4-1954

Breeding and Testing Fire Blight-Resistant Pears

University of Tennessee Agricultural Experiment Station

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Bulletin No. 236 April, 1954

BREEDING AND TESTING FIRE BLIGHT-RESISTANT PEARS

By

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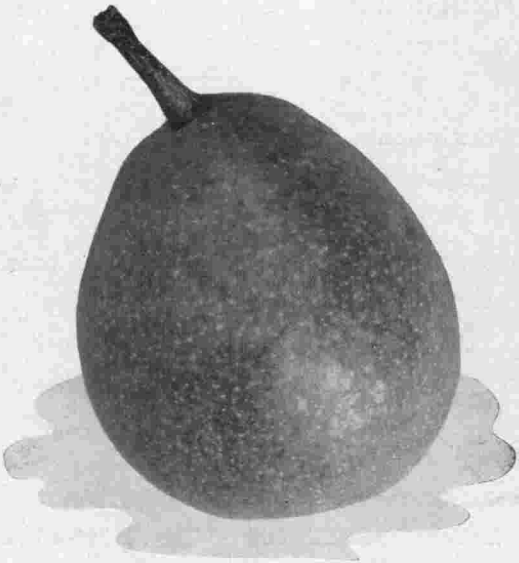

AGRICULTURAL EXPERIMENT STATION
THE UNIVERSITY OF TENNESSEE
KNOXVILLE

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ACKNOWLEDGMENT—Records previous to 1931 were kept by J. A. McClintock and H. L. Facker. E. M. Henry, 1932-35; Arthur Meyer, 1938-39; D. M. Bailey, 1940-41; Joan Wiley, 1944-46; and Earl Ogle, 1947-49; assisted with this project. P. L. Hawthorne, 1947; and W. E. Roever, 1948- assisted at the West Tennessee Agricultural Experiment Station. Dennis Latham, 1939-51; and Lawson Safley, 1952- assisted at the Highland Rim Experiment Station.

BREEDING AND TESTING
FIRE BLIGHT-RESISTANT PEARS

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Introduction

The history of fire blight-resistant pears is an interesting one extending over more than a century. Cox[1] gives the origin of Le Conte as a chance seedling discovered about 1846 and that of Kieffer about 1873. He also lists Sha Lea as the seed parent of Garber. The date of its origin has been given as early as 1840 while other writers are less definite. *The Pears of New York*[2] states that "Garber is one of many seedlings of the Chinese Sand Pear raised by J. B. Garber, Columbia, Pennsylvania, sometime previous to 1880." A very large number of crosses of the European and Chinese Sand Pear were made during this period. Some were named but are unknown in nurseries at this time. Pineapple, developed by the Georgia Station, Hood, Baldwin and Orient are in this group and in cultivation at this time. We assume that these varieties are one-half Asiatic pears. *The Pears of New York* lists the Douglas variety as originating about 1897 from a cross of Kieffer probably with Duchesse d' Angouleme. Waite, developed by the U.S.D.A., belong in a class with Douglas and is one-fourth Chinese Sand Pear.

Any blight-resistant pear tree should be growing on a blight resistant stock as this disease can develop in roots. *The Pears of New York* states that "The hybrids (of *Pyrus serotina culta)* do not make good stocks and intergrafts but poorly with the common pear." Reimer[3] has made a careful study of pear stocks and their blight resistance. *Pyrus calleryana,* a blight-resistant species, thrives in this area and has many characteristics desired by nurserymen. A number of Tennessee nurserymen have used this stock for many years. *Pyrus calleryana* trees at the Knoxville station

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[1]Cox, H. R. **Oriental Pears and their Hybrids.** N. Y. Cornell Agricultural Experiment Station Bulletin 332, pp. 445-486, 1913.

[2]Hedrick, U. P., et. al. **The Pears of New York.** 1921.

[3]Reimer, F. C. **Blight Resistance in Pears and Characteristics of Pear Species and Stocks.** Oregon Agricultural Experiment Station Bulletin 214, pp. 1-99. 35 figs, 1925.

are growing nearby Early Faulkner, Kieffer, *Pyrus ussuriensis* (several varieties), Late Faulkner and other trees all of which blossom about the same time. The resulting hybrid's seed is vigorous, somewhat more cold resistant and yet handles like pure *Pyrus calleryana* stock. Local nurserymen have used this seed for years and have had nothing but favorable results. The hybrid *Pyrus calleryana* stock is recommended to nurserymen for propagating Chinese Sand Pear hybrid varieties if the trees are to be planted in this area.

Orient[4], a variety named and described in 1945, has been grown by thousands of growers and is usually free from fire blight under field conditions, both blossoms and canker forms. Chilling requirements are likely to limit its Southern adaptation, but reports from along the Gulf Coast are favorable to date.

Mooers and Ayres varieties, described herein, have been grown for 12 to 16 years without developing any signs of fire blight. Furthermore, many inoculations[5] were tried in the nursery with negative results. Varieties Hoskins and Dabney developed only a few blighted twigs over a similar period and under the same conditions. Such data indicate to the writer that these varieties appear as resistant to the fire blight organism as many varieties of apples and perhaps more resistant than Kieffer pear trees.

Defoliation in late summer is very common on certain pear varieties when neglected and under southern conditions. The principal causes are leaf spot fungi, although there may be other factors, including dry weather. Defoliation is especially severe in the Lower South near the Gulf Coast. Leaf spots are likely to cause very little defoliation where a reasonable summer spray program is followed. Observations were made from time to time on unsprayed trees to secure an indication of the resistance to this trouble. Mooers has been very free from defoliation under Tennessee conditions while Hoskins has shown a large amount of defoliation when left unsprayed.

Standard varieties of pears often present a problem in pollination. The pollen of Seckel and Bartlett is considered incompatible. Orient produces very little if any viable pollen under Tennessee conditions. Mooers and Ayres varieties produce sterile pollen and must be pollinated by some other variety that blossoms at the same season. Further-

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[4]Drain, Brooks D. New **Blight Resistant Pears for the South.** Southern Florist and Nurserymen. No. 1, January 26, 1945.

[5]**Mostly natural inoculum used. Some cultures prepared by the Department of Plant Pathology.**

more, Roever[6] of the West Tennessee Station reports 15 to 27 per cent of the pollen grains shrunken on certain varieties rated as having fertile pollen. In other words, enough of the pollen is viable to pollinate another variety.

The Baldwin and Pineapple pears blossom so very early that the blossoms or fruit are usually killed by cold under Tennessee conditions. Kieffer and Orient blossom early but often escape cold injury. All of the new varieties mentioned heretofore start to blossom in mid-season or later, which is quite desirable as they often escape late cold spells. A variety used as a pollinator must have at least some of its blossoms opening at the same time as the variety to be pollinated. Hoskins and Dabney varieties should inter-pollinate each other, and either should furnish pollen for the Mooers variety. Blossoms of the Ayres pear open in mid-season and would be best pollinated by Dabney although the late blooming sorts would probably furnish enough pollen in most seasons. Tables 1 and 2 make this clear, although such observations vary from year to year.

Table 1.—*Pear Blossoming Dates, 1953, at Jackson, Tennessee*

Variety	Date of First Bloom	Date of Last Bloom
Kieffer	March 6	March 20
Orient	March 10	March 24
Ayres	March 17	March 27
Garber	March 7	March 19
Baldwin	March 1	March 14

Table 2.—*Pear Blossoming Dates, 1953, at Knoxville and Knob Orchards*

Variety	Flower Notes
Hoskins	Starting to open March 25 at Knoxville
Mooers	Starting to open March 19 at Knoxville
Dabney	Flowers ¾ open March 18 at Knob Orchard, Blount Co.
Ayres	Flowers 1/3 open March 18 at Knob Orchard, Blount Co.
Kieffer	Blossoms faded March 18 at Knob Orchard, Blount Co.

[6]Report dated March 25, and April 11, 1953.

Maturity is not easily determined in picking and ripening standard pear varieties, and most growers will need experience with new varieties. Fruits picked too early never ripen properly and those harvested overripe often have flesh breakdown and are of little value. There are several guides used in deciding when to pick, and most growers will use some or all of them. Pressure testers, instruments to measure the firmness of the flesh have been used in many commercial pear districts. The best firmness for picking has been determined for certain varieties in a given district. In general, the Chinese Sand pear hybrids such as Hoskins and Mooers varieties are likely to be picked with firmer flesh than varieties like Bartlett, Comice and Seckel. Wormy or injured specimens start to drop earlier than healthy ones and indicate picking time. A delay in picking will increase the percentage of drops. The size of the fruit has been used as a guide in picking Bartlett pears. In general, the larger specimens mature first. The coloring of the seed is considered an index of approaching maturity of pears and apples. Perhaps it has some value, but this color will vary with the variety and conditions. The fading of the green or ground color indicates time to harvest. The color change in Orient is not easily noticed while other varieties color a month before the fruit should be picked. The grower must make the final decision. We have usually made two or more pickings.

The writers prefer a temperature of about 60°F and high humidity for ripening pears. Higher temperatures hasten the ripening process, and lower temperatures increase the time of storage. Proper ripening improves the texture of the flesh of many varieties. Summer varieties of pears, like summer apples, ripen soon after they are picked. Most varaities of pears in the United States are harvested hard ripe and finish the ripening process off the tree. Some varieties in China are harvested eating-ripe, either on the tree or soon after picking. A good fungicidal residue on the fruit is likely to reduce decay in storage. Table 3 indicates the approximate picking and ripening dates under Tennessee conditions for the new varieties described in the following pages.

Table 3.—*Pear Ripening and Picking Dates*

Variety	First Picking Date	Ripening Date
Dabney	Last of July and August 1st	Early August
Ayres	Mid-August	To Early September
Mooers	September	Late Sept. and Oct.
Hoskins	About October 1	To Christmas or later if refrigerated

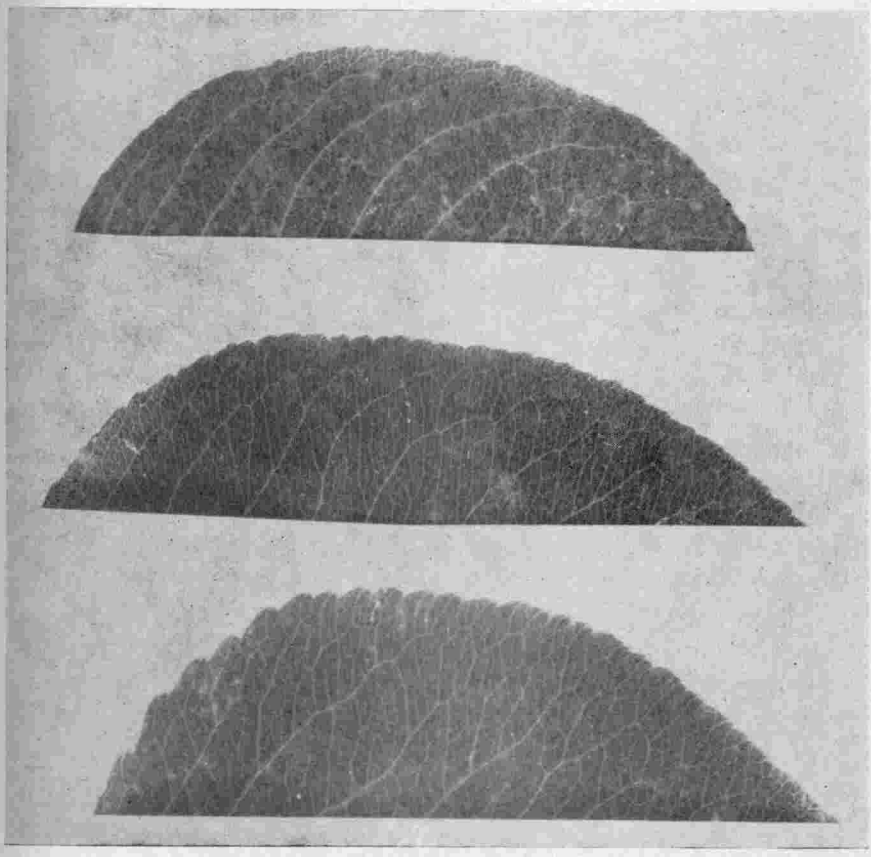

Figure 1.—Upper: Mooers pear leaf with dentate or toothed serrations. Middle: a Kieffer pear leaf. Bottom: Hoskins pear with crenate or saucer-edged leaf.

Figure 2.—A Dabney pear tree 15 years old that has been neglected for many years. It has had very little pruning, but was top grafted on Pyrus calleryana stock. Notice the small size and shape of the tree.

Identification of Varieties from Young Trees: Nurserymen have long used growth habits and shape of buds in identifying varieties in the nursery row. Fruit growers often want to check the identity of recently planted pear trees before they have time to fruit. Mature leaves near the middle of the current season's growth are fairly constant in form, size, serrations and the like. Figure 1 shows the serrations of two varieties compared with Kieffer. Dabney and Hoskins varieties have scalloped or crenate serrations. Another group of varieties has notched or tooth-shaped, called dentate, leaf margins such as Mooers and Ayres. About half of our new pear varieties tend to be spreading in habits of growth. This includes Dabney and Hoskins, while Ayres and Mooers are upright until bent with loads of fruit.

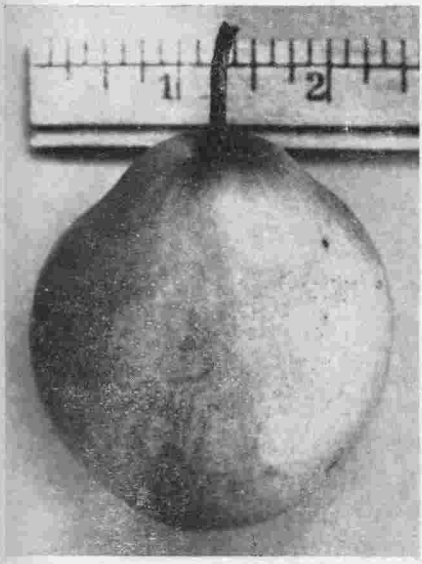

Figure 3.—A fruit of the Dabney pear. This variety is attractive and ripens very early.

THE DABNEY PEAR

The Dabney pear[7] was secured by crossing Seckel ♀ with Garber ♂ in 1935. The original tree, shown in Figure 2, was planted at the Mericourt Station, Clarksville, Tennessee, and has been fruiting for eight years. Nursery trees of this variety have slender branches and appear straggly in habits of growth but develop into satisfactory orchard trees (see Figure 2). A few blossoms and twigs developed fire blight during the past 15 years. This variety may need blossom sprays, but indications are that the trees are moderately resistant. Five experiment stations[8] have trial plantings.

The crop is picked in late July and early August at Knoxville, Tennessee, and ripens rapidly in summer temperatures unless refrigerated.

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[7]The Dabney pear was named in honor of Dr. Chas. W. Dabney, who was president of the University of Tennessee from 1887 until 1904. Dr. Dabney was granted leave in 1893 to become Assistant Secretary of Agriculture.

[8]Storrs, Connecticut; College Park, Maryland; Ardmore, Oklahoma; New Brunswick, New Jersey; and State College, Mississippi.

The sweet-subacid flavor and very good quality attracted attention as a dessert fruit. The appearance is medium to good, resembling Bartlett in coloring and shape as shown in Figure 3, but the flesh is more melting. Trees of this variety in our replicated plots came into bearing at five years and have produced good crops.

Technical Description

Tree: small, medium in vigor, spreading, becoming drooping with loads of fruit. Top open; trunk medium-thick, branches medium slender and gray-brown in color; branchlets slender and reddish-gray, dull with medium sized, raised lenticels.

Leaf buds small, short, pointed, brown-gray; leaf scars obscure. Leaves; petiole ¾ to 1¼ inches long, thick, color pinkish green; surface glabrous; blade 3 to 3¼ inches by 2 to 2¼ inches wide slightly folded; mid-rib straight to slightly reflex; sides waved, outline oblong; base medium narrow, apex narrow, point long and acute; general color dark green, vein color green tinged pink; position spreading; serrations crenate, direction forward, size small somewhat irregular; surface shiny, texture medium fine, pubescence short, fine and wooly.

Flower-buds large, long, plump, pointed and reddish-brown; flowers open medium late, ¾ open March 18, 1953 at Knob Orchard, Blount County, Tennessee; large—1¼ inches across; color white with maroon stigmas; blossoms appear with leaves; clusters 8-9 blossoms and umbel-like in form; pedicel slender, 1 inch long, somewhat pubescent; pollen fertile; distribution good.

Fruit: Picked in late July and early August at Knoxville, Tennessee: Size medium—2½ by 2¼ inches wide, uniform, oblong obovate, pyriform, sides unequal; stem 1¼ inches long and slender; cavity acute, shallow, medium wide and furrowed; calyx open and large; lobes separated at the base, long, narrow and acute; basin deep, wide, abrupt and deeply furrowed; skin thick, medium in toughness, smooth, waxen and dull; color greenish; dots many, medium in size, russeted and conspicuous; core large 1 by 1½ inches, closed, abaxile; core-lines clasping; calyx tube long, wide and conical; carpels ovate; seeds 3/16 inches long, narrow and plump; flesh yellowish white, melting, tender and juicy; flavor sprightly, sweet-subacid and very good in dessert quality. The fruit ripens rapidly in summer temperature and has been scored low for canning.

THE AYRES PEAR

The Ayres pear[9] was obtained by crossing Garber ♀ with Anjou ♂ in 1937. The fruits are golden russet with a rose blush, and are very attractive, as shown by the picture on the front cover of this bulletin. This variety was first fruited in 1945 and has a good production record. The trees are good growers, spreading in habits of growth, (see Figure 4) and to date have been free from fire blight. Unsprayed trees vary in the amount of defoliation from very little to very heavy. Replicated trials are located at the West Tennessee Experiment Station, Jackson; and trial plantings have been made at four other experiment stations[10]. Persons living near these stations should consult station research workers regarding local adaptation.

Technical Description

Trees: Large, vigorous, upright; top moderately compact; trunk medium in thickness and size, dark gray in color; branches medium to slender, reddish gray; branchlets medium in thickness, brown-gray, dull with small raised lenticels.

Leaf buds long, medium in size, pointed; leaf scars medium prominent. Leaves; petiole 1¾ to 1⅞ inches long, slender, color green tinged pink, surface glabrous; blade 3¼ by 2 to 2¼ inches wide, folded; midrib straight or nearly so; sides slightly waved, outline oblong base medium narrow, apex medium broad, point medium size and acute; general color dark green, vein color green tinged pink; position spreading; serrations dentate, direction forward, size small, moderately regular; surface shiny, texture medium, pubescence short, fine and wooly.

Flower-buds large, oblong spherical, pointed, plump, and brown in color; flowers open medium to late, 2/3 open March 18, 1953, at Knob Orchard, Blount County, Tennessee; size medium—1⅛ inches across; color white, unopened buds pink and stigmas maroon; blossoms appear with the leaves; clusters 7 to 9 blossoms and umbel-like in form; pedicel ¾ to ⅞ inch long, medium thick and glabrous or nearly so; pollen sterile; distribution spotty.

Fruit: Picked in mid-August at Clarksville, Tennessee; medium or below, 2¾ by 2¾ inches, roundish slightly pyriform; stem 3/4 to 1 inch long, thick and fleshy at the point of insertion; cavity acute, medium

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[9]The Ayres pear was named in honor of Dr. Brown Ayres, who was elected president of the University of Tennessee in 1904. Dr. Ayres, who succeeded Dr. Chas. W. Dabney, was president of the University until his death in 1919.

[10]State College, Mississippi; Ardmore, Oklahoma; Urbana, Illinois; and New Brunswick, New Jersey.

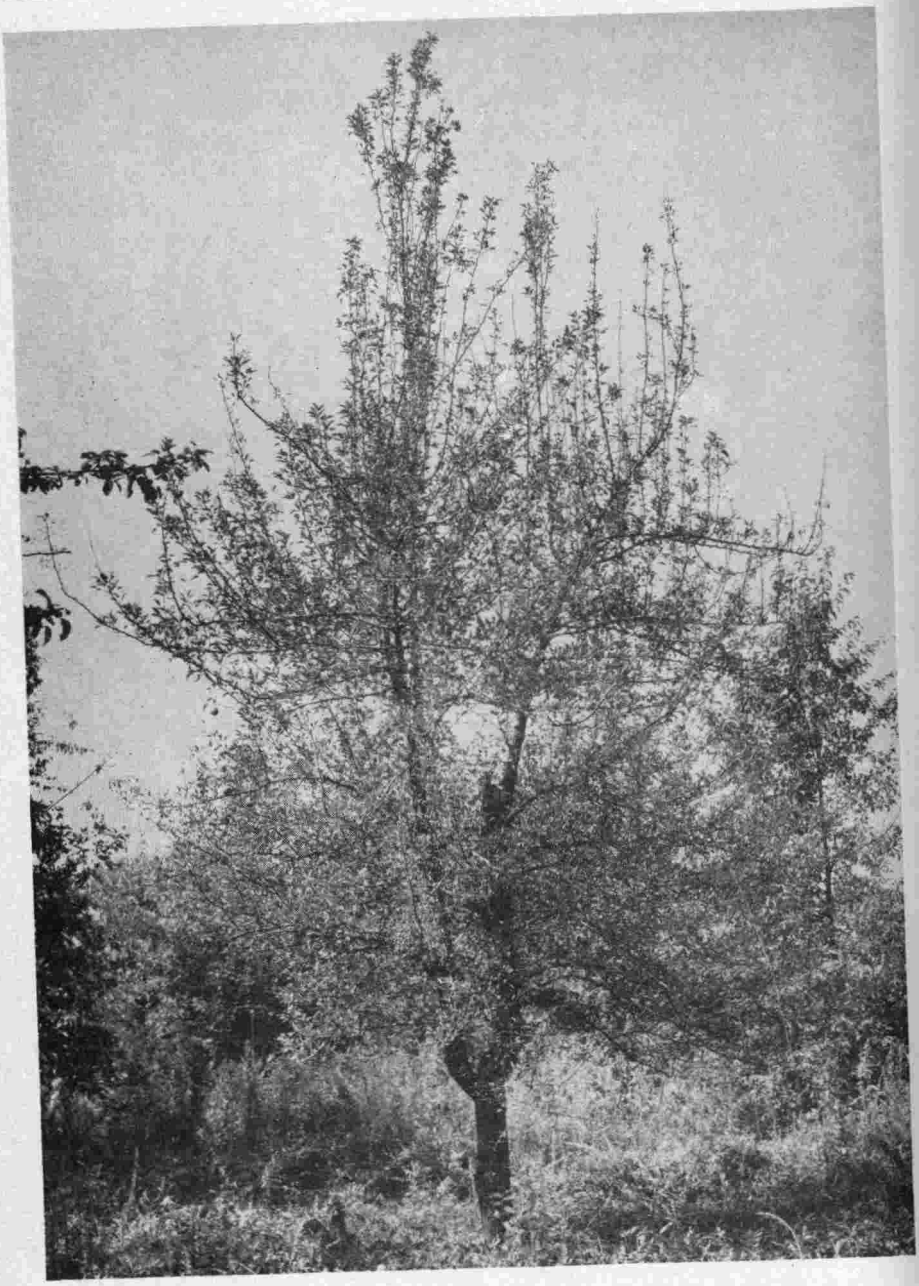

Figure 4.—The mother tree of the Ayres pear at 15 years. This large, sturdy tree appears somewhat upright due to crowding of other trees but is normally spreading in habits of growth.

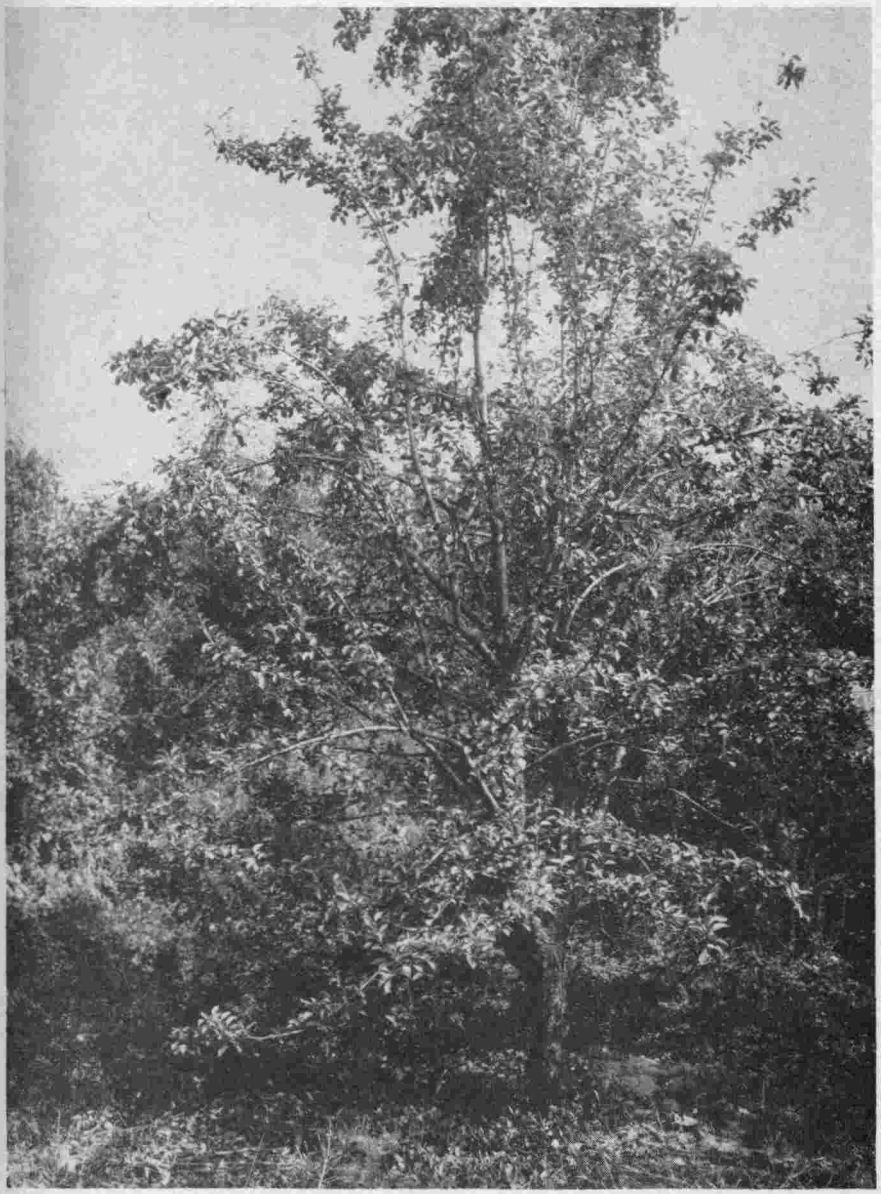

Figure 5.—A Mooers pear tree, 16 years old. This variety makes sturdy trees, which tend to grow upright unless modified by pruning.

deep, broad and russeted; calyx open and medium sized; lobes separated at the base, medium in length and width, and acute; basin deep, wide, obtuse and corrugated; skin medium thick, tough, russeted and dull; color light yellow blushed and mottled with golden russet and rose; dots many, large russeted and conspicuous; core medium—1 by 1¼ inches—closed, abaxile, with core-lines clasping; calyx tube very long, medium wide and funnel form; carpels ovate, seeds long medium wide—⅜ by 3/16 inches wide, plump; flesh white tinged with yellow, melting and juicy; flavor sweet-subacid, sprightly and very good; canning quality, medium.

THE MOOERS PEAR

The Mooers pear[11], has attracted attention as a late fall and winter variety that is resistant to fire blight. It was developed by crossing Duchessee d' Angouleme ♀ with Late Faulkner ♂ in 1934. Observations were delayed by stock troubles. Figure 5 shows the Mericourt tree as it looked in 1953. The tree is upright in habits of growth, sturdy and very healthy. Even unsprayed trees have remained healthy. It is likely to be especially valuable in locations where the leaf spots are very serious. The variety first fruited in 1944 and has produced good annual crops since that time. The crop is harvested in late September and may be ripened from October into December, depending on the method of handling. The fruit is large in size, golden russet in color, and attractive as shown in Figure 6. The flesh is crisp, subacid, and good in quality. We rate it good for canning. Figure 7 shows a sample of the canned product. Replicated trials are located at the Highland Rim

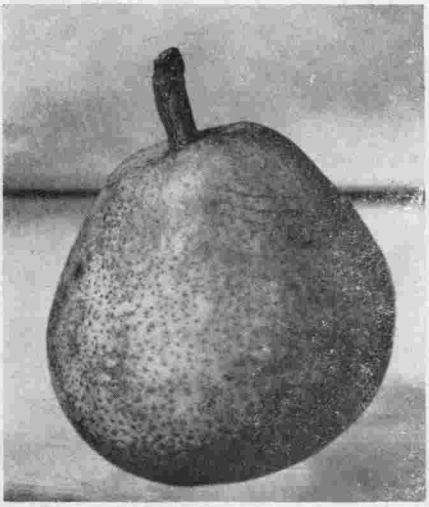

Figure 6.—A fruit of Mooers pear.

[11]The Mooers pear was named in honor of Director Emeritus C. A. Mooers, who served as director of the Agricultural Experiment Station, University of Tennessee, from 1923 until his retirement in 1946. It was under his administration that the pear breeding and testing research was started.

Experiment Station, Springfield, Tennessee; and six neighboring stations[12] have trial plantings.

Technical Description

Tree: Large in size and vigorous, upright, becoming a spreading tree with loads of fruit, top moderately dense. Trunk medium stocky and dark gray; branches medium in length and thickness, dull gray with medium-sized raised lenticels.

Leaf buds small, long and pointed; leaf scars obscure. Leaves; petiole 1 to 1⅜ inches long, thick, color pink, surface pubescent; blade

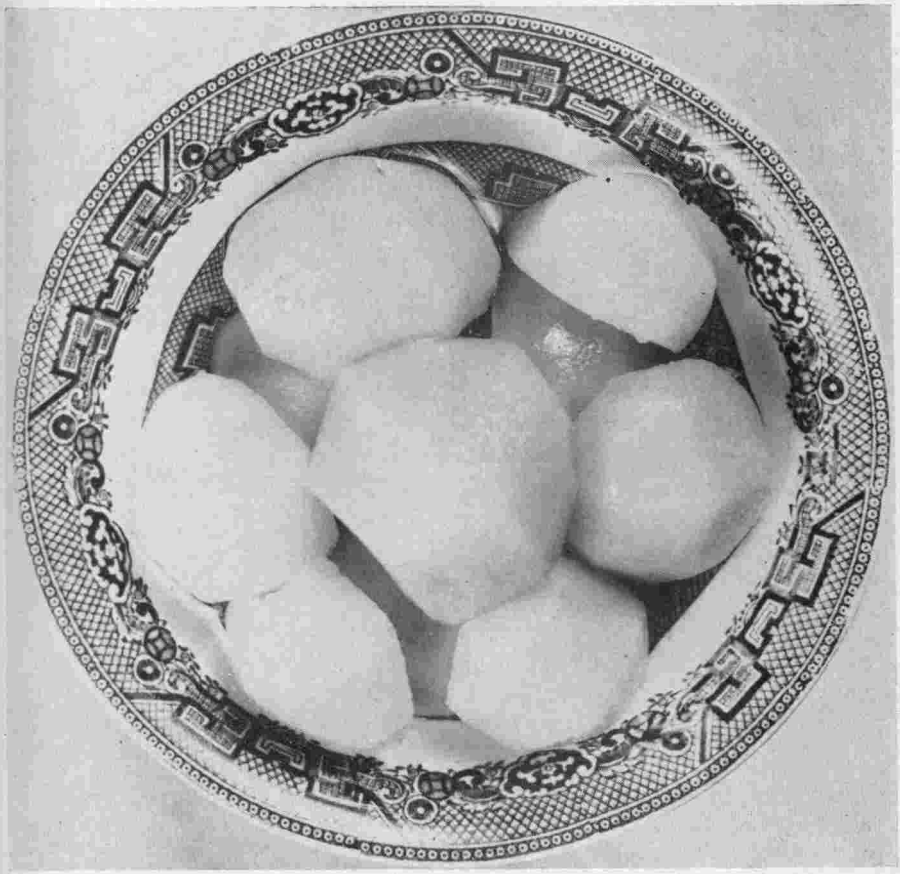

Figure 7.—Canned fruit of the Mooers pear. This variety is rated high for canning.

[12]Gainesville, Florida; Blacksburg, Virginia; Ardmore, Oklahoma; Tifton, Georgia; State College, Mississippi and Purdue Farm, Bedford, Indiana.

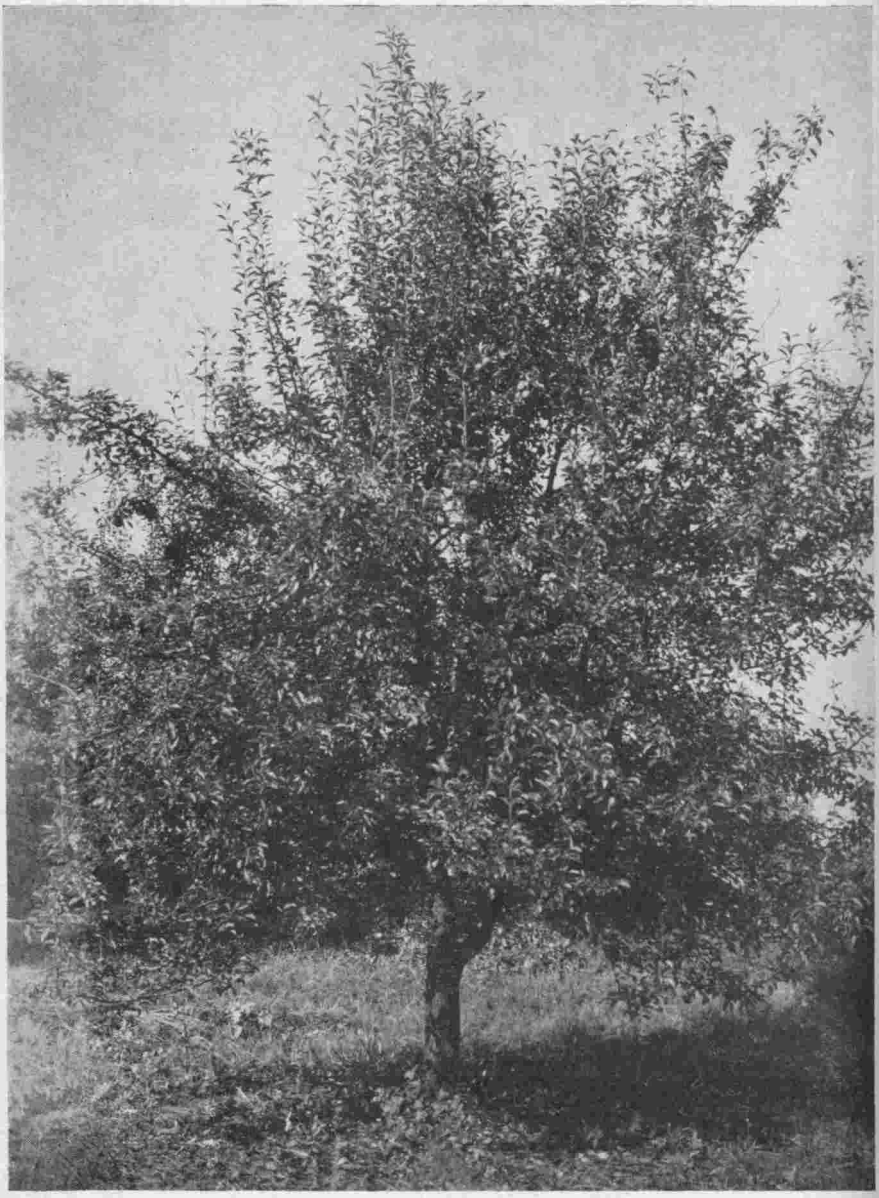

Figure 8.—A Hoskins pear tree as it looked in 1949 at the age of 12 years. This variety makes a large, sturdy tree with spreading habits of growth. The mother tree shown here received very little pruning.

2⅞ to 3 inches by 1⅞ to 1 15/16 inches wide, slightly folded; mid-rib slightly reflex; sides slightly waved, outline oblong; base broad, apex broad, point small, short and acute; general color dark green, vein color green; serrations dentate, direction forward, size small and regular; position spreading; surface shiny, texture medium, pubescence short, fine and wooly.

Flower buds medium in size, spherical, plump and bluntly pointed. Flowers: late, starting to open March 19, (1953) at Knoxville, Tennessee; medium size—1 1/16 inches across; color white tinged pink, blossoms appear after or at the start of leafing; clusters open, small, 3 to 6 flowers each, umbel shape, pedicel short, medium thick, ¾ inches long, sparingly pubescent to glabrous; pollen sterile, distribution good.

Fruit: Picked in September at Knoxville, Tennessee; large—3¼ by 3¼ inches—uniform in size and shape, roundish obovate, pyriform; stem ⅞ inch long, thick, often fleshy at the base and inserted at an angle; cavity acute, shallow, broad; calyx open, large; lobes separated at base, medium in length, broad; basin deep, wide, abrupt and furrowed; skin thick, medium in toughness, rough and medium glossy; color greenish-yellow mottled with russet; dots many, large russeted and conspicuous; core large, open, abaxile with core lines meeting; calyx tube medium in length and width and funnel-shape; carpels roundish; seeds large, long, wide and plump; flesh yellowish-white often tinged with green, firm, crisp, tender and moderately juicy; flavor subacid; sprightly, mild and good; canning quality good; can be kept until December.

THE HOSKINS PEAR

There are no varieties of winter pears, as far as the writers know, that are adapted to conditions prevailing in the southern part of the United States. Southern markets are supplied with pears shipped from other regions. This is an expensive practice which tends to limit consumption. It is anticipated that the Hoskins pear[13] will alter this condition. The Hoskins pear was obtained by crossing Seckel ♀ with late Fualkner ♂ in 1938. The latter is a variety found growing on a farm near Knoxville, Tennessee. It appears to be part Chinese Sand Pear, although its exact origin is not known. Trees of Late Faulkner at this Station are about 30 years old. Early records of progenies of this variety

[13]The Hoskins pear was named in honor of President Emeritus James D. Hoskins, who held an administrative position at The University of Tennessee since 1910. He became president of the University in 1934 and served in that capacity until his retirement in 1946.

indicated that it was promising as a fire blight resistant parent in pear breeding. Six growers have trial plantings[14] of the Hoskins pear in Tennessee, and 12 other experiment stations[15] have observational trees.

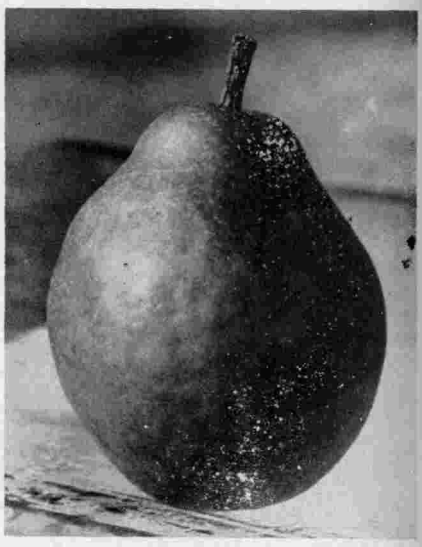

Figure 9.—A fruit of the Hoskins pear.

The original tree of Hoskins pear, shown in Figure 8, is now 16 years old and has been fruiting since 1943. Annual moderate crops have been produced. A few twigs blighted which soon dried up. Unsprayed trees developed considerable leaf spot, but sprayed ones were very healthy. Replicated plots of this variety started to bear at five years, and are growing at the Highland Rim Experiment Station, Springfield, Tennessee. Circumference measurements (see Table 4) indicate that the variety is a good grower. The fruit as shown in Figure 9 is medium size, golden russet, and very uniform. We have harvested the crop in late September and the first week in October. If held under favorable conditions, the fruit should be ripe by late October. If properly handled and refrigerated, it can be kept until Christmas and later. This variety is rated good for canning. Figure 10 shows a sample of the canned fruit. Its melting, subacid-flavored flesh is rated good for dessert.

Table 4.—*Circumference Measurements, Highland Rim Orchard No. 1*

Variety	Average Circumference			Average Increase in Circumference	
	inches 1951	inches 1952	inches 1953	inches '51-'52	inches '52-'53
Hoskins	6 13/64	8 31/32	10 62/64	2 49/64 (4 trees)	2
Kieffer	7 11/36	9 55/64	12 3/128	2 319/576 (8 trees)	2 21/128

[14]Grower trials were made in cooperation with J. J. Bird, of the Department of Horticulture, Agricultural Extension Service, University of Tennessee.

[15]Geneva, New York; College Park, Maryland; U.S.D.A., Meridian, Mississippi; Charleston, South Carolina; Baton Rouge, Louisiana; Ardmore, Oklahoma; Urbana, Illinois; New Brunswick, New Jersey; State College, Mississippi; Lexington, Kentucky; and Purdue Farm, Bedford, Indiana.

Technical Description

Tree: Large and vigorous, spreading; top open; trunk medium-thick and dark gray in color; branches medium stocky, dark gray; branchlets medium in thickness, gray-brown with few raised lenticels.

Leaf buds small, short, pointed, gray-brown; leaf scars obscure. Leaves: petiole ¾ to 1½ inches long, thick, color greenish pink, surface glabrous; blade 3⅜ to 2⅞ by 2 to 2¼ inches wide, folded; mid-rib reflex; sides slightly waved, outline oblong ovate; base broad, apex medium broad, point small and acute; general color dark green, vein color light green, position spreading; serrations dentate; surface shiny, texture coarse, pubescence short, medium fine and wooly.

Figure 10.—A can of Hoskins pears. These pears make an attractive pack and are of very good flavor. Large quantities of pears are marketed canned.

Flower buds small, usually bluntly pointed, spherical and brownish in color; flowers open late, starting to open March 25, 1953, at Knoxville, Tennessee; small, one inch across; color white; appear before leaves; clusters 5 to 7, umbel form; pedicel short, ⅝ inch, medium thick, pubescent; pollen fertile; distribution good.

Fruit: Picked September 25 to October 7 at Clarksville and Springfield, Tennessee; medium—2½ by 2½ inches—uniform in size and shape, roundish obovate, pyriform with sides unequal; stem about ⅝ inch long and thick; cavity usually obtuse, shallow and medium in width; calyx open and medium in size; lobes separated at the base, long and medium in width; basin medium in width and depth, abrupt and furrowed; skin medium in thickness and toughness, dull: color light yellow blushed and mottled with russet; dots many, large, russeted and conspicuous; core medium in size, closed, axile with core lines meeting; calyx tube funnel-shape, medium in length and width; carpels obovate; seeds ¼ inch long, wide, medium in length and plump; flesh white often tinged with pink, granular near the core, fine grained, tender, melting and juicy; flavor subacid to sour, sprightly, good.

The Tennessee Agricultural Experiment Station has no trees of the four new pear varieties described herein, but has supplied a number of nurseries with propagating wood. Trees may be ordered directly from these nurseries.