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PERFORMANCE EVALUATION OF SELF PROPELLED VERTICAL CONVEYOR REAPER

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Abstract: The study was conducted on mechanized harvesting of paddy for minimizing the cost of cultivation of paddy. A self propelled vertical conveyor reaper (KAMCO Model KR 120) was used for harvesting of paddy crop. The overall performance of the self propelled vertical conveyor reaper was quite satisfactory. The actual field capacity of the power reaper was found to be 0.29 ha/h with a field efficiency of 70% at an average operating speed of 3.00 km/h. The fuel consumption was 0.8 l/h. the cost of cultivation of paddy crop could be reduced through mechanization of harvesting operations. Cost of mechanical harvesting was 690 Rs./ha compared to 2500 Rs./ha as in case of traditional method i.e. manual harvesting using local sickle. The overall cost of harvesting was found to be decreased in case of mechanized harvesting by self propelled vertical conveyor reaper. Hence, the mechanical harvesting would be feasible and economical compared to traditional method in terms of time, labour requirement and money.
Keywords: mechanized harvesting, reaper, field capacity, field efficiency.

Introduction

Rice is one of the most important crop and staple food of millions of people which is grown in many countries of the world. The total area planted under rice crop in India is 42.20 million ha, which is the largest in the world as against the total area of 148.40 million ha (Choudhary and Varshney, 2003). Production of rice is increasing but in most of the parts of the country the harvesting of paddy is still being done manually. Manual harvesting requires about 25% of the total labour requirement of the crop. Depending upon the crop yield, 120 to 250 man-h required for cutting, bundling and on farm stacking of one ha of paddy field by using traditional sickle (Nadeem, 1983). Labour scarcity during peak period of harvesting leads to delay in harvesting and field grain losses. Also high labour wages during peak period adds extra cost in total cost of cultivation. Mechanized harvesting is an alternative solution to tackle this problem. Farm mechanization will also result in lesser cost of operation. An alternative straw handling and disposal technology may have to be developed and promoted

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where farmers have adopted combines for harvesting as burning of straw is creating environmental pollution and farmers are losing valuable animal feed material. Reapers on the other hand are other alternative harvesting equipments, provided straw is considered as economic by-product for animal feed and/or industrial applications (Singh, 2002). Keeping these facts in view, the study was conducted to minimize the cost of harvesting of paddy crop through farm mechanization.

Material and Methods

On farm trials and field demonstrations were conducted at Krishi Vigyan Kendra and Agriculture Research Station, Sakoli Dist. Bhandara (M.S.) during kharif 2010-2012 and rabi/summer, 2010-2012 to study the economic feasibility of self propelled vertical conveyor reaper for harvesting of paddy. The field trials/field demonstrations were also carried out on farmers field. Experimental details in respect of crop variety, area covered, date of paddy transplanting and harvesting, etc. are presented in Table 1. The detailed technical specifications of self propelled vertical conveyor reaper used are shown in Table 2. Speed of operation, width of cutting, total time required to cover the area and the fuel consumption were recorded. The following parameters were studied to study the performance of the self propelled vertical conveyor reaper.

1. Theoretical field capacity was calculated based on the speed of operation and width of cutting of the machine.
2. Actual field capacity was calculated based on area covered and actual time taken for covering the area including the time lost in turning.
3. Field efficiency was obtained by dividing actual field capacity by the theoretical field capacity.
4. Labour saving by using the machine compared to manual harvesting was also studied.
5. Cost of harvesting per ha by reaper was worked out after taking into consideration the fixed cost, labour cost, fuel cost, field capacity of the equipment and usage of the machine in ha per year and was compared with the manual harvesting.

Results and Discussion

Paddy crop was harvested using self propelled vertical conveyor power reaper. Based on the field demonstrations conducted during kharif 2010, 2011, 2012 and rabi/summer 2010-12, it was observed that the actual cutting width of the reaper was 1.20 m. The actual field capacity of the self propelled vertical conveyor reaper was 0.3 ha/h with a field efficiency of 72% at

an average operating speed of 3.2 kmph (Table 3). It took 3.45 h to harvest 1 ha area and the fuel consumption was 5.7 l/ha or 1.6 lit/h.

The working of self propelled vertical conveyor reaper was found to be satisfactory. The labour requirement was found to be 11 man days per hectare including manual collection and bundling of the harvested crop compared to 22 man days of labour per hectare in manual harvesting, collecting and bundling of the crop. Thus, it saved 11 man days of labour per hectare.

From the study, it can be concluded that the self propelled vertical conveyor powder reaper could be used successfully with a labour saving of 11 man days per hectare and reducing the drudgery of labours. The area of 2.32 ha can be harvested per day if the field capacity is kept as 0.29 ha/h. Considering the two months harvesting season, the maximum area that can be harvested using the self propelled vertical conveyor reaper will be 139.2 ha. If the machine is used for the maximum usage of 139.2 ha in a year, the cost of mechanical harvesting will be Rs. 690/- per ha as compared to Rs. 2500/- per ha in case of manual harvesting. Thus it is feasible to minimize the cost of operation of paddy harvesting. Thus mechanization in paddy harvesting is a feasible solution for reducing the cost of harvesting of paddy crop.

Table 1. Details of the demonstrations

Sr. No.	Particulars	Kharif 2010		Kharif 2011		Kharif 2012		Rabi/Summer 2011-12	
		Reaper harvesting	Manual harvesting	Reaper harvesting	Manual harvesting	Reaper harvesting	Manual harvesting	Reaper harvesting	Manual harvesting
1.	Paddy variety	PKV HMT	PKV HMT	IR 64	IR 64	IR 64	IR 64	MTU 1010	MTU 1010
2.	Area, ha	0.25	0.15	1.0	0.08	2.0	0.12	5.0	0.2
3.	Date of nursery raising	30.07.2010	30.07.2010	10.08.2011	10.08.2011	30.07.2012	30.07.2012	05.12.2011	05.12.2011
4.	Type of nursery raised	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
5.	Date of transplanting	25.08.2010	25.08.2010	10.09.2011	10.09.2011	26.08.2012	26.08.2012	09.01.2012	09.01.2012
6.	N:P_2O5:K_2O, Kg/ha	150:75:75	150:75:75	150:75:75	150:75:75	150:75:75	150:75:75	150:75:75	150:75:75
7.	Date of harvest	24.12.2010	24.12.2010	18.01.2011	18.01.2011	24.12.2012	24.12.2012	01.05.2012	01.05.2012

Table 2. Technical specification of self propelled vertical conveyor reaper

Sr. No.	Parameters	Specifications
1.	Manufacturer	Kerala Agro Machinary Corporation Ltd., (A Govt. of Kerala undertaking), Athani-683 585, Dist. Ernakulam
2.	Model	KR 120
3.	Dimensions, LxWxH, cm	239 x 147 x 90
4.	Weight, Kg	116
5.	Power unit	3.5 HP single cylinder 4 stroke, air cooled, petrol start, kerosene run engine
6.	Working capacity, ha/h	0.25 to 0.30
7.	Crop release	Right side of the machine (viewed from rear)
8.	Travel speed, km/h	
	Forward	3.5
	Backward	3.0
9.	Applicability	Dry and wet land
10.	Cutting device	Reciprocating knife bar
11.	Cutting height, cm	10-30 cm from ground level (adjustable)
12.	Cutting width, cm	120

Table 3. Performance of self propelled vertical conveyor reaper in transplanted paddy

Sr. No.	Parameters	Kharif 2010	Kharif 2011	Kharif 2012	Rabi/summer 2011-2012
1.	Date of harvesting	24.12.2010	18.01.2011	24.12.2012	01.05.2012
2.	Total area, ha	0.25	1.0	2.0	5.0
3.	Speed of operation, km/h	3.2	3.1	3.2	3.1
4.	Width of operation, m	1.2	1.2	1.2	1.2
5.	Time taken to cover 1 ha area	3.30 h	3.45 h	3.45 h	4 h
6.	Theoretical field capacity, ha/h	0.41	0.41	0.41	0.41
7.	Actual field capacity, ha/h	0.29	0.28	0.28	0.25
8.	Field efficiency, %	72	65	65	60
9.	Labour requirement, man days/ha	11	11	11	12
10.	Fuel consumption, l/ha	5.70	5.75	5.80	6.50
11.	Harvesting loss, %	0.98	1.04	1.01	1.05

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