

and potassium deficiencies; and not affected (on a per unit chlorophyll basis) by calcium deficiency. To determine phosphate deficiencies in crops, growers could, for example (through a technical service agency), sample leaves at random in a crop to determine whether photosynthetic rates were significantly below their maximum potential. If the rates were not low, there would be no need to apply phosphate fertilizer. If the rates were low, a determination would have to be made as to whether phosphate deficiency, or some other environmental factor, was causing the problem. At this point, other types of analysis would be needed—such as tissue and soil analysis—to complement the photosynthesis study.

Phosphate deficiency is a particularly good example of the usefulness of this approach, because visible symptoms of phosphorus deficiency in sugar beets do not become apparent until the blade phosphorus has decreased to 0.05 to 0.1%, whereas photosynthesis is reduced by a third by the time the blade phosphorus level has decreased to 0.2%. Thus phosphorus deficiency in sugar beets shows up first in photosynthesis, then growth, and lastly as visible symptoms. Also the advantage of measuring photosynthesis as compared with blade or petiole phosphate analysis is that it is a direct measure of plant metabolic activity. Even though tissue analysis may show the nutrient element concentration to be below the critical level, plant metabolism is not necessarily affected. Lower rates of photosynthesis would tend to confirm that the low level of phosphate was really damaging the plant.

There is another aspect of this problem which remains to be resolved. To what extent is photosynthesis actually related to crop yield? Even if it is determined that photosynthesis is below par for a crop in a particular environment, it is still unknown if the crop's productivity is actually limited by photosynthesis. Other factors may also be limiting: for example, the partitioning of photosynthate between the harvestable portion and other parts of the plant, or the expansion of the leaf surface.

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'CALIFORNIA'—

a new

fresh market

BEAUTY, TANTALIZING AROMA, and delicious flavor are combined in 'California,' a new pear soon to be available to California growers. The new cultivar, the result of an extensive and continuous pear-breeding program in the Department of Pomology at U.C. Davis, is expected to be used primarily as a fresh fruit dessert. In form, flavor, soluble solids content, season, and storage life, the fruit resembles Comice, but is distinguished by its more poignant aroma, freedom from russetting, and its color. The bright red on the side exposed to the sun harmonizes with the glistening yellows on the shaded areas, giving the fruit a strikingly attractive appearance. The originators feel that California will fill a need of the west coast pear industry for an excellent, productive, early- and annual-bearing fall and winter dessert pear.

The state of California produces about half of the nation's commercial crop of pears from 42,269 acres. The Bartlett cultivar occupies 95% of this acreage and produces 97% of the California crop. Bartlett bears early, heavily, and annually, and is generally well suited for fresh, canned, and dried fruit outlets. Bartlett has a short storage life, however, and must be canned or otherwise utilized during the summer or early fall months. Also, under certain cultural and climatic conditions, Bartlett develops only fair quality as a fresh dessert fruit.

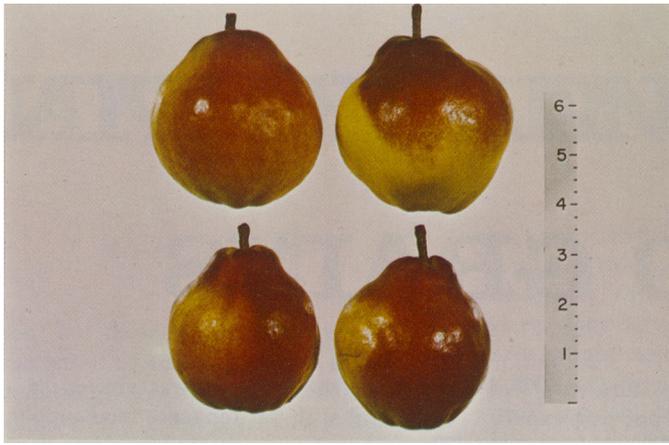
In the other important pear-producing states, Oregon and Washington, Bartlett accounts for 42 and 65%, respectively, of the total pear crop. The remaining production in these states comes mainly from Comice, Anjou, and Bosc cultivars, all

of which have relatively long storage lives, and are consumed as fresh fruits in late fall and winter. These cultivars have been tried in California, but their undesirable characteristics have resulted in constantly diminishing acreages. Anjou and Bosc attain only fair quality under California conditions, and both have a biennial bearing pattern. Comice is slow to come into bearing, and is also a biennial bearer. Its fruits have excellent quality, but are relatively unattractive because of their dull yellow skin, which is often partly covered with various amounts of russetting.

One of the objectives of the university's pear-breeding program was to develop an early, annual-bearing Comice-type pear with an attractive skin. This objective seems to have been attained with the introduction of California.

Development

The new cultivar resulted from pollinating the flowers on a Max-Red Bartlett pear tree (Plant Patent No. 741 of July 1, 1947) with pollen from a Comice (unpatented) tree on April 3, 1959. The seeds obtained from the resulting fruits were stratified during the winter of 1959-60 and planted in April 1960. When the seedlings bore fruits, one had commercially desirable characteristics. It was therefore selected for asexual reproduction and testing preparatory to patenting and introduction to the trade. California has been asexually reproduced by top-grafting on *Pyrus communis* pear seedling trees, and by budding into *P. communis* seedlings in the U.C. Davis orchards and nursery.



'California' pears ready for eating, December 7. The pears had been held at 32°F (0°C) from harvest to December 3, then ripened at 68°F (20°C).



Longitudinal and transverse sections of ripe 'California' pears showing small core (photos by Don Edwards).

pear

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The trees are similar to Bartlett in size, form, and vigor. They are productive and early bearing, setting and maturing a few years their second and third year in the orchard. One young tree matured 64 fruits in its fourth year. Based on the performance of young trees, California is an annual-bearing cultivar.

California trees have had very few fireblight (*Erwinia amylovora*) infections, and apparently are somewhat more resistant to the disease than Bartlett.

At Davis, California starts blooming about March 20, one to three days earlier than Bartlett. Average dates of full bloom and last bloom, March 30 and April 9, respectively, are about the same as for Bartlett. Controlled pollination tests indicate that California is intercompatible with Bartlett. Therefore, each cultivar may serve as a pollinizer for the other.

At harvest maturity, the flesh has a firmness of 15 to 18 lbs, as measured with a pressure tester equipped with a $\frac{5}{16}$ -inch plunger head. The fruits reach harvest maturity at Davis at the same time or a few days earlier than Bartlett—that is, during the first three weeks of August.

Average length and width of well-grown California fruits are 7.65 cm (3.01 inches) and 7.62 cm (3.0 inches), respectively. Thus the fruits are somewhat larger than those of Bartlett, and similar in size to those of Comice. In form, California resembles Comice more than it does Bartlett. In longitudinal section, the fruits are usually ovate-obtuse-pyriform, but some are ovate or turbinate. In transverse section they range from round to somewhat angular. The fruit stems are short and thick and brown in color.

At harvest, the ground color, or under-

color of the skin, is light green; and the over-color, which develops on the surface areas exposed to the sun, is dark red. The areas shaded by leaves are green and provide attractive shadow patterns. The numerous light green lenticels are conspicuous on the red surfaces, but inconspicuous on the green side of the fruit. After the fruits are removed from storage and are near eating ripe, the ground color becomes yellowish green to yellow, and the over-color changes to bright red. At the same time, the lenticels change from green to yellow, and become even more conspicuous in the ripe fruit.

The skin of California is about the same thickness as that of Bartlett, but somewhat coarser. The surface is smooth, generally free of russet, and glossy. The skin of this pear is much less subject to russetting and other blemishes than is Bartlett.

When California pears are ready for eating, the flesh has a firmness of 1.5 to 2.5 lbs, as measured with a pressure tester. The flesh of the ripe fruit is white, fine-grained, smooth, melting, tender, juicy, and sweet. The soluble solids content of juice squeezed from the flesh averages 14.8%, slightly higher than that of Bartlett and about the same as that of Comice.

The flavor of the fruits is similar to but slightly milder and less astringent than that of Comice. The ripe fruits have a fragrant, delicate aroma, more poignant than that of Comice, but not as strong as that of Bartlett.

The core is approximately the same size as that of Bartlett, and is small in relation to the size of the fruit.

California fruits are best in the fall and early winter seasons, similar to Comice. After about 4 weeks in storage at 32°F (0°C), the fruits soften to eating ripeness in about 6 days at 68° to 70°F (20 to 21.1°C). Prime quality is obtained when the fruits are removed from storage and ripened in October or November. Fair to good quality may be obtained when fruits are held at 30° to 32°F (-1.1° to 0°C) through December.

California pears, like Comice, will not ripen properly without a period of cold storage. If fruits are brought directly from the tree and kept at room temperature, they will eventually shrivel without ripening. Home refrigerators are not cold enough for afterripening of this cultivar, since best afterripening apparently occurs at about 32°F (0°C).

California is recommended as a fresh dessert fruit. Its attractive appearance, fine flavor, and long shelf life should make this pear desirable for the fresh fruit market.

Patent rights to the cultivar California were assigned to the Regents of the University of California, and a U. S. patent was issued in 1974. Qualified nurserymen may obtain commercial licenses for propagating and selling the California pear from the University of California Board of Patents, 575 University Hall, 2200 University Avenue, Berkeley, California 94720, phone (415) 642-4777.

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