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SOCIO-ECONOMIC VIABILITY OF BALER FOR BALING PADDY STRAW: A CASE STUDY

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Abstract: The present study was conducted in south western district Mansa of Punjab during the year 2014-15. The main objective of the study was to study the socio-economic viability of the paddy straw baler technology. Farmers' opinion regarding baler technology was studied using interview schedules and economics was studied from case study of successful entrepreneur practicing baler technology for income generation. It was found that farmers were ready to adopt this technology due their concerns regarding removal of loose straw to prepare field for sowing of next season crop and their sensitivity towards environmental pollution from open field burning. The economic analysis revealed that total fixed cost for baler technology is Rs. 15.04 lac and total variable cost was Rs.4.17 lac. Total straw collection during 45 days period was 973 tons. The benefit cost ratio of this technology was 1.77 which indicated its economic viability.

Keywords: *baler, economic, harvesting, rake, saving, technology*

INTRODUCTION

Rice wheat system is important cropping system that has given assured income to the farmers of Punjab (India). About 2.8 million hectare area is under rice in the state. The area under rice has increased during last five decades. Farmers have promptly adopted rice wheat cropping system on large areas due to assured marketing and thus assured and high returns in comparison to other crops. Despite all these benefits, today the major problem State facing is that the farmers after combine harvesting paddy fields burning paddy straw in-situ in order to clear fields [1]. The Farmers are considering it as the easiest and cheapest way to dispose of straw in order to save time in field preparation

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for the sowing of next crop. Sometimes the straw burning is also linked to eliminate sources of pests, diseases and rat infestation. However, the practice of open-field burning is polluting air with a various gases especially carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O); and fine particles which further effecting global climate and also impacting human in form of respiratory ailments [4].

Large number of sensitization programs is being organized by the State Department of Agriculture and Krishi Vigyan Kendras' to make the farmers aware of the consequences of open field burning, but despite all the farmers giving preferences to open field burning. In recent years, farmers have been compelled to burn crop residues due to shortage of human labor; high cost of removing the crop residues by conventional methods; use of combines for harvesting crops. The standing stubbles and loose straw in paddy harvested fields need to either incorporated into soil for enhancing soil fertility or removed from the field for other uses. Various technologies suggested by research scientists for straw in situ incorporation are still in trial phase from farmers' perspective. In situ rice straw incorporation as an alternate to burning has been adopted by only a few farmers because of high incorporation costs and energy and time intensive [5]. Further solution can be collection and removal of paddy straw from field and utilizing it for paper industry or feed for animals, mushroom production and electricity generation in biomass power plants. The State Government of Punjab also providing subsidies on machinery and technologies relating to rice straw management that could be more cost effective.

In the year 2011-12 a biomass plant was established for power generation in Khokhar Khurd village of Mansa district of Punjab State by Government. At same time Punjab Agricultural University, Ludhiana made the introduction of baler technology for collection of paddy straw in the district. In order to enhance the adoption rate of this technology among farmers Krishi Vigyan Kendra, Mansa conducted front line demonstrations in adjoining villages. The present study was conducted in operational area of the KVK to know the opinion of beneficiary farmers about the new technology and to analyze the economic viability of paddy straw baler-cum-knotter technology.

MATERIALS AND METHODS

For the purpose of the study the data were collected in form of a case study from successful entrepreneurial famer running paddy straw baler in the district on custom-hiring basis. Second set of data were collected by random sampling technique from 50 beneficiary farmers of 10 villages of the fields where paddy straw baler was operated.

Figure 1. View of rake machine, paddy straw baler in operation and bales transported from field for the sale

An interview schedule was developed to study the opinion of farmers regarding baler technology and reason for preferences/non-preference over open field burning. The view of bale and rake machine is shown in Fig. 1. For economic analysis of the paddy straw baler technology fixed costs regarding prices of baler, rake and stubble shaver was find out by interviewing entrepreneurial farmer. Empirical observation were also made on various aspects viz; working efficiency, twines required, diesel consumption during the baler machine was in operation at the farmers fields.

RESULTS AND DISCUSSION

The socio-personal characteristics of respondent farmers are given in Tab. 1 and the opinion of farmers regarding benefits of baler technology are given in Tab. 2.

Table 1. Socio-personal profile of respondents

Category	*Beneficiaries (n=50)*	
	Frequency	*Percentage*
Age		
Young	*8*	*16.00*
Middle	*35*	*70.00*
Old	*7*	*14.00*
Educational Qualification		
Below matriculation	*14*	*28.00*
Matriculation	*23*	*46.00*
10+2 and above	*13*	*26.00*
Land holding		
Small farmers	*14*	*28.00*
Medium farmers	*24*	*48.00*
Large farmers	*12*	*24.00*
Extension contacts		
Low	*4*	*8.00*
Medium	*29*	*58.00*
High	*17*	*34.00*

Table 2. Opinion of farmers regarding benefits of baler technology

S. No.	*Benefits*	*Beneficiary farmers n_1=50*	
		Average	*Rank*
1	*Cost saving*	*2.8*	*1*
2	*Timely sowing of next crop*	*2.4*	*2*
3	*Check on environmental pollution*	*2.3*	*3*
4	*Soil health conservation*	*2.0*	*4*
5	*Operation of new technology made easy*	*1.8*	*5*
6	*Reduction in risk to human life*	*1.75*	*6*
7	*Reduction in fire incidences*	*1.7*	*7*

**Multiple responses*

Timely Sowing of Next Crop. Due to a short time, many farmers were forced to burn the straw immediately to clear the field for the next crop season. Major reason for adoption of baler technology was the short period of operation for next crop. Timely collection and removal of straw influenced the decision of farmers regarding management of paddy straw using baler technology. Interviews showed that both beneficiary and non-beneficiary farmers were willing to adopt baler technology due to timeliness parameter. [3] reported that due to a short time many farmers were also forced to burn the straw immediately to clear the field for the next crop season.

Check on Environment Pollution. The response showed that farmers were well-aware of the consequences of on-farm burning. In recent years, farmers have been compelled to burn crop residues due to shortage of human labor; high cost of removing the crop residues, and difficulties in operating straw incorporation technologies. Therefore, majority of the farmers were willing to use baler technology for straw collection and removal as open field burning resulted in environment pollution.

Cost Saving. The entrepreneurs working with baler were using chopper in paddy fields before the operation of baler. As, chopping operation was performed by the entrepreneurs, thus, there was a cost saving of Rs. 500 per hectare where baler was operated.

Soil Health Conservation. Burning of paddy straw resulted in soil compaction and loss of nutrients and results in soil compaction. Third major reason for adoption of baler technology by majority of the farmers were due to perceived benefits of non-burning on soil structure and soil fertility.

Operation of New Technology. Farmers of the area were facing problem in use of innovative technology viz; happy seeder and zero till drill for soil incorporation due chocking problem. Large amount of loose straw in the combine harvested paddy fields was resulting in decreased efficiency of paddy straw incorporation technologies. Respondent farmers revealed that removal of paddy straw using baler resulted in use of zero till drill technology feasible and enhanced its efficiency.

Reduction in Risk to Human Life. Burning of loose straw in paddy fields caused each year many accidents in the field as well as roads accidents due to smoke. Respondent farmers realized that use of baler resulted in check on accidents.

Reduction in Fire Incidences. Each year open field burning caused many fire incidences that led to loss of mature crops in farmer's field and neighboring farmers' fields. Beneficiary farmers realized reduction in fire incidences as a result of use of baler technology.

Field performance of paddy straw baler. The field performance of the baler is given in Tab. 3. The baler was evaluated for bale size of 36 x 46 x 90 cm. The baler was operated by using 50 hp tractors. The Operational time of the baler was 45 days (starting from 5th October-20th November, 2014). The baler was operated by the farmer on an average for 10 hours a day and its field capacity varied from 0.30-0.36 ha per hour. In an effective span of 45 days the farmers was able to collect the straw in form of bales from 144 ha. Operating the machine with forward speed of 2.7 km/h, the average number of twine tied bales of paddy straw obtained per ha was 287.5 with bale weight of 23.5 kg. The average straw recovery from one hectare field was worked out to be 6.75 ton. To tie the bales recovered from one ha area 6.25 kg of plastic twine was used.

Economic analysis of paddy straw baler technology. The data given in Tab. 4 depicts the cost incurred by the farmer on purchase various machineries along with rate

of interest and their respective depreciation costs. The farmer except the 5 year old tractor had made fresh purchase all other machines such as baler, stubble shaver and rake. The present and depreciation value for the tractor was worked out to be rupees 3.28 lac and 4044, respectively. Fixed cost value of the machineries used was also worked out in order to find out the economics of the venture in 1st year of operation. The fixed cost value includes only rate of interest and depreciation costs.

Table 3. Performance of straw baler in combine harvested paddy fields

Parameter	*Observation recorded*
Machines operated	*Tractor, Baler (New Holland), Raker, Reaper*
Tractor (hp)	*50*
Operational time (days)	*45*
Forward Operating speed (km^{-hour})	*2.7*
Working hours^{-day}	*10*
Field capacity (ha)$^{-hour}$	*0.32 (Range 0.30-0.36)*
Area covered (ha) $^{-day}$	*3.2*
Total area covered by baler (ha)	*144*
Fuel consumption (liter)$^{-hour}$	*5*
Labour requirement	*2*
Size of the bales (cm)	*36×46×90 (H × W × L)*
Bale weight (kg)$^{-bale}$	*23.5*
No. of bales-ha	*287.5 (Rang 275-337.5)*
Total number of bales produced (NOS)	*41400*
Straw recovery (ton)$^{-ha}$	*6.75*
Total straw collected (ton)	*972.9*
Total twine used (kg)	900.0
Twine used (kg) $^{-ha}$	6.25
Twine used (kg) $^{-bale}$	0.022 (21.73g)

The findings given in Tab. 5 shows the economic analysis of paddy straw baler for the operational period of 45 days in season. The findings show that total fixed cost value and variable cost for a season was found to be rupees 2.79 lac and 4.17 lac, respectively. Variable cost include cost incurred on hiring the services of tractor operator, fuel charges, labor charges, transport cost, other expenses on purchase of twine and repair & maintenance of machinery. The net income of the farmers was worked out by subtracting total cost incurred (fixed cost value + total variable cost) from the Gross income generated from sale of straw. The net income of paddy straw baler for the season was found to be Rs. 5.38 lac. The benefit cost ratio of baler was 1.77. But, this income is only possible if the baler works in 20 km radius of biomass power plant.

Cost benefit analysis of paddy straw baler. The cost economics was worked out (Tab. 6) based on expenditure costs and income from sale of bales per hectare. The cost of producing one twine tied bale was Rs.16.84 and cost for twine used per hectare was Rs. 4.02. The cost of operation per ha was found to Rs. 2372.26 while, cost of baling per ha comes out to be 4841.75. The cost of twine used per hectare was Rs. 1156.25 and was almost one fourth of the total cost of bailing per hectare. The gross income from sale of collected straw was Rs. 8580.43 per hectare in addition to benefits to soil health and reduction in fire accidents by checking open field burning of straw.

Table 4. Machinery required along with costs and depreciation

Particulars	*Baler*	*Stubble shaver*	*Tractor (5 year old)*	*Rake*
Cost incurred (Rs)	*1025000*	*50000*	*328050*	*150000*
Interest (12.75%)	*128125*	*6250*	*0*	*18750*
Depreciation cost @ 10 %	*102500*	*5000*	*4044**	*15000*
Fixed cost value	*1255625*	*61250*	*4044*	*183750*
Grand Total	*1504669*			

**Depreciation value for tractor was worked out only 45 days due to its other uses*

Table 5. Economic analysis of paddy straw baler technology

Parameter	*Per Season (45 Days)*
Fixed cost value	
Interest on fixed costs value	*153125*
Depreciation cost of machinery used (Other than tractor)	*122500*
Depreciation on tractor (For 45 days)	*4044*
Total Fixed Cost value	*279669*
Variable cost	
Tractor operator	*18000*
Fuel charges, l/h (12 liters)	*130500*
Twine (Rs. 185/Kg)	*166500*
Repair and maintenance	*3025*
Labor cost (2 men days @ Rs. 262 per day)	*23580*
Transportation cost @ Rs 25 $^{-quintal}$ (With in radius of 20 kms)	*75937.5*
Total variable cost	*417542.5*
Total costs	
Fixed +variable	*697211.5*
Income from straw sale	
Total area covered (ha)	*144*
Total yield of paddy Straw , t/ha	*6.76*
Total straw collection during season (t)	*973*
Gross income from sale of straw @ Rs 1270 per ton	*1235583*
Net income from sale of paddy straw	*538371.5*
Benefit cost ratio	*1.77*

Table 6. Cost benefit analysis of paddy straw baler

Parameter	*Observation recorded*
Cost of operation (baler-cum-tractor) Rs^{-ha}	*2372.26*
Cost of bailing Rs^{-ha}	*4841.75*
Cost of bailing Rs-^{bale}	*16.84*
Cost of twine used Rs^{-ha}	*1156.25*
Cost of twine used Rs^{-bale}	*4.02*
Gross Income Rs $^{-ha}$	*8580.43*
Gross Income Rs $^{-bale}$	*29.84*
Net Income Rs $^{-bale}$	*13.00*
Net Income (Rs^{-ha})	*3738.69*
Relative income^{-bale}	*1.77*

Gross income per bale was Rs. 29.84 and net income per bale was Rs. 13.0. Net income from sale of twined bales from one acre was Rs. 3783.69. The relative income from sale of bale was Rs. 1.77. Thus, making it a viable option for removal of paddy straw from field. [2] also concluded that straw management in the combine harvested fields by straw collection and baling in the field is an appropriate and economically viable option for timely use of the field for subsequent sowing.

CONCLUSIONS

There is immense need to check the open field burning of paddy straw to avoid environmental pollution, soil degradation, health problems and other problems. From the findings of the study it can be concluded that baler technology is socially and economically viable in removal of paddy straw from the combine harvested paddy fields. Short window for sowing of next season crop, risk to human lives, environmental pollution and soil health are the sensitive issues for farmers. The baler technology is economically viable with relative income per bale of 1.77. But, it is mandatory that there should be proper market for bulk purchase of paddy straw and if operational area of technology is within 20 kilometers radius of the demand area. Moreover, entrepreneur needs to work extra hours to make this enterprise a viable one.

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SOCIO-EKONOMSKA ODRŽIVOST BALERA ZA BALIRANJE SLAME PIRINČA: STUDIJA SLUČAJA

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Sažetak: Predstavljena studija je provedena u jugozapadnoj oblasti Mansa u Punjabu tokom 2014-15 godine. Glavni cilj studije bilo je proučavanje socioekonomske održivosti tehnologije baliranja slame pirinča. Istraživana su mišljenja farmera o tehnologiji baliranja kroz upitnike, a ekonomičnost je ocenjivana iz studije slučaja uspešnog preduzimača koji uslužno primenjuje tehnologiju baliranja. Zaključeno je da su farmeri bili spremni da primene ovu tehnologiju umesto uklanjanja slame u rasutom stanju radi pripreme parcela za setvu sledećeg sezonskog useva i spaljivanja slame na parceli. Ekonomska analiza je otkrila da su ukupni fiksni troškovi baliranja Rs. 15.04 lac i ukupni varijabilni troškovi Rs.4.17 lac. Ukupna količina pokupljene slame tokom 45 dana iznosila je 973 tone. Analiza odnosa troškova ove tehnologije pokazala je vrednost 1.77 što pokazuje ekonomsku održivost.

Ključne reči: *baler, ekonomičnost, žetva, grablje, ušteda, tehnologija*

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