

THE ECONOMICS OF HIGH DENSITY ORCHARDS *In California*

A. D. Reed

Summary

High density plantings of apples have a definite potential under California conditions. The large development costs are more than offset by the early production of the high density plantings. The higher the interest rate, the more advantage there is to the high density plantings. Under the price and cost relationships used in this study, orchards with a 12 ton potential production were not profitable at any density of tree plantings.

A. D. Reed is Extension Economist at the University of California, Davis.

Apple orchards in California have traditionally been planted at 50 to 100 trees per acre depending on the variety, soil, climate, and other factors. Plantings with trees much closer together have been made successfully in other states and in Canada and Europe. Some close-spaced plantings have been made in California during the last few years but we still have no production records on which to base an economic analysis. This study is based on data accumulated from around the world which we have adopted to California conditions and hopefully will accurately indicate the economic results that will occur from increasing the number of trees per acre.

Close-spaced orchards are planted on various dwarfing rootstocks so that the mature trees are small. Many rootstocks have been used and a variety of pruning and shaping systems have been tried. This report does not evaluate the rootstocks or the pruning method but only the economics of close vs. standard plantings.

Many advantages have been given for close-planted trees. Their small size makes it much easier to prune and pick. The use of ladders, or at least the use of tall ladders,

may be eliminated. Simple mobile units for the pruners and pickers to ride on can often be used where they would not be practical with larger trees. Results on close-planted orchards in New York indicate that pruning and spraying costs can be lower than for the orchards with fewer trees. Less pruning is needed on the close planted dwarf trees and the pruning can be done from the ground. Less spray material is required and smaller spray machines can be used successfully.

The greatest economic advantage of the close-planted trees is that they start yielding a self sustaining crop much earlier than the wider spaced trees.

The yield data available for analysis comes from a conglomeration of rootstock test plots, planting distance of trees, and other research factors which introduce wide variations in the yields obtained. This plus varying weather conditions from one year to the next give a data base which is difficult to accurately analyze. Some investigators have projected that the close-planted orchards will yield up to four times the yield on standard plantings. Plant physiologists on the other hand have shown that the total production of fruit is a function of sunlight captured and used by the plant. Therefore the production per acre is more a function of plant cover rather than number of plants. A planting with less trees per acre but good coverage of the ground can yield as heavily as a closer planted orchard. Therefore we have projected our annual yields as being equal after the trees come into full production.

Results in New York indicate that the quality of fruit may be better with the close-planted trees. We have not considered this possibility in our analysis.

The major disadvantage of the close-planted trees is the higher development costs and the time it may take to recover that cost. Some

of the training systems used involve various types of trellises which are not only an additional original cost but may require constant repairs. A disadvantage at the present time is the lack of California experience on which to base a management decision.

The following analysis is based on these assumptions:

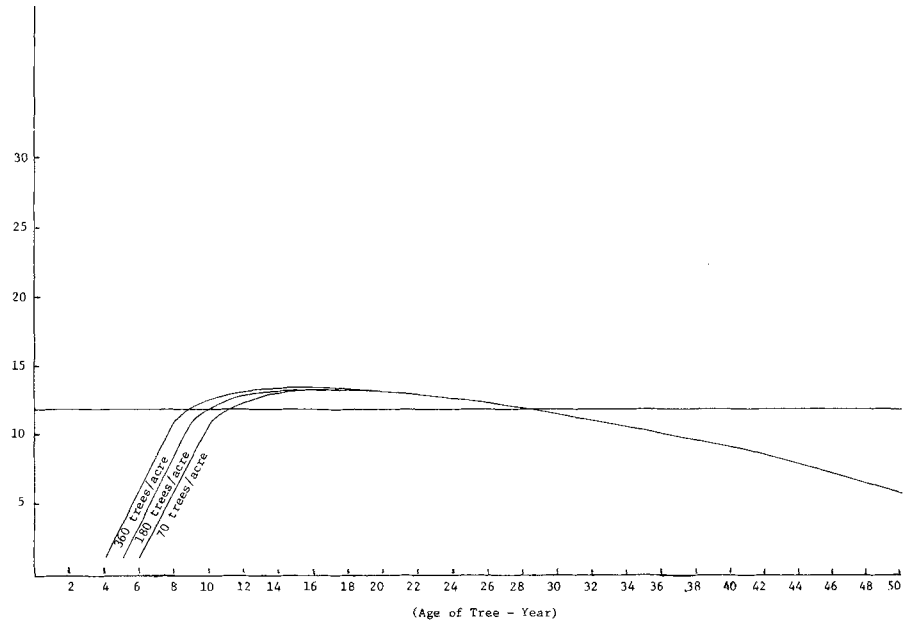
- Calculations were made on orchards with average yield levels of 12, 22, and 30 tons per acre.
- The 12 ton orchards were considered as non-irrigated but the 22 and 30 ton orchards were irrigated.
- Planting densities of 70, 180, and 360 trees per acre were assumed.
- A price of \$100 per ton for the apples f.o.b. ranch was used in calculating income.
- Comparable conditions of size, soil, climate, equipment, water supply, and other conditions were assumed.
- Comparable management practices were used for all situations.

Yields. The extensive data which were analyzed to arrive at the yield functions used in this analysis indicated that after the trees started producing a harvestable crop, the yield increased rapidly until a maximum was nearly reached. Then the production leveled off, reached a maximum level and then gradually declined as the trees became older. There has been some indication that yields of close-planted orchards may reach a higher level of production but then decline faster as the trees become older than would be the case with orchards with less trees per acre. This situation was not evident from the data analyzed so we have estimated yields being equal after the trees reach maximum production.

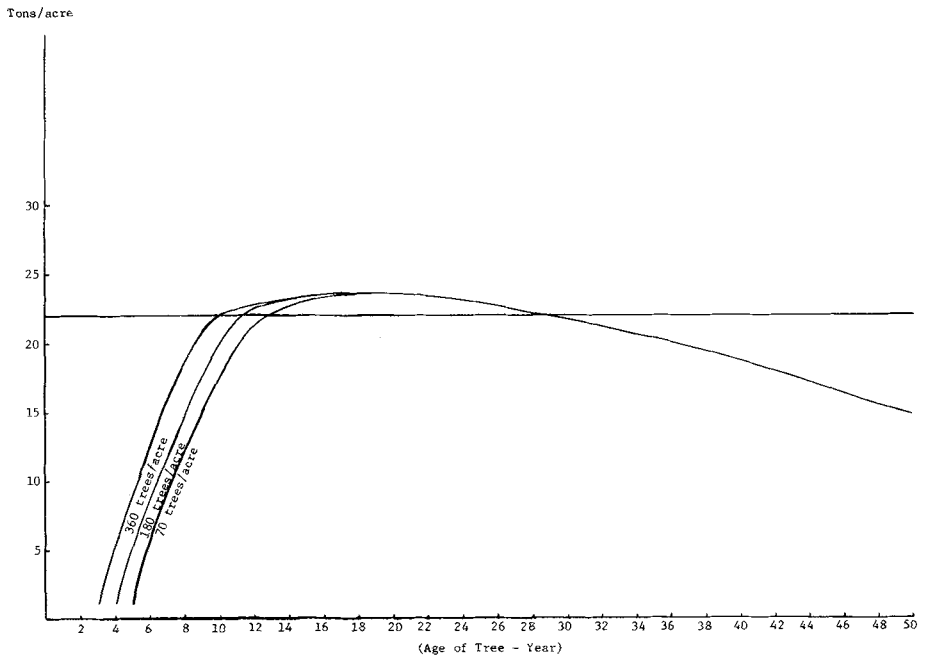
The following graphs indicate the estimated yields used in this analysis.

APPLE

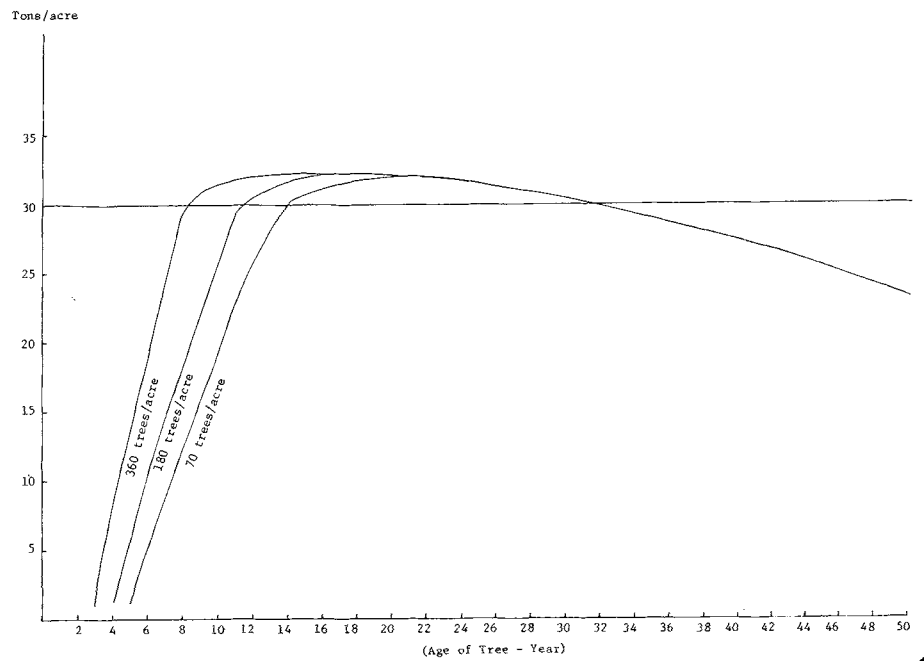
APPLE YIELDS — 12 TON ORCHARD

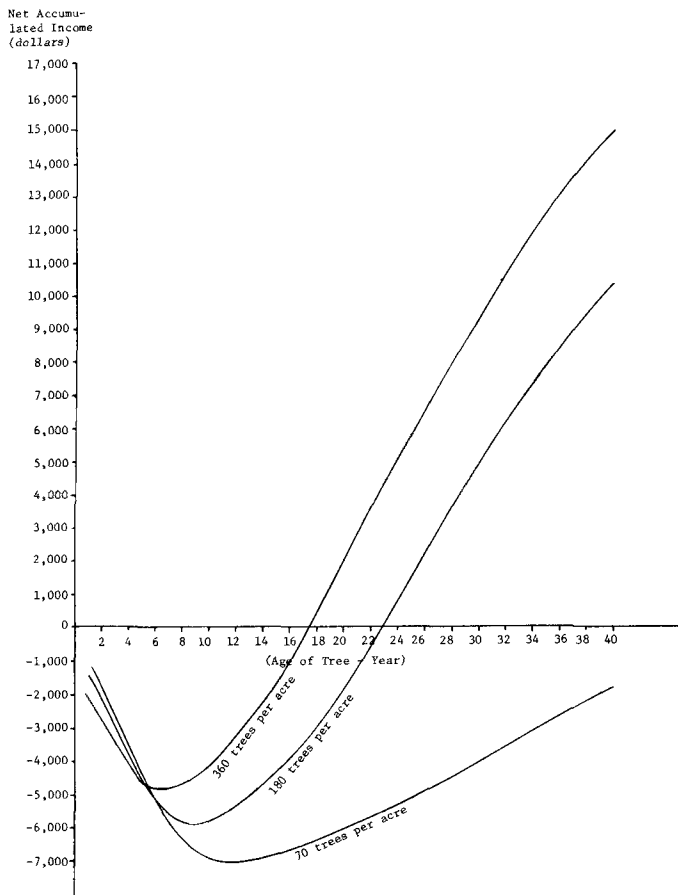


APPLE YIELDS — 22 TON ORCHARD

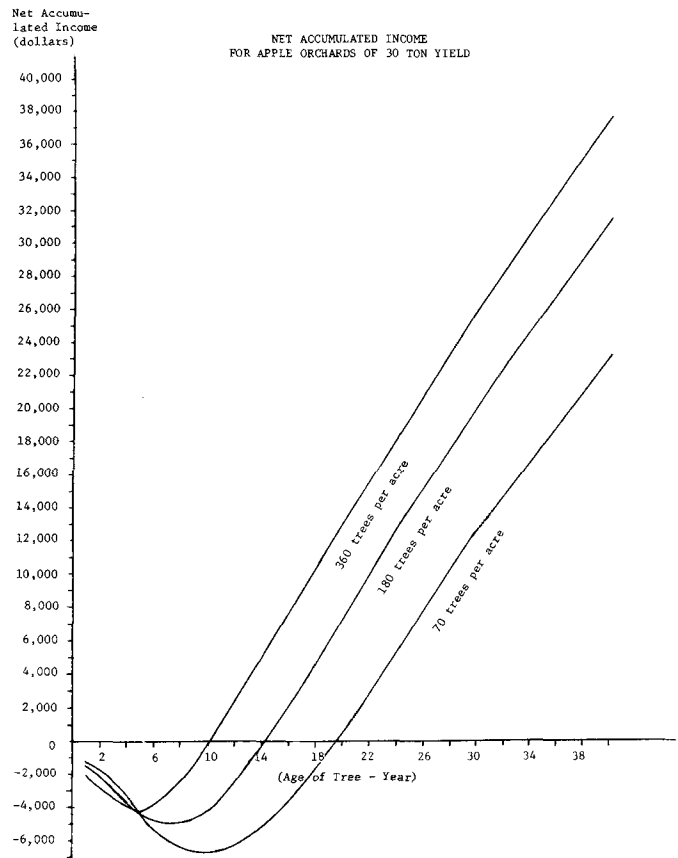


APPLE YIELDS — 30 TON ORCHARD





NET ACCUMULATED INCOME FOR APPLE ORCHARDS OF 22 TON YIELD



NET ACCUMULATED INCOME FOR APPLE ORCHARDS OF 30 TON YIELD

Net Income. The income analysis involved a determination of income and costs, year-by-year, during the lifetime of the trees. The net income at the end of each year was added to the net income of the preceding years to arrive at an accumulated net income at the end of each year. An interest charge was made for any negative net income carried over from previous years.

The analysis shows that although the close planted orchards cost more to establish, the early production of fruit means that the close planted orchards recover the planting costs much more rapidly than do traditional plantings and they maintain that advantage during the lifetime of the trees.

The following graphs show the difference in accumulated net income at different ages for the three

tree densities studied. Material on the 12 ton orchard is not shown because none of the plantings were profitable at that level of production.

Correction:

POLLEN TUBE GROWTH IN ALMOND FLOWERS

CORRECTION: "Pollen tube growth in Almond Flowers" by W. H. Griggs and Ben T. Iwakiri. Volume 29, Number 7, July 1975. Page 4, Table 1 should read:

Pollen tube development in non-pareil and Texas (Mission) Almond pistils at 24-hour intervals following cross-pollination (Davis, 1972).

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