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FURTHER STUDIES ON HARVESTING  
OF CHILI PEPPERS

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FURTHER STUDIES ON HARVESTING OF CHILI PEPPERS.\*

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This study, made in 1954, is a continuation of some work done in 1953\*\*. Pepper fields are normally harvested twice; both studies were of the first harvest. Since the peppers are to be dried they must be red-ripe before they are harvested. Several harvest procedures are used as follows:

A. Picking Containers and Sacks. The peppers are picked and placed in various types of containers, including pea hampers, carbide cans, and used grease-buckets. The choice usually depends upon cost and availability. In 1954, pail-shaped wire buckets of various sizes were made at Davis of hardware cloth over a 3/16-inch iron frame. The two larger sizes were used in pepper picking to determine the most efficient size.

A picking group is usually made up of four pickers and one sacker. The pickers harvest the fruit into the container and empty it into a cloth bag held by the sacker. Usually the sacker moves from picker to picker to gather the peppers. Sometimes the filled sacks are sewed before they are loaded.

B. Picking Directly into Sacks. In some areas the peppers are picked directly into sacks, which are then loaded on trailers for transportation to the drier. The sack is attached to the picker's belt and dragged through the field until it contains about 35 pounds of peppers. The picker has a sack full of empty sacks that he keeps throwing in front of him in his two rows that he is picking. Filled sacks are picked up and placed on trailers. Some pickers used surplus army belts, with metal eyelets every three or four inches to which metal hooks can be attached.

C. Pick into Containers and Dump into 1,000-Pound Wooden Bins. The peppers are picked and placed in a container, usually a carbide can. The filled container is carried to a man on a trailer, located near the center of the picking crew for dumping. Each trailer carries four bins of 1,000-pounds capacity each. Two trailers are pulled in tandem through the field.

D. Use of Trailers and a Belt Loader. The peppers are picked into cans, which are carried to a belt and emptied. The belt conveys the peppers to a trailer. The net weight of peppers per trailer in 1954 was about 2.6 tons. One man operates the self-propelled belt and the boss of the picking crew operates the

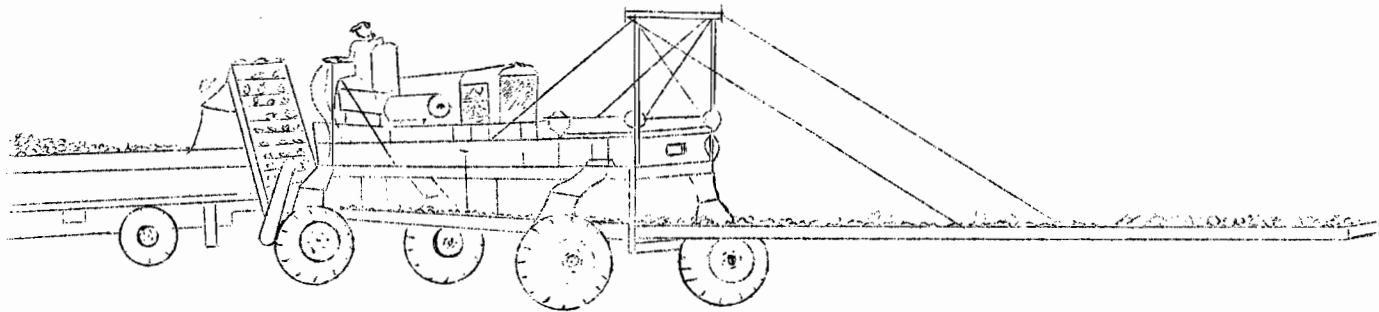
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\*\* John H. MacGillivray, L. J. Clemente, and R. A. Brendler: A preliminary study of labor use in the harvesting of Chili peppers in Ventura County - 1953: Vegetable Crops Series 63, Davis, California, 1953.

tractor, which pulls two trailers through the field. Both C and D are examples of bulk loading that make it desirable to have equipment for bulk unloading at the drier.

FIGURE 1



## DISCUSSION

Table 1 gives the major data collected during the 1954 season. Tables 2-4 are some interesting observations made during the same period. Different picking procedures affected the hours required to pick and load a ton of chili peppers. The shortest time, 7.7 hours, was accomplished with cloth sacks held by hooks on a belt. The greatest time requirement was 21.8 hours per ton. The data for items 10 and 11 (Table 1) were obtained when the belt was first used, so maximum efficiency would not be expected. It seems apparent from Table 1 that the most efficient operations are where a large proportion of the time is spent in the actual harvest. In items 5-6 and 10-16 the picking time also includes walking to the pepper bin or to the conveyor belt.

There are other savings than just field labor where a conveyor belt is used. Since the peppers are bulk loaded they can be dumped quickly as compared to emptying numerous sacks. Usually three men are required to dump sacks but with bulk unloading only one man is required. Since bulk loading eliminates the use of sacks this can mean an additional saving of some \$2,000 to \$3,000 for an average size drier.

TABLE 1

Effect of Different Harvesting Methods of Chili Peppers on the Time Required - 1954

County and Picking Procedure	Date	Hours of Test	Tons per Acre	Harvesting Hrs./Ton Fresh Peppers *						
				Picking		Sacking		Loading		Total
				Hours	%	Hours	%	Hours	%	Hours
<u>Manual Loading</u>										
1. Orange**	10/13	5.6	6.2	10.5	77	2.3	17	0.9	6	13.7
2. San Diego	10/15	3.5	3.8	8.6	89	0.6+	6	0.5	5	9.7
3. San Diego**	10/15	3.0	3.9	10.2	86	1.1+	9	0.6	5	11.9
4. Orange	10/14-15	18.0	3.0?	8.7	76	1.9	16	0.9	8	11.5
5. Ventura		9.0	---		11.1	95		0.6	5	11.7
6. Ventura**	10/20	7.0	7.7		16.7	97		0.6	3	17.3
7. San Diego	11/23	---	---		9.7	94		0.6	6	10.3
8. San Diego**	11/23	---	---		7.1	92		0.6	8	7.7
9. Orange**	-----	166	9.2		21.4	98		0.4	2	21.8
<u>Belt Loading</u>										
10. Orange	10/16	7.0	3.3		9.5	92		0.8	8	10.3
11. Orange	10/17	9.0	5.0		9.7	92		0.9	8	10.6
12. Orange	10/18	9.0	7.6		7.6	92		0.7	8	8.3
13. Orange	10/25	9.0	7.5		8.9	94		0.6	6	9.5
14. Orange	10/29-11/2	40.8	8.1		8.8	94		0.6	6	9.4
15. Orange	11/3-11/6	32.5	7.9		8.6	94		0.6	6	9.2
16. Orange**	11/8-11/15	55.0	7.6		9.4	92		0.8	8	10.2

\* Hours of labor per dry ton and drying ratios are available for some of the above fields - Field 2 - 53.35 hr., 5.5 to 1 ratio; Field 3 - 59.50 hr., 5 to 1 ratio; Field 5 - 67.2 hr., 5.75 to 1 ratio; Field 6 - 99.4 hr., 5.75 to 1 ratio; Field 7 - 40.17 hr., 3.9 to 1 ratio; Field 8 - 28.49 hr., 3.7 to 1 ratio; Field 9 - 100 hr., 4.6 to 1 ratio; Field 14 - 53.5 hr., 5.7 to 1 ratio; and Field 15 - 71.2 hr., 7.8 to 1 ratio.

\*\* California Chili in these, otherwise Mexican Chili in the remainder.

+ Carry to roadway, not sacking.

Containers. Various kinds of containers are used in harvesting peppers. Many times, containers can be obtained free or for small cost. Table 2 gives a comparison of six of these containers -- four were of the salvage type and the last two were built for study by the University. Five sizes of this wire and screen type were made to determine the proper size of container for various vegetables. The data in Table 2 indicate that the containers rank in the following order as to percentage of pepper weight: cloth sack (burlap), pea hamper, 35-qt. wire pail, 25-qt. wire pail, carbide can, and grease pail. The last container has the disadvantage of containing 40 per cent less weight of peppers than does the carbide can and 65 per cent less than the cloth sack.

A desirable container is light in weight, free from wooden or metal slivers, and easy to empty. The contents of the container should be visible so the picker can see when the container has been emptied in dumping. Some pickers may prefer

a container with a handle. There is a need for determining the optimum size container for harvesting Chili peppers.

TABLE 2

Comparison of Picking Containers as to Weight Empty and Net Weight of Peppers

Picking Container	Wt. empty container	Net Wt. of Peppers	Peppers as % of total weight
Carbide can	5.6	20.0	78
Pea hamper	3.2	22.3	87
Grease pail	4.1	12.0	75
Wire pail 35-qt. U.C.	3.8	21.2	85
Wire pail 25-qt. U.C.	3.3	14.9	82
Cloth sack	1.0	34.0	97

Container Efficiency. Table 3 gives some comparisons as to the time required to pick 100 pounds of peppers with different containers. Some data are also given on the time required to empty the various containers. This should be considered a preliminary study, since the number of determinations was not large. It does serve to illustrate what ideas may be developed from this type of data. The data would indicate that the pea hamper or wire basket was the most desirable container for picking peppers. The 25-qt. wire basket was less desirable than the 35-qt. basket, which suggests the desirability of trying a still-larger container. The emptying time was greater for the wire basket than for the pea hamper. The hardware cloth, of 1/2 inch mesh, entangled the pepper stems, making emptying difficult. Smaller mesh would probably correct this.

TABLE 3

Effect of Picking Container on Man Minutes per 100 pounds of Peppers using the Conveyor Belt.

Container	A		B		C		D	
	Min. per 100 lbs.	% Diff-erence	Min. per 100 lbs.	% Diff-erence	Min. per 100 lbs.	% Diff-erence	Min. to empty container	% Diff-erence
Pea hamper	18.5		21.5	11			0.057	
Wire basket 35-qt.(U.C.)	19.3	4	19.3		20.1		0.067	18
Wire basket 25-qt.(U.C.)					21.7	8		
Carbide can	22.3	21	24.4	26			0.097	70
Grease pail	25.9	40						

Rate of Hand Picking: Table 4 gives data obtained from two different picking crews. There will always be some variation in the accomplishment of different workers. In this case the variation between workers may be somewhat greater than

normal. The fastest third of the workers have greater production by 48 to 94 per cent when compared to the slowest third. Worker output will differ because of factors such as: training, supervision, size of crew, planning of work, and the caliber and skill of pickers. In industry it has been found that the most efficient workers output is approximately double that of the least efficient worker.

TABLE 4

Difference in time required to pick 100 pounds of Chili peppers using cloth sacks as a container. Sacks were hooked on pickers belts.

	Oct. 15	Oct. 15	Nov. 23	Nov. 23
Number of pickers	16	18	9	9
Fastest picker, minutes	18.3	18.6	21.8	10.5
Fastest third, minutes	22.8	25.0	24.2	14.7
Average, minutes	28.7	34.2	29.2	24.7
Slowest third, minutes	37.6	48.5	35.7	27.9
Slowest, minutes	48.1	56.3	51.8	41.3
Percent difference between slowest and fastest third	65	94	48	90

Size of Belt Picking Crew. When peppers are being loaded by means of a conveyor belt there is always the problem of how efficiency is affected by the number of workers. Table 5 is a calculated illustration of this problem. It is evident that a maximum number of pickers will increase efficiency.

When the belt is being used, there are three or four rows that are closer to the trailer than to the belt. The elevator on the end of the belt is partly responsible for this situation. If these few pickers dump their containers into the trailers they usually walk a shorter distance. Hence, this procedure is desirable.

TABLE 5

The effect of number of pickers on the efficiency of operating a 63 foot conveyor belt. Based on picking 200 pounds of peppers per hour.

Number of Pickers	Pickers plus belt operator & tractor driver	Manhours per ton	Per cent gain over	
			7 pickers	15 pickers
27	29	10.7	21	6
23	25	10.9	18	4
19	21	11.1	16	2
15	17	11.3	14	
11	13	11.8	9	
7	9	12.9		

Sack Picking. When pickers and sackers are used in picking and loading by hand, it is difficult to get the two operations well synchronized. Either the sacker is waiting for the picker, or vice versa. Some data indicated that the sackers work about 77 per cent of their time. The pickers were using hampers that held 22 pounds of peppers but were emptying their containers when they held only 10 pounds of peppers. This was because the sacker was trying to keep busy. Consequently, more time was spent emptying picking hampers.

Where bins were used to transport peppers, the pickers had to wait for the man on the trailer to empty their cans. If three or four empty cans had been available, the picker could have traded cans when he reached the trailer. The average time for emptying cans was 0.12 of a minute. When two or three pickers were waiting at one time, the period could be extended to 0.25 of a minute.

Are Small Savings in Time Worth While? There is also the question of whether small savings are important. Some might feel it is undesirable to rearrange work to avoid small delays. But it is clearly better to prevent these delays and remove reasons for not working. For instance, in Table 3 it requires 20.1 minutes to pick 100 pounds with the 35-qt. wire basket and 21.7 minutes with the 25-qt. wire basket. The difference of 1.6 minutes per 100 pounds is not large, but it represents a waste of 30 minutes per day for one worker or 15 hours per day for a crew of 30 men.