

Avocado Variety Trials

progress report describes tree and fruit characteristics of four most promising varieties in test at Riverside

M. M. Winslow

Four avocado varieties—in an experimental orchard of 36 varieties at Riverside—appear to be promising for commercial plantings.

The variety trial was started in 1943 when 36 varieties including 16 strains of the Fuerte, were planted in virgin land. Since then, new varieties have been added and unsuitable ones discarded.

The tested varieties are kept under observation for a sufficient period of time to determine their behavior as to amount and regularity of fruit production, fruit quality, frost resistance, blooming period, and tree characteristics. Those found unsuitable for the climatic conditions at Riverside are topworked to a new variety or pulled out to make room for a replacement planting.

Three of the four varieties which appear to be most promising for commercial production are of the Mexican race—*Persea drymifolia*—the Duke, the Emerald, and the Zutano. The fourth variety, the Hass, is of the Guatemalan race.

Duke

The Duke is an old variety, and has long been recommended for planting in the interior districts.

The tree is large, moderately spreading, and resistant to cold. The fruit is medium in size, somewhat pear-shaped, with a smooth green skin. The seed is of medium size and usually loose.

For the past season the fruit averaged 6.4 ounces, the seed one ounce, and the oil content 10.2%. The quality is only fair.

The season at Riverside is September and October. When mature the fruit drops heavily. Its main use will continue to be for planting in the home garden.

The Duke may have some promise for limited commercial planting because of its earliness.

Emerald

The Emerald is of rather recent origin, 1928, and came from San Diego County.

The tree is tall and rather upright. It has been moderately hardy to frost at Riverside. The cold winter of 1948-49, with a low of 25° F, damaged about 20% of the fruit and caused only small damage to low-hanging foliage.

The attractive, bright green, pear-shaped fruit is of medium size. The fruit has averaged 7.5 ounces and the seed two ounces plus. The oil content averaged 19% for the season. The quality is good.

The season is December 15 to April. This variety has borne good crops rather regularly at Riverside. The Emerald appears to warrant consideration for planting in interior districts.

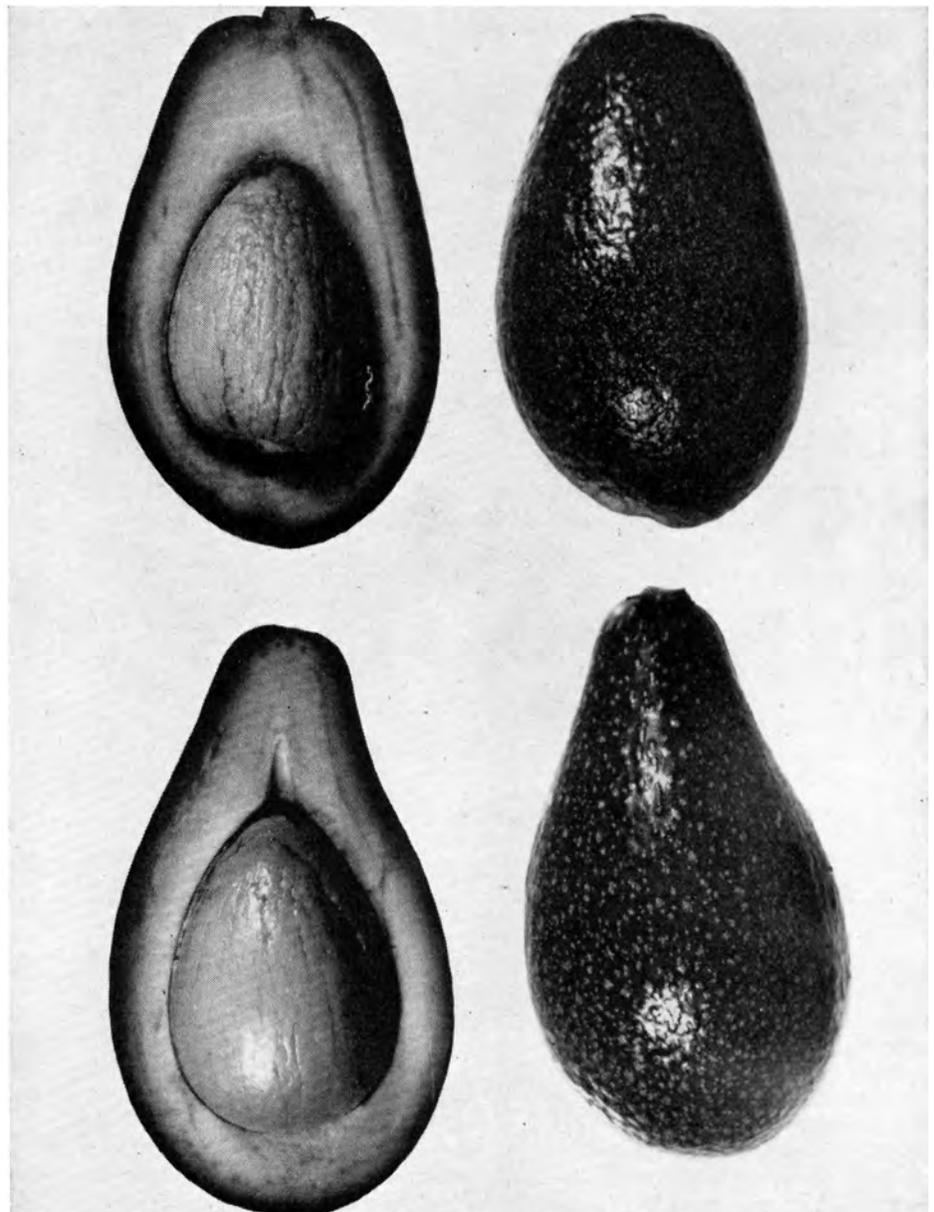
Zutano

The Zutano is from San Diego County and originated in 1926. The tree is tall, slender and upright. It is one of the cold resistant varieties and similar to Duke in this respect.

The fruit is pear-shaped, medium to large in size, and has a green skin. The

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Top, the Emerald variety; bottom, the Zutano variety.



Oriental Fruitfly Parasites

biological control of damaging pest established in Hawaii diminishes threat to mainland's fruit production

Robert van den Bosch

The oriental fruitfly threat to California's fruit industry has been reduced by the successful establishment in Hawaii of natural enemies of the pest.

The accidental introduction of the oriental fruitfly—*Dacus dorsalis* Hendel—into Hawaii, and its alarming increase in abundance was a threat to the mainland—especially California—fruit production.

Biological control was one of the first measures employed by entomologists in their attack upon the fruitfly in a large-scale, co-operative program to attempt its control in Hawaii. Co-operating agencies were the Territorial Board of Agriculture and Forestry, United States Department of Agriculture Oriental Fruit Fly Investigations, Hawaiian Sugar Planters Association, Pineapple Research Institute, University of Hawaii, and the University of California.

Foreign exploration to search for natural enemies was initiated within a year after the discovery of the fly in Hawaii. The extensive search soon resulted in the release in the Hawaiian Islands of more than a dozen species of natural enemies of the fruitfly.

Today, four parasites are well established in the Islands and three of them appear to have played important roles in the biological control of the fly. There is evidence that several additional species of parasites have become established.

The four well-established oriental fruitfly parasites in Hawaii are: *Opius longi-*

caudatus (Ashm.), *Opius vandenboschi* Full.—formerly called *O. persulcatus* (Silv.), *Opius oophilus* Full., and *Opius incisi* Silv. Only the first three species have played important roles in the biological control of *Dacus dorsalis*; *O. incisi*, though well established, has never occurred in large numbers.

Opius longicaudatus and *O. vandenboschi* are parasites which oviposit in the fruitfly larvae. They were first recovered in Hawaii in the fall of 1948 with the former becoming very abundant during the next year. However, in the fall of 1949, *O. vandenboschi* suddenly increased tremendously in abundance and replaced *O. longicaudatus* as the predominant species.

Predominant Parasite

O. oophilus was first recovered at a single locality on the island of Oahu in December of 1949. It proved to be a very efficient parasite and quickly spread over the island. By the summer of 1950 it exceeded the combined abundance of *O. vandenboschi* and *O. longicaudatus* on Oahu and has now become the predominant parasite throughout the Territory.

O. oophilus has the unique habit of ovipositing in the fruitfly egg. The parasite egg hatches at about the same time as the host egg. The larva feeds within the growing host larva and eventually kills the host when it is about to mature. The egg-loving *O. oophilus* has been respon-

sible for the destruction of enormous numbers of fly larvae during the past two years and at the present time is maintaining a very high degree of parasitization in larvae infesting a wide variety of fruits.

O. oophilus apparently derives its great effectiveness from its habit of stinging the highly vulnerable fruitfly eggs which are concentrated in cavities in the fruit rind. In searching for its host, the female parasite has merely to find the fruitfly egg puncture in the surface of the fruit and to thrust its ovipositor—sting—through this puncture into the cavity below. It then systematically deposits its own eggs in the fruitfly eggs. This habit enables *O. oophilus* to parasitize up to 100% of the fly larvae in individual fruits and undoubtedly has been the major factor which has enabled it to sustain a high degree of parasitization, ranging from 70% to 90% in larvae in wild guava over a period of a year and a half on Oahu.

The introduced parasites—particularly *Opius oophilus*—have played an important role in reducing the population level of the oriental fruitfly and its ravages in local fruits in Hawaii and have diminished the threat to mainland fruit production. It is anticipated that the fruitfly population density in the Islands will be maintained at a relatively low level by its natural enemies.

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fruit has averaged 10 ounces and the seed two ounces plus. The oil content averaged 14.5% for the season. The quality is good. The season is December 15 to February. It is the most consistent producer of good crops of all the varieties under test.

The Zutano can be recommended for the home garden and may have some commercial possibilities in the inland districts.

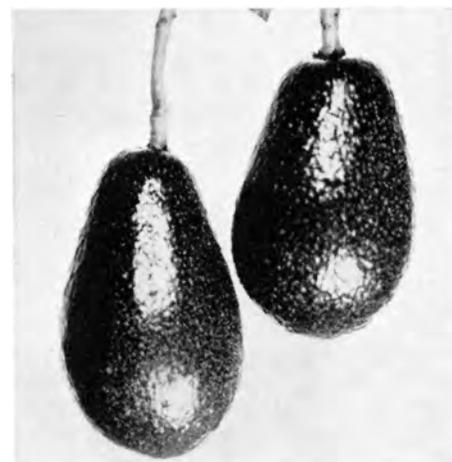
Before commercial plantings are made, the grower should investigate market outlets.

Haas Variety

The Haas comes from Orange County and is one of the newer varieties. The tree is large, moderately spreading, and—at Riverside—moderately frost resistant. During the winter of 1948-49 the tree suffered only slight leaf and twig damage. However, the fruit was severely damaged and about 90% of it dropped. The fruit is medium size, the skin pebbled and leathery, green colored early in season becoming black when ready to eat. The Haas avocado fruit has averaged seven ounces and the seed one ounce in weight. The oil content averaged 17% as early as April. The quality is good. The season

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The Emerald avocado.



Organic Wastes for Mulch

waste from packing houses processing organic materials studied for possible agricultural use

E. L. Proebsting

End-product wastes of some industries which process different types of organic materials are desirable as mulching materials in agricultural practice.

The solid pomace—the end-product waste from California wineries—consists mostly of skins and seeds and is a very satisfactory material for use in vineyards and orchards. The liquid effluent from brandy stills, however, is likely to kill trees or vines to which it is applied.

Another material which was tried with distinctly unfavorable results was the residue from vanilla beans after extraction. The small amount of vanillin remaining was enough to cause damage to young trees in pots in greenhouse tests. A layer about an inch thick applied to peach trees in an orchard eliminated weed growth but injured the trees.

More recently, in a search for a suitable mulching material, other things have been tried. A mulching material for the climate of the interior valleys of California requires somewhat different characteristics than in more cool and humid situations. It must be not only cheap and non-toxic, if not actually having some fertilizer value, but must be fire resistant. Straw, grass, sawdust, rice hulls, and similar materials have the defect of igniting easily. When present in a thick enough layer to serve as a successful mulch the temperatures created when they burn are high enough to kill or severely damage trees. There are several examples of heavy loss due to fire where these materials have been used and burned. It is possible that sprinkler irrigation may reduce the fire hazard. The mulching material should be one which will not float to the end of the run if a flooding method of irrigation is used.

Two materials—available in limited quantities—which approach meeting the requirements have been tried on a small scale. One of the materials is the residue from coffee which has been processed for powdered coffee.

Test plots were laid out in a walnut orchard in San Joaquin County. To a portion of the plots coffee waste was applied in 1949. More was used in 1950. The material is well leached but samples were found to contain 1.4–2.4% total nitrogen. Potassium was less than 0.1% and phosphorus from .04–.40%.

Soil samples from plots receiving the

coffee waste at the rate of about 10 tons per acre show a change in soil reaction from neutral—pH 7.0—to slight acidity of about pH 6.2 in the surface foot. Water soluble K (1–1)—potassium—is slightly higher and nitrate slightly lower than the check plots. Leaf analyses of samples taken in July and September of 1951 showed no significant differences between the two treatments on either date for the elements nitrogen, phosphorus, potassium, calcium, magnesium and sodium. Tree condition is about the same under the two treatments but the soil, a heavy clay, has a better surface structure in the treated than in the untreated areas. The coffee waste will burn but it does not ignite readily and has not created a fire hazard.

The second material considered—spent hops—can be ignited only with difficulty and will not support the fire even when the material has been oven dried. A sample obtained from Stockton for test on almond trees at Davis in 1949 contained 4.3% nitrogen but negligible amounts of phosphorus and potassium. Applied around the trees to a depth of about four inches, it prevented nearly all weed growth. Although essentially a very light material, it forms clumps which resist washing away with basin irrigation.

Leaf analyses were made of samples collected on three dates in 1950 and on five dates in 1951. There seems to be no significant difference in composition with the possible exception of a slightly higher potassium content in the mulched trees in 1951. There was no apparent difference in tree behavior.

The usefulness of organic residues varies tremendously with the source and previous treatment. The indiscriminate use of material simply because it is of organic origin may be dangerous. Materials of this type which are beneficial can be of use in different ways.

Grape pomace has about the same value as stable manure as a fertilizer, though more slowly decomposed but spent hops, with a higher nitrogen content is decomposed too slowly to be considered a satisfactory source of nitrogen. The use of spent hops should be as a relatively inert mulch to reduce cultivation or eliminate it and thereby aid in improving the soil structure and rate of water penetration.

An ordinary analysis of an end-product waste material is of little value without some information on the rate of release of the nutrients it contains, its physical properties and the possibilities of its containing minute amounts of material which may be highly injurious.

The theory—sometimes advocated—which holds all organic matter as material for addition to the soil may have severe limitations.

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F. M. Charles, University of California Farm Advisor, San Joaquin County, co-operated in the tests with the coffee waste.

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at Riverside is from April to August. This variety has been a consistent producer of medium to heavy crops.

The Hass may be considered for commercial planting in the warm locations of the interior area.

Other Varieties in Test

The varieties included in the original planting that have been found to be poor producers under the conditions prevailing at Riverside are: E 28, Karen, Middleton, Leucadia, Gottfried, Frances, Nabal, MacArthur, Wurtz, Campbell, Encanada, Edranol, Taft, Hellen, MacPherson, and Kimmel. They include nearly one half of the original varieties. Of the remaining varieties of the first planting, several are in the doubtful class and need further observation.

The following varieties have been added to the orchard since 1943: Kimball, Sonora, Hartman, Courtright, Ge-Hee, Rincon, Strong, Boley, Monica, Silliman, Santa Barbara, Routh, Mayo, Bacon, Tantos Fuerte, Harms, Wright, Geib, Dr. White, DeBard, Lois, Fuerte, Larry, and Wilhorne. None of them has been under trial long enough to draw definite conclusions.

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