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Jojoba is a shrub or small tree, *Simmondsia californica*, of the family Buxacea, and is a native plant of southwestern North America. It has edible seeds that contain a valuable liquid wax. Recent interest in the plant was stimulated by possibilities for using the wax during cold rolling of aluminum sheets. According to these studies, staining and viscosity deficiencies make jojoba unsuitable as a rolling oil for aluminum; however, tests are being continued to determine other possible applications.

JOJOBA--a new California crop?

. . . seed yield, cold tolerance, and evaluation for aluminum industry

Jojoba plants usually bear clusters with 1 to 3 fruit. The plant shown in photo above (and cluster to left), was selected from an introduction nursery of some 1000 seedlings from Arizona, and will bear up to 12 fruit per cluster.

VERY FEW DATA have been available on the seed potential of jojoba; however, yields of about 1 kg of seed per plant have been reported from fully developed shrubs in natural populations of California, Arizona, and Baja California, growing without benefit of cultural practices. The jojoba plantation established and maintained by J. E. Coit at Vista was made available to U.C. researchers to obtain data on younger shrubs growing in a fenced plot with weeds controlled. The plantation includes 24 shrubs which are clones from an outstanding single plant selected by Coit, and traceable in origin back to a population in Superior, Arizona. This clonal material has been referred to by Coit as the "Vista" variety. The remainder of the grove consists of 36 shrubs from seed collected in Baja California, and 54 shrubs from seed collected in Arizona. All of this material was planted on 5-ft centers in 1959.

Rainfall measured at the plot between 1953 and 1967 averaged 12.4 inches annually, with about 80 per cent of the precipitation occurring during the three winter months. The planting is situated on a mild slope, however, and a considerable portion of the rainfall is lost as runoff.

Observations at Vista indicate that anthesis (the period during which ovaries swell and anthers shed the pollen), extended from January 20 to February 10 in the Vista shrubs, from December 15 to February 15 in the Arizona shrubs, and from January 1 to March 31 in the Baja California shrubs. Most of the plants started producing some seed when they were three years old but measurable yields were recorded only after five years. In 1964 (the fifth year), the Vista plants produced 53 g of seed per plant, while the remainder of the plantation

produced 75 g per shrub. In 1965, the Vista plants produced 350 g each, the Arizona accessions 80 g each, and the Baja California accessions 135 g each. After harvest in that year, all shrubs were pruned quite heavily and, as a result, yields the following year (1966) ranged from only 10 to 70 g per plant.

An irrigation trial was conducted from November, 1965 to December, 1967. The 24 Vista plants were divided into three groups of eight plants each. No water was applied to group 1, 4½ gallons of water per plant was applied monthly to group 2 and 9 gallons to group 3. In 1967, group 1 yielded 142 g of seed per plant and group 2, 145 g, while group 3 yielded 290 g per bush. The Arizona planting that year yielded 135 g per shrub, and Baja California 286 g. About 80 per cent of the Vista seed matured between August 1 and September 30, while the seed of plants from Baja California matured between August 15 and October 10. About 50 per cent of the Arizona seed and 70 per cent of the Baja California seed was harvested between September 1 and 21.

In general, the Vista shrubs, being clonal material, were considerably more uniform in their anthesis, maturation and yield than were the other two populations. The Arizona plantings yielded seed earlier, and in smaller quantities, than did the plantings from Baja California.

On several occasions, jojoba plants were found to be severely damaged by cold night temperatures in southern California. To evaluate the cold tolerance of the species, six-month-old seedlings in flats and two-year-old plants in gallon cans were placed in growth chambers at 17°, 22° and 25°F night temperatures. The day temperature was 60° in all cases, the day length was 12 hours, and the treatments lasted for 14 days. Forty-two two-year-old plants and 600 seedlings were included in each experiment. After each treatment, the plants were returned to outdoor benches where the temperature ranged from 35° to 80°F, and were observed for about three months. At the 17°F night temperature, treatment damage was obvious even after the first night. The leaves became water-soaked and the growing tips showed severe wilting within a few hours; none of these plants recovered. In the 22°F night temperature, only one out of the 42 two-year-old plants resumed growth after the treatment. About 3 per cent of the seedlings retained green leaves but no new growth appeared three months after the treatment. After the 25°F treatment, the growing tips and young leaves of the two-year-old plants were wilted and some of the older leaves developed necrotic margins; however, all plants and seedlings retained their vigor and continued their normal growth after the treatment.

In a subsequent test, 42 two-year-old plants were placed at 22° night and 60°F day temperatures, and groups of three plants each were removed every day for 14 days. The first group of three plants, removed after 12 hours exposure to 22°F, slowly resumed growth, but the remaining plants were all killed.

A mixture of butyl stearate and a mineral oil is used in the aluminum industry as a cooling agent and to furnish lubrication to the aluminum sheets as they are rolled. The high content of long chain alcohols and fatty acids in jojoba wax, plus its ability to withstand high temperatures, and to remain liquid at room temperatures, suggested its possible use as a rolling oil or additive during the cold rolling of aluminum sheets. Tests were conducted, with the cooperation of P. Papafingos, Manager of Research and Development, Amax Aluminum, Riverside, to evaluate jojoba wax in such applications. The following data were obtained:

Acid value expressed as lauric acid	0.11%
Saponification value expressed as butyl stearate	45.12%
Specific gravity	0.86%
Viscosity SSU at 100°F	119.1 seconds
Viscosity SSU at 150°F	67.8 seconds
Stain test on aluminum	No. 10*

* 1 to 6 is acceptable range under Amax standards.

The tests showed that the wax stained the aluminum sheets when they were subjected to heat treatments after being rolled. The film of wax, which adhered to the surface, apparently carbonized when the sheets were exposed to temperatures of 450° to 650°F. Another undesirable property was the drop in the viscosity of the wax when its temperature was increased from 100° to 150°F.

Failure to meet the critical requirements of constant viscosity and no staining, makes jojoba unsuitable as a rolling oil. Investigations are continuing to determine other possible applications in the aluminum industry.

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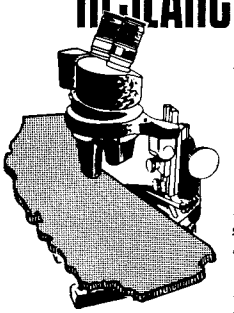
RESEARCH PREVIEWS



A continuing program of research in many aspects of agriculture is carried on at University campuses, field stations, leased areas, and many temporary plots loaned by cooperating landowners throughout the state. Listed below are some of the projects currently under way, but on which no formal progress reports can yet be made.

PEACH TREE DECLINE

Scientists in the Departments of Plant Pathology and Nematology at Davis have discovered evidence that decline of peach trees, formerly thought to be one of the results of attack by bacterial canker, is probably a separate and distinct disease brought on by a complex of soil organisms and nematodes.

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"WHY?" IS IMPORTANT

Basic research aimed at explaining why some things occur is helping plant breeders in the Department of Agronomy at Davis produce better varieties and strains of many plants. A recent experiment showed that substantial genetic variability was present in natural populations of *Festuca microstachys*, one of the common grasses of the California range, even though the plants of this species are almost exclusively self-pollinated. With information gained from previous experiments, even this unusual quality could be explained.

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HASTENING FIG MATURITY

The application of a drop of olive oil to the "eye" of the fig fruits has been known for centuries to hasten maturity. Davis pomologists have found that the olive oil stimulates ethylene in the fruit, so have exposed figs, at particular stages of growth, to minute amounts of ethylene and have thus brought about greatly accelerated growth and maturation.

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PEAR GROWTH REGULATORS

Davis pomologists are working with Alar for control of shoot growth, time and amount of blooming, and fruit set on pear trees planted in hedgerows. Postbloom sprays show promise in reducing shoot growth and increasing flower bud formation while fall applications are most effective in delaying bloom the following spring to avoid injury from late spring frosts.