

Longevity of Lemon Trees

long-term selection experiments indicate strains least likely to decline or develop shell bark

L. D. Batchelor and E. C. Calavan

Lemon decline—a deterioration of trees—shortens the period of their usefulness.

Decline is a characteristic of many lemon orchards in California, and is in great contrast to many of the old and useful orange and grapefruit orchards in the state.

To determine long-lived strains the Citrus Experiment Station started a study of rootstock selection in one lemon orchard planted at Fillmore in 1936 and in two orchards planted in the spring of 1940—one at Fillmore and one at Riverside.

The factor of probable length of tree life was given careful consideration when the selections were made. Parent trees selected for propagation belonged to one or more of the following four categories: 1, widely used trees with records of good production and good fruit quality; 2, especially old and healthy trees—free from shell bark and psorosis; 3, representative trees from especially successful orchards; and 4, trees whose progeny-orchards seemed very vigorous, productive, and promising in every way. All selected strains were medium to good producers for their respective varieties during the first eight or nine years.

Strains Compared

By the time the trees in the 1936 planting were nine years old the average production of seven strains of Lisbon amounted to 12% more total fruit during

five seasons than the average of five selections of Eureka. When the trees were in their 13th year—in 1948—the Lisbon strains for that year averaged 39% more fruit than the Eureka. Since then some of the weaker Eureka strains began to decline. Actual yields have not been recorded, but inspection revealed that during these past three years some of the

Showing the Average Degree of Lemon Tree Decline and Percentage of Trees Showing Shell Bark in 1951. (Orchard Planted 1936 in Fillmore, Sweet Orange Rootstock.)

Variety	No. of trees	Selection	Average degree of decline ¹	Trees showing shell bark
Eureka	45	Ross (10-1)	1.8	0%
	45	Sespe (3-42-15)	2.5	63%
	45	Sespe (17-13-19)	2.2	37%
	45	Thornton (12-4)	2.6	22%
	50	U.S.D.A.	2.5	53%
Lisbon	45	Cavers (7-21)	0	2%
	45	Ledig	0.2	0%
	45	Matzen	0.1	9%
	45	Rosenberger (2-2)	0	4%
	45	Ross	0.3	7%
	45	Thille	0	15%
	50	U.S.D.A.	2.2	23%

¹ Method of scoring for degree of general decline:

- 0 = Normal
- 1 = Just starting to show decline symptoms
- 2 = Badly declined, nearly worthless
- 3 = Extremely declined, actually worthless, dead, or removed.

best strains of Lisbon produced two or threefold as much fruit as the best of the Eureka selections.

The value of these experiments is clearly apparent at the present time when it is possible to determine the strains which are most prone to decline, and which are the earliest to come down with shell bark. Those few selections which are free from decline stand out in bold relief in the orchards.

Most of the Eureka strains in the 1936 planting began to show some decline as early as 1948. Some of the weakest Lisbon strains were also subnormal in their appearance by that date.

A review of the orchard planted in 1936 shows that all the Eureka strains average from badly to extremely declined except Ross 10-1—which is not considered a typical Eureka. The Ross 10-1 trees are, however, far from normal and have declined rather badly in the last year or more. All the Lisbons are relatively free from decline except the U.S.D.A. semidense strain which is affected by wood pocket and thus is not typical of the variety.

All the Eureka selections are quite badly affected by shell bark except Ross 10-1, and all the Lisbons—except the U.S.D.A. strain—are relatively free from it.

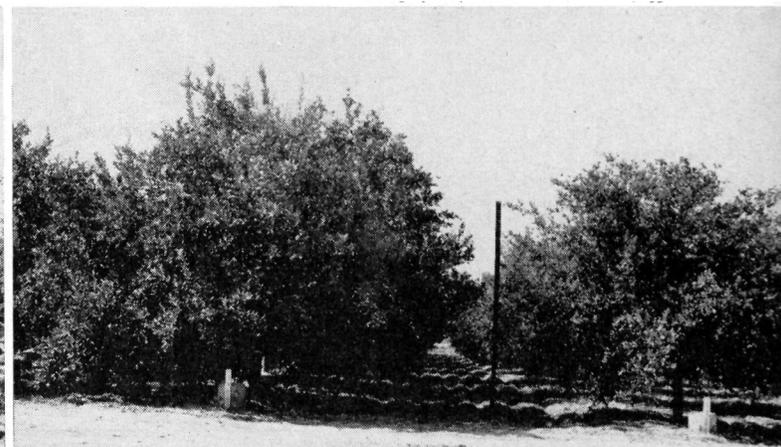
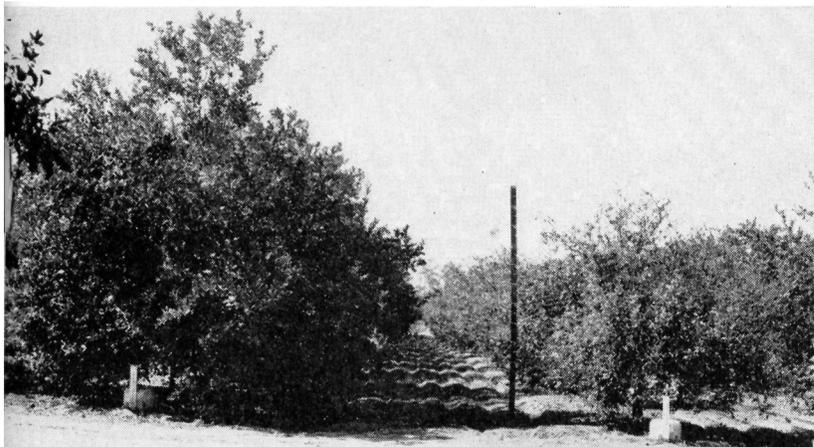
Whatever may be the primary causes of lemon decline, it seems probable that one of the seats of this trouble is in the

Continued on next page

Left, a Prior Short-thorn Lisbon tree and, right, a U.S.D.A. Semidense Lisbon affected with wood pocket. Measuring rod is 12 feet tall.

Left, a Keen Short-thorn Lisbon and, right, a Limoneira Open-type Lisbon. Measuring rod is 12 feet tall.

Photographs by W. P. Bitters, October, 1951



LONGEVITY

Continued from preceding page

trunks of the trees. Another contributing factor is in the rootstock or bud union.

If the method of scoring these trees is dependable, all the strains of Eureka in this orchard are very nearly—if not completely—worthless. One of the Lisbon selections—U.S.D.A.—has become worthless because of its complete deterioration with wood pocket. Two other Lisbon selections—Cavers and Rosenberger—are in excellent condition, and a very small percentage of the trees show any shell bark.

In the orchard planted at Fillmore in 1940, the various selections of Eureka deteriorated at an early age—in the 12th year since planting. Most of these are not in as good shape as the parent trees were when they were 20 to 30 years old. Some are not in as good condition as the parent trees are today. None of these Eureka selections looks promising, and several are already badly affected with shell bark.

In contrast, some of the Lisbon strains are in excellent condition and all are free from any indication of shell bark. In 1951 some of the greatest contrasts were between the normal vigorous Lisbon selections—such as the Prior, Keen, Monroe

and Price—and the subnormal selections such as the U.S.D.A.—affected with wood pocket—the Jameson open-type Lisbon, and the Limoneira open-type Lisbon.

The open-type Lisbon selections are short lived and are fast reaching a bad state of decline. The Prior, the Rosenberger, and the Monroe are Lisbon selections which made very favorable showings in previous fruit storage experiments.

In the test orchard planted at Riverside in 1940 certain strains of Eureka deteriorated greatly during the last two years. In this orchard the decline—in some cases—has become well advanced before the trees show clinical symptoms of shell bark. This is a common sequence of these two symptoms.

Commercial Orchards

In addition to studies in experimental orchards many observations were made of commercial orchards. These observations indicated that most—if not all—of the older strains of Eureka are relatively short lived. Some Lisbon strains—especially the open type—are about equally as short lived under most conditions. However, some of the so-called short-thorned Lisbon strains give promise of producing long-lived orchards. Some of the parent trees—Keen, Prior, Price, and

Monroe—are from 40 to over 60 years old and are in good condition.

Progeny orchards from some of these parent trees are more than 20 years old and in excellent condition. In addition, the Monroe and Rosenberger Lisbons are heavy producers in the extreme coastal area, while the Prior Lisbon has produced especially well in the intermediate area.

Some of the best selections of Lisbon lemon tend to be long lived, very productive, and to produce fruit which made a good record in packing house and storage trials.

With a large percentage of the lemons produced in California going to processing plants, there is much in favor of the long-lived Lisbons which habitually produce from 30% to 40% more fruit than the Eureka variety.

It seems probable that the nucellar strains of Eureka may add considerably to the useful length of life of Eureka orchards. If they should add as much as 50% to such a period of usefulness they will be of major importance.

L. D. Batchelor is Professor of Horticulture, University of California College of Agriculture, Riverside.

E. C. Calavan is Assistant Plant Pathologist, University of California College of Agriculture, Riverside.

The above progress report is based on Research Projects Nos. 1134 and 1381.

List of Lemon Strains and Selections Showing the Average Degree of Lemon Tree Decline and the Percentage of Trees Showing Shell Bark in 1951. (Orchard Planted 1940 in Fillmore on Sweet Orange Rootstock.)

Variety	Number of trees	Selection	Average degree of trees showing decline ¹	Percentage of trees showing shell bark
Eureka	20	Allen (F.G.S.C. 6408)	1.1	5
"	20	Cascade (F.G.S.C. 8372-B)	1.1	10
"	20	Meek (F.G.S.C. 6202)	0.6	0
"	20	Price	2.2	45
"	20	Richardson	1.1	0
"	20	Ross (10-1)	0.6	0
"	20	Rubidoux (C.E.S. 583)	2.7	100
"	20	Sespe (17-13-19)	1.7	0
"	20	U.S.D.A.	1.1	0
"	20	Wheatley ²	1.2	0
Lisbon Short Thorn	20	Cavers (7-21)	0.0	0
"	20	Deaver (4-15)	0.1	0
"	20	Galligan	0.0	0
"	20	Keen	0.0	0
"	20	Ledig (5-2)	0.1	0
"	20	Monroe (1-7) (F.G.S.C. 6150-5)	0.0	0
"	20	Price	0.0	0
"	20	Prior (13-6)	0.0	0
"	20	Rosenberger (2-2)	0.0	0
"	20	Jameson	0.5	0
"	20	U.S.D.A.	0.9	0
"	20	Jameson	1.5	0
"	20	Limoneira	1.6	0
Villafranca	20	Cavers (11-7)	0.0	0
"	20	C.E.S. (280)	0.1	0
"	20	Laidlaw (8-3)	0.2	0
"	20	Loch (21-8)	1.2	0

¹ For method of scoring degree of decline see footnote to table on page 9.

List of Selected Lemon Strains Showing the Average Degree of Lemon Tree Decline and the Percentage of Trees Showing Shell Bark in 1951. (Orchard Planted 1940 in Riverside on Seville Sour Orange Rootstock.)

Variety	Number of trees	Selection	Average degree of trees showing decline ¹	Percentage of trees showing shell bark
Eureka	20	Allen (F.G.S.C. 6408)	0.9	0
"	20	Cascade (F.G.S.C. 8372-B)	0.5	0
"	20	Meek (F.G.S.C. 6202)	0.0	0
"	20	Price	0.6	30
"	20	Richardson	0.1	0
"	20	Ross (10-1)	0.0	0
"	20	Rubidoux (C.E.S. 583)	1.6	85
"	20	Sespe (17-13-19)	1.5	0
"	20	U.S.D.A.	0.9	0
"	20	Wheatley ²	0.9	0
Lisbon Short Thorn	20	Cavers (7-21)	0.4	0
"	20	Deaver (4-15)	0.0	0
"	20	Galligan	0.0	0
"	20	Keen	0.0	0
"	20	Ledig (5-2)	0.2	0
"	20	Monroe (1-7) (F.G.S.C. 6150-5)	0.0	0
"	20	Price	0.0	0
"	20	Prior (13-6)	0.0	0
"	20	Rosenberger (2-2)	0.0	0
"	20	Jameson	0.1	0
"	20	U.S.D.A.	3.0	0
"	20	Jameson	0.7	5
"	20	Limoneira	1.7	0
Villafranca	20	Cavers (11-7)	0.1	0
"	20	C.E.S. (280)	0.0	0
"	20	Laidlaw (8-3)	0.0	0
"	20	Loch (21-8)	0.2	0

² From Thornton orchard tree 12-4.