Castor Beans

studied for potential values as oil crop for California production

P. F. Knowles

Approximately 300 million pounds of castor beans were imported during each of the past eight years.

The oil extracted from the castor bean is used primarily in the paint and varnish industry although a small percentage is used for medicinal purposes.

The University has a large collection of the various types of castor beans grown in other parts of the world, and studies of these varieties under California conditions are underway.

Castor beans are not true beans, nor are they remotely related to the other beans of commerce. Under tropical or semitropical conditions they behave as perennials, with the plants sometimes reaching a height of 30 feet. In most areas of the United States they are grown as annuals.

The types of castor beans are extremely diverse. Some reach a height of only four feet at Davis; others may grow to 15 feet under the same conditions. Some are early, but others will not flower under California conditions. Branches may be abundant or they may be almost completely lacking.

The seeds are borne in capsules. The plants which grow wild have capsules that split open very readily at maturity. Plant breeders in the United States are developing types which are resistant to shattering and therefore are more suitable for mechanical harvesting.

The color and size of castor bean seed are variable. Seeds measuring about one-half inch long and about one-quarter inch in diameter are preferred by processors and uniformity of seed size facilitates the removal of hulls by mechanical means.

Castor beans have not been an attractive crop because they required hand harvesting. Recently the University of Nebraska in coöperation with a castor oil company has developed a mechanical harvester which has given a promising performance. The machine has been tested in California and it is reported that with minor modifications it will handle the high yields in this state. Operating in somewhat the same manner as a corn picker or a cotton stripper, the harvester beats the capsules from the standing plants. Defoliants probably will be used prior to harvest to facilitate gathering the beans.

Hullers have been developed which remove the seed from the capsule. One designed by the United States Department of Agriculture is in commercial operation.

Davis Experiments

Castor bean varieties have been grown in yield tests at Davis for two years.

Results from these tests are shown in the accompanying table and would seem to indicate that under conditions such as those at Davis, yields of from 2,000 to 3,000 pounds an acre could be expected from the better varieties. The low-growing types have given some of the highest yields.

Extensive tests with castor beans have been conducted by a castor oil company in the Imperial and the San Joaquin valleys. The results obtained in 1947 and 1948 indicated that yields will be higher in the San Joaquin Valley than at Davis. In some cases yields were over 3,000 pounds an acre.

Yields in the Imperial Valley were disappointingly low in 1948. In many instances yields were less than 1,000 pounds an acre, and only in a few cases did they reach 2,000 pounds. The low yields can be attributed to the high summer temperatures which reduced seed-setting.

Experiments during the past season in the Imperial Valley have been distinctly more promising. Earlier seedlings permitted the production of a crop before the occurrence of the high temperatures, and yields up to 2,500 pounds an acre were obtained with the better varieties. Early-maturing varieties were sown in July for harvest in January, and indications were that yields might approach 2,000 pounds an acre.

Cultural Recommendations

1. Seed bed preparation is similar to that for cotton or corn. A pre-irrigation will be necessary in dry areas.

2. Seeding machinery used for beans, cotton or corn can be adapted to castor beans. The seeds crush rather readily if adjustments are not satisfactory, and the oil collects dirt and clogs the machine. Rows should be about 42 inches apart with seeds about 20 inches apart within the row. The seeds germinate rather slowly and should be planted in soil that will remain moist at least a week. Seeds should be sown no deeper than three inches and preferably, only two inches. Flood irrigation to germinate the seeds

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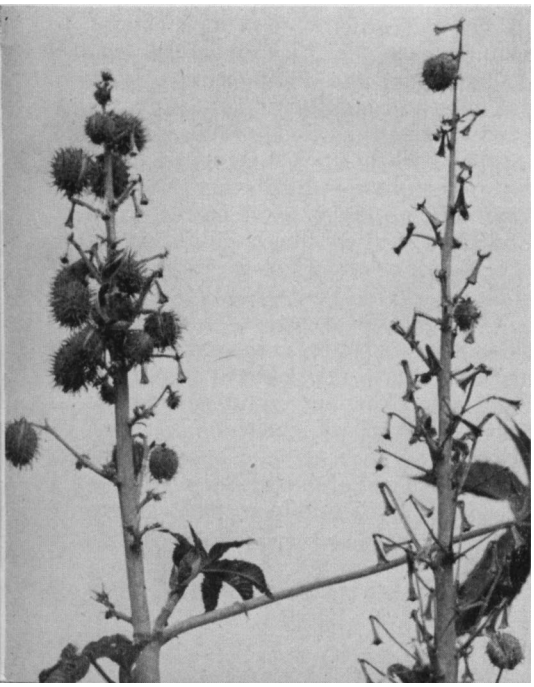

Right. **Castor beans grow vigorously.** ***Center.*** **Castor bean varieties vary greatly in seed appearance. The three varieties on the right are acceptable types.** ***Left.*** **Older varieties shattered very readily when ripe. Improved varieties are resistant to shattering.**

RED SCALE

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scale will increase rapidly during the first year or more since its enemies have been practically eliminated.

What has been learned thus far is encouraging. It is especially so to know that owners of some of the best producing orange groves in southern California—groves which formerly were regularly treated—have not treated for red scale for seven or eight years, while treatments were applied regularly by neighbors.

Further Studies Needed

It is not recommended, of course, that growers abandon treatment for red scale. There is reason to hope, however, that upon the completion of these studies it will be possible in many instances for other growers to duplicate what those owners of the groves now under study have done; i.e., utilize the biological method for control of this pest.

An important factor bearing on this possibility will be the occurrence of other pests in the groves.

The natural control of red scale seems to be a rather finely adjusted balance which may be upset rather easily, and it is probable that considerable management by man—including insectary culture and periodic colonization in the groves of the golden chalcid or other natural enemies—may be necessary. It may be that in some localities environmental conditions are so favorable to red scale that under no conditions can such a program be adopted.

The object of this investigation is, in general, to find out why red scale control by use of insecticides can be abandoned in some groves with satisfactory results, and then to learn how generally it is safe to follow such a program.

The red scale is a dangerous pest and to let it escape from control can result in severe injury to the citrus trees.

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has not been a successful practice. A stand of one plant every 30 inches is desired.

3. Cultivation is similar to that for cotton or corn.

4. Irrigation should be sufficient to keep the plants healthy. Too much water on fertile soils will cause excessive vegetative development. Water should be withheld from the crop for a period of a month to six weeks prior to harvest.

5. Fertilizer requirements are not too well known. Higher yields have been obtained with applications of nitrogen to soils low in this plant nutrient, but similar applications to soils high in nitrogen have given vegetative development rather than seed production.

6. Diseases and insect damage have not been serious in California. Castor beans are not resistant to nematodes.

7. Hand harvesting—the only alternative to the use of a specially designed mechanical harvester—will cost an estimated 1.5 cents a pound of seed where the yields are good. Because the crop matures over a long period, two or three harvestings may be necessary.

Castor beans have been selling for about seven to eight cents a pound of seed, with the price dependent upon world supplies. Anyone contemplating the growing of this crop should make prior arrangements with a processor of castor beans for disposal of the crop. Processors are the only known source of commercial quantities of seed.

All plant parts of castor beans are poisonous to humans and to livestock. The seed meal remaining after oil extraction can be used only as fertilizer.

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Results of Castor Bean Yield Tests at Davis

Variety	Height in inches			Yield in pounds per acre		
	1947	1948	Average	1947	1948	Average
Conner	76	96	86	2342	2497	2420
Wieman	80			1917		
Kentucky 38	54	63	58	2062	2332	2197
Illinois No. 1		74			2755	
Nebraska 51–1–1		66			2996	
No. 93	51	58	54	2692	2657	2674
No. 72		90			2307	
R–2		52			3058	
R–3		69			2442	
R–6		66			2504	

COLD DAMAGE

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The 1932 cold weather came before some walnut trees were thoroughly dormant and there was some crotch injury. A repetition of this damage in 1949 is not likely since the cold weather occurred about a month later than in 1932.

In midwinter although flower buds are somewhat less resistant to cold than leaf buds or cambium, nevertheless flower buds of the most tender kinds such as the peach, the apricot, and the almond will withstand temperatures as low as –13° F to –22° F. Consequently it must be concluded that no damage was done and normal crops in 1949 may be expected—unless frosts or other unfavorable climatic conditions exist at time of bloom and fruit setting.

Flower buds of deciduous fruit trees which produce a fruit crop any one year are initiated the preceding summer and continue their development during succeeding months and only open after two conditions are met: *1.* sufficient chilling weather must have existed during the winter months to break the rest and *2.* temperatures must be high enough to start growth in the spring.

It is no accident that the California deciduous tree fruit industry is concentrated north of the Tehachapi mountains. Spring temperatures in southern California are ideal but unfortunately the mild winter climate often results in delayed foliation of fruit trees and the shedding of most flower buds of apricots, peaches, and Japanese plums with resultant delay in maturity and greatly reduced yields.

Fruit trees have a chilling requirement which must be fulfilled before blossoming can take place. If this were not so, the frost hazards would be greatly increased since during many years, temperatures in January throughout northern California are high enough to initiate growth and blossoming.

There is a wide variation between species and varieties as to their chilling requirements. The fig needs the least chilling of all the deciduous tree fruits and nuts and is followed in turn by the almond, English walnut—southern California varieties—apricot, Japanese plum, European plum—which vary widely—sour cherry, peach, sweet cherry, pear, English walnut—northern California varieties—and apple, which needs the most chilling.

Temperatures under 45° F are considered to be effective in breaking the rest and cold hours are calculated as so many hours where the temperature in a standard weather bureau shelter is 45° F or below.

As of the end of the third week in January 1949, 1,287 cold hours had accumu-

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