



## Technical Note 06

### Sajna (*Moringa oleifera*) Cuttings

September, 2015



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Date: September 2015

Blue Gold Program

### **BWDB Office**

23/1 Motijheel Commercial Area, Hasan Court, 8th Floor, Dhaka 1000  
(T) +88 02 711 15 25; +88 02 956 98 43

### **Gulshan Office**

Karim Manjil, Ground Floor, House 19, Road 118, Gulshan, Dhaka 1212  
(T) +88 02 989 45 53



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## Issue and revision record

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# List of Abbreviations

BADC	Bangladesh Agricultural Development Corporation
BBS	Bangladesh Bureau of Statistics
BRRRI	Bangladesh Rice Research Institute
BWDB	Bangladesh Water Development Board
CAHW	Community Animal Health Worker
CBO	Community-Based Organisation
CDMP	Comprehensive Disaster Management Program
CEIP	Coastal Embankment Improvement Project
CO	Community Organizer
CSISA	Cereal Systems Initiative for South Asia
DAE	Department of Agricultural Extension
DAM	Department of Agricultural Marketing
DLS	Department of Livestock Services
DOC	Day Old Chicks
DoC	Department of Cooperatives
DoF or DOF	Department of Fisheries
DPHE	Department of Public Health Engineering
DPP	Development Project Proposal
DRR	Disaster Risk Reduction
DTL	Deputy Team Leader
EKN	Embassy of the Kingdom of the Netherlands
FCD	Flood Control and Drainage
FCDI	Flood Control, Drainage and Irrigation
FFS	Farmers Field School
FGD	Focus Group Discussion
FO	FFS Organiser
FT	Farmer Trainers
GAP	Gender Action Plan
GoB	Government of Bangladesh
GPWM	Guidelines for Participatory Water Management
ha	Hectare
HH	Household
HYV	High Yielding Variety
IGA	Income Generating Activity
IPM	Integrated Pest Management
IPSWAM	Integrated Planning for Sustainable Water Management
IPSWARM	Guidelines for Integrated Planning for Sustainable Water Resources Management
IRRI	International Rice Research Institute
KII	Key Informant Interview
LCS	Landless/Labour Contracting Societies
LGED	Local Government Engineering Department
LGI	Local Government Institutions
M&E	Monitoring and Evaluation
MFI	Microfinance Institutions
NGO	Non-Governmental Organisation
O&M	Operation and Maintenance

PDP	Polder Development Plan
PSF	Pond Sand Filter
PWMR 2014	Participatory Water Management Rules 2014
SAAO	Sub-Assistant Agricultural Officer
SAFAL	Sustainable Agriculture, Food security and Linkages
SLR	Sea Level Rise
SMART	Specific Measurable Attainable Relevant Time Bound
SRDI	Soil Resources Development Institute
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TOT	Training of Trainers
UP	Union Parishad
VC	Value Chain
VCA	Value Chain Analysis
VCD	Value Chain Development
VCS	Value Chain Selection
WASH	Water Sanitation and Hygiene education
WMA	Water Management Association
WAP	Water Management Group Action Plan
WMF	Water Management Federation
WMG	Water Management Group
WMO	Water Management Organisation
ZSE	Zonal Socio Economist



# 1. Introduction

## 1.1 Background

The Sajna tree (*Moringa oleifera*) – commonly known as the drumstick tree - grows widely in west, north-west and northern parts of Bangladesh. Although weather and climatic condition favour its growth in the Patuakhali area, Sajna is quite rare in this area. Sajna has a good nutrition value as a food item, fodder, a medicinal stock, a source of food oil and bio-fuel, and a water purifier. This simple tree could therefore provide at least a partial solution to nutritional famine, less household income, less soil fertility as well as fodder scarcity present in area like Patuakhali. But in Patuakhali area, Sajna tree is almost absent and people are not familiar with the tree. They are not aware on importance of Sajna tree. In Patuakhali area, almost all households have the potentiality to grow Sajna tree in their homestead.

As, Component-3 of Blue Gold Program is providing training support for increasing agricultural production and food security of Polder dwellers, especially for the poor & marginal farmers of the Polder. Last year, Component-3 tried to introduce Sajna tree in Patuakhali area to overcome nutritional shortages as well as to increase household income by planting 1200 cuttings in homestead area through 600 FFS members of Polder 43/2D and Polder 43/2F. As, we had to collect the cuttings from Khulna area, during transportation, there was some damage in the cuttings and again, due to less experience on drumstick cutting plantation technique, most of the cuttings were failed to establish.

Having learnt the lessons from poor performances in 2014, a trial was planned of drumstick tree with 500 cuttings (2 polders X 5 FFS X 10 Farmers X 5 cuttings) as well as with especial attention.

## 1.2 Objectives

- 1 To introduce Moringa in Patuakhali polder areas
- 2 To increase more vegetables in homestead in summer season.
- 3 To meet-up nutrient deficiency of rural poor.
- 4 To increase household income.
- 5 To increase best utilization of homestead area.

## 1.3 Location

The trials were all carried out in the Blue Gold Program area in Patuakhali (5 Farmer Field Schools area in each of 43/2F and 43/2D polders).

## 2. Importance of the Sajna Tree

### 2.1 Multi-Purpose Applications

All parts of the tree can be used in a variety of ways. Sajna is full of nutrients and vitamins and is good in our food as well as in the food of our animals. Sajna helps to clean dirty water and is a useful source of medicines. It provides lots of leafy material that is useful when using alley cropping systems:

- Human food
- Animal fodder
- Water purification
- Natural medicines
- Fertilizer
- Living fence
- Alley cropping
- Natural pesticide
- Domestic cleaning agent
- Fuel-wood and other uses

### 2.2 Human Food

All Sajna food products have a very high nutritional value. One can eat the leaves, especially young shoots, young pods, flowers, roots and in some species even the bark. Leaves are low in fats and carbohydrates and rich in minerals, iron, and vitamin B.

It is particularly useful as a human food because the leaves appear towards the end of the dry season when few other sources of green leafy vegetables are available. Comparison of Sajna nutrient elements with some other foods are given below in Table 1.

**Table 1**  
**Comparison of nutrient elements with some other foods**

Content	Sajna	Other food
<b>Vitamin A</b>	6,780 mg	Carrot: 1,890 mg
<b>Vitamin C</b>	220 mg	Orange: 30 mg
<b>Calcium</b>	440 mg	Cow milk: 120 mg
<b>Potassium</b>	259 mg	Banana: 88 mg
<b>Protein</b>	6.6 g	Cow milk: 3.2 g

\*Source: All values based on common food values per 100 g/weight; from Nutritive Value of Indian Foods, Gopalan, et al., 1989

### 2.2.1 Fresh leaves

Of all the products of the tree the leaves are used the most. They become tougher as they get older so it is best to pick the growing tips and young leaves. Remove the leaves from the woody stem, as this will not soften during cooking. The leaves can be used in the same way as spinach. An easy way of cooking them is to steam 2 cups of freshly picked leaves for a few minutes in one cup of water, seasoned with an onion, butter and salt or other seasonings according to taste.



**Figure 1: Leaves of Sajna**

### 2.2.2 Dried leaves

A leaf powder can be produced by drying the leaves (not in full sunshine) and crushing or pounding them. One can sift the powder to remove leaf stems. This powder can then be added to sauces at the same time as other condiments or vegetables are added.

### 2.2.3 Flowers

The flowers can be cooked and mixed with other foods or fried in batter. They can also be placed in hot water for five minutes to make a kind of tea. They are also a good source of nectar for honey producing bees.

### 2.2.4 Pods

The pods can be eaten from when they first appear to when they become too woody to snap easily (up to 30cm long). They are cooked like other green beans and have a similar flavour to asparagus. Beware as some bitter varieties are poisonous if too many are eaten. Noted that we have no bitter variety in Bangladesh. Even the pods that have become too woody can be boiled until they are tender. They are opened and the white flesh is scraped out and returned to the boiling water. This can be used in soups and stews. In Bangladesh, special curry of Sajna pods with fresh mustard seeds is very popular.

### 2.2.5 Seeds

The seeds are often referred to as peas and can be used from the time they appear until they turn yellow and their shells begin to harden. Experience will help decide when the best time to harvest the pods for their peas. To cook, remove from the pod with their soft winged shells intact and as much white flesh that can be scraped out from the pod. Put the peas and flesh into a strainer and wash them to remove the sticky, bitter film that covers them, or boil them for a few minutes then drain and boil again in fresh water. They can then be used as any other green pea.

When the seeds are mature, their coating hardens and becomes bitter. This can be pressed for oil extraction. If a press is not available the seeds can be browned or roasted, ground, added to boiling water and the oil floats to the surface. The seeds contain 35% oil and this is used for cooking purposes. The oil does not turn rancid and also burns without smoke.

### 2.2.6 Roots

A sauce similar to horseradish sauce can be made from the roots when the seedling is only 60cm tall. The root bark should be completely removed as it contains harmful substances, then the root is ground up and vinegar and salt are added. However, it should not be eaten in excess. It is best to store the sauce in a refrigerator.

### 2.2.7 Gum

The gum that is found in the bark can be used to season food.

## 2.3 Animal Fodder

Cattle, sheep, pigs, goats and poultry browse the bark, leaves and young shoots of Sajna. The best diet for pigs is 70% Sajna, 10% Leucaena and 20% other leaves. It is possible for their diet to be 100% Sajna but it should be no more than 30% Leucaena. The pork from pigs fed on this diet is lean. If trees are intended for animal fodder it is useful to prune them to 4m high, but if they are not they should be pruned to 6m so harvesting for human consumption can be easily carried out. Livestock diets are improved by the addition of Sajna products.

## 2.4 Water Purifying

Seed powder can be used as a quick and simple method for cleaning dirty river water. The powder joins with the solids in the water and sinks to the bottom. This treatment also removes 90-99% of bacteria contained in water. Using Sajna to purify water replaces chemicals such as aluminium sulphate, which are dangerous to people and the environment, and are expensive.

Twenty litres of water can be treated in the following way:

- (a) Remove the wings and brown seed coat and discard any seed kernels that have dark spots or any other signs of damage.
- (b) Pound the kernels to a fine powder.
- (c) Add 2 grams (2 small spoons) of powder to one cup of clean water, pour into a bottle and shake for 5 minutes.
- (d) Filter the solution through a clean cloth into the bucket of dirty water that is to be treated.
- (e) Stir the water quickly for 2 minutes and slowly for 10 to 15 minutes (do not use metal implements).
- (f) Leave the bucket undisturbed for one hour or until the water becomes clear and the impurities have sunk to the bottom.
- (g) Filter the water through a clean cloth
- (h) Boil the water before drinking.

Water from varying sources will need different amounts of powder because of the impurities present will not be the same. Experiments with a jar will help in working out the correct amount needed. Both the seeds and the seed powder can be stored but the solution made for purification should not be stored. It should be freshly made every time water is to be purified. Honey and sugar cane juice can also be cleared of impurities using the powder. *Moringa stenopetala* seeds have better water purifying properties than *Moringa oleifera*.

## 2.5 Natural Medicines

Around the world every part of the Sajna tree has been used effectively against varying ailments. Poultices made from leaves and bark act as antimicrobial agents when applied directly to wounds while leaf extracts are well known to be antifungal and antibacterial in nature (Radovich, 2009). Radovich goes on to state that because the Sajna is in the Brassicales order it contains isothiocyanates which have been shown to have antitumor and anti-carcinogenic properties, a claim that is backed up by studies at Johns Hopkins University (2009). Some of the remedies are described here but there is no guarantee they will work in every case.

### 2.5.1 Leaves

- Leaves rubbed against the temple can relieve headaches.
- To stop bleeding from a shallow cut, apply a poultice of fresh leaves.
- There is an anti-bacterial and anti-inflammatory effect when applied to wounds or insect bites.
- Extracts can be used against bacterial or fungal skin complaints.
- Leaf tea treats gastric ulcers and diarrhoea.

- Eating Sajna food products is good for those suffering from malnutrition due to the high protein and fibre content.

#### 2.5.2 Flowers

- Flower juice improves the quality and flow of mothers' milk when breast feeding.
- Flower juice is useful for urinary problems as it encourages urination. Pods
- If eaten raw, pods act as a de-wormer and treat liver and spleen problems and pains of the joints.
- Due to high protein and fibre content they can play a useful part in treating malnutrition and diarrhoea.

#### 2.5.3 Seeds

- Used for their antibiotic and anti-inflammatory properties to treat arthritis, rheumatism, gout, cramp, sexually transmitted diseases and boils. The seeds are roasted, pounded, mixed with coconut oil and applied to the problem area. Seed oil can be used for the same ailments.
- Roasted seeds and oil can encourage urination.
- They can also be used as a relaxant for epilepsy.

#### 2.5.4 Roots, Bark and Gum

The roots and the bark have all of the properties described above but are more concentrated. Therefore much more care should be taken if using them as medicines

### 2.6 Fertilizer

The seed cake, which is produced by pressing the seeds to extract oil, cannot be eaten as it contains harmful substances. However, it contains high levels of protein and makes a good fertilizer for use in agriculture.

### 2.7 Living Fence

Planted as a living fence, Sajna provides wind protection and shade. It grows very quickly and if cuttings are planted close together they will form a fence that livestock cannot get through in just 3 months.

### 2.8 Alley Cropping

Sajna has a large tap root and few lateral roots so it will not compete for nutrients with the field crops. It will also add to the nutrients available as it produces many protein rich leaves. They grow very quickly but do not provide too much shade due to the structure of their leaves. They are also very good at reclaiming marginal land.

### 2.9 Natural Pesticide

By digging Sajna leaves into the soil before planting, damping off disease (*Pythium debaryanum*) can be prevented among seedlings.

### 2.10 Domestic Cleaning Agent

Crushed leaves are used to clean cooking utensils or even walls.

### 2.11 Fuel-wood and other uses

The wood is light and is a good fuel for cooking. However, it is not suitable for building. The bark can be beaten into a fiber that can be used to make rope or mats and the wood produces a blue dye. Chippings of wood can be used to make a good quality paper. The tree also produces viscose resin that is used in the textile industry.

## 3. Preparation and Monitoring

### 3.1 Raising Farmer Awareness

In the regular FFS session of homestead gardening module, importance, growing technique and management of Sajna tree was discussed. Farmers were informed that all Sajna food products have a very high nutritional value. One can eat the leaves, especially young shoots, young pods, flowers, roots, and in some species even the bark. Leaves are low in fats and carbohydrates and rich in minerals, iron and vitamin B. Comparison of Sajna with some other foods was also discussed. In this way, FFS participants were aware fully on importance of Sajna tree and its planting techniques. Selected FFS participants were suggested to prepare 5 pits of 0.5ft x 0.5ft and 1.7ft deep each in a place where no standing water in the monsoon and no need to use fertilizer or manure at the time of plantation.



**Figure 2: FO is discussing importance of Sajna in FFS session**



**Figure 3: Collected Sajna cutting at Polder 30, Khulna**

### 3.2 Origins of Cuttings

As Sajna is not available in Patuakhali area, project has collected the cuttings of Sajna from Khulna to distribute among the FFS participants. To collect quality Sajna cuttings, we have to visited Polder 30 and Polder 29 area of Khulna. By the assistance of some FOs of Khulna and Mr. Abdullah Sani, finally we could collect 500 cuttings of Sajna from the different parts of the Polder area of Khulna.

### 3.3 Planting Technique

Prior distribution of 5 cuttings to selected 10 farmers each of the selected 10 FFS of 2 Polders, in the FFS, FOs demonstrated planting technique of the Sajna cuttings at one farmer's homestead which was practiced by all participants in presence of FOs so that, they could plant their cuttings properly in their respective homestead.



**Figure 5: Sajna cutting carrying to Polder level by Riksha Van**



**Figure 4: Sajna cutting carrying to Polder level by "Tomtom"**

### 3.4 Monitoring

Monitoring and follow-up of Sajna trees were included in the regular activities of FOs and they had report on Sajna in their regular reporting system.

## 4. Cutting Establishment

### 4.1 Lessons Learnt from 2014

In the Blue Gold area of Patuakhali, the initial performance of Sajna cuttings was an improvement on 2014. Based on experiences from 2014 trials, comparatively taller and thicker fresh cuttings were used from Khulna (polder 29 and polder 30) in 2015. The experiences from Khulna farmers in 2014 on Sajna cutting preparation and plantation techniques were collated and passed on to FFS participants and selected farmers in Patuakhali and Barguna.

### 4.2 Survival Status

In early April 2015, we distributed 500 cuttings among the 100 selected FFS members of polder 43/2D of Patuakhali Sadar and polder 43/2F of Amtoli Upazila of Barguna district. The survival status of Sajna in this year (2015) is given in Table 2 below.

**Table 2**  
**Survival status of Sajna in year 2015**

Polder	Name of FFS	No. of Farmers	No. of Cutting planted	Survival before Monsoon	Survival after Monsoon	Present Survival %
<b>43/2D</b>	Poschim Sharikkhali	10	50	28	09	18
	Purbo Gerakhali Uttar	10	50	16	00	0
	Chalitabunia	10	50	13	00	0
	Ballabpur	10	50	14	00	0
	Debuapur	10	50	20	00	0
<b>43/2F</b>	Purbo Dakhin Kalibari	10	50	27	05	10
	Dakhin Poschim Kalibari	10	50	18	00	0
	Dakhin Khekuyani	10	50	15	00	0
	Debpur	10	50	26	08	16
	Uttar Khekuyani	10	50	27	02	4
<b>Total</b>		<b>100</b>	<b>500</b>	<b>204</b>	<b>24</b>	<b>4.8</b>

### 4.3 Analysis of Survival Rates

Of the 500 cuttings which were distributed, 204 cuttings survived and were growing at the time before heavy and prolong rain started. Initial survival rate was comparatively better (42%) and were sprouted very nicely. But, in this year, the prolonged and heavy rain in Patuakhali area resulted in many homesteads being under standing water. This resulted in the loss of vegetables in the homestead areas, as well as



some fruit saplings/trees and the death of the majority of Sajna cuttings (which were previously growing). After the monsoon, we again monitored the survival status of Sajna cuttings, some cuttings were seen dead and were registered as dead (although there may have been later sprouting) and found that only 24 cuttings were growing - the survival rate is less than 5%.

## 5. Conclusion

### 5.1 Learning Experience

Considering the climate and soil condition, the cultivation of Sajna is theoretically possible in the high lands of Patuakhali and – on this basis - we selected homestead areas of Patuakhali for the trials in 2015. But the experiences of 2015 show that many Patuakhali homesteads suffer from standing water during the monsoon. Given the low rate of survival of the cuttings (refer to Section 4.3), we can conclude that for better success of Sajna cutting at Patuakhali areas, we should select homesteads which have no risk of flooding in monsoon at any condition and, also, spots along the polder embankment where there is no risk of standing water.

In order to expand the Sajna plantation in Patuakhali, our planning should include site selection and earlier preparation for the next season. Another option is to grow Sajna seedling first from seeds, using our trained nursery owners and then distributing it to potential homesteads that don't suffer from monsoon flooding.