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Bangladesh Agricultural Research Institute (BARI)
Joydebpur, Gazipur-1701, Bangladesh
Phone: +88-02-49270038
E-mail: editor.bjar@gmail.com
www.bari.gov.bd

# INTRODUCTION TO BARI DEVELOPED AGRICULTURAL MACHINERY

**Farm Machinery & Postharvest Process Engineering Division**
Bangladesh Agricultural Research Institute

# Introduction to BARI Developed Agricultural Machinery


**Research & Written by**

Dr. Md. Israil Hossain
Dr. Md. Ayub Hossain
Dr. Md. Nurul Amin
Kowshik Kumar Saha
Nusrat Jahan
Tasneem Nahar Barna

**Edited by**

Md. Hasan Hafizur Rahman



**Farm Machinery & Postharvest Process Engineering Division**

**Bangladesh Agricultural Research Institute**

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**Technical Assistance**
Md. Jubair Hasan
Sub-Assistant Engineer
FMPE Division, BARI, Gazipur

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Bangladesh Agricultural
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# Message

Bangladesh is an agro-based country with almost 47 percent of its total population directly engaged in agriculture. It has about 14.86 million hectares of land of which 8.52 million hectare are under cultivation. The main sources of farm power are human and mechanical in the country. The population of Bangladesh is increasing every year while cultivable land area is shrinking due to urbanization, industrialization and other uses. The cultivable land per head decreased from 0.135 hectare in 1990 to 0.12 hectare at present. To provide food for the increasing population the decreasing land areas, farmers are taking the benefit of using machinery to grow 3 to 4 crops in a year by introducing agricultural machinery. Farm machinery helps farmers to reduce their drudgery, mitigate labour crisis, reduce postharvest losses and save cost. It is important for the farmers and other people in the agriculture sector to keep themselves up to date on benefit and use of farm machinery and their latest development.

Good quality seed, fertilizer, irrigation and pest management are not sufficient to tackle the biggest challenge of agriculture but also equally important appropriate agricultural machinery for sustainable developed. Considering the need of farmers in Bangladesh, Farm Machinery & Postharvest Process Engineering (FMPE) Division, of Bangladesh Agricultural Research Institute (BARI) has developed a number of improved farm machinery for crop production, processing and postharvest management. These machines are being fabricated in local engineering workshops throughout the country with locally available iron materials and being disseminated through GOs, NGOs and international organizations.

Under the circumstances, first edition of a booklet in English containing the introduction, specification, advantage and operation is being published in March 2017. I believe that this publication will be very helpful for the scientist, extension personnel, policy makers, manufacturers, foreigners, and farmers to know about BARI developed farm machinery with their uses, operation and troubleshooting guideline.

I express my sincere thanks to the scientists of FMPE Division, BARI and others associated with this publication for their nice effort for publishing the booklet.

**Dr. Abul Kalam Azad**

**Chief Scientific Officer**
FMPE Division, BARI

# Preface

To achieve the increased food production target, Bangladesh has to go for vertical expansion of agricultural output over the current situation of its cultivable land. One of the most important means to boost up the vertical expansion of agricultural production is to adopt agricultural mechanization suitable for the Bangladeshi farmers. In order to increase the production and cropping intensity further, it has become necessary to mechanize certain farm operations. Moreover, rural labour force has started to shift from agricultural to industrial sector and service sector, creating an acute agricultural labour shortage during peak planting and harvesting times. In case of occurrences of flood, drought and other natural disasters mechanization is the only option which can handle problems for land preparation, crop establishment, harvesting, threshing and drying of different crops timely. Power-oriented implements, the power tiller holds a notable position. Farm machinery in Bangladesh needs a special consideration to landholding size and capability of the agricultural development process in order to augment land productivity. Farmers cannot successfully adopt a new technology unless they are aware of it and its know-how to incorporate the technology into their farming system.

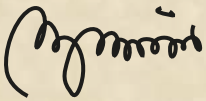
With the purpose of increasing power usage in agricultural field as well as considering the socio-economic condition of farmers in Bangladesh, some appropriate farm machinery has been developed. Few decades back, agriculture in this country was primitive, confined between the power of animal and low cost tools and equipment. Under such circumstances, using farm

machinery offers a low cost, less time consuming and less drudgery solution. So the uses of these machineries are increasing day by day and hopefully the necessities will be on the increase. As a result using the machinery the production capacity has also increased up to a significant rate.

Proper postharvest processing and handling is an important part of modern agricultural production. Produced crops, if not processed properly can devastate within any of the integrated functions of the processing processes. So technology and machineries have been developed to maintain and increase the quality of crops after harvesting.

The local manufacturers of Bangladesh are fabricating and marketing BARI farm machinery all over the country. So, all of these machinery are being more accessible to the farmers as well as the demand of these machineries are also increasing. To avail the manufacturers with the new machineries and to help the farmers to operate the developed farm machineries, practical training sessions are provided. We cordially hope and pray that the booklet, "Introduction to BARI developed machinery" will benefit the target groups i.e. the manufacturers, farmers and the extension workers.

Those who have worked hard to compile this booklet, I declare my earnest gratitude to them.



**Dr. Md. Israil Hossain**

# Contents


*Farm Machinery & Postharvest Process Engineering Division*

# BARI High-speed Rotary Tiller

Bangladesh is an agricultural country. In Bangladesh two-wheeled tractors (commonly called power tillers) are used for land preparation. About 90% of cultivated land is prepared by the two-wheeled tractors. At present about 0.7 million two-wheeled tractors are in use in the country which are fitted with conventional rotavators for land preparation. High speed rotary tiller (HSRT) is an improved version of these two-wheeled tractor driven conventional rotavators designed to prepare dry lands only in 1–2 passes (instead of 3–6 as required by the conventional rotavators. Thus, the HSRT saves about 50% of land preparation time and cost. It also makes the soil finer, ease the intercultural operation and increase crop yield. One special characteristic of the HSRT is that it can till comparatively wetter soils where conventional power tillers are not effective. So, crops can be planted earlier in the season giving a yield advantage. Similar to a conventional power tiller, a HSRT is attached behind a two-wheeled tractor of 9–12 kW.

*High Speed Rotary Tiller*

## Advantages

- Prepares dry land at optimum moisture content in one or two passes
- High-speed operation of its rotary blades produce a fine soil tilth ready for seeding or planting (especially for root and bulb crops)
- Saves about 50% time and cost compared to a conventional power tiller
- When used with a Sifeng type power tiller, the operator's seat can be fitted so that the operator can ride on it.

## Specifications

- Operated by a two-wheeled tractor (9–12 kW)
- Fabricated in a local workshop using locally available materials
- Rotor shaft has 48 blades and rotates at 450–500 rpm
- Overall dimension: 1310 mm × 930 mm × 520 mm
- Overall weight: 120 kg
- Cutting width: 1200 mm
- Cutting depth: Up to 80 mm (adjustable)
- Price: Tk. 50,000 (US $ 625) (without power tiller)

## Working Principle

The high speed rotary tiller is attached with nuts and bolts at the back side of the power tiller after removing the conventional rotavator unit. Depth of ploughing is controlled by a depth control lever. The machine is operated similar to a conventional power tiller used for land preparation.

## Field performance

- Field capacity : 0.1 ha/h (25 decimal/h)
- Field efficiency: 98%
- Fuel consumption: 1.75 l/h
- Operating cost: 2500 Tk/ha by HSRT (6500 Tk/ha by a conventional power tiller with 3 passes)

# BARI Power Tiller Operated Seeder

In Bangladesh farmers are sown some seeds in line like maize, potato etc. Hand sowing practice is time consuming, laborious and costly which discourage farmers crop production. Line sowing enables easy management such as weeding, top dressing overall enhance crop production. It works as shallow tilling, fertilizing, seeding in line, seed covering simultaneously at a time. After seeding field looks decend. At present power tillers are being used massively in cultivation of land. Wheat is planted after harvesting of rice in rabi season. Land is prepared 3-4 passes plouging followed by laddering. There is 70% land delay planting due to lack of awareness of modern technology which resulted potential yield loss. Two-wheeled tractor (power tiller) operated seeder which is commonly known as PTOS is an appropriate technology which can utilize residual soil moisture for crop establishment, reduce turnaround time, cost reduction and manage crop residue properly.

*BARI Power Tiller Operated Seeder*

This seeder can be used as strip till planter (Fig. 2) which acts as creating a narrow strip through crop residue and placing seed and fertilizers with proper depth, between the two lines remain until.

*BARI Strip till planter*

## Advantages

- It ensure timely planting
- Reduce turnaround time
- Seeds can be sown at uniform depth
- It saves 40% fuel and 66 % seeding cost
- Yield increases by up to 15-20%
- Environmental friendly
- It can be manufactured in local workshop
- It can be operated in small land and easily transportable

## Specifications

| | |
|---|---|
| Dimension | : 720 mm×1320 mm×700 mm |
| Weight | : 167 kg |
| Number of rotary blades: 48 | |
| Power requirement | : Power tiller (9-12 kW) |
| Number of rows | : 6 (line number adjustable) |
| Row spacing | : 200 mm (adjustable) |
| Normal working speed | : 2.0–3.5 km/h |
| Maximum speed | : 9.40 km/h |
| Working width | : 1200 mm |
| Normal seeding depth | : 50–60 mm |
| Type of seed meter | : Fluted type/inclined plate type |
| Seed box capacity | : 20 kg |
| Speed of blade | : 480–500 rpm |
| Price of the seeder | : Taka 70000.00 (US$ 875) |

**Type of inclined plate seed meter for different crop seeds**

| Sl No. | Types of crops | Inclined plate type | Seed rate (kg/ha) |
|---|---|---|---|
| 1. | Wheat | 35 | 120 |
| 2. | Mungbean | 40 | 25 |
| 3. | Rice | 40 | 25-30 |
| 4. | Chickpea | 35 | 40-45 |
| 5. | Maize | 24 (Winter)<br>21 (Summer) | 22-24 |

## Working Principle

The seeder has to be attached behind the power tiller after removing the rotavator of power tiller. Line to line distance, depth and the appropriate seed plate has to be selected according to seed size of crops. There are several agronomic adjustment ie. seed rate depth of seeding line spacing. At the beginning of operation, the gear of the rotating blades has to be got started. The machine has to start operation at a speed of 2 to 2.5 km per hour keeping the power tiller at first or second gear. When the machine moves forward, then seed plates rationally start falling seeds from the seed hopper. After that seeds fall into the furrow, created by furrow openers through a pipe. It is to be observed whether seeds are being poured in lines properly through a plastic tube. After reaching the end of the land, the seeder needs an about turn for which the rear part of the seeder has to be raised and started sowing again in the next row. It is to be observed carefully whether the metering device is moving properly or not. This process is continued.

## Field performance

- Crops: wheat, maize, jute, paddy, oil seeds, pulses and onion field preparation.
- Field capacity: 0.16–0.25 ha/h (40–60 decimal/h)
- Field efficiency: 85%
- Operating cost: 2500 Tk/ha by seeder (5890.0 Tk/ha by conventional method)

# BARI Bed Planter

Bed planting system adds a new era in modern farming system. It saves natural resources in modern production system without reducing yield. It increases yield, reduces production cost and facilitates different crop management. In Bangladesh, farmers are practicing bed planting system for potato, maize, chilli vegetables etc. from long ago for protect their crops from waterlog problem due to heavy shower. They make bed manually and it is very labourious, time consuming and costly. They do not know how to use bed planting technology in other crops and they had no idea on bed planting machinery. Also they had no idea about the crops which will give better result in bed planting. Considering the above facts, BARI have developed a bed planter for reducing labour requirement cost of bed formation and seeding time as well as higher yield and income of farmers.

*BARI Bed Planter*

## Advantages

- Bed formation, fertilization and seeding can be done in a single operation
- Facilitates easy irrigation and save water 30-40%

- Crop management easy
- Overcome water logging problem
- Escape moderate level salinity for crop establishment
- Reduces turnaround time and helps to increase crop intensity in cropping pattern.
- Increased cereal crops yields by 5–20%, pulse crops by 15–35% and fiber crops (Jute) by 10–15%
- Reduces:
    - Irrigation water by 25–30%
    - Nitrogen fertilizer by 10–15%
    - Seed by 15–20%
    - Tillage costs up to 60%
- Environmental friendly

## Specifications

- It is made of MS angle bar, MS sheet, MS flat bar, bearing, MS shaft etc.
- Height of bed: 150–200 mm
- Width of the bed: 600–700 mm (controlled)
- Distance between bed to bed: 300 mm wide
- Price: Tk 40,000 ( US $ 500) (without power tiller)
- Weight: 125 kg
- Overall dimension: 1200×800×720 mm

## Working principle

BARI Bed planter is attached with power tiller that can till soil, make bed, apply fertilizer and sow seeds simultaneously in same pass. Seed can be sown on bed either single or double lines and maintaining seed to seed distance following standard agronomy of different crops. In this bed planter, tines are allied in such a way that tilth loose soils are thrown in inner side from left and right side then form bed. A roller behind the rotating blades lightly presses the loose soil and makes the bed compact and uniform in

size and shape. A special type seed metering device which is called inclined plate seed meter is used in bed planter. Round aluminum or plastic plates with grooves of varying sizes are mounted within a plate holder which is rotating during power transmission. Individual seeds are separated along the peripheral grooves of plate and dropped in line maintaining proper seed rate and spacing.

The number and size of grooves on plate are depending on seed size and spacing of different crops. Such as 9 mm size and 24 grooved plate for maize and groundnut and 6 mm size and 35/40 grooved plate for wheat, mungbean, okra, lentil and black gram. On the other hand, fluted type seed meter is used for planting jute and sesame seeds. Fertilizer can also be applied through fluted type meter. Both Sifeng and Dongfeng model bed planters are available. Now seating arrangement is included in both models. It also called riding type.

**Field performance**

Field capacity: 0.12 ha/h (30 decimal/h)

Field efficiency: 85%

Operating cost: 2200 Tk/ha by bed planter (6000 Tk/ha for wheat, 15000 Tk/ha for maize by conventional practice)

*BARI Bed Planter*

# BARI Zero-till Planter

Zero till operation is one of the conservation agriculture practices. Zero-till is defined as the operation of planting crops in unprepared or uncultivated soil by opening a narrow slot or band only of sufficient width and depth to obtain proper seed placing through crop residuce. The traditional tillage methods have long resulted in exposed field surface, decrease soil fertility, serious water loss and soil erosion and increasingly worse ecological environment. Moreover, drought has become a critical restricting agricultural production in the country. No tillage and reduce tillage have been used since ancient times as indigenous practices. Because farmer has not enough muscle force to prepare the land to a considerable area and depth by hand. When mechanical tillage system appeared farmers started believing that the more tillage you do the more yields you get. But truth is that, the more tillage you do the more erosion and soil degradation you get, especially in warmer area. Zero-till minimizes the need for the number of tillage operations, reduces planting time and saves fuel and labour costs in both timely planting and late planting situations.

*BARI Zero-till Planter*

## Advantages

- The planting depth, row spacing and seed rate can be adjusted according to standard practices.
- Zero-till farmers saved plant establishment cost 50-65%, and minimizing the average turnaround time 7-9 days between the two crops.
- Planting cost by the seeder is Tk.1900.0/ha
- Long term trial (6 years), zero-tillage wheat yield shows continuously higher than conventional planting system in rice-wheat-mungbean crop rotation maintaining 30% residue

## Specifications

- Over all dimension: 2460x1120x1200 mm
- Power require: 9-12 kW Dongfeng type power tiller
- Hitch plate: 120 x 150 mm; Steel plate
- Toolbar frame: 800 x 1120 mm; 3 bar; 50 mm sq stainless steel
- Seed & fertilizer box: 800x330 mm; 22 gauge steel plate
- Seed meter mechanism: 170 mm, Inclined plate, variable cell size
- Furrow opener 510x70x10 mm “T” type; Steel
- Press wheel: 250–50 mm; rubber coated
- Power transmission: Chain No. 428 with different size sprocket
- Depth control bar: 460 x 10 mm steel bar
- Weight: 115 kg (without engine)
- Price: Taka 40,000 (US$512)

## Working principles

The main functional parts of the drill is toolbar frame, seed metering device, seed and fertilizer box, furrow opener, press wheel and chain with sprocket for power transmission from power

tiller wheel axel. The machine is to be attached at drawbar point of power tiller. Press wheel is attached at the back of zero-till drill to cover seed, fertilizer and soil. The planting depth and seed covering mechanism can be adjusted during the field operation. Roundup herbicide can be applied two days before of planting operation.

## Field performance

Crops: wheat, maize, jute, paddy, oil seeds and pulses

Seed rate: adjustable

Field capacity: 0.1 ha/h (25 decimal/h)

Field efficiency: 85%

Operating cost: 2200 Tk/ha by bed planter, 6000 Tk/ha, 15000 Tk/ha by conventional practice.

# BARI USG Applicator

For cultivation of modern high yielding rice, urea is very essential input. About 80% of urea fertilizer is used for cultivation of rice in the country. But in conventional application method (broadcasting), urea is mixed with the air by converting into gas, leached down into the soil or washed away with water to canal, ditch etc. To reduce the loss of urea and ensuring the highest use of it, USG (Urea super granular) has been developed. Effectiveness of the urea fertilizer can be increased by placing USG under 60–70 mm muddy soil in rice field. Although, there are many advantages of using USG, it could not gain popularity among the farmers due to application method. USG is generally applied in the muddy rice field in the centre of four hills of rice plants one by one which is tedious and time consuming task. On the other hand, skill labour is needed for doing the unpleasant and difficult job. Considering the drudgery of farmers and reduce application time, USG applicator has been developed by BARI.

*BARI USG Applicator*

## Advantages

- Reduces drudgery of labour and production cost
- Saves 80% time and 78% cost compared to manually application of USG
- Saves 43% urea
- One man can operate the machine
- Price of the machine is low

## Specifications

- This is two rows, push type manual operated machine
- All parts are made of plastic but handle, frame and shaft are made of mild steel
- Two plastic-made boat-shaped skids remain on two sides of the machine those help floating on the mud
- Two furrow openers remain 60 mm below the skids
- Furrow closer attached bottom of the skid
- A handle of 1.5 m length is placed in different angles according to the height of the operator
- The machine operates smoothly at 20–50 mm standing water
- The machine is operated at normal walking speed of a man of 1.0–1.5 km/h
- The machine should be operated after setting of mud i.e. 7–10 days after transplanting of seedling
- Weight of machine: 6 kg
- Price: Tk. 3,500 ( US$ 43.75 )

## Working Principle

Two-third of each hopper of the applicator will be filled up with USG (750 g). The machine has to be set at the middle of four rows in one side of the land. First, skids to be set parallel to soil surface and the handle will be set up to the waist of the operator, then the applicator to be driven forward by pushing the machine at the

walking speed. Operation of the applicator moves the power wheel like a spinning wheel and the cup type metering device places one by one USG under 60–70 mm of mud through the funnels and furrow openers. Furrow closer covers up USG with soft clay. Caution is required during walking through the line of the middling position of the machine, where fertilizer does not place. After reaching the end point of the land, the machine has to be lifted up by two hands and then reset among four rows avoiding a row and the machine has to be pushed ahead. The hopper has to be refilled with USG before being finished.

## Field performance

- Field Capacity: 0.10 ha/h (25 decimal/h)
- Field efficiency: 87%
- Operating cost: Tk. 700/ha by applicator (2500 Tk/ha by manually)

*BARI USG Applicator used in rice field*

# BARI Upland Weeder

Weeds are the main enemy of crops. If weeding is not done properly, crop production decreases and occurs fertilizer loss. In our country, farmers use hoe for weeding. Hoe is used for weeding or cleaning crop fields. Use of hoe requires enough time and labour resulting in increase of production cost. The hand-driven weeding machine has been developed for weeding out the dry lands of those crops sown in lines.

*BARI Upland Weeder used in Field*

## Advantages

- This machine is suitable for dry land weeding
- It can reduce production cost and time
- One man can easily operate this machine
- It can be made in any local engineering workshop
- This machine runs between two rows, therefore weeds are removed with its root

## Specifications

- It is a push and pull type manual upland weeder
- It is a shovel and rake type weeder
- It is made of MS pipe, MS rod and MS flat bar
- It is made of 12.5 mm mild steel of which main frame is placed on a metal wheel

- An operator can operate it easily in one row
- Number of row: one
- Dimension: 1500 mm × 370 mm × 260 mm
- Weight: 3.5 kg
- Price: Tk.1000 (US$ 12.5)

## Working Principle

For using the machine, minimum row to row distance should be 200 mm. The handle has to be set straight to the waist of the operator. Shovel or rake has to be used according to necessity of weeding out. Now the machine has to be driven at a speed of 1.5 km per hour by pushing forward and pulling behind. It has to be noticed so that the machine is driven keeping 20–30 mm distance from the plant and the root of the plant is not cut. If some grasses remain even after operation the machine, then those have to be weeded out by hand or by hoe.

## Field performance

Crops: upland crops planted in row such as-jute, oil seeds, wheat, maize, pulses, onion, vegetables etc.

Capacity: 0 .02 ha/h (5 decimal/h)

Field efficiency: 85%

Number of operator required: one

Weeding cost: Tk. 1900/ha by weeder (4500 Tk/ha by manually)

*BARI Upland Weeder*

# BARI Reaper

Rice and wheat are the main food crops in Bangladesh. At present harvesting of rice or wheat is one of the main problems of Bangladeshi farmers due to labour shortage. Farmers are to perform several jobs at a time during harvesting season of rice or wheat such as harvesting of crops, threshing, winnowing, drying, and preparing land for next crops. An acute scarcity of laborer is found at peak harvesting season of these crops. A study found that during this harvesting time about 50 percent of necessary labours remain available. As a result, the farmers compel to wait for laborers of cutting crops even after ripening. During boro and wheat harvesting season the problem becomes serious. Ripe crops are damaged by storm, rain, hailstorm and flash flood. The problem is more acute in low lying lands and haor areas. For solving the problem, BARI has developed a self-propelled reaper for harvesting rice and wheat.

*BARI Reaper*

## Advantages

- Rice and wheat can be harvested by this machine
- It can also harvest slightly slanted rice and wheat

- It can harvest crops even there is some water in the field without clay soil
- Harvested rice or wheat fall right side in rows so that these can be easily bundled
- Fuel cost is only 0.8 litre per hour (petrol or octane)
- A man can easily operate this machine
- It can be easily transported from one place to another

## Specifications

- A petrol engine of 5 hp (3.7 kW) with 2600 rpm supplies power to the reaper
- There is a gear box in the machine which supplies the power of engine to the wheels and cutter bar through main driving shaft. By changing the lever of gear box, the machine can be moved backward.
- There are 24 cutting blades in the machine which are specially made of carbon steel sheets.
- There are seven pressure springs in the machine which are made of carbon-steel-wires.
- The other parts of the machine are made of MS angle bar, shaft, flat bar, plastic fiber, chain sprocket V-belt, pulley, gear, pinion etc.
- Dimension: 2500 mm × 1500 mm × 1150 mm
- Width of harvesting: 1.2 m
- Price: Tk 1,70,000 ( US $ 2200)
- Weight: 150 kg

### Working principle:

Before starting the machine nut bolts of all parts and joints have to be checked. The engine is to be started keeping all levers in neutral positions. Then power has to be connected to the wheel by pulling the wheel lever. Then the machine will start moving forward. After reaching the land, the machine has to be placed at a convenient corner in such a way that the bund of the land remains at right side of the machine. At this situation, the machine has to be moved and made cutting lever on position. The machine has to be operated carefully in case of having high bund to avoid

accident between the bund and the machine. In case of having high bunds or another crop beside, first row of cut crop may be scattered, if crops of one crop from the border are harvested by a sickle, then the first row of the harvested crops will not be scattered. This time, the lever of the scissors has to be started. Drawing the lever of wheels of the machine power has to be connected to the wheels. The machine will advance while cutting and the crops harvested will fell in rows. Harvesting height has to be controlled manually. After reaching an end to the piece of land, power of the wheels has to be disconnected and pulling the machine backward, it has to be turned left straight to 90 degree and cutting has to be restarted. At a suitable time, the crops left in row have to be taken to the particular place of threshing after tying them up in bundles.

## Field performance

- Crops: Rice and wheat
- Field capacity: 0.14–20 ha/h (35–50 decimal/h) for rice 0.18–0.24 ha/h (45–60 decimal/h) for wheat
- Field efficiency: 85%
- Reaping cost: 1500 Tk/ha by reaper (6000Tk/ha by sickle)

*BARI Reaper used in Rice field*

# BARI Multi-crop Thresher

Generally farmers of Bangladesh thresh their paddy, wheat and pulses beating by hand or cattle treading. This increases the threshing cost, as more laborers are needed. A substantial amount of paddy and wheat are lost and quality is deteriorated during the rainy season, as threshing in traditional method is not possible then. As a result, market price of the product reduces. Production of paddy and wheat has been increased a lot in comparison with the past which made threshing difficult using traditional or pedal operated threshing machine. For this, power operated multi crop threshing machine has been developed by BARI.

*BARI Multi-crop Thresher*

## Advantages

- Paddy, wheat, oil seeds and pulses can be threshed by this machine
- Straw of 0.5–0.7 m length and low moisture content (20%, wb) of crops increases the performance of the machine
- High labour saving and cost effective
- Threshing capacity of the machine is eight times higher than that of pedal thresher

## Specifications

- The machine is made of MS angle bar, MS flat-bar, MS rod, MS sheet, MS shaft, ball-bearing, V-pulley, V-belt, etc
- Main parts of the machine are-frame, threshing cylinder, feeding chute, feeding tray, out-let chute, concave sieve, cylinder cover, blower, moving sieve, engine, chassis, wheel etc
- Dimension: 1980 mm × 950 mm × 1900 mm
- Size of the cylinder: Diameter-12 mm, length-30 mm
- Size of the spike: Diameter-12mm, length- 3mm
- No of blower: one
- Source of power: diesel engine of 9 kW (12.5hp)
- Labour required: 4 persons
- Weight : 160 kg
- Speed of cylinder : 550–600 rpm
- Price: 45,000 (US $ 562) ( Without engine)

## Working Principle

For threshing crops, the machine has to be placed at a level and open place. After getting started the engine, paddy, wheat, pulses crops have to be kept on feeding tray for threshing. Untied the bundles of the crops have to be fed into threshing cylinder using a

hopper keeping top of the grains ahead. Within a few moments, the grains would be deposited at a corner of the machine after being swept up by a fan and graded by a sieve. Straws will be thrown a little bit far from the machine through the outlet chute. After a certain time, the threshed grains have to be removed.

## Field performance

- Crops: Wheat, paddy and pulses
- Threshing efficiency : 99%
- Threshing capacity: Paddy: 930 kg/h

  Wheat: 340 kg/h
- Threshing cost: 300 Tk/ton for paddy, 800 Tk/ton for wheat by thresher

*BARI Multi-crop Thresher*

# BARI Hand Maize Sheller

Maize cultivation has been increasing rapidly in Bangladesh. The shelling process of maize is not easy like paddy, wheat and other crops. Farmers shell maize by hand with the help of bamboo basket. This job is drudgery and time consuming process. The grain of maize is attached tightly to the cob. So it is not possible shelling maize by beating. Farmers face a great difficult to shell grain from maize cobs. Considering these, hand operated maize sheller has been developed to shell maize in small scale level.

## Advantages

- It can be made in local engineering workshop with locally available materials
- The shelling cost of this machine is less than that of hand shelled. Small maize producer can use it as its cost is low
- One man or woman can operate the machine

## Specifications

- The machine is made of MS angle bar, MS sheet and MS flat bar
- The main frame of this machine is made of 254 mm x 254 mm MS-angle bar.
- The cylinder is rotated by handle
- There is a wooden seat for the operator at the back side of the frame.
- Dimension: 700 mm × 260 mm × 460 mm
- Number of fins : 4

- Dimension of fin : 60 mm × 10 mm × 100–180 mm
- Diameter of cylinder: 120 mm
- Weight: 7 kg
- Price: Tk.1000 (US $ 12.5)

## Working Principle

The sheller has to be placed on a plane and clean surface. One person has to sit back side of the frame for maize shelling. The cylinder is moved by moving handle with the help of right hand and at the same time maize cob is fed in the moving cylinder by left hand. During rotation of cylinder, the grain of maize easily separated from the cob.

## Field performance

- Capacity: 35 kg/h
- Shelling efficiency: 95%
- Required labour: one man or woman
- Shelling cost: 1000 Tk/ton

# BARI Power Maize Sheller

Maize is now the second most cereal crop grown all over the country. Farmers shell their maize cobs by sickle or rubbing with a basket. Shelling of maize at a large scale is not possible even with hand maize sheller. To meet up the farmers' demand, BARI has developed a high capacity power maize sheller for shelling in large scale.

*BARI Power Maize Sheller*

## Advantages

- The maize sheller is made of locally available materials in local workshop
- The operation of this machine is very easy
- To operate this machine four persons are needed
- The operation cost is low due to high capacity of the machine

## Specifications

- The machine is made of MS angle bar, MS flat bar, steel square bar, bearing, MS sheet, V-belt, V-pulley, blower, etc.
- The main parts of this machine are frame, shelling cylinder, feeding chute, outlet chute, blower, wheel, engine, chassis etc.
- The machine is supported on four iron wheel for easy movement
- Shelling cylinder is rotating by means of belt pulley of engine

- Dimension: 2000 mm × 1000 mm × 1800 mm (Large size) 1000 mm × 800 mm × 1450 mm (Small size)
- Source of power: 12.5 hp ( 9 kW ) for large size
  9 hp (7 kW) of engine for small size
- Weight: 110 kg (Large size)
  75 kg (Small size)
- Price (Large size): Tk 50000 (US $ 625) (Without engine)
  (Small size): Tk 40000 (US$ 500) (without engine)

## Working Principle

*BARI Power Maize Sheller in operation*

Before shelling, maize cobs have to be dried up because in case of improper drying, shelling capacity and quality of grains are reduced. Before starting shelling, the cobs of maize have to be piled up at a place near the sheller. Getting started the engine, cobs of maize have to be fed in the feeding hopper with a basket and cobs have to be inserted into the shelling cylinder. Grains of maize will fell down on ground through the tray below the machine after being separated from the maize and the stalk will be thrown away through the outlet chute. After a certain time, maize grains will be deposited in front of the machine and have to be removed.

## Field performance

- Threshing capacity: 2.5–3.0 t/h (large size)
  1.0–1.5 t/h (small size)
- Labour required: 3–4 people
- Shelling efficiency: 98%
- Shelling cost: 300 Tk/ton by small power sheller, 150 Tk/ton by large power sheller (1000 Tk/ton by hand maize sheller)

# BARI Potato Planter

In Bangladesh, the weather and soil conditions are very suitable for potato cultivation. Potato cultivation is increasing almost all districts of north Bengal and Munshiganj. Every year, potato is cultivated around 0.45 mha of land. Potato cultivation is labour depended, time consuming and expensive. In rural areas, potato farmers cannot plant potato timely for scarcity of labours. Timely planting of potato is prerequisite for gaining expected yield. In Bangladesh, two-wheeled tractor (power tiller) plays a vital role in different agricultural activities like tillage operation, irrigation, threshing, rice milling, and transportation. Utilizing this two-wheeled tractor, BARI potato planter machine has been developed which is easily used in small land.

*BARI Potato Planter*

## Advantages

- It ensures timely planting of potato
- It reduces labour dependency
- It reduces 67% of planting cost
- Four persons are required for planting of potatoes in one hectare of land whereas these are 60 persons for manual planting

## Specifications

| | |
|---|---|
| ❋ Overall dimension | 800 mm x 700 mm x 950 mm |
| ❋ Mechanism of potato planting | Cup type |
| ❋ Number of row | 1 |
| ❋ Number of metering cup | 10 pairs |
| ❋ furrow to furrow Distance | 600 mm ( whole potato seed )<br>550 mm ( cut piece seed ) |
| ❋ Seed to seed distance | 200–220 mm (whole potato seed)<br>150–160 mm (cut piece seed ) |
| ❋ Height of the bed | 150 mm |
| ❋ Number of blade | 24 |
| ❋ Power transmission | Chain and sprocket |
| ❋ Source of power | Power tiller (12 hp ) |
| ❋ Price: | Tk 40,000 ( US$ 500) (without power tiller ) |

## Working Principle

Twenty four rotary blades are attached to the planter for satisfactory bed formation by the two-wheeled tractor. The blades arrangement like this twelve blades are arranged from left to right way and other twelve blades are from right to left. Rotating blades create a furrow after tillage operation. Metering devices pick potato one after another and place them at pre-determined distance. Bed maker creates bed and covers the potato seeds. This planter can make bed and plant potato simultaneously.

## Field performance

- ❋ Field capacity: 0.1 ha/h (25 decimal/h)
- ❋ Planting efficiency: 85%
- ❋ Planting cost: Tk 4804/ha for BARI potato planter (manual cost: Tk 14,740/ha)

# BARI Potato Harvester

Bangladesh is still far behind in agro mechanization from many least developing countries due to many social, economic and geographic reasons. In Bangladesh, there is a huge labour shortage in rural areas during peak harvesting period of different crops. Manual potato harvesting is a slow, time consuming and costly operation. In conventional system, potato beds need to open first by an indigenous plough then pick up the exposed potatoes by hands. A number of tractor mounted equipment have been developed by different countries for harvesting potato but those are heavy and expensive machine. Land size and farm holding are major constraints that restrict the introduction of tractor operated imported large potato harvester in our agriculture. Also, majority of the farmers cannot afford to own a big machine because of its high initial cost. Hence, the tractor operated potato harvester cannot be adopted by the farmers. So, our farmer need small and low cost machinery .Considering the above facts, BARI has develop small and low cost potato harvester that can easily fit with power tiller; a common tillage tools in Bangladesh for easily harvest, reducing labour requirement and maximum recovery of tuber from soil.


*BARI Potato Harvester*

## Advantages

- Single ridge pulling/ cutting and maximum tuber exposing in a single pass
- Depth of ridge cutting/pulling is adjustable
- Most of the potatoes exposed on soil surface, no potato remain under the soil
- Potato harvester and its spare parts are manufactured locally
- Operation and maintenance is very easy
- Save 65% cost and 70% labour
- Save time and reduce labour dependency in peak harvesting time
- Maximize recovery of potato from field

## Specifications

- It is made of MS angle bar, MS sheet, MS flate bar, pulley, belts
- Overall dimension: 900 mm × 850 mm × 850 mm
- Flat iron columns are welded on the blade in such a way that blade is inclined to the ground at an angle of 20° when column is vertical
- Blade is 540 mm long and 325 mm wide and 6 mm sharpen at front
- It is provided with a 50 × 50 × 6 mm angle iron at the rear bottom to increase its strength against bending
- Single ridge opening devices can be bolted through opener bases at spacing of either 310 mm or 210 mm. In front of the conveyer chain there is high carbonated steel shovels bolted
- Price: Tk. 35000

## Working Principle

BARI potato harvester is agricultural equipment which attached with power tiller that can uproot potato and expose it on soil surface. In operating process, ridge cutter blade enters the ridge

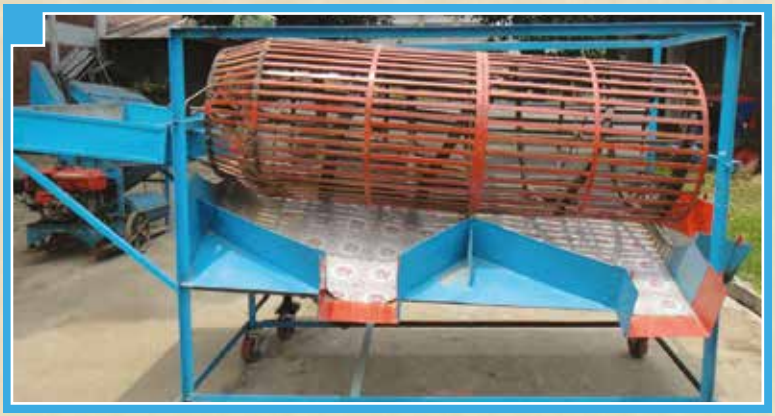
below the potato zone and cuts the ridge slice from the main soil mass. The cut ridge slice with tubers comes over high speed ladder type conveyer belt and most of the soil clods broken in small pieces and dropped among gapes of conveyer belt sticks and the potatoes are separated. The separated tubers are thrown behind the machine on loose soil surface.

**Field performance**

| Sl. No. | Items | Plan ter | Manual |
|---|---|---|---|
| 1 | Tuber exposes on soil surface (%) | 96–99% | 30–35% |
| 2 | Damaged tuber (%) | 1–1.2% | 5–6% |
| 3 | Maximum recovery of tuber (%) | 99–100% | 80–90% |
| 4 | Number of labour requirement (labour/ha) | 21 | 60 |
| 5 | Working capacity (ha/h) including hand picking time | 0.12 | 0.03 |
| 6 | Harvesting cost (Tk/ha) including manual collection cost | 8357.0 | 17100.0 |

# BARI Potato Grader

Potatoes are graded at different sizes for preservation and selling in market. At present cold storage workers and farmers grade potato manually by hand in different sizes. The manual grading process needs a lot of labourers and huge time. Thus, the grading cost becomes high. BARI developed Power operated potato grading machine can grade of potatoes in different sizes at a low cost and in a short time.



*BARI Potato Grader*

## Advantages

- The machine can be made of locally available materials in local engineering workshop
- Three people are needed for operating the machine
- In a shorter time and at a lower cost the potato can be graded in three sizes
- The graded potatoes are directly deposited in sacks
- It can be easily moved from one place to another

## Specifications

- The cylinder is placed on two bearings with the help of a shaft at an angle of 8° inside a frame
- Feeding hopper is made by MS sheet.

- This machine is operated by 0.38 kW motor or 4 hp (3 kW) engine
- Dimension: 3050 mm x 1540 mm x1900 mm
- No of sieve: 2
- Price: Tk 40, 000 ( US $ 500) (with motor)
- Weight: 50 kg

## Working Principle:

*BARI Potato Grader*

The potato grading machine has to be placed on a level place in such a way so that it cannot able to move. One person is needed only to deliver potato in the hopper and the other two processes are needed for filling up potato in sacks, replacing and removing those potatoes which are trapped on the sieve. The cylinder will be moving after getting the engine or motor started. Then potatoes are fed in the hopper. Potatoes size under 28 mm of diameter will fall into the sacks rolling on the first part of the sieve. Potatoes size 28–40 mm of diameter will go in the second category and fall into the sacks after rolling. Potatoes size larger than 40 mm of diameter will be filled in sacks after rolling through the last sieve. In this way, potatoes can be graded into three categories according to size. Graded potatoes can be used as seeds, as it does not cause injury on potatoes.

## Field performance

- Capacity: 1.3 ton/h
- Grading efficiency: 95%
- Grading cost: 75 Tk/ton by grader (400 Tk/ton by manual)

# BARI Winnower


*BARI Winnower*

Traditionally women clean the threshed grains using 'Kula'. Farmers of Bangladesh depend on natural wind for cleaning grains after threshing. A large amount of grains are lost for heaping up the unclean crops due to insufficient air. So, quality and market price of the grains are reduced. To solve the problem, power operated winnowing machine have been developed by BARI. This is a women friendly machine and reduces time, cost and drudgery.

## Advantages

- The machine can be used inside rooms during bad weather
- Grains can be cleaned and winnowed in a short time with low cost
- A woman can operate this machine easily
- It can be fabricated in local engineering workshop
- It saves time and labour

## Specifications

- The frame is made of MS angle bar on which the blower is placed
- It has four blades of MS sheet which are used for blowing the wind
- The hopper, tray and both chutes are made of MS sheet
- The blower shaft is rotated by an electric motor

- Dimension: 1.20 m x 0.66 m x 1.37 m
- Weight: 50 kg
- Wind speed: 3.50 m/s
- Speed of blades of blower: 475 rpm
- Source of power: 0.373 kW (electric motor)
- Price: Tk. 20,000 (US $ 250) (without motor)

## Working Principle:

*BARI Winnower*

The machine has to be positioned on a shadowy plane and open place. During operating, the machine by motor, attaching the motor with the chassis, v-pully has to be connected with the help of v-belt. The motor will start moving after connecting with power and the fan will start moving. In this situation, the unlearned grains have to be fed in the feeding tray with a basket or bowl. With light vibrations of the machine, when grains fall under the filter, the air of fan will separate those dusts of the grains. Clean grains will fall on two sides of the machine after being divided into two sides with two chutes or will fall on a side, which are to be collected with a basket or bowl before filling those in sacks.

## Field performance

- Crop: Paddy, wheat, pulses and oil seeds
- Capacity: Paddy: 800 kg/h
  Wheat: 1000 kg/h
- Field efficiency: 98%
- Winnowing cost: 110 Tk/ton for wheat and 90 Tk/ton for paddy by winnower (450 Tk/ton by Khula)

# BARI Mango Harvester

Mango is one of the most popular fruits in Bangladesh. It is called the king of fruits. In Bangladesh round shape bamboo basket is used for harvesting mango in which jute or nylon made net is connected with a pole. This basket is attached at the top of the bamboo. In this process, mango is stretched at the end of the pedicel which causes stem end rot disease. It reduces the shelf-life of mango and also reduces market price. In mango exporting countries, mangoes are harvested with pedicel which protects mangoes from stem end rot diseases. So, a mango harvester has been developed by BARI to harvest mango with 10–20 mm pedicel.

*BARI Mango Harvester*

## Advantages

- Mangoes can be harvested with its pedicel by this machine
- The mango can be harvested by the machine with 20% higher speed than that of the traditional methods
- Manually operated

## Specifications

- The machine is made of GI wire, high speed steel, and GP sheet and jute/nylon rope
- V-shaped blade is connected to one side of the GI ring by welding

- A narrow bamboo is inserted to GP sheeted clamp which is connected to the side of the ring
- When mango is harvested from the ground, it is set at 45° angle to the bamboo
- Diameter of ring: 230 mm
- Weight: 500 g (without bamboo pole)
- Price: Tk. 1000 (US $ 12.5) (with net, but without bamboo pole)

## Working Principle

Narrow portion of the thin bamboo pole/aluminum pipe is inserted to the clamp of the mango harvester. When mango tree is taller, the mango can be picked up sitting on a suitable place of the tree using the harvester. Otherwise, mango tree is shorter; mango can be easily picked up from the ground using the harvester**.** The mango is to be kept at the middle of the harvester and to be hold at lower part of the harvester. Keeping pedicel length 10–20 mm at the middle of two blades which are connected to the ring, the bamboo is pulled. Mangoes will fall in the net with pedicel. After harvesting several mangoes, these will be kept in a suitable place.

*BARI Mango Harvester in operation*

## Field performance

Field capacity: 150–200 kg/h

Field efficiency: 90%

Harvesting cost: 0.13 Tk/kg by harvester (0.15 Tk/kg by manual bamboo basket)

# BARI Hot Water Treatment Plant

*BARI Hot Water Treatment Plant*

More than 60 varieties of fruits are being grown in Bangladesh at different seasons. Major fruits include mango, banana, papaya, jackfruit, pineapple, guava, etc. Among the major fruits, mango has the most intense seasonality. On the other hand banana is another popular fruit grown round the year. The shelf lives of matured mango and banana are about 7–8 days and 6–7 days, respectively. The postharvest loss of fruits in Bangladesh is 20–30%. After harvesting these fruits are infected by different disease and insect. To reduce this loss, chemicals are used to increase shelf life which is harmful for human health. Hot water treatment plant may be a hygienic alternative to reduce postharvest loss as much as to increase shelf-life. Considering these issues, a hot water treatment plant has been developed by BARI.

## Advantages

- Digital temperature controller is used for controlling water temperature
- Motor operated conveyer roller is used to carry the fruit filled plastic crate
- Four persons are required to operate the machine
- The treated mango remains fresh up to 10–12 days instead of 7–8 days and the fruit surface becomes attractive
- The treated banana remains fresh up to 8–10 days instead of 6–7 days and the fruit surface becomes attractive

## Specifications

- The water tank is made of mild steel sheet
- Cork sheet of 25 mm thickness is used between two metal sheets of the tank to prevent heat loss of water.
- The mild steel roller is attached widthwise on the bottom of the tank
- The roller and stirrer are moved by an electric motor of 0.38 kW
- Water is heated by ten electric heaters each of 2 kW capacity for large hot water treatment plant
- Water is heated by six electric heaters each of 2 kW capacity for small hot water treatment plant
- Mango can be treated in hot water at 53–55 °C in 5–7 minutes
- Banana can be treated in hot water at 53–55 °C in 5–9 minutes
- Overall dimension
  : 3.11 m× 1.17 m × 1.53 m (large)
  : 1.62 m×1.18 m×1.53 m (small)
- Water holding capacity of tank
  : 1000 L (large)
  : 450 L (small)
- Weight
  : 400kg (large)
  : 235 kg (small)
- Price: Tk. 2,50,000 (US$ 3100) (large)
  Tk. 1,70,000 (US$ 2100) (small)

## Working Principle

The water tank has to be filled with clean water up to 100 mm below from the top. Then the heaters are plugged in. To maintain water temperature, the thermostat has to be set accordingly. The

temperature will rise up to desired level after 1.5 to 2 hours. Then the motor has to be started for moving roller. Next, the plastic crate will be filled with fruits and placed on the starting end of the machine and roller will carry the crate to another end at five minutes. Another crate will be placed on the roller after 40–45 seconds for large size and 80–90 seconds for small size. As soon as the crate reaches the other end, it should be picked up and should be spread out at the plastic sheet for drying. Electric fan can be used for drying the fruits. After the fruits have dried, they should be packed.

## Field performance

- Capacity:

  For mango: 1000 kg/h (large)
  : 500 kg/h (small)

  For banana: 600 kg/h (large)
  : 300 kg/h (small)

- Efficiency: 98%
- Treatment cost

  For mango: 0.60 Tk./kg (large)
  0.80 Tk./kg (small)

  For banana: 0.70 Tk./kg (large)
  1.00 Tk./kg (small)

*BARI Hot Water Treatment Plant in operation*

# BARI Hybrid dryer


*BARI Hybrid dryer*

Crops should be properly dried after harvesting for both processing and storage purposes. If crops are not dried properly, both the quality and quantity losses occurred. Sun drying of crop is the most common drying method in tropical countries like Bangladesh. The traditional drying method, crops are spread on the ground in the open sun and wind. Solar radiation provides heat to evaporate moisture from the crops and the air velocity enhances to remove the evaporated moisture. This practice is easy and cheaper but it requires large exposed surface, the intensity of sunlight fluctuates and the drying rate is very slow. Uncertain rainfall and cloudy or foggy weather reduce the quality of crops. Sometimes continuous rainfall for a few days spoils most or whole of the crops. In open sun drying, crops are infested by dust, dirt, insects, microorganisms, rodents, birds etc. Considering the necessities of the farmers of Bangladesh, a hybrid drier is developed by BARI.

## Advantages

- It is operated by the combination of solar and electrical energy, besides the solar energy is increased about 50% by the use of reflector
- This dryer is suitable for drying different types of grain seeds, fruits, vegetables, medicinal plants, etc.
- It can also be operated during rainy or cloudy weather when the sun is not visible
- There is a temperature controlling system, so crops do not suffer from over and under heat

- The heat energy is utilized property through recycling the warm air
- Wheels assist the dryer to move easily. The maximum sunlight is tracked by moving the dryer and adjusting the reflector.
- It can easily be fabricated in any local engineering workshop

## Specifications

- The dryer is made of flat plate collector, reflector, electric heater, temperature controller and drying chamber.
- Dimension: 2.3 m × 1.6 m × 1.0 m
- Electric heater: 4 kW
- Speed of air: 0.5 m/s
- Temperature of dryer: 40 °C–60 °C (adjustable)
- Price: Tk. 1,00,000 (US $1250)

## Working Principle

*BARI Hybrid dryer in operation*

The dryer has to be set at a place where sunlight is available all day long. Electric connection has to be set after setting up the dryer. Desired temperature has to be set on panel board and the temperature should be maintained by the controller. In general, the dryer should be set up facing to the sun. Reflectors have to be raised high so that the reflected rays of light fall directly on the cover of the collector. Then trays will be loaded with crops.

Then the trays have to be entered slowly into the drying chambers. Front doors of the trays have to be closed after entering all the

trays. The sensor of the temperature controller has to be set on a tray keeping it at middle position of the dryer. Then the dryer has to be operated after turning on the switches on panel board. The blower and the heater will start after switching the dryer on. It should be noticed whether the blower is moving properly and the heater is in operation. The heater will stop automatically after some time when the temperature rise to the desired level. If sufficient sunlight is available, then the heater will not be on. If sunlight reduces then the heater will start and stop automatically within a second. After every one hour the dryer has to be moved and the collectors have to be raised or lowered to face the sun directly so that the collectors get the maximum sunlight. The plastic pipe has to be set on the entry and exit way of the dryer so that heat can be saved by re-circulated warm air. However if the grain is wet, the entry and exit path way of air has to be kept completely open for 2 to 3 hours to avoid condensation. Later on it has to be kept partly open. Sometimes temperature may rise over desired level, then pipe has to be drawn out from the entrance of air so that warm air cannot enter into the dryer.

In case of not being dried up completely on the first day, keeping the grains loaded inside the dryer, the entry gate of air has to be kept closed so that rat or any insect can't enter inside the dryer. The reflectors have to be shut down so that rain or fog may not enter into the dryer. On the next day, placing the dryer facing towards the sun, power has to be connected after raising the reflectors. The dryer has to be switched off after desired moisture of crops is reached and the dried crops to be brought out opening the door after one hour.

## Field performance

- Type of crops: Rice, wheat, pulses, oilseed, fruits, vegetables, spices and medicinal plants.
- Capacity of dryer:

Rice- 250–300 kg/17 h , Wheat- 250 kg/12 h
Maize- 300–350 kg/16 h, Groundnut- 200kg/20 h
Fruits- 80–100 kg/20–25 h, Vegetables- 40–60 kg/12–15 h

# BARI Compost Separator

*BARI Compost Separator*

Vermi compost is the excretion of earth warm that can save up to 50 percent use of chemical fertilizers. Earth worms ingest cow dung, straw, perishable dust, creepers and herbs etc. and secrete a type of chemical from their bodies. Its defecate and this secrete chemical, when mixed up with organic substances, increase the nutritional value. When this waste material becomes granular like tea powders, then it is called vermi compost. Forming time of vermi-compost is required 25–30 days. Eggs of earth worms and its granular parts have to be separated from the fertilizer using a sieve. The most expensive and laborious job is to separate earth worm from the compost. Compost separation is not only tough, but also unhygienic job. Apart from this, the fertilizer is to be sieved at least twice. Using this machine, saves the health of warm as well as ensures quality fertilizer. Tricho compost or Trichoderma fortified organic compost is a wet and clamp fertilizer. Trichoderma is fungi that secrets antibiotic enzyme in environment or in compost that saves crop or plants from infestation of other harmful fungi. Reducing insect or fungi infestation by using tricoderma is an old practice. Trico compost is wet and sticky, sieving of which is very difficult. For getting expected fertilizer, it needs 3–4 times sieving, but the separator can sieve the desired humidified compost by 1–2 sieving.

## Advantages

- It can be fabricated using locally available iron materials
- It can successfully separate earthworm from the final part of manure

- Tricho compost can easily be sieved
- Three persons can operate this machine
- Fertilizer like tea dust ranging below 5 mm radius can easily be separated using the machine
- It can save time and cost

## Specifications

- Sieving cylinder covered with 5 mm MS net which is suspended on two bearing set on both ends of the shaft
- A 0.38 kW or 0.5 hp single phase electric motor is used as the source of power
- In case of vermi compost rotational speed of cylinder shaft is 10 rpm and for tricho-compost it is 15 rpm
- The rotating cylinder is set at 10° inclination input to output ends of the shaft
- The rotational speed is adjustable
- Dimension: 1.21 m×0.91 m×1.52 m
- Weight: 95 kg
- Price : Tk.35,000 ( US $ 438) (with motor)

## Working Principle

The machine is placed on a shady, level and open place. The motor has to be started and the cylindrical sieve will start rotating. The compost is fed into the entry hopper from the container. Compost having minimal moisture should be inserted uniformly. Within a moment the expected fertilizer like to tea dusts will start depositing on the collecting tray beneath the sieve. At the same time, earth worm and large compost clods will be deposited at exit end. Notable that during this operation, the earth worms will be deposited at one side and the waste will be piled up at a short distance. The earth worms may be kept in a new container along with organic waste after they are separated from the compost. If moisture of the trico compost remains high, then the big clod and unsieved fertilizers, that come out through the exit way may need

to be sieve for the second time. After a certain time, fertilizer is filled into sacks.

## Field performance

Capacity: 1500 kg/h (Vermi- compost)
1000 kg/h (tricho-compost)

Operating cost : Tk.70/ton ( Vermi- compost)
Tk.150/ton (Tricho- compost)


*BARI Compost Separator in operation*

# BARI Coffee Grinder

*BARI Coffee Grinder*

Coffee has been being cultivating in the hill tracts of Bangladesh since the last three decades by the initiatives of some government organizations and local people. But the coffee cannot be used coffee due to lack of proper processing technique and marketing facility. To brew coffee, the coffee cherry pulped is dried, roasted and grinded. These processes involve a series of machinery dependent operations. The local cultivators grind roasted coffee seeds manually which is tedious, time consuming as well as it reduces the quality of coffee. To reduce the drudgery and maintain the quality, a coffee grinder has been developed by BARI to grind roasted coffee seeds.

## Advantages

- The machine can be fabricated by locally available materials
- It can be operated by 0.38 kW or 0.5 hp electric motor
- Processing cost and time can be reduced by using this machine
- A desirable coffee powder can be produced as it is adjustable
- One man can operate the machine easily

## Specifications

- It is a motor operated disc type grinding machine
- This machine is made of MS plate, MS angle bar, MS sheet, MS flat bar, plastic box, bearing, V belt and pulley
- The main frame is made from MS angle bar of 250 mm
- Two grinding discs made of SS plat are attached vertically on the main frame.
- One of the discs is fixed with the frame and other rotates along with the shaft at 280 rpm
- A spiral shaped auger is placed at the top of the rotating shaft which conveys the coffee beans from the hopper to the center of the grinding discs for crushing
- A hopper with gate is placed at the top of grinder
- Power is transferred from electric motor to main shaft through attached belt and pulley
- A screw type knob is used to adjust the clearance between the grinding discs so that the desired fineness of ground coffee can be obtained
- Type: Disc-type electric motor operated
- Dimension: 560 mm × 450 mm × 740 mm
- Weight: 25 kg
- Price: Tk.25000 (US $ 321) (with motor)

## Working Principle

A clean and plane place is selected to operate the machine. The electric motor is started and the disk along with shaft will start rotating. The downward cover of the hopper should be kept closed and the hopper has to be fed with roasted coffee seeds. A screw type knob is used to adjust clearance between the grinding discs so that the desired fineness of ground coffee can be obtained. Hygienic condition should be properly maintained before and after using the machine.

## Field performance

- Capacity: 11.5 kg/h

# BARI Manual Groundnut Sheller


*BARI Manual Groundnut Sheller*

Groundnut, also known as peanut is an important oil seed crop of Bangladesh that is cultivated all around the year. It contains 48–50% oil and 22–29% protein. The kernel of the groundnut has to be shelled for its consumption as well as for planting as seed. Groundnut is shelled by hand is time consuming, tedious and boring. To solve these problems, a hand operated groundnut sheller has been developed by BARI for the small scale users.

## Advantages

- One person can operate this machine
- Graded groundnut (about 10 mm dia.) can be shelled
- It saves labor and cost at a higher level
- The efficiency of machine is satisfactory when it shells groundnut having moisture content within preservation level
- It can be fabricated in any local engineering workshop
- The price of this machine is cheap, so the small scale cultivators and owner of small bakery can purchase easily

## Specifications

- The machine is made of MS angle bar, MS rod, MS sheet, MS flat bar and rubber
- A semicircular rubber pad is moved through a semicircular net
- Rubber pad is rotated by a handle
- Radius: 230 mm
- Dimension of sieve:10 mm × 24 mm
- Capacity of hopper: 10 kg
- Weight of machine: 30 kg
- Price: Taka 7,000 (US $ 90)

## Working Principle

The machine is placed on plane and clean space. The hopper of the machine has to be fed with 10 kg groundnut. The clearance of the machine is set according to the average diameter of the nuts. The operator should seat behind the machine. By moving the handle at a reciprocating motion, the groundnut can be easily shelled.

## Field performance

- Capacity: 80–100 kg/h
- Required labour: 12 man-h/ton
- Shelling efficiency: 87%
- Rate of breakage: 1–2%
- Shelling cost: 2500 Tk/ton

# BARI Power Groundnut Sheller

The cultivation of groundnut is gradually increasing among the riverine settlers of Bangladesh. Hand operated groundnut sheller is not suitable for shelling a huge quantity of groundnut continuously. A power operated groundnut sheller has been developed by Bangladesh Agricultural Research Institute for large scale shelling of groundnut commercially.

*BARI Power Groundnut Sheller*

## Advantages

- The machine can easily be fabricated in any local engineering workshop
- One person can operate the machine
- Machine shelled groundnut kernel can be used as seed
- This machine is used for shelling, winnowing and separating the unshelled pod from the shelled kernel
- It is operated by a 0.38 kW or 0.5 hp electric motor
- It can save time and cost

## Specifications

- This machine is made of MS angle bar, MS rod, MS sheet, MS flat bar, V pulley, bearing etc.

- A semicircular rubber pad is moved forward and backward through a semicircular net
- Dimension of machine : 1060mm × 410mm × 1010 mm
- Capacity of hopper : 6–10 kg
- Weight of machine : 75 kg
- Rotational speed of blower : 2300 rpm
- Number of oscillation of sieve : 430 times per minutes
- No of stroke : 100 time per minute
- Price: Taka 30,000 (US $ 313) (with motor)

## Working Principle

A plane, shady and open space is suitable to operate the machine. The groundnuts should be well-dried prior to shelling because moist groundnuts reduce the efficiency and increase breakage. To start the operation, the electric motor should be started. The semicircular rubber pad will move forward and backward through a semicircular net, the fan will rotate and the sieves will oscillate. Then the hopper should be fed with groundnuts. To collect the clean nuts, a collecting tray is set the below the machine and another tray at the front of the sieve. The tray in front of the sieve collects unshelled nuts that should again be fed again in the hopper. After using the machine, it should be properly cleaned to ensure durability.

## Field performance

- Shelling capacity: 120–150 kg/h
- Shelling efficiency: 89%
- Rate of breakage: 1–2%
- Winnowing efficiency: 100%
- Sorting efficiency: 95%
- Shelling cost: 600 Tk/ton

# BARI Turmeric Polisher


*BARI Turmeric Polisher*

Turmeric is an important spice grown all over Bangladesh. Huge quantity of high quality turmeric is produced in hill tracts of Bangladesh which has high demand in home and abroad. The different steps of turmeric processing are cleaning, grading, boiling, drying, polishing and finally to grind into powder. Manual polishing consists of rubbing the dried turmeric fingers on a hard surface. Usually the dried fingers are kept inside a bag and are beaten on hard surface. This step is time consuming and tedious. To reduce the drudgery of the farmers, a turmeric polisher has been developed by BARI.

## Advantages

- The machine can easily be fabricated by locally available materials
- It is operated by a 0.38 kW or 0.5 hp electric motor
- One person can easily operate the machine
- Properly sun dried warm turmeric is better to increase the efficiency of the machine and ensures good quality

## Specifications

- The machine is made of MS angle bar, MS rod, MS sheet, MS flat bar, V-pulley, gearbox, bearing etc
- There are rough metal spikes attached inside the hexagonal drum

- The length of rotating hexagonal drum is 610 mm. Outer diameter of drum is 690 mm and inside diameter is 590 mm
- Overall dimensions of machine: 1.04 m × 0.85 m× 1.45 m
- Weight of turmeric: 30 kg/batch
- Weight of machine: 90 kg
- Price: Taka 30,000 (US $ 313) (with motor)

## Working principle

A shady, level and open place is suitable to operate the machine. Before starting the machine, the dried turmeric fingers are lightly heated in the sun prior to polishing to increase polishing quality. The hexagonal drum has to be filled with 30 kg turmeric and the door should be properly closed. Then, the electric motor has to be started and the drum will start rotating. During the rotation of the drum, the prickly spikes of the machine rub out the skin of dried turmeric finger. The empty portion of the drum removes the skin, roots and dirt of turmeric finger. It requires 20 minutes only to complete a batch of turmeric polishing and the machine is ready for the next batch. After using the machine, it should be properly cleaned and the rotating parts should be greased for the long term durability of the machine.

## Field performance

- Capacity: 65–90 kg/h
- Required operator: One person
- Efficiency: 95%
- Polishing cost: 1000 Tk/t

# BARI Coffee Roaster

*BARI Coffee Roaster*

The most important step of coffee processing is roasting the green coffee cherries. Roasting is a thermochemical process that transforms green coffee seeds into the aromatic brown beans. The coffee farmers roast coffee using stove and fry-pan. It results in uneven roasting that deteriorate the quality of coffee such as taste, colour and aroma. To process high quality coffee, coffee roaster machine is essential. Coffee roasting machine in not available in Bangladesh. To enhance commercial coffee farming, Bangladesh Agricultural Research Institute has developed a coffee roaster.

## Advantages

- The fabrication of the machine parts is easy so it can be fabricated in any local engineering workshop using locally available materials.
- The machine can be operated in a narrow space
- 0.18 kW (0.24 hp) electric motor is required to operate the machine
- It is operated by natural gas
- The temperature controller of this machine can roast coffee as per consumes' desire
- One person can operate the machine

## Specifications

- The machine is an electric motor driven rotary drum type
- It is made of SS sheet, MS square, MS sheet, MS flat bar, MS rod, MS shaft, bearing and gear box.
- The main frame is made of MS square of 200 mm
- A cylinder shaped bowl made of SS sheet is placed upon the main frame and covered by MS sheet

- The bowl is rotated at 30 rpm by an electric motor
- There are three spiral bars inside the rotating bowl to stir the coffee grains for proper roasting
- There is a door and a level at the end of the rotating drum for loading and unloading of coffee beans
- There is a gas burner under the bowl which is fired by natural gas
- The power is transmitted to main shaft through a gear box
- Fuel: Natural gas
- Dimension: 710× 400 × 610 mm
- Weight: 15 kg
- Price: Taka 20,000 (US$ 250) (with motor)

## Working principle

A clean flat place has to be selected to operate the machine. The bowl should be clean. Keeping the bowl empty and the vessel's doors closed, the burner should be lit. Then the electric motor has to be started. When the temperature reaches 100 °C, the motor should be turned off. Immediately after that, 1.0–1.5 kg dried green cherries should be loaded inside the bowl and the doors should be closed. Then the motor will be started again. The temperature should be maintained using gas cylinder control valve. To ensure coffee of different taste and aroma, the temperature and roasting time is important. So, light, medium or darkly roasted coffee is processed using the following time and temperature frame.

| Roast level | Temperature ranges, ˚C | Time, minute |
|---|---|---|
| Light | 195-205 | 20 |
| Medium | 205-220 | 18 |
| Dark | 220-230 | 23 |

After the roasting is completed, the rotation of the bowl should be stopped using attached lever and the other lever is used to incline the vessel to remove the roasting coffee beans. The roasting coffee beans should be cooled as soon as possible to maintain good quality. When the machine cools down, it should be cleaned and should be kept at a clean place.

### Field performance

- Capacity: 4.5 kg/h

# BARI Solar pump

*BARI Solar pump*

The price of fuel is increasing day by day. Bangladesh has 1.77 million irrigation pumps of which 85% run by diesel. The price of diesel is ever increasing. On the other hand, electricity in our country is insufficient and uncertain. This condition is creating adverse problem to operate irrigation pumps. The extraterrestrial solar irradiance in Bangladesh is 4.0–6.5 kWh and during summer, solar energy is available almost 6 to 9 hours in a day. The price of solar pump is reducing. So, solar energy can be used alternative in Bangladesh where grid electricity is not available. Solar pump is pollution free and environment friendly. To irrigate surface water, a pump of one horse power has been developed. The pump is operated using 900 Wp panel. The pump is directly coupled with one horse power DC motor. So, no battery is needed. The pump can run only by solar energy. The pump will not work during night time and cloudy or foggy weather.

## Advantages

- Centrifugal type solar pump is suitable for surface irrigation
- This pump can lift water from 6.0 m depth
- It is operated by 900 $W_p$ solar panel
- The pump requires no battery
- Vegetable cultivation is economically profitable using solar pump irrigation
- Rice cultivation is not economically feasible using solar pump irrigation

## Specifications

- Water lifting suitability: surface water
- Diameter of pipe: 38 mm (1.5 inch)
- Motor capacity: 746 W (1.0 hp)
- Motor type: DC
- Motor rpm: 3000
- Price of solar pump: Tk.100,000 (US$ 1250)

## Working Principle

The solar panel is made from silicon mono-crystalline chips. It consists of 900 W photovoltaic cells. The cells capture sunlight and a direct transformation of solar power into electric power is obtained. The panel provides power to a DC motor and the motor is directly coupled to a 1 hp centrifugal pump. No battery is required for this operation. The pump can lift water from 6.0 m depth.

The fluid is sucked in axially, due to the rotation effect of the impeller, into the pump body where it is radially accelerated in the vane before being forced out. The shaft is driven by the electric motor. The motor can only use solar energy. The pump will not work during night time or if the sky is cloudy.

## Field performance

- Panel power: 900 $W_p$
- Voltage: 60 V
- Average water lifting capacity: 140 liter per minute

# BARI Slicer

*BARI Slicer*

Slicer is a tool used in cutting vegetables and fruits in thin slices. Perishable crops such as potato, sweet potato, onion, etc. need both the short term and long term storage. Sliced pieces can easily be dried to chips or powdered. Globalization offers a huge demand of chips among the youngsters. This technology is economic and profitable to reduce seasonal surplus wastage and to meet up year round demand. Manual slicing is tedious and time consuming. Considering these facts, Bangladesh Agricultural Research Institute has developed a hand operated slicer which offers extensive help both at household as well as hotel or small entrepreneur level.

## Advantages

- This machine can be fabricated in engineering workshop with locally available materials
- It can slice potato, sweet potato, onion, cucumber etc.
- This machine is cost and energy effective
- One person can operate this machine
- The thickness of the slices are adjustable within 2–3 mm

## Specification

- The machine is made of SS sheet, SS pipe, SS bar, ball bearing etc
- It consists of three blades
- There are four feeding cylinders of 46–75mm diameter
- A collecting tray can easily be set below the machine

- Dimension: 360 mm×390 mm×780 mm
- The machine has a system of providing a strong grip on the crop by putting a gripping weight of 1.5 kg from the top
- The weight of the machine is 10 kg
- Thickness of the slice:2–2.5 mm
- Price of the machine is Tk. 7500 (US$ 95)

## Working principle

The gripping weight of the slicer is lifted to put the potatoes inside the feeding cylinders. The griping weight is set back to its original position and the handle is rotated clockwise. The cutting blades cut the crop and the slices fall on the collecting tray. The operator can adjust the blades to get desired thickness of the slices.

*BARI Slicer in operation*

## Field performance

- Capacity
  Sweet Potato: 60 kg/h
  Potato: 40 kg/h
  Onion: 35 kg/h
- Efficiency:83%
- Slicing cost: 2.40 Tk/kg by slicer (7 Tk/kg by manual method)

# BARI Carton

*BARI Carton (Large)*

Bangladesh is rich in seasonal and year round fruits. Mango, banana, guava, jackfruit are the main fruits of Bangladesh. Most of these fruits are perishable in nature with high nutritional value. Their qualities rapidly deteriorate if not transported safely. Inappropriate or rough handling can damage or injure the fruit surface resulting in reduction of market value. Carton is a box made of high-grade corrugated fiber board. It is used to carry fruits while transporting through the various marketing channels until consumption. It optimizes the postharvest handling losses and damage. It saves the fruits from abrupt shock loads. Keeping these facts under consideration, Bangladesh Agricultural Research Institute has developed carton that can ensure quality fruits for retailing, wholesaling and exporting.

## Advantages

- The carton is made with corrugated fiber board
- It is light in weight for easy handling
- It saves the fruits from internal and external injury
- Use of quality carton enhances commercial marketing
- It helps to maintain the quality of fruits until consumption
- Holes on the carton provide sufficient aeration to keep the fruits healthy

## Specification of CFB carton

For Banana

| | |
|---|---|
| Dimension | : 400 mm × 320 mm × 305 mm, 7 Ply |
| Holding capacity | : 10–12 kg for banana hands |
| Static load bearing capacity | : 70–80 kg |
| Price | : Taka 45 (US$ 0.60) |

For Guava

| | |
|---|---|
| Dimension | : 513 mm × 300 mm × 300 mm, 7 Ply |
| Holding capacity | : 18–20 kg of guava |
| Static load bearing capacity | : 70–90 kg |
| Price | : Taka 60 (US$ 0.80) |

# BARI Axial Flow Pump

*BARI Axial Flow Pump*

The farmers of Bangladesh rely on 1.77 million of centrifugal type irrigation pump of which about 174000 are centrifugal type low lift pump. An axial-flow pump, is a common type of pump that essentially consists of a propeller an axial impeller in a pipe. The propeller can be driven directly by an engine or electric motor in the pipe mounted to the pipe from the outside or by a right-angle drive shaft that pierces the pipe. Axial flow pump is an established technology which is generally used for low head surface water lifting in the Philippines, Vietnam and Thailand. This pump is widely used for surface water irrigation, drainage and aquaculture at the water head of 1-3 m. The discharge of axial flow pump is about 2 times higher than that of centrifugal pump of same size. It can save fuel about 40-60% for lifting same volume of water than low lift pump (Centrifugal pump). In this pump impeller is submersed in the water so that no priming is needed during operation. Length of driving shaft as well as hollow pipe may be as long as 7.5 m. Axial flow pump may be used alternatively to low lift centrifugal pump for surface water irrigation, drainage and aquaculture. To meet the farmers' demand, Bangladesh Agricultural Research Institute has developed three sizes of axial flow pump (76 mm, 102 mm and 150 mm) for low, medium and high discharge. These axial flow pumps may be efficiently used for surface water irrigation, drainage of excess water and aquaculture in fish ponds. Pump should not operate the pump if the strainer is blocked or if it is vibrating excessively. Pump should be maintained regularly for its smooth operation.

## Advantages

- Suitable for surface water lifting at low head (≤5.0 m)
- Axial flow pump produces relatively high discharge at low head (≤5.0 m)
- It can pump up to 2-3 times more water at 4 m head than centrifugal or radial flow pumps
- Compared to conventional irrigation pumps, axial flow pump required 40-60% less fuel to lift the same volume of water
- Priming is not necessary for axial flow pump like centrifugal pump
- Easy to transfer from one place to another
- It can be easily operated by available power tiller
- Lower price than same size of centrifugal pump
- Operating cost is also cheaper than same size of centrifugal pump

## Specifications

- Axial flow pump is made with locally available iron materials such as MS pipe, MS solid shaft, impeller, MS pulley, bearing, etc.
- Sizes of axial flow pumps are 76 mm (3"), 102 mm (4") and 150 mm (6")
- Length of driving shaft as well as hollow pipe may be as long as 7.5 m
- Small (76 mm), medium (102 mm) and large (150 mm), axial flow pumps are operated by 10.0 hp, 12.5 hp and 14.0 hp diesel engines, respectively
- The discharges of small (76 mm), medium (102 mm) and large (150 mm), axial flow pumps are 15, 26 and 45 L/s, respectively
- Rotating speed of axial flow pump is 1800-1900 rpm
- The prices of small (76 mm), medium (102 mm) and large (150 mm), axial flow pumps are Taka 15000, 20000 and 30000, respectively

- Weight of small (76 mm), medium (102 mm) and large (150 mm), axial flow pumps are 25 kg, 30 kg and 40 kg, respectively
- Pump efficiency: 80%.

## Working Principle

*BARI Axial Flow Pump in operation*

Axial flow pump is used for lifting surface water at lower water head. Axial flow pump, engine, delivery pipe and necessary fittings will be taken to the canal of pond. Lower side of axial flow pump with foot valve is submersed in the water so that it should be completely submerged in the water. Inlet end of the pump should be at least 30 cm below the water surface and 30 cm above the ground surface. The outlet end of the pump is inclined to the bed of the pond or canal and connecting with delivery pipe. Engine and pump should be properly fixed with ground with poles and ropes. Engine or motor is set with engine with pulley and V-belt. If the pump is operated by power tiller, then pump and power tiller engine is set with V-belt. During setting the pump with engine so that it should be aligned properly. The belt should be properly tightened to get proper speed as well discharge. Before starting the engine, lubricating oil, fuel and water must be checked. All bolts, nuts, clamp greasing in the bearings and bushings and pulley of pump should be checked. Then engine or motor will be started and water will be discharged through the outlet of the pump. During operation, proper pump speed as well as engine speed will be selected to get high discharge. If any undesirable sound comes from the engine or pump, then engine should be stopped urgently.

# BARI Mobile Maize Sheller

*Shelling operation of mobile maize sheller*

BARI maize sheller is the blessing of maize farmers' in Bangladesh as it solved the maize shelling problem which enhance farmers to grow more maize. Power maize sheller needs to carry from place to place by means of extra carrier which seems to be botheration for the service providers and users. Moreover, power tiller is the main power source for operating the maize sheller as well as carrier of the sheller. Existing maize sheller needs to carry, fix it to the farm yard, connect belt from power tiller fly wheel to maize sheller pulley. It needs about one hour to set up for starting shelling operation, same as to disassembling and returning.

BARI mobile sheller eliminate this fitting, fixing problem. It is mounted front side of the power tiller and allow operator/service provider to carry from place to place in assembling position. So, mobile sheller can moves easy way and start shelling operation instantly. It saves time and allow quick operation. Women farmers can participate with this shelling operation.

## Main features

- This mobile maize sheller is power tiller operated. It is connected to the front side of the tiller which allow easy transportation maize sheller from place to place.
- The service provider transport this sheller easy way and start operation instaltly
- It is easy to operate and less requirement of repair and maintenance.
- Two labours ( main operator and assistant) are required for its operation.

- The operation cost is lower due to higher capacity of the machine.
- Woman can use this machine easily

## Description of Mobile maize sheller

- The sheller is made of MS angle bar, MS flat bar, high speed steel square bar, bearing, MS sheet, V-belt, V-pulley.
- The main parts of this machine are frame, shelling cylinder, feeding chute, outlet chute, hitch plate, blower, wheel, engine, chassis etc.
- The sheller frame is fixed with power tiller engine base frame.
- Shelling cylinder is rotating by means of belt pulley of engine.
- Dimension: 1270x480x710 mm
- Weight: 56 kg (without engine)

## Working Principle

BARI mobile maize sheller is attached front side of the power tiller using nut bolt. There is a flexible stand below the base frame of the machine which facilitates to keep the machine in a level position. Maize sheller is connected to the sheller pulley to the power tiller fly wheel pulley through V-belt. Then the shelling machine has to be placed at dry. Before starting shelling, the cobs of maizes have to be piled up at a place. Getting started the engine, cobs of maizes have to be feeded in the feeding hopper with a basket and cobs have to be inserted slowly to the shelling cylinder. Grains of maizes will deliver into ground through the tray below the machine after being separated from the maize and the shelled cobs will be thrown through the outlet chute.

## Test results

- Maize shelling capacity: 1.5-2.0 ton/h
- Source of power: 9-12 kW/ , power tiller engine (Dongfeng/Sifeng type)
- Labour required: 1-2 persons
- Price: Tk.16,000; (US $ 200) (without engine)

# BARI Garden Boom Sprayer

*Operational view of garden boom sprayer*

Safe and efficient application of pesticides is important for commercial fruits producers as well as other field crops farmers. Recently farmers are showing more interest on fruits garden for higher value, less hazard, low risk, and cash income compare to field crops. The production of crops decreases if pest, diseases, and weeds are not control timely. Pesticides are being used for protecting crops in most developing countries due to continuous increasing demand for quantity and quality of food grains. Mango and litchi garden are expanding in North West part and hilly area of the country. Farmers reported that pesticides need to apply quickly to the whole area within short period of time for escaping attack of pest and diseases. Bangladesh is mainly operated knapsack sprayers, power duster, and foot pump sprayer. The majority of sprayers performed poorly with poor design and materials. Fifty - Eighty percent of applied pesticides wasted due to poor spray machinery and inappropriate application methods. Overcome these problems a power garden boom sprayer has been developed and all accessories set up on a tri-cycle van for easy movement and effective operation. Women farmer also can handle the sprayer effectively.

**Main Features:**

- It can spray pesticides in a small volume of quantity which is very efficient to control pest and diseases

- A minimal amount of pesticides can be sprayed uniformly throughout the fruit garden.
- It consists of high pressure hollow cone nozzle that helps to spray pesticides in tall trees.
- It maintain pressure steady uniform through the full length operation.
- The boon sprayer can operate correctly during in adverse wind situation.
- The plastic tank is white transparent which allow operator observing the level of pesticides status in the tank.
- The whole assembly is fixed on a tri-cycle rickshaw van for easy transportation and application.
- Local machinery workshop can fabricate the boom sprayer easily.

## Specification of BARI Garden boom sprayer

| Name of component | : | Specification |
|---|---|---|
| Power source | : | 5.5 Hp Diesel engine |
| Type of pump | : | Piston pump, Automatic |
| Width of boom | : | 1. 0 m |
| Boom discharge | : | Average 2.9 lit./min at 3 bar pressure |
| Number of nozzles | : | 2 |
| Type of nozzle | : | Hollow cone |
| Nozzle adjustment | : | Nozzle height adjustable |
| Tank capacity | : | 150 lit. |

## Advantages of BARI Gaden Boom Sprayer

- The boom sprayer is highly energy effective, which can cover more area within short period of time and reduce the pest attack.
- Operating cost of garden boom sprayer was Tk. 595/day and foot sprayer was Tk.1029/day, respectively.

- Boom sprayer takes 3 hours per hectare area to spray pesticides whereas foot pump sprayer 10 hours per hectare of land.
- Garden sprayer is 3 times faster than traditional foot pump sprayer.
- The pesticides requirement is 25% less than traditional sprayer
- One operator can handle the whole spraying which mitigate labour shortage
- Women can operate the boom sprayer effectively.

## Working principle

The garden boom sprayer is a power operated sprayer set up on a tri-cycle rickshwa van. There are diesel engine, pesticide tank, pump, boom nozzle. The boom assembles with a flexible rod which can be adjusted according to the height of trees. The high pressured pesticide sprayed over the canopy of the tree uniformly. The operator can move boom sprayer place to place driving the rickshawa van.

## Results

| | | |
|---|---|---|
| Capacity | : | 150-170 trees per day |
| Required labour | : | 1(Especial case two) |
| Cost | : | Tk. 30,000.0 |

## List of Agricultural Machinery Manufacturers

| Owner name | Company name and address | Phone and E-mail |
|---|---|---|
| Md. Mahbubur Rahman Khan Proprietor | Mahabub Engineering Workshop BSCIC area, Jamalpur | 01711-23 7785 Mahbub_jam@yahoo.com |
| Md. JahangirAlam Proprietor | MRS Jahangir Engineering Workshop Dhaka Road, Chandana-Chowrasta, Gazipur-1702 | 01924708186 |
| Poritosh Kumar Malo Proprietor | RK Metal Topakhola, Faridpur | 01710-928977 rkmetal77@gmail.com |
| Md. Abdur Razzak Proprietor | Bhai Bhai Engineering Workshop Shamganj Bazar, Purbadhala, Netrokona | 01713-547748 bhaibhaimymensingh@yahoo.com |
| Alimul Ehsan Chowdhury Managing Director | Alim Industries Limited BSCIC, Gotatikor, Kodomtoli, Sylhet-3100 | 01713-328796, 0821-840662 info@alimindustriesltd.com |
| Md. Abdul Kader Golap Proprietor | New Barsha Engineering Workshp Gohail Road, Sutrapur, Bogra | 01711-184282, 051-64072 Barsha10_bogra@yahoo.com |
| Abdus Samad | Uttoron Engineering Works Private Limited, Kalitola, Dinajpur | 01727-219946, 0531-51708 |
| Engg. Sadid Jamil Managing Director | The Metal Private Limited PBL Tower (14 floor), 17 North Kamal Ataturk Avenue, Gulshan-2, Dhaka-1212 | 01713-164269, 8835006 info@metalbd.biz |
| Md. Kamal Miah | MRS Kamal Machine Tools Silimpur, Bogra, | 01711-027205, 051-64000 |
| Yasir Ibn Asab | ACI Motors Limited 245, Tejgaon Industrial Area, Dhaka-1208 | 01755-551203, 88-78603 info@aci-bd.com |

| Owner name | Company name and address | Phone and E-mail |
|---|---|---|
| Md. Ehsan Habib Proprietor | Habib Engineering and Machinery Railway Market, Station Road, Bogra-5800 | 01716-397888 |
| Md. Golam Ajam Tikul Proprietor | MRS Pubali Traders Gohail Road, Sutrapur, Bogra-5800 | 01712-558773 tikul_bogra@yahoo.com |
| Md. Shah AlamSikder | Alam Engineering Works 25, Vajohori Saha Road, Wari, Dhaka-1100 | 01711-356055 |
| Md. Waliullah Proprietor | Janata Engineering, Sarojganj, Chuadanga | 01711-960861 Janataengineering786@mail.com |
| Michael Bokul Gomej | Mirpur Agricultural Workshop and Training School (MAWTC) 1/C, 1/A, Pallabi, Mirpur-12, Dhaka-1216 | 9002544 mawts@caritasmc.org |
| Rafiqul Islam | Resoma Engineering Works, Saidpur Road, Textile Mill gate, Dinajpur, Bangladesh | 01725011800 |
| Md. Khairul Islam | Khairul Engineering Works, Dasmile more, Dinajpur | 01718016170 |
| Abu Sayed | Sayed Engineering Works, Vodra More, Rajshahi | 01711467369 |
| Md. Zillur Rahman | Padma Engineering, Sopura, Rajshahi | 01716-535600 |
| Md. Kamal Uddin | Kamal Engineering, Solimpur, Bogra | 01711027205 |
| Md. Nazrul Islam | Expert Engineering Station Road, Tangi, Gazipur | 01819892165 |