

A Study on Effectiveness and Suitability of Different Types of Combine Harvesters in Ampara District

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Abstract

The study attempted to analyze the impact of using different types of combine harvesters namely Balkar, Standard, Claas and Agrotech for harvesting paddy on timeliness, harvesting cost and labour use and evaluate effectiveness and suitability of combine harvesters in Ampara District. The major reason given for the use of combine harvester was severe shortage of labour during the peak season. The primary data needed to this study were gathered through a survey from 61 farmers and 62 owners of combine harvesters. A descriptive evaluation and analysis were carried out to identify the objectives. The analysis of Variance (ANOVA) was used to find out the suitability and effectiveness of combine harvesters. The results shows combine harvesters ensure rapid harvesting, reduces harvesting cost, minimize the labour requirement and raises the farmer's income as well as machine owner's profit. The combine harvesters replaced the labour by 75 to 85 %, reduced the harvesting cost by 50%. The negative aspects of using combine harvesters were also reported as displacement of labours, low

quality paddy, climatic and soil constrains for the tyre type harvesters than the chain types, non availability of local technical supports and the difficulties in fixing charges due to competitions. However it could be shows that the prospects for using combine harvesters for harvesting paddy is becoming popular in the Ampara district. According to the analysis in Ampara district different types of soils are available and the results finding will suggest, that, chain type combine harvesters can work in clay and pours soils but the tyre harvesters can only better in sandy soils. So the farmers have to be clear on using the combine harvesters regarding to the field condition and climate. With proper technical support, practical demonstration and appropriate training program in using combine harvesters will enhance the profit of the farmers as well as machine owners can be increased.

(Key Words: Combine harvester, Paddy Farming)

Introduction

Agriculture, both subsistence and commercial, have played a dominant role in Sri Lanka's economy for many centuries. Agriculture accounts for around 20% of the GDP, (19.7% in the year 2000), nearly 50% of the total employment export earnings and about 40% government earnings. Harvesting, threshing and winnowing are done separately and require a great deal of labour application, usually in the range of 30-40 labour days per hectare on the condition of the crop and variety. Both men and women participate in these operations and the wage rate (in cash or kind) is substantially high as Rs.250-300/day owing to the high level of labour requirements and the current maturity of crops in many farmer fields more often difficulties are encountered in mobilizing sufficient labour and harvesting is delayed beyond the optimum crop maturity conditions. The delays harvesting result, reduction of the quantity and quality of paddy (Toquero et al., 1977). The post harvest losses in paddy production of Sri Lanka have been estimated to be high as 25 to 30 percent in year 1974. (Wickramanayaka and Wimberly, 1975).

Labour scarcity during the peak labour demanding periods and the high wage rate involved are becoming a challenge for rice cultivation.

The cost of labour is about 45-55 percent of the total cost of paddy production. Out of which 50 percent is used for harvesting, threshing and winnowing operations (Socio Economics and planning center of DOA, 2002).

In Sri Lanka, combine harvesters were introduced to the government seed paddy production farms at Polonnaruwa, Malwatta and Kantale to overcome the labour shortage during peak harvesting period. The major reasons encountered from the farmers for the need of the combine harvester were the labour shortage during the peak seasons. Since three years many types of combine harvesters were being used in paddy harvesting in Ampara district, after the tsunami the labour shortage during the peak harvesting in Ampara district was very much higher than the past. Currently in Ampara district the following types of combine harvesters are in used

1. Claas
2. Balkar
3. Agro tech (Farm rider) and 4. Sandard

Materials and Methodology

Source of Data

Field level data on use of different types of combine harvesters were collected through personal interviews with farmers, combine harvester owners and also perusal of records maintained at Agrarian Service Centers in particular areas. Data pertaining from 2003 to 2006 of maha season were used for the analysis. According to Proportionate Random sampling method Akkaraipattu, Addalacheanai, Sammanthurai and Nintavur, Divisional secretariat were selected for the analysis, in which Adalecheanai division was divided in to two divisions as Addalacheanai and Oluvil/Palamunai due to the large extent of it. Farmers sample size was 62 and the combine harvester owners sample size was 61.

Data pertaining to manual and different types of combine harvesters were analyzed. The following estimates were considered to evaluate the efficiency of these methods.

1. Timeliness and labour requirements of these methods were compared by ANOVA with estimated average labour hours taken for harvesting one acre
2. Cost of harvesting of different types of combine harvesters and manual harvesting were estimated by ANOVA with average cost involved in harvesting and drying one acre of paddy.

Results and Discussion

This chapter will discuss about the effectiveness and suitability in terms of timeliness, harvesting cost, labour use, quality of paddy and demand for the paddy harvested with different types of combine harvesters.

Suitability of Combine Harvester

The suitability of the combine harvesters were evaluated based on different parameters such as average selling price of a kg. Of paddy, cost /acre of paddy harvested, time required/acre to harvest and mixed with inert matters on harvested paddy.

Average cost of Harvesting of Paddy/acre

It shows the high cost for the manual harvesting was mainly due to shortage of labour and more time is needed for harvesting. Among the cost of the harvesting by harvesters the chain harvesters were high in rent.

ANOVA test shows, that the lowest cost of Rs 5,125/ ac was found for paddy harvested by the Balkar and Standard type of harvesters. There was no significant difference found in the average cost/acre by harvesting Balkar and Standard harvesters ($p=0.05$). The average cost for an acre of paddy harvested by Claas and Agrotech were Rs 7,250/ac and 7,383.33/ ac respectively and these costs were significantly greater than the cost of Balkar and Standard types of harvesters ($p=0.05$). There was no significant difference found in cost of harvesting of an acre of paddy between the cost charged by the Claas and Agrotech harvesters ($p=0.05$). The average harvesting cost for an acre of paddy land Rs 13,300/ ac was found in manual harvesting and it was significantly greater than all the harvesters used for harvesting ($p=0.05$).

Average Time Requirement per Acre of Paddy Harvest

There is a transparent result that the mechanization is quicker in harvesting when considering the drying and sacking of paddy harvested manually. It was found that chain harvesters were needed more time than the tyre harvesters for harvesting.

ANOVA test shows, that the lowest average time requirement for the harvesting of an acre of paddy hr/ac was found in the use of the Balkar and Standard type harvesters for harvesting. Among the Balkar and Standard harvesters there is no significant difference found in the average time required /acre of harvesting ($p=0.05$). Average cost for the paddy harvesting for an acre by using the Claas and Agrotech harvesters were 3.67hr/ac and 4.2 hr/ac respectively and these time requirements were significantly higher than the time required for Balkar and Standard Type harvesters ($p=0.05$). There is no significant difference in the time needed for an acre of paddy harvesting which was found that between the use of Claas and Agrotech harvesters for harvesting ($p=0.05$). The highest time needed for an acre of paddy harvested was 22.2 hr/ac in the manual harvesting and it was significantly higher than any type of harvesters used for harvesting ($p=0.05$).

Average Inert Matter Mixed in the Harvested Paddy

The tabulated statistic was done for the evaluation of the inert matter mixed in the harvested paddy. For this the following four types of inert mix coding and the results were obtained as follows:

1. High level of inert matter mix
2. Medium level of inert matter mix
3. Low level of inert matter mix
4. Very low level of inert matter mix

According to the statistical principles the inert mix levels were altered in to 2 levels to avoiding the presence of zero in the table.

Manual method was the most suited one for obtaining inert free paddy harvested than the combined harvester methods. The majority (90%) of the farmers those who harvested manually were confirmed this

opinion. At the same time in the case of machine harvest the Claas and Agrotech had low level of inert mix than the Balkar and Standard types harvesters and more than 70% of the farmers suggested that the Balkar and Standard harvesters are in the high inert mix levels.

Average on Selling Price of Paddy

It shows the price for the manual harvested paddy was higher than the machine harvest, among the machine harvested paddy, the paddy harvested from the Agrotech had a good price than the Claas, Balkar and standard harvesters. However there is a common belief that manually harvested paddy can be stored until a better price is obtained while and machine harvested paddy can not be stored for a long period. ANOVA test shows, that the lowest selling price of 14.06 Rs/kg was obtained for paddy harvested by Balkar and Standard type of harvesters. Among the use of Balkar and Standard harvesters there is no significant difference found in the average selling price of a Kg. of paddy harvested at 5% of significant level ($p=0.05$). Average selling price of paddy harvested by Claas and Agrotech were 14.95 Rs/kg and 15.07 Rs/kg respectively and these prices were significantly higher than the price obtained for the Balkar and Standard type harvester ($p=0.05$). No significant difference in selling price of paddy was found between paddy harvested by the Claas and Agrotech harvesters ($p=0.05$). The average selling price of paddy of Rs 15.76 /kg was obtained for the manually harvested paddy and it was significantly greater than all other prices ($p=0.05$).

Farmers Suggestions and Reasons for Suitability

Among the farmers who used combine harvesters, 70 % suggested that the Claas was the best harvester, while 23% of the farmers suggested that the Balkar and Standard harvesters were the best and the 7% of the farmers suggested the Agrotech was the best. The reasons for the selection of these types of harvesters were due to less inert mixed in the harvested paddy and it can work in any climatic and soil condition especially in clay land. The reasons for the suitability suggested by the tyre harvester users were the quick harvesting time and low rental / acre.

Effectiveness of Combine Harvesters

The effectiveness of the combine harvesters were evaluated according to the survey on harvester owners in which the different types of combine harvesters were evaluated against different parameters such as costs /acre of harvesting, fuel requirement for an acre of harvesting, rent/acre acre of harvesting, time requirement for an acre of harvesting and depreciation cost for an acre of harvesting. One way ANOVA was used for the reason of proportionate sampling. To identify the best machine which can give more profit, Fisher's pair wise comparison was used.

Average Cost per Acre of Paddy Harvesting.

There is a fact that the heavy machineries consume more fuel than the light machineries so that they cost more than the lighter one/acre of harvesting.

ANOVA test shows, that the lowest average cost per acre of harvesting was Rs 1,800/ac in the use of Balkar and Standard harvesters for harvesting. Among Balkar and Standard harvesters there was no significant difference found in the average cost/acre of harvesting ($p=0.05$). The average cost per acre of harvesting for the Claas and Agrotech were Rs 23,166.6/ac and Rs 2505.5/ac respectively and these costs are significantly higher than the cost in use of the Balkar and Standard harvesters ($p=0.05$). There was no significant difference in the cost/acre of paddy harvested found between the Claas and Agrotech harvesters for harvesting ($p=0.05$).

Average Fuel Requirement per Acre of Paddy Harvesting

The requirement of fuel for harvesting of an acre was mainly determined by the land condition and the type of harvesters, weather it is heavy or light.

ANOVA test shows, that

The lowest fuel consumption 3 lit/ ac was found in the use of Balkar and Standard for the harvesting of paddy. The average fuel requirement for the harvesting of an acre of paddy by using the Claas and Standard were 4.09lit/ac and 4.8lit/ ac and these fuel requirements are higher than the tyre harvesters. The reasons for the consumption of fuel were:

1. Heavy machinery needs more fuel
2. Chain harvesters need more time than the tyre harvesters

Average Rent per Acre of Harvesting.

It was observed that the chain harvester owners charge more than by the tyre harvesters because more fuel is needed for the chain harvesters.

ANOVA test shows, that the lowest rent/acre for harvesting was Rs 5,250/ac in the use of Balkar and Standard harvesters for the harvesting. Among the Balkar and Standard harvesters there was no significant difference found in the average rent for an acre of harvesting ($p=0.05$).

The average rent for the harvesting/acre of paddy by using the Claas and Agrotech harvesters were Rs 6,849 /ac and Rs 7,375 /ac respectively and these rents were significantly higher than the rents charge by Balkar and Standard harvesters for harvesting ($p=0.05$). There was no significant difference between the Class and Agrotech in their rent/acre of paddy harvesting ($p=0.05$).

Average Time Requirement/Acre for Paddy Harvest

The time requirement was high in the chain harvesters than the tyre harvesters. It was due to the less movement of the chain. ANOVA test shows, that the lowest time requirement was an hour / ac was found in Balkar and Standard harvesters for the harvesting of paddy. Between the use of Balkar and Standard, there was no significant difference found in the average time requirement for an acre of harvesting ($p=0.05$). The average time requirement for the harvesting of an acre of paddy by using the Claas and Standard were 3.19hr/ac and 3.32 hr/ac respectively and these time requirement were significantly higher than the time required for Balkar and Standard harvesters ($p=0.05$). There was no any significant difference noticed among the Class and Agrotech in the time requirement/acre of paddy harvesting ($p=0.05$).

Problems

It was observed that the rental rate for harvesters was declining over the past three years due to increase in number of harvester. The

middle man is exploiting the profit of both owners and as well as the farmers. The labour requirement is less for machine harvesting, however the labour also needed for sacking and winnowing purposes. The combine harvester displaces the labour force during the harvesting period this leads an uncertainty for the labours in employment. .In the area of manual harvesting the labours are paid in kind at the same time the labour used in the machine harvest has to pay in cash. Additional cost needed for transport in case of chain type harvesters. However the quality is always better in manual harvested paddy when compared with machine harvested paddy. The tyre harvesters can not work smoothly in the clay land. During rainy season the tyre type combine harvesters lost their total business and this has increased the demand for the chain type harvester as these machine can work better in those conditions.

Summary and Conclusions

The farmers in Ampara district using different types of combine harvesters namely Balkar, Standard, Claas and Agrotech. The major objective of this study was to investigate the suitability, effectiveness and financial viability of the different types of combine harvesters. The study also studied the socio economic characters of the farmers and machine owners. The effectiveness and suitability of the combine harvesters depends on the selling price of the harvested paddy, cost/acre of harvesting, time requirement/acre, fuel requirement/acre and the amount of inert matter in the harvested paddy. The highest selling price was obtained for manually harvested paddy, than the machine harvests. Among the machine harvested paddy, the chain type of harvester received higher price than the other harvesters. The selling price of paddy was depends on the purity of the harvested paddy.

The cost/acre for farmers was significantly differing among the harvesting methods and the higher cost was observed in manual harvesting which was Rs.13, 000. The cost/acre in machine harvesting was ranging from Rs 5000 to Rs. 7000. Among the harvesters the chain types were the highest in cost/acre than the other types of harvesters. The required harvesting time /acre and labour requirement were highly reduced in the harvesters. Average time requirement/acre harvesting was varied from 1hrs to 4 hrs. It was reported that the manual harvesting

require more than 10 hours/acre. Among the different types of harvesters chain type harvesters utilized more time. The results also indicated that the manual harvested paddy was pure and without inert materials than the machine harvested paddy. Among the machine harvested paddy the chain types produced better paddy than the tyre type of harvesters.

The operation and maintenance cost/ acre was not significantly differing among the machines and it was ranging from Rs.1700 to Rs. 2100/acre. The fuel requirement/acre was higher in the chain type of harvesters than the tyre types of harvesters and it was in the range of 3 to 6 liter/acre. Combine harvesters gained rapid acceptance from the farmers from their introduction has both advantages and disadvantages compared to manual harvesting. Advantages included faster harvesting, lesser labour requirement, reduced cost, quicker handling, faster and easier threshing and income increment for the farmers and machine owners. The reported disadvantages were lack of organization to decide the rental rate/acre for harvesting, the increasing number of harvesters, problems related to bank lease settlement and low quality of paddy. The use of combine harvesters has positive impact on welfare of the investors. Introduction of combine harvesters could be a key to over come the labour shortage during the peak period of harvest, that presently hinder the increased crop intensity. Adoption of this technique in paddy sectors provides a power full incentive to farmers. Among the different types of harvesters selecting a particular type would depends on soil type, rental rate, wether chain or tyre type, climate, crop conditions, availability of labour and the capital in hands.

Acknowledgement

I would like to express my heartiest gratitude to my supervisor Mr. A. N. Ahamed for his guides and advises. I really happy to thanks Mr. A.M. Rasmy for his helps in the statistical analysis of the results. I also wish to thanks all the staff and friends those who helped on my project works in these moments. I wish to extend my thanks to the donor agent for my project works.

Appendices

An Analysis on Effectiveness, Suitability and Financial Viability of Combine Harvester in Ampara District

Information on Harvesting Method

Method of harvesting

1. Combine harvester 2. Manual

If combine harvester, Reason for choosing combine harvester

1 Time

1. Take less time than manual
2. Same time duration as manual
3. More than manual

Average time needed to harvest per acre

Manual Combine

Cost

1. Low cost than manual
2. Same as manual
3. More than manual

What is the average cost per acre?

Manual Combine

Labour

1. Need low labour
2. Labour shortage
3. Wages is high

What type of combine harvester is used?

1. Balkar
2. Standard
3. Agro tech
4. Crop tiger/claas

Reason for choosing that type

Do you recommend any other types which is available in the area for harvesting than you used one

- 1. Balkarn
- 2. Standard
- 3. Agro tech
- 4. Crop tiger

If yes, reason for it

Are there any quality deviations in rice by harvesting combine harvester?

- 1. Yes
- 2. No

If manual harvesting, reason for it and reason for avoiding combine harvester

In yield

In quality

In cost

Selling price per Kg.....in Rupees

Inert mix in harvested paddy

- 1. high level
- 2. medium
- 3. low
- 4. very low

1 Information about the Combine Harvester

Why did you choose combine harvester for harvesting

How long you have being using the machine?

- 1. More than 3years
- 2. More than 5 years
- 3. Less than 3 years

What type.....

What are the reasons for choosing this type?

What is the charge per acre for the harvesting?

The sources of cost

Sources	Cost for the seasons in rupees		
	Yala	Maha	Total
Driver			
Fuel and lubricant			
Depreciation			
Transport			
Labour			
Maintenance			

What is the annual total cost for last year?

Yala Maha

Total for the last year

Total cost for previous years.....

What is the annual income for the last year?

Yala Maha

Total income for last year

Total income for previous years

1.....

Benefit

Yala Maha

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