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Questions and Answers on Fruit Culture

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CIRCULAR 35---JUNE, 1941

Questions and Answers on FRUIT CULTURE



Horticulture Department
AGRICULTURAL EXPERIMENT STATION
South Dakota State College
Brookings, S. D.

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Questions and Answers On Fruit Culture*

Orchard Tree Fruits

NIELS E. HANSEN¹

1. Is fruit culture profitable in South Dakota?

Hardy varieties of apples, crabapples, pears, plums, cherries, apricots, grapes, raspberries, gooseberries and currants can be grown successfully. Apples, crabapples and plums are grown commercially in the southern part of the state, in the Black Hills and in the northeastern part.

But of far more importance is the growing of fruit at home. The value of fruits in the diet has been established and if some fruit is raised at home much more will be consumed than when all had to be purchased. And more fruit means better health.

There is an old Chinese saying: "If you want to be happy in life, become a gardener."

A recent recommended fruit list is given in South Dakota Agr. Exp. Sta. Bul. 309.

2. Are crabapples profitable?

The main market for Siberian crabapples is for preserves and jellies. Here the Dolgo and the Alexis are important because of the bright red color they impart to the jelly. Such fruit will sell readily in any market. Owing to the

bright red color and because the fruit is full of pectin and excellent for jelly, the Dolgo, introduced by the South Dakota Station in 1917, has come to the front as one of the most popular crabapples in the state, and is also recommended in other states, such as Minnesota, New York and Ohio.

The Alexis is very much like Dolgo in fruit. It was introduced in 1919 with the idea that it would serve as a good pollinator for the Dolgo. The original tree of both the Dolgo and Alexis are still vigorous in the Station orchard. Both varieties are early and heavy bearers.

Many of the old crabapples have gone out of cultivation because the call is for red crabapples. Many, such as the Minnesota crab, are no longer on the list because of their dull color although very hardy and productive. The Sweet Russet crab, highly popular in the early days, is now rare despite the fact it is one of the best in quality.

Of the old standbys, the Whitney crab is still on the recommended list of Minnesota, Iowa and the Dakotas because of the excellent quality, early bearing and tenderness of the flesh. It is a striped apple.

* This publication is composed of questions and answers received from all parts of South Dakota. For further information see the following South Dakota Agricultural Experiment Station bulletins: Plant Introductions, No. 224; Experiments in Plant Heredity, No. 237; Fruits, Old and New and Northern Plant Novelties, No. 309; and New Hardy Fruits for the Northwest, No. 339.
1. Horticulturist Emeritus, South Dakota Agricultural Experiment Station.

The Virginia crab is widely distributed in orchards throughout the state. At this Station it makes strong growing trees but not heavy bearers and the fruit is too light in color. The Virginia crab, however, because of the wide-angled crotches which do not split down is one of the best stocks upon which to top-work less hardy varieties. Hibernial apple and Virginia crab are the most generally recommended stocks for top-grafting.

3. Are nut trees profitable in South Dakota?

The Black Walnut (*Juglans nigra*) is an excellent shade tree and the nuts find ready sale. But the trees must be of the northern type, those from the far south not being sufficiently hardy. The same holds true of the Butternut. The Persian or English walnut, the filbert, pecan and almond are not hardy in South Dakota. The native hazelnuts are hardy. The hickory nut is hardy if from the northern limits such as southeastern Minnesota or northern Iowa.

To meet the demand for larger, brilliantly colored all-red crabapples the South Dakota Station has introduced the Redflesh, South Dakota Jonsib, S. D. Bison, S. D. Bona, S. D. Eda, S. D. Macata and Keo—all noted in S. D. Exp. Sta. Bul. 339, June, 1940.

4. How are fruits originated?

The named varieties of cultivated fruits, such as the apple, usually do not come true to seed. Ten seeds from one apple will result in 10 different seedlings and no two will be alike. The tree bearing choice fruit is given a name and propagated by grafting or budding, which really are methods of subdividing the same individual. For example, the millions of trees of the Duchess apple now growing in many countries are all

descended from one seed which appeared a long time ago somewhere in Russia.

In most cases the original tree has been lost. In fact, the origin of many is not known. A seedling sprang up in some fence corner or in the open woods and bore such good fruit that it spread by grafting or budding from farm to farm long before it attracted attention enough to be placed in a book. Some varieties have been cultivated for hundreds of years, but no one now knows their history.

To originate a new fruit is to guide the natural reproductive forces of the plant. It is essentially the same as inventing a new machine.

5. Why are Latin names used so much for plants?

Common names differ so much over a wide area that they are confusing. Botanical names are all Latin and the same the world over. When the Latin name is used, we know it is for a plant for which the description is published, so that it is possible to understand what is meant.

In the United States the work of proper naming is done by the Department of Agriculture, the American Pomological Society and local state horticultural societies. When a new variety is to be named, it should be checked with these old lists to be sure there is no duplication.

6. Is the botanical or Latin name enough for the prairie horticulturist?

No, it isn't. It gives an idea where the plant is native but the winter hardiness depends upon the source of seed.

In Moscow, Russia, the American boxelder winter-killed—the seed came from St. Louis, Mo. Later the Russians obtained seed from Manitoba, Canada,

and it proved perfectly hardy at Moscow.

My experience with the pears of East Siberia and Manchuria may be of interest. Pear seed gathered from extreme southern Manchuria winter-killed but seed obtained in 1924 near the north limit of the species in northern Manchuria—winter minimum of -50°F. —proved perfectly hardy in Brookings.

In the matter of adapting plants a distinction should be made between acclimation, the work of nature, and acclimatization, the work of man. Man's work is possible within limited degree but as far as winter hardiness is concerned acclimation—the work of nature—is possible but acclimatization is impossible.

7. Should I plant new varieties that are not proven to be hardy?

Horticulture owes much to the eager, enthusiastic amateur who is willing to try anything once, or even many times. Out of it all we get to know definitely what is really hardy. By bitter and costly experience, the apple growers of the Mississippi Valley have learned much about relative hardiness of apple varieties.

But there is always a new generation coming on, so that every year we find men planting the high quality, far southern apples; the fancy European pears and sweet cherries on the open prairies—far north of their natural limits. To prevent needless loss, it is wise to study this early experience.

To make tests of real value, it is necessary to label the trees and shrubs when received. First make a map of the planting by row and number. The only really permanent labels are made of embossed metal, especially zinc or brass, fastened with copper wire to galvanized wire stakes. The stakes must, for safety, have a loop at the top end. Such metal

labels are made by embossing machines, and some firms make a business of supplying such labels to order.

8. Do apples and other fruits also come true to bud or graft?

Almost always, but sometimes a change takes place which is called a bud variation or bud-sport. The most recent scientific term is somatic mutation. Sports of various apples have appeared in recent years with fruit of larger size and darker red color than the original. Sometimes the bud-sport is more valuable for market because it colors earlier.

The cause of these changes is not known, but if a bud-sport is better for market it soon becomes popular and the original variety is gradually superseded.

A bud-sport may consist of a single branch, or even a single bud. Bud-sports may occur in many plants, especially in ornamentals, such as the Sword fern, chrysanthemum and Madame Salleron geranium. If a bud-sport in color of skin occurs in potatoes, care should be taken in cutting tubers for planting, otherwise the whole stock will soon be mixed.

9. How are fruit trees budded?

In brief, budding in nurseries is done the first two or three weeks in August by taking a bud from the growing shoots of this year and inserting it under the bark of a strong seedling. The bud is cut with a shield-shaped piece of the surrounding bark; about one-third inch of the leaf stalk is left on the bud to serve as a handle. A very thin layer of the young wood just forming is retained to sustain the bud, until it unites with the cambium layer of the stock. A T-shaped slit is made in the bark to insert the bud which is forced into the slit and bound securely with raffia. In recent years, the nurseries use special rubber

bands for tying. The bud is cut with a sharp, very thin-bladed knife. The insertion is made where new wood has just formed but is not yet hardened. It is easier to demonstrate the method than it is to describe it. A visit to a nursery in budding season is advised and will save much loss in the beginning.

10. Can we grow some of the tender and half-hardy varieties of standard apples?

Yes; this is done by top-grafting on established hardy varieties such as Hibernial apple or Virginia crab. The top-grafting is done two or three years after the trees are set in the orchard. Many half-hardy varieties fail from sunscald on the south side of the main stem and they split in the crotches. The Hibernial apple and the Virginia crab have wide-angled crotches and do not readily sunscald. They are also extremely hardy. In this way, at the South Dakota Station many varieties of half-hardy apples have been grown. Tender varieties that freeze from the top down are not helped by top-grafting. The method has obtained considerable success in Iowa and Minnesota. But most people would prefer a variety that is hardy all over.

To topgraft on all *Pyrus baccata* seedlings not yet advised. It depends on the branching habit and on individual differences. Whitney crab is not recommended as a stock for topgrafting because of the acute-angled crotches and the close upright habit of growth.

11. Rabbits have gnawed clear through the bark all around my old apple trees near the ground. Can anything be done to save them?

You can probably save your apple trees that have been injured by the rabbits by bridge-grafting. This is done by

cutting off the bark square across just above and below the injured portion and bridge the gap with a scion cut from the young wood. The scion must be kept dormant. A long, sloping cut is made on each end of the scion, and this is slipped under the bark at the top and bottom. The scion is made just a trifle longer than the open space so it can be sprung under the bark at the top and bottom. It is usually necessary to make a little slit in the bark at each end so the scion can be placed up under. The latest in this line is to use a slender steel nail at each end to hold the scion in place. The whole cut is covered with melted paraffin, applied as cool as possible. Six or more scions are placed all around the tree. They will unite and will enable the sap to get up in the spring. After two or three years they will be quite large. This forms a new way for the sap to get up and down. The entire subject of bridge-grafting is explained in Farmers' Bulletin No. 1369, United States Department of Agriculture.

12. Can apple, pear and hawthorn be grafted on each other? Can tame cherries be worked on choke cherries?

The wild American crabapple does not unite well in budding or grafting with the cultivated apple because it outgrows the wild stock, making a large bulge at the point of union. The cultivated pear on the wild crabapple would be very short-lived. Tame pears on tame apples will be short-lived. The tame pear has often been grafted or budded on native hawthorn, but the union is rather short-lived. However, the over-growing can be remedied somewhat by slitting the bark in several places right through the bark to the cambium layer. It is surprising how quickly the tree will expand in diameter

when given relief from the bark-bound condition.

The tame cherry does not work well on choke cherry but can be worked on the pin cherry. The usual rule is that cherries with flowers in clusters, like the tame cherry, do not unite in budding or grafting with cherries, like the choke cherry, with flowers in racemes. Peach does better on peach roots, but for dwarfing purposes works well on the western sandcherry roots.

13. How should apple scions be kept over winter?

It is necessary to keep the scions from heating or drying out. Apple scions are usually cut in the fall and stored over winter in a box of forest leaves in an outdoor tree cellar, or they may be placed in a scion-storage box, a wooden box which is buried in the soil with a foot of dirt over. There should be no bottom to the box and a board or two on top should be placed so it can be removed, whenever you want to put in or take out scions. The pit should be in the shade of some trees, such as an evergreen grove and should be mulched with straw. The idea is that the scions get just the right amount of moisture from the earth and they can be kept dormant until late in the spring. All kinds of scions may be cut any time during the winter when there is no frost in the wood. They can be cut late in the fall or early in the spring but be sure they have not been injured by winter freezing. After cutting they should be stored in an outdoor cellar in leaves or sawdust or mixed with half sand and half earth. The idea is to keep them plump but not get them too plump as then the buds start and the scions are useless. Sometimes scions are intended to be used as bud-sticks for spring bud-

ding. These should be kept cool and moist on ice in a refrigerator.

14. Is it possible to transplant large apple trees?

It is possible to move apple trees 15 feet high and six inches in diameter if it is done while the frost still holds the earth together around the roots. It is a costly job and it is necessary to take so much earth with the roots that it is rarely done. Such trees may have the earth kept in place with burlap and may be moved on a stoneboat. In the cities, special machines are used to move still larger shade trees in mid-winter. It will be necessary to go out far enough from the stem to get practically all the roots. But such trees do not recover to full bearing, and so it is much better to plant young trees. In other words, transplanting of old apple trees is not advised as a commercial proposition.

15. How should watering be done in transplanting?

The danger of putting a lot of water in the hole before planting a tree is that it is apt to puddle the soil, and this bakes very hard as it dries out. However, if you let the water drain away and the hole dry out, it will not make much difference. When you plant the trees, get plenty of good mellow earth packed in among the roots so that no cavities are left. This can be done with a pointed stick, or a man can wear heavy gloves and use his hands. When the earth is filled in around the roots, tramp it down gently and then put in some more earth and tramp again. Then pour in a lot of water and put earth in on top of that, but do not tramp. The plan is to get the soil thoroughly moist, but not tramped down when wet as that tends to puddle the soil so that it bakes.

16. Is color important in apples?

American markets more and more demand as bright red color as possible. Because of their color, the discrimination is against yellow apples, although some are of the choicest in quality. The English market favors firm flesh and high quality in apples, but apparently has small regard for the color. Some of the green market apples are of the highest quality, but do not sell as well in the markets. However, some of the old time apples are green, and still hold their own. The Dolgo crabapple from the South Dakota Experiment Station has won high favor because of its bright red color. For home plantations, the color is not so important, but a commercial planter will need to study the demands of the market and govern himself accordingly. A good bright yellow apple should hold its own in any market, as a contrast of red and yellow is useful for variety. Really, quality should be ahead of color.

An example is the Linda Sweet crabapple, a heavy and constant bearer introduced in 1922, (S. D. Exp. Sta. Bul. 224), a seedling of Malinda top-grafted on Sweet Russet crabapple. Linda Sweet is a large, late yellow crabapple with skin much russeted and flesh mild subacid sweet. The influence of the Sweet Russet pollen is evident from the sweet flesh and russet skin.

17. What is the special value of apples with red flowers, red fruit and red flesh?

Because they would serve a dual purpose as a choice ornamental lawn tree and a unique market fruit. (See S. D. Exp. Sta. Bul. 339). There is a real race now on among the fruit-breeders of several countries. The great value of the red color of the flowers is seen in the Hopa crab, popular over a large

part of the United States as a beautiful lawn tree. The red color of the Redflesh crab is imparted to the sauce and jelly; the fruit is late in coloring in the fall so should be left on the tree as long as possible. The red color of this variety attracts attention in the market.

Apples with red flowers and red fruit with red flesh of good quality would make a highly desirable addition to the fruit list and their market value would be greater.

The original tree of this remarkable type of apple (*Pyrus Malus Niedzwetzkyana*) was found by Mr. Niedzwetzky, an official in government service in the Tian Shan Mountains that separate Russian Turkestan and western China. Soon after it was sent to Europe and in 1894 reached England.

18. What is the market for sweet apples and crabs?

The market for sweet apples and crabs is rather limited, although in general children like them. There is a limited demand for sweet apples and crabs in making sweet pickles and for baking. The best large sweet apple developed at the South Dakota Station so far is the Tolmo, a cross of Duchess with Tolman Sweet. The Tolmo is hardy and productive; the fruit is juicy as compared to many sweet apples which are only moderately juicy. Of the older crabs, two of the best are Brier Sweet and Sweet Russet. Many sweet crabs have appeared among the seedlings at the South Dakota Station, especially Linda Sweet and Sugar crab, both very productive.

In the making of cider, sweet apples should be considered. Expert cider makers in France say that it takes three kinds of apples to make good cider—sour, sweet and bitter. Before planting sweet varieties in larger numbers, it

would be well to consider the market. In cider making, there is always a good place for sweet apples and crabs.

19. Can we grow winter apples on the open exposed prairies?

Our greatest problem is to develop a hardy winter apple. One item of compensation for the commercial orchardist who must contend with the severe northern prairie conditions is the fact that the local market is much better for early apples than further south where there is often more fruit than can be sold at a profit, with present means of distribution and marketing. One trouble with winter apples is that they usually ripen the wool late in the fall and are more subject to early freezing. Some times this trouble extends south and causes even greater damage because the wood is not as well matured as farther north. This happened especially in the November freeze of 1940. The nurserymen who dug the trees and either heeled them in outdoors, covering completely with earth, or storing in special nursery cellars, avoided this trouble.

To aid in the solution of this problem, the South Dakota Station has worked extensively with the native American apple as found in Minnesota, Wisconsin and Iowa. The fruit keeps a year or more. The problem is to combine this characteristic with large size and good quality.

The Haralson apple from the Minnesota Experiment Station is finding favor in Minnesota and other states. It is an open-pollinated seedling of the Malinda. In brief, there is a large number of early fall, late fall and early winter apples hardy enough for anywhere in South Dakota. Some writers maintain that cold storage will help solve the problem because many earlier season

apples may be kept far into winter by cold storage. Early apples are usually more tender in flesh than late winter apples.

20. Shall I plant the Anoka apple?

The Anoka is perhaps the best out of 10,000 apple seedlings which the South Dakota Station has grown in an effort to originate better apples. It is the earliest bearing of them all. The remarkable characteristic of this apple is that it bears on one-year-old wood and on young nursery trees. At several places it has the record of bearing the second year after planting, on one year budded trees. They are budded on Siberian Crab seedlings to prevent the root-killing which so often occurs when common apple seedlings are used in propagation.

The fruit is much like Duchess and may be briefly described as a round Duchess, with red stripes and flesh white and juicy. People generally prefer it as an eating apple to the Duchess as it is of milder flavor. It also ripens ahead of Duchess. Trees of Anoka planted in 1920 at the North Dakota Experiment Station bore in 1922, 1923 and 1924.

The Anoka is not recommended as a commercial apple, but it fills a place in the small home garden. A Fall River County orchardist reports raising two bushels of Anoka apples on a 7-foot tree. The Anoka is attaining some popularity for home use in states farther south.

All varieties bearing early and heavy crops of fruits demand extra water in dry seasons, in order to keep up size of fruit. Irrigation at the right time is necessary for the best results.

21. What are "international" or "3-species apples"?

This is a name proposed for hybrids combining the apples of three continents; or in other words, a blend of the wild crabapple of Siberia, the cultivated standard apple of Europe, and the native wild crabapple of Minnesota and the prairie Northwest. They are listed in South Dakota Experiment Station Bulletin 309. The theory is that the Siberian apple will contribute winter hardiness; the European apple, large size and good quality; and the native American crabapple, the early bearing and the winter-keeping capacity of one year or more. Some very productive crabapples of good quality have been obtained but not large size so far. The work is still in the experimental stage.

22. What is your method of germinating and growing apple seed?

The seed should not be allowed to dry too long after being taken from the apple. It should be taken out before the fruit is stored in a warm room any length of time as in such cases it seems to start premature growth. The seeds should be mixed with moist sand and put in a container such as a cracker box. Bury just under the surface of the ground in a well-drained spot in the garden. The box should have holes in the bottom for drainage. Be sure to wet the sand thoroughly as the seed should freeze wet. Plant as early in spring as possible. If the long rainy spell prevents planting the seeds promptly, stir the sand because the seed in the lower part of the box will germinate quicker than in the upper part. If the seeds germinate in the box before you get them planted, you will lose them.

Planting in the fall is usually inadvisable as on heavy clay soil the seeds will heave out by alternate thawing and

freezing. However, many prefer to plant the apple seed in the fall; the light mulch will usually prevent the heaving by thaws and freezes. In fall planting, the seeds are planted late just before the ground freezes. For small lots, plant thinly in rows in level beds four feet wide with a board on the sides and ends to prevent washing.

Dry apple seeds may be planted with success, but some freezing may be necessary in order to get the seed to germinate the first year.

23. Why do my apple trees fail to bear fruit?

Some varieties are rather slow to come into bearing, others are earlier. In the eastern part of the United States, some varieties do not come into bearing to amount to anything until they are 12 to 15 years of age. Here in the west, the Duchess or Wealthy should begin to bear the fifth year. The Anoka usually bears the next year after transplanting. The trees may not have made good growth because of too much grass and too little cultivation. There is no substitute for thorough cultivation in the early years. Some varieties of apples do not bear well standing alone, owing to lack of pollination of the blossoms. If you do not wish to plant a new tree, this can be remedied by top-working other varieties on to the limbs. Top-working includes either top-grafting or top-budding. As many varieties can be top-grafted on one tree as there are branches. Some nurseries are beginning to offer apple trees already topworked to two or more varieties. These are more for the small home orchard than for commercial orchards. In general, bees are necessary for the pollination of fruit blossoms.

Non-bearing often results when no pruning is done and the tops get too

dense. Trees may be pruned any time during the fall or winter when time and weather permit. The old style of heavy pruning has given away to the new idea of pruning as little as possible, as trees are sometimes injured by severe pruning. One should avoid pruning too late when the sap begins to flow. One needs a good pruning saw.

In general with fruit trees, any dead wood should be trimmed out, leaving no stumps. The limbs should be cut close, not leaving any projecting stubs which do not heal. Wounds heal best about the middle of June, so that is the best time, but October is a good time for heavy pruning. If the top is too close and there are many branches, it is necessary to thin out. Common lead paint is good for covering large wounds. Sometimes it is necessary to "dehorn" old trees, which means cutting back the large limbs severely close to the main stem and letting new sprouts run out, but this is done only as a last resort. The best way is to trim right from the beginning. Further details about pruning may be found in S. D. Ext. Circ. 388.

Non-bearing may result from lack of plant food, especially when the trees are in sod.

Sometimes old trees suffer from lack of nutrition, especially after bearing heavy crops of fruit. They need nitrogen. Nitrate of soda is used to stimulate the growth in fruit trees. It is applied early in spring, about 3 to 5 pounds to an old bearing apple tree. This is applied as a top dressing early in spring and the rain will gradually wash the nitrate into the soil. Later, standard commercial fertilizers may be applied as needed. Sheep manure is excellent for fruit trees.

24. What are standard and dwarf stocks for the apple?

Standard or full-sized apple trees are budded or grafted on standard understocks. Stocks and understocks are the same thing; the more common nursery word is stock. Dwarf apple trees are on dwarf stocks. For the milder sections of the United States, standard apple stocks are used, either saved from common apples in cider-making in Vermont and other eastern states, or imported from France, as one-year seedlings or as seed to plant in this country. Scions do not partake of the characteristics of the foundation or understock. In fact, it is more the other way. The scion that is naturally deep-rooted will make that kind of roots. Much remains to be learned regarding different stocks for the apple.

For severe climates in the prairie Northwest, the pure Siberian crab (*Pyrus baccata*) is a stock of perfect hardness, somewhat dwarf in tree but causing early bearing. Seedlings of hybrid crabapples such as Florence, Sweet Russet, Whitney and many more, make good stocks and are nearer the apple in affinity. The trees will usually be larger than on the *Pyrus baccata* stock. The trouble with the standard apple stock, French crab or Vermont seedling, is a tendency to root-killing during the severe winters, but this is evaded as much as possible by using a long scion and a short seedling root, thus putting the tender root as far beneath the surface as possible.

25. Should tall-stemmed apple trees be encouraged and planted on the prairies?

The standard tall-stemmed apple trees grow too large for the open prairies. They are hurt by the strong winds, and the exposed trunk is apt to sunscald. The best

fruit men agree on a low-stemmed tree. To meet this demand, the South Dakota Station introduced the Anoka apple, the original tree of which is a natural dwarf tree and forms fruit buds the first or second year. The plan is to originate many more along the same line—apples that are naturally dwarfed. Such trees would grow in bush form with tops starting very near the ground.

26. Should we plant American or Russian apples?

All the standard apples came over from western Europe in the early days. The first introduction is not known, but it dates back over 300 years. The early settlers planted mostly apple seed and so millions of seedling apples appeared in the eastern and southern states. The best few were named and propagated. These early apples are called American apples and some, such as Jonathan, date back more than 200 years. However, it was found that none of the apples that date back to western Europe were hardy in the prairie Northwest. It has been estimated that it cost over \$100,000,000 to determine the fact that these apples were not hardy in the northern Mississippi Valley and the prairie Northwest. The crucial test winters, such as 1872-73, 1884-85, 1908-09, proved the point. The Duchess was an outstanding survivor. It came over from Russia about 100 years ago. This led to the importation of more Russian apples. The late Prof. Joseph L. Budd, of Iowa State College, was the leader in this great work. Russia is a large country, and so Russian apples may be hardy or tender according to their geographical origin. Many of them are still in cultivation, such as Duchess, Charlamoff, Antonovka, Yellow Transparent and Anisim. They were hybridized extensively with

the American apples. It was hoped in these hybrids to obtain winter hardiness from the Russian apples; and good size, quality and long-keeping capacity from the European apples. This hope has been realized in many instances; Joan, a cross of Anisim and Jonathan, from the Iowa Experiment Station, is an outstanding example. This work of amalgamation is still under way.

Other blends of American and Russian apples are Goldo and Tolmo, noted in S. Dak. Exp. Sta. Bulletins 224, 309 and 339; Goldo is a cross of Grimes Golden and Duchess of Oldenburg; Tolmo, a cross of Tolman Sweet and Duchess of Oldenburg. Both Goldo and Tolmo are of large size and good quality.

Duchess of Oldenburg has also been crossed with the native American wild crab, resulting in many hybrids, such as Anoka, Nebo, S. D. Waldo, Wahoya, Wakaga, Elta and Sasha. (See S. Dak. Exp. Sta. Bulletins 224, 237, 309 and 339.)

27. How large should a Siberian crab-apple be for market?

The crabapple may be too small; for example, the old Yellow Siberian, one of the first trees planted in South Dakota some 75 years ago. There are still trees to be found in the southern part of the state. The trees are very hardy and productive and attain large size, but their main value now is to grow seedlings for grafting. They are too small in fruit to compete with the larger crabs. The same may be said of the old Red Siberian, which was also grown in the early days and still is to be found.

A variety may be too large to be a crab and too small to be a good apple. Apples like the Dolgo, Florence, Martha and Virginia are examples of the

right-sized crabapples for canning. Thousands of hybrids have appeared between the standard apple and the Siberian crab. Most of those named are examples of this kind.

A number of hybrid crabapples have been developed at the South Dakota Station, such as Jonsib, Eda, Bona, Ben, Bison and Macata, all of red color and good quality. They are described in Bulletin 309, 224 and 339.

The commercial propagators cannot use a long list. They must propagate the varieties for which there is a demand. This comes out of the experience of numerous experimenters who are willing to try the new varieties. If the demand for red color persists, a lot of old, duller colored varieties will disappear for lack of a demand.

28. Can anything be done with the native American crabapple?

The native wild American crabapple has been neglected because the European apples came to America over 300 years ago and have had preference. However, the native American apple has some good points, such as hardiness, early bearing and long-keeping capacity. It is worthwhile to improve the only apple which the Indians had before the white man came. The experiments in this line at this Station are outlined in Bulletins 224, 237, 309 and 339. In the wild crab of Minnesota, Wisconsin and Iowa (*Pyrus ioensis*), the strong wild flavor is being subdued by crossing with the standard apple. Centuries ago the Indians used to cache or bury the fruit in the ground over winter for use in the spring. Recent experiments at the South Dakota Station (Bulletin 339) found that fruit can be frozen by outside exposure in winter before cooking; this largely removes the acerbity. In early experiments in Iowa, the fruit

was cooked in sorghum to modify the flavor. An Illinois method is to grind the apples before cooking. The experiments are still under way.

29. Would you recommend planting Transcendent and Hyslop, the old standard crabapples?

The Transcendent and Hyslop crabs are especially subject to fire blight, and were discarded long ago at Brookings. The old Transcendent and Hyslop crabapples, popular in the early days, are still popular in the East. Many Transcendent crabs are shipped in from the Pacific Coast. Both of these varieties have long been in cultivation in America, but their origin is unknown. Transcendent was listed in an American nursery catalogue as early as 1844. In 1869 Downing wrote concerning Hyslop: "This variety has been long and pretty extensively cultivated."

30. What is meant by orchard sanitation?

In the plum orchard, sanitation means that all the rotten and mummied plums should be picked up and burned as promptly as possible. This will prevent their being a harbor for the disease over winter. If left on the tree, they will spread the rot to the trees the next year. Picking and burning will help a lot. Thinning the fruit will also be a great help. Brown rot is worse where plums are crowded in dense clusters. A heavy rain also hastens the development of rot. After a rain, the ripe fruit must be picked before the rot gets all of them. If we were as careful as they are in California to thin out the fruit promptly, the rot could not do so much damage. Also the fruits would have a better opportunity for normal and full development.

In the apple orchard all wormy apples should be collected and destroyed before the worm leaves the apple. This will help the spraying program. A farmer in Wisconsin picked up all the wormy apples and windfalls as soon as they fell and fed them to the hogs. In addition, the entire trunk of the tree and about a foot up into the main limbs was whitewashed in late spring to kill insect eggs. This orchard was remarkably free from worms for 40 years, as long as this program was followed. But the worms came in after this work was discontinued. A neighboring farmer let the hogs run in the orchard and they took care of the worms; however, unless closely watched, hogs may damage an orchard, and in general it is not advisable to let hogs have the run of the orchard. It is evident the codling moth can be destroyed while present as a worm in the apple. The latest in this line is to spray the fallen leaves in the apple orchard to destroy the scab spores and prevent scab on the fruit the next year. Orchard sanitation is highly important. Sometime it may become a national program, under the direction of entomologists and plant pathologists.

31. Should an orchard be given protection by a windbreak?

The writer does not favor high windbreaks for an orchard. The general effect is that the roots of the forest trees take away the moisture needed by the fruit trees, because there is too much heat and not enough air drainage. One South Dakota orchardist in Turner County said many years ago, "The best protection for an apple orchard is another row of apple trees." It is well to partially break the force of the wind by a low hedge, such as a hedge of Siberian Pea Tree (*Caragana arborescens*) as this stops the excessive drying effect of

the surface windsweep. Other plants may be used as a windbreak, but the windbreak should be far enough away from the roots so they do not take the moisture needed by the orchard. If compelled to choose, rather put the orchard on the north side than on the south side of the windbreak.

One way to kill an orchard quickly is to plant it on a south slope with a high windbreak on all sides. Such trees start too early in the spring or even in midwinter sometimes, and then thawing and freezing on the south side of the stem causes sunscald which is quickly followed by borers.

32. Can apple trees be forced into bearing by girdling the main stem, or can the branches be forced into bearing ahead of the rest of the tree? How is girdling done?

Girdling is done by removing from one-half to one inch wide ring of the bark clear around the stem, the latter half of June, being careful not to injure the cambium layer just beneath the bark. This stops the downward flow of the sap which starts about the middle of June and tends to change the wood buds into blossom buds. It is often done on a main limb to determine what variety has been planted, but it strikes at the vitality of the tree and cannot be recommended for the whole tree, unless, if for some reason, one expects to remove the tree. The objection to girdling is the tendency to starve the roots of the tree, and also it gives access to fungi, but it can be done.

In milder climates, grapes are often girdled, but not over one-third of the vine in any one year. Girdled grapes and apples are larger in fruit but are not fair competition in exhibitions with those grown in the normal way.

33. Why do apples apparently hardy in the top die after a hard winter?

The wood is sound when cut with a knife, but the roots are dead. This is called root-killing. The apples are often budded or grafted on French crabapple, which are seedling apples from the cider-making sections of France. A hardier type of apple seedling used for stocks is from seeds of the standard apples grown in the Northwest. The hardiest of all are the Siberian crabapples. It is still a question of which is the best variety. Many of these hybrid crabapples do not give as good germination as the crabapples nearer the primitive type. See S. D. Exp. Sta. Bul. 339.

34. After a hard winter with little snow on the ground, my orchard trees are dying. What is the trouble?

All the apple orchard troubles are not due to insects and fungus diseases. There has been much root-killing. Where there appears to be no insect or fungus disease, root-killing is the trouble. The leaves start out and die soon afterwards, which shows that the top is alive while the roots are dead. But, of course, insects and fungi come in and finish this work of destruction. The root-killing is caused by the fact that the common apple stocks used for the root-grafting of apples are not hardy in severe winters. If the tree roots had been wet down last fall they would have come through better. The way to prevent root-killing is to mulch the trees every fall, and remove in the spring to prevent the roots from coming to the surface. Most of it can be cultivated into the soil during the growing season. Root-killing is avoided by using Siberian crabs as understocks for budding. This will make the trees somewhat smaller but at least they will be free from root-killing. They will also bear

earlier. There are many reasons why orchards die. The main cause is that the variety is not hardy enough. Root-killing in apples, plums and other fruits is caused by tender nursery stocks. The Siberian crab is favored as a stock for apple, and in plums, the hardy native plum. Rootkilling in plums on tender stocks such as the peach, is avoided by using the hardy native plum as understock.

35. Can anything be done in the way of frost prevention in fruit culture?

No tests in frost prevention have been made at this Station. The main endeavor has been (1) to originate varieties of fruit that would be late enough to escape frost such as (a) the Hansen Buckcherries, (b) Sandcherry-plum hybrids like Opata and Sapa, and (2) to work with extra hardy varieties of plants that would endure some frost.

Plants that are close to the ground such as strawberries can be mulched with straw. Raspberries and grapevines may be bent over to the ground then covered entirely with earth and followed with a layer of manure over the earth.

36. What can be done to save apple trees injured by rabbits?

It is hard to tell what can be done without actually looking at the trees. If they are young trees, it is best to grub them up and start over again. Sometimes covering the wound with wet clay and a piece of burlap helps. If there are live buds left above the point of union, the tree may be cut back and the new sprout supported by cloth strips and a stake until the new growth is hardened the first season. A strip of burlap wound around the main stem will protect from rabbits. A sure way to keep rabbits from gnawing the main stem of apple trees is to use wire-cloth. Common window

screening or wire cloth will do for a few trees; but there is a special screen, with larger mesh and heavier wire made for orchard purposes. Better still, fence the whole orchard with rabbit-proof wire netting.

Common whitewash was quite commonly used by the early orchardists and is effective until washed off by rains. Some farmers quite successfully feed the rabbits by leaving a few shocks of corn in the orchard; this is much cheaper food for rabbits than valuable apple trees.

Rabbits may be controlled by various sprays and poisoned grains, also by hunting and trapping. The furs have some commercial value. Field mice often gnaw the bark off orchard trees. A number of bulletins on rabbits and field mice are published by various state experiment stations and the United States Department of Agriculture.

Where there are many rabbits, eternal vigilance is the price of success.

37. What is sunscald in apple trees?

Sunscald is caused by the alternate freezing and thawing of the main or trunk stem on the south and southwest side of the stem during the winter and early spring. This causes the bark to separate from the wood, followed by the general destruction of the tissues. The diseased part can be scraped away and the tree painted with some lead paint to keep out the air. Avoid the edge of the wood next to sound wood as this is where the new growth emerges from the cambium layer to heal the wound.

First scrape out the dead wood. Instead of white lead, melted parowax or paraffin may be used. Sunscald is obviated by strips of burlap or a board on the south side of the stem. The rays of the sun are usually broken up enough

by wire window screen so that there is not much trouble from sunscald.

If the variety is a hardy one, there is much less trouble from this than when the variety is not hardy. Still even the hardiest varieties are benefitted by shading during the early years until the rough bark is formed.

Many trees, growing singly with tall stems exposed to the sun, are troubled with sunscald. Some shade trees suffer from sunscald, such as the Mountain Ash and the Linden. Both of these trees have thin bark. Plant a group of shrubs on the south side to check the rays of the sun, or the trees may be planted on the north side of the house. Poplar trees, especially when obtained from too far south, suffer from sunscald, the southern varieties being especially subject as they are badly weakened by the winter.

Planting too large trees favors sunscald because the bark dries up too much before the tree gets established and they get bark-bound. Slitting the stems just through the bark up and down in several places from the branches clear to the ground, often helps if done about the middle of June when the downward flow of sap begins. This downward flow is really what heals all wounds. It is material for growth just manufactured in the leaves. Slitting the bark and shading with burlap at this time greatly favors the healing process, because it affords relief from the bark-bound condition and gives room for the deposit of new bark.

38. What is blackheart in apple trees?

The young wood of the apple tree becomes blackhearted from winter-killing. This may occur from premature freezing in the fall when winter sets in before the wood is ripened. Tender varieties that freeze from the top down

prevent drying out of the graft. This is the newest and best method.

Shriveled bark on trees when received from the nursery should be moistened to prevent drying. If dry when received, it is best to open the bundle and heel them in moist earth. This is done by digging a trench and covering the trees completely with moist earth. Water the earth freely and after a few days, the bark will assume its normal plumpness. Very dry trees may be covered entirely with water in a tank or in the creek for a day or two. Trees where the bark appears shriveled after planting should be sprayed frequently with water to moisten the bark and restore it to a normal degree of plumpness. Shriveled bark stops the normal flow of sap in the young shoots.

40. Can old forks of apple and other trees be prevented from splitting down when they get old and especially after exposure to a severe storm?

The tree surgeons have helped much, especially in recent years. Tree trunks that are split or in danger of splitting may be saved by boring clear through the trunk and inserting iron bolts with a large washer at each end. Sometimes heavy metal hooks are placed on the two inside limbs and connected with strong wire. This prevents them from splitting. Tree surgery has become a business in itself by companies that take contracts for saving old trees. It is easier to demonstrate this kind of work than it is to direct it. The decayed part of the trunk can be cleaned out and the cavity filled with cement, using one part of cement to three parts of sand in most of the cavity, and finishing with an outer layer of one and one-half inches, using one part of sand to one part of cement. Other special preparations are used.

suffer from blackheart. The recent dry years have not sent fruit trees into winter in the best condition. In the dry falls, the roots of fruit trees should be soaked with water so the roots are moist when they freeze. Hardy varieties do not become blackhearted.

It is remarkable how cherry trees survive for years after the wood has suffered winter-killing. The wood is renewed by the annual growth in the cambium layer so that in the later years it is only a live shell surrounding a dead center. If the young wood of an apple tree is light in color and there is no sign of blackheart after a hard winter, it is a reliable test that the variety is hardy.

Trees standing in sod or suffering from excessive drouth will be in a weakened condition and will be more subject to blackheart and fireblight. Some varieties are more subject to these troubles than others. The standard hardy varieties are not subject to fireblight, and if it does come, it will not kill them. Trees may be watered too much. Continuous soaking is not good for the tree. Trees should be watered when they are really thirsty, and in between waterings, the ground should be cultivated.

39. If after a dry season there is much dead wood in the apple orchard and in shade trees, what should be done?

The dead wood should be removed clear down to the live wood; it will help to reduce evaporation. This work should be done as soon as possible. Common lead paint should be used to cover the wounds. There are also special tree paints on the market. Parowax is a form of paraffin to melt and apply to wood. It sometimes peels off and should be renewed. It is used extensively in top-grafting, covering the whole scion to

As you describe the tree, it would seem that it would be possible to bring up this split portion of the apple tree to its normal position. About four feet up from the crotch bore holes clear through the heart of each limb and put the iron bar through with heavy washers at each end, also the heavy eyebolt higher up opposite each other on the main stem and on the branch. Connect these two eye screws with a heavy wire. This takes the strain off the limbs. If it is too late to save the trees, cut off the split portion and cover with melted paraffin. Be sure to apply it as cool as possible.

41. What is the best time to destroy an old tree so it will not sprout?

The best time is in August, by taking a ring of bark four to five inches wide clear around the main stem. By removing this ring of bark it stops the downward flow of sap and causes it to ferment. A very good way is to saw the main stem off the stump at this time or early in spring after the sap starts. Then the bark should be peeled back from the stem for several inches all around the stem so as to leave the bark flaring out. This permits water to get in between the bark and the wood and is quite sure to ferment the sap and kill the tree. Rotting the stump in this way makes it easier to dig them out a year or two later.

While you are doing all this you might as well grub up the tree, either with a one horse or two horse stump-puller, but it is not always convenient to do this.

The best and most recent method for orchards is to pull trees with a tractor, using a triple block. In this way 10 acres of old apple orchard were removed in the fall of 1940 in the State Orchard at Watertown. At the same time and place,

the 37 acres of Hansen Bush Cherry of the fourteenth generation (see Question 63) were cleared with a V-shaped tree-digger, using two tractors so that all the roots were cut in one operation.

The past two years the cost of clearing cut-over pine land in Minnesota, Wisconsin and Michigan has been cut to \$2.50 to \$10 per acre. The former cost was \$50 to \$100 per acre. The machines used are a Diesel-engined crawler tractor hauling a hydraulically actuated angle-dozer or bull grader. An average acre can be cleared in an hour.

42. Should the orchard be cultivated or seeded down to grass in the early years?

The first 10 years an apple orchard should be given thorough cultivation to get size and vigor of tree. After that it may be seeded to red clover. Timothy is not considered as good as red clover. Older orchards may be seeded to blue grass or timothy, but only with the understanding that not a pound of hay must ever be removed. The hay should be left on the ground to serve as a mulch. As a matter of fact, in most prairie orchards, nothing is sown in the orchard. The weeds come up and serve as a cover crop and are either cut later to serve as a mulch or left standing over winter for the same purpose. But in dry seasons the weeds take the water needed by the trees.

Where there is danger of rootkilling, a mulch of stable litter may be applied out as far as the limbs extend in the fall before the ground freezes. This mulch should be removed in the spring and scattered out over the entire surface. If the mulch is left around the tree, the roots grow too near the surface and there is rootkilling later.

In the eastern states, the greater rainfall permits the sod-mulch system, by

which the orchard is seeded down to grass. In such orchards, the humus of the soil is retained much better than in the case of soils kept under constant cultivation; the color of the fruit is also better. But eastern orchardists find that feeding is necessary even under a sod-mulch. Recent experiments at the Indiana Station show that "After 18 years, the cultivated trees, either nitrated or unnitrated, are nearly worthless from the standpoint of fruit production. Trees in blue grass sod and receiving annual nitrogen applications are vigorous and productive."

43. What is the best treatment for sod-bound trees?

● Old trees, fruit trees, evergreens and shade trees in the lawn usually suffer from standing in sod because the grass takes all the moisture. The sod should be removed for at least six feet around the tree. In the case of an old tree, the sod should be removed as far out as the limbs extend. To young trees, give as much cultivated space as possible. Water freely if necessary. In addition, the trees should be given a very thorough soaking in the fall before the winter sets in. That does not mean sprinkling, but it means at least a barrel of water to a tree.

Tree men often say, in a humorous way, a sod-bound tree is affected with "soditis." It simply means that the grass roots are killing the tree. The rain does not penetrate through the sod, and besides the grass roots take all the water leaving very little for the trees. This point is not understood by many people who otherwise take good care of their trees. A few trees may be watered by sub-irrigation. (See Question 48.)

44. Should the apple orchard be watered or mulched in the fall?

In dry falls it is necessary to irrigate the trees so they can go into winter quarters with the roots wet. Also provide a mulch of stable litter early in the fall to prevent the deep freezing and winter-killing of the ordinary apple roots upon which the trees are grafted. If they are on Siberian Crab stock this will not be necessary. The mulch must be taken away in the spring or cultivated into the soil. ● otherwise it will draw the roots too near the surface. Fall planting for trees in general is a bad practice for South Dakota as they dry out and freeze out. If fall planting is much practiced, it is excellent where there is plenty of snow and winter moisture where the roots get established for starting early spring growth. Where the bark is somewhat shriveled after a dry winter, it helps to spray the bark repeatedly with water. This applies to any tree where spraying is convenient. It also helps trees and shrubs whose bark is somewhat shriveled when received.

45. Will mulching stop the root-killing of fruit trees?

● Mulching will keep the frost from penetrating too deeply. It can be put on in the fall before the ground freezes too deeply and removed in the spring. It can be spread out evenly among the trees, but if the deep mulch is left too long, it will tend to draw the roots too near the surface. In the nurseries, the piece-root grafts have been used for many years; with a long scion and a short root, the stock is placed deeper beneath the surface. This encourages the formation of roots from the scion, and such scion roots are hardier than the roots of the French crab.

People often ask if mulching will delay the blossoming of the apples in the spring so that they will not be killed by late frosts. Mulching will not delay

the blossoming. They start as soon as the air is warm enough. It does not depend upon the soil. In fact, there is a danger of mulching too deeply after the ground is frozen. In that case, when the air is warm enough in the spring, the buds start and will require the moisture from the roots. But if the roots are still frozen, they cannot furnish the necessary moisture and the trees will die. Hence there is danger in deep mulching.

46. How can I keep birds from eating ripe fruit?

The problem of keeping birds from eating ripening fruit has not been fully solved. In England, a special netting is made to keep the birds from cherry trees. This netting is woven in very wide strips so that the whole tree can be covered during the fruit-ripening season. In the East, many favor hedges of the Russian Mulberry, as the birds prefer the fruit of the Russian Mulberry to better fruit. In sections where there is plenty of fruit, there is very little trouble, because the birds find plenty of food.

To trap or poison birds would be wrong because it is the birds that preserve the balance of nature. If we had no birds, insects would multiply and destroy all crops.

In the grape-growing sections, the birds are kept from fancy bunches of grapes by covering the young clusters with paper bags. In Europe, besides the bird-netting, other devices are used, such as scarecrows and bits of looking glass hung in the trees. They think that the reflected light scares the birds. The English bird-netting can be obtained through seedmen who import it. A few bushes can be saved by mosquito-netting, but this would be too expensive for a large number of bushes. Feeding the birds will be helpful.

Bees are often blamed, but they give very little trouble. Bees are essential to fruit production as they carry the pollen from tree to tree. Excessive spraying or spraying at the wrong time may kill so many bees that the fruit trees suffer from lack of pollen. On the Pacific coast, experiments have been made recently in pollinating apple trees by hand to make up for the shortage of bees.

47. A year ago, I planted apple, plum and cherry trees. I planted them, gave them the best of care and they were coming along in fine shape. Then in July or August we had a terrific hail storm, the worst that was ever known in this locality, and the hail just knocked the leaves and bark on one side entirely off. Consequently, I feel the trees are about "all in." Is there anything that can be done for them?

The general experience is that it does not pay to let young trees go on in their hail-marked condition. Much can be done by cutting off the tree clear down to the ground while dormant in fall or winter and confine all of the new growth to one shoot. It may be necessary to stake them at first to prevent their breaking off. Melted paraffin (parowax) can be applied over the wound. If they have not made a good growth, it is best to grub them up and start over again.

Many years ago, a hail storm came to an Iowa nursery and inflicted \$10,000 worth of damage. In the effort to save the trees, the one or two year old trees were cut to the ground and the new growth confined to one stem. These made heavy trees, but the roots were so unusually large that they did not fit the tree boxes, and the customers were not accustomed to such large trees. At the time it was figured that much the better way would have been to grub up and

burn the whole stock of trees as soon as the storm was over.

48. What is subirrigation for trees?

For a few trees sub-irrigation is the best method of watering. Trees in cultivated soil can be helped by surface watering. Too frequent surface watering is apt to cause baking. Putting a piece of old iron pipe or tile on a slant near the main stem is a very good method. Watering should be done through this pipe. The top of the pipe is set flush with the ground. A large tree, of course, takes water by the barrel; one watering with the hose running all night is all right, whereas a little sprinkling does no good. Trees standing in sod in the lawn can be benefitted greatly by sub-irrigation. The upper end is closed with a wooden plug to prevent drying out between waterings. By sub-irrigation the water gets below the sod which prevents most of the water from reaching to the roots and permits water to be poured in without disturbing the surface.

49. Is it possible to irrigate trees too much?

The damage is probably mostly from irrigating too much, although it is not always easy to determine the real cause. Many people keep trees soaked without any drainage. Then the leaves get yellow from too much water in the soil. The soil should be permitted to dry out somewhat between waterings. The ground should not be put in a swampy or water-logged condition. The roots must have air as well as water. The ordinary artesian water, as far as the writer has observed, has not damaged fruit trees.

50. I wish I could get information on insects and plant diseases.

Your County Agent will be glad to visit your place to give advice. Special bulletins are available from the South Dakota Agricultural Experiment Station, Brookings, South Dakota, and from the United States Department of Agriculture, Washington, D. C.; also from the Agricultural Experiment Stations of other states. There are also many special books on these topics.

51. What is Witches' Broom?

The dense bushy aggregation of branches known as Witches' Broom is also called *Höxzenbesen* (the German word for Witches' Broom). There are many species of Witches' Broom. It is a parasitic plant affecting various species of trees such as cherry, alder, poplar, maple, box elder, horse chestnut, hawthorn, elm, larch, cedar, juniper, pine, hackberry and other trees. About all that can be done is to cut out and burn the infected branches. This will prevent their spreading.

52. Can pears be grown in South Dakota?

A few years ago the answer would be "No." The early settlers planted plenty of the standard pears all over the state but with no success. Pears are not native of the North American continent. The standard pears come to us from western Europe; are of large size and choice quality but winter-kill. Many of the Russian pears are winterhardy but both European and Russian pears are subject to the American bacterial disease known as fire-blight, which cripples or kills the tree. The net result, no pears.

For our southern states it was found that varieties resistant to fire-blight could be obtained by crossing with the pears of Southern China. This gives pears like Kieffer which are grown by

the thousands of bushels in the southern states, but lack in hardiness at the North.

American pears are the descendants of the pears of western Europe. The early settlers grew thousands of seedlings and many were named. It was found that the hardiness of the oriental pears increased towards the north in China. *Pyrus Ussuriensis*, as received from southern Manchuria, winter-killed at Brookings while from the Haibin region of north Manchuria with 50" below weather, the trees are perfectly hardy. One of these north China pears (*Pyrus ovoidea*, *Pyrus Simonii*), is also a northern type but apparently does not go as far north. By crossing this northern type of Chinese pear with standard European pears, a large lot of seedlings have been originated and named at the South Dakota Station. Some have been hardy and productive for many years. The best stock for these named varieties is the north Chinese and East Siberian pear. They have perfect winter hardiness and are strongly resistant to the American fire-blight which killed the old European and Russian pears.

In general, the pear is not as early bearing as the apple, so for centuries in milder regions the Quince is used as a dwarfing stock. These are called dwarf pears. The fruit on dwarf pears appeared by the second year and are larger in size than those on standard stocks. But the Quince is not hardy in the prairie Northwest, so we are searching for a hardy dwarf stock. Meanwhile, we must content ourselves with the standard hardy stock. They do not bear quite as early but make sturdy productive trees.

53. Can apricots be grown in South Dakota?

The old standard varieties winterkill

in South Dakota, but are grown extensively in California and other states in the extreme south. In 1924 apricots were found in North China in a region where the minimum temperature reaches 50° below zero. Forty-five seedlings were grown from pits collected in this area, 12 of which were named and introduced in 1937 by this experiment station. They were named Manchu, Mandarin, Chow, Sing, Ninguta, Tola, Anda, Zun, Sino, Lalin, Hulin, and Sansin. Each has been found hardy and they are good producers. One grew six bushels of fruit in 1940. The trees are about double the size of an ordinary plum tree, grow rapidly, and are highly drouth-resistant.

54. What is the best stock for budding and grafting the new hardy Manchu apricots?

In regions where peach stocks are hardy, these are recommended because they do not sprout. Although apricots do not unite well with native plum, *Prunus Americana*, it was used for such work at this experiment station due to the absence of other stock. Such stocks should be supported by stakes and cloth bands. The trees will get in their own roots if set several inches deeper.

Apricot seedlings themselves probably will be the best stock when they become more common. Native sandcherry has made a good union in nursery trials and the wild Siberian apricot, *Prunus Sibirica*, with non-edible fruit, makes an excellent union in nursery work. The Morden Experiment Station, Morden, Man., is using the Yuksa (See South Dakota Bulletin 224) as intermediate stock.

In the present state of the work, every apricot seed should be saved, even if not up to the standard of the 12 main varieties. They all will be useful as

stocks. Fruit of all these varieties will make excellent sauce and preserves.

55. Can plums be grown successfully in South Dakota?

Yes, plums of some kind can be grown in every part of the state. The early settlers found wild plums everywhere. Many thousands of native plums have been grown from seed at this station. Slow progress can be made by selecting through a series of plant generations. The good points of the native plum are the early and heavy bearing under orchard conditions, and perfect hardiness. The main fault is the thick skin and strong flavor of the fruit. However, many people like this flavor, especially for jam.

Early experiments at this station in improving the native plum by straight selection culminated in two varieties, Teton and Oacoma. These are $1\frac{3}{8}$ inches in diameter. The Teton was found in Campbell County on the east bank of the Missouri. The Oacoma was found a few miles west of Oacoma, Lyman County, in the Missouri river region of South Dakota.

The author has heard of large plums, but they have not been located. Those who find such plums should mark them while the fruit is on the tree, so that they can be found again in October when the leaves have fallen and it is possible to cut scions for propagation. It depends much on the source of the wild plums.

In a 10-year test at the State Orchard at Watertown it was found that the native plum, *Prunus Americana*, varied in hardiness. Those from the south were too late or not hardy enough, and the northern varieties were distinguished by bearing well even in the hardy years. Some work has been done with the wild plum of Manitoba, *Prunus nigra*,

the best one being the Assiniboin; this is found to be very hardy and productive in the north.

Much more could be done with the wild plums of the Dakotas and Manitoba. But when the hybrid plums came in, the work with the native plum stopped to a large extent because there was no market for them. The people preferred to plant the large hybrids.

56. Are the large-fruited European plums and prunes received from California suitable for cultivation in South Dakota?

European plums are not hardy in this state. Many large-fruited varieties have been tested, including some from southern Russia. European plums are grown to some extent in southeastern Wisconsin. In South Dakota, two varieties grown near Hot Springs are the Koslov and Russian Gage which bear fruit, and at Newell is grown a small plum of the old Blue Damson type. This is the common "peasant plum" of Germany and other parts of western Europe.

The main advantage of the European plum is its very firm, pleasant flavored flesh, while all the native American plums have much free pulp. Many attempts have been made to hybridize the European plum with the native plum, but the great difference in the number of chromosomes apparently makes it impossible to obtain fertile hybrids.

57. What is meant by a short cut to better plums for South Dakota?

Much time has been saved by hybridization of the native plum with other species. The best combination was the native plum with the Japanese plum. This produced the first 2-inch, 2-ounce plums, Waneta and Kahinta. In the western prairie states, they quickly displaced the old native plums to a large

extent. Then came the fragrant plums, such as Kaga, Hanska, Kota and Tokato, produced by crossing the native plum with the apricot plum from China (*Prunus Simonii*). They are characterized by firm flesh and the delicious quality and spicy fragrance of the fruit. They are noted in Bulletins 224, 309 and 339. The Waneta plum is often exhibited at the South Dakota State fair.

58. What is the best method to grow native plum seedlings?

The best method is to imitate nature. The pits need freezing. For several years a newer method of exposing to cold by placing the pits in sand and keeping them in a cool cellar has been tested, but the tendency is of such seeds to germinate slowly and lie over one whole season before germinating, so we now are going back to the old method of severe freezing outdoors. This insures a good stand of seedlings the first year.

As soon as picked the plums should be spread out in a thin layer and allowed to remain until they get a little soft. The seeds now can be washed clean and spread out to dry, shaded from the sun, for a day or two. Then they should be mixed with moist sand in a small box; first a layer of sand, then a layer of pits, then a layer of sand, and so on alternately until the box is full. The box should have holes in the bottom for free drainage. It should also be buried two inches below the surface of the ground out of doors in a well-drained spot in the garden, and allowed to freeze all winter.

If snow comes too early in the fall, shovel it away so that the seeds will be sure to freeze very hard. If the fall is very dry the sand should be watered and covered with a light mulch to prevent

drying out. It is essential that the seeds do not dry out before planting, and still they must not be in water all the time, as that would water-soak them. As early in the spring as possible, the seeds should be planted. The land should be gotten in good condition by plowing and harrowing. If possible, use fall plowed land.

Make the rows four feet apart and plant the seeds two or three inches apart in the row and four inches deep. In a small way this can be done by opening up a shallow furrow with a hoe and stepping on the seeds, then filling the furrow with a hoe. In case the spring is a wet one, so that it is impossible to get the seed planted early, the sand should be stirred every day to prevent the seeds in the bottom of the box from germinating sooner than those in the top of the box, and if possible the seeds should be gotten out before there is any show of their germinating.

If good care is given, these young trees will be waist high by fall and can be planted into their permanent positions early the following spring.

59. When I plant an orchard of plum seedlings, should the root sprouts be allowed to form a thicket?

As for a plum thicket, do not let the sprouts grow up between the trees because soon there will be so many sprouts that they will be overcrowded. Trees 11 feet apart will be too close as they get older. Any orchardist finds the best results in having the trees closer one way and to cultivate the other way. A good combination plan is to leave the sod in the line of the row of the trees and cultivate the rest. If you have planted the improved native varieties and they are budded on native wild plum roots, it will be difficult to tell whether the plum sprouts are the improved plum or the

wild plum, so ordinarily it would not be safe to plant them.

If the suckers come from below the bud or graft, they will be the wild plum. If they come from above the bud or graft, they will be the improved tame variety. All the plum sprouts should be kept down as they detract from the strength of the main stem which is to bear the crop. If the plums are on their own roots, then, of course, the sprouts will be the same as the original tree, but such trees are very scarce in the nurseries.

In general, plum trees are pruned very little, except a little thinning of the surplus wood if the top gets too thick. If the main limb is broken, it should, of course, be pruned carefully the same as with apple trees, being careful to prune close and not leave any stump. The sandcherry hybrids (see Question 64) need pruning of old bearing shoots to promote growth of young shoots, as the best fruit is borne on one-year-old wood.

60. My Compass cherries bore fruit, but what appears to be wild plum has come up right from the root. What is the reason?

The Compass and other tame plums are usually grown in the nurseries by budding or grafting on native wild plum seedlings. But often it happens that the tame top winterkills or is crowded out because the wild root sprouts from below the bud or graft. The wild root will always favor its own shoots, instead of the tame bud or graft which has been inserted in the nursery. Rarely it happens in the nursery that the nurseryman has a surplus of some one-year tame buds on wild stock. Then he may re-bud these tame buds to some new and more valuable variety for which there is a demand. Time will tell

which of these two things has happened. If the peach stock is used for plums there will be no suckers or root sprouts, but the peach stock is not hardy up here in the north.

61. Why have my Compass cherries not borne fruit after waiting several years?

Your Compass cherry trees should have borne before this. Probably they need other plums near by to pollinate the blossoms. Better try some Opata and Sapa. If the trees are not well cultivated, they will not bear. Grass is an enemy to fruit trees. Quite often the fruit trees are planted too near Cottonwoods or other large trees which take the moisture. The Compass and other sandcherry hybrids are very productive. Compass is a good pollinator for other sandcherry hybrids. In the State Orchard at Sioux Falls both Sapa and Opata planted adjacent to each other bear heavy crops. Seedlings of the sandcherry, such as the Hansen Bushcherry, pollinate all the sandcherry hybrids.

62. Will it pay to plant pits of the Compass Cherry?

The answer is no, unless you wish to experiment. The Compass is a hybrid of the native sandcherry of North Dakota with the wild plum of Minnesota. It forms fruit buds on one-year-old wood, so usually bears the year after planting. The Opata and Sapa are hybrids of the native South Dakota Sandcherry with large Japanese plums and bear also on one-year wood. Their fruit is much larger than Compass. The Compass Cherry was originated in the spring of 1891, at Springfield, Minn., by crossing the sandcherry from near Bismarck, N.D., with the native *Prunus Americana* plum. This hybrid plant has proven to be an early and abundant bearer of small

plum-like fruit of pleasant, sprightly flavor. This Station began to plant Compass cherry pits and continued until over 700 seedlings were fruited at the South Dakota Experiment Station, but none were deemed worthy of propagation. They reverted either to the American plum or to the sandcherry. None of them had the high quality that is necessary for a market fruit.

63. What is the Hansen Bushcherry?

This is a selection from the native sandcherry, *Prunus Besseyi*, found especially in western South Dakota. It is native of the uplands and the dry plains rather than the low wet places. This select type of sandcherry is now called the Hansen Bushcherry to distinguish it from the unselected seedlings. Fourteen plant generations have been grown and the fifteenth generation is now ready for planting in the spring of 1941 to replace the 37 acres of the fourteenth generation removed in the fall of 1940.

In some of the selected plants, the pit is only one-fourth of the original size and the largest fruit is nearly one inch in diameter. The best of the earlier selections—Sioux—is the parent of many thousands of seedlings grown in the Dakotas, Manitoba and Saskatchewan. Many other varieties have been named and are noted in Bulletins 224, 237, 309 and 339. Perhaps the best is the Checkpa, 15/16 inches in diameter and the ratio of pit to fruit is 3.92. In other words, out of 100 pounds of fruit, a little less than 4 pounds would be pit. Checkpa was introduced in 1940.

The original plants of the fourteenth generation have been saved. The best ones have been budded on native plum. It is planned to get this large type and excellent quality and small pit to come true to seed. The Hansen Bushcherry

is a good plant to use in soil erosion work as it will grow on high dry slopes and stop soil erosion.

64. What are sandcherry hybrids?

An entirely new type of fruit came into existence when the native South Dakota sandcherry, *Prunus Besseyi*, was hybridized with Japanese plums. (See South Dakota Experiment Station Bul. 224.) These two species unite well and the result is a strong, bushy plant bearing fruit on one-year shoots from the ground up.

Nurserymen first made a mistake when they tried to make a tree out of it as it pruned off too much of the fruiting wood. It is best to dig them after one year's growth from the bud. In these hybrids between a bush and a tree, the habit of growth is intermediate. These cherry-plums or plum-cherries, as they are often called, are now popular over a vast area from Texas north into Manitoba. As the best fruit is borne on the one-year-old shoots, a gradual removal of the old shoots will favor a strong growth of young shoots.

65. Are the standard sour cherries hardy in South Dakota?

The sour cherries are hardier than sweet cherries, especially the Early Richmond. They are usually budded on Mahaleb stock, which is not hardy. It is apt to root-kill. The ordinary experience is that they will bear some fruit in the southern part of the state but suffer when severe winter comes.

66. Are the sweet cherries that are shipped in from California hardy in the Dakotas? Can they be made hardier?

Sweet cherries are not hardy. In general, you will need to go far south or to the Atlantic or Pacific Coast to find a climate mild enough for sweet cherries.

However, the Sapa plum with deep black-red flesh is a good substitute, when cooked, for the black flesh sweet cherries of the Pacific Coast. The Sapa and Opata do well together as they pollinate each other very well at the State Orchard at Sioux Falls. The Station does not advise raising seedlings of the sweet cherries with the aim of obtaining seedlings of greater hardiness. The favorable climate effects of the east slope of the Rocky Mountains extends over somewhat into western Montana until it merges into the prairie region of eastern Montana. The east slope of the Rocky Mountain region of the western states from north to south is a local problem; many of the tender varieties are protected by their sheltered location.

67. Has anything been done with the native wild chokecherry of South Dakota?

The common chokecherry, *Prunus virginiana*, is common along streams throughout the state. The objection to the tree is the great number of suckers from the root. Experiments at this Station showed that this is obviated by budding chokecherry on the Siberian May Day tree, *Prunus Padus commutata*, which does not sprout.

The chokecherry is much used for jelly. Choice jelly and jam are made from chokecherries by adding apple or crabapple.

There is considerable danger in eating the fresh fruit of chokecherries and drinking milk immediately afterward. The two make an injurious combination and is astringent, often producing unpleasant reactions when eaten in considerable quantity. The leaves and seeds are poisonous. The leaves in the wilted condition contain hydrocyanic acid.

Some effort has been made to collect chokecherries with mild flavor from various parts of the state and from Manitoba; some of these bear yellow fruit. (See South Dakota Experiment Station Bul. 260, "Ornamental Trees of South Dakota.")

68. Can peaches be grown in this state?

Scattering trees of peaches are growing here and there from the southern edge of the state north to Sioux Falls, but it is so difficult and expensive that it cannot be recommended.

The peach will fruit from seed the third year, so that two mild winters in succession after the pit comes up will mean some fruit. So at almost every State Fair, people show peaches; but when invited to come back, they usually find it impossible because of winter-killing. Better results would be obtained if given winter protection. The trees should be loosened from one side and bent over and covered with brush, but all this is for the experimenter and not recommended to the average planter.

One difficulty in working with the peach is that it is almost impossible to hybridize it with other species. It often sets fruit independently with pollen used; for example, hybrids with the native plum. They are usually entirely sterile.

69. Are Mulberry trees hardy in South Dakota?

The only cultivated mulberry hardy in South Dakota is the Russian mulberry. They are not long-lived here at Brookings but stand fairly well in the southern one-third of South Dakota. The Russian mulberry is a good tree for windbreaks, and the small fruit is taken by the birds in preference to better

fruits. Mulberries are readily grown from seed sown as soon as ripe. The seed should be washed free from pulp and sown in a shaded seed bed. Mulberries may be transplanted in two years or layered in early June. They may also be planted from 12-inch cuttings inserted in the fall after the leaves have fallen. They vary greatly from seed, and only about one in a thousand is superior in fruit.

This plant is widely cultivated in Kansas and Nebraska. It was brought over by the Russian Mennonites in 1875-76. The plant is valuable for hedges. The fruit is really too small to be of any market value. A hardier form of Russian Mulberry is now under trial at the Experiment Station, Morden, Man.

Much work should be done with the Russian Mulberry to improve the fruit in size and quality. The fruit is useful for sauce, but the birds get most of it. They prefer them to the common sour cherries, so many people plant Russian Mulberry for the birds and in this way have more of the sour cherries for themselves. Some mix the mulberries with other fruits to give it more flavor in sauce.

The common mulberry (*Morus nigra*) native of somewhere in the Orient and cultivated for thousands of years, is not hardy on the northwestern prairies. The white mulberry, the leaves of which are fed to silk worms, is a native

of China and is not hardy in the prairie Northwest. There are two kinds of mulberry flowers. Sometimes both staminate and pistillate are on the same tree, and sometimes they are on different trees; or, as the botanist would say, they are sometimes monoecious and sometimes dioecious. In other words, in the process of evolution, the progress toward the dioecious condition has not been completed.

70. Is the fruit of the native Hawthorn of any value?

The fruit of the native Hawthorn (*Crataegus*) is edible, but usually too small. It makes a beautiful small ornamental tree for the lawn. (South Dakota Experiment Station Bul. 263.)

71. Can the Japanese persimmons be grown in South Dakota?

Persimmons of two types are grown in America, the Kaki or large Japanese persimmon (*Diospyros Kaki*), native of Japan and China; and the American persimmon (*Diospyros virginiana*). Many choice varieties of native persimmons have been found in Indiana, Missouri, Kentucky and Pennsylvania; they are much smaller in fruit than the Kaki. The Japanese persimmons are grown in California and are a fancy fruit much prized by many. None of the persimmons are recommended for South Dakota as the trees are not hardy.