Labor-Input Requirements for Experimental Production of Summer Peppers Under Drip Irrigation[1, 2]

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ABSTRACT

The total man-hours per ha requirements were 2,868.2 and 3,029.0, respectively in plastic mulched and non-mulched plots for summer peppers under drip irrigation. Harvesting and post harvest operations consumed 51.7% of total labor input. Plastic mulch management needed 15.3% compared to 6.7% for installation and dismantling of the drip irrigation system. Weeding operation required 6.6 and 27.1%, respectively of the labor in mulched and non-mulched plots.

INTRODUCTION

In cultivation of any crop, expenditure is incurred on various farming operations. No specific information is available to correlate the cost incurred on various operations with increase in crop production. Theoretically, the source of energy is of no consequences to farm operations so long as the job is performed satisfactorily at the proper time.[4] Unaided, man can plow, sow, irrigate, harvest, and handle a crop. Practically speaking, however, the availability of non-human energy is of immense benefit in carrying out farm operations; it is cheaper and more efficient than man labor. In Puerto Rico the production of vegetable crop involves a technology which makes use of man and mechanical power as complementary inputs for most farm operations.

The crop type and associated acreage are the primary determinants of energy needs. Timeliness and intensity of operation are the essential ingredients for a successful experiment. Shortages of energy at any time will cause tardy or inadequate performance of activities[5]. There are two cropping seasons in Puerto Rico—summer (April to September) and

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[4] Goyal, M. R., D. M. Byg, and K. Singh, 1979. An appropriate technology for cotton production in India. Agricultural Mechanization in Asia, Japan, 10 (2): 73–78.

[5] Trickle Irrigation in Humid Regions—Puerto Rico. Annual Report No. 2/Puerto Rico/Hatch 326 (S-143)/1980–81. Agricultural Experiment Station, University of Puerto Rico, Mayaguez Campus, College of Agricultural Sciences, Río Piedras, P. R. October 1, 1980 to September 30, 1981.

winter (October to March). The energy needs are maximum for harvesting periods of vegetable production.[5]

This study estimated daily, weekly, and operational labor-input requirements for experimental production of peppers under drip irrigation during summer of 1981 at Fortuna Substation, Juana Díaz.

MATERIALS AND METHODS

The field experiment[5] on effects of plastic mulch and varying water application rates on pepper yield was used to estimate the operational, weekly, and daily labor requirements for experimental production of pepper (variety Cubanelle). The whole field was considered as a single unit for the purpose of this study.

Beds were shaped with a bed shaper for 1.8 m spacing. The 0.0015 gauge silver-coated black plastic mulch was manually placed over the desired beds. A 5-cm diameter galvanized pipe was used to punch the holes in the plastic at the desired positions. Plot size was 10.8 × 162 m (90 beds, each 10.8 m long). Pepper plants were transplanted March 25, 1981, on both sides of a dual chamber drip line in a zigzag pattern at a distance of 15 cm from the drip line. The plant spacing was 30 cm down the row (37,037 plants per ha). The daily labor requirement to complete each operation was recorded. The experiment was terminated July 20, 1981.

RESULTS AND DISCUSSIONS

The data collected was analyzed (tables 1, 2, and 3). Table 1 presents daily labor requirements for experimental production of peppers. A tractor was used for land preparation and spray applications on days 30, 77, 79, and 100. All other operations were completed manually. Total labor requirements during the crop season were 2,868.2 and 3,029 man-hours per hectare in plastic-mulched and non-mulched plots, respectively. Tensiometer reading operation consumed 22.5 man-hours per ha. Removal and disposal of plastic mulch consumed 232.6 man-hours per ha. Labor-input requirements were highest on the 112th day.

Table 2 reveals man-hours per ha requirements for each successive week. It also indicates percentage distribution of labor input for each week. Highest percentage of labor input was 21.8 and 17.7 percent on eleventh julian week in non-mulched plots and on sixteenth julian week in mulched plots, respectively. Drip irrigation installation consumed 2.0 percent of total labor input. The layout of plastic mulch used 7.2 percent of labor input.

The man-hours per hectare requirements for each operation are indicated in table 3. It also indicates percentage distribution of labor input for each operation and frequency of operation. This table reveals that

TABLE 1.—*Daily labor requirements for experimental production of peppers (var. Cubanelle) under drip irrigation. Date of transplanting: March 25, 1981. Date of last harvest: July 15, 81*[1]

Julian day	Operation	Labor input, man-hr/ha	
		Plastic	No plastic
—	Disc harrowing (Ford 5000)	6.5	6.5
—	Bed shaping (Ford 5000); Bed apart = 1.8 m	2.8	2.8
—	Layout main, submains, manifold and mark the field	5.0	5.0
—	Layout drip line	16.2	16.2
—	Connect hook up tube to drip lines and submains	9.3	9.3
—	Straighten drip lines and put soil to anchor drip lines	10.8	10.8
—	Flush submains, drip lines	4.0	4.0
—	Close ends of drip lines (180 connections) and submains	12.1	12.1
—	Put markers to mark each line	1.0	1.0
—	Layout plastic mulch	155.1	—
—	Punch holes in plastic mulch	52.6	—
—	Transport seedlings from Cabo Rojo	4.0	4.0
00	Transplant pepper seddlings	166.1	166.1
01	Soil treatment (back sprayer)	27.6	27.6
02	Tensiometer installation	3.0	3.0
05	Fertilization	29.4	18.8
05	Retransplant dead spots	57.7	45.4
07	Tensiometer station identification	1.5	1.5
14	Weeding, hand hoe	—	105.2
26	Weeding, hand hoe	77.5	—
27	Spraying, back sprayer	22.5	22.5
30	Spraying, Ford 3000	5.4	5.4
35	Weeding, hand hoe	—	304.6
41	Fertilization, 10:10:8	29.4	18.8
42	Spraying, back sprayer	27.6	27.6
47	Spraying, back sprayer	22.5	22.5
50	Weeding, hand hoe	44.3	155.1
54	Spraying, back sprayer	27.6	27.6
58	Harvesting	290.3	290.3
58	Grading, handling and weighing	92.2	92.2
62	Spraying, back sprayer	27.6	27.6
76	Weeding, hand hoe	66.5	254.8
77	Harvesting	253.5	253.5
77	Grading, handling, weighing	138.2	138.2
77	Spraying, Ford 3000	11.1	11.1
79	Spraying, Ford 3000	8.3	8.3
85	Spraying, back sprayer	22.5	22.5
86	Checking drip lines	—	13.8
92	Harvesting	149.8	149.8
92	Grading, handling, weighing	55.3	55.3
93	Fertilization, 10:10:8	29.4	18.8
100	Spraying, Ford 3000	8.3	8.3
112	Harvesting	354.8	354.8
112	Grading, handling, weighing	149.8	149.8

TABLE 1.—*(cont.)*

Julian day	Operation	Labor input, man-hr/ha	
		Plastic	No plastic
117	Dismantling the irrigation system		
	—Collect drip lines, submains, main, manifold, hookup tube	130.0	130.0
	—Remove and clean moisture cells	4.0	4.0
	—Remove and dispose plastic	232.6	—
—	Reading; repair and servicing moisture sensors	22.5	22.5
	TOTAL	2868.2	3029.0

[1] Bed spacing was 1.8 m. Pepper seedlings were transplanted on both sides of a dual chamber drip line and were spaced 30 cm down the row (37,037 plants per ha).

TABLE 2.—*Weekly labor requirements for experimental production of peppers (var. Cubanelle) under drip irrigation. Date of transplanting: March 25, 81. Date of last harvest: July 15, 81*

Week No.	Operation	Labor requirements			
		Plastic		No plastic	
		Man-hr per ha	Percent of total	Man-hr per ha	Percent of total
—	Land preparation	9.3	0.3	9.3	0.3
—	Installation drip irrigation system	58.4	2.0	58.4	1.9
—	Layout plastic mulch	207.7	7.2	—	—
—	Transportation of seedlings	4.0	0.1	4.0	0.1
01	Transplanting, fertilization, soil treatment, tensiometer installation	285.3	9.9	262.4	8.7
02	Weeding	—	—	105.2	3.5
04	Weeding, spraying	100.0	3.5	22.5	0.7
05	Spraying, weeding	5.4	0.2	310.0	10.2
06	Spraying, fertilization	57.0	2.0	46.4	1.5
07	Spraying	22.5	0.8	22.5	0.7
08	Weeding, spraying	71.9	2.5	182.7	6.0
09	Harvesting, spraying	410.1	14.3	410.1	13.5
11	Weeding, harvesting, spraying	469.3	16.5	657.6	21.8
12	Spraying	8.3	0.3	8.3	0.3
13	Spraying, drip line checking	22.5	0.8	36.3	1.2
14	Harvesting, fertilization	234.5	8.2	223.9	7.4
15	Spraying	8.3	0.3	8.3	0.3
16	Harvesting	504.6	17.7	504.6	16.7
17	Dismantling irrigation system, removal of plastic	389.1	13.4	156.5	5.2
	TOTAL	2868.2	100.0	3029.0	100.0

harvesting, grading, product handling, and weighing operations consumed 51.7 percent of total labor input and 1483.9 man-hours were required to complete these operations. The weeding operation consumed 27.1 and 6.6 percent of total labor input in non-mulched and mulched plots respectively. Which is equivalent of 819.7 and 188.3 man-hours per ha in non-mulched and mulched plots respectively. Installation and dismantling of drip irrigation system required 58.4 and 134.0 man-hours per ha respec-

TABLE 3.—*Operational labor requirements for experimental production of peppers (variety Cubanelle) under drip irrigation. Date of transplanting: March 25, 1981. Date of last harvest: July 15, 81*

Operation	Frequency	Labor requirements			
		Plastic		No plastic	
		Man-hr per ha	Percent of total	Man-hr per ha	Percent of total
Land preparation	1	9.3	0.3	9.3	0.3
Installation of drip irrigation system	1	58.4	2.0	58.4	1.9
Layout of plastic mulch and punching of holes	1	207.7	7.2	—	—
Transplanting	1	223.8	7.8	211.5	7.0
Soil treatment at planting	1	27.6	1.0	27.6	0.9
Tension measurement-installation, operation, reading, service, etc.	—	27.0	1.0	27.0	0.9
Fertilization	3	88.2	3.1	56.4	1.9
Spraying	10	183.4	6.4	183.4	6.1
Weeding					
—Mulched plots	3	188.3	6.6	—	—
—Non mulched plots	4	—	—	819.7	27.1
Harvesting	4	1048.4	36.5	1048.4	34.5
Grading, product handling, weighing	4	435.5	15.2	435.5	14.4
Dismantling of drip irrigation system	1	134.0	4.7	134.0	4.4
Removal and disposal of plastic	1	232.6	8.1	—	—
Miscellaneous					
—Transport seedlings	1	4.0	0.1	4.0	0.1
—Checking drip lines	1	—	—	13.8	0.5
TOTAL		2868.2	100.0	3029.0	100.0

tively. Plastic mulch layout and disposal operations used 207.7 and 232.6 man-hours per ha respectively. Transplanting consumed 223.8 and 211.5 man-hours per ha in mulched and non-mulched plots. Man-hours per ha requirements for the spraying operations were 183.4.

RESUMEN

El requerimiento total de hombres-hora por hectárea fue 2,868.2 y 3,029.0 en los predios con cubierta y sin cubierta plástica, respectiva-

mente, para pimientos regados por goteo durante el verano. La labor antes y después de la cosecha requirió el 51.7 por ciento de la labor total empleada. La labor requerida por la cubierta plástica fue 15.3 por ciento en contraste con 6.7 por ciento para la instalación y desmantelamiento del sistema de riego por goteo. Los desyerbos requirieron 6.6 y 27.1 por ciento de la labor total empleada en los predios con cubierta y sin cubierta plástica, respectivamente.