

Endangered and Promising Fruit Species in the Changing Context of Climate for Nutrition Security and Livelihood in Coastal Areas of Bangladesh.

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The study was conducted to explore the endangered and promising fruits species in the coastal areas particularly southern parts of Bangladesh which are prone to salinity intrusion. Moreover, it was also endeavored to assess the potentials of BARI, BAU developed fruits species along with well adapted local fruits varieties in the varying level of salinity in the study areas in terms of food and nutrition security and livelihoods. The findings of the study in accordance with objectives are summarized below:

The study was carried out through sample survey method for which three districts of coastal areas namely Khulna, Bagherhat and Barisal were selected. These three districts were selected because of their varying level of salinity and also considering time and funds constraints. Thereafter, four Upazilas of three districts were selected for the same reasons. Based on the discussion with the Officials of respective Upazila Agriculture Offices and Horticulture Centres, forty respondents of Agailjhara, forty respondents of Rupsa, twenty respondents of Morelganj and twenty respondents of Mongla were chosen. The number of selected fruit growers as respondents was presumable smaller in all study areas because of lower number of fruit growers used BARI and BAU developed fruits varieties. To fulfill the objectives of the study data were collected a pre-tested questionnaire. Focused Group discussion (FGD) was carried out with the personnel of the respective Upazila Agriculture Officers and promising fruits growers through a checklist for greater understanding of the relevant information for qualitative analysis of the study. In addition to that face to face interview was also conducted with the extension workers and Agriculture Experts of the relevant organizations through an interview schedule for the same. All data were analyzed and processed and then presented as averages, means, and percentages in a tabular form in view of discussing the study results in a meaningful way.

The study results showed that average family size was small at Mongla and Morelganj and a vast majority of the respondents belonged to the effective age group of 25-45 years in all study areas of which respondents of Mongla were so younger in terms of average age. Level of education attainment was low at Agailjhara compared to other study areas. The main profession of the respondents of all study areas was

agriculture of which Morelganj ranked first and most importantly fruit growers had different professions. The per capita average own lands was the highest at Mongla and the allocation of lands to fruits production was also the highest here and Morelganj lied in the lowest position in these lines. The highest ratio of lands was allocated for crops and shrimp gher and then fruits production compared to others purposes at all locations of the study areas. The average family income was higher at Rupsa and the lower at Morelganj. The contribution of fruits to the total income was higher at Agailjhara and the lower at Mongla. Agailjhara and Rupsa were found good for fruit production and Mongla and Morelganj were good for fish production in terms of their contribution to yearly income. These kinds of production and income scenarios are gradually being pronounced due to varying level of salinity in the study areas. Average yearly expenditure found greater at Rupsa and smaller at morelganj. The cost for foods and education was higher over other cost items in all study areas. Foods cost was higher at Morelganj and Mongla and lower at Agailjhara whereas education cost was higher at Agailjhara and lower at Morelganj. The weekly average food intake was higher at Rupsa and the lower at Mongla. Rice intake was greater in all areas compared to others foods items. Weekly fruits intake was lower at Mongla but vegetable intake was higher at Morelganj. Egg and meat consumption was lower in all study areas. Flour consumption was greater at Morelganj where Mongla respondents took more fish.

Sixteen, nineteen, twenty two and twenty fruits were identified as endangered fruits species at Agailjhara, Rupsa, Morelganj and Mongla respectively. But, Rose apple, Black berry, Kao, Tamarind, Dauwa, Sarifa and Caster Apple observed as more endangered fruits in all study areas in respect of farmer's responses. Almost all minor fruits are in danger or near to be extincted. The causes behind extinction of these fruits are presumably unavailability of seedlings, decreasing lands, increasing soil and water salinity, and water stagnation. Salinity intrusion problem is lower at Agailjhara, Rupsa and Morelganj but it is higher at Mongla. According to farmer's perception, Coconut, Sapota, Betel Nut, Aonla, Jujube, Tamarind and Pomegranate were observed as salt tolerant fruit species to low to moderate degree of salinity of which Coconut and Sapota performed better.

Fruit production increased at Mongla even after gradual increase in soil salinity presumably due to more use of salt tolerant of fruit species. On the other hand, fruits production decreased at Agailjhara and Morelganj at varying level of soil salinity presumably due to lesser use of salt tolerant of fruit. Use of salt tolerant of fruit species promotes moderate income at Mongla and Rupsa. It was greater at Morelganj but it was not increased at Agailjhara. Majority of respondents opined that income was increased due to

increasing use of salt tolerant fruit species and also expansion of more fruits plantation. There was no positive impact of salt tolerant fruit on food security in most cases where an insignificant number of respondents of Mongla experienced with increasing food security. A significant number of respondents experienced with increasing nutrition security due to cultivation of salt tolerant fruit species at all study areas except Agailjhara. A vast majority of the respondents opined that increasing consumption from own production improved family nutrition where a few reported that increasing yield and expansion of salt tolerant of fruit species cultivation improved family nutrition. Cultivation of salt tolerant fruit species ensured effective production fruits which was helpful to increase family education in all study areas. A vast majority of the respondents opined that additional income from fruits particularly having salt tolerant varieties helped to improve family education in all study areas except Rupsa. In Rupsa, respondents reported that additional income from fruits helped them address all aspects of livelihoods.

Twelve different fruits such as Aonla, Dragon Fruits, Jambura, Jujube, Coconut, Betel Nut, Carambola, Wax Apple, Guava, Sapota, Wood Apple and Elephant apple were considered as salt tolerant fruits by the growers in all study areas. Out of these, six fruits such as Jujube, Coconut, Wax Apple, Guava, Sapota and Betel Nut at Agailjhara and Rupsa, three fruits such as Sapota, Wax Apple and Jujube at Morelganj and three fruits such as Coconut, Guava and Sapota at Mongla were accepted as salt tolerant of fruits by the maximum number of respondents. A significant number of respondents do not involve in multiplication of mother plants of salt tolerant fruits in all study areas. Respondents of Agailjhara are very much interested in applying modern cultivation practices for mother plants management. Respondents of Rupsha showed less interest in selling & distributing of salt tolerant fruits species. Respondents of Morelganj were more interested in cultivating salt tolerant fruits species. None of the respondents of Mongla was interested in applying modern cultivation practices for mother plants management. Black Berry, Malta, Orange, Jambura, Wax Apple, Coconut and Jackfruits are more profitable fruits at Agailjhara in terms of net income. But cost of production is convenient for Black Berry, Jambura, Malta and Jackfruits, Coconut, Guava, Mango and Aonla. Production of these fruits were found more profitable at Rupsa. Banana production was found less remunerative in all study areas. Elephant Apple, Papaya, Black Berry, Betel Nut, Coconut, Carambola, Sapota and Wax Apple are suitable for cultivation at Morelganj. On the other hand Lemon was not profitable due low yield and higher cost of production. Wax Apple, Coconut, Elephant Apple, Black Berry and Sapota are profitable fruits at Mongla. On the other hand Guava and Mango are not profitable due low yield.

Respondents of Agailjhara produced fifteen different of fruits and on an average 35 per cent of them (total production) were consumed by the producers and the rest (65%) was sold to the market. At Rupsa, six types of fruits were produced of which only 12 per cent was consumed and the rest 68 per cent was sold to the market. At Morelganj, thirteen fruits grown of which 31% were consumed and 69% were sold. At Mongla, eight fruits grown of which 15% were consumed and 85% were sold. Producers of Agailjhara have consumed greater percentages of Sapota (60%), Guava (62%), Indian Olive (100%), Malta (80%), Sarbati (83%) and Black Berry (71%) from their production. At Rupsa, out of six fruits, only Guava was consumed by 51% and the rest 49% were sold to the market. On the other hand, the producers consumed smaller percentages of Coconut (13%), Mango (25%), Banana (9%), Jujube (20%) and Aonla (10%). At Morelganj, out of thirteen fruits, producers sold greater percentages of eight fruits such as Sapota (60%), Guava (62%), Jambura (55%), Coconut (76%), Black Berry (66.50%), Betel Nut (68%), Carambola (75%) and Elephant Apple (96%) from their production. At the same time, Hoggpalm was consumed 100% due to its minimum production and number of producer. At Mongla, out of eight fruits, producers sold greater percentages of 5 fruits such as Sapota (86%), Wax apple (76%), Coconut (83%), Elephant apple (94%) and Mango (82%) of their production. At the same time, producers consumed greater percentages of three fruits such as Guava (100%), Jambura (80%) and Black Berry (100%) due to their minimum production and number of producers. Promotion of salt tolerant fruits species in the coastal areas is of a great importance for the sake of avoiding the extinction of promising fruits species, maintaining better biodiversity, family nutrition and livelihoods. Fruit growers have given twenty two suggestions of which "training on fruit production", "distribution of improved fruits seedlings", "building of embankment", "increase people's awareness", "organization fruits plant fair/agriculture fair" and "motivation of farmer" have received higher responses. These suggestions might be helpful for promoting salt tolerant fruits species in the study areas.

A number of recommendations were derived on the basis of the study. A few of which included Government and non-government organizations should take efforts in the development and screening of area specific salt tolerant fruits and their promotion in the coastal areas; capacity building of field level DAE offices through training and supplying salinity testing equipments; and capacity building of researchers in terms of higher training and motivation for continuous addressing innovation works for new varieties and related technologies suitable in the context of climate change.