Preliminary Evaluation of a Snap Bean Harvester in Southern Puerto Rico[1]

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ABSTRACT

A snap bean planting was established on March 21, 1978, at the Fortuna Substation, in southern Puerto Rico, with the purpose of comparing mechanical with hand harvesting.

There were no significant differences between yields of the hand-harvested and the mechanical harvested plots. There was significant difference between the time consumed per ha in the hand and mechanical harvesting, i. e. 395.7 vs. 100.7 man-hours, respectively.

Although the percentage of extraneous matter harvested was high (32.8%) it could be reduced with adequate blower and reel calibration.

INTRODUCTION

According to Lorenz (4), in the United States bush snap beans grown for processing are harvested mechanically. Machines such as the Chisholm-Ryder Multi-D harvester are used extensively and results show that they gather approximately 90% of the pods. The machine's harvest rate is approximately 0.41 ha/h with costs of 3 to 4 cents/kg as compared to 8 to 13 cents/kg for hand picked snap beans. Thus, mechanical harvesting reduces harvest costs by about 67% of that of hand-harvesting.

Hoffman et al. (2) state that harvesting snap beans by machine causes obvious as well as unnoticed injury to pods. Machine harvested pods lose significantly more weight than the corresponding samples of hand-picked pods. Cultivars differ in response to injury as well as ease of abscission from the plant. Snap bean cultivars with greater hair concentration per unit area lose weight more rapidly, and to a greater extent than those with few hairs. Broken or split hairs do not heal and continue to be a source of water loss.

There are factors associated with the resistance to mechanical damage in snap beans. Dickson and Boettger (1) mentioned seed damage susceptibility as a serious problem in snap and dry beans. It has been studied in relation to threshing damage and to transverse cotyledon cracking. It has been generally considered that colored seed were more damage resistant

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than white seed, but some colored seed cultivars such as Tendercrop are very susceptible.

Reid and Brantley (7) evaluated four small and relatively inexpensive mechanical harvesters for southern peas. Picking efficiencies ranged from 67 to 96%. The material harvested was a mixture of about 50% pods and 50% leaves and stems.

In Puerto Rico, snap bean harvesting is traditionally a manual operation. Mangual Crespo (5) found no significant differences between the multiple harvesting system and a simulated once-over harvest. He concluded that a mechanical harvester should be made available to shorten the harvesting period and decrease costs in commercial snap bean production.

The purpose of this work was to evaluate the performance of a snap bean harvester under the conditions of southern Puerto Rico.

MATERIALS AND METHODS

A snap bean planting was established at the Fortuna Experiment Substation in a San Antón soil, Cumulic Haplustolls, fine-loamy, mixed, isohyperthermic in southern Puerto Rico March 21, 1978.

A paired plot design was used comparing manual vs. machine harvesting. Plots were 2.3 m wide (5 rows 45 cm apart) and 65.4 m long. Seed of commercial variety Bush Blue Lake 47 were drilled at approximately 8 cm apart in the row with a Stanhay Precision Planter. Dacthal 75W[3] was applied as a pre-emergent herbicide immediately after planting at the rate of 11.25 kg of active ingredient/ha.

Overhead irrigation was applied twice during the first week and once weekly afterwards, until flowering. Thereafter, furrow irrigation was used as needed. A weekly preventive spraying program was followed using a mixture of Diazinon AG 500 and Dithane M-45 at the rate of 120 ml and 2.75 kg/ha, respectively, to control insects and diseases.

The mechanical harvesting was performed with a Chisholm-Ryder Multi-D Harvester using blower speeds of 1025, 1050, and 1,100 r/min and reel speed of 200 r/min.

RESULTS AND DISCUSSION

Plant population was calculated to be only 50% possibly due to poor germination. The low plant population resulted in lower than normal production; however, machine operation should not be affected. Table 1

[3] Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

presents the performance of CRCO Multi-D Harvester at Fortuna, Puerto Rico.

No significant differences between the yields of snap beans hand or machine harvested was found. However, there was a significant difference between the time spent in hand-harvesting versus that spent in mechanical harvesting, then hand separating the extraneous matter from the marketable pods. A total of 395.7 man-hours were required for the manual harvest while only 100.7 man-hours were needed to harvest mechanically, and then separate the extraneous matter from the yield.

The harvester recovered a mean trash percentage of 32.8 which is excessively high. The highest trash percentage/plot (43%) occurred with the blower at 1025 r/min and the reel at 200 r/min while the lowest trash

TABLE 1.—*Performance of CRCO Multi-D Harvester, at Fortuna, Puerto Rico, 1978*

Plot Number	Recovered by harvester			On Branches		On the Ground		Overall		Recovery	Yield[1]
	Gross	Trash	Net								
	Kg	%	*Kg*	*Kg*	%	*Kg*	%	*Kg*	%	%	*Kg/ha*
I	21.5	20.9	17.0	0.7	4.0	0.6	3.2	1.3	7.2	92.8	1223
II	20.7	25.3	15.5	0.7	4.3	0.6	3.5	1.3	7.9	92.1	1119
III	15.0	40.4	8.9	1.2	10.8	0.8	7.5	2.0	18.3	81.7	728
IV	19.7	37.0	12.4	0.8	5.8	1.0	7.0	1.8	12.8	82.2	950
V	16.8	31.1	11.6	1.0	7.3	0.5	4.5	1.5	11.8	88.2	877
VI	19.0	29.7	13.3	1.0	6.7	1.1	7.3	2.2	14.1	85.9	1034
VII	15.8	38.9	9.6	0.7	6.0	1.0	8.5	1.6	14.5	85.5	752
VIII	29.2	26.6	21.5	1.0	4.3	1.9	7.8	3.0	12.1	87.9	1629
IX	26.4	39.1	16.1	0.6	3.5	1.3	7.3	2.0	10.8	89.2	1204
X	21.4	25.1	16.0	1.2	6.1	2.2	11.2	3.4	17.3	82.7	1295
XI	17.0	43.0	9.7	1.3	10.9	1.0	8.7	2.4	19.6	80.4	804
XII	16.1	34.9	10.5	2.0	14.2	1.3	9.6	3.3	23.8	76.2	920
XIII	21.1	36.1	13.5	1.8	10.6	1.8	10.4	3.6	21.0	79.0	1141
Mean	20.0	32.9	13.5						14.7	85.3	1052

[1] Clean green pods.

percentage (20.9) was registered at 1050 and 200 r/min, blower and reel readings, respectively.

Field harvesting losses due to leftover pods in branches and on the ground were surprisingly low and can be reduced with the proper adjustment of the reel and blower. The mean overall recovery of 85.3% was very encouraging and compares favorably with the reports of another investigator in the United States (4). The harvesting rate of 0.48 ha/h compares favorably with the performance of this harvester in the United States and in the harvest of pigeon peas in Isabela and Fortuna.

The possibility of defoliation prior to mechanical harvesting for reducing trash should be explored. Palevitch (6) reported Ethrel (2-chloroethyl phosphonic acid) in concentrations of 250–4,000 p/m as a preharvest treatment which causes considerable leaf abscission. However, following

the Ethrel treatments, he noted a reduction of both marketable and total yields. The reduction of the total yield can probably be attributed to the slight amount of pod abscission that occurred on the treated plants while the reduction of the marketable yield may be caused by both abscission and pod-yellowing phenomena.

RESUMEN

Una siembra de habichuelas tiernas se estableció el 21 de marzo de 1978 en la Subestación Experimental de Fortuna, en el sur de Puerto Rico, con el propósito de evaluar la cosechadora Chisholm-Ryder Multi-D.

No hubo diferencia significativa entre los rendimientos de las parcelas cosechadas a mano y las cosechadas con máquina, pero sí la hubo entre el tiempo requerido en ambos sistemas: 395.7 hombres-hora/ha para la cosecha manual contra 100.7 para la cosecha mecanizada. No hubo daño aparente en las vainas cosechadas mecánicamente.

Aunque el porcentaje de materia extraña fue alto (32.8), éste podría disminuirse si se logra una mejor calibración del aventador y del carrete.

Debe evaluarse la deseabilidad de usar un desfoliante antes de cosechar.

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