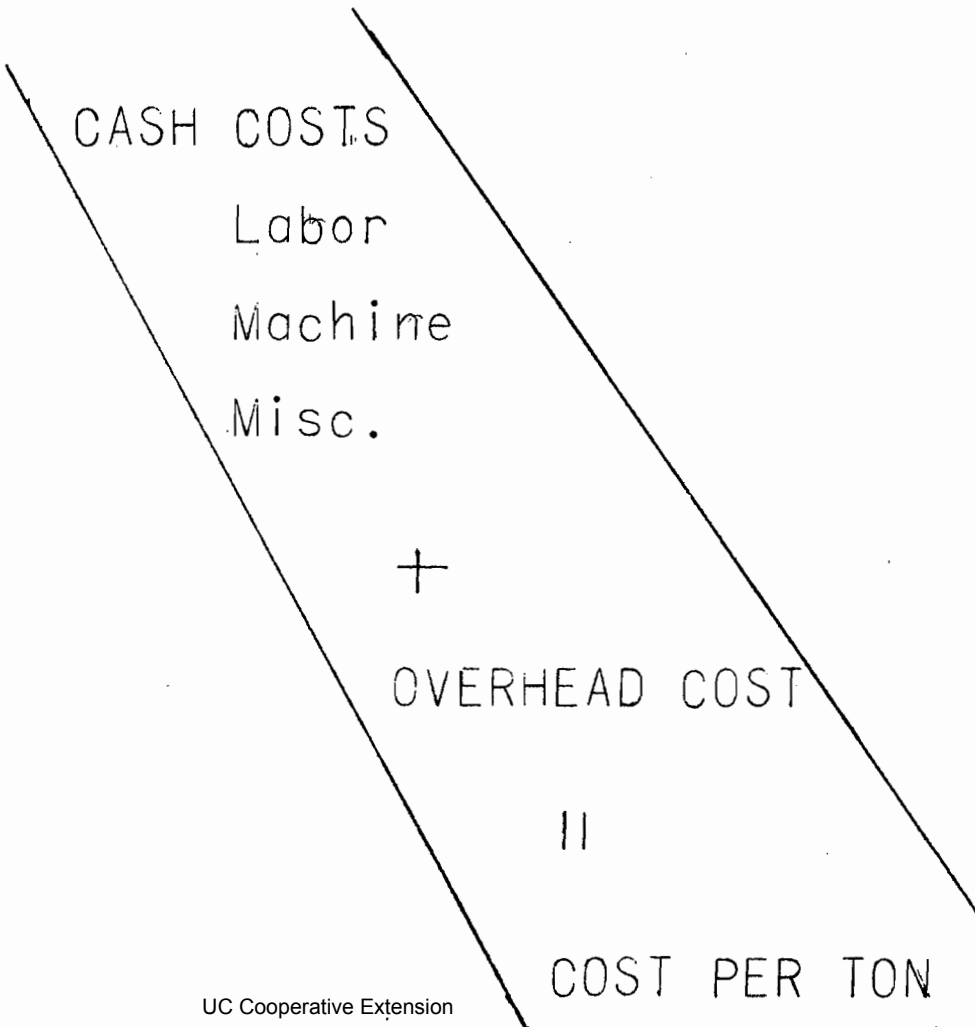
TOMATO HARVESTING COSTS BY MACHINE - 1966 YOLO COUNTY



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1966 TOMATO MACHINE HARVEST COST YOLO COUNTY

Conducted by Mel Zobel, Farm Advisor

Assisted by Phil Parsons, Extension Economist

Background

What and how much progress has been made in machine harvesting of tomatoes? Are there areas where improvements can be made or should be made? What is the current situation?

In several of the earlier years of mechanical harvesting, machine harvest studies have been conducted. The basis of these studies were surveys of performance of actual machine harvest operations. The data found (Table I) was averaged, which served, with adjustments, as a basis for the detailed cost analysis.

TABLE I

	1961	1963	1965	1966
Average Yield - Tons/Acre	17	23.2	20.1	23.0
Sorters/Machine	11	11.8	14	15.1
Average Tons/Hour	3.7	6.8	6.8	7.4
Average Tons/Machine	1000	1168	2537	3447
Average Days Operated	36	18	39	48
Average Acres/Day	2.2	2.8	3.1	3.3
Average Acres/Machine	80	50	122	152
Calculated Cash Cost/Ton	9.50	5.81	7.26	7.01
Calculated Overhead Cost/Ton	4.64	4.11	3.08	1.96
Calculated Total Cost/Ton	$14.14	$9.92	$10.34	$8.97

Machine harvest cost studies were published on the 1961, 1963 and 1965 harvest seasons. An additional study was started in 1964, but the accumulating data indicated no change from 1963, so the study was not completed. The 1965 study was a statewide study. Yolo County data was included as a part of the statewide study.

1966 Study Basis

For the 1966 study, information was obtained on the operation and performance of 41 machines used in 19 different grower operations. The total operation was used and the data then broken down to a one machine basis. Included were a number of multiple machine operations, a number of single machine operations, and one or more combined operations where several growers pooled their equipment and resources for the harvest operation. All data gathered was accumulated into total figures and then averaged. Averages are presented along with ranges, when ranges are of interest or value. (Tables II through V.)

Assumed performances, Table VI through VIII, for the detailed study, were based on the survey findings. Certain adjustments were made to make it a workable unit. The detailed study is assumed to be a single machine operation rather than the 2-machine base found in the survey.

TABLE II

Average machine harvest operation and performance based on 41 machines used in 19 operations. Ranges also shown. (Total may not add because averages and estimates used.)

Harvest machines - 17 Johnson, 16 Blackwelder, 8 FMC
Machines per operation - 2.1 (Range 1 to 5)
Acres represented in study - 6265
Tons represented in study - 145,068
Tons per acre - 23.0 (Range 15 to 31) Individual field range - 41 ton to 8 ton
Tons per machine per year - 3447 (Range 2175 to 5293)
Tons per hour (down the row) - 9.5 (Range 6 to 17)
Tons per hour, including nonproductive time - 7.4
Days operated - 48.5 (Range 26 to 83)
Acres per day - 3.6 (Range 2.4 to 6.0)
Acres per machine - 152 (Range 90 to 225)
Hours per day operated - 9.6 (Range 8.0 to 10.5)
Trailers per machine - 2.2
Forklifts per operation - 1.5 (Range 1 to 3)
Sorters per machine - 15.1 (Range 10 to 23)
Swampers - used in 63% of operations
Supervisors - used in 94% of operations
Other (mechanic) - used in 53% of operations

TABLE III

Average equipment (per unit basis). New costs, life, fuel and repair costs reported.(1)

	New Cost	Life Years	Fuel-Gal/day	Repairs Per year	% Time(3) On Tomato
Harvester	$20,818	4.9	29.8	$2,638 (2)	100
Trailer	994	6.6	--	46	99.5
Tractor	5,001	7.0	20.9	276	37.1
Forklift	6,079	7.2	18.9	205	72.2
Wash equip.	1,015	5.4	2.9	68	78.8

(1) Miscellaneous other equipment use - disc, scraper, tractor - $149/year Pickup use for harvest operation - $716/year.

(2) Harvester repairs range zero to $6000. (New warranty to major conversion.)

(3) Same equipment used in other operations part time.

TABLE IV

Machine harvest labor information.

Hours/day/employee

Operator	11.6 (Range 9 to 15)
Trailer men	10.1 (Range 8.5 to 12)
Forklift	10.2 (Range 8.5 to 12)
Sorters	9.6 (Range 8.0 to 10.5)
Swamper	10.0 (Range 8.0 to 11.5)
Mechanic	12.3 (Range - half time to 15)

Wages paid = Cash + Benefits = Total Cost.

Operator	- $1.97 + 0.16 = $2.13	(Range 1.50 to 2.50)
Trailer men	- $1.60 + 0.14 = $1.74	(Range 1.50 to 2.20)
Forklift	- $1.78 + 0.18 = $1.96	(Range 1.50 to 2.50)
Sorters	- $1.50 + 0.13 = $1.63	(Range 1.40 to 2.30)
Swampers	- $1.49 + 0.11 = $1.60	(Range 1.40 to 1.65)
Supervisors	$2.17 + 0.25 = $2.42	(Range 1.40 to 4.50)
Mechanic	$2.66 + 0.25 = $2.91	(Range 2.00 to 5.00)

TABLE V

General and miscellaneous information reported on the machine harvest operation.

Varieties used - 18 of 19 operations used VF145-7879 in all or part of acreage. Rest of acreage was 13L, 21-4, Gus, F5, Red Top, B.

Toilet facilities - cost per machine	$ 97.40
Drinking water supplies per operation	69.36
Bin rental	.40/ton
Inspection	.20/ton
Misc. supplies - soda, goggles, gloves, etc.	134.84/operation

Fruit per bin, average 882 lbs. (Range 800 to 1000)
Rejected loads - 49% of growers had 1 or more. Some dumped, some reconditioned, some passed on re-inspection.
Years experience average - 2.6 years (Range 26%, 1 yr.; 38% 2 yrs.; 10%, 3 yrs.; 5%, 4 yrs.; 5%, 5 yrs.; 16%, 6 yrs.)
Growers offhand estimated costs per ton - Range $5.30 to $14.00
Twin rows vs. single - 57.9% twin row, 42.1% single
Clump thin - 94.7% clump, 5.3% single
Hand vs. machine thin - 36.8% hand, 31.6% machine, 26.3% both, 5.3% plant to stand
Hand harvest - 37% also had hand harvest, 63% none.

Indicated problems that growers had:

37% weeds
26% labor
42% culture (schedules, irrigation, etc.)
21% machine adjustment

Going to expand - 63%, yes; 21%, no; 5% depends on price; 11%, no comment.

TABLE VI

(Based on Tables II through V)

Assumed and projected machine harvest operation.

Projected performance, specification and miscellaneous charges for an assumed single machine harvest operation.

Tons per acre	23	Bin rental per ton	$ .40
Tons per hour	7.7	Inspection fees per ton	$ .20
Tons harvested total	3450	Toilet facilities per year	$120.00
Tons per day	69	Drinking water supplies per year	$ 75.00
Days operated	50	Miscellaneous supplies per acre	$ 1.00
Acres per day	3.0	Association dues per ton	$ .10
Acres per machine	150	Pickup use per acre	$ 5.00
Hours per day	9.0	Miscellaneous equipment per acre	$ 1.00
Number of sorters	12	Fruit per bin - lbs.	850
Numbers of trailers	2		

TABLE VII

Assumed equipment costs, life, fuel use, repairs and percent usage on tomato harvest. (Based on Tables II through V)

	Cost New	Life Yrs.	Fuel Gal/day	Repairs $/year	Use on Harvest % of time
Harvester	$21,000	5	30	2500	100
Trailer (per unit)	1,000	7	--	50	100
Tractor (per unit)	5,000	8	20	300	33
Forklift	6,000	7	20	200	75
Wash equipment	1,000	5	3	75	75

TABLE VIII

Assumed labor - number, wages, hours worked, Based on Tables II through V.

	Number	Hours Per Day	Wages				
			Cash	+	Benefits	=	Total
Operator	1	12	2.00	+	0.16	=	2.16
Trailer men	2	10	1.60	+	0.14	=	1.74
Forklift	1	10	1.75	+	+ 0.18	=	1.93
Sorters	12	9	1.40	+.10	+ 0.13	=	1.63
Swamper	1	10	1.40	+	.11	=	1.51
Supervisor-Mechanic	1	12	2.50	+	0.25	=	2.75

DETAILED BREAKDOWN OF HARVEST COSTS

(Single Machine Basis)

Cash Operating Cost	Per Day	Per Ton
Labor[1]		
Sorters - 12 @ $1.40 - 9 hours/day	$151.20	
Machine operator - $2.00 - 12 hours	24.00	
Trailer men - 2 @ $1.60 - 10 hours	32.00	
Forklift - $1.75 - 10 hours	17.50	
Swamper - $1.40 - 10 hours	14.00	
Supervisor-Mechanic - $2.50 - 12 hours	30.00	
Additional benefits - costs	35.46	
Labor manager fees[2]	28.00	
Total Labor Costs	$332.16	
Total Labor Costs/Ton ($332.16 ÷ 69 ton)		$4.81
Machine Operation		
Fuel		
Harvester - 30 gal. @ 20¢/gal.	$ 6.00	
Tractor - 2 x 20 gal @ 20¢/gal.	8.00	
Forklift - 20 gal. @ 20¢/gal.	4.00	
Wash equipment - 3 gal. @ 20¢/gal.	.60	
Repairs (includes parts, oil, lubrication)		
Harvester - $2500 ÷ 50 days	50.00	
Trailer - 2 x $50 ÷ 50 days	2.00	
Tractor - 2 x 300 ÷ 50 days x 33% of time	3.96	
Forklift - $200 ÷ 50 days x 75% of time	3.00	
Wash.Equip. - $75 ÷ 50 days x 75% of time	1.12	
Total Machine Cash Costs	$ 78.68	
Total Machine Cash Cost/Ton ($78.68 ÷ 69 Tons)		$1.14
Miscellaneous Operating Costs		
Bin rental		$ .40
Inspection fees		.20
Association dues		.10
Rigid costs per ton		$ .70
Toilet facilities $120/year (2 units - 2 months @ $30/mo.)	$ 2.40	
Drinking water supplies	1.50	
Miscellaneous supplies - soda, goggles, etc.	3.00	
Pickup use	15.00	
Miscellaneous equipment - scraper, disc, etc.	3.00	
Sub total	$ 24.90	
Miscellaneous costs per ton ($24.90 ÷ 69 ton)		.36
Total miscellaneous cash operating costs		$1.06
TOTAL CASH OPERATING COSTS-	$435.74	$7.01

(1) Cash wage shown: Additional wages paid, shown as additional benefits, is for social security, work compensation, insurance, bonus, etc.

(2) Temporary or seasonal labor managed by a labor contractor is charged here at $2.00/day/man. Sorters, swamper and one trailer man.

Detailed breakdown of harvest costs - (continued)

Overhead Costs	Per Year	Per Ton
Harvester Investment - $21,000 (includes sales tax)		
Depreciation - 5 year life $21,000 - $500 salvage = $20,500 $20,500 ÷ 5 = $4100/year	$4100.00	
Interest on Investment $21,000 + $500 salvage = $21,500 $21,500 ÷ 2 = $10,750 average value $10,750 x 6% interest = $645.00	645.00	
Taxes, Insurance and Storage Costs @ 2% of average value $10,750 x 2% = $215.00	215.00	
Total Harvester Overhead Costs	$4960.00	
Harvester Overhead Cost/Ton ($4960 ÷ 3450 Tons)		$1.44
Trailer Investment (includes sales tax)		
2 trailers @ $1000 = $2000. Depreciation - 7 year life $2000 ÷ 7 = $285.71	$ 285.71	
Interest on Investment $2000 ÷ 2 = $1000 average value $1000 x 6% per year = $60 per year	60.00	
Taxes, Insurance and Storage @ 2% of average value $1000 x 2% = $20 per year	20.00	
Total Trailer Overhead Costs	$ 365.71	
Overhead Costs/Ton ($365.71 ÷ 3450 Tons)		$ .11
Tractor Investment		
2 - 30 H.P. diesel @ $5000 each = $10,000.		
Depreciation - 8 year life $10,000 - $800 salvage ($400 each) = $9200. $9200 ÷ 8 = $1150 per year	$1150.00	
Interest - $10,000 + $800 salvage = $10,800 $10,800 ÷ 2 = $5400 average value $5400 x 6% = $324 per year	324.00	
Taxes, Insurance and Storage $5400 x 2% = $108 per year	108.00	
Total Tractor Overhead Costs	$1582.00	
Tractors are used for other operations. For tomato harvest the use is 33% of total use. $1582 x 33% = $522.06	522.06	
Total Tractor Overhead Costs	$ 522.06	
Tractor Overhead Costs/Ton ($522.06 ÷ 3450 Tons)		$ .15

Detailed breakdown of harvest costs (continued)

	Per Year	Per Ton
Forklift Investment (includes tax) $6000.00		
Depreciation - 7 year life $6000 - $400 salvage = $5600. $5600 ÷ 7 = $800 per year	$ 800.00	
Interest - $6000 + $400 = $6400.00 $6400 ÷ 2 = $3200 average value $3200 x 6% = $192.00 per year	192.00	
Taxes, Insurance and Storage $3200 x 2% = $64.00 per year	64.00	
Total Forklift Overhead Costs	$1056.00	
Forklift used elsewhere. For tomato harvest the use is 75% of total use. $1056 x 75% = $792.00	792.00	
Total Forklift Overhead Costs	$ 792.00	
Forklift Overhead Cost/Ton ($792.00 ÷ 3450 Tons)		$ .23
Washing Equipment Investment - $1000.		
Depreciation - 5 year life $1000 - $500 salvage = $500 $500 ÷ 5 = $100 per year	$ 100.00	
Interest on Inventment - 1 $1000 + $500 = $1500.00 $1500 ÷ 2 = $750 average value $750 x 6% = $45.00 per year	45.00	
Taxes, Insurance and Storage $750 x 2% = $15.00 per year	15.00	
Washing Equipment Investment	$ 160.00	
Washing Equipment is used elsewhere. For tomato harvest the use is 75% of total use. $160.00 x 75% = $120.00	$ 120.00	
Total Washing Equipment Overhead Costs	$ 120.00	
Washing Equip. Overhead Cost/Ton ($120 ÷ 3450 Tons)		$ .03
TOTAL OVERHEAD COST FOR EQUIPMENT	$6759.77	$1.96

TABLE IX

Summary of Investment and Overhead Costs

Machine	Cost (new)	Yrs. Life	Depreciation	Interest	Tax, Ins. Storage	Total Overhead
Harvester	$21,000	5	$4100.00	$645.00	$215.00	$4960.00
Trailer (2)	2,000	7	285.71	60.00	20.00	365.71
Tractor (2/3) 33%	10,000	8	379.50	106.92	35.64	522.06
Forklift	6,000	7	600.00	144.00	48.00	792.00
Wash.Equip.	1,000	5	75.00	33.75	11.25	120.00
TOTAL	$40,000		$5440.21	$989.67	$329.89	$6759.77

TABLE X

Summary of Cost/Ton

Overhead:	Harvester	$1.44	
	Trailer	.11	
	Tractor	.15	
	Forklift	.23	
	Wash. Equipment	.03	
	Total Overhead	$1.96	$1.96
Cash:	Labor	$4.81	
	Machines	1.14	
	Misc. operations	1.06	
	Total Cash	$7.01	$7.01
	TOTAL ALL [redacted] COSTS		$8.97

FIGURING COSTS UNDER OTHER CONDITIONS

Cash costs per hour for an individual working harvest unit of machine, men and equipment do not change, or only change very little. Differences in costs (cash costs) between different operating units would be mainly in number of sorters used, and in wages paid to sorters and equipment operators. Cash costs per hour, for machine and equipment operation, remains rather constant. Cash costs per ton is determined by the money input and by the tons per hour harvested.

Investment costs for machines and equipment are rigid for each operating group. Differences between harvest operations would mainly be in the kind, number, and size of equipment used. Costs per ton would depend on numbers of tons harvested by the group of machinery.

To have a change in costs per ton for harvesting, either or both the tons per hour rate of output, or the total tons harvested must change. The most efficient and most economical operation would use as few sorters as possible for a high rate of tons per hour output, and also use the machines on many tons. The quantity (tons per acre) and quality (per cent ripe and machinability) contribute considerably to the rate (tons per hour) of output and total tons harvested.

If your operation is similar to this assumed operation, your costs could be roughly interpreted from the following cost tables. Cash costs would be added to overhead costs to find the total cost per ton under different rates of harvest and total tons harvested. (In this study it was found that it cost $48.41 per hour to operate. Yearly overhead was $6759.77. There was a rigid or constant cash charge of 70¢ per ton regardless of production.) For example, if your harvest rate was 6 ton per hour and you harvested 5000 tons during the season, your cost would be $8.77 + $1.35 or $10.12 total. Again, if the harvest rate was 10 ton/hour for 3000 tons, the cost would be $5.54 + $2.25 or $7.79 total.

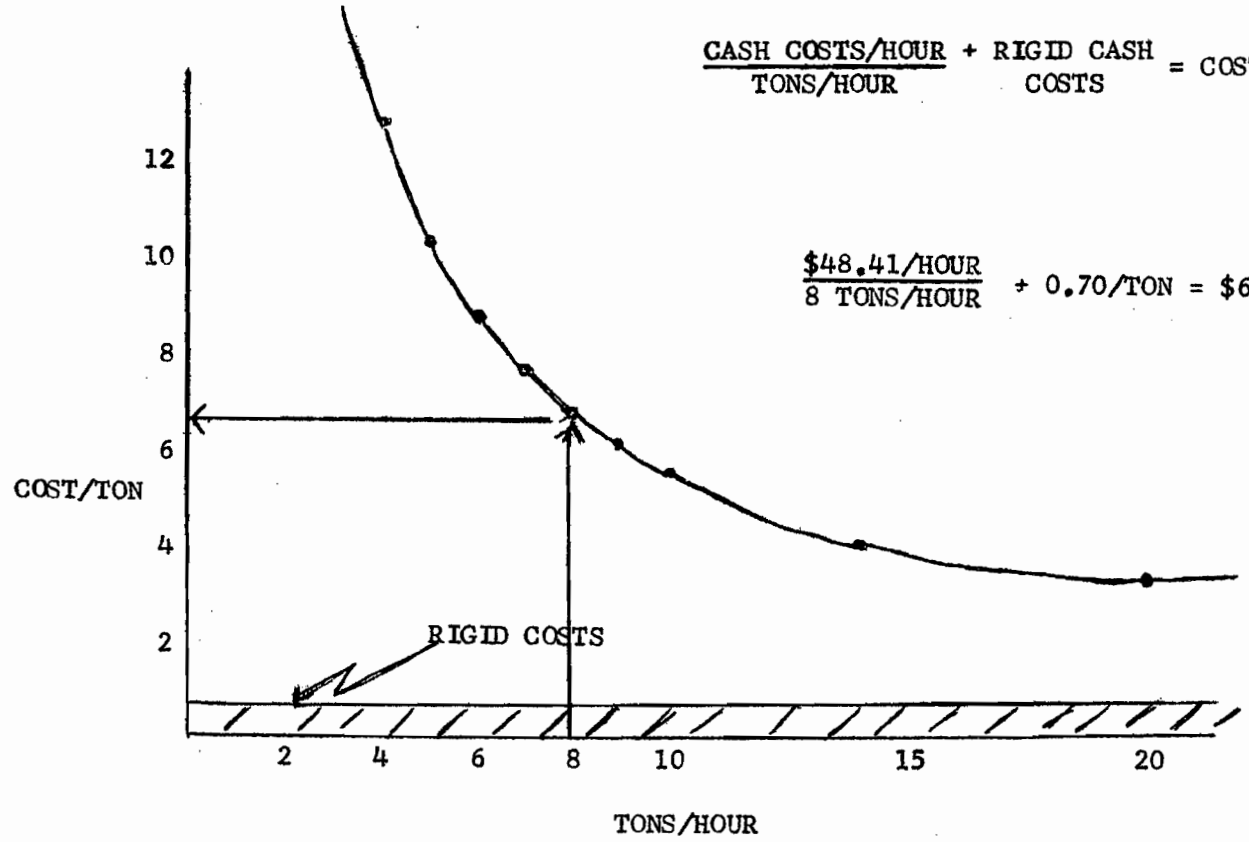
Tons/Hour	Cash Cost/Ton	Tons Harvested	Overhead Cost/Ton
4	12.10	500	13.52
5	10.38	1000	6.76
6	8.77	2000	3.38
7	7.61	3000	2.25
*7.7	7.01	*3450	1.96
8	6.75	4000	1.69
9	6.08	5000	1.35
10	5.54	6000	1.12
15	3.93	7000	0.97
20	3.12	8000	0.84

*Used in study.

The following graphs present a linear picture of how the costs rise and fall under differing output and usage conditions. Using the formula shown with the graphs, and using your figures, a similar diagram can be developed for your operation. This diminishing cost curve is similar for all operations. The location of the lines depends on the cost inputs and harvest outputs.

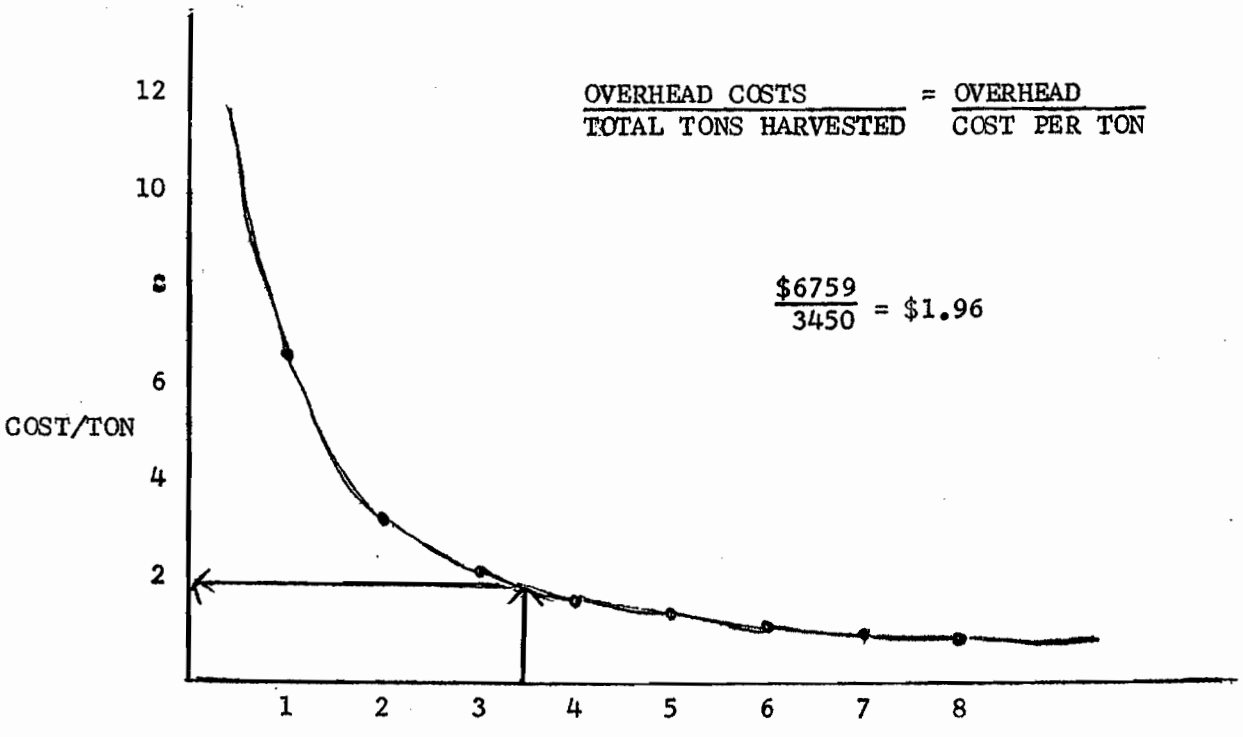
$$\frac{\text{CASH COSTS/HOUR}}{\text{TONS/HOUR}} + \text{RIGID CASH COSTS} = \text{COST/TON}$$

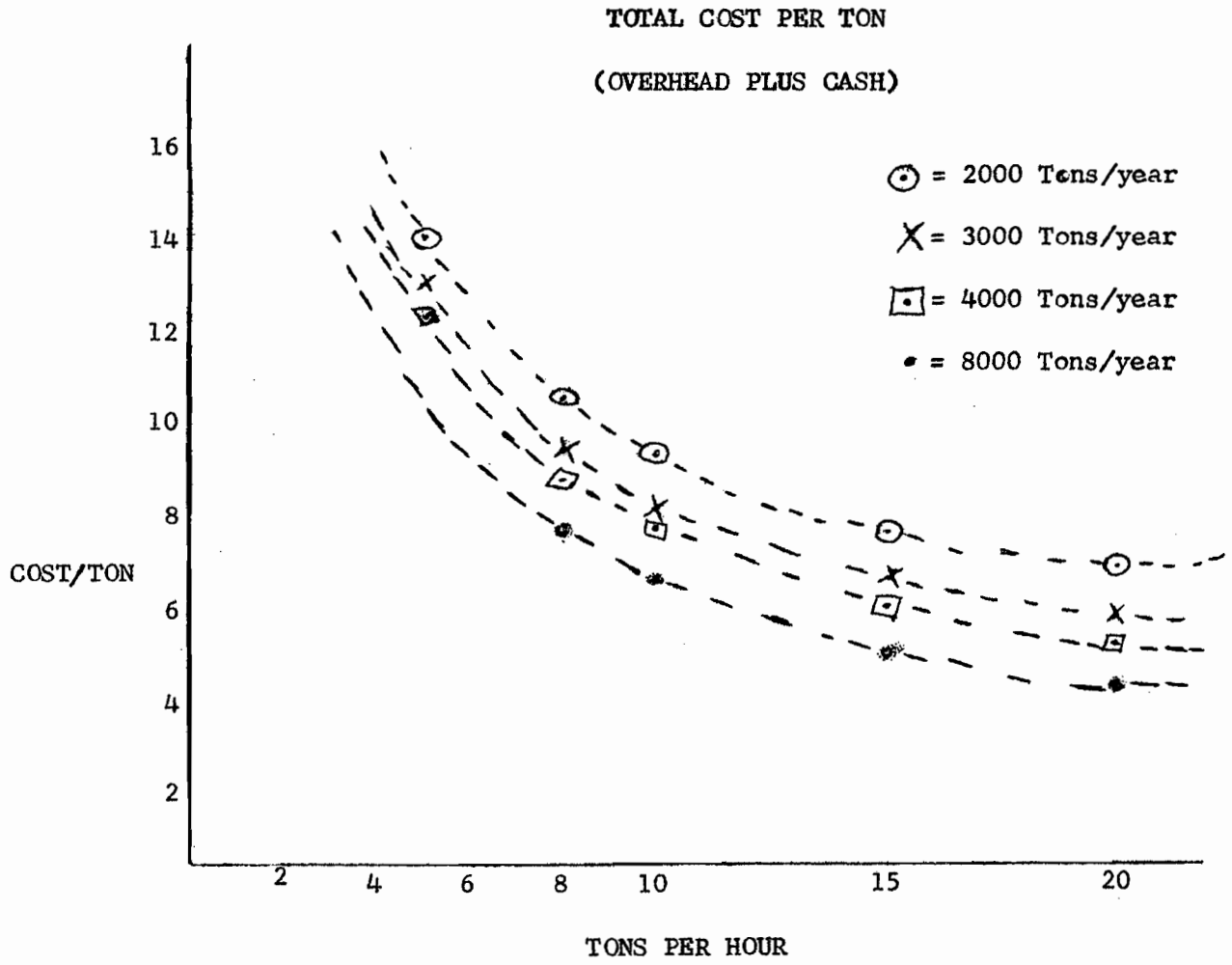
$$\frac{\$48.41/\text{HOUR}}{8\ \text{TONS/HOUR}} + 0.70/\text{TON} = \$6.75$$



$$\frac{\text{OVERHEAD COSTS}}{\text{TOTAL TONS HARVESTED}} = \frac{\text{OVERHEAD}}{\text{COST PER TON}}$$

$$\frac{\$6759}{3450} = \$1.96$$




TOTAL COST PER TON
(OVERHEAD PLUS CASH)
= 2000 Tons/year
= 3000 Tons/year
= 4000 Tons/year
= 8000 Tons/year
COST/TON
16
14
12
10
8
6
4
2
2
4
6
8
10
15
20
TONS PER HOUR