Fundamental and Applied Agriculture
Vol. 6(1), pp. 86–94: 2021
doi: 10.5455/faa.47248

AGRICULTURAL ENGINEERING | ORIGINAL ARTICLE

Assessment of farmers' perception on rice reaper in the haor region of Bangladesh

Muhammad Ashik-E-Rabbani[1*], A N M Arifur Rahman[1], Md Samiul Basir[1], Kaniz Tamanna[1], Debashish Sarkar Dev [2]

[1]Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh
[2]Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

ARTICLE INFORMATION

Article History
Submitted: 20 Jan 2021
Accepted: 11 Mar 2021
First online: 30 Mar 2021

Academic Editor
Anisur Rahman
anis_fpm@bau.edu.bd

**Corresponding Author*
Muhammad Ashik-E-Rabbani
ashik@bau.edu.bd

ABSTRACT

This study was conducted to assess and identify the problems of handling reaper and their effects on the farmers' adoption in the haor region of Kishoreganj and Brahmanbaria district through personal interviews with a well-structured questionnaire and focus group discussion. Six different characteristics were selected namely, age, level of education, annual family income, farm size, access to information sources, and extent of machine used to study the adoption of reaper by 44 selected farmers. Results of statistical analysis with SPSS software indicated that education, access to information sources, and extent of different machinery use played a very significant role in the adoption of the reaper. It was found that the higher secondary educated respondents scored 11.43, the high extent of media contact respondents scored 14.57 and the medium extent of machinery users scored 8.65 in the case of measuring the satisfaction level within the range of −18 to +18. Based on data from the selected farmers, the result revealed that 82% of them were satisfied. This study also identified some constraints of reaper operation that were obtained from the respondents like slipping and skidding problems on muddy soil, problems in cutting over inclined crops, problems in cutting over flooded crops, problems in cutting over matured crops, etc. Some suggestions were made by the respondents for further improvement of reaper like wheel bit should be more ridge or iron wheel or plastic wheel should be used to overcome the slipping or skidding problem, a binding mechanism should be attached to save both time and labor.

Keywords: Adoption, haor, problems, reaper, satisfaction

Cite this article: Rabbani MA, Rahman ANMA, Basir MS, Tamanna K, Dev DS. 2021. Assessment of farmers' perception on rice reaper in the haor region of Bangladesh. Fundamental and Applied Agriculture 6(1): 86–94. doi: 10.5455/faa.47248

1 Introduction

Rice (*Oryzae sativa* L.) is the staple food of Bangladesh and the production of rice is one of the most significant driving factors of agriculture that occupies 74.85 per cent of total agricultural land with a yield contribution of an average of 4.61 tons per hectare (BBS, 2018). Bangladesh, in terms of rice production, ranks as the 4th largest rice-growing country in the world that produces about 34.86 MT of rice to feed the growing population (Kabir et al., 2015). In rice production, harvesting of rice is one of the most challenging practices as it has constraints of weather and time. In Bangladesh, rice is harvested traditionally by labours with a sickle, which is laborious, costly and time-consuming (Pandey and Devnani, 1985). During harvest time, the peak demands of labours are 240-man hr ha^{-1} using sickles (Mondol, 1997; Khan and Salim, 2005) which consumes 24% of the total labour require-

ment in the rice production system. As labour shrinkage is acute and labour wage is increasing day by day, the huge percentage of labour inclusion in harvesting needs to be substituted by mechanical harvesting practices and it is a demand of time to introduce small scale mechanical rice harvesters like hand and power reapers to overcome the labour scarcity considering the socio-economic status of marginal farmers.

In Bangladesh, farmers' interest in mechanisation for cereal crop harvesting is increasing due to the high cost and seasonal shortage of labour and the timeliness of operation in double and triple cropping pattern. Harvesting is the first and major operation for the separation, processing and storage of grains. Timely harvesting of the crop is vital to achieve better quality and higher yield of the crop. The shortage of labour during harvesting season and vagaries of the weather causes greater losses to the farmer. It is, therefore, essential to adopt the mechanical methods so that the timeliness in harvesting operation could be ensured and field losses are minimized to increase yield and land productivity. This will also allow the land to be prepared for the subsequent crops. The combine harvesters have failed to find acceptance among the farmers of Bangladesh due to their exorbitant cost and requirement of the large-sized plot for operation (Mondol, 1997). Alam et al. (2018) studied three power reapers in a farmer's field and stated the harvesting loss of the Korean Reaper as significantly higher (1.66%) compared to the Chinese Reaper (1.50%) and BRRI developed Reaper (1.45%). They also found a loss of 1.40% in the manual harvesting method. Iqbal et al. (1980) developed a mathematical model to estimate harvesting and threshing losses of wheat in the field. They found that the harvesting loss with normal operation increased linearly with time ranging from 3% in the first week and 7% in the third week after ripening of the crops. It was indicated that a delay of two weeks in harvesting could seriously affect the yield of crops. REFPI, a component of DFID funded by the UK imported some reapers such as Thai made Kubota (SK-120L), Chinese (SHANDONG HUAXING) and Philippines (MORALLO) reaper in DFPM for academic and research purpose. Different manufacturers fabricated reaper with the financial assistance of REFPI but could not popularize their product due to lack of post-sale service (Hossain, 2003). According to Ziauddin (2011), there were 140 numbers of reapers available in the different research centre and private level in Bangladesh where the number increased to 500 in 2014 according to Ahmed (2014). Moreover, some imported reapers are costly, some have excess shattering losses. As a consequence, at present there are very few numbers of reapers are available in the farmer's field in working condition in Bangladesh. Thus, it is indispensable to identify the constraints of the existing reapers to increase popularity in Bangladesh by considering both researcher's point of view as well as the farmer's point of view.

The objective of this research was to assess farmers' perception on rice reaper adoption to identify problems and satisfaction level while handling reaper, and to determine the relationship between farmers' socio-economic characteristics and their perception on rice reaper adoption in the haor region of Bangladesh.

2 Materials and Methods

2.1 Data collection

Data were collected from 44 selected respondents of the selected Upazilas of Brahmanbaria (Sarail, Bancharampur, Nabinagar, Bijoynagar and Nasimnagar) and Kishoreganj (Sadar and Karimganj) district. Department of Agricultural Extension subsidised some reaper (Model: AR 120; Country of origin: Vietnam) to all respondent farmers in 2017 after arranging training for 5 days at Korona Industries Ltd. in Narayanganj. To collect data, a well-structured questionnaire was prepared containing all inquiries about the whole research objectives. Data from different respondents of Brahmanbaria and Kishoreganj district were collected through both personal interview method and focus group discussion method. All of the respondents were experienced in using reaper at least one time.

2.2 Data processing and analysis

After data collection, data were coded, compiled, tabulated and analysed by IBM SPSS 25 statistical software in accordance with the objectives of the study. Two-way ANOVA and Pearson's Correlation (Pearson, 1920) was done to achieve the desired outputs and objective fulfilment.

2.3 Measurements of data

The fourteen characteristics of the farmers constituted the quantitative data of this study. The measurement procedures of these data have been discussed below.

2.3.1 Quantitative data

General information Some general information like respondent name, his/her father's name, present and permanent address, contact number etc. was collected through personal interview.

Age The age of a respondent was measured in terms of actual years from his/her birth by the time of the interview in order to justify the capability to run agricultural machinery.

Family size The family size of a respondent was determined in terms of the actual number of members. The scoring was done by the actual number.

Education The level of education was measured on the basis of classes s/he had passed. For example, if a respondent passed class five (v), his/her education score was taken five (5) (Kuri, 2013).

Family annual income The average annual family income of a respondent's family was measured on the basis of yearly total earnings. A score of one (1) was assigned for each of "10,000" Tk for measuring the annual family income of a respondent.

Area of rice cultivation The total cultivated area of rice (Aus, Aman and Boro) was measured in hectare.

Cropping intensity The cropping intensity was measured using the equation (Faruque, 2013) as follows:

$$CI = \frac{TCA}{NCA} \times 100 \quad (1)$$

where CI = cropping intensity (%), TCA and NCA represent total and net cultivated area, respectively.

In order to measure the total cultivated area, the cultivated area was multiplied with the cropping intensity. For example, if the size of cultivated land was 2 hectare and the cropping intensity was 3, then the amount of total cultivated land was taken as 6 hectares.

Training exposure The training on using agricultural machinery was a dummy variable measured by scoring (1) for training received and (0) for no training. The information was collected.

Rice harvesting procedure The rice harvesting procedure was measured both in terms of using labour and using harvesting machinery. In the case of using only labour, only harvesting machine and using both, the score was taken as 1,1 and 2 (1+1) respectively.

Cost of harvesting The cost of harvesting was measured individually for using only labour, using the only machine and for using both labour and machine.

Present status of reaper If the reaper of the respondent was in working condition, then the dummy variable was measured by scoring (1) and if not then it was scored (0). Technical information on reaper: Some technical information such as name of reaper, number of reapers, model of reaper, on-farm test, the technical problem to use, harvesting season etc. were collected.

2.3.2 Measurement of qualitative data

The qualitative data of the study was the adaptability of reaper by farm-level farmers. Adoption of reaper was measured based on the following dimensions:

Extension media contact Extension media contact may be defined as one's extent of exposure to different extension teaching methods. The extent of the contact was determined like not at all, rarely, occasionally and frequently scores as 1, 2, 3 and 4 respectively. The extension contact score could range from 9 to 36 for each respondent, where 9 indicating no extension contact and 36 indicating very high contact.

The extent of use of farm machinery The extent of use of farm machinery was determined like Not at all, Rarely, Occasionally and frequently scores as 1, 2, 3 and 4 respectively.

Problems faced during the operation of the reaper The farmers were asked to mention the problems they encountered in the adoption of the reaper. It was measured by using a closed form of questions. Thus, the possible problem confrontation score of the respondents could range from 21 to 84 for each respondent, where 21 indicating no problem confrontation while 84 indicating high problem confrontations.

Farmers' level of satisfaction on reaper It was measured by using a closed form of questions. Weights on responses against the applicable ones of the 13 statement among which 11 statements were a positive barrel and 2 statements were negative barrel statement of a farmer were assigned in the following way. For positive barrel statement, Weights on response were suggested as strongly disagree (-2), disagree (-1), agree ($+1$), strongly agree ($+2$). For negative barrel statement, Weights on response were suggested as strongly disagree ($+2$), disagree ($+1$), agree (-1), strongly agree (-2). At the same time for the negative barrel statement, the possible satisfaction level confrontation score could range from $+4$ to -4, where -4 indicating strongly agree on confrontation while $+4$ indicating strongly disagree confrontations.

Suggestions and problem statements by respondent farmers Different suggestions were made by the respondents to minimize the problems. Their suggestions were made as follows, parts need to be improved, opportunity, constraints, performance and others. The overall satisfaction on the adoption of reaper was a dummy variable measured by scoring (1) for the positive answer and (0) for the negative answer.

Table 1. Selected characteristics of the farmers with scores

Characteristics	Score Ranges		Categories	Trained		Mean	SD
	Possible	Observed		No.	%		
Age (Year)	Unknown	24-77	Young (Up to 35)	8	18.18	45.55	10.47
			Middle aged (36-50)	22	50		
			Old (Above 50)	14	31.82		
			No Schooling (0)	9	20.45		
Education level (score)	Unknown	0-13	Can sign (0.5)	7	15.92		
			Primary (1-5)	5	11.36		
			Secondary (6-10)	9	20.45	6.49	5.4
			Above Secondary (Above 10)	14	31.82		
Annual Income (000′ Tk)†	Unknown	12-106	Low (up to 40)	32	72.73		
			Medium (41-80)	10	22.73	34.49	16.99
			High (Above 81)	2	4.54		
Cultivable Land (ha)	Unknown	0.04-0.38	Landless (< 0.02)	0	0		
			Marginal (0.02-0.10)	13	29.55		
			Small (0.11-1.00)	31	70.45		
			Medium (1.10-3.00)	0	0	0.14	0.07
			Large (>3.00)	0	0		
Access to information sources (score)	9-36	15-36	Low (9-18)	5	11.36		
			Medium (19-27)	32	72.73	23.98	4.34
			Large (28-36)	7	15.91		
Extent of machine use (score)	10-40	18-28	Low (10-20)	10	22.73		
			Medium (21-30)	34	77.27	22.55	2.34
			High (31-40)	0	0		

† Categorized by Asian Development Bank (ADB) (Billah, 2020)

Table 2. Problem and satisfaction scores

Characteristics	Score Ranges		Categories	Trained		Mean	SD
	Possible	Observed		No.	%		
Problem (Score)	21-84	33-69	Low (21-42)	5	11.36	52.68	9.6
			Medium (43-63)	36	81.82		
			High (64-84)	3	6.82		
Satisfaction (Score)	−18 to +18	−6 to 18	Low (−18 to −6)	1	2.28	8.75	5.07
			Medium (−5 to 6)	9	20.45		
			High (7to18)	34	77.27		

3 Results and Discussion

3.1 Characteristics of the respondents

The selected characteristics included their age, education level, annual income, cultivable land, access to information sources, the extent of machine use, problems and satisfaction. These characteristics are shown in Table 1 with the computed scores and analysed values and the problem and satisfaction scores are shown in Table 2. For determining the extent of the major and minor problem faced by the different respondents, all the responses of the 44 respondents were analysed and then a configuration was achieved like the Table 3.

3.2 Characteristics of respondents *vs.* problems and satisfaction (PS) level

3.2.1 Age of respondent *vs.* PS level

The computation of the relationship between age and the problem (Fig. 1(A)) indicates that the extent of problem faced by a reaper user varies from person to person according to their age. It also indicates that among the three categories of age, the middle-aged

Table 3. Rank of problems associated with reaper and their scores

Types of Problem	Score	Rank	
Functional	1. Excessive vibration	105	1
	2. Clearance between the cutting blade and the base plate	80	5
	3. Poor quality guide spring	77	6
	4. Noise of the star wheel	112	2
	5. Power transmission	101	3
	6. Conveyor Problem	98	4
Operational	1. Clogging of the harvested crop with chain	89	8
	2. Twisting of harvested crop with lug and chain	84	10
	3. Turning problem	144	5
	4. Corner cutting problem	142	6
	5. Shattering grain loss	101	7
	6. Lack of repair and maintenance facilities	171	1
	7. Cannot repair in the local workshop	155	2
	8. Wheel problem	153	3
	9. Transportation problem	150	4
	10. Damage of crop	85	9
Operator	1. Lack of training	134	1
	2. Lack of technical knowledge	131	2
	3. Complex operation system	103	4
	4. Problem in seating arrangement while operating	101	5
	5. Lack of formal education	109	3

respondents were more satisfied with reaper use than the other categories of age in spite of facing the same problems while using reaper. The graphical representation was formed in accordance with the range 21 to 84 for the problem and -18 to $+18$ for satisfaction level.

3.2.2 Education level *vs*. PS level

From the analysis of the study, it was found that the respondents with no schooling or can only sign be facing more problems than the other categories of education level. So ultimately, they were less satisfied to adopting reaper. Fig. 1(B) is the graphical representation showing the relationship between education level and problem and satisfaction. From the graph, it was found that the respondents with higher secondary education were more satisfied having the score of 11.43 to adopt reaper because of having much knowledge about agricultural machinery. But the most notifying fact is that the primary educated respondents were also quite satisfied with facing fewer problems (44.4) than secondary (49) and above secondary (51.85) educated respondents.

3.2.3 Annual income *vs*. PS level

After the analysis of the study, it was found that most of the respondents were with low annual income facing more problems and having less satisfaction to adopt reaper. Very few respondents were with high annual income facing fewer problems to use reaper. The relationship between annual income and problem and Satisfaction is shown in Fig. 1(C). From the above representation it was found that the respondents with medium income were more satisfied (10.3) compared to the low (8.25) or high (9) income respondents.

3.2.4 Farm size *vs*. PS level

The analysis of the study showed that among the selected respondent's none of them were landless or medium or large-scale farmers. The following graphical representation shows the relation between farm size and problem and satisfaction is shown in Fig. 2(A). The graphical representation shows that the small-scale farmers were facing more problems (54.19) than the marginal scale farmers (48.77). But the satisfaction level to adopt a reaper was more noticeable to the small-scale farmers (9.1) than the marginal farmers (7.69). As the more the land size will be, the more the reaper will perform better so the small-scale farmers showed a quite satisfactory mode towards using reaper than the marginal level farmers.

3.2.5 Access to information source *vs*. PS level

It was found that plenty of respondents were connected with the medium extent of information sources related to agricultural machinery. Very few were familiar with low or high extent of information sources. Fig. 2(B) is the graphical representation

Table 4. Correlation between selected characteristics and problem and satisfaction

Characteristics of the respondents	Value of coefficient of correlation (r)	
	Problem	Satisfaction
Age	0.187	−0.085
Education level	−0.294	0.457**
Annual Income	0.022	0.106
Cultivable Land	−0.006	0.098
Access to information sources	0.178	0.434**
Extent of machine use	0.359*	0.318*

Here, * = p<0.05, and ** = p<0.01

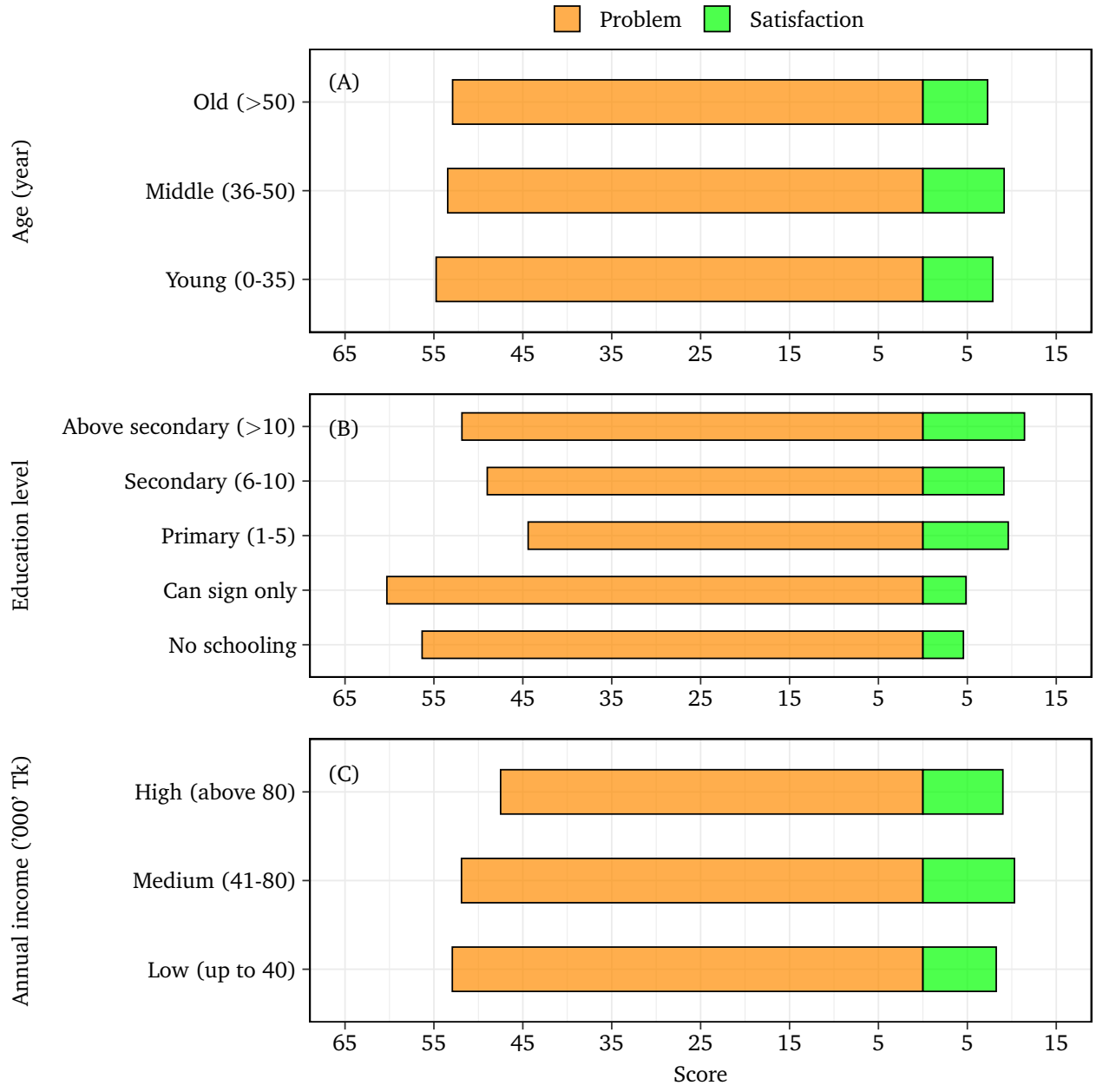

Figure 1. Problems and satisfaction scores of respondents in relation to their (A) age, (B) education levels, and (C) annual income

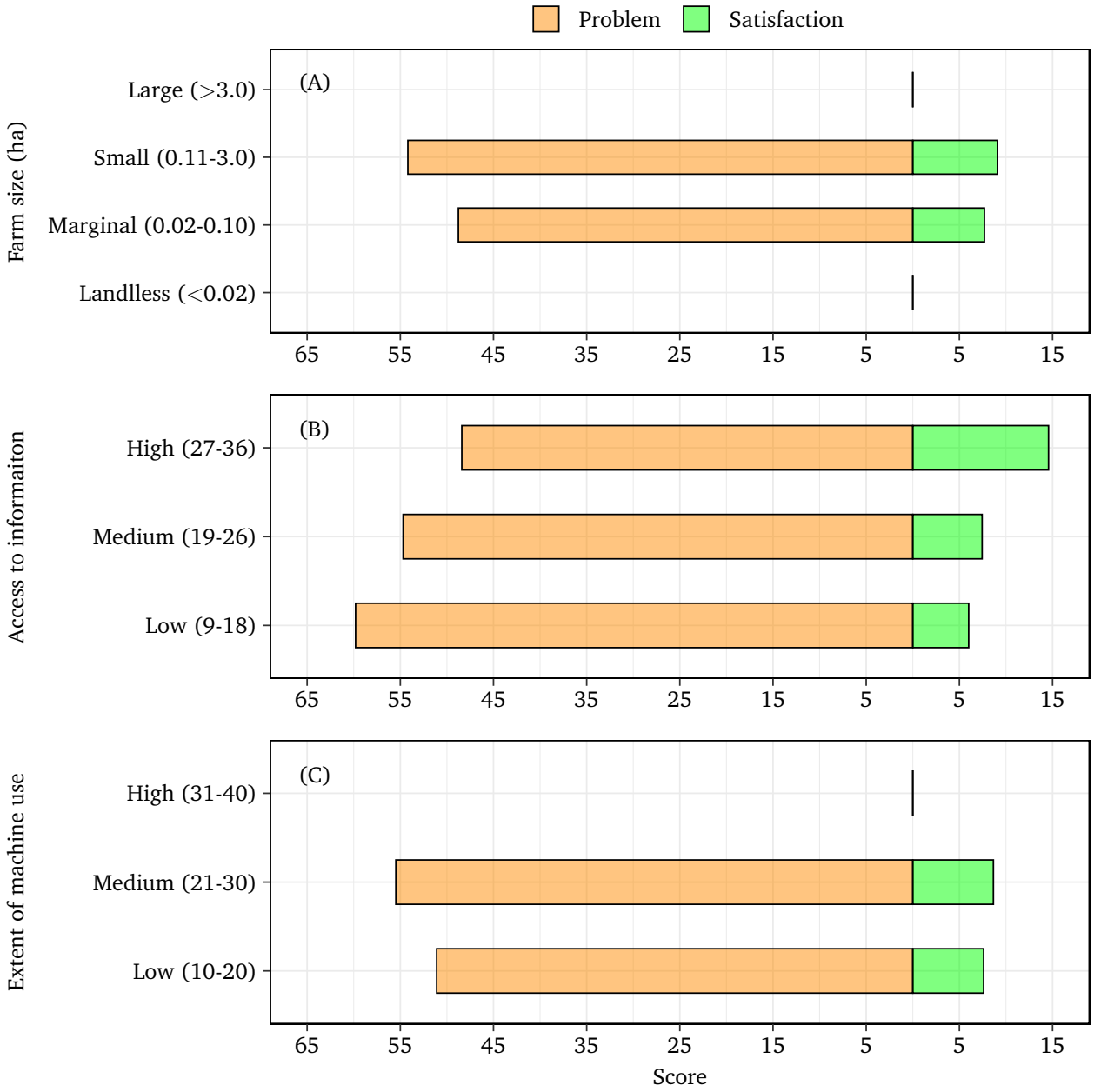

Figure 2. Problems and satisfaction scores of respondents in relation to their (A) farm size, (B) access to informaiton source, and (C) extent of machine use

between accesses to information sources to problem and satisfaction. The graph was formed in accordance with the range 21 to 84 for the problem and −18 to +18 for satisfaction level.

3.2.6 The extent of different machinery uses *vs.* PS level

The study found that none of the respondents were experienced with high extent of machine use. Fig. 2(C) represents the relationship between the extent of machine use and problem and satisfaction. The figure characterises that the respondents with the medium extent of machine use were faced with high extent of problems (55.48) while using reaper compared to the low extent of machine user (51.1). But although the medium extents of machine users were facing more troubles (55.48), their satisfaction level to adopt reaper except for all sorts of the problem was much higher (8.65) than those of low extent of machine users (7.6).

3.3 Correlation between characteristics of respondents and PS level

The result of correlation analysis on the relationship between selected characteristics of farmers and problems and satisfaction is shown in Table 4. From the table, it can be showed that education level and access to information sources were significantly correlated with the satisfaction level to adopt a reaper at 1% level of probability and extent of machine use was significantly correlated with the satisfaction level to adopt a reaper at 5% level of probability. While age, education level, annual income, cultivable land and access to information sources had no significant relationship with the problem to adopt reaper. The positive significant correlation of access to information sources of the respondents with the satisfaction level ($r = 0.434**, p > 0.01$) clearly points out that with the increase of the access to information sources of the respondents the satisfaction level significantly increases as the more access to information sources enhance the understanding capacity of the respondents to realize the complex issues of the satisfaction level to adopt a reaper.

The positive significant correlation of extent of machine use of the respondents with the satisfaction level ($r = 0.318*, p > 0.05$) and with the problem ($r = 0.359*, p > 0.05$) clearly point out that with the increase of the extent of machine use of the respondents the problem and satisfaction level significantly increases as the more access to extent of machine use enhance the understand capacity of the respondents to realize the complex issues of the problem and satisfaction level to adopt a reaper.

3.4 Overall satisfactions of the respondents

By analysing the response of the selected respondents, it was finally calculated that 36 respondents among 44 were eager to adopt reaper. It was found that most (82%) of the respondents within this study area were satisfied to adopt reaper while a few (18%) were unsatisfied at all.

3.5 Problems encountered

Trained farmers were able to identify some problems in frequent use of the reaper which includes obstacle in operating as slipping & skidding on muddy soil, problems in cutting over inclined crops, in cutting over flooded crops, in cutting over-matured crops, grain loss, rough handling of hill and lack of crop binding mechanism which leads to extra man-power requirement.

3.6 Suggested precautions

Their suggestion includes these options to minimize the constraints while using reaper; wheel bit should be more ridge, iron wheel of power tiller or plastic wheel of rice transplanter can be used to overcome the slipping or skidding problem, the binding mechanism should be attached to save both time and labour.

4 Conclusion

This study assessed the farmer's point of view on the use of reaper by knowing their degree of difficulties and by qualifying their contentment level. In the study area, almost 82% of farmers were willing to adopt reaper with no significant relationship of the age with their implementation. The education level possessed a relation with problem identification and satisfaction level that the uneducated or little educated group faced more problems in using the reaper, but the people educated to secondary and higher secondary level faces less problem with more satisfaction. The study also reveals that the more access to information, the lower the difficulty in using the reaper with greater satisfaction, so as the machinery use experience. The study indicates a significant correlation of education with the adoption of reaper which may lead to an affirmative favourable judgment towards the adoption. Also, a significant and positive relationship represents in the case of the degree of machine used by the respondent farmers will play a role to encourage farmers to adopt reaper through various incentives. Extension media contact of the farmers had a significant and optimistic relationship with their adoption of a reaper; this implies that the farmers with supplementary extension media communication with different extension methods

are expected to have more acceptance of reaper. The study encounters the problems from farmers' point of view in vibration, noise, and power transmission system of the machine. Farmers face problems in the adoption of the reaper for lack of training, technical knowledge, and formal education. The concepts generated by the farmers' perception in the adoption of the machine can be the opportunity of research and modification of the reaper machine in the context of Bangladesh for root-level farmers.

Acknowledgments

This research was undertaken by the support of the Ministry of Science and Technology, Government of the People's Republic of Bangladesh. The contents are the sole responsibility of the authors and do not necessarily reflect the views of Government of Bangladesh.

Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

Ahmed S. 2014. Country paper presentation, Bangladesh. In The 10th session of the technical committee of CSAM and regional workshop on establishing a regional database of agricultural mechanization in Asia and the Pacific. pp 17–19.

Alam MA, Hossen A, Islam AS, Alam M. 2018. Performance evaluation of power-operated reapers for harvesting rice at farmers' field. Journal of the Bangladesh Agricultural University 16:144–150.

BBS. 2018. Yearbook of Agricultural Statistics 2017. Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

Billah M. 2020. Who are the middle class in Bangladesh? The Business Standard (04 October 2020). https://tbsnews.net/feature/panorama/who-are-middle-class-bangladesh-141073. Accessed on 20 December 2020.

Faruque MO. 2013. Performance Appraisal of the Field Level Workers in Social Safety Net Programmes. MS Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural university.

Hossain MD. 2003. Fabrication of self-propelled reaper by locally available materials. MS Thesis, Department of Farm Power and Machinery, Bangladesh Agricultural university.

Iqbal M, Sheikh G, Sial J, et al. 1980. Harvesting and threshing losses of wheat with mechanical and convential methods. Agricultural Mechanization in Asia 11:66–70.

Kabir MS, Salam MU, Chowdhury A, Rahman NMF, Iftekharuddaula KM, Rahman MS, Rashid MH, Dipti SS, Islam A, Latif MA. 2015. Rice vision for Bangladesh: 2050 and beyond. Bangladesh Rice Journal 19:1–18.

Khan AS, Salim M. 2005. Rice harvesting and threshing. Pakistan Journal of Food Science 15:45–52.

Kuri SK. 2013. Awareness of the small farmers regarding effect of climate change on farm ecosystem. MS Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural university.

Mondol MRA. 1997. Performance evaluation and improvement of power tiller mounted cereal reaper. MS Thesis, Department of Farm Power and Machinery, Bangladesh Agricultural university.

Pandey MM, Devnani RS. 1985. Design, development and field evaluation of vertical conveyor reaper windrower. Agricultural Mechanization in Asia, Africa and Latin America 16:41–52.

Pearson K. 1920. Notes on the history of correlation. Biometrika 13:25–45. doi: https://doi.org/10.2307/2331722.

Ziauddin ATM. 2011. Mechanization towards reducing cost of production and enhancing yield. Keynote paper presented at the annual paper meet by Division of Agricultural Engineering, IEB.

The Official Journal of the **Farm to Fork Foundation**
ISSN: 2518–2021 (print)
ISSN: 2415–4474 (electronic)
http://www.f2ffoundation.org/faa