Figure 1. This experimental carrier provides three seated and three prone positions. Workers alternate at the end of each row.

LABOR CARRIER

M. B. ZAHARA • R. E. GARRETT

FOR MANY CROPS, planting seeds at a rate comparable with the desired stand is impossible because of problems in placing the seeds accurately, and such hazards as low germination rates, soil crusting, and bird and insect damage. Over-planting is usually necessary to increase the probability of obtaining adequate stands. Subsequently the crop must be thinned to single plants at prescribed spacings and weeded. Because hand thinning and weeding are difficult and tedious, and the supply of labor to do the work is increasingly uncertain, many growers have provided labor carriers to make the work easier and more attractive.

A two-man experimental carrier was constructed in the department of agricultural engineering at Davis to study the ability of workers to thin and weed while riding in various positions. Later, a six-man, self-propelled carrier was built incorporating the most feasible design features.

The two-man carrier was mounted on the hitch of a wheel tractor. It provided one seated and one prone support. The seat was padded and equipped with adjustable foot rests. The prone support was also padded, and it included provisions for various degrees of bend at the knees. An adjustable, padded support was also provided for the forehead. Both the seated and prone supports could be positioned directly over and parallel with the row, or they could be adjusted to 30, 45, or 90 degree angles with respect to the direction of the row.

Preliminary trials indicated no clear preference among several workers between the various angles to the row, and since positioning the supports directly over and parallel with the row resulted in the simplest structure, all subsequent tests were conducted from that position.

The two-man carrier was used to thin an experimental plot of cauliflower. A randomized block with six treatments and five replications was designed. Sixty feet of row were thinned and the time recorded for each treatment. The treatments were as follows:

1. Check—normal thinning without carrier.
2. Normal thinning from carrier, either seated or prone and directly above and parallel with the row.
3. Plant row blocked to 4-inch islands of plants every 14 inches, prior to thinning from carrier.
4. Plant row blocked to 2-inch islands of plants every 15 inches, prior to thinning from carrier.
5. All weeds removed from the plant row prior to normal thinning from carrier.
6. Plant row singled to 1- to 2-inch spacings between plants prior to thinning from carrier.

Table 1 summarizes the data from the plot. Use of the carrier alone had little effect on the time required to thin an acre. But when the carrier was used in combination with blocking, weed control, and precision planting, the results became more significant. When the carrier was used with blocking, a saving of 61% in time required to thin an acre was obtained with 2-inch islands and 38% with 4-inch islands. Eliminating the weeds in the plant row made thinning easier and decreased the time by 26%. Spacing the plants 1 to 2 inches apart in the row reduced the thinning time with the carrier 32% when compared with normal thinning without the carrier. It was not determined whether these effects are cumulative, or whether the results of blocking, weed control, and precision planting would be the same without the carrier.

Workers using the crew carrier differed in their preference for the seated and prone supports, but they generally agreed that either position alone induced fatigue. Thus, the practice of alternating positions at the end of each row was adopted.

A six-man labor carrier was designed

Figure 2. The carrier is self-propelled and self-guided. tractor along a furrow.

EXPERIMENTS IN ROW CROPS

W. S. SEYMAN • R. G. CURLEY

The six-man labor carrier designed and tested by the University of California demonstrates a basic concept that can be adapted to the needs of individual growers and produced at a low cost per man—offering a useful tool to aid in attracting and keeping labor for thinning and weeding.

to provide a self-propelled, self-guiding frame at a low cost per man. The size of the crew was set at six men primarily because this appeared to be the largest crew possible for side-by-side positioning on a frame that could be turned at the end of the field. The size of the crew was also limited because of problems in matching workers of comparable skill and in supervising the crew.

The frame of the carrier was made from standard structural shapes. The design allowed for individual variations in position of the supports both laterally and vertically, and it provided ample room for working.

his view shows the tongue which guides the one-wheel

Because the crew carrier offered only small increases in productivity, it was designed to operate without a driver. The front wheel was powered by a 1½ hp motor. The motor and wheel were mounted in a frame connected to the main frame through a vertical pivot, to provide steering. A tongue, with a boat-shaped end, was hinged to the front frame and floated in an irrigation furrow to guide the unit down the rows. The drive system provided slow speed of travel for normal operation. The crew manually guided and propelled the unit around the end of the row with the drive disconnected by means of a clutch.

The six-man labor carrier was used to compare a crew thinning with and without the carrier in a lettuce plot laid out in a grower's field (table 2.) The crew reduced their thinning time one-third by using the labor carrier in a lettuce stand that averaged 12 plants per foot of row before thinning. Without the use of the carrier, the plants were thinned to 1.16 plants per foot of row, and with the carrier the same crew thinned the plants to a stand that averaged one plant per foot of row.

Summary

It is questionable whether a labor carrier alone can increase the output of a thinning crew enough to justify its cost. Weed control, precision planting, and mechanical blocking make the work easier and provide significant increases in productivity. Preblocking established the space between plants. Elimination of this decision is particularly helpful to the inexperienced worker. Both the seated and prone positions seemed to induce fatigue, but alternating positions at the end of each row was satisfactory. During the test periods, experienced thinners were reluctant to use the carrier; however, workers just learning to thin enjoyed riding more than walking. There probably is some potential for the use of a labor carrier to attract laborers who would not thin without it. Such benefits are difficult to evaluate economically.

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TABLE 1. MAN-HOURS OF LABOR REQUIRED TO THIN AN ACRE OF CAULIFLOWER

	Treatments					
	1	2	3	4	5	6
	10.9	9.8	5.8	4.2	10.0	7.9
	11.1	9.7	11.5	5.0	9.9	6.5
	14.2	9.8	5.3	3.9	8.2	9.2
	9.7	9.2	6.8	4.6	7.7	7.0
	12.4	9.9	6.5	5.3	7.8	8.9
Mean	11.7	9.7	7.2	4.6	8.7	7.9
L.S.D. 5%	1.25					
1%	1.70					

TABLE 2. MAN-HOURS OF LABOR REQUIRED TO THIN AN ACRE OF LETTUCE

	Normal thinning without carrier	Thinning with carrier
	45.0	35.0
	50.0	33.4
	50.0	28.4
	50.0	28.4
Mean	48.75	31.3
L.S.D. 5%	9.54	
1%	17.5	