



PERFORMANCE EVALUATION OF HAND HELD CROP CUTTER USED IN WHEAT AND RICE HARVESTING

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Abstract- In this study, harvesting of rice and wheat using crop cutter was evaluated. Results showed that the field capacity of crop cutter was 2.44 times higher than the manual operation. The labour requirement was 32.74 and 149.25 man-hr/ha for crop cutter and manual operation, respectively. In case of wheat, the field capacity of crop cutter was 2.23 times greater than manual harvesting and labour involvement was 23.20 and 115.74 man-hr/ha for crop cutter and manual operation, respectively. The cost of wheat harvesting operation for one hectare was Rs. 2,340.40/ in case of crop cutter and Rs. 3,750/- for manual operation. Whereas in rice harvesting the cost was Rs. 2,464.28/- for crop cutter and Rs. 5,596.87/- for manual operation, respectively.

Keywords- Crop cutter, Rice harvester, wheat harvester and brush cutter.

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Introduction

Harvesting of crops in India is still done using human labour. However, in some parts of country, harvesting of rice and wheat is carried out using engine power. Rice and wheat are the two most important staple foods for the people of the Asian countries. Harvesting is one of the major field operations for food grain crops and consume as much as 20-30% of manual labour requirement. The harvesting process begins when the crop is physiologically matured, to get maximum recovery of grains. Harvesting should be done at an appropriate stage to minimize losses, and to increase the yield [8]. Manual harvesting of field crops is considered a labor intensive operation and takes from cutting to bundle making about 185-340 man-h/ha for paddy or wheat crops [7] and 170-200 man-h/ha for paddy crop [5]. A few authors reported [3, 4] that harvesting of rice crop using reapers have maximum effective field capacity. In recent years, various low cost reapers and Chinese brush cutters were entered in India for rice harvesting operation. In eastern parts of the country, especially in Bihar, most of the farmers are resource poor with small land holdings. The big harvesting machines like combine harvester is neither accessible to these farmers nor practically feasible due to small and fragmented lands. Therefore, the main objective of this study was to evaluate the performance of crop cutter suitable for harvesting of both wheat and rice for small and marginal farmers.

Description of the Crop cutter used

The machine is similar to the brush cutter, in which only circular saw blade and windrowing system was incorporated to operate the machine. The present brush cutter consists of circular saw blade, safety cover, drive shaft with housing, handle, hanging band for operator, fuel tank, starter knob, choke lever and air cleaner [Fig-1]. The blade rotates through a long drive shaft operated by petrol engine. An aluminum sheet of half cylindrical shape of height 25 cm and radius is equal to the blade radius of 12 cm was fitted at the upper portion of the cutting blade. The gap between blade and windrower was maintained at about 16 cm. In this system, windrower helps in collecting and delivering the cut straw along with the movement of the operator.



Fig-1 The main assembly of the Hand held crop cutter

Salient features of the crop paddy cutter

Engine	2 stroke petrol (48 CC Max. power)
RPM	6800
Blade diameter	415 mm
Cutting width	255 mm
Fuel tank capacity	1.2 L
Net weight/Gross weight	7.7/9.2 kg
Cost	INR 16,500/-

Field performance

The cutter performance was evaluated in the experimental agricultural farm of ICAR Research Complex for Eastern Region, Patna, Bihar. Two trials were conducted for rice and wheat harvesting operation. The latitude and longitudes were measured by GPS system (ETREX-10, Garmin make). The detail is shown in [Table-1].

Table-1 Location of the operational trials

Sl. No	Crop (variety)	Date of operation	Trial location	Latitude/ longitude
1	Wheat (Kundan)	20 th April 2015	ICAR Research Complex for Eastern Region, Patna, India	N:25° 35.485 E:085° 04.951
2	Rice (Naveen)	26 th November 2015	-do-	N:25° 35.408 E:085°04.851

Field evaluation for harvesting of wheat

The crop cutter worked efficiently in field conditions. The field capacity and fuel

consumption during harvesting operation were recorded to compare the performance of manual harvesting. The operational view of the cutter is shown in [Fig-2]. The result indicated that the forward speed of the operator was 1.8 km/hr and the total harvesting time of 43.2 m² plot was 6 minute. The labour requirement for harvesting was 23.20 man-hr/ha in case of crop cutter and 115.74 man-hr/ha for manual harvesting. The field capacity of paddy cutter was 0.029 ha/hr and for manual operation, it was 0.013 ha/hr. The results revealed that field capacity was found 2.23 times higher than the manual harvesting. On an average 27.77 liters fuel (Petrol) was required for harvesting of wheat in one hectare area. The cost of operation for one hectare was Rs. 2340.40/ in case of crop cutter and Rs. 3750/ for manual operation.



Fig- 2 Testing of the crop cutter for wheat harvesting at ICAR Research Complex Farm, Patna

The same crop cutter was also evaluated for harvesting of rice var. Naveen in the same experimental farm of the ICAR RCER, Patna [Fig-3]. The result showed that the forward speed of the operator was 2.76 km/hr and the total harvesting time for harvesting 56 m² plot was 11 minute. The labour requirement for harvesting was 32.74 and 149.25 man-hr /ha for crop cutter and manual labour operation, respectively. Paddy cutter was found most suitable tool and it was 7.8 times faster than the manual harvesting as 121 hr (16 man-days/ha) reported by [2,6]. In other countries [3, 9] reported that field capacity of similar cutter was seven times higher than field capacity of manual harvesting operations. In our study the field capacity of machine was 0.041 ha/hr and 0.01 ha/hr for manual labor. Results showed that field capacity of the cutter was 2.44 times higher than manual harvesting. The fuel consumption was quite low and 41.07 liters fuel (Petrol) is required for harvesting of rice in one hectare area. Cost of operation for harvesting one hector area was Rs. 2464.28/- in case of crop cutter and Rs. 5596.87/- for manual operation, respectively.



Fig-3 Testing of the crop cutter for rice harvesting at ICAR Research Complex Farm, Patna

Conclusion

The study revealed that the capacity of crop cutter was 2.23 times higher than manual harvesting for wheat and 2.44 times higher for rice depending on operator's skill, variety and harvesting condition. The labour requirement for harvesting of wheat was 23.20 man-hour/ha and manual was 115.74 man-hour/ha. Whereas for rice harvesting labour requirement was 32.74 and 149.25 man-hour/ha for crop cutter and manual operation, respectively. Thus, as compared to manual harvesting labour saving through crop cutter was 5.0 and 4.6

fold in wheat and rice harvesting, respectively. The cost of operation for wheat harvesting in one hectare area was Rs. 2340.40/- in case of crop cutter and Rs. 3750/- for manual labour operation. While in rice, it was Rs. 2464.28 /- and 5596.87 /- for crop cutter and manual operation, respectively.

Conflict of Interest: None declared

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