

UNIVERSITY OF TENNESSEE

Agricultural Experiment Station

BULLETIN

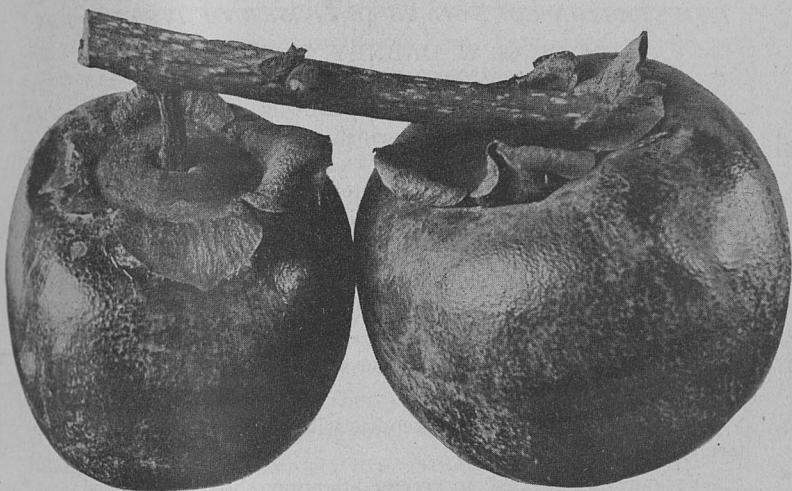


Fig 2.

ZENJI.

VOL. XI.

APRIL, 1899.

No. 1.

PERSIMMONS.

KNOXVILLE, TENN.
THE UNIVERSITY PRESS
1899

THE AGRICULTURAL EXPERIMENT STATION

OF THE UNIVERSITY OF TENNESSEE.

CHAS. W. DABNEY, *President.*

EXECUTIVE COMMITTEE.

O. P. TEMPLE.
JAMES MAYNARD.

T. F. P. ALLISON.
HUGH G. KYLE.

TREASURER:
JAMES COMFORT.

SECRETARY:
J. W. GAUT.

THE STATION COUNCIL IS COMPOSED OF ITS OFFICERS:

DR. CHAS. W. DABNEY, President.
CHAS. F. VANDERFORD, Secretary.
R. L. WATTS, Horticulturist.
J. B. McBRYDE, Chemist.
S. M. BAIN, Botanist.
C. E. CHAMBLISS, Entomologist.
F. H. BROOME, Librarian.
J. L. SPINKS, Farm Manager.

The Station has facilities for analyzing and testing fertilizers, cattle foods, milk and dairy products; seeds with reference to their purity or germinating power; for identifying grasses and weeds, and studying forage plants; for investigating the diseases of fruits and fruit trees, grains and other useful plants.

The Station Bulletins and Reports will be sent, free of charge, to any farmer within the State.

Packages by express, to receive attention, should be prepaid.

All communications should be addressed to the
SECRETARY OF THE

AGRICULTURAL EXPERIMENT STATION,

Knoxville, Tennessee.

 The Experiment Station building, containing its offices, laboratories and museum, and the plant-house and horticultural department, are located on the University grounds, fifteen minutes walk from the Custom House in Knoxville. The Experiment farm, stables, milk laboratory, etc., are located one mile west of the University, on the Kingston pike. Farmers are cordially invited to visit the buildings and experimental grounds.

Bulletins of this Station will be sent, upon application, free of charge, to any Farmer in the State.

PERSIMMONS.

R. L. Watts.

INTRODUCTION.

In 1895, the attention of the horticulturist was called to a few specimens of Japanese persimmons that had been grown at Pickle, Knox County, Tennessee. As this fruit is generally cultivated at a much lower altitude and latitude, he was surprised to find such excellent specimens of East Tennessee production. This was the beginning of an investigation the results of which are published in the following pages. In the study of Japanese persimmons it was found that many people are interested in the American persimmon; hence a few notes are given concerning its culture.

Acknowledgments are due to many friends for valuable service rendered in furnishing fruits of nearly all the varieties of Japanese persimmons cultivated in the United States and also important data. We are especially indebted to the following persons:

T. C. Schnicke, Pickle, Tenn.; W. G. Jones, Athens, Tenn.; Prosper J. Berckmans, Augusta, Ga.; G. L. Taber, Glen St. Mary, Fla.; Prof. H. N. Starnes, Athens, Ga.; Prof. James M. Troop, Lafayette, Ind.; Prof. P. H. Rolfs, Lake City, Fla.; Prof. F. H. Burnette, Baton Rouge, La.; Prof. R. H. Price, College Station, Texas; J. F. Wilson, Poulan, Ga.; Smith Bros., Concord, Ga.; E. S. Hubbard, Federal Point, Fla.; B. W. Stone, Thomasville, Ga.; W. R. Speir, Orlando, Fla.; E. O. Painter, DeLand, Fla.; and W. A. Yates, Brenham, Texas.

THE AMERICAN PERSIMMON.

Distribution in the United States.

The American persimmon is common in the natural flora of all the Southern and most of the Western States. It is frequently found in the Southern parts of Illinois, Indiana, Ohio, and Pennsylvania. The tree is said to be entirely hardy at least fifty miles north of New York City, but it thrives best in a warmer climate.

Several improved varieties have been originated in Indiana,

showing that the climate of that latitude is well adapted to its growth. It is probably most abundant in those States bordering on the Gulf of Mexico. Native persimmons are exceedingly plentiful, however, in each of the three political divisions of this State, and Tennessee persimmons are doubtless equal in quality to those of any other section of the country.

BOTANICAL CHARACTERS.

The American persimmon or American date plum (*Diospyros Virginiana*, L.) belongs to the order Ebenaceae. The genus *Diospyros* contains about 150 species, the fruits of which vary in size from a small cherry to a large apple. All of the wild fruits are astringent in the green state, but several of them when well ripened are pleasant to the taste and are esteemed for their food value. Three species are valued for cultivation in the United States, namely, *Diospyros Virginiana*; *Diospyros Texana*, which is grown in Texas; and the Japanese persimmon, *Diospyros Kaki*.

Trees of the American persimmon are generally of small size, not often exceeding forty feet in height. When grown in the forest and crowded by other trees they sometimes attain a height of sixty or more feet, with a trunk diameter of two or three feet. The wood is dark in color, hard and very close grained, but it soon decays when placed in the soil or exposed to the weather.

The leaves are simple, alternate, ovate-oblong, entire, smooth or nearly so, varying greatly in size; peduncles short and downy. The flowers are borne singly or in small clusters; calyx, 4-parted; corolla, tubular or bell-shaped, usually pale yellow; styles, 4-lobed at apex; ovary, 8-celled; usually eight stamens in fertile bowers and sixteen in sterile.

Prof. James Troop, who has made a special study of the American persimmon, gives the following valuable information in Bulletin No. 60 of the Indiana Agricultural Experiment Station regarding the fertility of the flowers: "The opinion held by some that a male or non-bearing tree is needed to fertilize the blossoms of the fruitful tree is erroneous; both sterile and fertile flowers appear on the fertile tree. Occasionally, however, trees are found which do not bear fertile flowers and, of course, are worthless so far as the production of fruit is concerned. These trees, however, produce more honey, or nectar, than the fertile

ones, as shown by the much greater number of honey-bees which visit these in comparison with the fertile trees. This is one of the compensations which nature has provided to insure the proper fertilization of the pistillate flowers, for the bees in visiting the staminate flowers for pollen and honey become dusted with the pollen which is transferred to the fertile flowers during the course of their rambles."

The fruits of the American persimmon vary greatly. Some

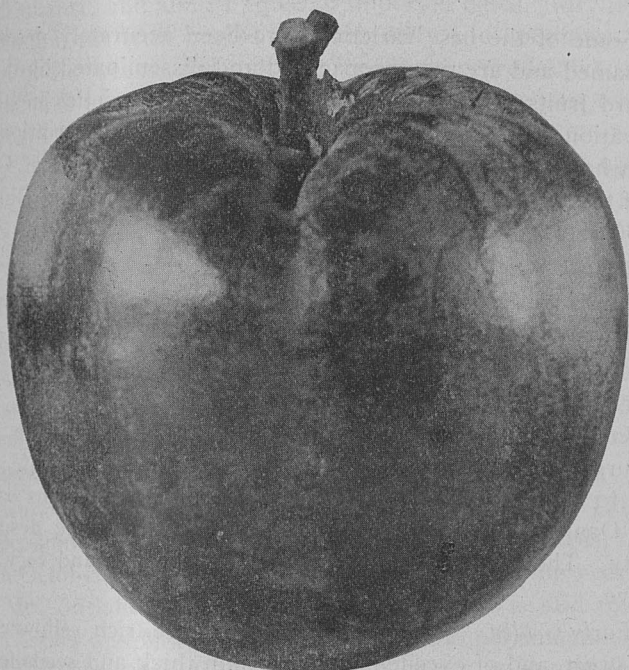


Fig. 1.

HIYAKUME.

trees yield specimens which are edible the first of September and do not require frost to complete the ripening process. Others are very late in ripening and are not palatable before December.

There is a marked difference in the size. The fruits of some trees are very small, while others attain a diameter of an inch and a half or two inches. Some persimmons are highly astringent, and frost and sunshine have little effect in removing this un-

pleasant quality. Fortunately, there are varieties which are less astringent and are also sweeter and better flavored.

It should be stated in this connection that there are usually four to eight seeds in each fruit, but the number varies widely. Several seedless varieties are mentioned by Prof. Troop. These are generally smaller than the seeded specimens, although one from Floyd County, Indiana, measured three-fourths of an inch to an inch in diameter.

VARIETIES.

Some of the best varieties have been accurately described and named and are now propagated and disseminated like other orchard fruits. There are a dozen or more varieties in actual cultivation, including those mentioned below, descriptions of which have been taken from reports of the Pomological Division of the United States Department of Agriculture and Bulletin No. 60 of the Indiana Experiment Station.

Daniel Boone. The fruit is roundish oblate; yellow, with a dull blush in the sun. Skin rather tough and seeds numerous. Quality good, though not so rich as some other varieties. Season, October and November. Tree handsome, productive, and a vigorous grower, with very large, thick leaves.

Early Bearing. This was introduced by James Little, Cartersburg, Hendricks County, Indiana. Fruit, round-ovate; medium to large; dull yellow and of good quality. Ripens earlier than Daniel Boone, and, though smaller, is a more desirable variety. The tree is a good grower, early bearer, and very productive.

Early Golden. Oblong, medium to large, rich yellow color, very sweet, and of excellent quality; skin thick and seeds few in number. Ripens in September without frost. Twigs and under side of leaves covered with whitish down. Tree productive and handsome. Introduced from Illinois.

Golden Gem. Roundish or slightly oblong; medium to large in size; color dark red orange to red; seeds few; flesh soft, very sweet and rich; free from astringency even if picked before fully ripe. Commences to ripen about the last of August and continues till October. This variety was brought to notice by Mr. Logan Martin, of Borden, Indiana, who found the original tree on his farm 35 years ago. He has propagated from this by budding and now has more than 300 trees, including top-worked wild

and young trees growing in the nursery. He reports that the persimmon pays him better than any other fruit.

Hicks, synonym *Superior*. Originated by E. H. Trueblood, Indiana. A choice native variety, the trees of which have been propagated and their fruit marketed locally for many years. Size medium; color dull, grayish red; seeds somewhat numerous, of medium size; flavor sweet and rich, free from astringency when fully ripe; very good. Specimens of the fruit of this variety, dried in the shade without sugar, were found to be of excellent quality, and almost equal to imported dates. Mr. Hicks reports that the fruit begins ripening early and continues for a period of six weeks, and that the tree is very productive. The original tree has not failed to fruit annually for the past twenty-five years.

Kemper. We have not ascertained the history of this variety, but learned from a report of the Division of Pomology, United States Department of Agriculture, that it was originated in Tennessee and is one of the best varieties thus far named and introduced.

Kansas. This was introduced from Missouri. The fruit is roundish, slightly oblate; rather large; splashed with red on yellow ground; flesh tender, rich, and highly flavored. Season, September. The tree is productive and is very handsome in general appearance.

Marion. Originated by Samuel Miller, Missouri. This native persimmon is a large, handsome fruit, with few seeds, ripening in October. The original tree was found growing near Fulton, Mo., on land owned by J. H. Marion and is said to have larger leaves and blossoms than the common persimmon.

Shoto. This variety was introduced by A. C. Chambers, Danville, Hendricks County, Indiana. The fruit is oblong-ovate, slightly conical; large to very large; color dull yellow, with blush in the sun; rather tough skin and few seeds; quality, very good. Season, October. Tree, an early bearer, productive, and a vigorous grower. The original tree began bearing at three years of age.

Smeech. Fruit, roundish-oblate; medium size; dull yellow, with red splashes; superior quality, being very rich and sweet. Tree, a good grower and productive. Introduced from Pennsylvania.

IMPROVEMENT OF VARIETIES.

Bulletin No. 60 of the Indiana Experiment Station asserts that the fruits of early ripening varieties have sold for from \$6.00 to \$8.00 per bushel in large cities. Mr. R. L. Martin, of Borden, Indiana, reports to the United States Department of Agriculture that the persimmon pays him better than any other fruit. The trees bear annual crops which find ready market in Chicago and Indianapolis at \$1.00 to \$1.50 per twelve pint case, shipped by express. As high as \$2.00 has been received for special cases. Mr. Martin states that fifteen to twenty-five gallons is an average yield per annum of a well grown tree.

These high prices and the demand for first-class persimmons have been an incentive for the improvement of the best types found in the wild state. Some progress has been made in this direction and it is hoped that systematic work will be continued. This would doubtless result in the production of varieties superior to those now in cultivation.

The persimmon does not reproduce all the fruiting characteristics of the tree from which it has been taken. One hundred seeds picked from the same tree and planted under like conditions will produce as many trees, each one of which will differ more or less from every other in tree and fruit. The fruit from one seedling may be roundish, that from another oblong; one will ripen early and another late; the seeds will be few in some and numerous in others; there will also be considerable difference in quality, astringency, etc. This tendency to vary so widely renders it possible to effect marked improvements in the quality of the fruit by selection and cross fertilization.

We should have earlier ripening varieties. A persimmon one-third larger in size than any thus far introduced would be a valuable acquisition. The numerous large seeds found in most persimmons are objectionable; and one purpose in creating new varieties should be to reduce the number of seeds. A seedless variety comparatively free from astringency, as large as some of the Japanese class and ripening before the advent of frost in most sections of the South, would be one of the most valuable fruits that have ever been introduced.

SOIL AND LOCATION.

A light, well drained soil is best adapted to the culture of the American persimmon. This fruit does well, however, in a

great variety of soils. Some of the largest trees in this State are growing in rather heavy clay lands, but soils of a less compact nature and of good natural drainage are doubtless preferable for the production of first-class fruit. Although the persimmon is most frequently seen on poor soils, it grows, of course, more vigorously on fertile lands.

We do not believe that fruit of the largest size and best quality can be produced on soils deficient in plant food. A large

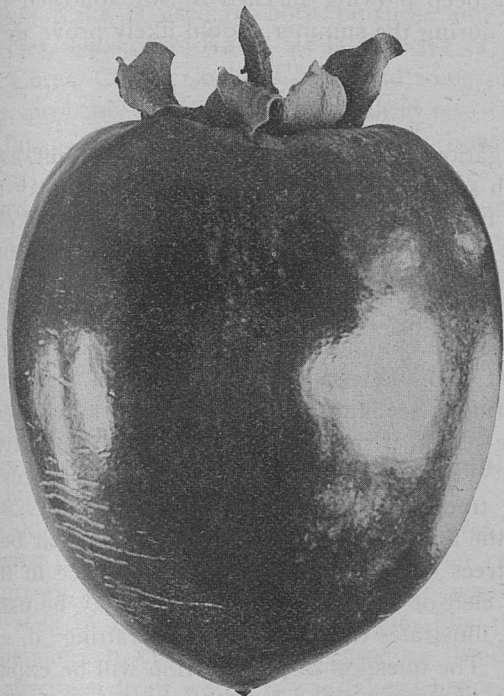


Fig 3.

TSURU.

supply of nitrogenous matter in the soil is not necessary for the best development of tree and fruit, but a liberal supply of phosphoric acid, and particularly potash, is essential to secure the best results. It is highly probable that those who engage in persimmon culture in the future will find it just as important to use commercial fertilizers in the production of persimmons as in growing any other fruit.

CULTIVATION

The trees should be cultivated until they are several years old and it is likely that tillage during the entire life would give the best results. Cultivators in Indiana have found it impossible to obtain choice fruit without frequently stirring the soil during the growing season. As the persimmon has a long tap root and is naturally a deep rooter, there should be little or no trouble in using almost any kind of implement in cultivating the orchard. Moderately deep plowing in early spring followed by frequent harrowing during the summer, would likely prove most satisfactory.

PROPAGATION.

Propagation is readily effected from seeds, but, as previously stated, each seed produces a new variety which may be superior to the fruit from which it has been taken, or, more likely, inferior; hence it is impossible to secure trees of uniform productiveness and fruit of uniform quality without resorting to budding or grafting.

The method commonly employed is to gather large, plump seeds, treat them as peach pits during the winter and plant in early spring. Seedlings from these will attain a height of two feet in one season if they are given the proper cultivation and attention. Winter root grafting has not been successful; hence the young trees are left in the ground two years and crown-grafted in the nursery row in the spring. For their best development the trees should be given plenty of space in the nursery. Either the cleft or splice form of grafting may be used. Fig. 7, a, b, and c, illustrates the splice form of grafting; d, e, and f, the cleft form. The question of propagation will be explained more fully in the discussion of the Japanese persimmon.

Hundreds of farmers have old persimmon trees which produce fruit of little or no value. These may be readily converted into profitable trees by grafting them with scions from improved varieties. Too much care cannot be exercised in selecting sorts to be used. Nearly every community has one or more trees which produce fruit much superior to that produced by others in the vicinity. Scions from these may be used, or probably it would be better to secure wood of the leading varieties described in this Bulletin. Those who have had experience in top-working old persimmon trees assert that they may be

grafted as easily as old apple trees. The scions should be inserted in young, vigorous wood. If there is no thrifty wood on the tree, remove some of the branches, thus inducing the sending out of new, vigorous shoots which may be grafted the following year, and cut away all surplus shoots at the time of grafting.

THE JAPANESE PERSIMMON. IN FOREIGN COUNTRIES.

The term Kaki, is used by both Japanese and Americans for this species, *Diospyros Kaki*. It is a native of Japan, but is found in Corea, China, Cochín-China, and some parts of the East Indies, probably having been introduced into these countries from Japan. There is considerable doubt, however, about this point, as the varieties found in China and Corea are said to be more hardy than those of Japan. Japanese persimmon trees are conspicuous in the landscape of the Island Empire. The trees are plentiful in the native flora and they have been largely planted in cultivated grounds. The people of Japan regard the persimmon as their most valuable fruit. No tree in their gardens is more admired than the persimmon with its large, broad, glossy leaves and handsome crimson or golden fruit. The Japanese have not made a mistake by giving this fruit such high rank simply as an article of food, since chemical analyses show that it has a high nutritive value.

The Kaki has been improved by the Japanese until it is much superior to the wild fruit. A large number of seedlings have been grown and the best ones retained for general cultivation. The seed of the Japanese persimmon, like that of the American persimmon, does not fully reproduce the characteristics of the specimen from which it was taken; hence, many varieties have arisen, the fruits of which vary more or less in every particular. It is these same varieties of Japanese origin, excepting a few of American production, that are cultivated in the United States.

IN THE UNITED STATES.

The first attempt to introduce Japanese persimmons into the United States was made in 1863 by the Department of Agriculture. Seeds of the best varieties grown in Japan were imported and planted in the experimental gardens at Washington. The next winter proved too severe for the young trees and all

were destroyed by freezing. Another importation was made the following year and the trees were again frozen. About ten years later the Department imported a large number of trees instead of seeds and distributed these through the Southern States. Rev. Henry Loomis, of San Francisco, also received a large importation about the same time, and his trees are widely disseminated. *The American Fruit Culturist* says concerning the work of Mr. Loomis: "His circulars, with descriptions and brilliantly colored full-sized illustrations of several varieties, astonished and fascinated fruit growers, inciting them to try this, the most interesting pomological novelty ever brought forward." Additional importations have been made from time to time by the Department of Agriculture, mainly under the direction of Prof. H. E. Van Deman, formerly chief of the Division of Pomology. Since the first importation of trees nurserymen have been propagating and disseminating the best varieties, and the Japanese persimmon is now grown, perhaps, in every state in the South.

The Kaki is most largely cultivated in Florida, Texas, and California, although none of the plantations are extensive. In fact, we have learned of no orchards that are more than a few acres in extent. The largest orchard of which we have any knowledge is in Texas. This plantation contains 2,000 trees, which are planted so close together that the area occupied is not large. The bulk of the persimmon crop in the United States is grown for home use rather than for market.

It is probably correct to say that the Kaki thrives best in Florida and California. The trees grow and fruit well, not only along the Pacific coast, but also in the interior of Florida. All of the Gulf and South Atlantic States yield fruit of large size and fine quality.

IN TENNESSEE.

It is gratifying to the fruit growers of Tennessee to learn that the Kaki is successful in this State. Although the number of trees grown here is small, the results secured are positive and justify the conclusion that satisfactory crops from the Japanese persimmon in East Tennessee, if not in the entire state, are just as certain as from apples, peaches, or other orchard fruits set in this climate.

A special study has been made of two plantations in Tennessee, one owned by Mr. W. G. Jones, Athens, McMinn County, and the other by Mr. T. C. Schnicke, Pickle, Knox County, the

latter place being ten miles above Knoxville on the French Broad River. Mr. Jones has over fifty trees, about a dozen of which are in bearing. None of his trees are more than five or six years old from the graft, and hence the total crop each year is small. Mr. Jones harvested about ten bushels of persimmons last year and about the same quantity this season. The trees are very productive, as shown in one of the illustrations in the bulletin.

Mr. Schnicke has a much larger number of trees, but only one is old enough to produce more than a few fruits annually.

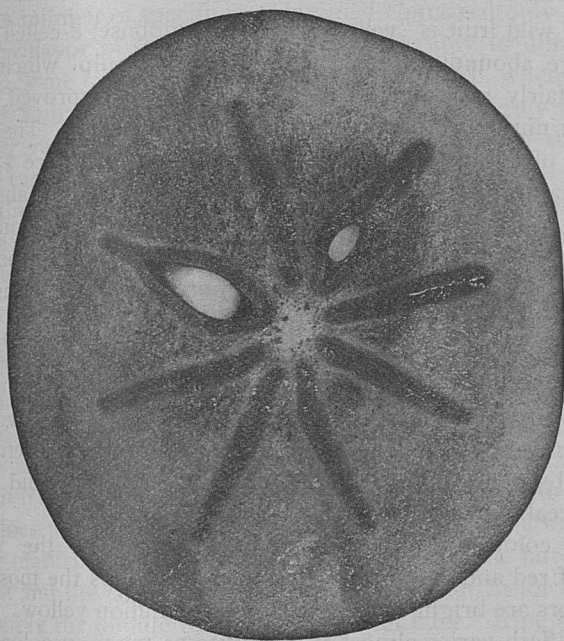


Fig 4.

HACHIYA—Transverse section.

The largest specimens grown in this State, which we have seen, were produced by Mr. Schnicke. These were equal in size to the average Florida grown persimmon, most of them weighing from five to six ounces. Figure 5 illustrates two specimens, natural size, grown by Mr. Schnicke.

BOTANICAL CHARACTERS.

The trees of the Japanese persimmon are of medium size

when grown on their own roots and in their native habitat. It is very probable that they will attain a much larger size in this country when worked on roots of the native persimmon. The leaves vary considerably in shape and size in the cultivated varieties, but are generally ovate, elliptic, acuminate, elliptic-oblong, or obovate, cordate at the base, paler underneath, downy on both sides, entire, varying in length from three to eight inches. The flowers are inconspicuous, whitish green; the peduncles are usually three flowered. The flowers are complete but all varieties are not equally self fertile.

The wild fruit is "yellow when ripe, globose, 8-celled, size of an orange, abounding in yellow, fleshy, edible pulp" which is considered fairly pleasant. The Kaki has been improved by the Japanese until it is much superior to the wild fruit. The size of the fruit of cultivated varieties is illustrated by Figure 1, which is the natural size. The average specimen weighs about six ounces. Some specimens examined of the Hachiya from Florida, weighed over ten ounces. By extra care single specimens have been made to weigh a pound or more, which weight is rarely surpassed by the apple.

Fruits of the Japanese persimmon vary greatly in shape, being globular, oblate, oblong, or a combination of these forms.

The surface is generally smooth, although some have small, slightly raised specks, and the fruits of several varieties are marked by a network of dark lines at the blossom end caused by the breaking of the skin.

The color ranges from light yellow through the various shades of red and yellow to a dark red. Perhaps the most common colors are bright orange, red, and vermillion yellow.

The flesh varies almost if not quite as much in color as the skin, the shades frequently resembling that of the skin. A general classification is made into light and dark fleshed varieties. The fruits of some varieties have both dark and light flesh, but the two shades are always more or less distinct. The astringency of the fruit may be known to some extent by the color of the flesh. Dark fleshed specimens are rarely puckery and may be eaten and relished before they become soft, while the light fleshed types are always astringent and must soften before this peculiar quality disappears. Dark fleshed fruits are more solid and resemble somewhat the consistency of an apple. Although they may be eaten before reaching maturity, some of the dark fleshed fruits

are better after softening, while others should be eaten when still hard and crisp.

The astringency of the light fleshed class is lost in some varieties as the fruit begins to soften. Others must be fairly soft and some must become almost jelly-like before the astringency disappears. Dark fleshed varieties have seeds; those with light flesh are frequently seedless. The seeds are large and exceedingly hard, and vary in number in different specimens from the same tree. There are never more than eight seeds in a single fruit and usually less than this number, these being solitary in the cells. A number of specimens examined contained only one seed.

The flavor of the Kaki varies considerably in different varieties. Some fruits are sweeter than others. All, when properly ripened, contain sufficient sugar to make them highly palatable, but they vary widely in juiciness. The Tsuru when sufficiently ripe to eat is so soft and juicy that a spoon is required to eat it, while the Zenji contains much less juice and is more compact when at the proper stage for consumption. The Hyakume is different in consistency from either of the two varieties just named. When slightly overripe it approaches a mealy condition, but if eaten at the proper time the fruit is crisp and sufficiently juicy to be relished.

There is a general impression that frost is required to ripen the Japanese persimmon as well as the native species. This is erroneous, as nearly all of the Japanese persimmons are ripened without frost since most of the trees are grown in sections where frost does not occur until after the fruit is fully matured. The earlier maturing varieties are edible in Florida the latter part of August and the latest varieties do not yield fruit fit for consumption before the middle of October or even later. Ripe specimens are frequently picked from the same tree for a period of a month or more. This is quite an advantage to persons desiring fruits for home use, but really a disadvantage to the shipper who prefers selling in large installments. The ripening process with some varieties continues for some time after the fruit is harvested, and, if picked before affected by frost, the best varieties will remain solid until January or February. It is probable that none of the varieties will ripen in East Tennessee before the occurrence of frost.

VARIETIES.

During the fall months of 1898 we studied fruits represent-

ing every variety described in the reports of the Department of Agriculture and nearly all the varieties mentioned in the catalogues of nurserymen who make a specialty of propagating the Japanese persimmon. It is not necessary to describe all the sorts examined; hence, our notes will be confined to a few typical varieties which are commonly grown.

Costata. Fruit medium size, conical, pointed, somewhat quadrangular; longitudinal diameter two and one-half inches and transverse diameter two and three-fourths inches; surface smooth, salmon-yellow, rarely cracked; flesh light yellow; seeds few; astringent until ripe, when it is of excellent quality. It ripens late and is valued for its keeping qualities. The tree is upright in habit, a strong grower, producing broad, roundish leaves. A prominent grower considers it the most ornamental of all the varieties.

Hachiya. The largest specimens studied were of this variety. Some weighed over ten ounces, which is quite a common weight for this sort. Prof. Van Deman reports rare specimens that weighed twenty ounces. These fruits had an average longitudinal diameter of three and three-fourths inches and a transverse diameter of three and one-fourth inches. The skin is dark, bright red with spots or blotches, and rings occasionally at the apex; flesh deep yellow, astringent until fully ripe; seeds few. (See Fig. 4.)

Hiyakume. Large to very large; shape varies from roundish oblate to roundish oblong; oblong. Specimens from the same tree are extremely variable in shape. Skin buffish yellow, generally marked with lines or veins at the apex; flesh yellowish, crisp, of excellent quality. It ripens late and is a good keeper. A leading market variety. (See Fig. 1.)

Tsuru. Medium to large; the fruits or their seedlings are the most elongated in proportion to size of all the varieties in cultivation. Skin bright red, smooth and very little tendency to crack; flesh almost as brilliant in color as the skin, astringent until very soft when the quality is superior. It is very late in ripening. (See Fig. 3).

Tane-nashi. Fruit medium to large; form conical, pointed, very symmetrical; stem cavity usually deep; skin very smooth and tender, light yellow, changing to bright red at full maturity; flesh tender, melting, clear orange yellow, quality very fine. This

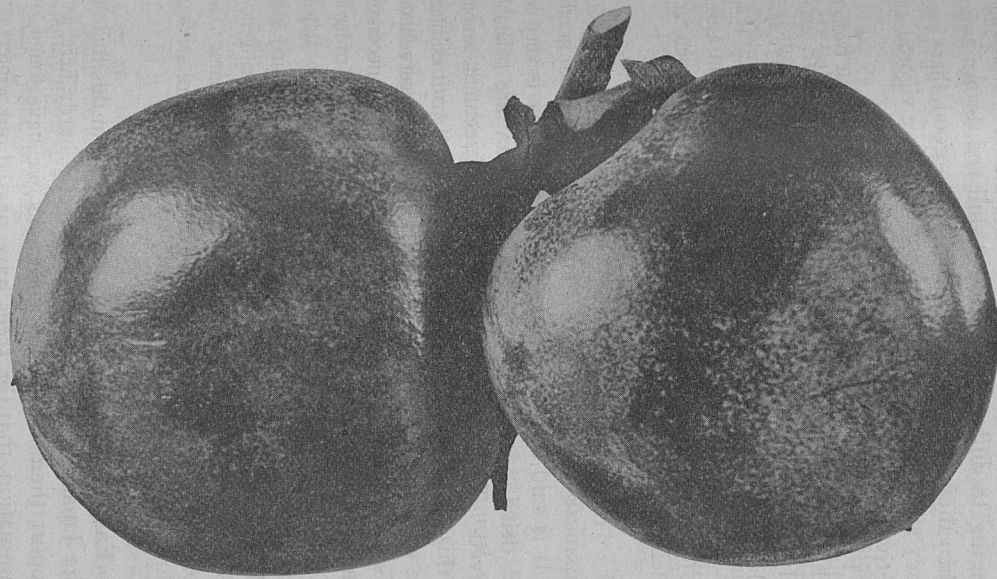


Fig 5.

JAPANESE PERSIMMONS, GROWN IN EAST TENNESSEE.
Natural Size.

is considered one of the best for drying and the making of marmalade.

Yemon. One of the most extensively grown varieties. The fruit is large, rather oblate, somewhat quadrangular; skin light yellow changing to dull red; flesh deep dull red, brown around the seeds when they are present. Quality very good, there being no astringency after the fruit begins to soften. Tree vigorous and very productive.

Zenji. Fruit small, transverse diameter being about two and one-half inches; varies from distinctly oblong to globular, sometimes slightly depressed at the apex; flesh rather stringy, dark, with black dots and white fibers which show when the fruit is cut transversely. Generally quite seedy; the flesh is seldom astringent. Quality good. It is one of the earliest to ripen, and this is its chief value. (See Fig. 2.)

USES OF THE FRUIT.

The Japanese persimmon is generally consumed in the fresh state. It is said that the fruit of some varieties is very delicious when dried. It is also claimed that they are palatable when preserved. There is, however, not an agreement among growers on this latter point, for one very practical fruit culturist informed the writer that the attempt of his wife to preserve thoroughly ripe specimens was entirely unsuccessful. It is necessary to be familiar with the fruits of the different varieties in order to know when they should be consumed. As previously stated, some are edible when still hard, while others must be fairly soft, and some almost mushy before they are free from astringency. When served on the table they are delicious with cream. The more solid varieties may be sliced like tomatoes before serving.

HARDINESS.

The two East Tennessee growers referred to in this Bulletin claim that the Japanese persimmon is perfectly hardy here, and we must support them in their position, as we have found, by repeated examination, that the trees have passed our winters uninjured. Mr. W. G. Jones, of Athens, Tennessee, states that his trees were not damaged at all by the freeze of 1894, which was destructive to the small twigs of the native forest trees, including the maple.

From information regarding the hardiness of this fruit in different States of the South, we conclude that the Kaki is fully

as hardy in East Tennessee as in sections farther South, where the trees sometimes succumb to severe winter weather. The autumn weather of East Tennessee seems to be more favorable to the proper ripening of the wood than some sections at a lower latitude, or the soils and locations of the East Tennessee plantations produce wood which is more resistant to freezing.

PROPAGATION.

The Japanese persimmon may be readily propagated from seeds, but this method cannot be used when it is desired to reproduce the characteristics of the fruit from which the seed has been taken; hence seeds are used only for the creation of new varieties. A few seedlings of American origin equal and even surpass some varieties introduced from Japan.

Budding is sometimes employed, but this method has not been so successful as grafting. In Fig. 7, g shows a method of crown budding used with fair success by Mr. T. C. Schnicke. It is not desirable, however, to resort to budding, as grafting gives far better results.

The cleft and splice forms of grafting have been most satisfactory. A union of the scion and stock is most certain when the operation is performed in early spring before the buds have swollen to any considerable extent. In Fig. 7, d shows the cleft form when used with a root of the American persimmon. In Fig. 7, f represents the stock. It may be any size from three-eighths of an inch to two inches in diameter. The wood should also be in a healthy state.

The stock is prepared by cutting it off squarely and smoothly with a sharp saw, then with a grafting knife the stub is split to the depth of nearly two inches. The wedge, which is an essential part of most grafting knives, is inserted in the split previously made and the two halves of the stub are separated sufficiently to admit the scion. A section of the scion is shown by e, Fig. 7, and the upper part of d, Fig. 7, shows the entire scion with two buds. Some propagators use scions with three or even four buds. The scions should be cut close above the upper bud and the lower end then dressed into the form of a wedge. This should be done with a sharp knife and if possible with one single draw cut on each side. The scion is inserted in the stock with the lower bud on the outer side of the cleft and just above the wedge portion of the stock. This side of the scion should be slightly thicker than the inner side so the stock will hold it securely in

place with the cambium layer of each part in close contact. The cambium layer is the green growing tissue lying between the bark and the wood, and it is important that this layer of the scion should come into close contact with the same tissue in the stock. After placing the scion in the cleft, carefully remove the wedge of the knife. When this method is used in working stocks exposed to the air it is best to cover all wounds with grafting wax. This may be made by using, by weight, four parts of resin, two parts of bees-wax and one part of tallow. These materials should be broken up finely and melted together. After they are thoroughly melted pour the liquid into a vessel of cold water. When the mixture becomes sufficiently hard, it should be pulled or worked until it toughens. While grafting, it is necessary for the operator to use grease on his hands to prevent the wax from sticking to them. When cleft grafting is used on the crown of seedlings under ground, wax is not necessary. In this case the top of the stock is bound with cotton twine or raffia, as indicated by d, Fig. 7. This is used to hold the scion securely in place. The tying material decays by the time the scion and stock have united.

Splice grafting is also employed sometimes by nurserymen in working seedling roots. The method is illustrated by a, b, and c, in Fig. 7. As the cleft form is more simple and probably just as satisfactory, we recommend it to amateurs in preference to splice grafting.

Most of Mr. Schnicke's work has been done in an old field containing many small persimmon trees ranging in age from one to three years. Mr. Schnicke prefers grafting two year old trees. He almost invariably uses the cleft form, grafting the crown of the tree three or four feet from the ground. Fig. 8 represents a young tree which grew from a scion inserted in the spring of 1898. As the photograph was made last fall it represents one season's growth. When worked upon these young trees a very vigorous growth is secured. The total length of the graft shown in Fig 8 is slightly over six feet. Fig. 9 shows another tree grafted by Mr. Schnicke which has made two years' growth from a crown graft on the American persimmon.

While Mr. Schnicke has confined his work to trees ranging in age from one to three years, Mr. W. G. Jones, of Athens, has top grafted trees from three to ten or more years of age. Fig. 10 shows a tree worked by Mr. Jones which is four years old from the graft, and at the time it was photographed the tree was



Fig 6.

JAPANESE PERSIMMONS GROWN IN TENNESSEE.
One-third Natural Size.

and other Southern States in which the persimmon is most extensively grown, it will probably pay to use commercial fertilizers, especially in the form of potash and phosphoric acid. Judging from the heavy foliage of trees grown in naturally poor land we should conclude that the use of nitrogen is rarely if ever necessary. It is believed that too much nitrogen is one cause of the fruit sometimes dropping prematurely.

CULTIVATION.

The majority of growers in the Southern States recommend thorough cultivation during the summer season, contending that the persimmon responds to this kind of treatment as well as any other fruit. Two or three persons, however, discourage cultivation, claiming that it causes premature dropping of the fruit. As summer tillage is, without doubt, necessary for the best results with all other fruits, and as the majority of the most successful growers practice frequent cultivation, it is proper to conclude that this operation is desirable on most, if not all, persimmon plantations. The dropping of the fruit referred to was probably due to other causes.

TRANSPLANTING.

Persimmon trees are more difficult to transplant than other orchard fruits on account of the long tap roots. In digging young trees care must be exercised not to cut off too much of the tap roots, for this is quite certain to result in the death of the trees. It is best to transplant the trees before the tap root has attained any considerable size. It is safest to use trees not more than one or two years old.

Soil intended for persimmons should be plowed deeply, using a sub-soiler if possible. The holes for the reception of the trees should be deep enough to allow a foot or more of loose soil below the lower end of the tap root. If the trees have been grown in this climate and are well hardened, fall planting will give the best results. If the trees are received from a more Southern nursery it will be safer to get them in the spring and plant as soon as possible after their arrival. As we do not know what size the trees will attain in this climate it is impossible to make safe recommendations concerning the proper distance between the trees in the orchard. It is likely that twenty-five or thirty feet between the trees would give them plenty of room during their entire existence.



Fig 8.

One year's growth from crown graft on native Persimmon.

PRUNING AND THINNING.

Trees of the Japanese persimmon do not require much pruning. It is simply necessary to remove dead limbs and those which interfere with the growth of others, and to cut back the leading branches so that a symmetrical head is formed. Mr. W. A. Yates, of Texas, who has two thousand trees, recommends cutting back the previous season's growth one-half, and the training of low pyramidal heads.

Thinning is an essential operation when a considerable quantity of the fruit does not drop prematurely. The Japanese persimmon is exceedingly productive and thinning is important for the following reasons: First, to secure larger and finer fruits. It would be unreasonable to expect each one of the numerous fruits found on some trees to attain a large size. Second, to promote longevity. A prominent grower of Florida believes that overbearing kills sixty per cent. of all the trees in the South that die from various causes. Third, to secure annual crops of uniform proportion. A tree which overbears one year is not in condition to yield even a fair crop the following year. Thinning should be deferred until the fruit is at least one inch in diameter. Removing the surplus specimens at this time will not result in overthinning as premature dropping generally occurs before the fruit has attained the size mentioned. Thinning is especially important for very young trees.

HARVESTING, STORING AND MARKETING.

In this latitude probably none of the Japanese persimmons will ripen before the advent of frost. As the keeping power of the fruit is injured by frost it is important to pick the fruit before its occurrence. Care should be exercised not to bruise the specimens in handling. After harvesting, store the fruits in a cool, well ventilated, moderately moist place where they will ripen gradually.

Persimmons should never be marketed until fully ripe, for if the consumer secures an unripe specimen with considerable astringency, it is not likely that he will make another purchase unless he understands the real merits of this fruit. When the grower becomes familiar with the fruit of the varieties which he cultivates he should experience no difficulty in ascertaining when each specimen is ready to market without sampling it.

COMMERCIAL ASPECT.

Japanese persimmons are sold in Southern cities, in local markets where they are grown, and in a few Northern cities. Mr. W. G. Jones disposes of his crop in Athens at twenty-five cents per dozen. Mr. W. A. Yates, of Texas, has received from \$1.50 to \$2.50 per bushel. The best specimens sell in New York at fifty to eighty cents per dozen. Very small specimens from Florida sell on the Knoxville market for twenty-five cents per dozen. With these prices the Japanese persimmon should be profitable, especially if the grower can deliver the fruit himself to a local market.

Mr. Yates regards it as a paying crop. He says: "Last year's supply was equal to the demand, but this year I have more orders than I can fill. There are many people in the United States who have never seen a Japanese persimmon, and when it is better known and the people understand how to handle it and when to eat it, the demand will doubtless be greater."

Mr. W. F. Mally, another intelligent fruit grower of Texas, writes: "The demand in Texas has never been supplied. If the fruit were put up in some manufactured form so it could be sold along with other preserved and canned fruits, there would be very extensive sales and an almost unlimited market."

In this State there is little demand, but if the people fully understood the real value of the fruit the demand would doubtless be much greater. Mr. Jones, of Athens, sells in the market at that place, all he produces at the price named above, and could sell many more.

We received many specimens for examination last fall and had enough to pass among our friends, who almost without exception pronounced them most delicious. Doubtless these people and others would gladly pay liberal prices for such fruit could it be secured on our markets. So the question of profitability depends largely upon the demand, and it rests with the grower to a very great extent to create this demand.

IN THE HOME GARDEN.

Perhaps the most valuable use for the Japanese persimmon in Tennessee will be in the home garden. Although it may not prove profitable as a commercial crop, there is no doubt of its value for planting on the home grounds for adornment and to supply fruit for the family. None of the orchard fruits are more

beautiful than a well-formed Japanese persimmon tree laden with golden or crimson fruits. If the fruits are not at first liked a taste for them can soon be cultivated, after which they will be sought as eagerly as pears or apples.



Fig 9.

Two year's growth from crown graft on native Persimmon.



Fig 10.

Four year's growth from crown graft on native Persimmon.

NOTES ON THE CHEMISTRY OF THE PERSIMMON.

By J. B. McBryde.

With the exception of some six analyses by the Indiana Station, and one estimation of sugar by the California Station, the Station literature of this country shows nothing bearing on the chemistry of the persimmon. The attention that this fruit is attracting from fruit growers fully justifies some attention from the agricultural chemist, but it seems that along with most other fruits it has been neglected.

We present in the following pages a few analyses of both the cultivated—Japanese graft—and wild persimmon; the samples having been kindly furnished us by the Horticultural Department. These analyses were undertaken primarily to show the sugar content; limited material prevented us from making more complete analyses than those here recorded.

The analytical methods were substantially as follows: The larger varieties after being weighed were sliced up and a portion quickly weighed off for analysis. This portion was thoroughly pulped up with water in a porcelain mortar and made up to a definite volume—500^{cc}. In this solution the sugars and acids were determined. For the estimation of sugar one of the "official methods" was used, and the acid was determined by titrating against tenth normal alkali, using phenolphthalein as the indicator. The remaining portion of the fruit, after drying for several days at a temperature sufficient to prevent fermentation, served for the determination of water, ash, and nitrogen. The wild fruit was treated in a similar manner, the pulp from a number of berries being used for analysis. The proportion of seed was determined in a separate portion, about two dozen berries being used for each determination.

The first five analyses in Table I are of cultivated varieties—Japanese grafts on native stock—No. 5 having been grown by Mr. W. G. Jones, near Athens, Tennessee. The other four samples were grown in Florida and Georgia. Of the wild varieties No. 6 was sent in by Mr. Paul F. Kefauver, of Madisonville, Tennessee. Nos. 7 and 8 were from trees growing in the neighborhood of Knoxville.

TABLE 1.

	Average weight of fruit in grams.	Per cent of seed in fruit.	SUGAR.		Total acid in pulp.	PROXIMATE ANALYSIS OF PULP.			
			In pulp.	In fruit.		Water.	Crude Protein.	Fats and Carbohy- drates.	Crude Ash.
No. 1. Hachiya.....	180.	Seedless	16.83	16.83	0.13	71.77	0.93	26.42	0.88
“ 2. Tsuru.....	194.	“	15.67	15.67	0.16	73.46	0.74	25.16	0.64
“ 3. Hiyakume.....	175.	1.71	17.83	17.52	0.13	70.17	1.10	27.58	1.15
“ 4. Yemor.....	150.	Seedless	15.99	15.99	0.10	76.26	0.45	22.69	0.60
“ 5. Japanese graft on native.....	103.	“	16.55	16.55	0.11	75.00	0.42	24.13	0.45
“ 6. Wild.....	6.6	15.5	18.72	15.74	0.26	66.78	0.64	31.32	1.26
“ 7. “.....	8.9	17.5	23.50	18.19	0.15	57.24	0.58	41.34	0.84
“ 8. “.....	9.2	16.3	23.48	19.35	0.17	57.25	0.48	40.99	1.28

The most striking thing shown by these analyses is the large proportion of sugar, which in this fruit is all in the form of glucoses¹. Thorough tests failed to show a trace of cane sugar.

In the next table these analyses are compared with the only available analyses of persimmons made elsewhere. First, the average of the improved varieties is shown, then the average of the wild varieties, and finally the average of all eight analyses is shown beside the average of six analyses reported by the Indiana Station. Of the six specimens analyzed by the Indiana Station were five wild fruit and one, the Golden Gem, cultivated.

TABLE II.

	SUGAR		Total acid in pulp.	PROXIMATE ANALYSIS OF PULP			
	In pulp.	In fruit.		Water.	Crude Protein.	Fats and Carbohydrates.	Crude Ash.
Average Japanese grafts.....	16.54	16.51	0.13	73.34	0.73	25.20	0.73
Average wild specimens.....	21.90	17.76	0.19	60.42	0.57	37.88	1.13
Average of both varieties....	18.57	16.98	0.15	68.49	0.67	29.95	0.89
Average of six analyses ¹ ..		14.29		64.82	0.89	33.51	0.73
One analysis ²		18.20					

1 Bul. 60 Ind. Stat. The sugar in the pulp of one sample of wild fruit, determined by solution in 80 % alcohol, was found to be 14.29 %.

2 Cal. Ex. Sta. Rept. 1894-95. Total sugar in a sample of Hiyakume.

It appears from the figures in this table that the wild fruit contains one and a quarter per cent more sugar than the cultivated fruit, and, furthermore, that they contain nearly 13 per cent more dry matter. On the other hand, the cultivated fruit is higher in protein. While these figures are, no doubt, correct for the samples so far examined, it will not do to be too hasty in drawing conclusions. The analyses in Table I show that different specimens of the same variety vary widely in composition, and it is evident that a larger number of analyses will be necessary to establish correct averages.

¹ GLUCOSES.— $C_6H_{12}O_6$ — a general term including the principal sugars of honey and sweet fruits. A part of the sugars of sorghum cane and sugar cane also belong to this class. The glucoses are less sweet than cane sugar— $C_{12}H_{22}O_{11}$.

The best way to form a clear idea of the meaning of these analyses is to compare them with similar analyses of well known fruits. This is done in the following table, analyses of apples, cherries, strawberries, and oranges being used for the purpose.

TABLE III.

	SUGAR.		Total acid.	PROXIMATE ANALYSIS.			
	In pulp.	In fruit.		Water.	Crude Protein.	Fats and Carbohydrates.	Crude Ash.
Persimmons, 8 analyses.....	18.57	16.98	0.15	68.49	0.67	29.95	0.89
Apples ¹		9.79	0.56	82.35	0.52	16.73	0.40
Cherries ² 20 analyses.....	11.32	10.59	0.40	80.95	1.09	17.46	0.50
Strawberries ³ 20 analyses....		5.46	1.37	90.52	0.99	7.87	0.62
Oranges ⁴ 31 analyses.....		4.11	0.58				

¹ Figures for acids and sugar from Bulletin 3, Iowa Station, average of nine analyses, acid in whole fruit calculated as malic. The figures for the proximate analysis are from Expr. Stat. Bul. 11, U. S. Dept. Agr., average of seven analyses.

² Average of analyses from Bulletin 55, Oregon Station and Report 1894-95 of the Cal. Station. Acid in juice calculated in terms of SO_3 .

³ From Bul. No. 4, Vol. II, Tenn. Station. Acid in whole fruit calculated as malic.

⁴ Report of the Cal. Station 1896-97. Acid in whole fruit calculated as citric.

The persimmon is richer in sugar, by more than six per cent, than any of the fruits here shown. The California Station¹ comments on the sample which they examined as follows: "This sample² contains nearly as much sugar as the fresh French prune with 18.50, and the White Adriatic fig with 19.20 per cent sugar, though it is some 2 per cent behind the average California grape in this respect." It is safe to conclude that of all our table fruits the persimmon is one of the richest in sugar. In oranges about one-half the sugar is in the form of cane sugar, which makes them relatively much sweeter than the 4.11% would indicate. In the other fruits shown in this table nearly all the sugar is in the form of glucoses.

¹ Report for 1894-95.

² See Table II.