Adoption of potato variety ACI Alu-10 (Valencia) to ensure food security in Bangladesh

ABSTRACT

To transform the cropping pattern or add a new potato variety like ACI Alu-10 (Valencia) to the existing cropping pattern, it is essential to have adequate farmers' knowledge and a favorable attitude towards that variety. In addition, the better performance of the variety in comparison to other market leader varieties is also necessary. Against such a backdrop, the present study determined farmers' knowledge and attitude towards the potato variety (Valencia) and compare the selling price, yield, harvesting period, and cost of production of this variety with other potato varieties. Data were collected from randomly selected 139 farmers of Bogura and Joypurhat districts. A face-to-face interview followed by a structured questionnaire were used to collect data. The survey revealed that the Valencia users had higher knowledge and a more favorable attitude towards the variety than the non-Valencia users. The t-test showed a significant difference between Valencia users and non-Valencia users regarding the price, harvesting period, and cost of production, indicating that Valencia has a shorter harvesting period, higher selling price, and lower production cost. On the other hand, the result indicates that 62 days Valencia yield was almost near to the 74 days of other check potato varieties yield. By getting early and higher cash through selling Valencia, farmers can utilize the amount to improve their livelihood and solve problems. The findings may be helpful to policymakers in the decision to include Valencia in the current cropping pattern to increase potato production and food security in Bangladesh.

Keywords: Cropping pattern, Earliness, Profit, Food security, New Potato Variety, Valencia

1. INTRODUCTION

Agriculture is the bedrock of Bangladesh's economy. The sector is the third most important regarding Gross Domestic Product (GDP) contribution and play an important role in the second most important sector (industry) by supplying raw materials [1,2]. The country produces various crops, including rice, wheat, maize, and potato. Potato is one of the most important tuber crops

grown in Bangladesh for its higher yield, good nutrition, easy digestibility, and many industrial uses [3]. Because of its high yield potential and food value compared to rice and wheat, it is considered a promising candidate crop for feeding the world's hungry people [4]. Bangladesh occupies the 6th position in potato production around the world. It produces around 10 million tons per year from half a million hectares of land yielding about 20.4 tons per hectare [5].

The country produces different varieties of potatoes like BARI Alu-7 (Diamant), BARI Alu- 8 (Cardinal), BARI Alu-25 (Asterix), and ACI Alu-10 (Valencia), etc. These varieties differ in yield, production cost, and harvesting period. The Valencia is a potato variety that started its journey to the country since a few years. Advanced Chemical Industries (ACI) Seed, a private agro-based company launched this variety in Bangladesh. High-yielding potato varieties significantly influence potato production, profitability, and cropping patterns. A good variety of potatoes lead to higher yields due to improved plant vigor, disease resistance, and tuber quality [6]. It is assumed that this Dutch import (Valencia) variety may play an important role in the potato industry with its impressive yields, disease resistance, and suitability for both table consumption and industrial uses.

The cultivation of potatoes is a common scenario in the country's cropping pattern [7]. Cropping pattern means the number of crops cultivated in a year one after another in a locality. At present, in Bangladesh, four types of cropping patterns exist. These are single cropping (one crop is cultivated in a year), double cropping (two crops are cultivated in a year), triple cropping (three crops are cultivated in a year), and quadruple cropping (four crops are cultivated in a year). Among these patterns, the quadruple cropping area is the lowest, and the double cropping area is the highest [8]. The cropping pattern has a direct relation with cropping intensity. The cropping pattern can be changed to increase cropping intensity. The county is trying to increase cropping intensity by adding more crops to the existing cropping pattern. To achieve this milestone, the selection of short-duration crop varieties is very much important.

Gradually decreasing cultivable land is one of the major challenges of Bangladesh agriculture. The highest utilization of land through the increase in the number of crops in the cropping pattern may help to overcome this challenge. The present study is an attempt to assess the probability of introducing the potato variety ACI Alu-10 (Valencia) in the existing cropping pattern to increase the cropping intensity as well as potato productivity in Bangladesh. Lack of

knowledge and unfavorable attitude towards a variety may failure to implement that production by the farmers. Besides, variety performance is also another important aspect of accepting a variety by the farmers. In this regard, the present study will assess farmers' knowledge and attitude towards ACI Alu-10 (Valencia) and compare the performance of Valencia with other market-leading potato varieties. The indicators of variety performance are selling price, production cost, harvesting period, and yield. There are several studies on potato production, but there is an acute scarcity of research on assessing farmers' knowledge and attitude towards Valencia and checking the performance of Valencia with other potato varieties. The study has been conducted to fill this gap.

2. METHODOLOGY

In Bangladesh, potato is grown everywhere however it's plenty of production is observed in the northern part of the country [8]. Therefore, the study has been conducted in Bogura and Joypurhat -two intensive crop production districts in Bangladesh [9]. Two villages from these districts were selected through multistage purposive sampling. There were 462 potato growers lived in the villages that were considered as population for the study. Considering 30% of the total population, 139 farmers were selected randomly to collect data.

Data were collected by using a household survey followed by a questionnaire. For this, a structured questionnaire was prepared before the survey keeping objectives in mind. The questionnaire consisted of three parts. In the first part, farmers' knowledge regarding Valencia was included. To measure farmers' knowledge, they were asked questions regarding various aspects of Valencia. A total of 10 questions regarding this potato variety were formulated in the questionnaire [10]. A score of 2 was assigned for each question. The farmers were evaluated based on their performance of giving the right answer. The second part of the questionnaire was farmers' attitudes towards the performance of Valencia. To measure farmers' attitudes a number of statements was formulated in the questionnaire. The statements were collected through a literature review. Then farmers were asked to give comments on the statement on a 5-point rating scale such as strongly agree, agree, neutral, disagree, strongly disagree [11]. The performance of Valencia in comparison to other potato varieties regarding selling price, production cost, harvesting period, and yield was highlighted in the third and last part of the questionnaire. Before

applying the questionnaire for data collection, it was checked by the expert opinion and pre-test with a few potato growers. The collected data were then coded and entered into the software. Some common statistical parameters, such as mean, percentage, frequency, standard deviation, and t-test, were used to analyze the data. The analysis was done through the use of software SPSS version 23.

3. RESULTS AND DISCUSSION

3.1 Farmers' Knowledge on Potato Variety Valencia

To adopt a technology the farmers first know or hear about that technology [12]. Therefore, knowing users' or farmers' knowledge is the first and most important step to accept or cultivate a technology like Valencia. The observation score of potato growers' knowledge of Potato Valencia was 2 to 20. Based on the score the farmers were divided into 3 groups namely poor knowledge (up to 7), fair knowledge ((>7 to 14), and high knowledge (above 14 to 20) [10, 13]. However, the observation score and mean was varying between Valencia users and Non-Valencia users. The finding regarding the knowledge score of both groups are presented in Table 1.

Table 1. Distribution of the potato growers based on their knowledge on Valencia

Categories and score	Valencia users			Non-Valencia users		
	Number	%	Mean	Number	%	Mean
Poor knowledge (up to 7)	9	12.5	15.75	38	53.7	8.60
Fair knowledge (>7 to 14)	44	61.1		12	20.9	
High knowledge (above 14 to 20)	19	26.4		17	25.4	
Total	72	100		67	100	

t=1.846* (*= significant at .05 level)

It was observed from table 1 that among the Valencia users, the majority of the farmers (61.1%) had fair knowledge about the variety while in the case of the non-users, the majority of the farmers (53.7%) had poor knowledge about the variety. There was a significant mean difference between the two groups (Valencia users and non-users) regarding the knowledge score of Valencia. It means the Valencia users had significantly higher knowledge than the non-Valencia users. It may happen due to the reason that the Valencia users gave more effort and spent time to learn about the Variety as they thought about its cultivation. Therefore, it is recommended that the concerned authority should take steps to increase farmers' knowledge of this variety.

3.2 Farmers' Attitude towards performance of Valencia

After gaining farmers' knowledge on a technology, a favorable or unfavorable attitude forms in their mind which helps to take decisions either accept or reject about that technology. The observation score of potato growers' attitude towards Potato Valencia was 4 to 50. Based on the score, the farmers were divided into 2 groups- favorable attitude (≥ mean) and unfavorable attitude (< mean) [14, 11]. However, the observation score and mean was varying between Valencia users and Non-Valencia users. The findings regarding the attitude score of both groups are presented in Table 2.

Table 2. Distribution of the potato growers based on their attitude towards Valencia

Categories	Valencia users			Non-Valencia users		
	Number	%	Mean	Number	%	Mean
Favorable attitude	40	55.6	42.10	20	29.9	16.69
Unfavorable attitude	32	44.4		47	70.1	
Total	72	100		67	100	

t=10.447** (**= Significant at .01 level)

It was observed from table 2 that among the Valencia users, majority of them (55.6%) had a favorable attitude towards the variety while the picture is reversed for the non-Valencia users. Among the non-Valencia users, majority (70.1%) possessed unfavorable attitude towards the performance of the variety. Attitude is an important option to receive and implement a technology [12]. A favorable attitude towards the Valencia may help the users to take decision for cultivation this variety. The concerned public and private sectors should take steps to make a favorable attitude of the farmers towards the variety for higher implementation.

3.3 Comparison between Valencia and other potato varieties regarding selling price, yield, harvesting period, and cost of production

The first fortnight of November is the right time for potato plant in Bangladesh. In certain north-western area (Bogura, Joypurhat and Nilphamari), farmers even plant potatoes in October to harvest the crop early. The potato farmers of these districts are happy with the good price of early potatoes. Notably, there is an increasing trend in the production of potatoes in the early season in Bangladesh. To check the early performance of ACI Alu-10 (Valencia) in comparison to other commonly cultivated potato varieties BARI Alu-7 (Diamant), BARI Alu-25 (Asterix), and BARI Alu- 8 (Cardinal), a t-test was done. Four indicators of Valencia's performance such as

selling price, yield, harvesting period, and production cost were considered and tested. The result is shown in table 3. It was observed from the table that regarding selling price the mean value of the Valencia users was significantly higher than the non-users. Thus, the test showed a significant relationship between Valencia users and non-users regarding potato selling prices. It means there was a significant difference of Valencia and other potato varieties selling price. The price of Valencia was higher than other potato varieties. It happened due to an earlier harvesting option. In Bangladesh, not only potato but also for any other crops usually get higher price if it can be harvest earlier than other similar crops. The consumer prefers most a crop if they get to market early or at the beginning of the harvesting season. The demand for potatoes was high when only one variety or little amount exist in the market.

Table 3. A comparison between Valencia and other potato varieties regarding selling price, yield, harvesting period, and production cost

Item	Valencia User		Non-Valencia user		t-value
	Mean	SD	Mean	SD	
Selling price (Tk./Kg)	42.76	7.08	30.51	8.15	7.47*
Yield (Ton/acre)	7.62	3.64	8.24	4.05	3.59^{NS}
Harvesting period (days)	62.48	9.07	73.84	11.41	10.08**
Cost of production (000 Tk/acre)	96.95	85.55	117.28	96.77	2.87*

NS= Non-significant, * = Significant at 5% level of confidence, ** = Significant at 1% level of confidence, Tk= Bangladeshi currency

In the context of yield, it was observed that the average yield of Valencia compare to other potato varieties have not significant difference. This means the yield of Valencia and other potato varieties are more or less similar. The characteristics of Valencia such as growth, early bulking, disease tolerance, and adjusting ability to the local environment may be the reasons behind higher yield at 60-65 days [15]. Additionally, taking the initiative for increasing farmers' knowledge and favorable attitude towards Valencia may be helpful to increase the level of yield of this variety.

The test also revealed that there is a significant difference between Valencia and other potato varieties regarding the harvesting period. This means the bulking comes first in Valencia compared with other varieties. It was found from the analysis that on average the Valencia can

be harvested within 62 days whereas it was almost 74 days for other potato verities. The potato farmers can save about two weeks if they choose the variety Valencia. This time may help them to prepare land for other crop cultivation earlier.

The last parameter of crop performance was the production cost. If the production cost of a variety is high then there is a less probability to adopt that variety by the farmers [16]. In this consideration, the present study selected this parameter (production cost) and found that there is a significant difference between Valencia and other potato varieties regarding production cost. It requires comparatively less cost to cultivate Valencia. The earlier maturity period may be one of the important reasons for the lower cost of cultivation. For earlier maturity or short duration variety, it requires less fertilizer, pesticide, irrigation and labour.

So, regarding the performance of Valencia, we found three important findings which are high selling price, early maturity, and lower production cost. In a country like Bangladesh where land is gradually decreasing and population is increasing, the number of crop can be cultivated throughout the year utilizing same land is very much important. In this context, the selection of short-duration crops and include in the existing cropping pattern can be helpful to ensure crop productivity or food security in Bangladesh. Valencia can be an ideal selection of variety to include in the present cropping pattern to increase crop productivity in Bangladesh due to its nature regarding selling price, short duration, and lower production cost.

4. CONCLUSION AND RECOMMENDATION

Ever-increasing trend of population and decreasing trend of cultivable land is a major challenge to ensure food security in Bangladesh. Development and implementation of short duration crop varieties may help to overcome the challenge. This study found the potato variety Valencia as a short-duration crop. To use any technology or variety it is important to examine farmers' knowledge, attitude, and crop performance. The present study fulfilled this necessity and found that the Valencia users had higher knowledge and favorable attitudes towards the variety than the non-users. It is therefore concluded that to disseminate Valencia it is important to increase farmers' knowledge and form a favorable attitude toward the variety. It can be said from the statistical analysis that Valencia had a lower harvesting period, higher selling price, and a lower cost of cultivation in comparison to other potato varieties. By getting early and higher cash through selling Valencia, farmers' can utilize the amount to improve their livelihood and solve problems. They may also make better plans to cultivate the next crop, especially hybrid rice/

HYV rice/ other crops based on local demand, and prepare the land accordingly. Due to the proper plantation time of hybrid rice/ HYV rice/ other crops, the farmers may get higher yields and better benefits from their same land.

As the Valencia cultivars got production in a shorter period with less production cost and higher selling price, therefore, the public organizations specially Bangladesh Agriculture Development Corporation (BADC) and the Department of Agricultural Extension (DAE) along with private sectors should come forward to supply and motivate farmers to cultivate Valencia variety. Thus, it may help to desired change of cropping pattern, increase cropping intensity, increase overall crop production, and ensure food security for the country.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

We declare that generative AI technologies such as large language models (ChatGPT, COPILOT, etc.) and text-to-image generators have NOT been used during manuscript writing or editing.

COMPETING INTERESTS

The authors have declared that no financial or other competing interests exist.

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