



Impact of Rice Seed Production, Processing, and Distribution Training on the Stakeholders in Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study examined the impact of rice seed production, processing, and distribution training on the rice seed stakeholders. Ten one-day training events were conducted by Bangladesh Agricultural Development Corporation (BADC) and funded by the International Rice Research Institute (IRRI). Sample size of trainees included 199 rice seed dealers, 62 rice growers, and 29 dealers cum growers across four divisions of Bangladesh. The perceived impact of training was determined by employing a t-test. Almost all of the stakeholders showed improvement in their learning of the subjects designed and the correlation between their knowledge before and after training sessions were highly correlated.. Dealers expressed their views of moderate use of the training outcomes in determining seed demand, storage, and sale, whereas growers and dealer cum growers were highly optimistic about using their knowledge and skills obtained in seed production, processing, storing, and marketing in a better way. Significant changes in knowledge and skills and favorable perceptions were observed among all the stakeholders for better production, processing, and utilization of rice seed.

Keywords: Growers; dealer cum growers; dealers; training; impact; utilization.

1. INTRODUCTION

Training is a systematic and organized effort to modify or enhance knowledge, skills, or attitudes through learning experiences to attain efficient performance in a particular task or set of activities [1]. Its goal in the workplace is to help an individual develop skills that will allow them to perform well in a specific activity or job and reach their full potential [2]. Agricultural training is an informal education; it is a practical use of science, economic and social development in the principles of preparation for agricultural production. In the agricultural sector, stakeholders are required to learn about new technologies and skills to bring positive changes against all future calamities. In this regard, training might be useful to spread updated knowledge among the stakeholders. Training positively impacts farmers' efficiency in farming by increasing work quality, farm products, income, network, and saving time and cost [3]. The study also stated that, the farmers' training has not only increased their skills and abilities, but it has also boosted their morale and motivation, which has contributed to their better performance level. Training is one of many ways to spread agricultural education among farmers. Continuous learning in agriculture is important as agricultural technology is developing day by day. To introduce farmers to these new technologies, trainings play a vital role.

With a clear picture of how the participants are using the information after training in place of local practices and what they have adopted for future use, one can determine the effectiveness of training. The pre and post-test is a common form of evaluating training programs in terms of

improving the knowledge of the participants. Even though the modern economy is mostly reliant on industrialization, agriculture remains the lifeblood of Bangladesh's economy. Agriculture has traditionally been used in Bangladesh as a catalyst for the country's long-term development and progress [4]. Many governmental and non-governmental institutions arrange agricultural training programs every year in Bangladesh to ensure development in agricultural sectors, but many of these trainings are not capable of bringing about the expected behavioral change in the participants. One of the reasons is that the participants don't go through any assessment tests.

Training assessment is important to determine the impact of training. This paper will show the result of training through assessment. Training assessment is not a very popular topic in Bangladesh and there are not many studies that have shown the impact of training among farmers through assessment. However, in Bangladesh, the impact of training on vegetable farmers in integrated pest management was only just an observation but has never been assessed [5]. In addition, the impact of training on livestock technology transfer for poor farmers' livelihood improvement in Bangladesh [6]. The study was conducted through a questionnaire but no pre and post-tests were done to assess the impact. Therefore, the main objectives of the study were to: i) understand the socio-demographic characteristics of the rice seed stakeholders; ii) assess the perceived impact of rice seed production, processing, and distribution training on the stakeholders; and iii) investigate the utilization of the knowledge gained from the training by the rice seed stakeholders.

2. METHODOLOGY

Based on the selected objectives, quantitative and qualitative mixed research methods were used for the study. The growers, dealers, and dealer cum growers trained by the BADC in ten seed zones of Bangladesh (Sylhet, Cumilla, Chittagong, Jessore, Kushtia, Mymensingh, Dhaka, Rajshahi, Rangpur and Barishal districts) and monitored by IRRI were the sample of this study. Out of 597 dealers, 186 growers, and 87 dealer-cum-growers a total of 290 trainees including 199 dealers, 62 growers and 29 dealer-cum-growers were interviewed in face-to-face situations before and after each training session using a pre-designed interview schedule that included fifteen relevant questions. The answers to the questions were accentuated in the discussions at each training session. The questions were on rice seed production, processing, and distribution training for the stakeholders. Socio-demographic characteristics of the rice seed stakeholders were assessed following standard techniques. The dependent variables (Y) of the study were the impact of training on each group of rice seed dealers (Y_d), growers (Y_g) and dealer-cum-growers (Y_{dg}) and the independent factors of this study include 12 variables (X) viz., age (X_{d1}, X_{g1}, X_{dg1}), education (X_{d2}, X_{g2}, X_{dg2}), family members (X_{d3}, X_{g3}, X_{dg3}), earning members (X_{d4}, X_{g4}, X_{dg4}), farming experience (X_{d5}, X_{g5}, X_{dg5}), farm size (X_{d6}, X_{g6}, X_{dg6}), net income (X_{d7}, X_{g7}, X_{dg7}), commercial seed harvesting experience (X_{d8}, X_{g8}, X_{dg8}), dealership experience (X_{d9}, X_{dg9}), seed dealership experience (X_{d10}, X_{dg10}) seed dealer committee membership (X_{d11}, X_{dg11}) and their training experience (X_{d12}, X_{g12}, X_{dg12}). Here, **d** = dealers, **g** = growers, and **dg** = dealer-cum-growers. As rice seed growers were not involved in any dealership business, they certainly did not have any experiences related to dealerships, likewise, dealers did not have any seed harvesting experience, but socio-demographic independent variables were taken from all the stakeholders. All the variables related to age, education, membership and experiences were measured in years, while farm size was considered in hectares of total land. R studio version 4.2.1 was employed to demonstrate Pearson's correlation of coefficient matrix of the selected characteristics of the respondent stakeholders to find the interrelation among selected variables of each stakeholder group. Three different correlation matrixes were measured for three groups of agricultural stakeholders to understand the intercorrelation

and strength among the independent variables of each group separately. This study assumed that the association among variables are not a sign of multicollinearity because each respondent's response was recorded twice and some variables related to knowledge and experiences are inevitably interconnected. Knowledge of the respondent dealers, growers and dealer cum growers was evaluated based on a knowledge scale constituting 15 questions. Each question was in equal weave length weighing 2.0 marks. F-test was performed to calculate the variance in the knowledge of all the groups of respondents both before and after training. The impact of training was measured by evaluating the differences between the pre and post-test scores by employing a t-test. The perceived utilization of training outcomes was measured by using a five-point rating scale employed to recode respondents' expressions into scores such as; very much= 4, More= 3, Fairly= 2, less= 1 and not at all= 0, to understand the extent of application of knowledge gathered in the training programs.

3. RESULTS AND DISCUSSION

The findings of the study are shown below in accordance with the objectives.

3.1 Socio-demographic Characteristics of the Respondents Rice Seed Stakeholders

The socio-demographic characteristics of the respondents are presented in Table 1. The majority of dealers (82.9%), growers (87.1%), and dealer cum growers (94.7%) were between middle and old-aged [7]. All 29 dealer-cum-growers and more than four-fifths (80.6 and 95.0%, respectively) of solo growers and dealers were highly educated and the majority had a high number of attended training programs (31.6, 51.6 and 41.7%, respectively) [8,9,10]. The majority of the dealers (87.9%) and dealers cum growers (84.2%) had small to medium-sized families whereas growers (77.4%) had medium to large-sized families [11]. More than half respondents of different stakeholders were the only earning person in their families. Dealers (74.1%) mostly had low to medium farming experience, but the farming experience of growers and dealer cum growers (69.4 and 73.7%, respectively) was quite noticeable [9,10].

Results also show that the growers and dealer cum growers (91.9 and 89.5%, respectively)

grew and harvested more seeds in 2020, thus low-level net income from seed production was earned by growers (58.1%) and dealer cum growers (42.1%). The dealership experience of the dealers (89.9%) was short to medium whereas 82.7 percent of dealer cum growers (83.4%) had medium to long experience in the dealership. Both dealers (81.9%) and dealer cum growers (86.2%) had short to medium length of seed dealership experience.

3.2 Rank Order of Knowledge Statements

The mean knowledge score on each knowledge question was calculated both before and after a training program. Any change in mean values for every question after the training program indicates that the respondents were paying attention and received the information instantly, which helped them to respond better in post-evaluation.

Results shown in Table 2 indicate that before training, a reasonable part of the respondent dealers answered the question on naming aromatic rice varieties developed by BIRRI and essential information printed on the rice seed packets. After training, most of the respondent dealers answered the questions on the optimum moisture level of rice seed for storage. Here both the respondent growers and dealer cum growers obtained higher marks before and after the training on answering the question about the optimum moisture level of rice seed for storage. It is observed from Table 2 that the mean values of after-training evaluation for all of the respondent groups were increased.

A higher mean value obtained from the after-training evaluation of any knowledge question than that of the pre-training evaluation indicates the achievement of the training program. If there is no change in the mean value of any knowledge question after training evaluation then it can be said that the respondent might not be attentive or the trainer would not be able to make them understand the answer to the knowledge question. Interestingly, in all the cases, the mean post-evaluation values were higher than those of pre-evaluation values. It means that there were some achievements in the training participants. Others study identified that farmers' overall knowledge level increased from low (84.0%) to medium (64.0%) after attaining training and

training has a significant and positive impact on the knowledge level of respondents [12].

3.3 Variation of Knowledge

To determine the significance of the variation in knowledge, F-test was conducted (Table 3). An insignificant variation in knowledge was observed for the pre-training period, but post-training, the variation of knowledge was significant at 0.01 level. This indicates that the majority of the respondents were not able to answer the questions, i.e., there was little or minimum variation among their answers. After the training, most of the respondents received the actual information and their answers differed widely because of their different learning capacities.

3.3.1 Correlation coefficient among independent variables of the respondent stakeholders

The information displayed in Fig. 1 show the correlation between selected variables for a dealer. Positive correlations are displayed in blue and negative correlations in red color. The color intensity and the size of the circle are proportional to the correlation coefficients. A positive correlation exists when two variables move in the same direction. When one variable tends to decline as the other decreases, or when one variable tends to rise as the other increases, there is a positive connection. The negative correlation is vice versa. A strong positive correlation was observed between knowledge before and knowledge after the training (0.6). It means that the respondents having high-level knowledge of rice seed production, processing, preservation and marketing had more improvement in their level of knowledge on the same. Positive correlation between the two variables was also reported by others [13]. In addition, dealers' knowledge before training (0.2) was positively correlated with training and seed dealership experience, which indicates that dealers with an increasing number of obtained training and years of seed dealership experience had better knowledge prior to training. Also, dealers with higher experience tend to attain more training programs and the number of training programs positively influenced getting membership of the seed dealers' committee.

Table 1. Selected variables of the respondents along with their dominant categories

SI#	Socio-demographic characteristics	Respondents					
		Dealers (N=199)	Percent	Growers (N=62)	Percent	*DCG (N=29)	Percent
i.	Age	Middle age to old	82.9	Middle age to old	87.1	Middle age to old	94.7
ii.	Education	Secondary to above secondary	95.0	Secondary to above secondary	80.6	Secondary to above secondary	100.0
iii.	Family size	Small to medium	87.90	Medium to large	77.4	Small to medium	84.2
iv.	Earning members	Only respondent	63.8	Only respondent	58.1	Only respondent	63.8
v.	Farming experience	Low to medium	74.1	Medium to high	69.4	Medium to high	73.7
vi.	Commercialization of harvested seed	-	-	Low to medium	91.9	Low to medium	89.5
vii.	Net income	-	-	Low	58.1	Low	42.1
viii.	Dealership experience	Short to medium	89.9	-	-	Medium to long	82.7
ix.	Training experience	High	41.7	High	51.6	High	31.6
x.	Seed dealership experience	Short to medium	81.9	-	-	Short to medium	86.2

*DCG= Dealer cum grower

Table 2. Analysis of knowledge scale based on mean values of answers given by the respondents during before and after training

SI.	Knowledge statements	Dealers		Growers		*DCG	
		Before	After	Before	After	Before	After
i.	Food security risks of Bangladesh	0.40	1.05	0.50	1.08	0.58	0.96
ii.	Activities undertaken for popularization of a rice variety	0.60	1.02	0.70	1.27	0.62	0.82
iii.	Nutrient enriched rice varieties released by BRR1	0.27	0.49	0.31	0.68	0.45	0.66
iv.	Aromatic rice varieties developed by BRR1	0.74	0.91	0.38	0.61	0.65	0.89
v.	Recommendation gave by the dealers along with seed selling	0.45	0.76	0.23	0.47	0.38	0.61
vi.	Means of determining quality rice seed	0.41	0.88	0.67	1.12	0.64	1.13
vii.	Important activities of rice seed production	0.48	0.82	0.74	1.12	0.86	1.02
viii.	Essential information printed on the rice seed packet	0.74	1.09	1.04	1.36	0.89	1.24
ix.	Optimum moisture level of rice seed for storage	0.48	1.30	1.22	1.70	1.03	1.51
x.	Needful processing activities of rice seed	0.33	0.60	0.71	1.10	0.56	0.71
xi.	Means of ripened rice seed identification	0.28	1.03	0.59	1.17	0.86	1.24
xii.	Preferable stages rice seed production field visit	0.24	0.58	0.58	1.03	0.52	0.95
xiii.	Storage activities performed by the dealers to keep rice seed healthy	0.40	0.71	0.33	0.57	0.45	0.81
xiv.	Need for branding	0.20	0.49	0.16	0.52	0.17	0.60
xv.	Activities to be taken for determination of seed demand	0.19	0.35	0.10	0.32	0.20	0.37

*DCG= Dealer cum Grower

Table 3. Knowledge variation of the respondent stakeholders between before and after participation in the training

Group	Knowledge before			Knowledge after		
	Mean	SD	F-statistics	Mean	SD	F-statistics
Dealers	6.1792	4.82461	2.032 ^{ns}	10.9627	5.01454	4.085 ^{**}
Growers	7.6962	4.40445	(P=0.134)	13.4019	4.18065	(P=0.018)
Dealer cum Growers	7.8986	6.33412		12.5586	6.39261	

^{ns}Non-significant, ^{**} significant at 0.01 level

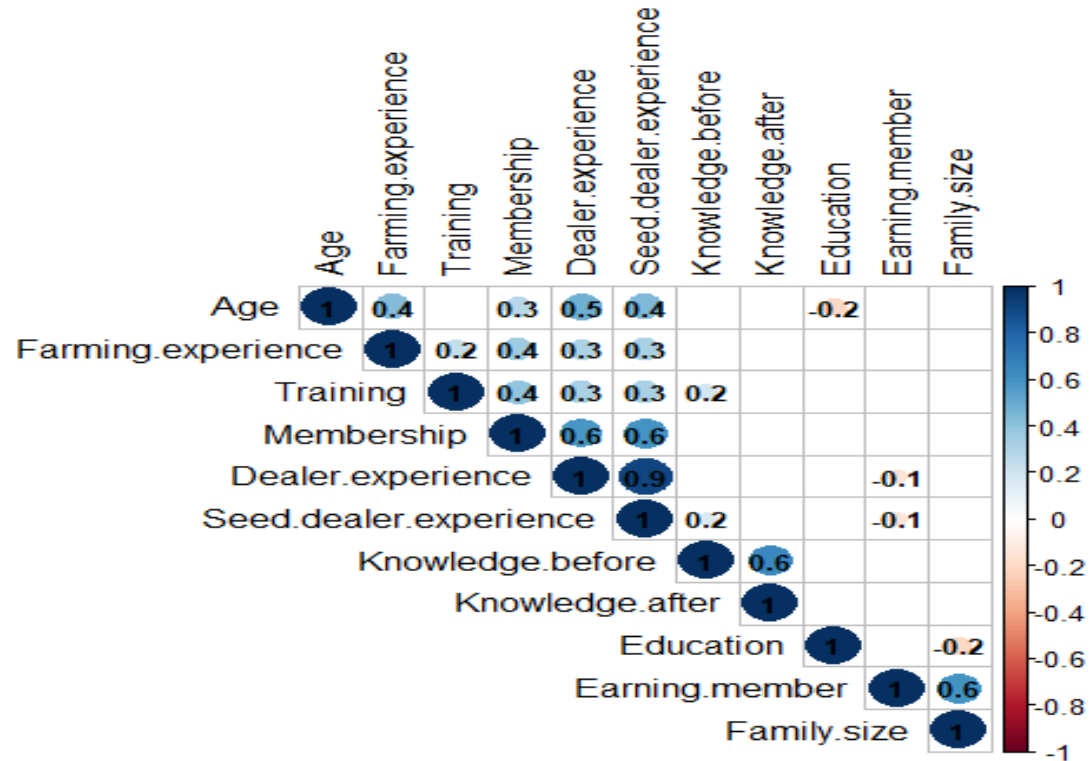


Fig. 1. Correlation coefficient matrix of the selected characteristics of the respondent dealers

There is also a noticeable positive correlation between dealership experience, seed dealership experience and farming experience with age (0.4). A corroborating study found that work experience (0.92**) has a significant positive correlation with age, which indicates that work experience such as; dealership experience, seed dealership experience and farming experience changes with age. Moreover, dealership experience and seed dealership experience had a positive correlation with the membership of the seed dealers' committee, which means experienced dealers have a better chance to be in the seed dealers' committee than the armatures'. There was a strong correlation (0.9) between dealership experience and seed dealership experience, while both kinds of experiences had a negative correlation with the number of earning members of families (-0.1). Education (-0.2) also had a negative correlation with age and family size, which states that with increasing age and family members, the dealers showed a declining trend in education level.

Results shown in Fig. 2 mean the correlation among selected variables for growers. A positive correlation between knowledge before and knowledge after is visible with a value of 0.7. It means that the higher the before-knowledge level of the respondents, the higher their after-knowledge. Training on seed production activities has a positive correlation with growers' seed commercialization ability (0.5) which means an increasing number of training increase farmers' ability to market their products. Others study also found the same result that training had a positive influence on the farmers' entrepreneurial and organizational competencies such as; agronomic practices, business planning, and value addition [15]. There is also a positive relationship between commercialization with age (0.4) and farming experience (0.5). It means that the longer the farming experience, the better the commercialization of harvested rice seed. This might be due to the fact that the respondents with long experience, knew the loopholes of rice seed production and they might have profited from rice seed production. Education (0.3) was found to be an influential factor for the dissimilation of growers' knowledge level before being trained. Farming experience had a significant influence on the access to agro-processing training for small-scale farmers and their coefficient was positive, which means that small-scale crop farmers with higher farming experience were more likely to receive a greater number of agro-processing training [16] and Fig.

2 reveals similar positive correlation of coefficient (0.3) results between growers farming experience and training on seed production. Though earning members increased with larger family sizes, growers' net income (-0.3) declined with increasing age. But grower's level of education was found to have a negative correlation with age, farming experience and the number of family members. It means that the older farmers with higher farming experience and a larger number of family members tend to have less chance to be educated. This is true because the country is going ahead along with the national literacy level. Therefore, the younger respondents showed a higher level of education.

Information contained in Fig. 3 present the correlations among selected variables for dealers cum growers. Dealer cum growers' number of attained training had a positive correlation with knowledge prior to training (0.4), while knowledge before and after training had a significant correlation value (0.6) indicating that training programs influence the level of knowledge, as training made a positive difference in knowledge level before and after being trained. Strong positive relationships were observed among age and different kinds of experiences such as; farming experience, dealership experience and seed dealership experience, which was found similar to the independent rice seed dealers and growers. In addition, the age of the respondents was highly related to their farming experience because a dealer cum grower becomes mature with his/her profession based on his/her attachment to the same. A big farmer or dealer has options to get involved with multiple farming entrepreneurship. They are very careful about their input and output association. Moreover, organizational membership is very closely related to agro-product dealership and seed dealership experience. This might be due to the fact that the experienced dealers cum growers are benefitted because of their involvement with the different organizations. Furthermore, dealer cum growers' organizational membership also positively correlated with training (0.5) and harvested seed commercialization (0.4). Experienced dealers cum growers can be more efficient about their investment at the same time efficient use of input and output in seed production. Again, seed dealership experience was significantly related to the commercialization of harvested rice seed, which means dealer-cum-growers having long experience in seed dealership maximize the sale

of their portion of products. The number of earning members in dealer cum grower's families was moderately related to age and number of family members.

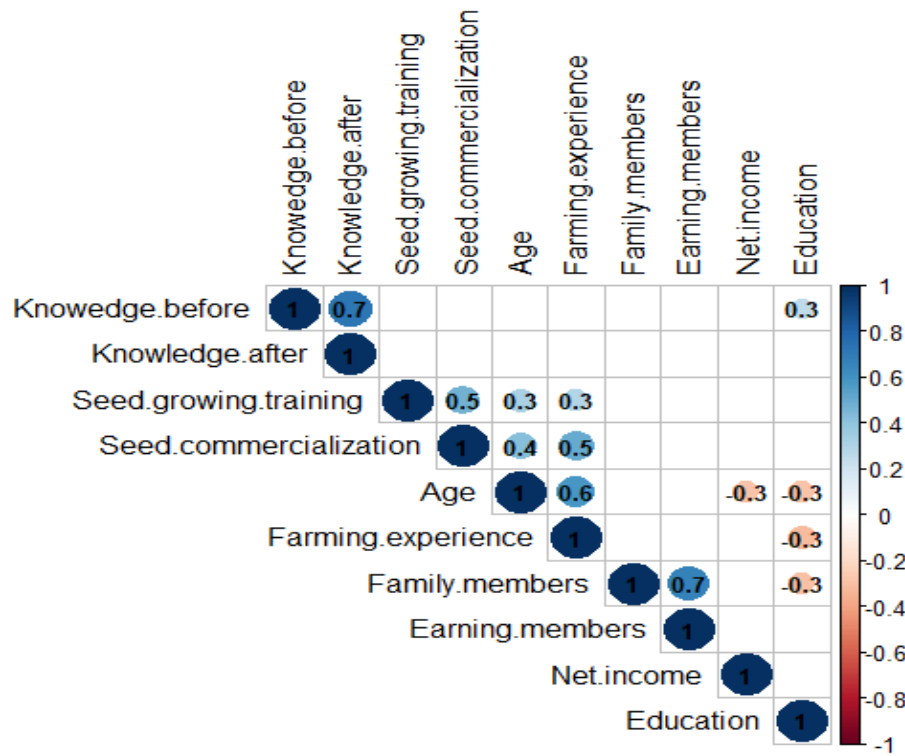


Fig. 2. Correlation coefficient matrix of the selected characteristics of the respondent growers

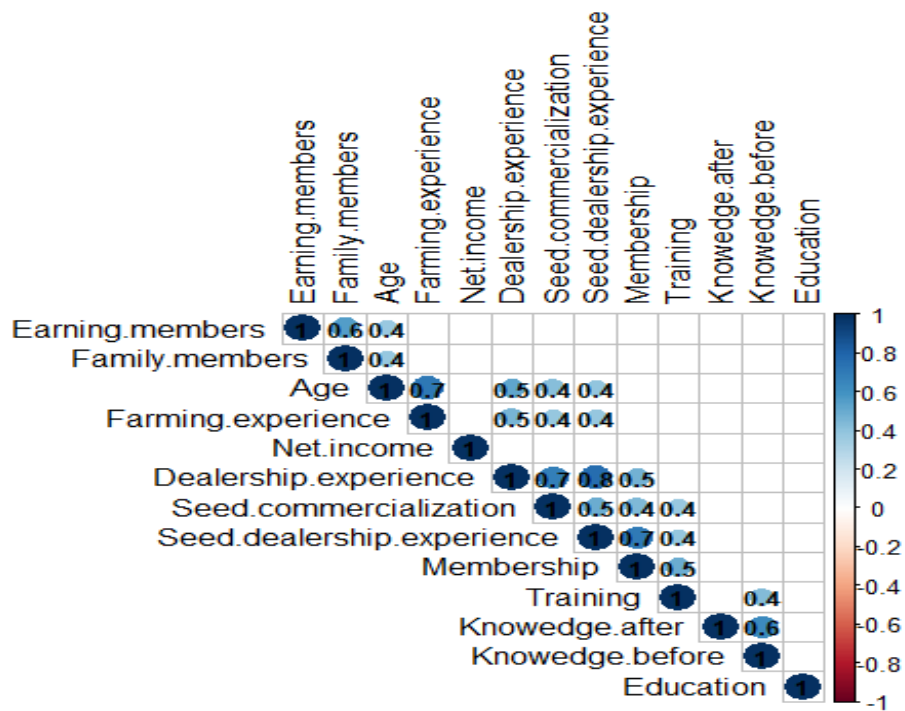


Fig. 3. Correlation coefficient matrix of the selected characteristics of the respondent dealer cum growers

3.4 Impact of Training on the Respondent Stakeholders

A t-test was employed to identify the significance of the difference between pre and post-training evaluations. Results indicate that the differences are significant for all three groups of respondents (Table 4). That means all three groups gained knowledge from the training and improved upon it. As a result, it can be inferred that the majority of the respondents had low knowledge prior to the training, whereas most of them demonstrated moderate knowledge after the training, and a few of them indicated high knowledge.

Table 4. Differences in the knowledge of respondent stakeholders during pre and post-training evaluation

Respondent	t-values	Significance (2-tailed)
Dealers	19.67	.000
Growers	14.80	.000
Dealer cum growers	4.82	.000

This clearly demonstrates that training has a large and favorable impact on responders' knowledge levels. The results were also in line with several studies that vegetable growers showed better knowledge of insect pests, and the proper use of pesticides adopted more IPM practices and reduced the frequency of spraying after getting training on Integrated Pest Management (IPM) [5,12]. Moreover, goat farmers who participated in different training programs had significant positive t- values, which

means after attending these training programs made some difference in the knowledge of the farmers [17]. Average knowledge scores of all different stakeholders for pre and post-training evaluation were increased significantly which indicates to the effectiveness of training programs.] Study contributing the same results state that training is a crucial factor in knowledge generation and information dissemination among farmers, also taking an additional training program could increase the likelihood of organic farming by 13.0 percent and reduce the prevalence of inorganic farming by 11.0 percent [18].

3.5 Perceived Utilization of the Training Outcomes

Results contained in Table 5 show the perceived use of knowledge acquired from the training. Around 45.0 to 70.0 percent of the dealers cum growers shared that they would use the knowledge acquired from the training to a very high extent. The opinion was recorded against a five-point rating scale that was designed to measure the utilization of the training by the respondents. A major portion (41.2 and 38.2%, respectively) of dealers mentioned that they would use the knowledge gained moderately for seed demand assessment and seed marketing; whereas 46.8 percent of growers expressed that they would use the knowledge to a very high extent for advising other farmers. Among the dealers cum growers, 51.7 percent shared that they would use the knowledge to a very high extent for seed marketing.

Table 5. Perceived utilization of knowledge by the respondent stakeholders acquired from the training

Respondents	Subject	Extend of use	Percent
Dealers (N=199)	Advising farmers about using seed	Very high	44.7
	Advising about seed production	Moderate	32.7
	Seed storing	Moderate	36.7
	Seed demand identification	Moderate	41.2
	Seed marketing	Moderate	38.2
Growers (N=62)	Seed production	Very high	45.2
	Seed processing	Moderate	37.1
	Seed storing	High	40.3
	Advising other growers	Very high	46.8
Dealer cum growers (N=29)	Seed marketing	Moderate	37.1
	Advising farmers about using seed	Very high	69.0
	Advising about seed production	Very high	51.7
	Seed storing	Very high	51.7
	Seed demand identification	Very high	44.8
	Seed marketing	Very high	51.7

Another similar study found that more than half of the dealers used their knowledge for advising on product choice. They also advise on product application, handling, storage, health effect, disposal, environmental effect, and labeling [19]. In a separate study, supporting the result, found that more than three-fourths (85.0%) of the farmers had low to medium knowledge and they used their knowledge for quality seed production [20]. However, dealer cum growers assume the responsibility to maintain the market demand for the rice varieties by using their knowledge [21].

4. CONCLUSION

Regular training is important to improve the skills and adoption ability of seed systems stakeholders with respect to agricultural innovations. Most of the stakeholders do not want to switch over to new technologies or new varieties of seeds. This is because of the lack of awareness about new products or their lack of interest in new things, and that is a major reason why Bangladesh lags in agricultural productivity. Proper training among the seed stakeholders can improve this situation. As seen in this study, most of the stakeholders responded positively to the training and their responses towards the utilization of the knowledge were really up to the mark. This indicates an expected change in their adoption ability for new innovations. Post-training assessment gives an idea about the extent of knowledge gained by the respondents. There is a huge scope for government and private organizations in Bangladesh for arranging proper training to actors in the agriculture sector. Such organizations may conduct need-based training and also evaluate the impact of training for further information.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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