripe. This philosophy is hardly justified as numerous experiments at Michigan, Minnesota and in Canada have repeatedly shown that quality as well as yield improve from blossoming time to maturity and that the quality continues to improve for some days after maturity, probably until storms cause swelling of the kernel.
A FEW YEARS AGO, chickens were dying right and left on farms with a disease called range paralysis, fowl paralysis and various technical names. At that time we little understood the disease—its cause or what to do about it. Probably in the last 10 years this disease has caused more losses to the poultry raiser than any other single disease of adult poultry.

In order that we might study the disease, find its cause, the method by which it was transmitted from one bird to another and what to do to prevent it, we bought an entire flock that was badly infested with the disease. This flock was taken to the Poultry Research Farm of Iowa State College.

We soon discovered that the disease showed up not only as paralysis of the legs, wings or internal organs, but in various other forms. Some of these other forms affected the eyes (sometimes complete blindness), tumors in various parts of the body, a sort of anemia infection of the marrow of the bones.

It is obvious that to call this disease range paralysis or fowl paralysis isn't satisfactory, for a bird suffering from the disease may be able to transmit it on to other members of the flock and still not be paralyzed. So to work out a nomenclature for the disease as a whole, a group of poultry pathologists met at the Regional Poultry Disease Laboratory at East Lansing, Mich., last summer and adopted the following nomenclature:

**FOWL LEUKOSIS COMPLEX**

1. Lymphomatosis
   - Ocular (eye type)
   - Neural (paralysis)
   - Visceral (tumor infiltrations)
   - Osteopetrotic (enlarged bones)
2. Erythroleukosis
3. Myeloid leukemia

We found that infected material taken from a bird affected with one type of leukosis injected into susceptible birds might produce any of the other types. Fowl leukosis is an infectious disease caused by a filterable virus.

The disease is highly infectious, spreading readily within a flock. It usually strikes birds between 4 and 8 months of age and most often around 6 months. Birds of all breeds are affected, and no recoveries from the disease have been noted, but temporary let-ups do occur.

Going back to the flock which we purchased about 12 years ago for study of the disease—we trapnest the layers to keep track of them. We made some matings the first year, and part of the chicks were inoculated with leukosis virus, while control lots from the same matings were not inoculated.

In this first year of our study, the control chicks which received no virus came down about as badly with leukosis as the birds injected with the virus. Then we began to notice few-
er of the chicks from certain families died—the chicks from certain hens seemed more resistant than others.

With this lead we continued our breeding to see whether or not careful selection and breeding could conquer the disease. Now after about 10 years of breeding we have certain strains or families that are 95 percent resistant to leukosis, and other strains of which 40 to 100 percent will die when inoculated with the leukosis virus.

It is our observation that practically all flocks have some leukosis. So we have watched the effort of certain breeders and hatchery operators to control leukosis. The work of these men has supplemented our own efforts.

We have come to the conclusion that the breeder or hatchery operator who follows a thorough practice of culling and breeding can control the disease. Here is the schedule he needs to follow:

Cull several times a year, removing at each culling all birds that have gray eyes and those that are light in weight or have pale combs. Obviously, any that are paralyzed in the wings or are lame should be removed.

The control program may be speeded up by using as many 2-year-old hens in breeding flocks as possible. In using 2-year-old birds, care must be taken in control of other diseases, as tuberculosis.

The eyes, weight of the birds and comb color are about the only obvious symptoms of the disease. By continually removing these birds showing infection (these infected birds have had an opportunity to pass the disease on to the other members of the flock), you will be saving as breeders the birds that have stood up and showed resistance to the disease. The more frequently the flocks are culled, the better the results will be.

Such careful culling and selection will bring another indirect benefit—it gets rid of the low producers, and better chicks will be turned out.

About the various forms in which fowl leukosis appears, we have made the following observations:

Neural

Neural is the nerve type. Paralysis in these birds may be general or local. Paralysis of one or both legs, or one or both wings may occur. The paralysis may be slight or so severe that the bird is practically helpless.

When the brain is involved, various symptoms may show as well as abnormal head movements. Some of these may be a waving motion of the head, throwing the head backwards or the beak downward, lateral movements and, in general, a lack of ability to hold the head in a normal position.

Many cases show a paralysis of the internal organs. In some cases the nerve of the neck is affected and the bird has difficulty in breathing. It may breathe through its mouth. The disease may strike suddenly or it may come on gradually.

Ocular

In the eye cases the iris or red portion of the eye frequently shows in the beginning a depigmented circle around the pupil. The circle is gray at first or may be only a slightly faded color, but gradually extends until the red or bay color is almost completely replaced. The process may start in any part of the iris as a small depigmented spot, or it may start as a generalized depigmented process throughout the iris, characterized as a faded gray appearance.

In many birds the depigmentation appears to start in several places in the iris at the same time, giving the appearance of a normal bay color, interspersed with faded or gray areas.

Often the depigmentation is irregular and has a streaked appearance, mingling the bay color with gray. The color changes

When chicks were hatched from eggs from a mating of males and females with the iritis type leukosis, the blood of these chicks was found to be infective when the birds were only one day of age.
may vary from a faded bay to a dark or light gray, bluish gray or slate gray. In some cases a black colored tissue appears as a multiple tumorous mass. Generally both eyes are involved, with one appearing more severely affected than the other.

Many cases show involvement of only one eye. In a high percentage of cases regular or irregular constriction of the pupil occurs with impaired vision or even blindness. The condition may spread rapidly or slowly, and in many cases it appears that the disease has become arrested. The birds usually remain in good health unless blindness occurs or unless the eye type cases become complicated with other forms of the disease.

Frequently we have observed birds with uncomplicated eye cases in the beginning which developed some other type eventually. We have also seen several uncomplicated eye cases that have lived 2 years without any great impairment of health.

While most of the popular breeds of chickens should have normally a reddish bay colored iris, some do not have. The iris of the Cornish, and some game birds, is normally a yellow or pearl color, and many crosses of this breed may have normally pearl or gray eyes.

**Visceral**

Clinical symptoms in cases affected with lymphocytoma tumors and tumor-like infiltrations in various organs vary greatly, depending upon the tissues or organs involved. Many cases in good flesh have died suddenly and upon autopsy were found to be suffering from an enormously enlarged liver.

Respiratory difficulty was observed in a few cases which upon autopsy showed an involvement of the lungs by lymphocytoma (tumors). The symptoms in general are more obscure than in the other types of the disease.

**Erythroleukosis**

Many degrees of affection are noted in the erythroid type. The most characteristic symptom is a severe paleness with a definite yellow discoloration of the skin of the face. The tendency in most of these cases is toward "going light."

The course of the disease is also variable, in some cases progressing rapidly and in others slowly. The appetite usually remains normal except in the very acute, generalized cases and in cases of prostrated birds.

**Myeloid Leukosis**

The clinical manifestations of myeloid leukosis are widely variable. The onset may be gradual or rapid and general weakness with diarrhea is quite common. The skin, comb and wattles may not show any color changes, while some birds show varying degrees of paleness as well as a peculiar pallor. The tendency in these cases is toward a rather rapid emaciation.

In order to seek an answer for this question, we made matings of paralyzed birds but with very little success because of lack of production or fertility. Birds suffering from erythroleukosis or myeloid leukosis rarely produce eggs. In cases of ocular type or eye type, birds may produce normally with a normal degree of fertility. Matings were made of iritis females and iritis males. The birds were hatched and placed in isolated colony houses. During a 12-month period 65 percent of these birds died of some form of the fowl paralysis complex. Matings were made of iritis females and normal males and about 50 percent of these birds died of the complex. Matings of normal females with an iritis male were used and about 16 percent of the chicks hatched of this mating died of fowl leukosis.

To further this investigation, blood from day old chicks hatched from a mating of iritis females and iritis males was injected into 1-week-old susceptible stock from our own breeding flocks. These inoculations resulted in a 60 percent mortality from some form of fowl leukosis during a 12-month period. These experiments were repeated using blood from 1-week-old chicks from iritis matings and at weekly intervals for 12 weeks. We found the blood to be infective at about all ages.

**Control Methods**

A rigid culling program eliminating all birds with faded gray eyes, light colored comb and wattles, lame or paralyzed birds, and extremely light birds, will eliminate carriers, thus greatly decreasing this disease in the flock.

When the disease becomes prevalent the above procedures should be followed and the birds surviving kept as a source of resistant breeding stock.

In only extreme cases should a flock be disposed of and new birds brought on the farm as they will, in most instances, be very susceptible to the disease, whose infective agent is already present on the premises.

**Summary and Conclusions**

The disease known as range paralysis or fowl paralysis is more aptly named fowl leukosis and this term includes the various manifestations such as paralysis, tumors, iritis, erythroleukosis and myeloid leukosis.

The disease in all its manifestations may be produced by injecting infective material, by contact of healthy with diseased chicks and by contact of healthy birds with infected premises or litter.

An injection of a suspension made from one type of this disease produced all the manifestations generally attributed to this disease.

The disease has an extremely long incubation period in most instances, as chicks injected at 1 week of age did not show symptoms or die of the disease until between 4 and 8 months of age. The disease rarely attacks birds over 12 months of age.

The disease was transmitted by way of the egg in mating of iritis birds. The virus was present in the blood of chicks of such mating when the chicks were 1 day old.
The damage to apple trees which resulted from the Nov. 11, 1940, freeze could have been prevented in a large measure by the use of hardy, intermediate stocks, like Hibernal and Virginia Crab. This was the general opinion of a large group of midwestern fruit growers and horticultural specialists who met at Ames recently to observe results in the experimental stock orchards of the Iowa Agricultural Experiment Station. The use of certain stock combinations in these orchards indicated that hardy stocks were the most important single factor in preventing cold injury. It was also observed that the new varieties, Sharon, Edgewood, Secor, Hawkeye Greening and Norwel, came through the storm in perfect condition, even to the extent of carrying a crop of fruit at the present time.

A subsequent visit to the Apple Groove Orchards at Mitchellville, Iowa, owned and operated by Robert M. Clark, further convinced the horticulturists that the use of hardy stocks is practical in large scale orchard operations. Mr. Clark has been experimenting for 23 years with hardy stocks and has used them extensively in developing about 92 acres of orchard. Notwithstanding the November freeze the crop in this orchard for 1941 will approximate 6,000 to 8,000 bushels. Of course there was injury to a number of the trees in the orchard but the evidence was strongly in favor of the use of hardy stocks as a method for preventing damage such as resulted from the November blizzard. Mr. Clark demonstrated how the stocks may be topbudded over a period of 2 to 4 years and emphasized that the buds should be set on the main scaffold branches at a distance of 2 or 3 feet from the trunk. After the past freeze, this practice resulted in less injury than where buds were inserted close to the main trunk. In some instances tender varieties, such as Delicious and Grimes Golden, were killed back to the stock, but the stock was uninjured and in good condition to be reworked. With stocks from 5 to 10 years old, this operation should not mean great loss in time or money.

The Apple Trees on Hibernal and Virginia Crab Were Least Injured by the Freeze in November
orchard may keep one young and an old orchard may make one old—it is always well to have something to look forward to.

Future orchards should be longer lived and more productive if they are developed by the use of hardy stocks. If hardy stocks are not used, then midwestern growers must insist that nurserymen sell them root-grafted trees. Experience has shown that budded trees are short-lived under our severe climate. Our local nurserymen appreciate this fact, but eastern and southern firms will continue to pass out budded trees to Iowa growers.

This is a good time for the orchardist or prospective orchardist to plan for the future, for now the opportunity is at hand to take advantage of the best information on varieties, stocks, methods for the prevention of soil erosion, orchard location, soil fertility and other modern orchard practices.

The blizzard of Nov. 11, 1940, which swept across Iowa will probably go down in history as a major disaster to the horticultural industry of the state. To appreciate the full effect of this storm on horticultural plants, one must consider the conditions which preceded the freeze. The fall had been unusually warm, and sufficient moisture was present in the soil to keep plants in an active growing condition up to the time of the first killing frost, Nov. 7. On this date, the temperature dropped to 24°F., a degree insufficient to injure the leaves on most fruiting plants.

Then on Nov. 11 came the blizzard. In less than 24 hours, temperatures throughout the state dropped from a high of 50°F to a low of 0°F. During the period from Nov. 11 to 15, temperatures from -3°F. to -15°F. were reported in various sections. Fruiting and ornamental plants were caught in an immature condition and injured to such an extent that many orchards were total losses. The full extent of the injury is not apparent even at this time. Some injured plants may fold up quickly during the late summer, or again they may survive over a period of years.

Fruiting plants which were damaged included the apple, peach, pear, sour and sweet cherries, apricot, blackberry, and red and black raspberries. Currants and gooseberries were only slightly injured. Plums, except for certain hybrid varieties, withstood the freeze.
Grapes, apparently uninjured, showed considerable bud injury when growth started. Strawberry plants, which were unmulched at the time of the cold snap, where not entirely killed, were injured in the roots and dormant fruit buds. This injury was shown at picking time by low yields of small, knotty berries.

Injury to ornamental plants is most noticeable in the evergreen group. In all parts of the state Junipers, including Pfitzer, Irish, Swedish, Greek, Chinese and other selected types, fared badly. Douglas-fir, Yellow Pine, Arborvitae and Yew were also damaged. Roses in the hybrid tea and hybrid perpetual group were killed or badly damaged. Even hardy roses, like the R. rugosa, were killed to the ground line. In the main, the commonly planted ornamental shrubs, with the exception of Morrow honeysuckle, escaped serious injury. The same holds true for deciduous trees; the exception being ornamental crab apples, some varieties of which were killed or badly hurt. The Chinese elm, whose dead trunks and branches are a blot on the landscape in every midwest community, was severely injured.

Unseasonal freezes of the Nov. 11 type are not common in Iowa, but nevertheless they have occurred. In the first annual report of the Iowa State Horticultural Society, published in 1868, a cold spell was reported as happening late in October. In this case, there was no frost until Oct. 26. Then there was rain attended by snow and a hard freeze, which was reported to have killed three-fourths of all apple trees in southwestern Iowa.

Again on Oct. 28, 1925, a cold spell developed with temperatures dropping to -5°F. This freeze caused heavy damage to young trees in the nurseries, but orchard trees, although they showed evidence of bark and wood injury, came through with little permanent damage.

The known cold resistance of plants to low temperatures was no index to their hardiness under the conditions imposed by the November freeze. Some of the most hardy varieties were badly injured while some of the most tender escaped damage. Apple varieties like Duchess, Wealthy, Yellow Transparent, Whitney Crab, Haralson, Hawkeye Greening and Willow Twig were uninjured in nurseries and orchards. The new varieties, Edgewood, Secor and Sharon, recently introduced by the Iowa Agricultural Experiment Station, fared better than the standard sorts such as Grimes, Delicious, Golden Delicious and members of the Winesap group. In general new varieties developed in Iowa, Minnesota and Canada were superior in cold resistance to the varieties developed in eastern states. Cortland, Milton and Early McIntosh were the least injured of the New York varieties; while Orleans, Kendall, Newfane and Webster were killed outright or badly injured.

Above: This Jonathan tree, grown on its own stem, was uninjured in its top, but the trunk was killed.

Left: Extensive commercial orchards in southwestern Iowa, like the one shown here, were almost total losses in many instances.
Farm Women Falling Behind Goal Set for Canning Fruits and Vegetables

A recent survey investigating the number of jars 390 farm women put on the shelf in one year indicated that they were falling almost 50 percent below the canning goals set up by Extension Service nutritionists at Iowa State College.

Although wash boilers and pressure cookers are doing double duty these days, Iowa farm women will have to "up" their record to reach the goal of 575 quarts fruit, vegetables and tomatoes recommended for a family of four for one season.

Of the vegetables actually canned by the 390 women last year, only three—tomatoes, string beans and pickles—were canned by three-fourths or more of the group.

Those who canned tomatoes and snap beans put up only about half the recommended amounts of 125 and 60 quarts, respectively. Pickles, on the other hand, are not among the recommended vegetables, but were canned in abundance. Those canning corn exceeded recommendations of 20 quarts per family by averaging 28 quarts a family. Not quite half of the families canned peas, and this group canned three-fourths as many as recommended.

Fruits for the most part were canned by from 50 to 60 percent of the families. The combined cannings of apples, peaches, pears and apricots were fairly close to standard. Cherries were slightly below the recommended 25 quarts and berries were canned in less than half the suggested amounts, but over twice as many plums as suggested were canned. This indicates that farm families will can more of one fruit to balance the lack in another, if the first fruit is more available.

The average total of fruits canned by the 390 families was 139 quarts and of vegetables, 158 quarts—totalling 297 quarts per family. Extension nutrition specialists say that they should be canning 225 quarts of vegetables at least an equal amount of fruit, plus 125 quarts tomatoes, making a grand total of

Note:
This survey of home canning and home production, made by Miss Tiffany, included 203 women enrolled in the home economics extension work, 76 whose families had FSA tenant purchase loans and 111 farm women chosen at random. Each of these three groups represented all parts of the state. The latter group was personally interviewed. The families averaged between four and five members each.

—The Editor
of 575 quarts. However, it should be pointed out that the families surveyed bought some canned fruits and vegetables—an average of 60 cans. This would actually increase the total amount of canned goods used, but would still leave the families considerably below nutrition recommendations.

Tomatoes Popular

The most popular vegetable on the farm basement shelves was tomatoes. They were canned by 85 percent of the families either as a vegetable, as juice or both. Four-fifths of the families canned them as a vegetable, while nearly half canned juice.

Those canning the whole or stewed tomatoes put up between 55 and 60 quarts each. The average amount of juice canned per family was 38 quarts. The total amount of tomatoes canned per family was 74 quarts, compared with the recommended 125 quarts for a family of four.

About the same number of families canned green beans and pickles as canned tomatoes, but the quantities canned were considerably less—around 35 quarts per family for each of these two vegetables.

Corn was canned by well over half of the families, the average amount being about two boilerfuls—28 quarts.

Peaches, Plums, "Tops"

Peaches were the most popular fruit—three-fourths of the families canned them and averaged about 40 quarts.

Plums were next—63 percent of the families canned an average of 22 quarts.

Fewer families canned berries, but those who did canned larger quantities than those who canned plums. In fact, the average number of quarts was 33, or less than half the standard.

Cherries were canned by about two-fifths of the families, and canned corn by a third of them.

Pickles and relishes, too, were seldom used. Fewer of those canning pears and even fewer of those canning peaches raised their own.

Less than half as many renter families as owners produced all the fruit they canned. The owning and renting families were approximately even, however, on the proportion raising all the vegetables they canned.

Only a relatively small amount of canned fruit was purchased to supplement that canned at home. Peaches and cherries were bought by the largest number of the families. A few bought canned Italian plums, peaches, and pears. Most of these fruits were bought in gallon cans when there were extra men to feed. A few women recanned what was left, but most of those who had electric refrigerators found that they could keep the surplus fruit conveniently without spoilage and therefore did not bother with the work of canning.

With so few families buying canned fruits, the average expenditure for canned fruits and vegetables was only $11.86. Renters spent more than the owners, probably to make up for the smaller amount of fruit they had on their farms.

<table>
<thead>
<tr>
<th>What 390 Iowa farm women canned in 1939</th>
<th>Extension What the women did</th>
<th>Percent canned</th>
<th>Av. Amt. canned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berries</td>
<td>Qts.</td>
<td>73</td>
<td>55</td>
</tr>
<tr>
<td>Cherries</td>
<td>Qts.</td>
<td>23</td>
<td>48</td>
</tr>
<tr>
<td>Peaches</td>
<td>Qts.</td>
<td>10</td>
<td>62</td>
</tr>
<tr>
<td>Apples</td>
<td>Qts.</td>
<td>59</td>
<td>76</td>
</tr>
<tr>
<td>Cherries</td>
<td>Qts.</td>
<td>100</td>
<td>69</td>
</tr>
<tr>
<td>Peaches</td>
<td>Qts.</td>
<td>100</td>
<td>76</td>
</tr>
<tr>
<td>Apricots</td>
<td>Qts.</td>
<td>85</td>
<td>58</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Qts.</td>
<td>85</td>
<td>77</td>
</tr>
<tr>
<td>Snap beans</td>
<td>Qts.</td>
<td>77</td>
<td>90</td>
</tr>
<tr>
<td>Corn</td>
<td>Qts.</td>
<td>90</td>
<td>20</td>
</tr>
<tr>
<td>Peas, lima beans, shell beans</td>
<td>Qts.</td>
<td>20</td>
<td>37</td>
</tr>
<tr>
<td>Pickles and relishes</td>
<td>Qts.</td>
<td>80</td>
<td>30</td>
</tr>
</tbody>
</table>
What it costs to run a refrigerator in your home depends as much on you as on the refrigerator you select. The way the refrigerator is used will influence greatly its cost of operation.

Today, both ice and mechanical refrigerators look very much alike so far as the construction of the box is concerned. And whether they're cooled with ice, electricity, gas or kerosene, all of them do a good job. The type to choose will depend on where you live, whether you have natural gas or electricity in your home, whether ice is easily available, or whether kerosene's the solution.

Initial cost will influence you, too—in recent years electric refrigerators have been greatly reduced in price. The less expensive models are as well constructed as the more costly, but they don't have all the special features. Appearing on the market are large refrigerators with flexible shelf arrangement for the storage of large containers in the rural homes. An 8-cubic-foot refrigerator uses very little more gas or electricity than a 6-cubic-foot.

The newer refrigerators are less expensive to operate. The electric refrigerator ordinarily uses from 18 to 22 kilowatt hours a month; the older ones use 40 kilowatt hours or more. Gas refrigerators of 6-6½-cubic-foot capacity average 1,400 cubic feet of natural gas of 1,000 Btu content when running full flame and only about one-third this amount at minimum flame. It probably would pay to buy a new mechanical refrigerator if your present one is fairly old.

The national defense emergency doubtless will affect refrigerator production. Not only may fewer refrigerators be available to the consumer, but models doubtless will not change much during the emergency.

There just isn't any comparison between the old and new ice refrigerators. The new ice refrigerator ice from the top. The air simply circulates across the bottom surface of the ice. An almost constant temperature is maintained so long as a sheet of
Most refrigerators are made of wood or steel with an external surface of enamel baked on. Some of the more expensive models may be finished in porcelain enamel but the “organic” enamels are very satisfactory. They are chip and scratch-proof and will retain their original white color. The floor of the food chamber is porcelain enamel and frequently the entire lining is of the same material. Steel frames are more rigid than wood and allow joints to be welded securely to prevent moisture from penetrating the insulation. Before the finish is applied, the steel is treated to make it rust resistant.

Different makes of refrigerators feature certain specialties which add to the convenience or attractiveness of the machine, but are not always essential. An interior light may be automatically switched on as the door is opened. The door may be opened by hand or simply by pushing the arm against it—certainly convenient if one’s hands are full. Sliding shelves which do not tip when pulled out permit easy access to foods. Adjustable shelves accommodate containers of varying sizes, allow the storage of a turkey or, in summer, a watermelon.

Some models have a bin or cellaret compartment at the bottom in front of the motor and condensing coils, made possible because the coils are smaller and more compact in the newer models. In the bin, root vegetables and fruits may be stored, and even beverages not needing constant refrigeration. In at least one model this lower compartment is refrigerated, which gives extra storage space and may be used for milk, jars of fruit and other food in tall bottles.

Most of the new refrigerators have their own freezing locker which will hold 50 pounds of food at a temperature of 10°F.

Food compartments are wider and shallower than they used to be. That fact, along with the sliding shelves, makes it a lot easier to reach the bowl or dish at the back of the shelf. The doors are of better design and frequently are lined with Bakelite which, as you know from its use as handles on pots and frying pans, is an excellent insulating material. Some ice cube trays have shelf releases and a type of ejector for freeing the cubes from the sections, one at a time or by the trayful. Most of the units are sealed in, too—that is, the motor and condensing coils are under one housing.

Tests were made in the household equipment laboratories at Iowa State College to determine what affected the temperature in the food compartment. It was found that the refrigerator door should be opened for as short a time and as infrequently as possible to prevent the temperature from rising excessively.

The food chamber should not be overloaded. If the food containers are placed too closely together the cool air cannot circulate between them. Anything which hinders efficient circulation retards refrigeration. Ice, for example, should not be covered. It is the melting of the ice which cools the food chamber.

Heat always flows from a warm to a cool body. When food at room temperature is placed inside the refrigerator the warmth it contains diffuses into the surrounding air which circulates toward the ice or mechanical unit. As the air passes over the ice or unit, the heat is absorbed.

In the ice refrigerator the coldest place is the drop of air from the ice chamber. In the top-icer refrigerator this place may be on the top shelf of the food compartment directly under the opening through which the cold air falls. In some models, however, it is the center of the chamber floor. The coldest location in the mechanical refrigerator, outside the unit sleeve, is immediately below the unit. Milk and meat should be put in the coldest place. The warmest sections are those through which the air circulates just before passing over the ice or unit.

In some of the new ice refrigerators tested the ice cake only covered the rack completely for the first day or two after icing. Then as the ice continued to melt the rack gradually became uncovered for several inches on each side of the cake, allowing the air to circulate over the entire surface of the ice. Under these conditions the temperature rose, sometimes to 50° or above. Chipping the ice which remained on the rack, to form a bed of crushed ice on which the new cake was placed, slowed up this process, and is therefore recommended.

We usually set the upper limit for temperatures in a refrigerator at 50°. There is nothing magic about the 50°, however. Yeasts and molds and the even more undesirable bacteria are not going to be vigorous and active above 50° and at 49° quietly abandon their bad behavior and die. It isn’t as simple as that. Most refrigerators

Oiled silk bags and covered containers prevent refrigerator dehydration.
maintain maximum temperatures below 50°. In the mechanical refrigerator the average temperature is usually about 42°. Lower temperatures than 42° are not essential unless we are storing foods easily susceptible to spoilage for 10 days or more.

We have talked a lot about temperature for food preservation, but only recently have we begun to consider the part which humidity plays, although commercial cold storage plants have realized its importance. Cold air will hold less moisture than warm air, but foods stored uncovered at any temperature will tend to dry out unless the relative humidity is approximately 100 percent—in other words, unless the air is saturated with water vapor.

Placing warm foods in a refrigerator and frequent or lengthy opening of the door will cause an increase in relative humidity of 10 to 25 percent. Since cold air can hold less moisture than warm air, the excess moisture in the ice refrigerator will be deposited with the film of ice meltage when the air circulates over the cake of ice and will be carried away through the drain pipe. In the mechanical refrigerator, however, the excess moisture is deposited as frost on the unit. This makes defrosting necessary much more frequently during the warm, humid summer months, and is further argument for opening the door as seldom as possible.

Refrigerator manufacturers have tried to solve the humidity problem in various ways. Those marketing ice refrigerators believe that the presence of the melting ice supplies sufficient moisture. For some years the manufacturers of mechanical refrigerators have provided containers to preserve the crispness of succulent vegetables.

More recently some refrigerators have been divided into two compartments—one containing the cooling unit as usual and storage space for milk, meats, frozen foods, and extra ice cubes; the other with additional coils between the walls permitting high humidity for preservation of fruits and vegetables without the necessity of covering any but the most succulent. A minimum of air circulates in this second section, because it is the circulaton of air which removes the moisture.

Extensive tests in our laboratories at the College have shown that fresh succulent vegetables unless protected with a skin should be covered in all types of refrigerators—ice and mechanical. Vegetables containing a high percentage of water, such as lettuce and celery, keep best when stored tightly covered; others—beans, carrots, radishes, and so forth, are stored preferably in a ventilated container.

Containers are of various kinds. There are hydrators of porcelain enamel, with or without openings for ventilation. The openings may be round holes on the sides or slender slits in the cover, or the cover may simply fit loosely enough to allow a slight amount of air to circulate. Some hydrators even have humidity controls—a series of shutters on the sides of the pan, which are opened to different degrees by setting the pointer on the dial to the mark for one-fourth, one-half or full, according to the amount of food stored. If the pan has only a little food in it, the shutters must be nearly closed to prevent evaporation.

Glass covered dishes in a variety of shapes and sizes may be purchased in a hardware store or dime store. Bags are of oiled silk or pliofilm with zipper or slide fastenings. Covers of the same materials with elastic edges may be used over bottles and bowls.

Hydrators should be carefully fitted loosely enough to allow a slight amount of air to circulate; other—beans, carrots, radishes, and so forth, are stored preferably in a ventilated container.

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Leafy vegetables often are more crisp at the end of 24 hours of storage than they are when placed in the refrigerator.

Raw meat should be covered lightly with waxed paper—and that is a good way to store cooked meat, too. Other protein foods, milk and cheese are always covered. Peaches, apricots, strawberries and similar fruits keep better if stored in ventilated containers, but plums and pears, like tomatoes, are protected by their skins against dehydration. Strongly flavored fruits and vegetables such as cantaloupe and cabbage tend to contaminate the air of the refrigerator and should be stored in covered containers or be wrapped in waxed paper if it is necessary to put them into the refrigerator. Leafy vegetables remain fresh longer if stored covered, unless your refrigerator has the high humidity compartment.

Some general suggestions for the economical use of a refrigerator are:

Leave spaces on shelves between containers to allow free circulation of air.

Store foods covered to prevent drying out and excess collection of moisture on unit.

Defrost when frost is about one-fourth inch thick.

Open door as infrequently as possible.

Remove all waste parts, such as carrot tops, celery tops, pea pods before storing. There is no need to refrigerate what will later be thrown away.

Cool most foods to room temperature before placing in food chamber.

Remove water in drip pan at end of defrosting to prevent fresh deposit on unit.

A refrigerator is a worthwhile investment. It reduces spoilage, frequently improves flavor of foods, and saves the time and energy of the home-maker.