

## CAROB INVESTIGATIONS; REPORT OF PROGRESS

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The carob demonstration orchard near Vista sponsored by Dr. Walter Rittenhouse as a public service is now ten years old. The objective of the project is to work out such problems as economical propagation, cultural methods, harvesting and, most important, the testing and evaluation of many varieties both foreign and domestic to find those best suited to our local environment. From its inception to the present time the writer has had personal management of the project.

When the site was selected the Weather Bureau estimated the normal annual rainfall to be about 15 inches. This amount has been reached or exceeded only twice in eleven years. The land has no water rights and no irrigation has been possible. In order to economize on area the trees were spaced 15 by 30 feet. While small they grew quite well but are now showing the effects of the drought. It is now evident that, when dry farmed, carob trees should be spaced 40 by 40 feet or given some supplementary water after winters of scant rainfall. The carob tree thrives on a very much smaller amount of soil moisture than avocados and citrus. This fact is of significant importance in an area where water is limited and where rapidly increasing domestic and industrial demands are raising the cost of water beyond the economic reach of some farmers.

### PROPAGATION

Seedling rootstocks vary widely in vigor, habit and cold resistance. This is especially true of a mixture of seeds from old trees growing along the streets. More uniformity is gained by using seeds from one satisfactory variety of budded trees. Research on rootstocks is badly needed, a project which would require many years to show results. Meanwhile imported seeds of the Tylliria variety give fairly good results.

It is possible to root the carob from cuttings but that has been found to be too uncertain and expensive to be used commercially. Conventional shield budding in late spring or early summer is highly successful for seedlings growing in the ground. However, because of the exceptionally strong tap root, it has been found much better to grow nursery stock in 15 inch, deep bottomless, tar paper containers. Shield budding or whip grafting in containers has been tried by many people and gave such poor results that many growers now prefer to plant seedlings in the field and bud the trees when one year old. Recently Elwood Trask has found that by using a twin-bladed knife and ring budding the stocks in containers in June the degree of success indicates that this problem may have been solved.

## TILLAGE

Disking or cultivating the carob orchard, especially when dry farmed, disturbs the root system and results in defoliation and reduction or loss of crop. It is amply demonstrated that non-cultivation is best for bearing carob orchards. However it is necessary, especially when dry farmed, that the growth of weeds and grass be prevented by spraying with oil or chemical herbicides. Carob trees three years or older are fairly resistant to Karmex-W when sprayed on the ground in the fall to prevent weed growth.

## INSECT PESTS AND DISEASES

While the carob tree is singularly free from insect pests and diseases and no spraying has been necessary in the demonstration orchard, the pods of some varieties, especially near the coast, become infested, while maturing and before harvest is complete with a small scavenger worm **Paramyelois transitella**, (Walker). Newly-hatched larvae gain entrance through cracks in the skin or checks near the stem. This, where serious, is naturally objected to by local mills which manufacture products for human consumption. This market is more profitable for growers than that for livestock feed with which the country is over-supplied.

Some of our good varieties found wormy at harvest, may be promptly fumigated with ethyl bromide to prevent any further damage in storage. Tests are now in progress to kill the young larvae before much damage has been done by putting the pods in cold storage for a few days at or below zero. Fortunately several of our best varieties are highly resistant if not actually immune to infestation by this pest.

## YIELDS

Varieties differ in their bearing habits and many fluctuate in yield from year to year as they respond to rainfall and other weather conditions. In general the trees should begin to bear the fifth year from budding and increase in production with age. Young trees will come into bearing much earlier if given some irrigation the first two years during which time their tap roots should have penetrated the subsoil. Some mature trees, over twenty years old, occasionally bear enormous crops of more than one thousand pounds to be followed by a light crop or failure the next year. While there are as yet no large bearing orchards of budded trees in California, a conservative estimate indicates an average yield, when 15 to 25 years old, of 200 pounds per tree or from three to four tons per acre. Carob trees attain a great age. Many trees in Europe still bear profitable crops more than one hundred years from budding.

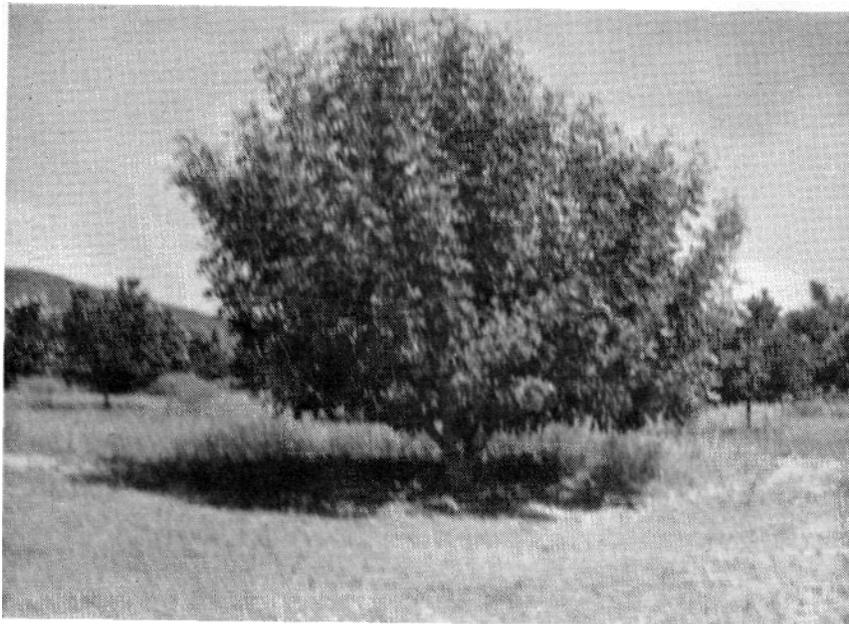
## HARVESTING

In California carobs are harvested in the months of September and October. Any varieties maturing after November 1st are liable to be damaged or lost by fermentation caused by an early rain. The pods of a given variety are all harvested at one time. The ground under the trees is raked clean of fallen leaves. As soon as the pods are mature and dry, one vigorous shake of the tree brings down all but a few which are knocked

down with a light pole. They remain on the ground for two to four days according to weather conditions or until quite dry and ready for sacking and storing.



Young 85-acre carob planting. San Luis Rey, California.



Bearing Bolsa Carob 7 years from bud. Bonsall, California.

## **DISPOSITION**

In Europe, until recently, the chief uses of carob have been for livestock feed and

industrial alcohol; a relatively small amount being reserved for human consumption. Research chemists have now developed a number of new uses; viz various forms of human foods, a substitute for chocolate, stabilizers, pharmaceuticals, etc. There is now an active demand in California mills for a more dependable supply than is now available from Europe. Previous imports have come mostly from Cyprus and Lebanon, both of which countries are now subject in political turmoil. Annual imports from Europe are valued at ports of export at more than four million dollars. Current prices in California are around \$120.00 per ton for good quality carob pods from budded trees.

### **ANALYSES OF THE PULP OF 40 VARIETIES**

Total sugar from	37 to 62 per cent.
Protein	2.2 to 6.6 per cent.
Fiber	5.5 to 8.59 per cent.
Ph	4.5 to 5.2 per cent.
Vitamins	Moderate amounts.
Calories	1,595 per pound.
Starch	None.

### **TRAGASOL GUM**

From the seeds there is made a stabilizing gum known as Tragasol or locust bean gum which is widely used in food products as well as many industrial processes. Annual importations of Tragasol into the United States are more than fifteen million pounds. The seeds constitute 10% of the pods by weight.

### **VARIETIES**

As it has been with avocados and macadamias the carob variety problem is very important as well as intriguing. Since 1950 additions to our variety collection from both foreign and domestic sources have been made each year. At present there are 70 different clones growing in the orchard. Of these 23 came from foreign countries including Portugal, Israel, Spain, Yugoslavia, Greece, Cyprus, Crete, Italy, Tunis and Algeria. The rest are from selected seedlings found growing in California and Arizona. In 1954 the writer spent the harvest season in Mediterranean countries where carob culture is most important making a study of both production and utilization. Innumerable varieties were found, and with few exceptions, the nomenclature was in great confusion.

At this date about 20 varieties in the demonstration orchard have borne fruit in sufficient quantity for evaluation. In judging a variety consideration is given to yield, sugar content, season of maturity, flavor, susceptibility to worms, fiber content, porosity, ease of harvest and sex. The chocolate-like flavor varies with the variety and is not always correlated with sugar content. All of the European varieties so far fruited are females requiring an inter-planting of males or hermaphrodites for cross pollination. A number of

domestic varieties, including two of the best are self-fertile hermaphrodites.

No special evaluation of male trees has been made except for dates of blooming. Two male varieties, one early and one late, appear to cover the season for all females and hermaphrodites. At the present, varieties approved for planting in southern California are few in number but several very promising kinds are just beginning to bear.



Budded carob orchard in bearing. Bonsall, California.

SFAX	female	Origin Tunis
TYLLIRIA	female	Origin Cyprus
CASUDA	female	Origin Spain
SANTA FE	hermaphrodite	Origin Santa Fe Springs, Calif.
CONEJO	hermaphrodite	Origin Vista, Calif.
BOLSER	hermaphrodite	Origin Bloomington, Calif.
MOLINO	hermaphrodite	Origin Riverside, Calif.

Budwood of these varieties is being distributed to nurserymen and growers in California and also to many foreign countries including Israel, Australia, South Africa, Brazil, Argentina, Chile and Mexico.

There are a number of other varieties in the orchard which are very good but not quite equal to those listed above. It is our aim to restrict the number of varieties distributed, having in mind the confusion resulting from too large a number of varieties grown in the early years of the avocado industry. Some of those listed may be displaced by better ones in the future. Where we have more than one tree of a variety of good but second rating, the best one is selected to remain permanently and the others are sawed off two feet from the ground. Many vigorous sprouts arise and, budded to a new kind the following year, produce fruit much sooner than would be the case if budded on a small

seedling stock. This variety collection is by far the most comprehensive of any in the world. It is to be maintained until 1980 as a variety reservoir for world wide accommodation.

## **ECONOMICS**

It has been demonstrated that the carob produces equally well and that the fruit is of equal quality in California as that produced in the Old World. An active market exists here now. In addition to the money return carob culture is of great value for erosion control on sloping lands.

It is the ambition of Dr. Walter Rittenhouse, by his benefaction, to provide the groundwork for a new agricultural industry for semi-arid lands in southern California in particular and for other similar climatic areas of the world. A number of commercial orchards have been planted and budded to our best varieties. Here and there a few of the older trees are beginning to bear in amounts equal to our expectations. Lacking funds for promotion, progress has been slow, but will accelerate as more and more growers become interested and informed.