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Performance of BAU Sapota–1 at three selected upazillas in Nonthern Region and BAU-GPC of Bangladesh

R. Roy*, M. H. Rahman and M. A. Rahim
Department of Horticulture, Bangladesh Agricultural University, Mymensingh–2202, Bangladesh, *E-mail: rumaroybau@gmail.com

Abstract

Three years experiment was conducted to establishment the BAU–GPC released BAU Sapota-1 at three selected upazilla of Northern region and BAU–GPC, Mymensingh of Bangladesh during the period from July 2009 to June 2013. Among the locations, Palashbari, Gaibandha exhibited the tallest plant, maximum leaves, maximum branches and higher canopy in all the years (2010, 2011 and 2012), Palashbari, Gaibandha also noticed the minimum time for fruit setting, maximum harvested fruit and fresh fruits as well as the higher fruit yield of BAU Sapota–1 compared to other locations. The overall results suggest that BAU Sapota-1 can be recommended to cultivate in the Palashbari Gaibandha area for obtaining higher yields.

Keywords: Performance, Growths, Yield, Sapota-1, BAU-GPC

Introduction

Bangladesh is an agro-based country and its development is inherently linked with the development of agriculture. It has a land mass of 143999 km^2 with a population of about 150 million. This country has only a land area of 14.39 million hectares where total cultivated area of horticultural crops is about 1.2 million hectare which is about 7% of the total cropped area (BBS, 2010). Sapota (*Achras sapota* L.) commonly known as chiku (Saraswathy *et al*., 2010) is mainly cultivated in India for its fruit value. It belongs to the family Sapotaceae or the 'naseberry family'. It is also called by other names, such as sapota plum, sapodilla or prickly pear (Gupta *et al*., 1981). In Bangladesh it is called Shopheda. It is native to central and south America, specifically from the Yucatan Peninsula of Mexico to Costa Rica, where the largest population of native trees still exists (Gilly 1943). It is now widespread throughout the tropical regions of the world, including central and south America, the West Indies, India, and Florida in the United States. Sapotaceae includes trees or shrubs comprising about 70 genera and 800 species while the genus Manilkara comprises some 85 species of tropical and warm-temperate, fruit-bearing plants. In South-East Mexico, Guatemala and other countries it is commercially grown for the production of chickle which is a gum like substance obtained from latex and is mainly used for preparation of chewing gum (Suhasini *et al*., 2012). Sapodilla is the source of chicle which extracted from the trunk of the tree as a white latex exudate (Mickelbart, 1996). Although synthetic gums are primarily used, some countries such as Mexico, Venezuela, and Guatemala, still grow sapodilla for chicle. The pulp of sapota when ripe is soft, granular and very sweet. Sapota is an energy rich fruit with high total soluble solids (20-22%) and good source of digestible sugar, and has an appreciable amount of protein, fat, fiber and minerals like calcium, phosphorous, iron (Shanmugavelu and Srinivasan, 1973). In Bangladesh, temperature ranges from 5^oC to 28^oC in winter and from 22^oC to 40^oC in the summer in Bangladesh with the variation in rainfall from 1430 mm in the North and North-west to 4,338 mm in the East and South-east (Rahim and Rahman, 2012). Northern region of Bangladesh is highly vulnerable to sandy soil. Local people informed that most of the vegetation including fruit plants was affected by sandy soil. In that case, BAU Germplasm Centre developed some potential fruits varieties which have made suitable for greater adoption in different northern regions of Bangladesh where sandy soil areas are rapidly increasing through climate change effect (Rahim 2012). Adaptability of a species and its suitability to a site is indicated by its frequency and growth. The proper area selection is very essential for getting good yield and quality of fruit varieties of Bangladesh. Hence, keeping in view an attempt was made to select the suitable area of northern regions of Bangladesh. So, the present study was to determine the performance of BAU–GPC released BAU Sapota–1 at different parts of northern region and to select the suitable area for obtaining the better growth and higher production of Sapota.

Materials and Methods

The study was conducted at different area of northern region and BAU–GPC area of Bangladesh during the period from July 2009 to June 2013 to select the suitable location for obtaining greater yield of Sapota. The experiment consisted of 4 treatments of locations namely Palashbari, Gaibandha; Gaibandha Sadar, Pirgonj, Rangpur (AEZ–2) and BAU–GPC, Mymensingh were selected. BAU Sapota–1 was used as planting materials which was released by BAU–GPC, There were 12 (treatments 4 × replication 3) unit plots altogether in the experiment. A distance of 4 m was for both plant to plant and line to line and 5 m for block to block. Two-three years old BAU Sapota–1 were planted on September 2009. Fertilizers were applied by the instruction of Rahim (2008). Weeding was done by spade, niri, khurpi and other implements and soil was also ploughed by spade for loosening the growth of roots. First irrigation was done after planting. Besides, two to three times irrigation was also done during the summer season depending on the soil moisture and also used after applying the fertilizer in each year. Weak, diseases or pest infected, dead and criss–crossed leaves and branches were pruned. Decis was applied @ 2.5 ml/L water between 10-15 days interval starting from planting and continued up to flowering for controlling the bark borer, mealybugs and other insect pest. To prevent black sooty mold disease, Dithane M-45 was also applied @ 4.5 g/L water at 10-15 days interval from two to three weeks after fertilization and continued up to the last date of recording final data. Fruits were harvested when they attain full size, hardy, deep brown colour and plain skin and acid blend. The data were recorded on plant height, leaves/plant, branches/plant, canopy volume (m^3), days to 100% flowering, days to fruit setting, total fruits/plant, harvested fruits/plant, fresh fruits/plant and yield/plant (kg). The experiment was laid out with three replications. Statistical analyses of the data were done by RCBD and means were adjudged by LSD.

Plate 1. Photograph showing the sampling plant of BAU Sapota–1 at 45 DAP in 2009

Results

Plant height: The data on plant height of Sapota were recorded in the years of 2010, 2011 and 2012 whereas plant height was significantly affected due to studied areas (Table 1). Among the areas, all the locations were produced statistically similar height of Sapota at 2010 while Palashbari, Gaibandha registered the tallest plant (1.45 and 2.09 m) in 2011 and 2012, respectively. Similarly, Pirgonj, Rangpur showed the shortest plant (0.96 and 1.60 m) at 2011 and 2012, respectively.

Number of leaves/plant: A highly significant variation was found due to studied areas in respect of leaf production of Sapota in 2010, 2011 and 2012 (Table 1). Among the studied areas, Palashbari, Gaibandha produced significantly the maximum production of leaf/plant (73.19, 144.48 and 207.97) followed by Gaibandha Sadar (70.61, 132.17 and 195.66) in 2010, 2011 and 2012, respectively. However, minimum leaves/plant (67.03) was found under Pirgonj, Rangpur in 2010 but it was minimum (123.29 and 187.11) under BAU–GPC in 2011 and 2012, respectively.

Number of branches/plant: Data on branch production/plant significantly affected due to areas at all the data recording years of 2010, 2011 and 2012 (Table 1). The maximum number of branches/plant (7.67, 14.15 and 16.86) was registered under Palashbari, Gaibandha in 2010, 2011 and 2012 while Pirgonj, Rangpur noticed the minimum branches/plant (6.60, 10.48 and 13.13) followed by BAU–GPC (6.83, 1.20 and 13.94) in 2010, 2011 and 2012m respectively.

Canopy volume: Effect of different areas of the study was significant on canopy volume at all the data recording stages except 2010 (Table 1). It was found that all the areas produced statistically identical canopy volume in 2010. In 2011 and 2012, Palashbari, Gaibandha recorded the higher canopy volume (1.29 and 1.92 m^3, respectively) followed by Gaibandha Sadar (1.16 and 1.81 m^3, respectively) than other studied areas. Similarly, Pingonj, Rangpur exhibited the lowest canopy volume (0.96 and 1.60 m^3) in 2011 and 2012, respectively.

Table 1. Effect of different locations on morpho–physiological characters of BAU Sapota at different DAP (2010, 2011 and 2012)

Location	Plant height (m)			Number of leaves/plant			Number of branches/plant			Canopy volume (m^3)		
	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
BAU-GPC	0.73	1.31	1.90	**68.33**	123.29	187.11	6.83	11.20	13.94	0.42	1.15	1.77
Palashbari of Gaibandha	0.82	1.45	2.09	73.19	144.48	207.97	7.67	14.15	16.86	0.47	1.29	1.92
Gaibandha sadar	0.79	1.28	1.92	70.61	132.17	195.66	7.43	11.89	14.54	0.45	1.16	1.81
Pirgonj of Rangpur	0.72	1.19	1.83	67.03	128.82	192.31	6.60	10.48	13.13	0.40	0.96	1.60
$LSD_{0.01}$	**0.10**	**0.166**	**0.17**	**0.68**	**1.884**	**5.41**	**0.29**	**0.438**	**0.37**	**-**	**0.271**	**0.21**
Level of significance	**	**	**	**	**	**	**	**	**	NS	*	**

** Significant at 1% level of probability and NS=non significant; DAP=Days after planting

Days to flowering: The data on days to 100% flowering of BAU Sapota was significantly influenced by the studied areas (Table 2). Among the locations, Gaibandha Sadar requiring longest days for 100% flowering (39.37, 40.00 and 37.33 days) in 2010, 2011 and 2012 while Palashbari, Gaibandha requiring the shortest time in 2010 (30.48 days), Pirgonj, Rangpur in 2011 (31.36 days) and BAU–GPC in 2012 (30.67 days).

Days to fruit setting: The data on days to fruit setting were calculated from the beginning of flowering to 100% fruit setting in each year of 2010, 2011 and 2012. Table 2 showed that Palashbari, Gaibandha requiring the shortest time (30.80, 28.98 and 28.56 days) followed by Gaibandha Sadar (33.20, 30.39 and 29.94, respectively) while Pirgonj, Rangpur requiring the longest time (36.10, 32.44 and 31.79 days) for fruit setting in 2010, 2011 and 2012, respectively.

Number of fruits/plant: Fruits/plant showed significant difference due to studied areas (Table 2). It was found that significantly the maximum fruits/plant (3.22) was obtained under Gaibandha Sadar while Pirgonj, Rangpur did not produce any fruits of Sapota and BAU–GPC recorded the minimum fruits $plant^{-1}$ (1.40) in 2010. Similarly, Palashbari, Gaibandha recorded the maximum fruits/plant in 2011 (10.72) and 2012 (15.81) while Pirgonj, Rangpur noticed the minimum fruits/plant (3.33 and 6.33, respectively).

Number of harvested fruits/plant: A highly significant variation was found due to the effect of studied areas in respect of number of harvested fruits/plant (Table 2). The mean number of harvest fruits/plant was significantly higher in Palashbari, Gaibandha during the study year of 2010, 2011 and 2012 (3.67, 9.67 and 13.66, respectively) and Pirgonj, Rangpur produced significantly the minimum harvested fruits/plant (3.33 and 5.33) in 2011 and 2012, respectively and BAU–GPC in 2010 (1.33) while Pirgonj, Rangpur did not initiate any fruits in 2010.

Number of fresh fruits/plant: A significant variation was also observed due to studied areas regarding fresh fruits/plant in 2010, 2011 and 2012 (Table 2). Maximum number of fresh fruits/plant (3.33, 9.33 and 11.99) was taken under Palashbari, Gaibandha in 2010, 2011 and 2012, respectively while Pirgonj, Rangpur were unable to produce any fruits in 2010. However, Pirgonj, Rangpur obtained the minimum fresh fruits/plant (2.67 and 4.66) in 2011 and 2012, respectively and BAU–GPC in 2010 (1.00).

Fruit yield: The data on fruit production of sapota varied significantly due to the studied areas in every year of 2010, 2011 and 2012 (Table 2). It was found that the fruit production of Sapota was higher (0.63, 1.66 and 2.35 kg $plant^{-1}$) in Palashbari, Gaibandha and lower (0.0, 0.52 and 0.83 kg $plant^{-1}$, respectively) in Pirgonj, Rangpur in 2010, 2011 and 2012, respectively.

Table 2. Effects of different locations on various yield and yield contributing characters of BAU Sapota–1 at different DAP (2010, 2011 and 2012)

Locations	Days to 100% flowering	Date to fruit setting	No. of fruit/plant	No. of harvested fruits/plant	No. of fresh fruits/plant	Yield/ plant (kg)
	2010					
BAU-GPC	35.66	35.40	1.40	1.33	1.00	0.21
Palashbari of Gaibandha	30.48	30.80	3.05	3.67	3.33	0.63
Gaibandha sadar	39.37	33.20	3.22	2.67	2.33	0.44
Pirgonj of Rangpur	33.45	36.10	0.00	0.00	0.00	0.00
$LSD_{0.01}$	**0.72**	**0.69**	**0.38**	**0.33**	**0.14**	**0.10**
Level of significance	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
	2011					
BAU-GPC	33.67	31.59	6.67	5.33	5.33	0.87
Palashbari of Gaibandha	36.71	28.98	10.72	9.67	9.33	1.66
Gaibandha sadar	40.00	30.39	8.67	7.33	5.67	1.20
Pirgonj of Rangpur	31.36	32.44	3.33	3.33	2.67	0.52
$LSD_{0.01}$	**0.61**	**1.366**	**0.932**	**0.735**	**0.783**	**0.214**
Level of significance	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
	2012					
BAU-GPC	30.67	30.74	10.10	7.77	6.44	1.25
Palashbari of Gaibandha	34.69	28.56	15.81	13.66	11.99	2.35
Gaibandha sadar	37.33	29.94	12.84	11.51	10.84	1.87
Pirgonj of Rangpur	31.35	31.79	6.33	5.33	4.66	0.83
$LSD_{0.01}$	**0.25**	**0.21**	**1.21**	**1.04**	**1.34**	**0.17**
Level of significance	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

** Significant at 1% level of probability

Plate 2. Photograph showing the mature fruits during harvest in 2012

Discussion

In the present experiment it was seen that all the data regarding morpho–physiology, yield and yield attributing significantly affected due to different locations. The cultivar BAU Sapota–1 showed the higher adaptability with the climatic condition (such as temperature, rainfall, relative humidity and other climatic factors, soil pH, physical and chemical properties of the soil) of Palashbari, Gaibandha which maximizing the Sapota yield than other studied areas. The morphological characters such as plant height, leaves/plant, branches/plant and canopy volume had greater developed under Palashbari, Gaibandha region whereas Pirgonj, Rangpur perform lower. The similar variation of Sapota due to studied areas were also reported by Goenaga and Jenkins (2012) who conducted a five years experiment on six Sapota cultivars grown on Ultisol and Oxisol soils at Corozal and Isabela. They found significant differences and showed higher results in maximum characters of plant morphology and yield attributes of Sapota at Isabela. Similarly, three selected white Sapote (*Casimiroaedulis*) were evaluated by Abo-El-Ez *et al*. (2013). Similar field observation was also reported by Shirol *et al*. (2009) who observed that the significantly higher number and weight of fruits $tree^{-1}$ in Virudhnagar while significantly higher individual

fruit weight was noticed in Cricket Ball (Udupi). Arabhavi. Shirol *et al*. (2006) also reported that Virudhnagar and Singapore were found to be better yielder followed by Guthi and Cricket Ball (ARSA), whereas Cvs. Murabba, Mohangootee and Cricket Ball (Udupi) were found to be medium to poor yielder due to different agro-climatic condition. Dinesh and Reddy (2000) also found that fruit weight was the maximum in Krishna Rao and least in Pilipatti. TSS was highest in Kirtibarti (big) and Pakala Oval. The average number of seeds per fruit was least in Guruvayya, Gavaraiah and Pakala Oval under Bangalore (Karnataka, India) conditions.

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