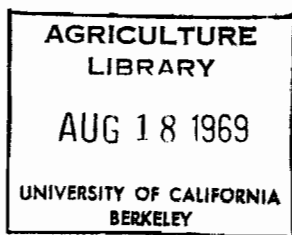


MECHANICAL HARVESTING

COSTS FOR APRICOTS

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Purpose of Trials

The purpose of the 1968 trials was to obtain economic data on mechanical harvesting of apricots. The harvesting was done on a commercial scale, with complete harvesting of various orchard blocks. In 1968, fruit condition was evaluated by California Canners and Growers. This report is limited to the economics of mechanical harvesting.

Orchard Conditions

The orchards used in the test were mature Blenheim apricots, over 20 years old, with 20 x 20 and 24 x 24 foot spacings, except for one block of young Blenheims, 8 years old, planted 20 x 20 foot spacing.

The trees were trained in an upright fashion with 3 to 4 main scaffold limbs arising from 1½ to 2 feet above the ground. A few trees were headed at 1 foot. All orchards had many limbs in the center of the trees, creating a limb-over-limb situation.

In most orchards the soil surface was level and generally firm. One orchard had a slope of 5 - 9% which did not present a problem except along one steeper slope. Mounded soil around the tree trunks was rarely a problem.

Maturity was quite variable from tree to tree. Some trees were completely harvested the first pick. Some were skipped until the second pick, and approximately 40% were shaken during both the first and second pick.

Harvest Equipment

Two types of harvesters were used. The Fabco Butte Mark II, built by Fabco Division of Kelsey Hayes, and the Gould Bros. Tow-Catch frame and truck-mounted shaker.

The Fabco Butte is a single unit with self-contained trunk shaker using a wrap-around inverted umbrella principle. The crew included an operator and two sorters.

The Gould Bros. Tow-Catch and inflatable Tow-Catch units were used in the first pick and the latter unit was used alone in the second pick. The crew consisted of one trunk shaker operator, and for each tow-catch frame, a tractor driver, two sheet pullers, and a sorter.

A piece of sponge rubber was placed in the tree crotch to reduce fruit damage in both operations.

Cost Information

The cost data is reported on a per-acre basis, since the time required to harvest was not affected by yield in these trials. Yields of orchards harvested this season varied from 1.75 tons per acre to 7.25 tons per acre, but the time per tree harvested did not vary due to yield. Time per tree did vary between first and second pickings because of the decisions during the first pick.

Cost calculations are shown in the examples so that costs may be determined for other individual orchard conditions.

It is assumed that forklifts are available and used in hand harvesting in most orchards and, therefore, no costs were included for this equipment.

Time for bin changing, turning, and other normal operations is included in the operating time per acre. Repair time and crew breaks were not included.

Hand Harvest Cost

The prevailing rate for hand picking apricots in San Benito County during 1968 was 20¢ per bucket or \$22.50 per ton. Adding costs for supervision and overhead, total cost per ton was \$28.00. For a yield of 7.25 tons per acre, the hand harvest cost totaled \$203 per acre.

HARVEST COSTS

24 Ft. x 24 Ft. Spacing

Harvester: Fabco Butte Mark II

The harvest time per tree was the same as for a 20 x 20 ft. planting, but the total hours required per acre for a 24 x 24 ft. planting were reduced. The harvest rate was 1.77 minutes per tree or 3.2 hours per acre, thus the acreage capacity for one machine is:

$$150 \text{ hrs.} \div 3.2 \text{ hrs./Acre} = 46.87 \text{ acres/machine}$$

Cash cost per acre: \$11.20 per hour x 3.2 hours/A. = \$ 35.84

Overhead cost: \$4,800 annual int. & deprec. \div 46.87 acres = 102.41

TOTAL COST PER ACRE

\$138.25

HARVEST COST PER TON
MACHINE VS. HAND PICKING

20 x 20 spacing
108 Trees/A.

Fabco Butte - Mark II *

HARVEST
COST
PER
TON

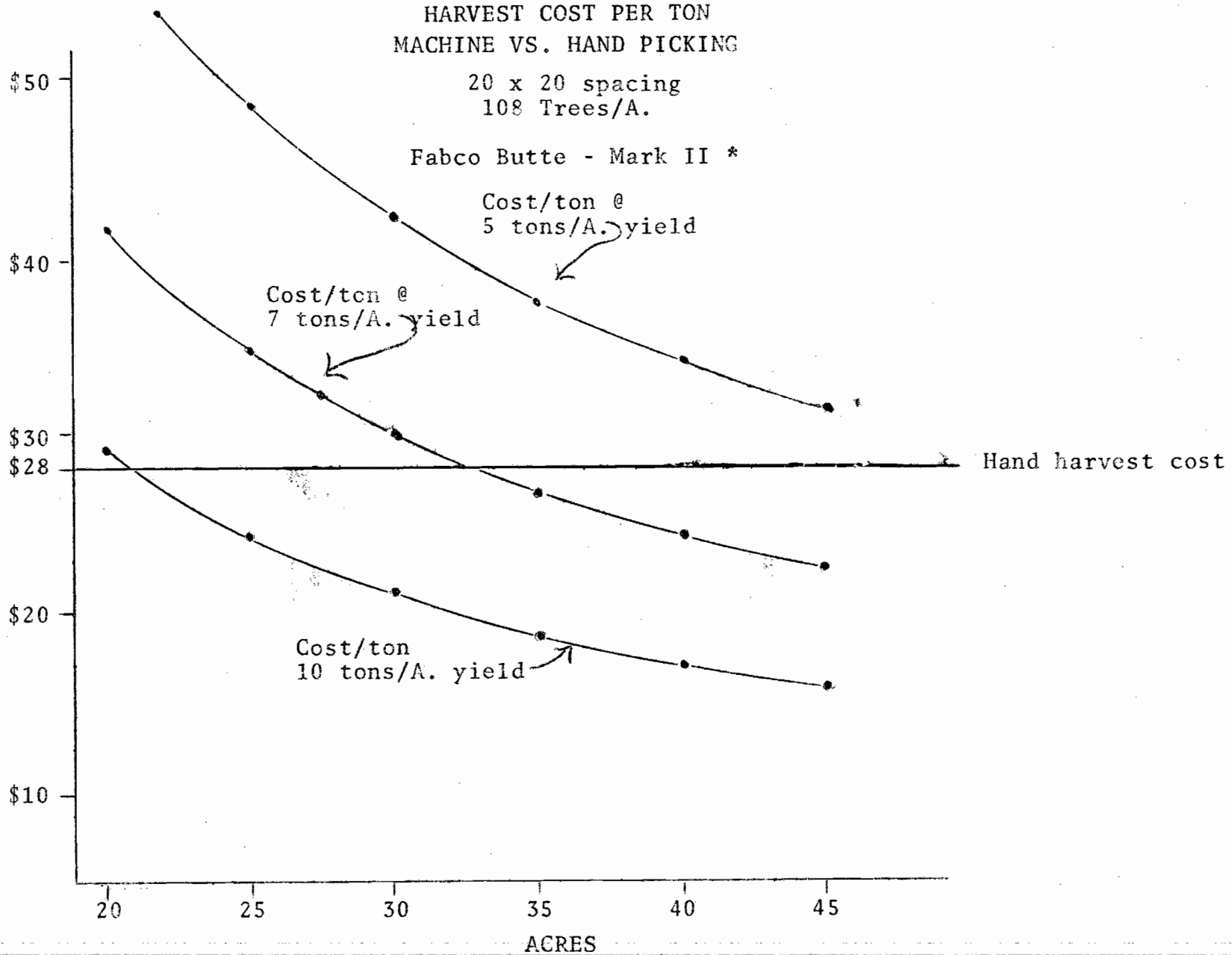


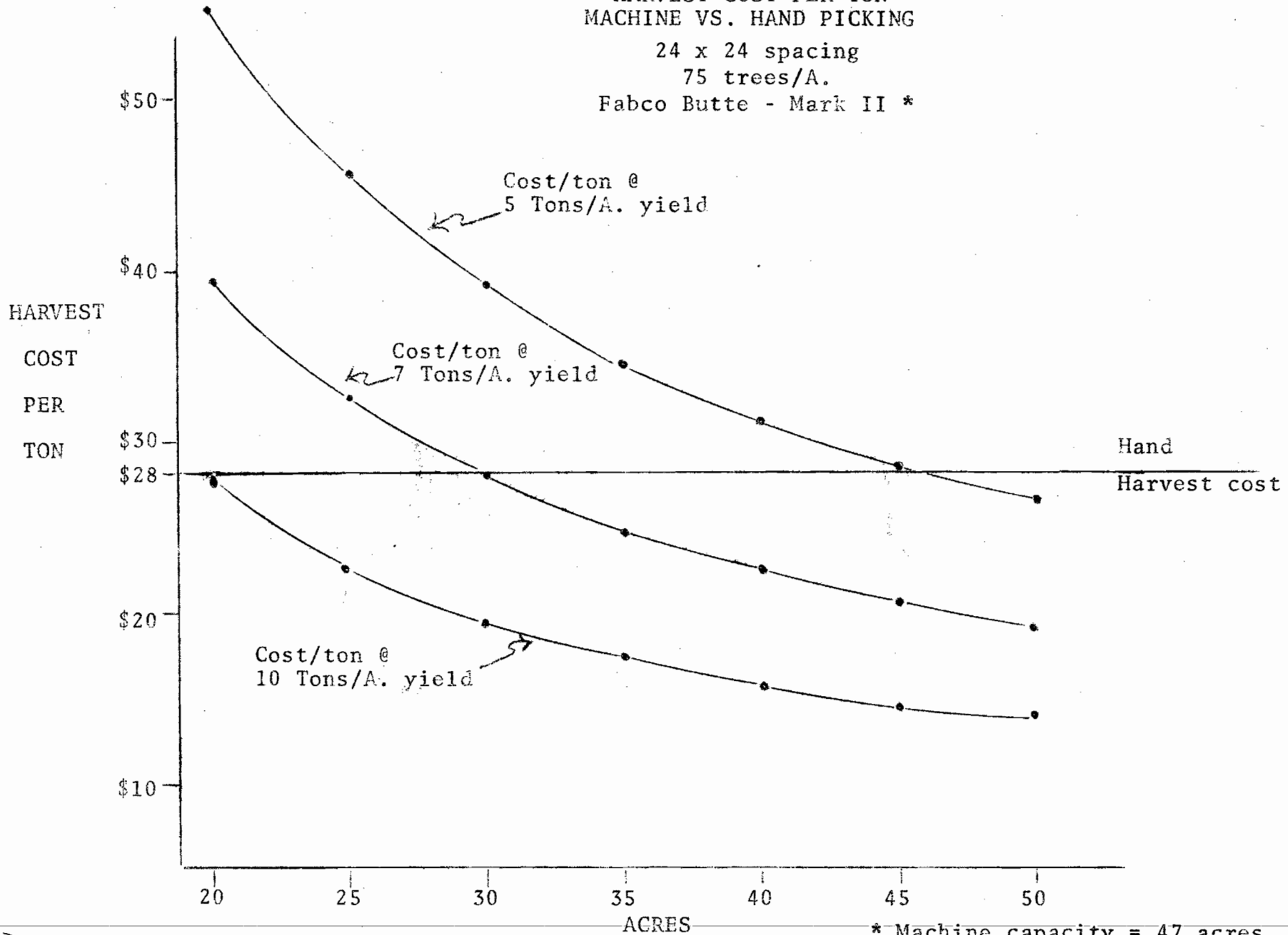
Chart 1

*Machine capacity = 33 acres

HARVEST COST PER TON
MACHINE VS. HAND PICKING

24 x 24 spacing
75 trees/A.

Fabco Butte - Mark II *



* Machine capacity = 47 acres

Chart 2

The harvest operation with Gould Bros. equipment used two Tow-Catch units during the first pick and one the second pick. Cost figures are presented on the basis of using two catching frames for both picks, and one catching frame for both picks.

The use of two catching frames increases the efficiency of the shaker, and reduces the time required to harvest an acre by 48.4% compared to using one tow-catch frame. By increasing the acreage capacity, the total cost per acre is reduced.

HARVEST COSTS

24 Ft. x 24 Ft. Spacing

Harvester: Gould Bros. One Tow-Catch frame
 Acres: 5.4 (40% of trees harvested twice)
 Harvest Rate: 2.5 min. per tree
 4.36 hours per acre
 Machine capacity: 34.4 acres (150 hrs. ÷ 4.36 hrs./A.)

Cash Operating Cost Per Hour

Shaker operator (1) @ \$5.00	\$ 5.00
Crew (5) @ \$1.50	7.50
Fuel and repairs	1.75
	\$14.25
Total hourly cost	\$14.25

Overhead

Shaker	\$ 8,500
Tow-Catch Frame	4,600
Tractor	1,000
	\$14,100

Depreciation:	\$14,100 @ 5 yr. life	=	\$2,820
Interest:	8% on ½ value	=	564

Total annual overhead \$3,384

Cash operating cost per acre: \$14.25 x 4.36 = \$ 62.13

Overhead cost per acre: \$3,384 ÷ 34.4 = \$ 98.37

TOTAL COST PER ACRE \$160.50

HARVEST COSTS

20 Ft. x 20 Ft. Spacing

Harvester: Gould Bros. One Tow-Catch frame

Harvest Rate: 2.5 min. per tree

6.3 hrs. per acre

Machine Capacity: 23.8 acres (150 hrs. ÷ 6.3 hrs./A.)

Cash cost per hour: \$14.25

Cash cost per acre: ($\$14.25 \times 6.3 \text{ hrs.}$) = \$89.77

Overhead: \$3,384 annual int. & deprec. ÷ 23.8 acres = \$142.18

TOTAL COST PER ACRE = \$231.95

HARVEST COSTS

24 Ft. x 24 Ft. Spacing

Harvester: Gould Bros. - Two Tow-Catch frames
Harvest Rate: 1.8 minutes per tree
2.25 hours per acre
Machine Capacity: 66.6 acres (150 hrs. ÷ 2.25 hrs./A.)

Cash Operating Cost Per Hour

Shaker operator (1)	\$ 5.00
Crew (10 @ \$1.50)	15.00
Fuel & repairs	2.55
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Total hourly cost	\$22.55

Overhead Costs

Shaker	\$ 8,500
Tow-Catch frames (2)	9,200
Tractors (2)	2,000
	<hr/>
	\$19,700

Depreciation: \$19,700 @ 5 yr. life = \$3,940

Interest: 8% on ½ value = 788

Total annual overhead

\$4,728

Cash operating cost per acre: \$22.55 x 2.25 = \$ 50.74

Overhead cost per acre: \$4,728 ÷ 66.6 = 70.99

TOTAL COST PER ACRE

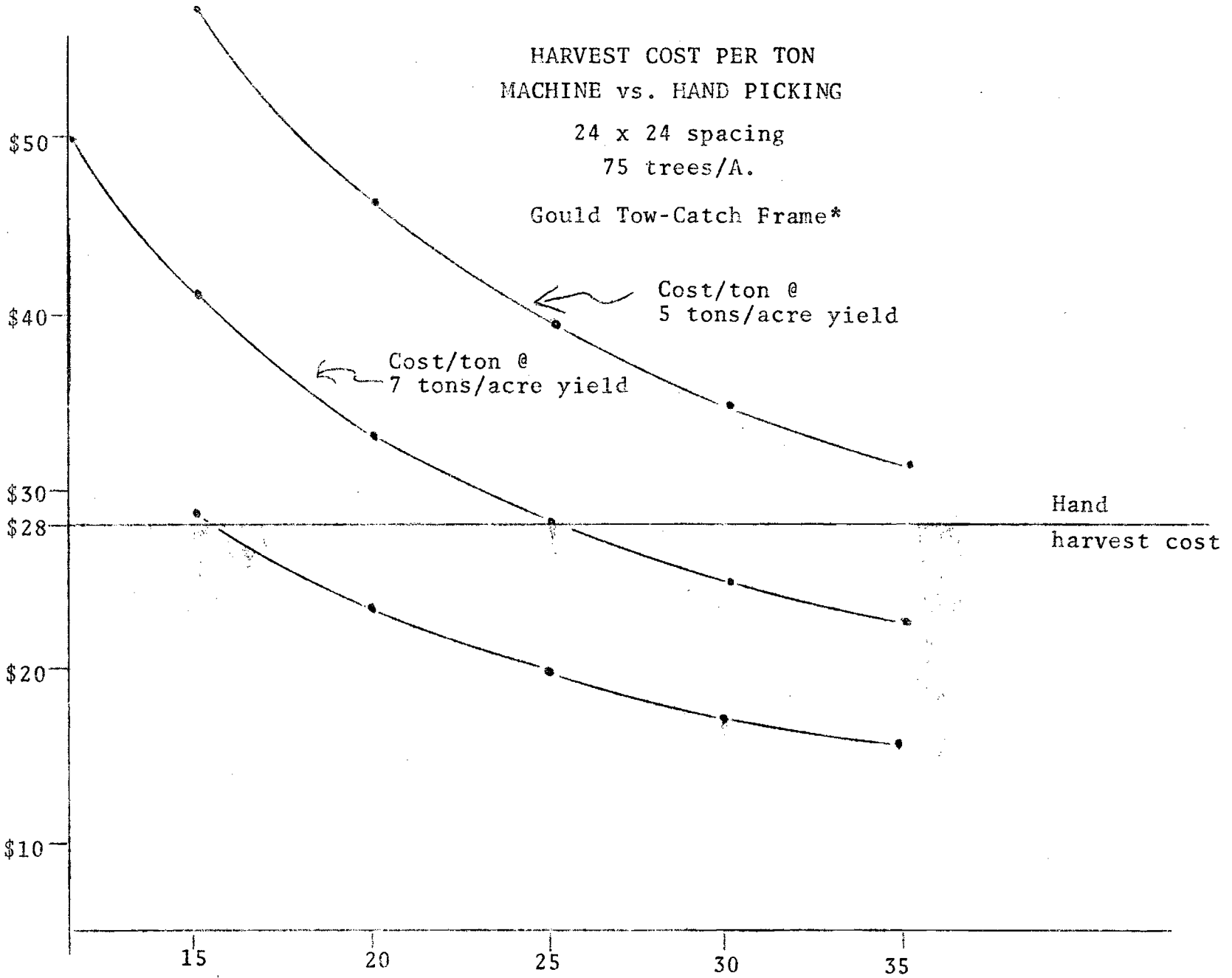
\$121.73

HARVEST COST PER TON
MACHINE vs. HAND PICKING

24 x 24 spacing
75 trees/A.

Gould Tow-Catch Frame*

HARVEST
COST
PER
TON



*Machine capacity = 34.4 acres

Chart 3

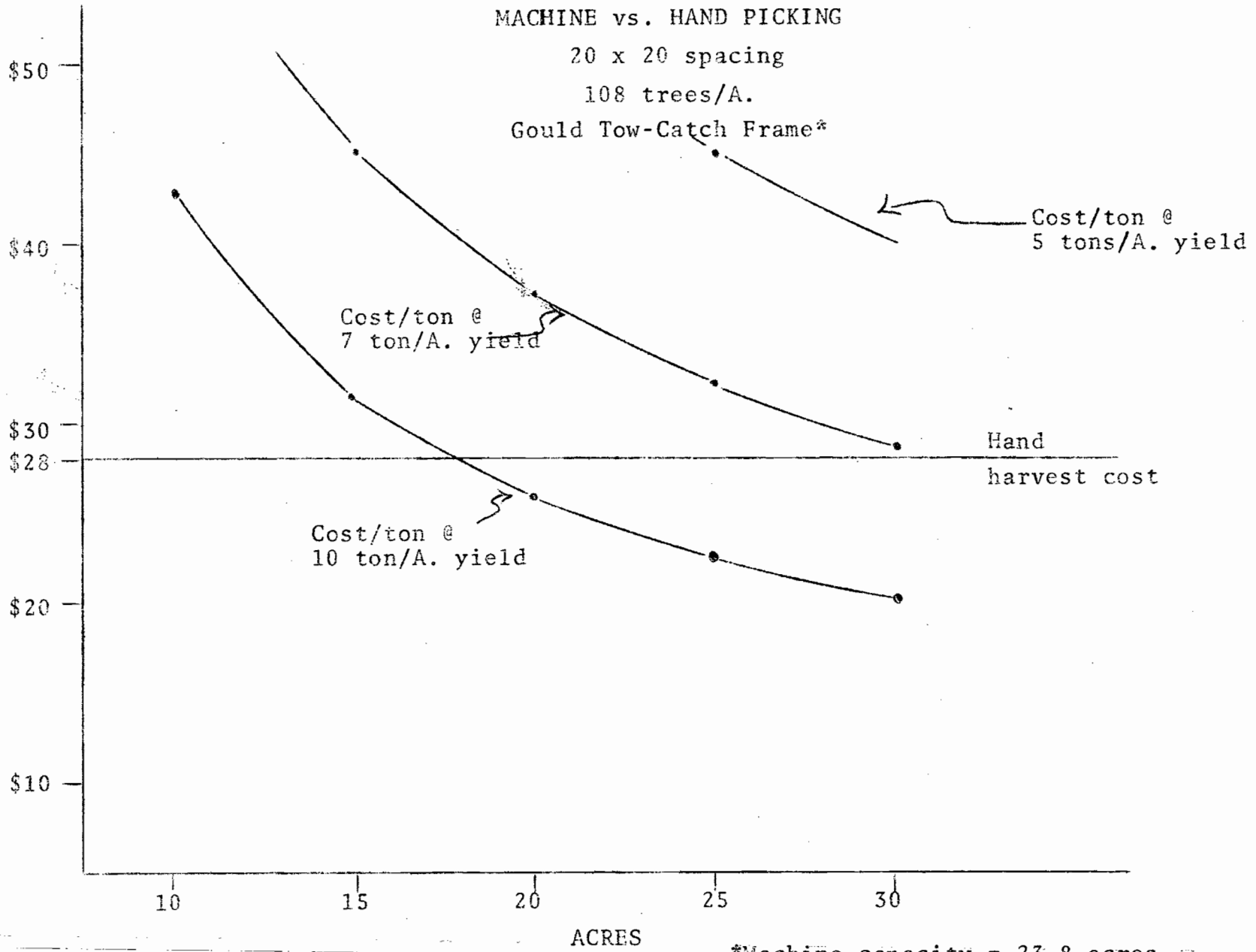
HARVEST COST PER TON
MACHINE vs. HAND PICKING

20 x 20 spacing

108 trees/A.

Gould Tow-Catch Frame*

HARVEST
COST
PER
TON



*Machine capacity = 23.8 acres

Chart 4

HARVEST COST PER TON
MACHINE vs. HAND PICKING
24 x 24 spacing
75 trees/A.
Gould - 2 Tow-Catch Frames*

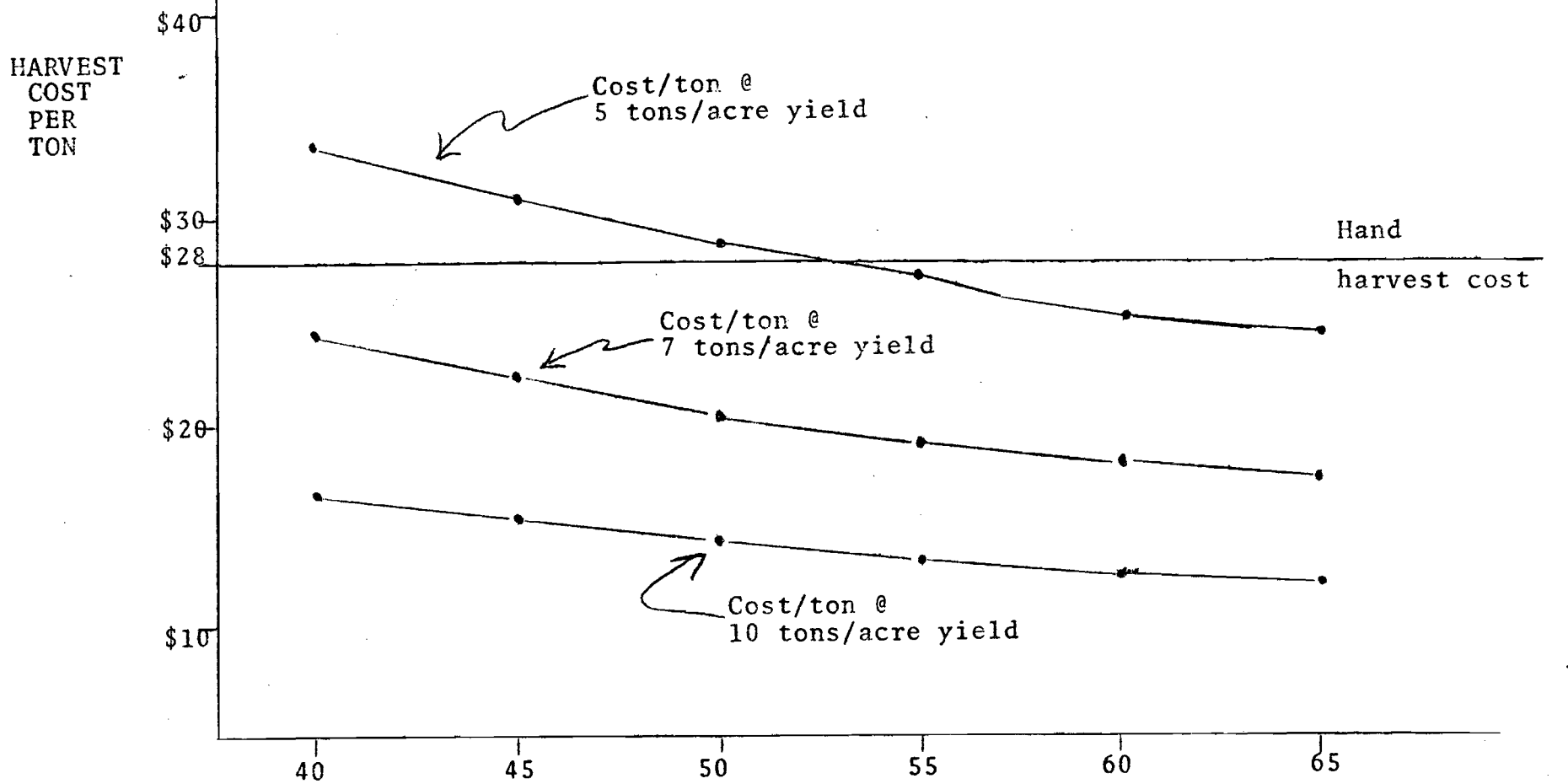


Chart 5 *Machine capacity = 66.6 acres

DISCUSSION AND CONCLUSIONS

A direct comparison should not be made between the two machines included in the 1968 trials. Differences between orchard conditions and crew experience may be greater than between types of equipment, both from the standpoint of time to harvest a given acreage and in fruit quality.

The harvest time per tree was greater for the first pick with both machines. This was because a decision had to be made on many trees, whether to shake off all the fruit, part of the fruit, or skip the tree. During the second pick it was merely a case of shaking the tree if it had fruit.

The variable maturity between trees and within trees requires that a machine must harvest an orchard twice. To move through an orchard more times within a 15-day season would reduce the acreage capacity of the machine, if the assumption of 15 ten-hour days per harvest season is maintained. This in turn would change the economic feasibility.

The machine costs per acre were independent of yield for the conditions met in 1968 trials. At some higher yield than experienced, yield may become a limiting factor in time per tree and therefore costs per acre.

The total cost per acre must be compared with hand picking costs, which are directly related to yield, and therefore charts are included to show the break-even point between hand and machine harvest.

The break-even point is dependent upon yield, acres harvested, and harvest cost per ton.

As can be seen on Chart 1, the break-even point for a 7 ton per acre yield, 20 x 20 foot planting, is at the acreage

capacity of the Fabco machine. Therefore, for any yield less than 7 tons per acre, machine harvest will be more costly than hand picking at \$28 per ton.

With a 24 x 24 foot planting, Chart 2, machine harvesting is competitive with hand picking at a yield of 5 tons per acre, and is within the machine acreage capacity. This is because overhead is spread over a larger acreage, reducing the per acre costs.

The Gould Tow-Catch frame on a 24 x 24 foot planting, Chart 3, would require a minimum yield of 5.7 tons per acre to break even at the machine capacity of 34.4 acres. An average yield of 7 tons per acre would reduce the acreage requirement to 25 acres.

The same machine on a 20 x 20 foot planting, Chart 4, would need a minimum yield of 8.5 tons per acre to break even at the machine capacity of 23.8 acres.

The use of two Gould Tow-Catch units with one shaker reduces the harvest time per acre by 48.4% and allows a bigger acreage to be harvested. This results in a higher hourly cash cost, but can reduce the overhead due to increased capacity. With this combination, it can be seen on Chart 5 that a 5-ton per acre yield can be economically harvested if 53 or more acres are harvested.

While it is not the purpose of this report to discuss fruit evaluation, a statement must be made in order to clarify the machine status. According to Scott McRitchie, California Cannery & Growers, who conducted fruit evaluation tests, the fruit maturity of mechanically harvested apricots this year was comparable to hand picked fruit

except in heavy orchards. Damaged fruit ranged from one to four percent greater in mechanically harvested than with hand harvested fruit. The damage occurs primarily in the tree as falling fruit strikes limbs; however, some does occur on the machine and this varied by machine.

None of the machines observed this season had adequate sorting space. The 1968 season produced a crop exceptionally free of defects. Sorting facilities must be large enough to handle from four to six sorters in order to make grade in most years.

During the harvest of one bin, two sorters picking out only severe cuts were able to reduce the severe cuts to 16.6% of unsorted fruit. This involved removing 2.8% of the harvested fruit.

The economic feasibility was favored this year by excellent quality fruit and little sorting was done for defects or mechanical damage. For this reason, the data should be used conservatively.

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For clarity, it is sometimes necessary to use trade names. No endorsement of named products is intended nor is criticism implied of similar products which are mentioned.
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