Custom Hiring Centre (CHC) Operation Manual

অসম চৰকাৰ
GOVERNMENT OF ASSAM

ARIAS Society
GOVERNMENT OF ASSAM
Assam Rural Infrastructure and Agricultural Services Society

ASSAM AGRICULTURAL UNIVERSITY

CGIAR

IRRI

Custom Hiring Centre (CHC) Operation Manual

অসম চৰকাৰ
GOVERNMENT OF ASSAM

ARIAS Society
GOVERNMENT OF ASSAM
Assam Rural Infrastructure and Agricultural Services Society

ASSAM AGRICULTURAL UNIVERSITY
1969

CGIAR

IRRI

This product has been developed under the Assam Agribusiness and Rural Transformation Project (APART), funded by the World Bank through the Assam Rural Infrastructure & Agricultural Services (ARIAS) society

Contributors

Kanwar Singh[1], Rupam Borgohain[2], Suryakanta Khandai[1], Suarajyoti Baishya[1], Vipin Kumar[1], Vivek Kumar[1], Jyoti Bikash Nath[1], Virendar Kumar[1], Ashok Bhattacharyya[2] and Sudhanshu Singh[1]

[1.] International Rice Research Institute [2.]Assam Agricultural University

Acknowledgements

We earnestly acknowledge the support of Dr. Ashish Kumar Bhutani, IAS, Additional Chief Secretary to the Government of Assam (Agriculture Department), Agriculture Production Commissioner & State Project Director, ARIAS Society, and Dr. Bidyut C. Deka, Vice Chancellor, Assam Agricultural University, Jorhat, Assam for their valuable suggestions and overall guidance. We sincerely thank all the scientists, professors, officers of AAU, IRRI and Dept. of Agriculture, Govt. of Assam, for providing much needed support and valuable information in developing the booklet "Custom Hiring Centre (CHC) Operation Manual". We are also thankful to Mr. Baljeet Singh, Market Analyst-cum-Operations Specialist, APART, ARIAS Society, Govt. of Assam, for his continuous support during the development of this booklet.

First Edition 2022

The content in this module is collected from different sources and prescribed in the user-friendly mode. The training module is the compilation of detailed description and specification of different machines, their cost economics and business plan promoted in the project by a large team of contributors from IRRI, Assam Agricultural University and the Department of Agriculture. The team of scientists from Assam Agricultural University and officials from Department of Agriculture, Govt. of Assam helped in localizing the content of training module.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion, whatsoever, on the part of IRRI and AAU concerning the legal status of any country, person, territory, city, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. Where trade names are used, this does not constitute endorsement of, or discrimination against any product by IRRI and AAU.

www.rkbassam.in **E-mail: rkbassam2021@gmail.com**

Contents


ICAR
IRRI

Introduction

In Assam, agriculture is a principal means of livelihood for about 75 per cent of the population, engaging 53 per cent of the workforce and contributes about 20 per cent of the state's net domestic product. Eighty-six per cent of farm holdings belong to small and marginal farmers in the state and a major portion of agricultural land is rainfed. There is a narrow window for completing land preparation, sowing and inter-culture operations on time for cultivation of crops. Failing to fit into the narrow window, farmers often face lower productivity. In this context, mechanization of agricultural operation can play a significant role in increasing productivity and profitability of rice-based cropping system. Use of rice-based cropping system of machines ensures timely operations, brings down the cost of cultivation, addresses the challenges of unavailability of labour and increases the efficiency in use of resources and applied inputs.

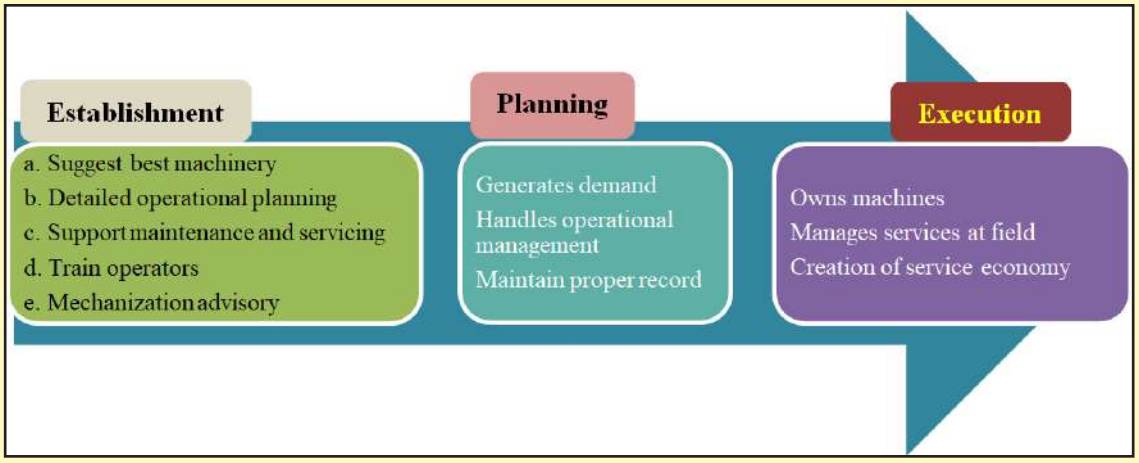
Assam is far behind in the use of modern agricultural technology to improve its agricultural productivity compared to the rest of the country. During 2014-15 the availability of farm power in Assam was 1.78 HP per hectare which was less as compared to 2.05 HP per hectare at national level. The Govt. of Assam has been extending support to the farming community by distribution of tractor and other machineries free of cost or by providing subsidy at capital cost. In-spite of the best efforts of government, small and marginal farmers face challenges in individual ownership of machinery. If they somehow manage to purchase a machine or be a part of any farmers' group, it is not sufficient to manage his entire crop operations. With the high investment cost of machinery, a farmer must have to think about the recovery of the investment at a specific time. Individual ownership of machinery by small and marginal farmers has led to higher cost of production and lower net income of farmers. They cannot make high investment in farm machinery as they are costly and unviable but at the same time the situation demands machines for agricultural operations. The only way out is to depend on hiring of implements. However, the existing service provider can offer machine services to a limited number of farmers during the peak period of agricultural operations. Therefore, to bring farm machinery available within the reach of small/marginal land holders, collective ownership or Custom Hiring Centers is the need of hour.

Custom Hiring Center (CHC) : What does it mean?

Custom Hiring Centre (CHC) is basically a unit comprising a set of farm machinery, implements and equipment meant for hiring by farmers. The main objective of CHC is to supply farm implements to small and marginal farmers at subsidized rates on hire, this enables them to take up farm operation on time.

Objectives :

- To make available various farm machinery / equipment to small and marginal farmers
- To offset the adverse economies of scale due to high cost of individual ownership
- To improve mechanization in places with low farm power availability
- To provide hiring services for various agricultural machinery/implements applied for different operations
- To expand mechanized activities during cropping seasons in large areas especially in small and marginal holdings
- To provide hiring services for various high-value-crop-specific machines applied for different operations.



Principle of CHC:

The CHCs are working on the principle as follows:

Management of CHC

For successful management of the CHC, an institutional mechanism needs to be put in place at the village or block level for its effective management. The CHC can be run by a group of individuals. The Farmer Producer Company (FPC) has been found to be one of the effective platform for formation and management of CHCs in Assam. An FPC Management Committee is constituted of 10 Board of Directors (BoD) amongst the members of the FPC with nominated members as President, Secretary and Treasurer. This committee will help to run CHC in full capacity.

CHC can be established by the FPC with the involvement of few selected members as Management Committee member

- The location of the CHC should be easily accessible to the farmers. Ideally, the CHC shall have to be located at a place where large number of small land holdings are located within a radius of 5 to 7 kms. This will reduce the transport cost and time of transport of agricultural machinery. In other terms, one CHC is expected to cater to 4/5 villages, and therefore a common place equidistant from the villages will be suitable.
- The name of the CHC with the contact numbers of its management committee members should be displayed on the board of FPC/CHC.
- A bank account is opened in the name of FPC/CHC and is operated by two signatories. The committee is responsible for day-to-day management and maintenance of the CHC and its machineries.
- The committee fixes the charges for hiring of different implements.
- The hiring rates are to be displayed prominently in front of the CHC office.
- The revenue and expenditure details must be shared with the general body periodically.
- For maximum utilization and profit of the CHC, it should be ensured that all machines operate at their full capacity.
- Management committee will organize one pre-season meeting to fix the tentative target for each machine at the start of the crop season.

The committee members are assigned different work and responsibility such as

- Two (2) members will be responsible for account management
- One (1) member will be assigned to provide monthly report, status of machineries, number of

hours the machine would work in the field, income generated from each machine and other related information

- Two (2) members will be engaged in demand creation of machines at different locations
- One (1) FPC member shall be a part of district level industry association/district level coordination committee to know about the marketing/status of different products/schemes
- One (1) member will be assigned on machines to keep a track on achieving the tentative targets for different machines
- A team of ten (10) operators will be engaged from FPC/CHC for running the machines
- Three (3) members out of selected 10 operators will take the responsibility for repair and maintenance of machines

Backstopping plan and schemes

Sub Mission on Agricultural Mechanization (SMAM): To boost the farm mechanization in the country, a special dedicated scheme 'Sub Mission on Agricultural Mechanization (SMAM)' was introduced by the Government of India in 2014-15. The scheme aims at 'reaching the unreached' by making farm machines accessible and affordable for the small and marginal farmers (SMFs) through the establishment of Custom Hiring Centers (CHCs), creating hubs for hi-tech & high-value farm equipment and Farm Machinery Banks. Distribution of various subsidized agricultural equipment and machines to individual farmers is also one of the activities under the scheme.

Assam Agribusiness and Rural Transformation Project (APART): APART supports 80% of the total cost of the machines for CHCs development through FPCs.

Details of the schemes which are being implemented in Assam for promotion of CHCs are as follows:

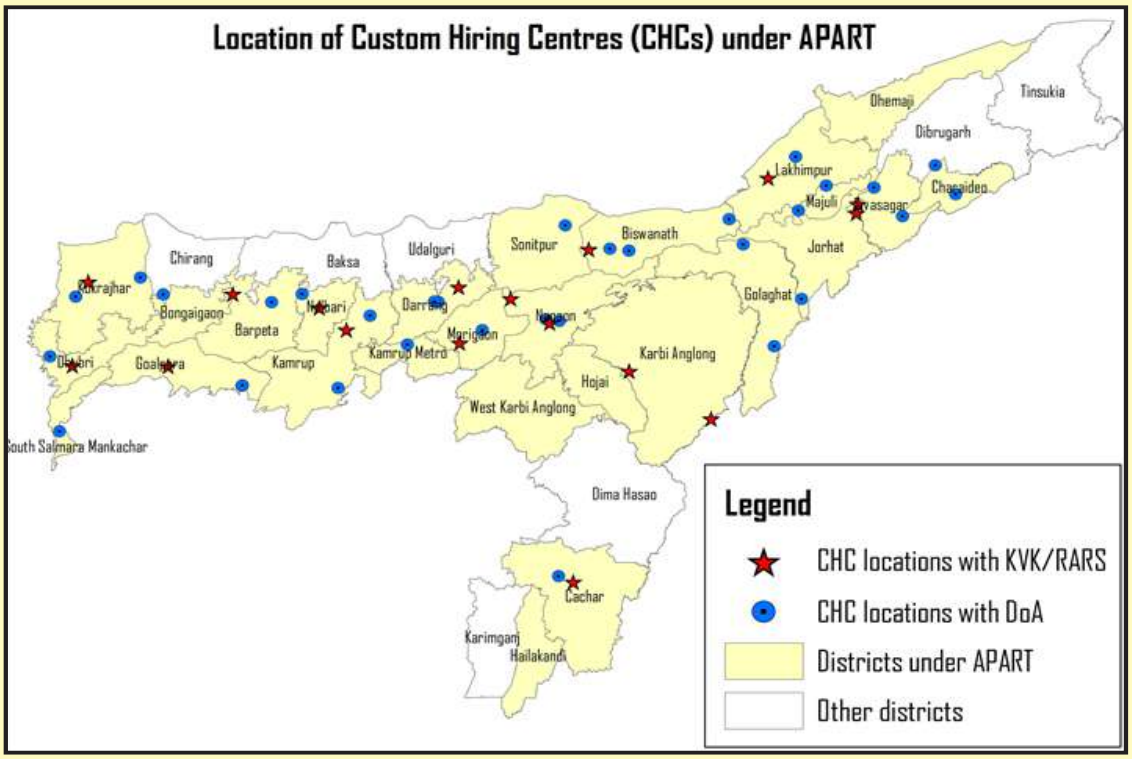
Sl No	Scheme Name	Support	Share
1	Sub Mission on Agricultural Mechanization (SMAM)	Village level Farm Machinery Bank (VLFMB)	95%
		i. Power tiller	50% (maximum Rs. 0.85 lakh)
		ii. Reaper	50% (maximum Rs. 0.75 lakh)
		iii. Self-propelled rice transplanter	50% (maximum Rs. 1.50 lakh)
		iv. Tractor driven implements Rotavator/ Potato digger/ Paddy thresher/ Multi-crop thresher	50% (maximum Rs. 0.50 Lakhs /0.40 lakh/1.00 lakh /1.00 lakh)
		v. Sugarcane crusher with prime mover	50% (maximum Rs. 0.40 lakh)
		vi. Mini rice mill	50% (maximum Rs. 2.40 lakh)
		vii. Oil mill	50% (maximum Rs. 1.50 lakh)
2	Chief Minister Samagra Gramya Unnyan Yojana (CMSGUY)	Tractor & implements	70% (Maximum Rs. 5.50 lakh)
3	RKVY (Mechanization & Irrigation)	Power tiller	50% (maximum Rs. 0.85 lakh)
		Power paddy thresher with prime mover	50% (maximum Rs. 1.00 lakh)
		Tractor PTO operated paddy thresher	50% (maximum Rs. 1.00 lakh)

Sl No	Scheme Name	Support	Share
4	Agriculture Tools (Specific Grants-in-Aid under 5th Assam State Finance Commission)	i. Mechanical dryer one for each selected ZP	50% (maximum Rs. 1.00 lakh)
		ii. Reaper one for each selected GP	50% (maximum Rs. 0.75 lakh)
		iii. Transplanter 10 for each ZP	50% (maximum Rs. 1.50 lakh)
		iv. Establishment of small-scale processing unit for individual women/ women SHG at selected GP and AP level with provision of (a) Oil extractor (b) Dal processing (c) Fruit processing (d) Juice extractor (e) Packaging and bottling unit	50% (maximum Rs. 3.00 lakh/ Rs. 1.50 lakh

Source: Department of Agriculture (Engineering), Govt of Assam, 2018-19

Custom Hiring Centers established under Assam Agribusiness and Rural Transformation Project (APART)

A total of 49 numbers CHCs have been established till now in different districts of Assam under APART during 2019-22.



In these CHCs different farm machineries are made available on hiring basis to the farmers at nominal charges. Following table describes the machines available in CHCs promoted under APART with their unit cost.

Sl. No.	Name of the machine	Purpose	Unit cost (INR)
1	Paddy transplanter	Transplanting of nursery	2,50,000
2	Drum seeder	Wet direct seeding of pre-germinated seed	5,000
3	Seed-cum-fertilizer drill	Dry direct seeding of rice and sowing of other crops like maize, pea, mustard	1,10,000
4	Power weeder	Weeding of inter-row weeds	35,000
5	Power spryer	Spraying of insecticide, herbicide	5,000
6	Reaper	Harvesting and windrowing	1,50,000
7	Combine harvester	Harvesting, threshing, cleaning and support for bagging	16,00,000
8	Axial flow thresher	Threshing of harvested crop	2,00,000
9	Open drum thresher	Threshing of harvested crop	50,000
10	Portable rice mill	Milling at door step	3,50,000
11	Dry grinding machine	Making rice powder, turmeric powder, wheat flour, Mix Chattu	40,000

Business planning for CHC

A successful business plan is one that has found a way to create value for customers – i.e., a way to address a need of customers. The need here is a fundamental problem in a situation, that needs a solution. As the need is understood with all its dimensions including its environment, nature of operation, possible areas of improvement, the offering can be designed accordingly. Here, the better the offering, the better Customer Value Proposition (CVP), when a higher level of customer satisfaction is achieved through addressing the need of the customer better than other similar offerings and at an attractive price point. Business plan of a CHC must include round- the-year service provision opportunities of the machines in farmer's field. Examples of business opportunities by CHC in rice value chain as depicted below.

Month	Round-the-year service provision opportunities
January	Field preparation, Mat-type nursey raising
Feb-Mar	Mechanical transplanting
April	Mechanized weeding, Fertilization and Spraying
May	Field preparation, Mechanized DSR, Harvesting, Threshing
June	Mechanical transplanting, Wet DSR, Harvesting, Threshing
July	Mechanical transplanting
August	Mechanized weeding, Fertilization and Spraying
Sept-Oct	Rice milling
Nov-Dec	Harvesting, Threshing

Fixing service charges for machines and account management

The major income of CHC is generated out of custom hiring. For each machines recurring costs like fuel / lubricant use, driver charges, repair maintenance charges, labor, interest on bank loan and insurance are considered in the economic analysis of each machine in the next section. Based on the income and expenditure statement of each machine the hiring charge is fixed for individual machine.

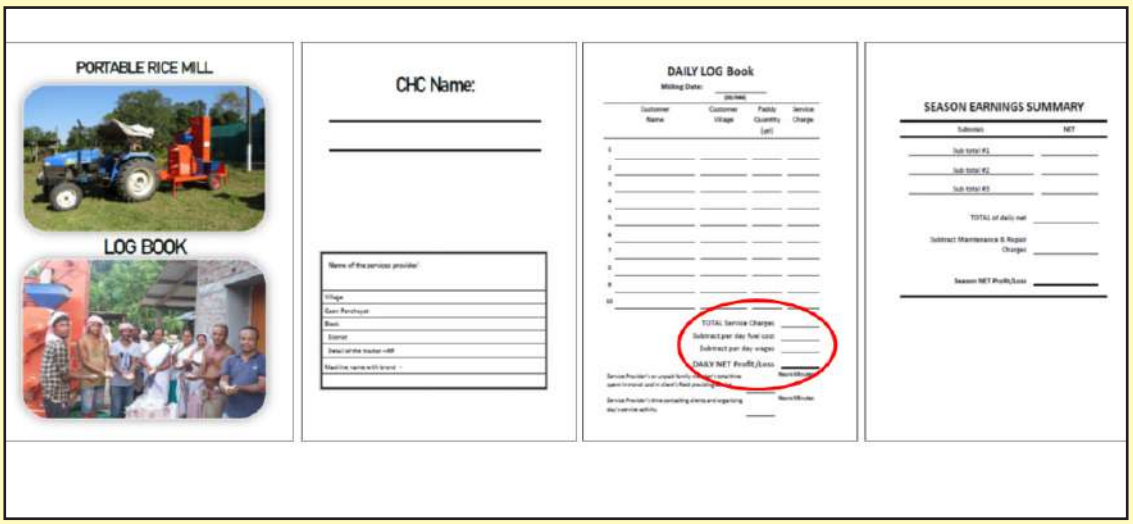
The rental charges of different machines recommended for different CHCs promoted under APART are shown in the below table

Sl. No.	Name of the machine	Rental charge in INR
1	Paddy transplanter (without nursery)	1000 per bigha
2	Drum seeder	200 per bigha
3	Seed-cum-fertilizer drill	400 per bigha
4	Power weeder	200 per bigha
5	Power sprayer	50 per bigha
6	Reaper	500 per bigha
7	Combine harvester	1500 per bigha
8	Axial flow thresher	1200 per hour
9	Open drum thresher	600 per hour
10	Portable rice mill	1200 per ton

The CHC should maintain a log book to keep record of daily income and expenditure. One specimen of the logbook is given below.

The CEO of the FPC along with key office bearers and board members should collect the basic financial data regarding the CHC. Profiling on basic business aspects of FPC including its present position in terms of members, share capital collected, asset position and costs will help in working out the financial statements. The assumptions regarding the yield, procurement cost, transportation cost, storage costs, etc., should also be considered based on the current year's data by discussing with experts. The annual financial statements should include:

- Trading and Profit & Loss Account (Expenses & Losses and Incomes & Gains)
- Cash Flow Statements (How cash flows through operations, investing and financial activities)
- Balance Sheet (Assets, Liabilities and Capital)



Machine-wise description, operational guidelines & adjustment

Paddy transplanter

Mechanical transplanting of rice is the process of transplanting young rice seedlings, which have been grown in a mat-type nursery, using a self-propelled rice transplanter. In a mat-type nursery, the seedlings are raised on a thin layer of soil placed on a perforated polythene sheet. The polythene sheet prevents the seedling roots from penetrating the underlying soil, creating a dense mat. This type of nursery is a prerequisite for machine transplanting. The mat can be cut into cakes of desired shapes and sizes to fit into the trays of the transplanter.

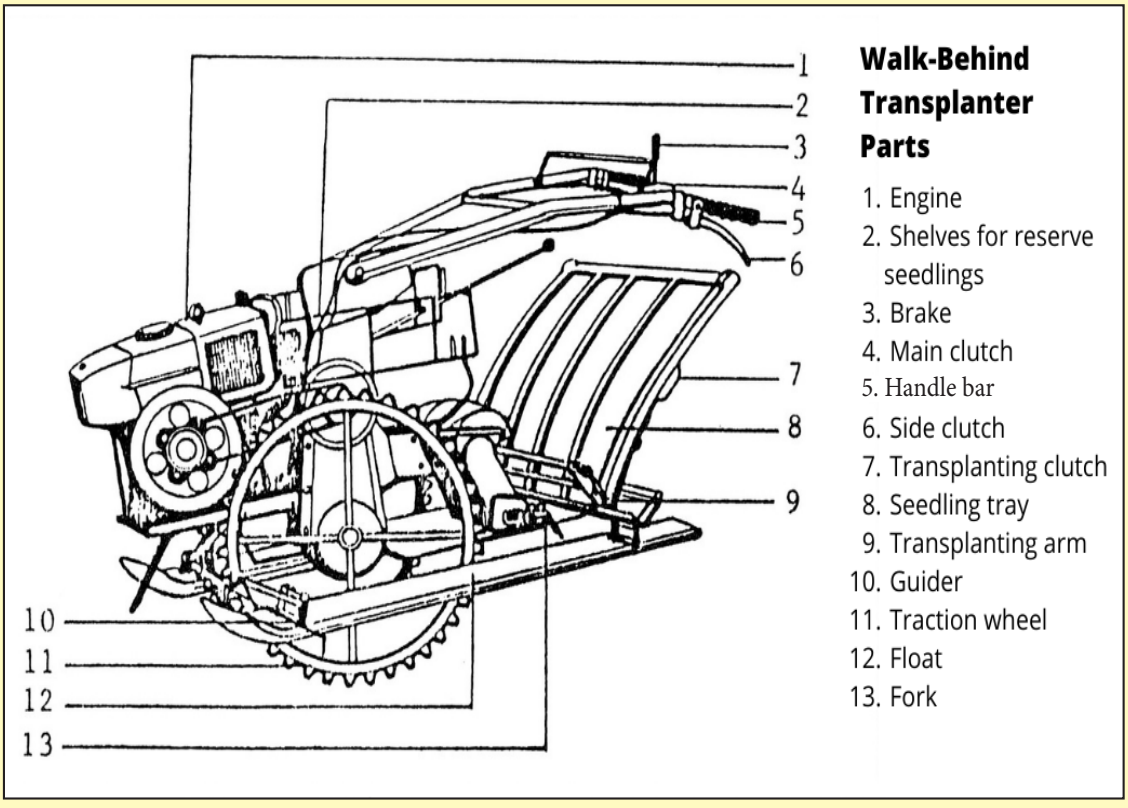
Advantages of mechanical transplanting

- ✓ Transplanting of seedlings at the optimal age (18-20 days) during *Sali* season and 20-30 days during the *Boro* season in Assam when the seedlings attain a height of approximately 18 cm
- ✓ Uniform spacing and optimum plant density (26-28 hills/m^2 with 2-3 seedling per hill)
- ✓ Added productivity (0.5-1.0 t/ha) compared to traditional methods where plant spacing, and density may not always be consistent
- ✓ Less transplanting shock, early seedling vigor and uniform crop stand
- ✓ Lower stress, drudgery and health risks for farm laborers
- ✓ Better employment opportunities for rural youth through the development of custom service business
- ✓ Addresses the problem of labor scarcity
- ✓ Increases farmers' net income

Specification:

Type: Walk behind,

- Engine: Air cooled, single cylinder, 4 strokes
- Displacement: cc, 190-210, Petrol/Diesel
- Rated output: 5-7hp, 1600-1800rpm
- Rubber lug wheel (2), 600-700 mm
- No. of speed: Forward - 2 or 3, Backward - 1
- Vertical handle adjustment: Rotating, steeples adjustment
- Depth adjustment lever should be present with different depths, 4-6 rows
- Row to row distance: 30 cm, plant to plant distance: 16, 18, 21 cm
- Planting pitch: Wide feeder belt system
- Planting speed and travel speed on road: 0.3-0.9 and 1.5 to 2 m/s, respectively
- Dimension: length 2200 to 2500 mm, width 1600-1800 mm, height 700-900 mm, and weight 150 – 250 kg



Steps to follow

Checking prior to operations

Step 1 **Familiarize with the major parts, controls, and functions.**

Make sure that you are familiar with the major parts of the transplanter (like engine, wheels, float, seedling platform, planting tines, etc.) and the controls (main switch, main clutch, transport/planting clutch, etc.).

Step 2 **Do the WOGAM check on the transplanter**

Perform the WOGAM check, which stands for -

- **W**ater and fuel
- **O**il
- **G**rease
- **A**ir
- **M**iscellaneous

» Check whether the fuel tank is full or not. If not, then fill it.

» Open the oil circuit.

» Open the throttle.

» Check whether the clutch is separate and the gear shift lever is in the neutral position.

Step 3 **Check whether all the fingers are working**

Before going to the field for transplanting, check whether all fingers are working or not in the following order:

- The transplanter should be placed on a flat surface.
- Start the engine.
- Engage the gear to run the transplanter and check whether all fingers are in working condition or not.

Step 4 **Prepare the field for transplanting**

Prepare the field 1-2 days before the transplanting:

- Plough the field to a depth of 5-7 cm using a harrow or cultivator. Puddle the field and level it using a plank and allow the soil to settle for 12-24 hours.
- Under non-puddled conditions, the soil should be tilled one to two times using a harrow or cultivator, and then planked/leveled.
- Before transplanting, apply a light irrigation and drain off any excess water.
- While transplanting, maintain a uniform depth of 2.0-3.0 cm of standing water.

Transporting the transplanter

Step 5 **Transport the transplanter to the field**

Mechanical transplanter is a slow-moving machine. Its wheels are not designed for long distance transport. It is recommended to load and unload the machine in a mini tempo or light transport vehicle. Caution must be taken when loading and unloading the machine. Change the transport wheel of the transplanter with the transmission/lugged wheel and remove the rear wheels.

Operating the transplanter

Step 6	Check the soil and the seedlings

Step 7	Adjust and prepare the machine

The proper maintenance and operation of the machine will affect its operation and service life.

With all controls in neutral or starting position and with fuel cock open, start the engine and let the engine warm up for about 2 minutes. Also, it is very important to know how to stop the engine. Put the seedling mat in the seedling platform and make sure the seedlings are properly set and can be picked up readily by picker bar. Make sure there are no stones in the seedling mat. Adjust planting depth and distance between hills.

Step 8	Place the machine in the field

Move the machine at right angle to the field or border. Raise the transplanter using transport position lever and move at slow speed.

Use bridges/planks if the difference in the elevation between farm road and main field is 10 cm or more. Position the machine in the main field and plan the path of operation based on the determined operating pattern.

Step 9	Start transplanting the seedlings

Planting seedlings may become impossible if the field and seedling condition are not appropriate. Put nursery cake in the space provided on the tray. Also keep some cakes on the float/rack. If the cakes in the tray finish in the middle of the operation, then use the extra cakes placed on the float/rack.

Start transplanting by leaving the space equal to the width of the transplanter at three sides of the field near the bunds. This helps in avoiding any damage to the already transplanted field.

Step 10	Monitor the planting

Always check whether all fingers are picking seedlings or not. If any finger misses, then reverse the nursery cake, adjust or replace it. Supply seedlings in a timely manner and do not transplant the seedlings while turning at the end of the field.

Step 11	Practice safety at all times

Don't touch any rotating part during transplanting to avoid accidents. Stop the machine if something is abnormal during operation and find out the problem and adjust it.

If the paddy transplanter gets stuck in the field, do not pull out the machine by force. Reduce the load (mats, drivers, assistants, etc.) from the machine and then run the transmission wheel forward by pressing the pedal. Fill the space left at corners, missing gaps or hills manually.

Economic Analysis

Basic information:

Life span of equipment (year)	5
Life span of workshop, (year)	7
Working period, a day, (hour/day)	8
Capacity (hour/bigha)	1
Working days each year, (days/year)	40
Capacity per year, (bigha/year)	320

Cost economics

Sl. No.	Investment	Unit
1	Total investment cost (1a+1b) in INR	3,20,000
1a	Cost of transplanter in INR	2,50,000
1b	Cost of workshop for parking and maintenance in INR	70,000
2	Depreciation (INR/bigha) (2a+2b)	187.5
2a	Depreciation cost of equipment (INR/bigha)	156
2b	Depreciation cost of workshop (INR/bigha)	31.5
3	Maintenance cost (INR/bigha) @ 0.5% of total depreciation cost	93.75
4	Interest (INR/bigha) @ 10%/year	50
5	Labor (INR/bigha) including operator, labour for handling and management cost	143
6	Fuel cost (@INR 100/lt) (INR/bigha)	200
7	Total operational cost (INR/bigha)	673.75
8	Transplanter service fee (INR/bigha)	1000
9	Net profit (INR/bigha)	326
Note: One hectare has 7.5 bighas in Assam		

Seed-cum-fertilizer drill/Multi-crop planter

Seed-cum-fertilizer drill/ multi-crop planter is a specially developed solution for the sowing of seeds. This versatile tractor attachment machine is capable of sowing different seeds and fertilizer at the same time. It is best suited for crops such as wheat, corn, paddy, oilseeds, soybean, pulses and millets in all types of soil. Paddy sowing should be done in rows 20-25 cm apart at a depth of 2-3 cm using a seed rate of 35-40 kg/ha depending upon the variety, seeding machines, soil type and quality of the seed. As seed depth is critical to successful establishment, adjust depth control / setting wheels to ensure correct seed depth. The biggest advantage of this machine is that seeds can be sown directly after harvesting of the preceding crop, which saves time, cost and labor.

Functions of a seed-cum-fertilizer drill are:

1. To carry the seeds and fertilizer in separate compartments.
2. To open furrows at uniform depths.
3. To meter the seeds and fertilizers.
4. To deposit the seed and fertilizer in the furrows in an acceptable pattern.
5. To cover the seed and fertilizer and compact the soil around the seed.

DSR guidelines

- ✓ Field should be prepared thoroughly by ploughing with desi plough 3-4 times followed by harrowing and planking. Ploughing should be started at least 2-3 weeks ahead of seeding so that weeds are dried up/decayed.
- ✓ The ploughing intervals should be spaced in such a way that the weeds that germinate after the first round are knocked down in the next round. This facilitates a clean seed-bed for seeding of the crop.
- ✓ If available, apply compost or manure uniformly prior to field preparation and mix well with soil.
- ✓ Repair the bunds to reduce water losses from the field during the cropping season.
- ✓ Level the fields with leveler before sowing.
- ✓ The basal dose of fertilizers MOP and $ZnSO_4$ is applied to the field with last ploughing (see fertilizer dose in fertilizer section below).
- ✓ Sufficient moisture is required at sowing time for good germination.
- ✓ Plot size should be kept ideally as the per resources and irrigation availability. An ideal plot size of 2000 sq. meter is helpful in irrigation management.

Machine maintenance

- ✓ The multi-crop planter (DSR-drill) should be properly serviced and maintained.
- ✓ It should be checked before use to ensure that all the nuts and bolts are tightened and that all the parts are in good condition.
- ✓ The fertilizer and seed boxes should also be properly cleaned and need to be in a good condition to allow free flow of seed and fertilizer.
- ✓ Chains should be adjusted and to be properly oiled.
- ✓ After use at the end of each day, the machine should be checked, the seed and fertilizer boxes are to be cleaned, and the moving parts to be oiled.
- ✓ After the planting season, the machine should be properly stored.

Machine parking

- ✓ For parking the seed drill after completion of sowing season, clean each part of the machine, particularly seed and fertilizer boxes, carefully.
- ✓ Apply grease/oil to the transmission chain and moving parts.
- ✓ Store the machine in a dry and well-ventilated store.
- ✓ Keep the appropriate tools with the machine during storage for ensuring availability as and when needed next time.

Specifications

No. of rows	9, 11, 13
Tractor required	35-40 hp or more
Seed metering device	Inclined plate
Fertilizer metering	Agitator & sliding orifice type
Hitching	Tractor mounted with 3-point linkage
Frame	Strong and robust

Row space	7” standard & adjustable with ‘U’ clamps
Drive	Ground wheel driven (Driving wheel is at front in center)
Sowing depth	Adjustable (Depth control wheels are provided on both sides of drill)
Furrow openers	Inverted T type; Zero tillage blade type openers for sowing in un-prepared / no till fields.

Steps to follow

Calibrating the seed drill

Step 1 **Calibrating the seed drill**

- Measure the width of the seed drill
- Adjust the seed metering indicator
- Tie a poly bag at the outlets
- Fill the seed box
- Measure the distance
- Operate the tractor slowly and safely
- Check the seeds
- Measure the weight of the seed
- Compute the seed rate
- Adjust the seed rate setting

Preparation for seeding

Step 2 **Do the WOGAM check for the seeder**

Perform the WOGAM check, which stands for:

- **W**ater and fuel
- **O**il
- **G**rease
- **A**ir
- **M**iscellaneous

Step 3 **Make sure the field is ready for seeding**

Clean and pulverize to attain fully tilled soil or weed-free field for zero-till seeding. Ensure the field is accessible and free of any hazard that might cause accidents.

During the field inspection, determine the operating pattern to use (for big tractors, it is recommended to use the “headland pattern”).

Step 4 **Transport the machine to the field**

Most seeders are attached to the tractor by the three-point hitch system where the seeder implement is lifted during transport and lowered during planting operation.

Step 5 **Inspect the field prior to starting**

Inspect the field to:

- Check the depth of hard pan or field condition;
- Check the dryness of the soil;

- Check for any hazard that may hamper operation (weed density) or cause accident (bumps or humps); and
- Determine the pattern and the starting point.

Step 6	Make the necessary adjustments to the machine

Ensure the following:

- All controls in neutral or starting position, start the engine of the tractor and do the traction.
- Check the functionality of the hydraulic position control of the tractor (up for lifting the seeder and down for lowering the seeder).
- Adjust planting depth by adjusting the land wheel or seeder depth wheel or use the tractor position lever and lock to the desired position.
- Seed tubes are not clogged.

Step 7	Enter the field

Move the machine at a right angle (field boundary) or about 45 degree (irrigation canals or furrows). Raise the seeding implement using the transport position lever and move at a very slow speed.

Position the machine in the corner of the main field and plan the path of operation based on the determined operating pattern. Recommended pattern: ***"Headland" pattern for medium-sized fields*** *and* ***"Circuitous" pattern for huge fields****.*

Step 8	Start seeding

Note: *Direct seeding may become impossible if the field is with lots of weeds or stubbles and with incorrect type of furrow opener.*

After the seeding operation

Step 9	Transport the machine back to storage

The agricultural tractor can travel for a long distance from field to field or on-road. Make sure the implement is lifted up and the hydraulic position lever is locked during transport.

Step 10	Clean and check the machine

Make sure to clean and check the machine:

- » Check condition of machine parts.
- » Recall and record problems encountered in the field.
- » If possible, make minor repair or maintenance of the machine before storage.
- » Report any malfunction and needs of major repair to authorized mechanic.

Economic Analysis

Basic information:

Life span of equipment (year)	5
Life span of workshop, (year)	7
Working period, a day, (hour/day)	6
Capacity (hour/bigha)	1
Working days each year, (days/year)	40
Capacity per year, (bigha/year)	240

Cost economics

Sl. No.	Investment	Unit
1	Total investment cost (1a+1b) in INR	1,70,000
1a	Cost of seed drill in INR	1,00,000
1b	Cost of workshop for parking and maintenance in INR	70,000
2	Depreciation (2a+2b) (INR/acre)	125
2a	Depreciation cost of equipment (INR/acre)	83
2b	Depreciation cost of workshop (INR/acre)	42
3	Maintenance cost @ 0.5% of total depreciation cost (INR/acre)	62.5
4	Interest (INR/acre) @ 10%/year	35
5	Labor (INR/acre) including operator, labor and management cost	67
6	Fuel consumption @ INR 100/lt (INR/acre)	75
7	Tractor rent cost (INR/acre)	300
8	Total operational cost (2 to 8) (INR/acre)	665
9	Seed drill with tractor service fee (INR/acre)	1200
10	Net profit (9-8) (INR/acre)	535

Drum seeder

Drum seeder is one of the revolutionary equipment that changed the face of sowing paddy seeds in wetland fields. Direct seeding through drum seeder has eliminated the need of transplantation and hours of backbreaking manual work of the farmers while transplanting the rice seedlings in the main field. At one stretch with single operator effort, it covers 8-12 rows spaced at 20 cm. The plastic frame of the drum seeder makes its working easy.

Advantages:

- Easier (less work involved) and timely establishment of the crop
- Reduced labour costs for crop establishment
- Possible savings in water consumption

Guidelines to use drum seeder

Field Preparation:

- Puddle the land and level thoroughly.
- Drain out excess water before sowing, but do not let the soil surface become dry.
- Pre-germinate the rice seeds - do not let shoots become too long. Growth for 24 h is usually sufficient.
- Air-dry the sprouted seeds in the shade for about 10-15 minutes before sowing to facilitate singling/separation of seeds.

Sow the seeds with drum seeder:

- Do not fill drums more than 2/3 of full capacity.
- Walk at steady speed.
- Do not irrigate for 2-3 days after sowing to allow roots to anchor.
- As the seedlings grow, increase the depth of water gradually, but do not completely submerge seedlings.
- Take care during the wet season - as rainfall immediately after seeding may wash away the newly sown seeds.
- As the seedlings grow, flood water gives better control of weeds.

Specifications

Dimension:	Length 200 cm, width with handle 150 cm, height (diameter of attached wheel) 60 cm
Drum:	Fiber/Plastic
Wheels:	Fiber/Plastic
Number of rows sown:	8
Row to row spacing (cm):	20
Number of seed metering holes:	16
Diameter of the metering holes:	9 mm

Economic Analysis

Basic information

The life span of equipment (year)	4
Life span of workshop (year)	7
Working time, a day (hours/day)	5
Capacity (hours/acre)	3
Working days each year (days/year)	30
Capacity per year (acre/year)	50

Cost economics

SL. No.	Investment (INR)	Unit
1	Total Investment cost (1a+1b) in INR	5,000
1a	Cost of drum seeder in INR	5,000
1b	Workshop cost in INR	0
2	Depreciation (2a+2b) (INR/acre)	25
2a	Depreciation cost of equipment (INR/acre)	25
2b	Depreciation cost of workshop (INR/acre)	0
3	Maintenance cost (INR/acre) @ 0.5% of total depreciation cost	12.5
4	Interest @ 10%/year (INR/acre)	5
5	Labor including operator, labor and management cost (INR/acre)	200
6	Total operational cost (INR/acre)	242. 5
7	Drum seeder service fee (2 to 5) (INR/acre)	400
8	Net profit (7-6) (INR/acre)	158

Battery operated sprayer-cum-spreader

Mechanization in intercultural operations is very much essential. So, the battery-operated sprayer-cum-spreader is being used for different intercultural operations such as spraying weedicide, insecticide, fungicide and spreading of fertilizer. This type of machine has option to spray and spread with control switch to change the mode of operation. This type of battery-operated machine will reduce human drudgery to a great extent.

Different parts of the battery sprayer help in working of the machine. Pump is a device used to move fluids, such as liquids or slurries, or gases from one place to another to discharge the chemical solution. The discharge capacity of these pumps is approximately proportional to the speed. Tank is the container to hold the chemical solution. It is made up of PVC, brass, etc. The size of the tank varies according to the pump capacity and the requirements.

Agitator present in the tank helps in stirring the solution and keep the contents in homogenous condition. In a reciprocating type pump, an air chamber is provided on the discharge line of the pump to level out the pulsations of the pump and thus providing a constant nozzle pressure. The pressure regulator serves several functions such as adjusting the pressure as required for any spray job within the pressure range of the pump. With the positive displacement type of pump, it also serves as a safety device in automatically unloading the excess pressure by directing the unused discharge flow from pump back to the tank. Cut-off valve is provided in the delivery line to control the flow from the pump. By-pass valve is provided in the delivery line to divert the flow from pump to tank when flow in delivery line is reduced than the pump capacity.

Nozzle is the component which breaks the fluid into fine droplets. Spray gun is a handheld metallic or PVC pipe, to one end of which the nozzle is fitted and a flow cut-off valve and a handle are fitted at the other end. The delivery hose is connected to the spray gun. It conducts the fluid from the delivery hose to the nozzle. The operator holds the gun and does the spraying job. Area of coverage by a spray gun is less compared to the coverage of a spray boom. Spray boom is a long metallic or PVC pipe to which several nozzles are fitted with.

Precautions to take while using a sprayer include:

- Keep the label on each container so everyone can see what it contains and its safety precautions.
- Read the label on the product you are using. The label will identify the Personal Protective Equipment (PPE) you need to wear when handling the product and the hazards of using that product.
- Always follow the application rate as directed on the product label.
- Always wear eye protection goggles, gloves, long-sleeve shirt and long-leg pants when handling chemicals, and take your time when mixing.
- Triple-rinse the empty pesticide containers and do not reuse them; dispose of empty containers properly after rinsing.
- Immediately wash with clean water and change your clothes if pesticides are sprayed or

spilled on you. Wash your work clothes separately from other clothing after mixing and using pesticides to prevent cross-contamination of yourself and your family.

- Wash your hands before eating, drinking, smoking, chewing or touching your nose or mouth.

Specifications

Fertilizer box-cum-spraying tank:	Made of fiber/plastic
Size:	415mm x 245mm x 545mm
Capacity:	15-18 L
Net weight:	6 to 7 kg
Strap with adjustment should be there for carrying at back or front.	
Spraying method:	Stainless steel (SS) lance with multiple nozzle boom type,
Spreading method:	Spreader disk, speed control regulator
Power source:	Battery – 12 V/ 9A, plug-in design, water pump, impeller

Calibration

Calibration is necessary in order to achieve accurate and uniform applications. Calibration is simply determining sprayer output for a known area. Speed, nozzle capacity and pressure influence sprayer calibration.

Step 1 Determine the walking speed

Speed is inversely proportional to spray application when boom output is kept constant. As you walk faster, less spray is applied to a given area.

Walk in the field to be sprayed for 100 meters with the sprayer and equipment that will be used during the time of spraying. This will most nearly simulate the conditions during the time that the chemical is actually being applied. Record the time required to travel the 100 meters.

Step 2 Determine the spray volume

As pressure increases, sprayer output increases. However, this relationship is not direct. Pressure must increase four times in order to double nozzle output.

With the sprayer stationary and an operating pressure preferably at 280 kPa or 40 psi, collect the volume of water discharged from the nozzle for the length of time that it took to walk over the 100 meters. Record the volume from the nozzle and calculate how much would have been delivered from all nozzles (multi nozzle boom) using the following formula.

$$\text{Liters applied over 100 meters} = \frac{\text{Liters collected x No. of sprayer nozzles on}}{\text{No. of nozzles sampled}}$$

Step 3 Determine the swath width

This will vary according to the nozzle type and number of nozzles. For a single nozzle on a lance, a good way of judging coverage or swath width is to do multiple sprayings on a dry concrete surface and observe the collection of the spray, and therefore the effective width. A good rule of thumb is 5 meters for a lance and the number of nozzles multiplied by 0.5 meter for a boom.

Step 4 Calculate the amount of water

Calculate the amount of water applied per hectare by using the following formula:

$$\text{Liters / hectare} = \frac{\text{Liters applied over 100 meters x 100}}{\text{Swath width treated by sprayer in meters}}$$

Power weeder

Weeds causes heavy losses in rice crop. Integrated Weed Management (IWM) can effectively help in reducing the weed population. IWM is an appropriate combination of several different weed control methods, rather than relying on herbicides only. No single weed control method is effective and sustainable against all weeds. This is important because different weed species require different kinds of weed management. Weeds also develop resistance to herbicides; hence integrated management is needed. Ideally, IWM helps in improving productivity, reduce the cost of labor, fuel, fertilizer, water and pesticides, and ensures sustainability in the long-term. The major weed control methods are cultural, mechanical, biological and chemical.

Mechanical weed control

Mechanical weed control using power weeder, not only uproots the weeds between the crop rows but also keeps the soil surface loose, ensuring better soil aeration and water intake capacity. Provided with additional accessories, this machine can perform multipurpose functions such as harvesting and mowing, besides weeding.

Advantages

- Intra-row weeding in rice fields with uniform row spacing
- Saving in time and labor
- Cost-effective

Specifications

Displacement	Between 25-35 cc
Crank case	Professional design, separate two halves & changeable
Power output	More than 1.6 hp
Engine idle speed	Not more than 3503 rpm
Max. engine speed	At least 10800 rpm
Ignition	Electronic Magneto ignition type
Carburetor	Compensator technology & diaphragm type with fuel pump,
Fuel tank capacity	Transparent & not more than 0.75 L
Dry weight	Not more than 7 to 9 kg
Clutch	Clutch shoe lining metal only
Air filter	Need main filter paper type
Safety interlock	Must safety interlock with trigger
Gear head	Spiral toothed, Bevel gear type with Aluminum body & deep grove ball bearing
Drive shaft	Rigid and square shaft

Combine harvester

The modern combine harvester, or simply combine, is a versatile machine designed to efficiently harvest a variety of grain crops. The name derives from its combining four separate harvesting operations - reaping, threshing, gathering, and winnowing - in a single process. Among the crops harvested with a combine are wheat, rice, oats, rye, barley, corn (maize), sorghum, soybean, flax (linseed), sunflower and rapeseed. The separated straw, left lying on the field, comprises the stems and any remaining leaves of the crop with limited nutrients left in it; the straw is then either chopped, spread on the field and ploughed back into soil or baled for bedding and limited-feed for livestock.

Combine harvester guidelines

Steps to follow

Checking prior to operations

Step 1 **Familiarize with the parts**

Familiarize with the different major parts, controls, and its functions -

- Major parts like engine, wheels/tracks, cutter bars, conveyors, belt systems, safety signage, and controls
- Control levers like main switch, main clutch, harvesting, and steering stick/lever
- Emergency stop or lever
- Condition and sharpness of cutting blades/bars
- Safety signage and devices
- Standing crop with mature grains ready for harvest

Step 2 **Do the WOGAM check on the machine**

Perform the WOGAM check, which stands for -

- **W**ater and fuel
- **O**il
- **G**rease
- **A**ir
- **M**iscellaneous

Step 3 **Make sure crops are ready for harvesting**

Make sure the crops are ready for harvest and the field condition is appropriate for combine harvesting.

- Clean the field (e.g. clear of weeds).
- Field is accessible and free of any hazard.
- Operator shall inspect the field. The operating pattern must be determined 1-2 days before the harvesting operation using the combine harvester.

Transporting the combine harvester

Step 4	Transporting the machine from storage

The combine harvester may be considered a slow-moving machine. They are not designed for long distance transport on concrete road. If the model has track wheels, it is recommended to load and unload the machine in a truck or trailer. Caution must be taken when loading and unloading the machine from the truck. When loading in and unloading from the truck, use no-skid bridges or ramp with sufficient width, strength, and length.

Operating the combine harvester

Step 5	Check the field

Before operations, make a final look at the field

- Check the crop stand, crop height, cropping density, maturity of the grains, and degree of crop lodging.
- Check the field of any hazard that may hamper operation or cause accidents.
- Determine the pattern and the starting point.

Step 6	Adjust the machine

The proper maintenance and operation of the machine will affect its operation and service life.

- With all controls in neutral or starting position, start the engine and let the engine warm up for about 3 minutes and about 1 min running of power transmission system (belt/chain system). Also, it is very important to know how to properly stop the engine.
- Do a troubleshooting of any abnormalities (sound, loose part) during machine test run.

Step 7	Enter the field

Move the machine at right angle to the field or border. Raise the combine reaper head using position lever and move at slow speed. Use bridges/planks, if the difference in the elevation between farm road and main field is 30 cm or more.

Step 8	Start harvesting

After operations

Step 9	Transporting the machine back to store

Same as step 4

Step 10	Clean the machine

- Check the condition of the machine parts.
- Recall and record problems encountered in the field.
- If possible, make minor repair or maintenance work of the machine before storage.
- Report any malfunction and need of major repair to authorized mechanic.

Specifications

Dimension Length (mm)	4,300
Width (mm)	1,830
Height (mm)	2,360
Weight (kg)	2,335

Total displacement (cc)	2,435
Engine power / rotating speed/rpm	62 hp/2700 rpm
Fuel tank capacity (L)	65
Centre distance of crawler (mm)	1,000
Crawler width x grounded length (mm)	400 x 1350
Average pressure of ground contact (kgf/cm^2)	0.216
Travelling minimum ground clearance (mm)	175
Speed changing type	HST (Hydrostatic transmission)
Travelling speed (m/sec), Forward	Lodging rice: 0 ~ 1.0, Standing rice: 0 ~ 1.5
Travelling speed (m/sec), Reverse	Transporting: 0 ~ 1.9
Reaping width (mm)	1,450
Number of rows (rows)	4
Width of reaping knife (mm)	1,436

Economic Analysis

Basic information:

Life span of equipment (year)	5
Life span of workshop, (year)	7
Working period, a day, (hour/day)	8
Capacity (hour/bigha)	0.4
Working days each year, (days/year)	50
Capacity per year, (bigha/year)	1000

Sl. NO.	Investment	Unit
1	Total investment cost (1a+1b) in INR	15,70,000
1a	Cost of combine harvester in INR	15,00,000
1b	Cost of workshop for parking and maintenance in INR	70,000
2	Depreciation (INR/bigha) (2a+2b)	310
2a	Depreciation cost of equipment (INR/bigha)	300
2b	Depreciation cost of workshop (INR/bigha)	10
3	Maintenance cost @ 0.5% of total depreciation cost (INR/bigha)	155
4	Interest @ 10%/year (INR/bigha)	79
5	Labor including operator, labor and management cost (INR/bigha)	223
6	Fuel consumption @ INR 100/lt (INR/bigha)	285.0
7	Total operational cost (2 to 6) (INR/bigha)	1051
8	Combine harvester service fee (INR/bigha)	1,500
9	Net profit (8-7) (INR/bigha)	449
Note: One hectare has 7.5 bigha in Assam		

Reaper

It is an engine-operated, walk-behind type harvester suitable for harvesting paddy. During forward motion of the reaper, crop row dividers divide the crop, which come in contact with cutter bar, where shearing of crop stems takes place.

Guidelines for reaper

It consists of crop row divider, star wheel, cutter bar, and a pair of lugged canvas conveyor belts and a handle fitted with clutch and brakes. This type of machines cut the crops and conveys it vertically to one end and windrows the crops on the ground uniformly. Collection of crops for making bundles is easy and is done manually. Self-propelled walking type, self-propelled riding type, and tractor-mounted type vertical conveyor reapers are also available. These types of reapers are suitable for crops like wheat and rice. In this type of reaper, there is no shattering of the crop.

To efficiently use reapers, fields need to be leveled and water drained at least 10–20 days before harvest.

Steps to follow

Step 1	**Safety first**

The machine can be dangerous. Wear suitable clothing, and never wear loose-fitting clothes. Always wear shoes. Always ask bystanders to keep at least two meters away while you use the reaper.

Step 2	**Do the WOGAM check on the reaper**

Perform the WOGAM check, which stands for -

- **W**ater and fuel
- **O**il
- **G**rease
- **A**ir
- **M**iscellaneous

Step 3	**Determine the operating pattern**

Determine the operating pattern, then position the reaper in the field.

In step 5, a circuitous pattern is recommended. Place the reaper at one corner of the field.

Step 4	**Operate at normal walking pace**

Put the reaper in forward gear. Start the cutter bar by shifting the cutter lever, which will allow the reaper to move forward. Run the machine at your normal walking pace. The reaper will start to cut the crops as it moves forward.

Step 5	**Reap around the edge, then move towards the center**

Start reaping from the edge of the field, then move towards the center.

OPTIONAL	**Use the reverse gear to move backwards**

To move the reaper backwards, put it in reverse gear. The machine will move backward when you pull on the moving lever.

OPTIONAL **Stop when the machine produces unusual sounds**

Stop the self-propelled multi-crop reaper and **TURN IT 'OFF' IMMEDIATELY** if it produces any cracking or other unusual sounds. Check for straw that may have jammed in the splitting bracket and cover while you've been operating the machine – clear it away.

Safety operations

1. **After and before operations:** Inspect your machine before operating. Check and repair of every unusual condition, service after using this machine.
2. **Operating the reaper:** Turn off the machine before servicing or maintaining. Be sure the blade clutch lever and main clutch lever are in "Off " position, and the shift lever on "Neutral" position.
3. **Keep the machine in a good condition**: Check your machine periodically on each harvest season to anticipate any problem when it will be used. So good maintenance will be very helpful to run the machine safely.
4. **Driving the machine on the road**: Use trailer or carry on truck for long distance movement. The lugged wheel system in the reaper will be used for moving the machine from one field to other field and short distance movement.

Specifications

Working efficiency:	1.2-1.8 h/Acre
Type:	Walking type reaper
Power:	5hp, Working speed: 2.5 - 3 km/h
Cutting type:	Vertical
Cutting width:	1200 mm

Economic Analysis

Basic information

Life span of equipment (year)	5
Life span of workshop, (year)	7
Working period, a day, (hour/day)	6
Capacity (hour/acre)	0.5
Working days each year, (days/year)	40
Capacity per year, (acre/year)	160

Cost economics

Sl. No	Investment	Unit
1	Total investment cost (1a+1b) in INR	1,50,000
1a	Cost of reaper in INR	1,50,000
1b	Cost of workshop for parking and maintenance in INR	0
2	Depreciation (2a+2b) (INR/acre)	187.5
2a	Depreciation cost of equipment (INR/acre)	187.5
2b	Depreciation cost of workshop (INR/acre)	0
3	Maintenance cost @ 0.5% of total depreciation cost (INR/acre)	93.75
4	Interest @ 10%/year (INR/acre)	47
5	Labor including operator, labor and management cost (INR/acre)	293
6	Fuel cost @ INR 100/lt (INR/acre)	142.5
7	Total operational cost (2 to 6) (INR/acre)	763.13
8	Reaper service fee (INR/acre)	1200
9	Net profit (INR/acre)	437

Axial flow thresher

The crop in this thresher is fed into the cylinder through a feeding chute located at one end of the threshing drum. The straw is thrown out of the threshing unit by paddles. The cleaning and separation of grain is accomplished by a set of sieves and a blower or aspirator.

Guidelines for axial flow thresher

Steps to follow

Step 1	Safety first

The machine can be dangerous. Wear suitable clothing; never wear loose-fitting clothes. Always wear shoes. Always ask bystanders to keep at least two meters away while you are passing from the thresher while in use.

Step 2	Do the WOGAM check for the seeder

Perform the WOGAM check, which stands for -

- **W**ater and fuel
- **O**il
- **G**rease
- **A**ir
- **M**iscellaneous

Step 3	Make sure the crop is ready for threshing

Ensure the crop is dried to proper moisture content to avoid losses which may happen due to high moisture for un-threshed grain or less moisture leads to high broken percentage. Ensure the crop is accessible and free of any hazard that might cause accidents.

Step 4	Transport the machine to the field

Most threshers are attached to the tractor by the three-point hitch system where the implement is

dragged with the help of two pneumatic wheels during transport and lowered to put in stand during threshing operation.

Step 5 **Make the necessary adjustments to the machine**

Ensure the followings:

- All controls in neutral or starting position, start the engine of the tractor and do the traction.
- Check the functionality of the PTO shaft of the tractor.
- Adjust the speed of tractor for threshing to adjust the RPM of the thresher.

Step 6 **Start threshing**

Ensure sufficient number of labors are available and fuel tank of the tractor is full before start of the day.

After the threshing operation

Step 9 **Transport the machine back to storage**

The agricultural tractor can travel for a long distance from field to field or on-road. Make sure the implement is lifted up and the PTO connection is detached during transport.

Step 10 **Clean and check the machine**

Make sure to clean and check the machine:

- Check condition of machine parts.
- Recall and record problems encountered in the field.
- If possible, make minor repair or maintenance of the machine before storage.
- Report if any malfunction and needs of major repair to authorized mechanic.

Because of the different threshing characteristics, it is necessary to use different threshing principles, so that better threshing effect can be obtained.

Do's of axial flow thresher

- Check each belt's alignment and tension. Adjust the idler pulley on the blower/cylinder belt to correct tension. Improper alignment and tension are the major causes of premature belt failure.
- Check pulley surfaces. Rough grooves must be smoothened with a fine file if nicked. Cracked pulleys should be replaced immediately.
- Open the cover and check all pegs on the threshing cylinder for tightness. Loose pegs will damage the machine and can be dangerous to the operators.
- Examine the peg teeth for wear. Maximum wear occurs at the feed end of the cylinder and is more prominent at the leading side in the direction of rotation. Worn pegs must be rotated 180 degrees or interchanged with those located near the straw paddles. Badly worn pegs must be replaced or rebuilt by welding.
- Rotate the threshing cylinder manually at least five revolutions to ensure that there are no obstructions or interferences.
- Make sure there are no loose or missing bolts and set screws. Tighten or replace as necessary.

- Lubricate all bearings with good quality grease (see maintenance and service section). The belt idler and oscillating screen eccentric bearings are lubricated for life, thus require no lubrication.
- Check engine oil and fuel levels. Follow the engine manufacturer's recommendations.
- Start the engine and allow it to warm up. Feed the thresher with the crop to be threshed for performance checking. Increase cylinder speed if excessive amounts of un-threshed and unseparated grains are observed with the straw. Optimum threshing and cleaning are obtained with cylinder speeds of 600 to 700 rpm.

Specifications

- Output capacity: 1.5 to 2.0 metric tons of grains per hour,
- Suitable to be driven by 25-35hp/540 PTO RPM tractor,
- Transport wheel: 2, pneumatic platform for easy feeding.

Economic Analysis

Basic information

Life span of equipment (year)	7
Life span of workshop, (year)	7
Working period, a day, (hour/day)	8
Capacity (hour/acre)	1
Working days each year, (days/year)	60
Capacity per year, (acre/year)	480

Cost economics

Sl. No.	Investment	Unit
1	Total investment cost (1a+1b) in INR	2,50,000
1a	Cost of axial flow thresher in INR	1,80,000
1b	Cost of workshop for parking and maintenance in INR	70,000
2	Depreciation (2a+2b) (INR/h)	74.4
2a	Depreciation cost of equipment (INR/h)	54
2b	Depreciation cost of workshop (INR/h)	21
3	Maintenance cost @ 0.5% of total depreciation cost (INR/h)	37.2
4	Interest @ 10%/year (INR/h)	26
5	Labor including operator, labor and management cost (INR/h)	260
6	Fuel cost @ INR 100/lt (INR/h)	285
7	Tractor rent cost (INR/h)	300
8	Total operational cost (2-7) (INR/h)	983
9	Axial flow thresher service fee (INR/h)	1200
10	Net profit (8-9) (INR/h)	217

Open drum thresher

This machine is more affordable and easier to operate by resource-poor small farmers compared to the larger machines which may not be available in the market or accessible to smallholder farmers.

Advantages

- Specially designed for women farmers' use
- Threshing and winnowing in one operation
- Portable open drum thresher with wheel system
- Diesel engine is provided which will help to operate in field also
- Protective concave is present to avoid accident

Do's for open drum thresher

✓ Harvest the grain at optimum maturity to maximize yield and minimize losses. Open drum thresher is particularly designed as hold-on type for threshing of paddy to get full length straw for further marketing.

✓ Timing of threshing: Ideally, machine threshing should begin immediately after cutting and often these crops can be threshed in the field. Immediate threshing reduces the exposure of crop to insects, birds and rodents, disease, and moulds. Crop that is piled over a period of time generates heat that will serve as an ideal medium for growth of moulds, disease and pests. Piling for several days will lead to grain discoloration, germinated grains, and spoilage.

Machine adjustments

➢ Always make sure that threshing drum speed and the cleaner settings are done properly according to the crop conditions. Wrongly adjusted threshers create higher threshing loss and grain damage.

Specifications

Frame:	Mild steel
Drum diameter:	1-2 feet
Drum length:	4 or 5 feet
Wire loop or spikes over threshing cylinder	
Prime mover:	Diesel engine (4.5 hp)
Winnower attachmen	
Wheel system should be present for easy movement	

Portable rice mill

Milling is the process wherein the rice grain is transformed into a form suitable for human consumption, therefore, has to be done with utmost care to prevent breakage of the kernel and improve the recovery. Brown rice is milled further to create more visually appealing white rice.

Working principle of portable rice mill

- ✓ When paddy comes into the mill, it contains foreign materials such as straw, weed seeds, soil, and other inert materials. If these are not removed before hulling, the efficiency of the huller and milling recovery will be reduced. So, paddy should be cleaned properly, free from inert matter.
- ✓ Brown rice is produced by removing the husk from rough paddy rice. The husk is removed by friction as the paddy grains pass between two abrasive surfaces that move at different speeds. After dehusking, the husk is removed by suction and transported to a storage dump outside the mill. Husk accounts for 20% of the paddy weight and an efficient husker should remove 90% of the husk in a single pass.
- ✓ The paddy separator separates unhusked paddy rice from brown rice. The amount of paddy present depends on the efficiency of the husker and should not be more than 10%. Paddy separators work by making use of the differences in specific gravity, buoyancy, and size between paddy and brown rice.
- ✓ White rice is produced by removing the bran layer and the germ from the paddy. The bran layer is removed from the kernel through either abrasive or friction polishers. The amount of bran removed is normally between 8 and 10% of the total paddy weight. To reduce the number of broken grains during the whitening process, rice is normally passed through two whitening stones.

After polishing white rice is collected in the discharge chute.

Steps to follow

Step 1	Safety first

The machine can be dangerous. Wear suitable clothing; never wear loose-fitting clothes. Always wear shoes. Always ask bystanders to keep at least two meters away while you are passing by the rice mill, while in use.

Step 2	Do the WOGAM check for the seeder

Perform the WOGAM check, which stands for -

- **W**ater and fuel
- **O**il
- **G**rease
- **A**ir
- **M**iscellaneous.

Step 3	Make sure the paddy is ready for milling

Ensure the paddy is dried to proper moisture content (14% -16%) to avoid higher broken rice with better head rice recovery. Ensure the paddy is accessible and free of any hard inert material that might cause accidents.

Step 4	Transport the machine to the field

Most mills are attached to the tractor by the three-point hitch system where the implement is dragged with the help of two pneumatic wheels during transport and lowered to put in stand during milling operation.

Step 5	Make the necessary adjustments to the machine

Ensure the followings:

- All controls in neutral or starting position, start the engine of the tractor and do the traction.
- Check the functionality of the PTO shaft of the tractor.
- Adjust the speed of tractor for milling to adjust the RPM of the portable rice mill.

Step 6	Start milling

Ensure sufficient number of labors are available and fuel tank of the tractor should be full before start of the day.

After the milling operation

Step 7	Transport the machine back to store

The agricultural tractor can travel for a long distance from field to field or on-road. Make sure the implement is lifted up and the PTO connection is detached during transport.

Step 8	Clean and check the machine

Make sure to clean and check the machine:

- Check condition of machine parts.
- Recall and record problems encountered in the field.
- If possible, make minor repair or maintenance of the machine before storage.
- Report any malfunction and need of major repair to authorized mechanic.

Specifications

Trolley mounted rice mill	
Capacity:	700-1000 kg /h
Rubber roller with paddy cleaner, Jet polisher, Cyclone	
Preferred:	Control clutch system, To be operated by 35-45 hp tractor PTO

Economic Analysis

Basic information

Life span of equipment (year)	5
Life span of workshop, (year)	7
Working period, a day, (hour/day)	6
Capacity (hour/ton)	1
Working days each year, (days/year)	140
Capacity per year, (ton/year)	840

Cost economics

Sl. NO.	Investment	Unit
1	Total investment cost (1a+1b) in INR	420000
1a	Cost of rice mill in INR	350000
1b	Cost of workshop for parking and maintenance in INR	70000
2	Depreciation (2a+2b) (INR/ton)	95. 24
2a	Depreciation cost of equipment (INR/ton)	83
2b	Depreciation cost of workshop (INR/ton)	12
3	Maintenance cost @ 0.5% of total depreciation cost (INR/ton)	47. 62
4	Interest @ 10%/year (INR/ton)	25
5	Labor including operator, labor and management cost (INR/ton)	170
6	Fuel consumption @ INR 100/lt (INR/ton)	428
7	Tractor rent cost (INR/ton)	300
8	Total operational cost (INR/ton)	1065.36
9	Rice mill service fee (INR/ton)	1200
10	Net profit (INR/ton)	135

Indent cylinder separator

The indent cylinder machine utilizes the forces of gravity and centrifugal force in its operation. The particles to be removed from the mass are loaded into the indents by a combination of gravity and centrifugal force.

Guidelines for indent cylinder separator

- This helps to separate seeds according to the length.
- The equipment consists of a slightly inclined horizontal rotating cylinder and a movable separating trough.
- The inside surface has small closely spaced hemispherical indentations.
- Small seeds are pressed into the indents by centrifugal force and can be removed.
- The larger seeds flow in the centre of the cylinder and are discharged by gravity.

Do's for indent cylinder separator

- Indent cylinder machines are relatively service-free but one thing should be made clear in order to eliminate some potential dissatisfaction on a new machine.
- A new machine will not operate properly until the indented surface has an opportunity to become polished.
- Sometimes it is necessary to clean new cylinders with a thinner or steam. Until polishing is accomplished, grain or seed mass will surge (wash back and forth in cylinder), or will carry over the top of the cylinder at normal speeds due to increased friction.
- Cylinders which have not been used recently may become rusty and act the same way.
- Polishing can be done by running waste grain or fine chick grit in the machine until they become shiny.
- Cylinder should be run backward with trough turned to emptying position. When handling oily material, indents may tend to "fill" with dust imbedded in oil and effective depth of the indents is lowered. Periodical "scouring" may be needed in this case.

Specification

Capacity t/h:	Rice (white) 1-6
Air Requirement (m^3/min):	6-9
Length:	3500-3600 mm, Width: 900-950 mm, Height: 850-900 mm
Net weight (kg):	600-650

Dry grinding machine

Value addition and innovation are solutions for rice grinding, adding high value to rice and broken rice, and significantly improving return on investment by customers. Rice powder can be packed and used as business for the women SHG. Grinding helps in adding a added value to the rice wherein the women section can easily inculcate the technology and can use it for business purposes. This also helps in getting added value in the market as compared to selling broken rice. The broken rice can be further processed to dry powder by using the dry grinding machine.

Working principle of dry grinding machine

- The flow of material from the feeding hopper is regulated by means of side handle easily to suit the load. Rotor runs in anti-clockwise direction. The beaters pass just beneath the ratchet teeth liner fitted inside the top half of the crushing chamber, leaving a gap of 3 mm between the liner teeth and the tips of the rotating beaters. This cuts the material caught between the liner teeth like a sword with a scissors action at a 2880 RPM
- After the required size reduction, the material will pass through the screen fitted inside the lower discharge end of the grinding chamber. No sieving is required, as the appropriate sized screen fitted will not allow coarser material to pass through.
- The air generated in the crushing chamber forces the powder to pass through the screen fitted at the bottom discharge end of the crushing chamber, into a filter attached to the delivery trough below.

Specifications

Chamber size:	200 mm x 200 mm
Pulverizer RPM:	2600-3000
Motor hp (KW):	2-3 hp
Capacity:	10-12 kg/h
Standard accessories:	Filter, stainless steel vessel to collect the ground materials, different-sized hole screens for getting different mesh powders
Electricity connection:	1/3 phase

Grain quality kit

The grain quality kit consists of the components listed below. Please note that IRRI compiles the kits from tools that are partly manufactured to the specifications of IRRI and partly sourced in the markets. Depending on the suppliers, the tools can look different than they appear on photos but they will perform similarly.

- Graduated cylinder (Flask): The cylinder is calibrated and is easy-to-read, raised graduation allows precise measuring of the volume of grain samples.
- Scale: The mini scale weighs samples in different modes: grams, ounces, troy ounces and penny weights. It can weigh a maximum of 250g.
- Calliper: Used to measure the length and width of the grain.
- Infrared thermometer: The non-contact thermometer can be used for monitoring grain temperature in rice milling and drying.
- IRRI moisture tester: The affordable decision making, tells you whether your paddy needs drying, can be stored safely before milling or as seed.
- Indented sheet grader: Used to separate the broken rice (large & small) from the whole kernel.
- Magnifier: Double the size of the item being viewed. Used for observing cracks and insects in the grain.
- Rice milling chart: Indicates the level of polishing of white rice. It ranges from 8-14% with 10-12% the preferred range.
- Documentation and tables: Contain printed user's manual and training videos. EMC table and psychometric charts, and many other tools allow you to measure air properties and determine safe drying and storage conditions.

Specifications

- Graduated cylinder (Flask): material- plastic, transparent for easy reading; maximum reading - 100ml; graduation- resolution 1ml, engraved or raised, for easy reading; Others - needs to stand so that it can be placed on balance.
- Caliper: material - anti corrosive material; maximum reading - 10 mm; resolution - 1/10 mm.
- Rice milling chart: The rice milling chart indicates the level of polishing of the white rice. It ranges from 8 to 14% (10 to 12% is preferred).
- Indent sheet grader**:** material-preferably aluminium for light weight. If made of iron it must have anti corrosive coating; dimensions- 150 * 300 mm, at 3 sides folded in 90° angle, 20-25mm high.
- Magnifier specs: lens protected when not in use (retractable); batteries and light for illuminated viewing; uses AA batteries (availability in developing countries).
- Moisture meter: application - paddy, brown rice, polished rice, barley, wheat & naked barley; measuring range - paddy, brown rice, polished rice -10-40%; barley, wheat & naked barley -10-35%; accuracy - ±0.5 % (10% - 20%); display method - digital display by LCD; temperature compensation - automatic.

- Infrared thermometer: temperature range - 10-200°C; temperature display - 0.2°C; accuracy - ±2 % of reading; ambient operating range: - 0-50°C; relative humidity 10-95%, non-condensing; power - either AA or 9V block; pointer - laser pointer; distance to spot size - preferably 8:1, not below 6:1;
- Mini scale: range - 250g; resolution - 0.1g; power - AA or AAA batteries (availability in developing countries); others - weighing tray needs to have a cover for transport in the quality kit.
- Thermometer: temperature range - 10 to 60°C; max. error- ±1°C temperature; Hygrometer: humidity range - 10-99%; max. error - ±5% RH
- Palm husker: material - moulded rubber.

Repair, maintenance, and parking of machines

- Engine, gear, and hydraulic oil should be checked regularly and replaced as per the manufacturer's recommendation. Oil, fuel, and air filters should be changed regularly according to manufacturer's recommendations.
- Service the air cleaner, fuel filter, fuel line, carburettor. Clean the spark plug and replace it if it shows any damage, is very old, or the engine does not start easily. Apply lubricant to the lug chain, cutting blade, bearings, and other moving parts.
- Check regularly during reaping for any straw and other objects in the blades, chain, and shaft, and remove them.
- Lubricate cylinder and fan bearings with good-quality general purpose grease every 25 hours of operation or as per operator manual.
- Periodically apply a small amount of oil to all hinge points. Inspect the machine regularly for loose, worn, or damaged peg teeth, concave bars, cylinder, discharge paddles and other parts, and tighten, repair, or replace them immediately.
- Missing bolts or nuts must also be replaced.
- Reduce belt tensions by loosening the idler pulley and engine mounting bolts when the machine will not be used for an extended period to minimize deterioration.
- Clear the thresher of any grain, chaff by idle operation.
- Take out the sieves from the frame and crank mechanism and inspect for damage, and replace if necessary.
- Repair and maintain equipment before you get to the field. Adjust equipment (see operator's manual) to reduce draft (friction) that can increase fuel consumption.
- Replace worn tillage surfaces (plough shears, chisel points, disk blades) on tillage tools, check disks for worn bearings and missing scrapers, check and tighten nuts and bolts, check resets for proper operation.
- Replace worn shovels or sweeps on spring-tooth harrows and field cultivators. Level front to back and side to side so tillage depth is even.
- Make sure the seed dispersal mechanism works properly – monitor for proper operation and clean seed drop tubes. Grease and lubricate per the manufacturer's recommendations.

Parking

If storing the machines for more than a few days, keep them in the shade, and in a clean, dry place where they will not come into contact with dust, rain, sun or other materials.

- Wash and clean the self-propelled multi-crop reaper thoroughly using water and a brush. Store all engine belts in a dry place.
- Throw away the used oil from transmission box and replace. Apply grease at the points where needed.
- After drying the self-propelled multi-crop reaper, apply oil to the metal parts to protect them. Before applying oil to cutter blades, make sure they are well-dried.
- Rotate the blades while applying oil to make sure each one is well-lubricated.
- Store the machine in a dry place – in a shed, or at least protected from the sun and rain.
- Apply grease to the other mechanical parts and cover them with a polythene sheet to guard against rust and protect from dust.

Knowledge Management Committee

Sl. No	Name	Designation	Department
Assam Agricultural University			
1	Dr. Ashok Bhattacharyya	Director	Directorate of Research (Agri.), AAU, Jorhat
2	Dr. Mrinal Saikia	Assoc. Director of Research	Directorateof Research (Agri.), AAU, Jorhat
3	Dr. Rupam Borgohain	Principal Scientist and Nodal officer	Directorate of Research (Agri.) and OPIU_AAU Jorhat
4	Dr. Debanand Das	Principal Scientist and Alternate Nodal officer	Directorate of Research (Agri.), AAU, Jorhat
5	Dr. Ranjit Kr. Saud	Assoc. Director of Extension Education (P&I)	Directorate of Extension Education, AAU, Jorhat
6	Dr. Ramani Kanta Thakuria	Principal Scientist	Horticulture Research Station, Kahikuchi, AAU, Jorhat
7	Dr. Kalyan Pathak	Professor and Head	Department of Agronomy, AAU, Jorhat
8	Dr. Kulendra Nath Das	Professor	Department of Soil Science, AAU, Jorhat
9	Dr. Bipul Deka	Principal Scientist	AICRP on Water Management, Department of Soil Science, AAU, Jorhat
10	Dr. Khagen Kurmi	Principal Scientist	AICRP on Weed Management, Department of Agronomy, AAU, Jorhat
11	Dr. Phuleshwar Nath	Senior Extension Specialist	Directorate of Extension Education, AAU, Jorhat
12	Dr. Sanjay Kumar Chetia	Chief Scientist	RARS, Titabor, AAU
13	Dr. Pulin Patgiri	Principal Scientist	AICRP on Post-Harvest Technology, Department of Agriculture Engineering, AAU, Jorhat
14	Dr. Sailen Gogoi	Principal Scientist	AICRP on Vegetables, Department of Horticulture, AAU, Jorhat
15	Dr. Surajit Kalita	Junior Scientist	Directorate of Research (Agri.)
16	Mr. Manash J Barooah	Assistant Professor	AICRP on Farm Implements and Machinery, Department of Agriculture Engineering, AAU Jorhat
17	Dr. Sundar Barman	Assistant Professor	Department of Extension Education, AAU, Jorhat
18	Mr. Apurba Das	Assistant Professor	Department of Plant Pathology, College of Sericulture, AAU, Jorhat
International Rice Research Institute			
19	Dr. Kanwar Singh	Senior Associate Scientist II - Precision Agronomist & Resident Project Coordinator	
20	Dr. Virendar Kumar Yadav	Consultant	
21	Dr. Suryakanta Khandai	Associate Scientist (Post harvest & Rice Value Chain)	
22	Ms. Suranjana Bhaswati Borah	Senior Specialist - GIS & Remote Sensing	
23	Mr. Jyoti Bikash Nath	Specialist - Agriculture Research & Development (Agriculture Extension)	
24	Mr. Vipin Kumar	Specialist - Agriculture Research & Development (Crop & Natural Resource Management)	
25	Mr. Vivek Kumar	Specialist - Agriculture Research & Development (Agriculture Extension)	
26	Dr. Lisa Mariam Varkey	Specialist: Socio-Economics	
27	Dr. Rahul Priyadarshi	Specialist - Agriculture Research & Development	
Assam Rural Infrastructure and Agricultural Services (ARIAS) Society			
28	Mr. Baljeet Singh	Market Analyst cum Operations Specialist	
29	Dr. Pranab Mahanta	Agri Adviser, APART	
Department of Agriculture, Govt. of Assam			
30	Mr. Madhuram Patiri	Nodal Officer, APART, DoA	


DANGSUING FARMERS
Dhansiri Valley
Improving Lives

অসম চৰকাৰ
GOVERNMENT OF ASSAM

ARIAS Society
GOVERNMENT OF ASSAM
Assam Rural Infrastructure and Agricultural Services Society

ASSAM AGRICULTURAL UNIVERSITY

CGIAR

IRRI