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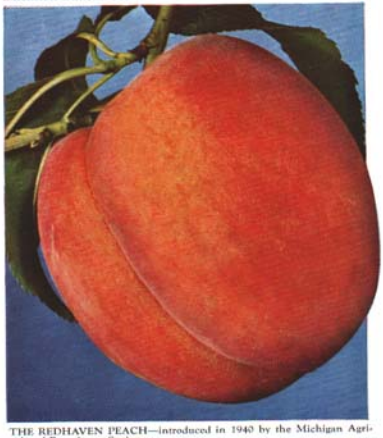

THE REDHAVEN PEACH—introduced in 1940 by the Michigan Agricultural Experiment Station

PEACH CULTURE
in Michigan

COOPERATIVE EXTENSION SERVICE
Michigan State University, East Lansing

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CONTENTS

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Figure 1. Suitability of various Michigan areas for commercial peach production: **number 1** — the best area, good soils and sites with long record of minimum temperatures of —13°F not more than one year in seven; **number 2** — slightly colder than (1) but extensive areas of good soils and high sites; **number 3** — some locations with high elevation (above surrounding area) suitable for peaches; **number 4** — favorable winter temperatures but generally unsuitable because of flat and poorly drained land or industrial and residential developments; **number 5** — generally too cold except in limited areas having high sites and light soils; **number 6** — generally unsuitable for commercial peach production. The preparation of this map has been based partially on U.S. Weather Bureau records and partially on experiences in peach growing in Michigan.

THE PEACH IS NOT NATIVE to the United States but was brought to the southeastern part of the country by the early Spanish explorers. From there it spread throughout the nation until now 27 states are considered of importance in commercial peach production.

Early records indicate that the peach was first grown in Michigan in 1775 when a few pits were planted near St. Joseph by an Indian trader named Burnett. Commercial production did not begin until 1848 when three men planted an aggregate of 25 acres of orchard also near St. Joseph.

The industry was growing rapidly when suddenly in 1863 a new disease called "the yellows" made its appearance. By 1877 the disease was destructively prevalent throughout the orchards of southwestern Michigan. No cure was known or has since been discovered. The only control was to pull and burn the diseased trees. Despite ravages of the disease, peach growers persevered, replanted their orchards, and by 1884 the industry was recovering rapidly.

From 1884 until 1906 peach plantings increased greatly. Prices were good and there was virtually no competition on the Chicago and nearby markets. A veritable peach planting mania swept the southern and western parts of Michigan, and trees were planted in many localities and on many sites with almost total disregard of their qualifications for growing peaches.

The peak of peach planting in Michigan was reached in 1898 when there were about 12,500,000 trees of all ages, a high percentage being young trees. Many trees were killed in the very severe winter of 1898-99. A few years later, on October 10, 1906, a unique and very severe storm struck the southwestern part of the state where peach plantings were heaviest. There was a heavy fall of snow, followed by a drop in temperature to from 11° to 15° F. at various places. The leaves were still on the trees, and many growers were still picking late varieties such as Smock and Salwey.

About 73 percent of the state's 7,500,000 peach trees were killed by this prematurely low temperature. Most of the damage occurred in the heavily planted southwestern counties of Berrien, Van Buren, and Allegan.

Since that severe blow, the peach industry in Michigan has never reached its former proportions. Several reasons can be given. Growers realized that it was dangerous to rely almost entirely on one fruit for their income, especially on one as susceptible to extreme weather conditions as the peach. Consequently, new plantings were more diversified and an increased number of apple, cherry, pear, and other fruits were planted.

At about this time the refrigerator car came into use and with its coming, Michigan's monopoly of the Chicago peach market disappeared. Henceforth, the Chicago markets received peaches from all parts of the country, from May to November. It is very likely that the "Big Freeze" of 1906 accomplished in a single blow what the law of supply and demand, together with better transportation and refrigeration, would have brought about slowly and possibly even more painfully over a period of years.

Following the "Big Freeze" of October 1906, the Michigan peach industry maintained itself on the level of approximately 2 million trees until about 1920 when the census showed 2,774,860 trees of all ages. From then until 1950 the industry grew steadily. In 1949 there were 3,603,866 peach trees of all ages in the state.

Another unusual freeze occurred in southwestern Michigan on November 24, 1950, when the temperature dropped to −21° F. in some parts of the area. Practically all flower (fruit) buds were killed and such severe damage occurred to trees that the number of peach trees of all ages in the state declined to 1,776,000 in 1959. While the new census tabulation of trees are not presently available, the industry has been gradually expanding once more. It may expand considerably with the increased interest in growing clingstone varieties for processing. The commercial processing of peaches has increased steadily in Michigan from approximately 5 percent of the total crop in 1920 to 25 percent in recent years. This trend is likely to continue.

The trend in peach production in the United States moved sharply upward, beginning in 1944 when a new record was established with about 78 million bushels. This record was broken the following year with a production of 82 million bushels, and again in 1946 with an all-time record of approximately 87 million bushels. Another large crop of 82 million bushels was produced in 1947. The average crop for the last six years, 1959-64 inclusive, was 74,930,000 bushels.

Michigan has usually ranked from third to fifth in peach production among the states.

The average value of the peach crop per year in Michigan for the years 1950-62, inclusive, was $5,667,000.

The outlook for peach growing in Michigan seems to be quite good if plantings are restricted to favorable sites in recognized peach growing areas. While injury from low temperatures is a constant hazard, the danger is less in Michigan than in other northern states because Michigan is nearly surrounded by the Great Lakes. Excellent processing and fresh fruit markets are nearby in a heavily populated part of the country.

SELECTING A LOCATION FOR PEACH GROWING

Several factors are of importance in selecting a location for peach growing in Michigan. One of the most important is local climate.

Local Climate

The peach is the most tender of the tree fruits commonly grown in Michigan and whether it can be grown successfully in a certain part of the state will depend more upon the frequency and severity of low temperatures in fall and winter than on any other factor.

It is impossible to state definitely what degree of low temperature is required to kill peach flower buds, because of variable growing conditions from year to year. However, varieties now commonly grown in Michigan will usually survive a temperature of −13° F. in the dormant season. Serious budkilling will usually take place at −14° F., especially with available freestone varieties. Flower buds of some clingstone varieties will withstand −16° F. without serious injury.

It is likewise virtually impossible to designate exactly a temperature that will result in severe injury to the wood of the tree. For instance, in October 1906, millions of peach trees were killed in Michigan by temperatures ranging from 10° to 15° F., but the trees were in full leaf. If the trees are well matured, they will usually withstand a temperature of −18° to −20° F. without being killed. The temperature at which flower buds are likely to be killed is, of course, most important inasmuch as crops of peaches must be produced fairly regularly if the enterprise is to be profitable.

Loss of all or a portion of the peach crop from spring frosts is not nearly as serious a problem in Michigan as in some states. If flower buds survive the winter, seldom are enough of them lost in a spring frost to severely reduce the crop, if the orchard is located in a recognized peach growing area. There is a difference in the resistance of varieties to injury from spring frost, but usually the swelling buds will withstand a temperature of 25° F. when they are beginning to show color, 27° F. when in full bloom, and about 29° F. when in the small, green fruit stage.

The safest area in Michigan for growing peaches is shown as *number* 1 in the heavily shaded portion of Fig. 1. This area experienced a minimum temperature of −13° F. not more than 15 percent of the years in a long period of time (about 60 years). Varieties now being grown in Michigan will usually withstand this temperature without serious loss of flower buds.

On the eastern side of the state a narrow belt having favorable winter temperatures for peach growing extends from the southeastern part of Monroe County to a point approximately halfway between Port Huron and Harbor Beach. This area is shown as *number* 4 in Fig. 1. However, a combination of low, flat, and poorly drained land makes most of this area unsuitable for peach growing. Also, the few sites that might have been suitable for this purpose are in a thickly settled, heavily industrialized area where the land is used for other purposes.

Areas shown on the map on the western side of the state (*number* 2) and west and north of Detroit (*number* 3), are somewhat colder. But these areas contain many excellent peach orchards. In these areas, a site having high elevation above the surrounding country is extremely important. This point cannot be over-emphasized. In fact, high elevation is a very valuable asset to a peach orchard even when located near Lake Michigan. Elevation above sea level is not as important as elevation above the immediate surrounding country.

There are some profitable peach orchards in the southern tiers of counties in Michigan inland from Lake Michigan (*number* 5). Invariably they are on sites having high elevation above the surrounding country. This permits the heavier, colder air to drain off to lower land. Sometimes an increase in elevation of one or two feet will mean the difference between enough buds or blossoms surviving low temperatures to produce a crop or a crop failure.

The average annual precipitation for southwestern lower Michigan for the years 1931-1960, inclusive, was 34.4 inches. This is the area where about 70 percent of the peaches in the state are grown. This is slightly more precipitation than received in other peach-growing areas in the state, where it ranges from 30.5 inches in northwest lower Michigan to 31.3 inches in the west-central area and 30.7 inches in southeastern Michigan.

Although this amount of rainfall is, as a rule, sufficient to produce good crops of first-grade peaches, provided the trees are well cared for and not permitted to carry excessive loads of fruit, it is not too much and lack of moisture can easily become a limiting factor if the orchard is not handled properly. (See sections on Soil Management and Irrigation.)

SELECTING THE ORCHARD SITE

When selecting a site on which to plant a peach orchard, several important factors should be considered. These include elevation above the immediate surrounding country, soil, and the possibilities of erosion.

Years of experience have shown that orchards planted on sites having good elevation above the surrounding country are not so frequently injured by low fall and winter temperatures and spring frosts as those on low lands.

A factor to be considered in connection with the advantages of adequate elevation is the problem of soil erosion. Most of Michigan's finest peach growing sites are located on rather high, sloping ground and erosion has taken a heavy toll of the top soil.

Soil

For best results, the peach tree requires a reasonably fertile soil that is well drained. Generally, sandy loam soils produce the finest fruits, although clay soils are suitable, provided they are well drained. Exceptionally fertile loam soils are hazardous unless very carefully handled because of the danger of the trees making too vigorous growth, rendering them more susceptible to winter injury. On the other hand, light, infertile soils will fail to produce trees of sufficient size and bearing capacity to be profitable.

Poorly drained soils have caused great losses of peach trees. Sometimes injury is apparent the first year. Again, the trees will grow well until 3 or 4 years old, and then die when an exceptionally wet or dry season occurs. Poor drainage is an important factor in Michigan because of the great variability of the state's soils. In one part of the orchard the trees may grow very well, while in another they will either die or grow so weakly that they cannot produce profitable crops. Strange as it may seem, poor drainage is frequently a problem on the very best sites from the standpoint of elevation.

A practical suggestion can be made that might be helpful in detecting poorly drained spots in the field. After the proposed orchard site is plowed, disked, and harrowed early in the spring, it should be allowed to stand until a few days have elapsed, during which there have been drying winds. The wet spots can then be located because the surface soil will remain moist on them, while the soil in the remainder of the field will dry slightly on top. A field having many such spots should not be planted to peaches. Such observations should be made a year or two in advance of planting. The presence of soil mottling and grayish-drab subsoils are very good indications of poor drainage.

The question frequently arises as to the advisability of trying to tile-drain soils otherwise well suited for peach-growing. While no general rule can be laid down, usually it would be better to avoid such soils for peach culture.

VARIETIES

The choice of varieties should be influenced by several factors, including the freedom of the particular site from winter injury, the type of market to be supplied, and the distance to market. It is often considered a good policy to set the more tender varieties on the higher elevations of a particular site and place the hardier varieties on the slopes and lower elevations.

If the crop is sold largely at the orchard or nearby roadside stands, it is best to have a number of varieties ripening in succession over a period of several weeks. If the peaches are sold in the commercial peach growing areas, fewer varieties and only those having a good reputation in the large commercial markets should be grown in quantity. The following varieties are suggested for Michigan.

Freestone Varieties

The Very Early Season. Sunhaven is the earliest variety grown in Michigan that is a freestone when fully ripe. However, when firm-ripe it is a semi-freestone. With peaches, unless they are processing-type clingstones, the earlier the season of maturity, the more prevalent is clinging of the stone and softness of the flesh. A number of varieties have been introduced maturing as much as 17 days earlier than Sunhaven. However, they are complete clings and have soft flesh. They should not be grown in Michigan as the consumer is usually disappointed with them, and better varieties from earlier producing areas are on the market at the same time.

Sunhaven matures about 40 days before Elberta. Introduced in 1955, it is a strong, hardy, productive tree. Fruits have the brilliant red and golden coloring of Redhaven. They are large and have bright yellow flesh of good texture for an early peach, and good flavor. Sunhaven is a partial cling until fully ripe. It is recommended as an early variety for local market and shipping to nearby markets.

Redhaven, introduced in 1940, matures about 30 days before Elberta. It is now undoubtedly the most extensively planted freestone peach variety in the world. It has the rare ability to do well in many different climates and on a variety of soils. The tree is vigorous, productive, and above average in hardiness. It usually sets fruit heavily; thus, thorough and early thinning are required to obtain peaches of large size. Fruits are brilliant red over bright yellow. Beautiful color is obtained while the fruits are firm. The flesh is firm, fine-grained, and non-browning. It is excellent for fresh use, freezing, and home canning.

Fairhaven, introduced in 1946, matures about 20 days before Elberta. The tree is vigorous, productive, and above average in hardiness. Fruits are medium in size and mostly golden with a bright red blush. Fairhaven is attractive in appearance, but lacks the amount of bright red color now preferred by the fresh market. It is very good for home canning and freezing, but does not pit well on the mechanical pitting machines used in commercial processing. The variety is doing well in southern France and Italy where it acquires better color than in this country.

Richhaven matures about 17 days before Elberta. This variety was introduced in 1955, and has not been grown commercially long enough to accurately evaluate it. Reports on its behavior have been contradictory. Richhaven seems sensitive to minor changes in local climate at blossoming time. Therefore, it is suggested that it be interplanted with another fertile variety to insure better pollination. The tree is moderately large, usually very productive, and is moderately hardy in flower bud and blossom. Richhaven is a yellow-fleshed freestone with large, bright red fruits. It is excellent for fresh market, ships unusually well, and is satisfactory for processing by canning or freezing.

Glohaven matures about 16 days before Elberta. Introduced in 1963, this variety is not yet growing in commercial quantities. Trees are medium-large, vigorous and productive. Wood and flower buds are moderately hardy, and above average in resistance to spring frosts. Fruits are large, even when the trees are heavily loaded, and are of uniform size. They are mostly red over a deep yellow undercolor. Flesh is clear yellow, firm-textured, and very resistant to browning. There is almost no red color in the pit cavity, a characteristic much liked by commercial canners. Glohaven is a general purpose variety suitable for fresh market, canning and freezing.

Halehaven matures 14 days before Elberta. This was the first of the Haven series of peach varieties and was introduced in 1932. It soon became a standard variety of its season. It had much more red color than other varieties available at that time. However, its color is not as bright as that of Redhaven, which was introduced later and set a new standard for peach color. Plantings of this variety have been declining because of its comparatively dull color when picked at the firm-ripe stage. It will continue to be of value as a local market peach and for canning. It is one of the best freestone varieties for commercial canning maturing before Elberta.

Cresthaven matures about a week before Elberta. It was introduced in 1963, and is not yet growing in commercial quantities. Trees of Cresthaven are medium-large, vigorous, and productive. They are

above average in hardiness of wood and flower buds. Fruits are medium-large, nearly round, and quite uniform in size and shape. The ground color is golden overlaid with an abundance of bright red, and is very attractive in appearance. It should be popular on the fresh market. Flesh is clear yellow, firm-textured, and very resistant to browning. There is too much red color in the pit cavity to meet commercial canning requirements, but the variety freezes unusually well. It also makes a satisfactory home-canned product.

Kalhaven matures about 4 days before Elberta. Introduced in 1936, it has steadily increased in favor in Michigan and some other northern areas because it matures part of its crop just before Elberta, has excellent shipping ability, and is popular for commercial freezing. The tree is large, vigorous, productive, and above average in hardiness. Fruits usually set well and should be well thinned. When mature, the fruits are normally medium to large in size and colored much like J. H. Hale, being mostly bright golden with a bright red blush.

Redskin was introduced by the Maryland Agricultural Experiment Station in 1944 and has had a long trial period in Michigan. It ripens with Elberta and has gradually replaced that variety in new plantings because it has much more red color in the skin. It consistently outsells Elberta on the fresh market, and it ships well. Redskin has a large amount of red color in the pit cavity, making it unsatisfactory for commercial canning, although it is suitable for home canning. It freezes well but the market for the frozen product is restricted to outlets that do not object to considerable red color in the slices. Redskin trees make many sharp-angled crotches which tend to split easily. Wood and flower buds are above average in hardiness. The variety blossoms very early, but has shown considerable resistance to injury from spring frosts.

Elberta. This famous old variety, which dominated the peach variety list for so many years, is now planted only to a small extent in Michigan. Sensitivity of flower buds to low temperatures, lack of red color now demanded on the fresh market, and variability of flesh color and quality from season to season are the principal faults that caused the decline of this variety. It is still extensively grown in the Pacific Coast states for processing.

Varieties Maturing after Elberta. There is need for a first-class freestone variety maturing a week after Elberta for use in the three southern tiers of counties in Michigan. Varieties maturing this late should not be grown farther north. Many varieties have been tested in this season but none have proved satisfactory. For example, **Rio Oso Gem** ripens about a week after Elberta and has gone through a long trial period in Michigan. While the fruit is attractive and sells for good prices, the tree is very weak and subject to injury from low temperatures. The tree seldom lives very long. The variety cannot be recommended for planting in Michigan. Attempts are continuing through breeding and variety testing to find suitable varieties for this late season.

Clingstone Varieties

The clingstone peach makes a better-appearing canned product than the freestone because its firmer-textured flesh retains its shape during the canning process. In addition, the juice is clearer and the color of the flesh brighter and more uniform. Processors of baby foods have found that the puree made from clingstone varieties has better texture and more uniform color than that made from freestone varieties.

Fruit growers in California, being far removed from the large fresh fruit markets of the country, early became interested in the processing of fruits and soon discovered the merits of the clingstone peach for canning. As a result, they encouraged the industry and developed a list of suitable varieties for canning purposes. At the request of fruit canners in Michigan, a collection of clingstone varieties, including the most important ones grown in California, were brought to the South Haven Experiment Station for trial in 1923. Without exception, the California varieties were found to be unsatisfactory, usually because of poor growth or unproductiveness.

Among the other varieties tested was a clingstone seedling from the New Jersey Experiment Station, later named **Ambergem.** After preliminary trials it was planted on a fairly extensive basis commercially in 1938. Plantings increased until Ambergem now constitutes about 13 percent of the total peach trees of the state.

Interest in planting clingstone varieties has increased in recent years, and a search has been made for a succession of suitable varieties maturing through August and until the middle of September.

The **Suncling** variety was introduced by the Michigan Agricultural Experiment Station in 1961. It matures a week before Elberta. The tree seems to be hardier and stronger than Ambergem. The fruit is better in some respects in that it has a small pit and almost no red color in the pit cavity. Suncling has been planted rather heavily in the state and the young trees are just coming into production.

The New Jersey **Babygold** series of clingstone varieties are under trial in Michigan, but insufficient

time has elapsed to thoroughly evaluate them. Those attracting the most attention at present are Babygold 5, 6, and 7, ripening 3 weeks, 2 weeks, and 1 week before Elberta, respectively. Babygold 5 and 7 seem to be the most promising at this time. Babygold 8 is unusually hardy and productive but ripens about four days later than Elberta. This is too late in the season to grow peaches safely north of Allegan County, and most processors do not want to receive peaches this late.

The new clingstone varieties are considerably hardier in flower bud than standard freestone varieties. However, there is a tendency for the trees to form sharp-angled crotches. Such crotches are more susceptible to winter injury and breakage. Careful training while the tree is small will be required to eliminate this type of crotch.

Other promising clingstones have been found and are under trial. Prospects are excellent for a series of suitable varieties of this type maturing over a period of six weeks earlier than Elberta.

All new varieties should be first planted in small numbers. It should be remembered that the percentage of new varieties that succeed in becoming standard varieties is extremely small. A good rule for the fruit grower to follow regarding varieties, and also in adopting new orchard practices, would be the passage in the Bible (First Thessalonians 5:21): "Prove all things. Hold fast that which is good."

The Need For Pollinators

All of the varieties recommended for Michigan are self-fertile and can be planted safely in a solid block of a single variety, except that Richhaven will benefit in an occasional season if inter-planted. However, if the grower desires to plant a self-sterile variety such as J. H. Hale, it should be planted in alternate rows with another variety that is self-fertile and which produces an ample supply of pollen. Self-sterile varieties are not recommended for planting in this climate because the weather at blossoming time is sometimes too cold for insects to fly. If insects do not transfer pollen from the self-fertile to the self-sterile variety, the latter will not produce a crop.

SELECTING AND HANDLING NURSERY STOCK

The peach tree is susceptible to many serious and often uncontrollable diseases; therefore, the greatest care should be exercised in the purchase of nursery stock. The chance of obtaining stock untrue to name is also especially serious in the case of the peach because the trees cannot be successfully grafted to another variety and because of close external similarity of many varieties. Price, therefore, should be a minor consideration in the purchase of peach nursery stock. Saving a few cents on the price of a tree could prove to be very costly. The reliability of the nurserymen should receive first consideration. The prospective purchaser should also determine if the nurseryman grew the trees himself or purchased them from someone else. There is greater danger of mistakes occurring when the trees have passed through other hands.

Inquiries are frequently made concerning the advisability of purchasing trees in the South for northern planting. If the trees are well grown, free from disease, and have been properly handled, stored, and shipped, there is no reason why they should not grow satisfactorily in the North. There is, however, always an added danger in bringing in trees from a distance in that a new disease may be introduced into the orchard. There are several serious virus diseases of peaches in other parts of the United States that have not yet become established in Michigan.

Medium-sized peach trees (9/16 - 11/16 of an inch in diameter) are generally preferred, although many persons desire the large sizes if they have been well heeled-in or stored in such a manner that they have not been winter-injured. Small sizes are less likely to survive if a very dry season is encountered the first year. A small size may also indicate, in some instances, that the tree came from an inferior rootstock.

Peach trees in the nursery row are usually dug late in the fall and either heeled-in or placed in storage. If the trees are heeled-in, they should be placed in a trench in a well-drained location with the tops pointing south. The roots should be covered deeply with the soil extending well up on the trunks to prevent any injury to the crowns during the winter. Trees are usually received in bundles and often heeled-in without opening. This results in some of the trees drying out. The bundles should be opened and the trees spread out in the trench before being covered with soil. Peach trees properly heeled-in should pass the winter safely.

If the field is not ready for planting when the trees arrive from the nursery in the spring, the trees should be heeled-in to make certain that they will not dry before planting. It is not advisable to plant peach trees in the fall in Michigan.

LAYING OUT THE ORCHARD

In the past, Michigan peach orchards were commonly planted on the square system with the trees 20 feet apart and cultivated both ways. The continued use of this method caused great loss of soil by erosion.

The contour system of planting was then advocated to reduce soil erosion. However, few orchards in Michigan are now planted on contours. The spraying problem was too great because the winding rows made it impossible to gauge wind direction accurately. This resulted in the operator being frequently drenched with spray, and good coverage of the trees was often not obtained.

Most Michigan peach orchards are now planted approximately 24 feet x 18 feet. The wider distance one way makes all orchard operations easier. There is some interest now in the so-called hedge system of planting where the trees are planted 24 feet x 12 feet. This requires more trees per acre but advantages include (1) larger yields in the early years and at comparatively small added expense; (2) increased production per acre; and, (3) as trees gradually die out, a good stand is left for later years production.

Interplanting

Years ago it was rather a common practice in Michigan to plant peach and apple trees together. The reasons for this practice have been: (1) to obtain an earlier income than could be obtained from the apple trees alone; and, (2) to have a permanent apple orchard on the land after the shorter-lived peach trees were removed. There have been two serious disadvantages of this method of planting: (1) the spraying program for each fruit is so conflicting that considerable loss and damage has frequently occurred, and, (2) many of the choicest peach sites in the state are now occupied by apple orchards. Very often fruit growers wish that these sites were available for peaches, but hesitate to remove mature apple orchards already there. If peach and apple trees are to be planted together, it probably would be best to do so only on sites that are essentially apple sites. Choice peach sites should be retained for peaches.

Planting

Planting should be done as early in the spring as the soil can be prepared. Early planting is desirable because it gives the trees more time to become established before early droughts occur.

Care should be used to prevent the roots from becoming dry before planting. It is a good policy to have the roots actually moist when the tree is planted because the soil adheres to them at once, which is beneficial.

The bruised ends of the roots should be trimmed before planting, and all broken and discolored roots should be removed.

If the soil is rather light, the addition of soil, well supplied with organic matter, in the tree hole, will be beneficial. However, peat should not be used alone but should be mixed at least half and half with the soil present in the field. Fertilizer should not be placed in the tree holes because trees can be killed by this practice. The use of liquid fertilizer starter solutions in the tree holes has sometimes given poor results. It is better to apply a small amount of fertilizer in a band around the tree about two weeks after planting, if needed. However, if the soil is reasonably fertile, no fertilizer should be used the first season.

The tree should be planted deep enough so that the bud union is about 2 inches below the surface of the soil. Trees are often planted either too shallow or too deep. To prevent the roots from drying after planting, the soil should be well firmed about the roots during the planting operation. Care should be used to work the soil under the crown to avoid leaving an air space. Shaking the tree up and down two or three times during the planting process helps distribute the soil around the roots.

Usually, sufficient rainfall occurs in Michigan following the planting season to insure enough moisture for the young trees. However, a few instances are on record where lack of rainfall at that time has resulted in newly planted trees dying or being greatly stunted in growth the first year. If exceptionally dry weather prevails following planting, or if the soil is dry at planting, young trees should be watered.

Replanting

Immediate replanting of peaches on land that has just grown peaches may give poor results. A soil building program for a year or more is necessary before replanting. Rye, Sudan grass, or other "fibrous" crops should be grown and plowed down to help increase organic matter for the new orchard. In some orchards, where nematodes have been a problem, it may be necessary to treat the soil with a fumigant before replanting. If a soil building program is not possible, it is well to bring in new, fertile soil to place in the tree hole when replanting trees.

TRAINING THE YOUNG TREE

Training the young tree correctly is one of the most important operations in peach growing. A correctly trained tree will usually live several years longer. It will be more resistant to severe injury to the trunk and lower portions of the main scaffold limbs, and it will carry heavy loads of fruit with less breakage than the poorly trained tree.

The peach tree is naturally inclined to form an open-center. This type of tree was accepted by early peach growers, and usually the young tree was

headed at from 18 to 30 inches above the ground, depending on whether the grower believed in low or high-headed trees, and from three to five scaffold limbs were allowed to develop near the top of the trunk.

In later years, the modified-leader method of training young peach trees was advocated in some places. Years of trial with this method in Michigan demonstrated that it is a difficult system for most growers to use, and it frequently results in developing a tree having serious structural weaknesses. It is not recommended as a method of training peach trees in this state.

Open-Center Method

Height to Head the Trunk. There is some difference of opinion among peach growers regarding the height to head the tree. Heights vary from about 18 to 36 inches.

Lower-headed trees have the most advantages. They are easier to prune, thin and harvest. High-headed trees carrying a crop are more susceptible to injury from strong winds. More trunk area is exposed to the sun in the winter, which results in more of what is known as "southwest injury." The bark is often severely damaged from the effects of alternating high temperatures in the day and freezing temperatures at night. High-headed trees are more likely to sway in the wind causing openings to form between the trunk and the soil. Water accumulates in these openings in the fall and winter. Ice formation in these openings can seriously damage the trunk. All trees, however, should be headed high enough to permit necessary cultural management (cultivation, etc.) under the trees, Figure 2.

Selection and Pruning of Scaffold Limbs. Experience indicates that not more than three main scaffold limbs should be allowed to remain in the tree permanently. Excess scaffolds should be removed in the spring of the second year, and again in the third and even later. Do not allow excess scaffolds to remain in the tree two or three years and then remove them. The resulting pruning cuts will be too large to heal properly. *Remove excess scaffolds each year.* It is likewise important to remove all growth from the trunk below the scaffolds and from the crotch area of the scaffolds to reduce possible points of breakage or other injury and subsequent entrance of peach canker. It is also important to leave an open area (between two scaffolds) toward the prevailing wind to avoid upward bending of a major scaffold by the wind.

The three scaffolds selected should have wide angles with the trunk at the point of attachment, Figure 3. This is very important. Scaffolds having

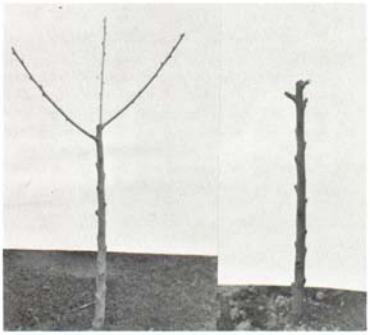

Figure 2. Trees pruned when planting, to be trained by the three-scaffold, open-center method. If three branches of equal size can be found close together, they can be retained and cut back to 10 or 12 inches as shown at left. Often three branches cannot be found at a desirable height of 18 to 24 inches. In this case it is best to cut back the branches present to short stubs, being careful not to cut away the basal buds next to the trunk (shown at right). Shoots developing from these buds can be selected for scaffold branches.

Figure 3. Trees can best be trained to three-scaffold open center when the three branches originate close together but on nearly opposite sides of the trunk. Three such scaffolds will form a knot-like head of great strength. Pruning should be as light as possible during the first two or three years, but the scaffolds should be kept in balance by doing the most pruning on the most vigorous scaffold branches.

Figure 4. Scaffolds selected should be far enough apart that they will not grow together in later years, causing "bark inclusion" pressures and splitting. Top picture shows ideal scaffold spacing of 6-year old tree (face down view). Bottom is similar aged tree with narrow "angled" branches which grew together causing splitting and providing for easy entrance of peach canker disease (note darkened areas of canker infection).

Figure 5. Above: A 13-year-old Elberta tree developed by the three-scaffold method of training. This tree continued to produce fruit at the height of its bearing capacity for about 12 years after this photograph was taken. Below: The result of too many scaffolds causing crowding and narrow angles. This tree was producing profitably for only about 8 years compared to about 22 years for the one shown above.

sharp angles at this point split off the trunk easily. Also, bark and wood unite poorly in this narrow area, making them very susceptible to injury from low temperatures, and the entrance of canker-forming organisms.

The three scaffolds selected should be far enough apart so that they will not grow together later, Figures 4 and 5. They should be especially well spaced around the trunk. If scaffolds touch each other, a sharp angle is formed. The bark does not knit properly in this area and cankers are likely to develop.

It is better to have two wide-angled scaffold branches than three which may grow together in the future, Figures 6 and 7. And, either two or three scaffolds are much preferred to more than three.

The length to leave the scaffolds at the time the tree is planted will depend upon their size and uniformity. If they are large and uniform in size they can be left 10 to 12 inches in length. If they are rather slender and uneven in size, it would be better to cut them off to short stubs an inch or two long. New shoots will develop from the basal buds and

Figure 6. This 5-year-old tree has strong, "sound" trunk and scaffold branches. However, narrow areas where scaffolds arise will ultimately grow together causing injury and splitting.

three of these, well distributed around the head of the trunk, can be selected the next spring for the main scaffold limbs.

Some advocate summer training young trees in the first and second years by removing unwanted shoots. This is a questionable practice since it removes leaves that will contribute to the tree's growth and proper maturity. However, pinching out the terminals of unwanted shoots in early summer will assist in proper early training. It is recommended that correct pruning be done in the spring of the second and third years. It is too late to do corrective pruning in later years.

Side-Leader Method

Often, for various reasons, newly planted peach trees fail to develop more than one good shoot. Some growers consider such trees as practically worthless and will replace them the first spring, if not too late, or will pull them out with the idea of planting another tree in the same location the next spring. By using the side-leader method of training, these trees can be developed into some of the best in the orchard.*

To train the young tree by this method, one branch is selected, at the desired height for the head, which is as nearly horizontal in direction as possible and has a wide angle at the point of attachment with the

The side-leader method, as used in Michigan, was developed and very successfully used by W. W. Teichman, a peach grower living near Eau Claire, Michigan.

Figure 7. A wide-angled two-scaffolded tree (top photo) is much preferred to three scaffolds which may crowd in future years (bottom photo). Also a two-scaffold tree is better than one with four or more scaffolds.

trunk. This branch is headed back to 10 or 12 inches in length and all of the remaining branches are removed, Figure 8. It is considered better if the branch selected is on the side opposite the prevailing winds. If it is known beforehand that this method is to be used, a suitable branch can be selected and placed in this position during the planting operation. The reason for doing this is that the force of the prevailing winds blowing across the branch will aid in keeping it in more of a horizontal position. This will result in the scaffold branches arising from it having wide-angled unions at the point of attachment with the original side-leader.

Figure 8. A newly planted peach tree, pruned to start its training by the side-leader method (bottom). One strong lateral branch is selected that is as nearly horizontal as possible. In planting, this branch should be placed opposite the direction of the prevailing wind. Three shoots to be used as scaffold branches are allowed to develop the first season (top). Others should be removed.

Figure 9. A 4-year-old peach tree trained by the side-leader method. The scaffold branches are well-spaced and have strongly "knit" unions with the head of the trunk.

During the first season, three scaffold branches are allowed to develop from the side-leader, retaining those that have wide angles at the point of attachment. Others should be removed as they develop. The pruning given during the second and third springs is somewhat similar to that given in the regular three-scaffold method already described. The problem is primarily to keep the scaffold limbs in balance until the tree is well established. To do this it is very important to keep the terminal scaffold as the leader. This can be done by pruning the other two scaffolds sufficiently to keep them slightly smaller. If this is not done during the first three or four years, the two scaffold branches nearer the trunk will have a tendency to grow faster and strangle the terminal scaffold, leaving a two-scaffold tree. If this should happen, a strong tree is still very likely to develop.

Despite heavier pruning on the side branches, the three scaffolds will be of nearly equal size when four or five years old. This is to be desired, for the more nearly equal the three scaffolds are in size in the mature tree, the stronger the head and longer-lived the tree.

The heads formed by this method of pruning are generally very strong. Instances of defective unions at the point of attachment of the scaffolds with the original side-leader are extremely rare. Fig. 9 shows the development of this type at the end of the fourth year.

The pruning given the tree immediately after planting by this method may seem to be unusually severe.

Actually, however, it is no more severe than that given trees pruned to a whip or three short stubs, as is frequently done in the three-scaffold, open-center method. On the average, trees trained by the side-leader method should be as large as those trained by the three-scaffold method at the end of three or four years' growth.

Pruning in the Second, Third and Fourth Years

Only a light corrective pruning should be given in the second and third years.

Main scaffold branches should not be headed back if they are reasonably well in balance. If one is considerably out-growing the others, it should be headed back to bring the tree in balance.

The small wood in the lower center part of the tree, but away from the crotch area, should not be removed as it is on this wood that the first peaches will be produced. If this wood is left in the tree, it will be possible to harvest a fairly good crop of peaches the third summer. This small wood can be removed in the spring of the fourth year as it will no longer be very productive.

The light pruning recommended for the first few years of a peach tree's life is a wide departure from the method in common use years ago. Then it was thought that young trees should be pruned severely to insure the development of a strong tree. It has been shown that such a severe type of pruning does not create a stronger tree. Rather, growth is reduced, production is delayed, and the tree is kept in such a highly vegetative state that it is more susceptible to injury from low temperatures in late fall and winter.

Best Time to Prune Young Trees. Young peach trees should not be pruned in Michigan until after mid-March or early April in the more northern peach areas because the peach canker disease (Valsa) is more likely to be spread by earlier pruning.

PRUNING THE BEARING TREE

The severity of the pruning given bearing trees in Michigan should be largely determined by the number of live flower buds remaining on the trees about March 1.

If the trees at that time are carrying a high percentage of live flower buds, they should receive some heading back to prevent their growing too tall, as well as a sufficient thinning out of shoots to assist in reducing the task of fruit thinning and to insure a reasonable amount of strong new wood for the following year's crop.

If low temperatures have greatly reduced the number of live flower buds, it would be better to leave the trees unpruned, except for the removal of dead wood and broken branches, in the hope that sufficient live buds remain for at least a partial crop.

One may easily be deceived when inspecting the trees to determine the amount of bud-killing that has taken place. In some instances, growers have thought that all buds were dead and have severely cut back trees to renew the tops, only to discover later that enough live buds were present to produce at least a partial crop.

In determining the extent of injury to flower buds following low temperatures, care should be exercised to see that buds are examined from all parts of the tree, and from trees growing in all parts of the orchard.

In the past, severe cutting back of bearing peach trees following total winter-killing of flower buds

Figure 10. When pruning, always remove branches or shoots with narrow-angled crotches as they do not mature properly in the fall and therefore are subject to cold (winter) injury. Note the cold injury and Valsa canker in the narrow crotch, **lower left,** and the absence of it in the wide-angled crotch **above.**

has been a common practice. It is doubtful if such severe pruning should be done under any circumstances. The very vigorous growth sometimes resulting from such pruning is susceptible to winter injury. Many large pruning wounds are made that do not heal well and which provide entrances for wood-destroying insects and diseases. It is considered wiser to prune with moderate severity only in those years when the percentage of live buds present early in March gives promise of a full crop.

At one time it was thought that peach trees should be heavily cut back if temperatures had been sufficiently low to injure the wood. The fallacy of this belief has since been demonstrated. Such trees recover better if left virtually unpruned. The objection may be raised that peach pruning cannot be left until March because of the necessity of having the brush out of the way at least by the latter part of March, so that the dormant spray for the control of leaf-curl can be applied on time. It is suggested in this connection that fall spraying for the control of leaf curl be done, because many orchards are almost impassable late in March when the frost leaves the ground; moreover, the rush of spring work would be considerably relieved and peach pruning could continue through April, if necessary. Other tree fruits should be pruned in late fall and early winter, and the general farm work planned so that peach pruning can be left until last and then rushed through to completion. Pruning later than the blossoming season is not advised.

The usual pruning of bearing peach trees consists of a combination of heading back and thinning out. Little heading back should be necessary until the trees become too high to harvest easily, or until new terminal growth is slowing down to less than approximately 12 inches in length.

When heading back is needed in the bearing trees, the cuts should be made to a side branch in 2-or 3-year-old wood. Numerous cuts in 1-year-old wood result in a dense growth of short shoots in the top of the tree, which interferes with the best coloring of the fruits. Cutting back the tallest branches to side branches is an effective way to keep the tree from growing too high.

POWER PRUNERS AND PRUNING PLATFORMS

Bearing peach trees require considerable annual pruning. This is an expensive task and involves a lot of hard work. Careful consideration should be given to the use of power pruners. There is evidence to indicate that such equipment will speed up the pruning of bearing peach trees from 50 to 100 percent, and the work is made easier. Ladder work is eliminated and compressed air provides the energy.

Ladder work can also be eliminated to some extent by the use of a one- or two-story platform built on a truck or trailer. Men standing on either side of the platform prune one side of each of two rows as the vehicle is slowly moved between rows. Mechanically elevated platforms are also available.

Brush Removal

The removal of pruning brush from the orchard by hand is a tedious and disagreeable task. However, a tractor and brush pusher makes this task comparatively easy. The brush should be pushed into piles away from the orchard and burned to help get rid of sources of disease infection and insects.

The brush chopper is a very useful implement around the farm, but it should not be used to chop brush in the peach orchard. The chopped pieces left in the soil provide innumerable sources of infection for such diseases as brown rot and peach canker, and provide a hibernating place for some insects.

Helping Trees Carry a Heavy Crop

Peach trees frequently carry such a heavy crop that severe breakage of limbs and splitting of trunks occur.

Proper training, pruning and fruit thinning will reduce breakage to a minimum. However, further measures often must be taken to protect the trees from serious damage.

The use of wooden props is effective but involves considerable work and expense. Often they are not easy to obtain. A considerable amount of labor is required to move them into the orchard, put them in place and remove them after the harvest. While in place they interfere with some orchard operations.

Braces made of heavy grape trellis wire stretching to opposite branches and fastened by means of large screw eyes have been used by many growers. Large bolts have also been placed through trunks to hold them together. Much work and expense are involved, however, in putting in the screw eyes and bolts. Also, severe gumming frequently occurs where the screws and bolts are inserted.

Some peach growers have been getting good results wrapping two or more strands of binder twine or nylon-type strapping around the outside of the tree at about its center, or a little above. This should be done before the branches pull down with the weight of the crop. This is an easy and economical method of supporting the loaded tree.

Wrapping galvanized steel strapping around the tree is practiced in some western states. The strapping is three-quarters of an inch wide, and is commonly used to place around boxes and bales to strengthen them for shipment. This method is not recommended for Michigan where peach canker is more of a problem than in western states. The strapping is likely to injure the bark sufficiently to permit the entrance of the peach canker fungus.

SOIL MANAGEMENT

Peach orchard soil management should be aimed at (1) reducing weed and grass growth under the trees early in the season to allow good tree growth, (2) promoting sufficient cover growth late in the season to compete with the tree for soil moisture and provide winter cover*, (3) maintaining soil tilth through renewal of organic matter, and (4) preventing soil erosion.

Clean cultivation was the major soil management system of past years. Where used carefully and moderately, it is still a good practice. But, no more cultivation should be done than is necessary to obtain practical control of weeds and grass and to partially incorporate cover crops into the soil. Trashy cultivation is much better than clean cultivation. Excessive cultivation depletes organic matter, increases erosion, and is expensive.

Cultivation should be done early enough in the spring to prevent cover growth from competing excessively with the trees for moisture and nutrients. Whether this is before or after bloom depends on differences between orchards, year to year variation, and on individual grower preferences. It has been shown, however, that orchards on firmed, bare ground may have higher temperatures during still nights of freezing spring temperatures than neighboring areas located on freshly cultivated soil or on soil with heavy covers. Freshly cultivated soil and heavy cover growths act as insulators which prevent the absorption and radiation of heat in and out of the soil. Thus, if cultivation is to be done to prevent possible cold injury, it should be done early enough to allow the soil to be settled by spring rains well before the blossoming season.

Cultivation should always be across the slope, rather than up and down, to aid in preventing loss of soil by erosion. Young orchards, especially if planted on good soil and growing vigorously, do not need to be cultivated as late in the season as bearing orchards. It is advisable to stop cultivating young peach trees by at least the middle of July to prevent excessive or late growth which would render the tree more susceptible to cold injury. Cultivation of bearing trees should be continued late enough to prevent weed growth from affecting fruit size. In dry years, this may be until harvest. The best time to plant a cover crop is when cultivation is stopped.

In many young orchards only a strip along the rows, or an area around the trees, need be kept free of weeds. The centers can be planted to cover crops to be disked under, thereby helping to build up the soil.

Cover crops, when properly grown, help supply organic matter, and provide soil cover to prevent erosion and protect tree roots from deep soil freezing. The most common "annual" cover is rye. Among its advantages are: (1) it will develop a good stand even in a mature orchard with considerable shading, (2) the seed will often remain in the soil during a long period of dry hot weather and germinate later in the season when moisture is available, (3) growth made by rye does not seriously compete with the trees for moisture during the year it is sown, (4) it lives over winter, and (5) it is easily killed by disking in the spring. The principle objection to its use has been the failure of growers to disk it under early enough in the spring to prevent excessive competition with the trees for moisture and nutrients.

Some growers like to use wheat instead of rye because wheat does not grow as rapidly in the spring and can be disked under more readily before it competes with the trees. Vetch or buckwheat has been used in combination with rye, but both grow very little before the time to be disked under. Sudan grass, or a mixture including Sudan, will make more growth than rye if planted early. But a heavy Sudan grass growth may compete too much with young trees unless it is mowed once or twice. Also, in a bearing orchard it may compete with the developing peach crop and be such a nuisance at harvest time that it will have to be mowed.

Another good cover crop mixture is three parts of oats and one part perennial rye grass, planted at 30 to 35 pounds per acre. The oats grow fast in late summer and fall and then are killed out over winter. The perennial rye grows more slowly and thus does not compete for moisture as much in dry springs as some other covers.

Occasionally, weed seeds are so prevalent in orchard soils that a satisfactory cover crop can be obtained by simply ceasing cultivation and allowing the weeds to grow. However, the weed growth in

In Michigan peach-growing areas, the prevention of winter injury is a problem of first importance and the peach grower must keep it constantly in mind in all of his cultural operations. (See low temperature injury, page 18).

most orchards is not uniform. The places in which the weeds do not grow are generally those most deficient in organic matter.

Sod covers are usually not suggested for peach orchards unless the trees are heavily mulched or irrigated. Deep rooted perennials, legumes (alfalfa and clover) or quackgrass may seriously compete with the trees for moisture and nutrients. However, sod strips of dense, relatively shallow-rooted grasses such as blue grass or Chewings fescue, provide a very effective cover for easy movement of equipment and erosion control. Grass strips should be mowed two or more times during the season to prevent annual weeds from taking over and to reduce moisture transpiration.

Mulching, when possible, is a very desirable orchard practice. It controls erosion, provides nutrients and organic matter, increases potassium availability, improves soil structure and tilth, increases water penetration and moisture availability, and helps control weeds. Disadvantages of mulching are: (1) excessive amount of labor to apply mulch, (2) added danger of mice, (3) danger of fire in mulched orchards, and (4) scarcity of mulching material. Peach trees do well when mulched with straw, hay or similar materials. Enough should be applied to cover the area under the tree spread to a depth of 4 to 5 inches. If clean, non-spoiled mulch material is used, extra nitrogen fertilizer will be needed during the first year to assist in initial decomposition of the mulch. After that, the amount of nitrogen needed may become less than used on non-mulched trees, sometimes by half or more. Mulches of alfalfa or other legumes may release more nitrogen than is needed, particularly late in the season, thus resulting in too much late growth of the trees.

Irrigation has been found by many growers in Michigan to be beneficial for peaches. A readily available supply of soil moisture throughout the growing season is needed for optimum tree growth, fruit development, and flower bud initiation to develop the next year's crop. In many years, natural rainfall does not provide enough soil moisture, particularly late in the season, to insure optimum fruit size. Irrigation of peaches for 2 to 4 weeks prior to harvest has increased fruit size up to 40 percent. It has not been demonstrated conclusively, however, that an irrigation system for peaches alone will always justify the costs of installation. But, if a grower has irrigation available for strawberries or other crops, he should consider using it on the peaches.

Chemical Weed Control. The use of chemicals for controlling weeds in orchards has become an established practice for many growers. Chemical weed control has several advantages over tree hoeing or cultivation, including the following: (1) it does not disturb the soil or roots of the tree, (2) it is relatively inexpensive and easy to apply, and (3) applications need be made only once each year, and often only every second year.

On the other hand, there are several problems with chemical weed control which reduces its potential effectiveness for peaches. These include (1) lack of adequate materials, (2) increase of weeds hard to control, (3) improper application resulting in injury, and (4) adjustment to other cultural management practices.

There are good chemicals which will provide excellent weed control, without tree injury, when properly applied. Specific suggestions regarding chemicals, rates and time of applications are contained in Extension Bul. E-433, Chemical Weed Control for Horticultural Crops.

A specific herbicide sprayer is needed for effective weed control. It should have (1) a low pressure system to operate at 20 to 60 pounds per square inch (psi), (2) a low pressure gauge, (3) mechanical or pressure agitation, (4) a carefully constructed boom, and (5) flat fan nozzles. Other features such as quick-action shut-off valves, etc., are helpful. In addition to good equipment, herbicide chemicals must be applied at the right rate and in the right manner. The highest suggested rates may be used on moderate to heavy soils which have heavy quackgrass or weed growth. On light sandy soils, however, tree injury can occur unless the rates are reduced by half or more. Even lower rates should be used where weeds have been controlled for a year or more.

Some chemicals, such as simazine, may result in a nitrogen-like stimulation of peach trees in addition to controlling the weeds. If this occurs and the trees grow more vigorously than desired, growers should reduce the amount of nitrogen applied to bring growth down to a desired limit. It has not been demonstrated that herbicide chemicals alone will result in enough stimulation to cause cold injury.

A common concern about chemical weed control is the complete elimination of weed or grass cover growth under the trees. Completely bare soil going into the winter might expose the trees to possible deep soil freezing and root injury. In some areas or years where there is little snow cover, this may be a serious problem. However, complete weed elimination is not necessary for satisfactory weed control. As experience is gained with chemical weed control, individual growers should be able to manipulate the chemicals used, rates applied, and other cultural

practices so that some cover growth will be present under the trees in late summer and fall.

FERTILIZERS

Nitrogen is the most important nutrient in fruit production and is usually the only fertilizer element that should be applied annually to Michigan peach orchards. Trees need sufficient nitrogen to insure optimum growth and production. Too little may result in low yields, poor fruit size, and excessive cold injury. But too much may result in excessive growth, poor fruit color, and excessive cold injury.

The amount of nitrogen to be applied to a peach tree should be based on the previous growth and performance of the tree. Young peach trees should not make more than 18 to 24 inches of new terminal growth annually; 12 inches is sufficient to maintain mature trees in good vigor and full production. Leaf analysis is also an aid in determining nitrogen needs of fruit trees and for making necessary adjustments in the fertilizer program.

It is difficult to suggest a definite amount of nitrogen fertilizer to apply to a peach orchard. Usually, tree growth is not uniform so, where possible, it is best to make individual tree applications. In general, a mature bearing tree will need about one pound of actual nitrogen per year. Nitrogen should be applied in late fall after leaf drop, or before growth starts in the spring. The kind of nitrogen to use should be chosen on the basis of cost of actual nitrogen and ease of application. Ammonium nitrate is the most commonly used. Other nitrogen sources provide responses equal to ammounium nitrate when used in quantities to provide an equal amount of nitrogen. However, *urea should not be used because it will frequently injure peach trees.*

Potassium is the only nutrient element, other than nitrogen, that is frequently deficient in Michigan peach orchards. Potassium deficiency reduces tree growth, yields and fruit quality. The leaves of trees with this deficiency are smaller than normal with chlorotic or "burned" margins. And, the leaves may be rolled and crinkled on the edges. The best way to determine a need for potassium before the trees reach a deficient condition is through leaf analysis. Potassium in the form of potash (K_2O) may be applied in the spring or fall. Orchards low in potassium may need up to 100 pounds of K_2O per acre, but this amount can be applied in relatively large amounts every 3 to 5 years. The most common potassium fertilizer is muriate of potash (60 percent K_2O). Other sources appear to give equal responses and selection should be based on cost.

Potassium deficiency can be brought about by the excessive use of lime when soil potassium is low. Thus, lime as dolomitic lime should be applied to Michigan peach orchards only when magnesium is needed rather than as a general practice.

Phosphorus is utilized in only small amounts by fruit trees as compared to either nitrogen or potassium. No direct benefits have been observed from applying phosphorus to peach trees in Michigan.

In rare cases, however, fertilizers containing phosphorus may benefit cover growth. Superphosphates or complete fertilizers are suggested for this purpose. Do not apply rock phosphate.

Manganese deficiency has occurred in Michigan peach orchards in which the soils had high pH or had been over-limed. Trees with manganese deficiency have leaves with chlorosis between the secondary veins. The condition can be temporarily corrected by applying sprays of manganese sulfate (2 pounds per 100 gallons) at times of the first and second cover sprays.

No other minor elements are deficient in Michigan peach orchards and none should be commonly included in the fertilizer programs. Leaf analysis should be used to diagnose suspected nutrient shortages prior to application.

Foliar sprays of urea or other materials containing nitrogen, phosphorus, or potassium have not been found useful for peaches. In fact, with peaches, they often cause injury and are usually prohibitive in cost.

PEACH THINNING

The buying public wants large (2¼ inches in diameter or larger) peaches. The smaller fruits, which were so commonly grown and sold a decade or two ago, have no place in today's markets. Unless flower buds have been killed or injured by winter or spring cold, the normal bearing peach tree will usually set many more fruits than can be matured to a size of 2¼ inches or larger. Thinning is one of the major production costs, but it is also one of the most important practices, not only to improve the size and quality of the fruit, but also to reduce branch breakage and to keep the trees vigorous and productive. Unthinned, overloaded trees become weakened and thus are more subject to cold injury than trees producing moderate crops.

Removing excess fruit on a given branch increases the leaf area per fruit, thus supplying the remaining peaches with a larger amount of food materials and producing larger size and higher quality. Removal of too many peach fruits by thinning may reduce the total yield of the tree. But, the remaining fruits usually will increase in size and quality enough to make greater financial returns. Only 190 peaches of 2¼-inch size are required to fill a bushel, whereas it takes 380 peaches of 2-inch size to fill a bushel.

In addition, large fruits (2¼ inches and up) often can be sold for $.50 to $1.00 per bushel more than small fruits of 2 inches in diameter or less.

Amount of Thinning

The amount of thinning the tree should have depends on other cultural factors which influence the tree's vigor and ability to produce. Some of the thinning may have been done by moderate or heavy pruning. This is particularly true if the tree has had detailed pruning with careful attention to the removal and spacing of fruiting branches or twigs. If the tree has been lightly pruned or not pruned at all, much heavier fruit thinning is needed. In general, thinning should take into account the tree condition, past yields and future performance. Thinning should be tied, if possible, to the leaf surface on the tree. About 50 leaves per fruit are needed for development of good size and proper quality. The leaf area does not always need to be adjacent to the peach. The sides and tops of most peach trees can carry many more fruits than the bottom inside areas of the tree. Thus, the whole tree should be considered rather than the simple removal and spacing of fruits on individual twigs or branches. In the case of freeze damage, lower areas of a tree may not have any fruits; therefore, the upper areas may be left with more fruits than when no freeze damage occurred.

The amount of thinning also depends on the variety. Such varieties as Redskin, Sunhaven and Redhaven need more thinning and better spacing of the fruits than such varieties as Richhaven and Elberta.

Hand Thinning

Probably the best method of thinning peaches is by hand. This is the only way by which the fruits can be spaced at a standard distance, (usually 6 to 8 inches) and all unwanted fruits can be individually removed. However, hand thinning is laborious, monotonous, and expensive (often $50-$80 per acre). In many areas, labor costs and availability for hand thinning are almost prohibitive. Therefore, many other methods have been sought to reduce the amount of labor required.

Mechanical Thinning Aids

Various kinds of poles and rubber hose attachments have been used in recent years for thinning peaches. The labor cost is usually about half that of hand thinning alone. The peaches are knocked off by striking the branches a short distance below the fruit clusters. Pole thinning has worked well on varieties maturing in mid-season or later. It has been most effective where the poles were used to take off the bulk of the fruit quickly, after which hand thinners followed up to finish the trees. Hand blossom thinning has been done successfully for early varieties. The thinning is done when most of the blossoms are in the balloon stage, at which time they break off easily and the thinning operation can be done rather quickly. A faster but not as accurate method of blossom thinning is the use of brush brooms. These may be simply branches or lawn type wire brush rakes.

Mechanical Shaking

With the advent of mechanical tree shakers for harvesting cherries, a number of research workers and growers have been trying shakers to thin their peaches. This type of thinning can be done very quickly with little use of labor, about 1/10 that required for hand thinning. The shakers have done a fair job alone, but some hand follow-up after the shakers has been needed for good thinning. A serious question regarding the extensive use of shakers for thinning peaches, however, is the injury caused to the scaffold branches by the shaker attachments. Unless the shaker injury can be reduced considerably, it is questionable whether the shaking operations will be feasible year after year, because of increased peach canker infection in injured areas. Perhaps improvements in claws and clamps on various shaking devices may reduce or eliminate the injury.

Chemical Thinning

Experiments have been conducted for many years with various types of chemical thinners. Results with these materials have been variable. Some years, good thinning has been obtained and other years little thinning occurred. Also, there is always the hazard of excessive thinning by chemicals. At the present time, no reliable chemicals are available for thinning peaches in Michigan. Some growers are using DN compounds in early bloom, but results differ so greatly from one orchard to another and from year to year that they cannot be suggested generally.

N-1-naphthylphthalamic acid, sold as Peach-Thin 322 and Nip-A-Thin, has been tried experimentally and by growers in Michigan. This chemical has performed very erratically under Michigan conditions and cannot be suggested for thinning peaches except on a trial basis.

INSECT AND DISEASE CONTROL

A coordinated program including good cultural management, orchard sanitation, and a carefully prepared pesticide schedule is essential for effective control of the many disease and insect pests that attack peach trees. The major insects of peaches in Michigan include oriental fruit moth, plum curculio,

lesser peach borer, regular peach borer, and the tarnished and other plant bugs. The major peach diseases are peach leaf curl, brown rot, peach scab, and peach canker (Valsa). Other troublesome diseases on some varieties include bacterial spot and several virus diseases.

Adequate descriptions and control measures of insects and diseases are beyond the scope of this publication. Therefore, the following publications of the Michigan Cooperative Extension Service are suggested for detailed information on disease and insect control:

Extension Bulletin 154, Fruit Spraying Calendar
Extension Bulletin 372, Fruit Insects of Michigan
Extension Bulletin 361, Tree Fruit Diseases in Michigan

INJURY CAUSED BY LOW TEMPERATURES

The importance of injury from low temperatures as a factor in peach growing was again brought to the attention of Michigan and midwestern peach growers with stunning suddenness during the night of November 24, 1950.

A new record for November cold was set with temperatures ranging from 10 to 19 degrees below zero throughout the major part of the western Michigan fruit-growing area. Most peach flower buds were killed and extensive damage to trees occurred.

Cold injury, sometimes called winter injury, might be described as injury to wood and dormant flower buds by low temperature, as compared with "frost" injury which is usually restricted to opening flower buds or blossoms. Cold (winter) injury, however, is a broad term, and injury of this type may occur in the fall or spring. In fact, one of the greatest peach tree kills on record was the freeze of October 10, 1906, when very late maturing peaches were still on the trees.

The results of cold injury are very apparent — even spectacular — when a peach crop is lost because all the flower buds are killed, or the trees themselves virtually killed, by one extreme drop in temperature. Of almost equal importance, though less noticeable, are the minor injuries in the tree which provide an entrance for the peach borer and the destructive peach canker disease, which, working together, considerably shorten the life of the tree. Spring frosts can be destructive, but seldom cause serious damage in Michigan peach orchards in comparison to peach-growing areas farther south.

Injury to peaches from low temperatures cannot be avoided entirely, but it can be reduced considerably by following these suggestions:

1. Commercial peach orchards should not be planted in those parts of the state where the temperature drops to −13° F. more often than 15 percent of a long period of years.

2. Choose a site that has good elevation above the surrounding country. Some exceptions may be made in the most favorable areas very near to Lake Michigan. However, in this case, orchards on higher elevations usually are injured less than those on lower elevations. Moderately fertile, well-drained soils are preferred. Exceptionally fertile soils are likely to be hazardous because of the danger of the trees growing too late into the fall. Such soils should receive a minimum of nitrogen fertilizer and cultivation.

3. Choose varieties that are hardiest in flower bud and wood.

4. Train young trees very carefully. *Do not leave more than three main scaffold limbs.* Overcrowding of main scaffolds will result in serious injury in the head of the tree from low temperatures. Avoid severe, heavy pruning of trees at any age.

Figure 11. Two peach flower buds with a leaf bud in the center. The flower bud at the right was killed by winter cold, while the one at the left was injured very slightly but not enough to prevent its development.

5. Be very careful in the use of nitrogen fertilizers. Too much nitrogen will cause the trees to grow excessively and too late, making them susceptible to injury from low temperatures, especially those occurring in the fall or early winter. Young trees making 18 to 24 inches of terminal growth annually and having foliage of good color are making enough growth for safety. The same can be said for bearing trees making about 12 inches of terminal growth. However, trees actually deficient in nitrogen are subject to severe injury or death from low temperatures. Moderation in tree growth is the best policy.

6. If cultivation is used, begin early and stop early (late June or early July) in young orchards, or in orchards not producing a crop because of winter-killing of flower buds or other reasons. Mature orchards bearing a crop will usually need to be cultivated longer (about the first or middle of August). These orchards can be cultivated longer without much danger of the trees not maturing properly before winter.

7. Sow a cover crop at the time of the last cultivation. Avoid leaving the ground bare around the tree. To do so might result in very serious root injury from low temperatures during the winter.

8. Fill any depressions in the soil around the base of the tree before November 1 to prevent the accumulation of water and ice around the trunk.

9. Peach trees carrying a heavy crop should be well thinned, not only to insure having a high percentage of fruits of 2¼ inches and larger in size, but to conserve the vitality of the tree and to permit it to enter the winter in good condition.

10. If certain diseases and insects, (for example, leaf-curl and borers) are not controlled, their attacks will greatly weaken the tree and render it more susceptible to winter injury.

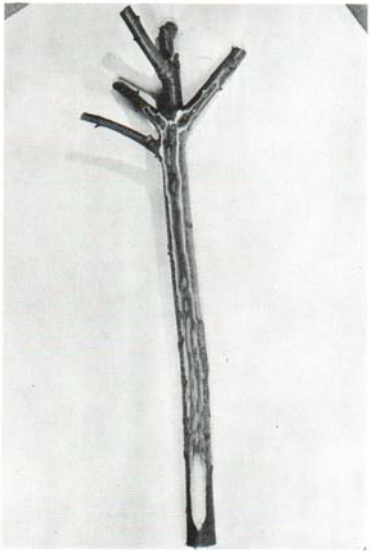

Figure 12. Two-year-old peach tree showing severe cold injury above the snow line. Lower three inches of trunk was protected by snow. It is doubtful if a tree injured this severely will live. New shoots may develop just below the injured area, and a new tree trained from one of them.

Care of Trees Severely Injured by Low Temperatures

Sometimes temperatures drop so low in fall and winter that severe injury to the wood of peach trees occurs. Injured wood will show discoloration. Slightly injured wood will be light brown or amber. Severely injured wood will be very dark, almost black. (Fig. 13). Suggestions for handling severely injured trees are as follows:

1. Delay pruning until growth starts. Then remove only dead wood. Make no large pruning cuts.
2. Do not use oil sprays on injured trees.
3. Apply nitrogen fertilizer before growth starts.
4. Protect foliage from diseases and insects. Do not omit the leaf-curl spray. Protect young trees against cutworms.
5 Give trees good cultural treatment. Keep weeds away from young trees.
6. If bark splits, tack it down at once and paint with tree paint. Dead areas should be cleaned out and covered with tree paint.
7. Do not be hasty in removing injured trees. Give them good care and see what they can do for themselves.

Black-Hearted Nursery Stock

Nursery stock not properly stored or well heeled-in at the time an extremely low temperature occurs is likely to be black-hearted. Such nursery stock should not be planted. Examine nursery stock carefully before accepting or planting.

PEACH HARVESTING AND HANDLING

Probably no other fruit is so often picked and sold immature as is the peach. A peach that is fully mature, well-ripened, juicy, and flavorful is truly the "Queen" of fruits, but those that are picked too early

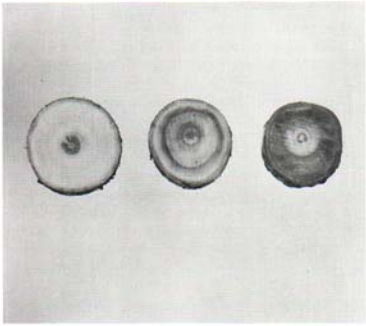

Figure 13. Cross-sections of one-year-old peach trees showing varying degrees of cold injury. Left: very slight injury. Center: moderate injury. Right: severe injury.

never develop good appearance or flavor, nor instill the desire for more. Harvesting peaches early, with the hope of high prices and good profit, too often leads to depressed prices later because of markets loaded with immature fruit.

When to Pick

"Mature" and "ripe" are often used interchangeably but these words actually describe distinct and separate processes. Maturity involves fullness of growth and completeness of development. The enlargement of cells and accumulation of carbohydrates and other materials that influence the ultimate quality of the peach occur only while the fruit is on the tree. Ripening, which takes place after the fruit is mature, involves softening and development of juiciness and flavor. This may occur before or after the fruit is removed from the tree.

The best way to tell when a peach approaches maturity is to watch the ground color (skin undercolor). For commercial shipping, peaches should be picked when the ground color begins turning from green to yellow. Such a "firm-ripe" peach can be held for several days while moving to market and still develop full flavor and quality. "Tree-ripe" peaches are those that have developed full color, softness, and juiciness on the tree and are ready for immediate eating or processing.

They are best suited for orchard sales or local market. All peaches do not mature and ripen at the same time; therefore, trees should be picked over three or more times. Each time only the largest and most mature are taken; the others are left to gain size and color. Many experiments have shown that peaches will increase in size from 20 to 40 percent during the week preceding optimum picking maturity. Studies have shown also that fruit harvested at optimum maturity will hold up in transit or storage just as long as immature fruit.

Picking and Hauling

Peaches should be picked, handled, and hauled as carefully as eggs. Picking containers should be rigid and shallow. The best kind are those that hold about ½ bushel and can be unstrapped from the picker and hauled directly to the packing house without dumping. Pickers should be taught to pick the fruit by the "cushions" of the hands and fingers, not the finger tips, and to place, not drop, the peach into the picking container. Hauling from the orchard should be done just as carefully.

Bulk Harvesting and Handling

Several fruits are being handled in bulk boxes from the orchard to the packing house, and their use has several advantages over smaller containers. Bulk boxes are well suited for cling peaches going to processing; however, their use for freestone peaches going to fresh market is not recommended.

Packing, Storage, and Marketing

It is not the purpose of this publication to detail methods of packing, storage or marketing. These are specialized functions apart from growing. Only a few general aspects are included herein.

In keeping with the present day trend to specialization, a large share of Michigan peaches are now handled through specialized sales organizations. Most growers, as individuals, cannot keep abreast of all the complexities of present day marketing. In addition, large buyers demand larger volumes than most individual growers can supply. The need for large volume sales has resulted in vastly increased investments in grading and storage facilities. Peach packages have likewise changed from the old ring-faced bushel basket to cell-packed containers of various sizes. The use of refrigerated storage, hydro-coolers, and refrigerated vans have increased greatly in the marketing of peaches.

Many growers, however, still pack and sell their own fruit. There will always be good demand for high quality peaches grown and sold in many local areas, at the orchard, in roadside markets, or through other outlets which do not demand large volumes. Many growers will continue to sell their peaches through various produce markets such as Benton Harbor.

"Pick-your-own" peaches could be greatly expanded, particularly near large centers of population. The most commonly expressed fear against allowing customers to pick their own fruit is that, "they will break the trees down." This has not proven to be true for those who have opened their orchards for self-picking. In fact, they have found that most people who will come out to pick their own fruit are very careful and considerate. Peaches are ideally suited for "pick-your-own" because the customer can select his own peaches on the tree. In so doing, he picks only fruits which are large, well colored, and essentially tree-ripe. Thus, he gets fruits of the highest quality and will probably come back for more. In turn, the grower does not have to furnish containers nor pay to have the fruit picked. In addition, since the tree is picked over several times, the smaller, immature fruits are left to grow for a later picking.

Processing of peaches is increasing each year in Michigan, yet the importance of the processing market is sometimes overlooked. Several of the freestone varieties, in addition to the clings, are well suited for canning or freezing. The processing market is not a "dump" market. Processors must have fruit of good size and good quality to insure quality processed products. Peach growers should become well-acquainted with local processors and their needs.

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