Present Practices and Constraints of Juice and *Gur* Production from Date Palm Trees in Bangladesh

ABSTRACT

Aims: The aim of this study was to determine the present status of date palm juice and *gur*, to assess the socioeconomic characteristics of respondents involved in date palm juice and *gur* production, and to explore the production-based constraints of date palm *gur*.

Study Design: The cross-sectional survey method was used in this study, along with a descriptive research design.

Place and Duration of the Study: The study was conducted in 4 upazilas (sub-district), namely Bagha, Lalpur, Khjjuria and Dumuria, under the 4 districts Rajshahi, Natore, Jessore and Khulna in Bangladesh, from November 2020 to March 2021.

Methodology: Out of 133 farmers, 97 were selected as samples using a random sampling technique. Data collected using a structured questionnaire were subjected to descriptive analysis, including frequency count, percentage, and mean for describing the level of selected variables.

Results: Rajshahi had a maximum area covered by date palm trees (12.02 ha), the highest number of trees (1129), and the highest amount of produced *gur* (14454 kg) compared to other districts. The greatest percentages of farmers were old (43.3%) and had a high annual income (42.3%). All the farmers used seed as propagating material. In case of constraints, 'decrease of number of *gachi'* ranked first followed by 'adulteration of *gur'* second and 'decrease of number of date palm trees' third.

Conclusion: It can be concluded that a decreased number of gachi is one of the major constraints for juice and *gur* production in Bangladesh. Continuous training and management of date palm trees, as well as the production of juice and *gur* with scientific technology, will improve farmers' incomes and livelihoods.

Keywords: *Gur* adulteration; date palm; farmers, Juice

1. INTRODUCTION

A major plantation crop in many nations in the arid regions of West Asia and North Africa is the date plum (*Phoenix sylvestris* L.), which belongs to the family Arecaceae [1]. The plant can withstand extreme temperatures, water stress, and salinity better than many other

fruit crops; it is regarded as an emblem of life in the desert. Date palm fruit, juice, and *gur* are very popular in urban and rural people in Bangladesh. Date fruit contains carbohydrates, proteins, fibers, fats, vitamins and minerals, viz., Fe, Ca, K, Mg, S, Cu [2]. Fruit is one of the most nutrient-dense foods readily available to people in arid and semiarid regions of the world due to its high sugar content [3]. Furthermore, depending on the variety and maturity stage, fruit contains 15-30% water [4]. Products made from date palm trees, such as juice, *gur*, vinegar, wine, and chocolate, are crucial components of the food and allied industries, providing good opportunities for people to enhance their income and, consequently, their standard of living [3]. Furthermore, it is critical to environmental and ecological balance. It aids in the mitigation of natural disasters. It also serves as a protective barrier against storms, cyclones, and other natural disasters. It can also survive both flooding and drought. The leaves can be cut and mixed with straw to be fed to livestock during floods. *Gur* can be used in place of sugar to significantly reduce sugar consumption. Additionally, date palms are a significant source of home fuel. Recently, brick kilns have employed it extensively. Making mats, using building materials, and creating other handicrafts are all excellent uses for these materials. It also serves as insurance for the farmers throughout their difficult economic times. Date palm is grown as a homestead crop in Bangladesh, but it also naturally occurs or is grown in fallow areas, next to dwellings, along the edges of farmlands, and even in marginal areas along roads and canals. It is the most profitable tree because it has low or no production costs for a farmer [5]. It is mainly grown in the greater districts of Jessore, Khulna, Noakhali, Patuakhali, and Rajshahi. According to Year Book of Agriculture 2021, date palm is grown on around 68400 hectares of land, and total estimated juice production is 149760 MT @ 10 percent *gur* recovery. 14976 MT of *gur* is produced per year in Bangladesh. Farmers in Bangladesh's rural agrarian regions use their own indigenous expertise and utilization pattern in every stage of date palm upkeep, from planting through sap collection and product processing. Farmers primarily manage the palm for sap production, which is used to make sugar-based secondary commodities (e.g., *gur*). The sap is either consumed fresh or processed into molasses, *gur*, and/or alcoholic beverages [6].

Date palm trees require minimum management effort, farmers get juice from the trees every year, and production cycle runs many years [7]. It provides farmers with year-round income generation, and their products also serve as a backup in case their crops fail due to unfavorable meteorological circumstances [8]. In Bangladesh, farmers are cultivating date

palm trees to sustain their livelihood with higher income [9].Date palm cultivation in our country is declining due to a lack of technical understanding about date palm plant cutting, juice tapping (collection), *gur* manufacturing, and preservation [10]. Insufficient fuel is another issue that affects the production of *gur* from date palm plants, as well as juice collection, date palm cutting man (*gachee*), juice tapping, and marketing and storage facilities for both *gur* and juice. *Gachee* wages have also increased. Date palm trees, however, could be able to help the rural economy of the nation to a significant level if we are able to identify the limits' solutions in a more sustainable and scientific manner with the assistance of farmers' indigenous knowledge. Farmers can profit from date palm juice and gur, which helps boost their income and livelihood. Although date palm is a significant crop, no studies have been done to determine why date palm tree populations are declining, how they are currently being cultivated, or what would happen if no action is taken. Therefore, the objectives of the research were as follows

I. To determine the present status of date palm juice and *gur* in Bangladesh;
II. To assess the socioeconomic characteristics of respondents involved in date palm juice and *gur* production;
III. To explore the production based constrains of date palm *gur.*

2. METHODOLOGY

This study was conducted using a cross-sectional survey method. A systematic interview schedule was meticulously constructed in order to capture relevant data for a pre-determined sample, and it comprised both open and closed form questions.

2.1 Description of the study area

The study was conducted in Bagha, Lalpur, Kjajuria, and Dumuria upazilla of Rajshahi, Natore, Jessore, and Khulna districts, respectively. The increased incidence of date palm agriculture led to the deliberate choice of the study region. Bagha, Lalpur, Kjajuria, and Dumuria are the main districts, with average altitudes ranging from 23.25 meters to 10.89 meters above sea level with an annual rainfall of 186 cm.

2.2 Population and sampling

Four upazillas (sub-districts) namely Bagha, Lalpur, Kjajuria, and Dumuria, of the four districts of Rajshahi, Natore, Jessore, and Khulna, were chosen purposively. All the date palm-growing farmers from the selected area comprised the population of the study, which

constituted a total of 133 farmers. Among them, 97 farmers (80% of the total respondents) have been selected randomly as sample of the study [11]. Respondents were chosen using proportionate random sampling from each upazila.

2.3 Data collection and statistical analysis

During the period from November 2020 to March 2021, information was gathered directly from respondents who were farmers. Data were analyzed using the SPSS v23 statistical package for social science. To meet the study's aims, descriptive statistics such as frequency count, percentage, and mean were generated. For a better understanding and interpretation of the phenomenon of interest, the data were divided into several groups. Furthermore, the findings were presented in the form of tables and figures.

2.4 Calculate constraints index

An attempt has been made to compare the constraints faced by the respondents. There are 11 constraints that have been selected based on the farmers' opinions. To determine the constraint index the following formula has been followed:

Constraint index (PI) = $(N_h \times 3) + (N_m\ 2) + (N_l \times 1)$

Where,

N_h =Numbers of respondents faced high constraints

Nm = Numbers of respondents faced medium constraints

N_l = Numbers of respondents faced low

The constraint index of all the items could range from 97 to 291, while 97 indicated low constraints faced and 291 indicated high constraints faced.

3. Results and discussion

3.1 Area coverage by date palm tree

Table 1: Area coverage by date palm trees in the study area

District	Upazilla	Area (ha)
Rajshahi	Bagha	12.02
Natore	Lalpur	11.77
Jessore	Khajura	8.25
Khulna	Dumuria	3.12

Total	**35.16**

Table 1 shows the area coverage by date palm trees in four districts, namely Rajshahi, Natore, Jessore and Khulna. Among the four districts, four upazillas, viz., Bagha, Lalpur, Khajura, and Dumuria, were designated as study areas. The maximum (12.02 ha) area covered by date palm trees in Bagha upazilla was followed by lalpur upazilla (11.77 ha), and the minimum area (3.12 ha) was covered by date palm trees in dumuria upazilla of Khulna district.

3.2 Age wise distribution of date palm trees

Table 2: Distribution of date palm trees according to their age in the study area

Age (years)	Bagha	Lalpur	Khajura	Dumuria
6-10	146	173	105	113
11-15	354	448	279	132
16-20	435	330	270	131
21-25	163	120	88	22
>25	31	16	36	0
Total	**1129**	**1087**	**778**	**398**

Date palm trees distributions on the basis of their age were represented in table 2. The survey data showed that the number of date palm trees falling into the 6-10 year age category was 146, 173, 105, and 113 in Bagha, Lalpur, Khajura, and Dumuria upazilla, respectively. Similarly, according to the age group 11-15, the number of date palms was 354, 448, 279, and 132; according to the age group 16-20, the number of date palm trees was 435, 330, 270, and 131; and the number of date palm trees above the age of 25 was 31, 16, 36, and 0 in the study area, respectively. From the table, it was found that highest number of date palm trees fall into the11-15 years age category, while the lowest numver of date palm trees belonged to the group up to 25 years. Lalpur upazilla of Natore district had the maximum number of date palm trees (448) falling into 11-15 years age category, while no date palm trees were found in Dumuria upazilla of Khulna district falling into the group up to 25 years.

3.3 Distribution of date palm trees

According to the data in Table 3, there has been a decrease in the number of date palm trees in recent decades. The survey found a large number of date palm trees prior to 20 to 30 years ago when compared to subsequent decades.

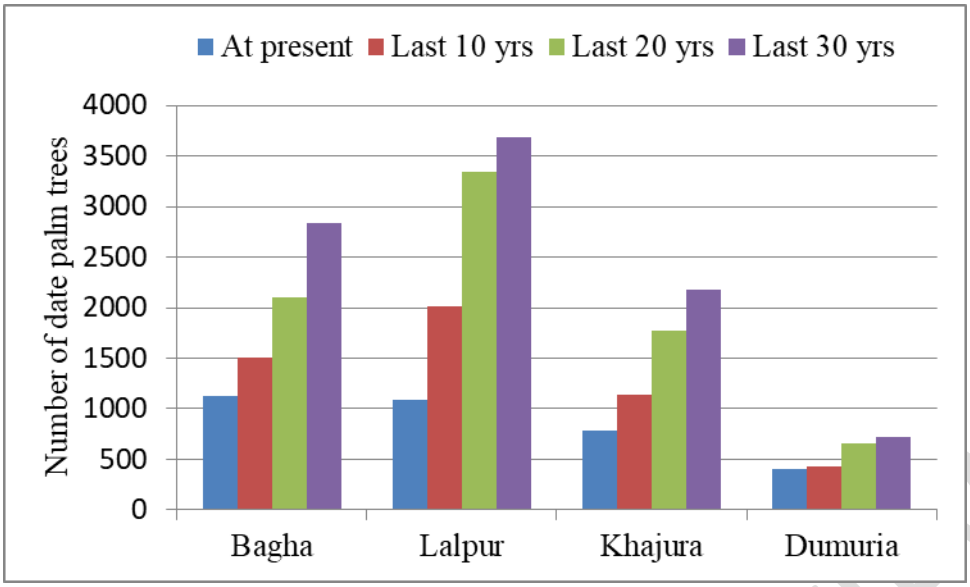

Figure 1: Number wise distribution of date palm trees in last 30 years in the study area/Distribution of number of date palm trees in the study area in last 30 years

At present, Bagha upazilla has 1129 date palm trees, whereas Lalpur, Khajua, and Dumuria have 1087, 778 and 398 date palm trees, respectively. Before 10 years, Bagha, Lalpur, Khajua, Dumuria upazilla had 1509, 2018, 1142, and 434 date palm trees, respectively. Before 20 years, Bagha, Lalpur, Khajua, Dumuria upazilla had 2100, 3338, 1776, and 658 number of date palm trees, respectively. Before 30 years, Bagha, Lalpur, Khajua, and Dumuria upazilla had 2840, 3680, 2178, and 719 date palm trees, respectively. Kamaluddin *et al*. [12] also observed a similar reduction while conducting a survey on the distribution of date palm in the rural landscape of Bangladesh. The drastic reduction in the number of date palm trees was found in Dumuria upazilla of Khulna district. Dutta and Iftekhar [13] identified the cause of reduction of date palm as the salinity intrusion in the greater part of khulna region.

3.4 Date palm gur production (kg)

Table 3: Date palm gur production in the study area

District	**Upazilla**	**Amount (kg)**
Rajshahi	Bagha	14454
Natore	Lalpur	14123
Jessore	Khajura	5258
Khulna	Dumuria	1188
Total		**35023**

There were three forms of date palm *gur* produced in the study area: semi-liquid, solid, and patali. Table 4 displays the output of date palm gur. The maximum amount of *gur* (14454 kg) was produced in Bagha upazilla of Rajshahi district, followed by lalpur upazilla (14123 kg) of Natore district. Whereas the minimum amount of gur (1188 kg) was produced in Dumuria upazilla of Khulna district.

3.5 Annual income of respondents

Table 4: Distribution of respondents according to their annual income from date palm trees in the study area

Annual income (Tk.)	**Frequency (n=97)**	**(%)**
Low (up to 50,000)	33	34
Medium (>50000-100000)	23	23.7
High (>100000)	41	42.3

n: number of respondents

On the basis of annual income, the respondents were classified into three categories, as presented in Table 5. Based on annual income, the highest proportion (42.3%)of the respondents had a high annual income of more than 100 thousand BDT, compared to 23.7% with a medium annual income of 50-100 thousand BDT and 34 % under a low annual income of up to 50 thousand BDT.

3.6 Age of the respondents

Table 5: Distribution of respondents according to their age in the study area

Age (yrs)	**Frequency (n=97)**	**(%)**
Young (up to 30)	21	21.6
Medium (>35-50yrs)	34	35.1
Old (>50 yrs)	42	43.3

n: number of respondents

Table 6 lists the number of respondents' ages in the study area. The highest percent (43.3%) fell into the group up to 50 years of age, while the lowest portion (21.6%) of them belonged in the group of up to 30 years.

3.7 Intercultural practices of date palm trees

Table 6: Distribution of respondents according to intercultural practices of date palm trees in the study area

Intercultural practices	Frequency (n=97)		Percentage (%)	
	Yes	No	Yes	No
Fertilizer	0	97	0	97
Irrigation	0	97	0	97
Pest management	0	97	0	97
Propagation by seed	97	0	97	0
Vegetative propagation	0	97	0	97

n: number of respondents

The most significant intercultural operations in an orchard are fertilization and irrigation. It is especially significant in date palm cultivation since date palms are frequently cultivated in sandy soil with low water and nutrient retention capacity. Since date palm trees have a shallow root system, the effectiveness and frequency of watering are crucial for sustaining production [14]. Based on the data, 97% respondents did not irrigate their date palm trees.

Several diseases and insect pests damage date palm trees and fruits. The severity of the difficulties varies according to the cultivar utilized, climatic conditions, and cultural practices applied [15]. In most situations, insect pest damage results in significant yield losses and, hence, economic losses. Despite the presence of many pests and diseases in the research area, 97% of respondents did not perform pest management.

Date palms, like other fruit crops, can be propagated vegetatively and generatively. According to the data, 97% of the respondents in the study area employed seed for date palm tree growth. Date palm trees propagated by seeds are produced low inferior-quality fruit and low yields [3]. The results of this investigation showed that the propagation technique used in the chosen area is typically not the best for date palms which is in agreement with the findings of Salah *et al*. [16] and Hussen *et al*. [17].

3.8 Common practices of date palm juice and gur production

Table 7: Distribution of respondents according to common practices of date palm juice and gur production in the study area

Practices	Frequency	Percentage (%)

	(n=97)			
	Yes	No	Yes	No
Cutting by own	44	53	44	53
Cutting by Gachi	07	90	07	90
Use of V-type cutting	97	0	97	0
Use of U-type cutting	0	97	0	97
Use of soil made pot for juice collection	97	0	97	0
Use of others type of pot for juice collection	0	97	0	97
Use of protection for juice collection	0	97	0	97
Use of lime during juice collection	47	50	47	50
Use of crops residue as a fuel for juice boiling	44	53	44	53
Use of garments debris for juice boiling	47	50	47	50
Use of fuel wood for juice boiling	22	77	22	77

n: number of respondents

Common practices of date palm juice and *gur* production in the study area were represented in the Table-8. Data showed that 44% of respondents were involved in cutting on their own, whereas 7% of respondents engaged gachi for cutting. For extraction of juice, 97% respondents used V-type cutting, while no respondents were involved in U-type cutting. During juice collection, 97% of respondents used soil made pot and 47% used lime, whereas no respondents used protectors like bamboo skirts, polythene skirts, jute stick etc for juice collection. In case of boiling of juice for gur production 44% of respondents used crop residue, 47% used garments debris and 22% respondents used wood as fuel.

3.9 Constraints of date palm gur production in the study area

Table 8: Ranking order of production based constraint of date palm Gur in the study area

Sl. No.	Items	High	Medium	Low	Performance indices	Rank
1	Decrease of number of gachi	94	3	0	288	**1**
2	Decrease of number of date palm trees	90	7	0	284	**3**
3	No new plantation	87	10	0	281	4
4	High wage rate of gachi	6	70	21	179	8

5	Insect and pest attack	7	14	76	125	9
6	Weather condition	7	9	81	120	10
7	Use of date palm trees as fuel	24	65	8	210	7
8	No training as gachi	34	54	9	219	6
9	Lower market price of Gur	73	24	0	267	5
10	Adulteration of Gur	91	6	0	285	**2**
11	Shorter winter period	4	5	88	110	**11**

n: number of respondents

The ranking of major production problems is presented in Table 8. It was found that a decrease in number of gachi, adulteration of gur, and a decrease in the number of date palm trees were the major problems in production, with rankings 1, 2, and 3 respectively. It was followed by other production problems like no new plantation (4), a lower market price of gur (5), and no training for gachi (6). In addition to that, the high wage rate of gachi, insect and pest attack, weather conditions, and shorter winter period seem to least bother the date palm farmers with ranks 8, 9, 10, and 11, respectively.

4. CONCLUSION

Date palm juice and *gur* are important seasonal livelihoods in rural Bangladesh. It makes an active economic contribution to the rural economy as well as to the local people's cultural heritage. Traditional and inefficient agronomic practices such as propagation, irrigation, and fertilizer management are used in the production of date palms that are passed down from generation to generation. Continuous training, extension services, and the management of date palm trees, as well as the production of juice and gur with scientific technology, are all recommended to help farmers in the study area improve their incomes and livelihoods.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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