

COST COMPARISON  
OF  
HAND AND MECHANICAL HARVEST  
OF  
EARLY AND MIDSEASON ORANGES  
FOR  
PROCESSING

BY

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1 COST COMPARISON OF HAND AND MECHANICAL

2 HARVEST OF EARLY AND MIDSEASON ORANGES FOR PROCESSING<sup>1</sup>

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8  
9 Introduction

10 During the early stage of mechanical harvesting development, costs  
11 were not the prime consideration for fear of discouraging creative  
12 efforts in this field. However, the technology has developed to a  
13 stage where a comparison of the economics of certain harvest systems  
14 would be useful in guiding future research and development activities.  
15 Representative cost data for harvesting oranges are difficult to derive  
16 because of the wide range of grove conditions found in the citrus  
17 industry. Therefore, for a cost comparison to be relevant, the harvest  
18 systems must be considered for a specific fruit type and grove condition.

19 A fairly common orange grove condition found on the ridge section  
20 of Florida was selected which would be suitable for both hand and  
21 machine harvest systems (Table 1). Early and midseason oranges were  
22 selected because they are better suited for mechanical harvesting than  
23 other types of citrus fruit grown in Florida. This fruit type has only  
24 one crop on the tree at harvest and the harvest period for processing  
25 extends from January to the middle of March or approximately a 10-week  
26 period. During this period the fruit has a high Brix-acid ratio which  
27 enhances loosening with abscission chemicals.

1 The cost of harvesting for 3 different systems was estimated and  
2 compared for the selected grove. The harvest operation included the  
3 removal of fruit from the tree and its delivery to a roadside truck.  
4 The systems compared were conventional hand harvest and 2 machine  
5 systems. One machine system used an air shaker and the other used a  
6 limb shaker to remove the fruit. In both machine systems, the fruit  
7 was picked up mechanically and delivered to the roadside in the same  
8 manner.

9 The performance factors for comparison of the 3 harvest systems  
10 were estimated based on data collected in an industry incentive program,  
11 reports and procedures from the Food and Resource Economics Department,  
12 University of Florida (5) and field observations over several years by  
13 experienced engineering personnel. Factors pertaining to the harvest  
14 system considered optimum for the select grove are given in Table 1.  
15 Equipment items are listed in Table 2 and a budget for operating the  
16 systems are given in Tables 6, 7, and 8.

17 Hand Harvest System

18 A conventional hand harvest crew consist of 20 pickers, a truck  
19 driver and a foreman. In operation the pickers remove the fruit from  
20 the tree and place it into 10-box equivalent capacity tubs spotted near  
21 the trees. When a tub is full, it is picked up and emptied by a grove  
22 truck. The empty tub is then spotted in a new location. The foreman  
23 credits each picker's account by punching a ticket previously issued to  
24 the picker. This process is repeated until the grove truck 90-box capa-  
25 city body is full. The fruit is then transported and dumped into a  
26 semi-trailer spotted at the edge of the grove.

27 The hand harvesting system was considered to operate 100 days per  
28 season which included late season 'Valencia' oranges, of which 50 days

1 would be in early and midseason oranges with a daily capacity of 1200  
2 boxes of fruit.

### 3 Machine Harvest Systems

4 The 2 machine harvest systems consist of several elements performed  
5 in order: grove preparation, abscission chemical application, fruit  
6 removal, fruit collection and fruit transportation. The difference in  
7 the 2 systems is that one uses an air shaker and the other uses a limb  
8 shaker to remove the fruit after it has been loosened by an abscission  
9 chemical. Both systems use the same fruit collection and transporta-  
10 tion element. The capacity of this element established the capacity for  
11 both systems at 2000 boxes per day. The number of units and operational  
12 time of individual equipment items in the systems were adjusted to  
13 match the 2000-box daily capacity (Table 2).

### 14 Grove Preparation

15 Grove preparation is an integral part of the production operation  
16 and may include hedging, ground smoothing, and trash removal. A clean,  
17 soft, smooth ground surface is desired for efficient fruit collection.  
18 No cost was charged to the harvest system for this element because it  
19 would logically be included in fruit production costs.

### 20 Abscission Chemical Application

21 Several abscission chemicals are available to loosen the fruit be-  
22 fore harvest; however, all of them are not cleared for commercial use (6).  
23 A chemical solution consisting of 1 qt (946 ml) of Release, 1/8 qt (118 ml)  
24 of Acti-Aid, 2 qt (1993 ml) of X-77 surfactant in 500 gallon of water  
25 applied at 750 gallons per acre was considered optimum for the select  
26 grove condition. Later in the season when new leaves start to appear,  
27 Acti-Aid should be reduced to 1/16 qt (59 ml) to avoid leaf burn. The  
28 cost of abscission chemical and surfactant was estimated at \$69.36 per acre.

1 The abscission chemical is normally applied with a conventional  
2 air carrier sprayer, although at a slower ground speed to assure  
3 better fruit coverage than when applying insecticides. Only one-fourth  
4 of the fixed cost of application equipment was charged to harvesting  
5 because the same equipment could be used, also, in fruit production.

6 Fruit Removal

7 Fruit is removed from the trees by shaking the limbs with either  
8 an air shaker or a limb shaker. The air shaker (2) is drawn contin-  
9 uously by a tractor along a row of trees, making a pass on each side  
10 of the tree. The continuous operating characteristic of the air  
11 shaker enables it to remove fruit at a very high rate (500 boxes per  
12 hour in the selected grove). However, to accomplish this high rate  
13 and to maintain a high fruit removal efficiency (percent of fruit  
14 removed) the fruit must be loosened uniformly to an attachment force  
15 of less than 5 lbs. This level of loosening has been difficult to  
16 attain consistently in Florida because of intermittent cold fronts  
17 during the season. The inconsistent fruit loosening has resulted in  
18 a lower than desired fruit removal efficiency and limited the seasonal  
19 use for the air shaker to an estimated 25 days.

20 The self-propelled limb shaker attaches on individual limbs to  
21 shake the tree. This intermittent operation accounts for the lower  
22 fruit removal rate (128 boxes per h) compared to the air shaker. The  
23 limb shaker has a higher fruit removal efficiency than the air shaker  
24 because it is less dependent on the abscission chemical for loosening  
25 the fruit to a low attachment level. The lower fruit removal rate of  
26 the limb shakers made it necessary to use two shaker units in the  
27 harvest system and operate them 8 hours per day to be comparable to one  
28 air shaker operating 4 hours per day.

1 Fruit Collection and Transportation

2 After the fruit has been removed to the ground, it is raked into  
3 a windrow, then picked up later and hauled to the roadside (1, 3). To  
4 maintain a system capacity of 2000 boxes per day in the select grove,  
5 fruit collection and transport equipment has to operate 8 hours per day.

6 Comparison of Costs

7 The total system cost consists of fixed, variable and labor cost  
8 factors while the total harvest cost included the system cost factors  
9 plus the cost of fruit lost during the harvest operation. The total  
10 harvest cost was calculated using the following formula:

11 Total harvest cost

12  $(\$/\text{box}) = \frac{\text{daily fixed cost} + \text{daily variable cost} + \text{daily labor cost}}{\text{daily capacity}}$

13 + daily fruit loss cost

14  
15 Annual fixed cost for the air shaker and limb shaker machine systems  
16 was 3.1 and 3.5 times larger, respectively, than the hand system (Table 2)

17 The daily variable cost (not including labor) of the air shaker and limb  
18 shaker machine systems was 9.7 and 11.5 times greater, respectively,  
19 than the hand system (Table 3). This was a reflection of the large  
20 machinery investment in the machine systems. The daily labor cost of  
21 the hand system was 2.7 and 2.1 times greater than that of the air  
22 shaker and limb shaker, respectively, (Table 4). The hand system  
23 required 3.0 and 2.5 times greater man-hours of labor, respectively,  
24 than the air and limb shaker machine systems. The labor requirements  
25 were less for the machine systems but the average hourly rates of the  
26 machine systems were greater because higher skilled labor is required  
27 in the machine systems.

1 The total hand system cost (\$1.15 per box) per box was lowest.  
2 The air shaker and limb shaker systems cost per box were \$1.51 and  
3 \$1.29 (Table 5), respectively. The total harvest cost was \$1.15,  
4 \$1.95, and \$1.50 per box, respectively, for the hand, air shaker and  
5 limb shaker systems.

6 Conclusion and Comments

7 The limb shaker harvest system was the closest to competing cost-  
8 wise with the hand harvest system under the prescribed grove condition.  
9 Its cost could be reduced by increasing annual use and reducing the  
10 machinery requirements.

11 The air shaker system would be more competitive if its consistence  
12 of operation was improved, thus increasing annual usage. However,  
13 factors affecting inconsistence of operations are weather related and  
14 may be difficult to improve.

15 The system costs given in this report do not include overhead  
16 costs or profit, nor do they include the cost of fruit that might be  
17 lost at the processing plant due to spoilage. Also, not included are  
18 any extra costs that may be involved in having skilled labor available  
19 for the 2 1/2 month harvest period.

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**Table 1. Characteristics of Selected Grove and Performance Factors Pertaining to Three Orange Harvest Systems**

**GROVE CHARACTERISTICS**

Fruit type	Early and Midseason Oranges
Length of season	2 1/2 Months
Tree characteristics:	
Spacing, feet	25 x 25
No. per acre	70
Height, feet	18 - 20
Skirt height, feet	3
Yield, boxes per tree	7.1
Terrain	Level to 5° slope
Ground condition	Smooth and free of trash

**PERFORMANCE FACTORS PERTAINING TO HARVEST SYSTEMS**

Hand System

Picking time, hours per day	6
Travel time, hours per day	2
Picker capacity, boxes per day	60
System capacity, boxes per day	1200
Picker's pay rate, dollars per box	.65
Picker's fringe benefits, dollars per box	.18
Fruit recovery efficiency, %	100

Machine System - Air Shaker

Air shaker capacity, trees per hour	70
System capacity, boxes (acres) per hour	2000 (4)
Fruit recovery efficiency, %	90
Abscission chemicals:	
1 qt. of Release and 1/8 qt. of Acti-Aid plus 2 qt. X-77 in	
500 gal. of water applied at a rate of 750 gal. per acre.	

Machine System - Limb Shaker

Limb shaker capacity, trees per hour	36 (2 req.)
System capacity, boxes (acres) per day	2000 (4)
Fruit recovery efficiency, %	95
Other factors same as air shaker system	

Table 2. Annual Fixed Cost of Individual Items Used in Three Orange Harvest Systems

Items	No. Required	Purchase Price	Life	Total Annual Fixed Cost <sup>b</sup>
		\$	Yrs	\$
<b>HAND SYSTEM</b>				
Crew bus	1	10,000	5	2,618
High-lift loader	1	35,000	5	8,975
Ladders	20	1,500	3	561
Tubs	20	2,400	3	898
Ladder trailer	1	<u>1,500</u>	3	<u>561</u>
Total		50,400		13,613
<b>MACHINE SYSTEM - AIR SHAKER REMOVAL</b>				
Tank truck	1	10,000)	10	430 )
Sprayer	1	25,000) a	7	1,268 )
Sprayer tractor (50 hp)	1	12,000)	10	493 ) a
Fruit rake	1	20,000	5	5,086
Rake tractor (50 hp)	1	12,000	10	1,972
Fruit pickup	1	35,000	5	8,901
Pickup tractor (50 hp)	1	12,000	10	1,972
High-lift truck	2	40,000	7	8,264
Air shaker	1	60,000	7	12,172
Air shaker tractor (50 hp)	1	12,000	10	<u>1,972</u>
Total		202,750		42,530
<b>MACHINE SYSTEM - LIMB SHAKER REMOVAL</b>				
Same as listed for air shaker except air shaker and tractor		130,678		28,386
Limb shaker, self-propelled	2	<u>80,000</u>	5	<u>20,344</u>
Total		210,678		48,730

a. One-fourth of fixed cost charged to harvesting operation

b. See Tables 6. 7. 8.

Table 3. Variable Costs and Hours Used Per Day for Individual Items in Three Orange

Harvest Systems<sup>a</sup>

Items	<u>Hand System</u>		<u>Machine Systems</u>			
	Hrs/day	Cost/day <sup>b</sup>	<u>Air Shaker</u>		<u>Limb Shaker</u>	
			Hrs/day	Cost/day <sup>b</sup>	Hrs/day	Cost/day <sup>b</sup>
Crew bus	2	15.50	-	-	-	-
High-lift loader	6	76.50	-	-	-	-
Ladders	6	-	-	-	-	-
Tubs	6	-	-	-	-	-
Ladder trailer	1	-	-	-	-	-
Tank truck	-	-	4	31.00	4	31.00
Sprayer	-	-	4	70.00	4	70.00
Sprayer tractor (50 hp)	-	-	4	32.20	4	32.20
Rake	-	-	8	24.00	8	24.00
Rake tractor (50 hp)	-	-	8	64.40	8	64.40
Pickup	-	-	8	42.00	8	42.00
Pickup tractor (50 hp)	-	-	8	64.40	8	64.40
High-lift trucks (2)	-	-	8	148.00	8	148.00
Air shaker	-	-	4	111.00	-	-
Air shaker tractor (50 hp)	-	-	4	32.20	-	-
Limb shakers (2)	-	-	-	-	16	312.00
Abscission chemical	-	-	-	<u>269.36</u>	-	<u>269.36</u>
<b>Total</b>		<b>92</b>		<b>888.56</b>		<b>1057.36</b>

a. Does not include labor cost

b. See Tables 6, 7, 8

Table 4. Labor Requirement and Cost Per Day for Three Orange Harvest Systems<sup>a</sup>

Items	Hand System		Machine System			
	Hrs/day	Cost/day <sup>b</sup> \$	Air Shaker		Limb Shaker	
			Hrs/day	Cost/day <sup>b</sup> \$	Hrs/day	Cost/day <sup>b</sup> \$
Crew bus driver	2 (S)	14.00	-	-	-	-
High-lift loader	8 (S)	56.00	-	-	-	-
Supervisor	8 (S)	80.00	-	-	-	-
Hand pickers	160 (U)	996.00	-	-	-	-
Tank truck driver	-	-	4 (S)	28.00	4 (S)	28.00
Sprayer tractor driver	-	-	4 (S)	28.00	4 (S)	28.00
Pre-raking cleanup	-	-	8 (U)	40.00	8 (U)	40.00
Rake tractor driver	-	-	8 (S)	56.00	8 (S)	56.00
Pickup tractor driver	-	-	8 (SP)	80.00	8 (SP)	80.00
Pickup grader	-	-	8 (U)	40.00	8 (U)	40.00
High-lift driver	-	-	16 (S)	112.00	16 (S)	112.00
Air shaker tractor driver	-	-	4 (SP)	40.00	-	-
Limb shaker operator	-	-	-	-	16 (SP)	160.00
	178	1146.00	60	424.00	72	544.00

a. Labor cost was based on \$5.00, \$7.00, and \$10.00 per hour, respectively for unskilled (U), skilled (S), and supervisory (SP) labor. Supervisory labor also fills a skilled labor position. Cost for handpicker was based on a piece rate of \$0.83 per box (includes \$0.18 per box for benefits).

b. See Tables 6, 7, 8

Table 5. Summary of costs for Three Orange Harvest Systems<sup>a</sup>

Item	<u>Hand System</u>	<u>Machine System</u>	
		Air Shaker	Limb Shaker
	\$	\$	\$
Labor cost, per day	1146.00	424.00	544.00
Fixed cost, per day	136.13	1701.11	974.57
Variable cost, per day	<u>92.00</u>	<u>888.56</u>	<u>1057.36</u>
Total system cost, per day	1374.13	3013.67	2575.93
Total system cost, per box	1.15	1.51	1.29
Lost fruit cost, per box <sup>b</sup>	00	.44	.21
Total harvest cost, per box	1.15	1.95	1.50

a. Calculations were based on a 100 day annual use at 1200 boxes per day for the hand system and 25 day annual use at 2000 boxes per day for air shake and 50 day annual use at 2000 boxes per day for limb shaker.

b. Fruit cost was calculated at \$4.00 per box on-tree fruit price at 100, 95 and 90% fruit recovery efficiency for hand, machine with air shaker and machine with limb shaker. respectively.

APPENDIX  
BUDGET DATA

Budget data for each component of a system are itemized separately. This enables the reader to estimate the effects that changes in a system would have on harvesting costs. The following is an explanation of "items" in the budgets.

Machines	Number of units of each component
Machine operation	Number of hours of machine use per day
Size	Engine size of equipment in horsepower
Purchase price (PP)	Estimated new cost of the equipment
Salvage value (SV)	Estimated value at end of useful service life = 0.1 PP
Average value (AV)	$(PP + SV) \div 2 = (0.55 PP)$
Service life	Expected years useful life of equipment
Fixed costs:	
Depreciation (D)	$(PP - SV) \div (SL) = \text{cost per year}$
Interest (I)	$(0.12 AV) = 0.066 PP = \text{cost per year}$
Taxes (T)	$(0.01 AV) = 0.0055 PP = \text{cost per year}$
Insurance (IN)	$(0.005 AV) = 0.0028 PP = \text{cost per year}$
License (L)	License cost per year for highway vehicles
Total fixed cost (TFC)	$(D + I + T + In + L) \div (\text{days used per year}) = \text{cost per day.}$
Variable costs:	
Repair and Lubrication (R & L)	$(0.15 PP) \div (1,000) \times (\text{hours used per day}) = \text{cost per day}$
Fuel (F)	$(0.1) \times (\text{maximum pto horsepower}) \times (\$1.25 \text{ per gallon}) \times (\text{hours used per day}) = \text{cost per day}$
Abscission chemical (AB)	$(\$67.34 \text{ per acre}) \times (\text{acres per day}) = \text{cost per day}$
Total variable cost (VC)	$(R \& L + AB) = \text{cost per day}$

Total fixed plus  
variable cost

$(TFC + VC) = \text{cost per day}$

Skilled labor (SK)

Hours of labor for equipment operators  
per day

Unskilled labor (UK)

Hours of other labor per day

Supervisory labor (S)

Skilled labor that also supervises the  
operation

Total labor cost (L)

$(SK + UK + S) = \text{cost per day}$

The superscript definitions for the budget tables.

- a. Budget prepared for a crew of 20 pickers working 8 hours per day harvesting 2.4 acres per day.
- b. Includes 20 items used 8 hours per day.
- c. Based on 100 day annual use.
- d. The variable cost does not include labor, lost-fruit cost or overhead.
- e. Labor cost was at an hourly rate of \$7, \$5, and \$10 per hour, respectively, for skilled, unskilled, and supervisory labor. Supervisory labor also works.
- f. Budget prepared for harvesting 4 acres per day.
- g. All equipment assumed on hand for regular spraying operation, so only one-fourth of the fixed cost was charged to harvesting.
- h. Lubrication and repairs increased by 100% for high maintenance equipment.
- i. Based on 50 day annual use.
- j. Based on 25 day annual use.

Table 6. Budget for operating a hand harvest system with 20 pickers in Florida, 1980-81 season<sup>a</sup>

Item	Units	Crew bus	High-lift loader	Ladders	Tubs	Ladder trailer	Total
Machines	No.	1	1	20	20	1	N/A
Machine operation per day	Hr./day	2	6	160 <sup>b</sup>	160 <sup>b</sup>	1	N/A
Size	Hp.	50	60	N/A	N/A	N/A	N/A
Purchase price	Dol.	10,000.00	35,000.00	1,500.00	2,400.00	1,500.00	50,400.00
Salvage value	Dol.	1,000.00	3,500.00	150.00	240.00	150.00	5,040.00
Average value	Dol.	5,500.00	19,250.00	825.00	1,320.00	825.00	27,721.00
Service life	Yrs.	5	5	3	3	3	N/A
Fixed cost:							
Depreciation	Dol./yr.	1,800.00	6,300.00	450.00	720.00	450.00	9,720.00
Interest	Dol./yr.	660.00	2,310.00	99.00	158.00	99.00	3,326.00
Taxes	Dol./yr.	55.00	192.00	8.00	13.00	8.00	276.00
Insurance	Dol./yr.	28.00	98.00	4.20	6.72	4.20	141.12
License	Dol./yr.	75.00	75.00	N/A	N/A	N/A	150.00
Total fixed cost per year	Dol./yr.	2,618.00	8,975.00	561.20	897.72	561.20	13,613.12
Total fixed cost per day <sup>c</sup>	Dol./day	26.18	89.75	5.61	8.98	5.61	136.13
Variable cost:							
Lubrication and repair	Dol./day	3.00	31.50	N/A	N/A	N/A	34.50
Fuel	Dol./day	12.50	45.00	N/A	N/A	N/A	57.50
Abscission chemical	Dol./day	N/A	N/A	N/A	N/A	N/A	N/A
Total variable cost per day <sup>d</sup>	Dol./day	15.50	76.50	N/A	N/A	N/A	92.00
Total fixed and variable cost	Dol./day	41.68	166.25	5.61	8.98	5.61	228.13
Labor Requirement:							
Skilled	Hr./day	2	8	N/A	N/A	N/A	10
Unskilled	Hr./day	N/A	N/A	N/A	N/A	N/A	N/A
Supervisory	Hr./day	N/A	8	N/A	N/A	N/A	8
Total labor cost per day	Dol./day	14.00	120.00	N/A	N/A	N/A	150.00

See superscript on page 10

Table 7. Budget for operating an air shaker - pickup harvest system, 1980-81 season<sup>f</sup>

Item	Units	Tank truck	Sprayer	Sprayer tractor	Rake	Rake tractor	Pickup	Pickup tractor	High-lift truck	Air shaker	Air Shaker tractor	Total
Machines	No.	1	1	1	1	1	1	1	2	1	1	N/A
Machine operation per day	Hr./day	4	4	4	8	8	8	8	16	4	4	N/A
Size	Hp.	50	110	50	N/A	50	N/A	50	100	150	50	N/A
Purchase price	Dol.	10,000.00 <sup>g</sup>	25,000.00 <sup>g</sup>	12,000.00 <sup>g</sup>	20,000.00	12,000.00	35,000.00	12,000.00	40,000.00	60,000.00	12,000.00	238,000.00
Salvage value	Dol.	1,000.00	2,500.00	1,200.00	2,000.00	1,200.00	3,500.00	1,200.00	4,000.00	6,000.00	1,200.00	23,800.00
Average value	Dol.	5,500.00	13,750.00	6,600.00	11,000.00	6,600.00	19,250.00	6,600.00	22,000.00	33,000.00	6,600.00	130,900.00
Service life	Yrs.	10	7	10	5	10	5	10	7	7	10	
Fixed cost:												
Depreciation	Dol./yr.	900.00	3,214.00	1,080.00	3,600.00	1,080.00	6,300.00	1,080.00	5,142.00	7,714.00	1,080.00	31,190.00
Interest	Dol./yr.	660.00	1,650.00	792.00	1,320.00	792.00	2,310.00	792.00	2,640.00	3,960.00	792.00	15,709.00
Taxes	Dol./yr.	55.00	137.00	66.00	110.00	66.00	193.00	66.00	220.00	330.00	66.00	1,339.00
Insurance	Dol./yr.	28.00	70.00	33.60	56.00	33.60	98.00	33.60	112.00	168.00	33.50	666.50
License	Dol./yr.	75.00	N/A	N/A	N/A	N/A	N/A	N/A	150.00	N/A	N/A	225.00
Total fixed cost per year	Dol./yr	429.50	1,267.75	492.90	5,086.00	1,971.60	8,901.00	1,971.60	8,264.00	12,172.00	1,971.60	42,527.95
Total fixed cost per day <sup>h</sup>	Dol./day	17.18	50.71	19.72	203.44	78.86	356.04	78.86	330.56	486.88	78.86	1,701.11
Variable cost:												
Lubrication and repairs	Dol./day	6.00	15.00	7.20	24.00	14.40	42.00	14.40	48.00	36.00	7.20	210.00
Fuel	Dol./day	25.00	55.00	25.00	-	50.00	-	50.00	100.00	75.00	25.00	225.00
Attraction chemical	Dol./day	N/A	269.36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	269.36
Total variable cost per day <sup>d</sup>	Dol./day	31.00	339.36	32.20	24.00	64.40	42.00	64.40	148.00	111.00	32.20	683.56
Total fixed and variable cost	Dol./day	48.18	390.07	51.92	227.44	143.26	398.04	143.26	478.56	597.88	111.06	2,384.67
Labor Requirement:												
Skilled	Hr./day	4	N/A	4	N/A	8	N/A	N/A	16	N/A	N/A	32
Unskilled	Hr./day	N/A	N/A	N/A	8	N/A	8	N/A	N/A	N/A	N/A	16
Supervisory	Hr./day	N/A	N/A	N/A	N/A	N/A	N/A	8	N/A	N/A	4	12
Total labor cost per day <sup>e</sup>	Dol./day	28.00	N/A	28.00	40.00	56.00	40.00	80.00	112.00	N/A	40.00	424.00

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Table 8. Budget for operating limb shaker - pickup harvest system, 1980-81 season<sup>f</sup>

Item	Unit	Tank truck	Sprayer	Sprayer tractor	Rake	Rake tractor	Pickup	Pickup tractor	High-lift truck	Limb shaker	Total
Machines	No.	1	1	1	1	1	1	1	2	2	N/A
Machine operation per day	Hr./day	4	4	4	8	8	8	8	16	16	N/A
Size	Hp.	50	110	50	N/A	50	N/A	50	100	120	N/A
Purchase price	Dol.	10,000.00 <sup>g</sup>	25,000.00 <sup>g</sup>	12,000.00 <sup>g</sup>	20,000.00	12,000.00	35,000.00	12,000.00	40,000.00	80,000.00	246,000.00
Salvage value	Dol.	1,000.00	2,500.00	1,200.00	2,000.00	1,200.00	3,500.00	1,200.00	4,000.00	8,000.00	24,600.00
Average value	Dol.	5,500.00	13,750.00	6,600.00	11,000.00	6,600.00	19,250.00	6,600.00	22,000.00	44,000.00	135,300.00
Service life	Yrs.	10	7	10	5	10	5	10	7	5	
Fixed cost:											
Depreciation	Dol./yr.	900.00	3,214.00	1,080.00	3,600.00	1,080.00	6,300.00	1,080.00	5,142.00	14,400.00	36,796.00
Interest	Dol./yr.	660.00	1,650.00	792.00	1,320.00	792.00	2,310.00	792.00	2,640.00	5,280.00	16,236.00
Taxes	Dol./yr.	55.00	137.00	66.00	110.00	66.00	193.00	66.00	220.00	440.00	1,353.00
Insurance	Dol./yr.	28.00	70.00	33.60	56.00	33.60	98.00	33.60	112.00	224.00	1,377.00
License	Dol./yr.	75.00	N/A	N/A	N/A	N/A	N/A	N/A	150.00	N/A	225.00
Total fixed cost per year	Dol./yr.	429.50	1,267.75	492.90	5,086.00	1,971.60	8,901.00	1,971.60	8,264.00	20,344.00	48,723.35
Total fixed cost per day <sup>i</sup>	Dol./day	8.59	25.36	9.86	101.72	39.43	178.02	39.43	165.28	406.88	974.57
Variable cost:											
Lubrication and repairs	Dol./day	6.00	15.00	7.20	24.00	14.40	42.00	14.40	48.00	192.00 <sup>h</sup>	363.00
Fuel	Dol./day	25.00	55.00	25.00	N/A	50.00	N/A	50.00	100.00	120.00	425.00
Abscission chemical	Dol./day	N/A	269.36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	269.36
Total variable cost per day <sup>d</sup>	Dol./day	31.00	339.36	32.20	24.00	64.40	42.00	64.40	148.00	312.00	1,057.36
Total fixed and variable cost	Dol./day	39.59	364.75	42.06	125.72	103.83	220.02	103.83	313.28	718.88	2,031.96
Labor Requirements:											
Skilled	Hr./day	4	N/A	4	N/A	8	N/A	N/A	16	N/A	32
Unskilled	Hr./day	N/A	N/A	N/A	8	N/A	8	N/A	N/A	N/A	16
Supervisory	Hr./day	N/A	N/A	N/A	N/A	N/A	N/A	8	N/A	16	24
Total labor cost per day <sup>e</sup>	Dol./day	28.00	N/A	28.00	40.00	56.00	40.00	80.00	112.00	160.00	544.00

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