# DIRECT SEEDED RICE PRODUCTION TECHNOLOGY



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GOVERNMENT OF ASSAM

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Assam Rural Infrastructure and Agricultural Services Society

ASSAM AGRICULTURAL UNIVERSITY
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# DIRECT SEEDED RICE PRODUCTION TECHNOLOGY


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## Adapted from

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# Contents

## Direct seeded rice

Direct seeded rice (DSR) is a method of sowing rice seeds directly into the main field, without raising nursery for transplanting seedlings. More than 60% of the world population relies on rice as a staple food. Increasing water scarcity and labor wages for rice cultivation are forcing the growers to search for such alternative crop establishment methods which can increase water productivity and reduce cost of cultivation. In other words, DSR is the process of establishing a rice crop from seeds sown directly in the main field rather than by transplanting seedlings from the nursery. Direct seeding can be done by sowing pre-germinated seed into a puddled soil (wet seeding through broadcast or drum seeder) or sowing dry seed (dry seeding through broadcast and seed-cum-fertilizer drill/ multi-crop planter) on prepared land. Improved short-duration and high-yielding inbred varieties/hybrids, nutrient and weed management techniques encouraged the farmers to shift from manual transplanting to DSR cultivation. Direct seeded rice offers certain advantages like substantial saving of irrigation water, labor, energy, time, and decreases emission of greenhouse gases. Besides this, it also offers a congenial soil environment for better growth and productivity of succeeding crops.

DSR can be operationalized on soils ranging from medium texture (loam) to heavy texture (clay). However, it is recommended not to go for DSR if the soil is light textured and poorly drained.

## Types of direct seeding

There are two methods of direct seeding of rice:

| Dry direct seeding | Wet direct seeding |
|---|---|
| Broadcasting | Broadcasting |
| Seed sowing using seed-cum-fertilizer drill | Drum seeding |

Broadcasting is the oldest and most basic form of direct seeding, and is practiced quite widely in parts of Odisha, Chhattisgarh, Assam, etc. But broadcasting comes with its own disadvantages.

### Disadvantages of broadcasting

- Non-uniform distribution of seeds
- Seed damage by birds, rodents
- Uneven and inadequate plant population
- High seed rate is required
- Inappropriate and non-uniform fertilizer application
- Proper seed depth is not maintained
- Weeds are more rampant and manual weeding is cumbersome
- Difficult to conduct intercultural operations
- Insect-pest and disease attack is more

- Difficulty while applying plant protection measures, resulting in lesser yields and net returns.
- Non-congenial micro-environment for plant growth

Today, there are mechanized options available for direct seeding in both wet and dry conditions. The aim of this document is to present the best management practices associated with mechanized direct seeding of rice. Specifically, two machines are presented in this document, the drum seeder and multi-crop planter (DSR-drill), both of which are well suited for the edaphic conditions in Assam.

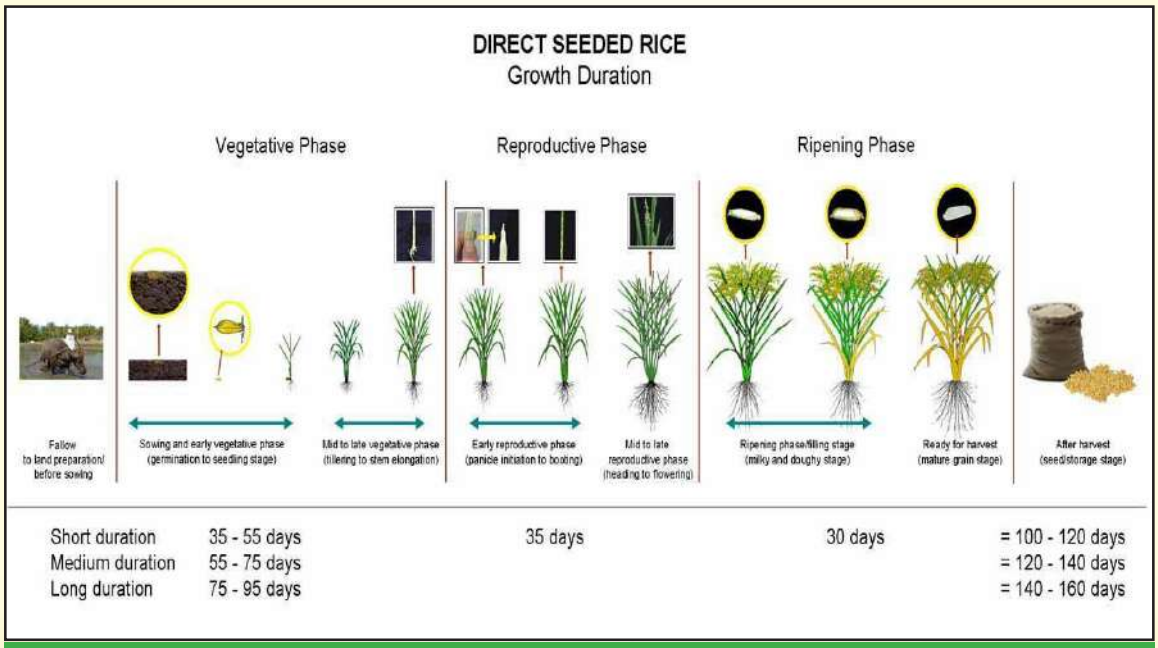
**Sowing by seed-cum-fertilizer drill**

# Management practices for direct seeded rice

## Crop planning

**Use a crop calendar to plan activities for the season**

A crop calendar is the series of activities during the rice growing season beginning from the fallow period and land preparation, to crop establishment and maintenance through to harvest and storage. The use of a crop calendar allows better planning of all farm activities and the cost of production.




Crop calendar

## Land leveling

Elevation differences between high and low-lying spots can be as high as 10-20 cm or more in a single hectare field under traditional land leveling practices. This condition often leads to poor establishment of DSR crop due to uneven depth of seeding and also due to uneven water distribution in irrigated fields. Laser land leveling improves crop establishment and also enables the farmer to apply uniform irrigation, leading to improved weed control and nutrient use efficiencies.

Laser land leveler

## Varietal choice

**STRVs promoted under APART in Assam**


Use high-yielding, stress-tolerant rice varieties for dry- and wet-DSR during *Sali* season, and short-duration and drought-tolerant rice varieties for *Boro* season. Varieties like Swarna-Sub 1, Ranjit-Sub 1, Bahadur-Sub1 and BINA Dhan 11, are able to tolerate complete submergence up to two weeks. Depending on flood-water quality, the tolerance period may vary. Turbidity of water hinders sunlight, thereby affects tolerance. BINA Dhan 11, a medium-duration submergence-tolerant rice variety may also be grown in areas having low and delayed rainfall, and under post-flood sowing condition. The varieties for different growing situations along with brief characteristics description are listed below.

| Name of variety | Days to maturity | Grain type | Plant height (cm) | Yield (t/ha) | Salient features |
|---|---|---|---|---|---|
| Swarna-Sub 1 | 140-145 | Medium bold | 100 | 5.5-6.5 | Suitable for cultivation in lowland areas. Submergence tolerance up to two weeks. However, if stagnation prolongs for more than a month over 25 cm water depth, tillering is drastically reduced. |
| Ranjit-Sub 1 | 150-155 | Medium slender | 115 | 5.0-5.5 | |
| Bahadur-Sub 1 | 150-155 | Medium bold | 115 | 5.0-5.5 | |

| Name of variety | Days to maturity | Grain type | Plant height (cm) | Yield (t/ha) | Salient features |
|---|---|---|---|---|---|
| BINA Dhan 11 | 115-120 days in *Sali* season and 125-130 days during *Boro* season | Medium slender | 107-115 | 5.5-6.0 | Suitable for medium shallow low land. Submergence tolerance up to two weeks. Shorter duration, may permit delayed transplanting/ sowing, and help escaping drought. |

## Seed quality and treatment

**Seed quality:** Quality seed is both physicaly & genetically pure (contains only seeds of one variety), (contains no pebbles, soil particles, weed seeds) and has healthy seeds (physically clean which means seed is filled, of same color, without cracks, and no obvious disease or pest damage). Use good quality seed, free of impurities.


**Seed cleaning**: The seed cleaning should be done in salt solution at a concentration of 200g common salt per liter of water. To check optimum concentration of the solution, put a potato/egg in solution, and go on adding salt till it floats. After that, seed should be poured into the prepared solution for cleaning. The light and diseased seeds, which float on the prepared solution, should be removed. The seeds settled at the bottom should be cleaned three times with plain water to remove any traces of salt that may hamper germination.

After seed cleaning, soak the seed for 12 hrs. Mix the crop protection products well and let the seed incubate. Ensure not to over germinate the seed.

After seed priming process, seeds are dried in shade to decrease moisture content, which facilitates the proper functioning of seed metering mechanisms during sowing. Both hydro- and osmo-priming induce a wide range of biochemical changes in the seed, the products of which persist following desiccation and are expressed quickly once the seeds again absorb water. Thus, priming accelerates seed germination and crop emergence. Priming can also be used to treat the rice seed with systemic and / or contact fungicides to eliminate or reduce certain seed-borne diseases. Based on the large number of field data, it is evident that seed priming is useful in both wet- and dry-DSR.

## Step-by-step seed cleaning and treatement process

**Seed cleaning process with egg drop test:** In water, salt is to be added continuously until the egg floats. Once the egg floats, remove it and add uncleaned seed. Seeds that float are to be discarded. While the seeds settled at the bottom indicate clean in nature and are to be cleaned and washed 2- 3 times before use.

**Seed treatment**

**Advantages:** Protects the seedlings from seed-borne diseases, i.e., seed rot, seedling blights, etc., and improves the seed germination and promotes plant growth.

**Safety precaution**: Plastic gloves should be used while handling chemicals to avoid ill-effect on health

**Time of sowing:** Generally, the mid-May to end of June is optimum sowing time for DSR for *Sali* season (winter rice), but depending on the onset of monsoon rainfall, it can be adjusted accordingly. Keep in mind, uniformly emerged and well-established crops before peak rainfall will be better equipped to tolerate subsequent stress events (flood, drought).

Note: Pre-germinated seeds are used only in case of wet-DSR.

# Dry direct seeding of rice (Dry-DSR)

## Main field preparation

For preparation of the main plot, the following points should be kept in mind:

- Field should be prepared thoroughly by ploughing with tyne-cultivator/disc harrow/ rotavator/ 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.
- Allow the weeds to grow in a stale/virgin seedbed. The ploughing intervals should be kept in such a way that the weeds germinating after the first round are knocked down (through tillage) in the next round.
- 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 fertilizer potash and zinc should be applied in the field before last ploughing and phosphorus should be applied through seed-drill at the time of sowing.
- Sufficient moisture is required at sowing time for good germination.
- Plot size should be kept ideal as per resources and irrigation availability.

**Hands-on training on seed-cum-fertilizer drill**

**Seeding machine**: A multi-crop planter fitted with inclined plate seed metering mechanism and depth control wheel (DSR-drill) is used for precise seeding and fertilizer placement.

**Planking**: In dry DSR, a heavy pre-seeding planking is required to keep the soil moisture intact in the soil for maintaining the required depth and improve seed to soil contact resulting in better and uniform germination and thereby improved crop establishment. Light post-seeding planking may be required to cover the bare seed. Nowadays, seed drills are fitted with spring-loaded wheels /flappers / chains attached behind the tynes, which improve the proper seed to soil contact and seed coverage. In such case, post-seeding planking is not required.

Sowing should be done in rows 20-25 cm apart at a depth of 2-3 cm (depth must not be more than 2-3 cm in any case) using a seed rate of 40-45 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. Both very shallow and deeper depths are risky for crop emergence.

**A Dry-DSR field**

# Wet direct seeding of rice (Wet-DSR)

## Main field preparation

For preparation of the main plot, the following points should be kept in mind:

- Field should be prepared thoroughly by ploughing with desi plough 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. Alternatively, one pass of mould board plough followed by one or two passes of modified helical blade puddler are sufficient for obtaining good quality puddled soil.
- The ploughing intervals should be spaced such that the weeds germinating after the first round of ploughing are knocked down in the next round.
- If available, apply compost or manure uniformly prior to field preparation and mix it well with soil.
- Repair the bunds to reduce water losses from the field during the cropping season.
- Level the fields, best by maintaining a shallow water layer in the field.
- The basal fertilizer dose is applied to the field. (Please see fertilizer section).
- Also keep the plot size ideal as per the availability of resources and irrigation access.

**Filling the drum with germinated seeds**

**Seeding**: The direct seeding under wet condition i.e., wet-DSR is accomplished with the help of drum seeder. For drum seeding, ideally field should be saturated, but there should be no stagnating water. Excess moisture / water leads to decay of seed. A thin layer of water is helpful in improving the seed to soil contact.

**Wet-DSR**

## Fertilizer application

For DSR, the fertilizer recommendation in *Sali* season is 60-20-40-5 and in *Boro*/early *Ahu* season it is 60-30-30-5 kg/ha of N-$P_2O_5$-$K_2O$-Zn. Nitrogen is applied into 3 splits i.e., 1/3rd at 15 days after emergence, 1/3rd at maximum tillering, and 1/3rd at panicle initiation. In addition to this, if submergence occurs during *Sali* season, 20 kg N and 20 kg $K_2O$ is applied 5-7 days after recession of flood to facilitate regeneration, and boost recovery from flood-shock. The detailed schedule and method of applying all nutrients is given in the table below.

**Table : Fertilizer doses (kg/bigha) in *Sali* and *Boro*/early *Ahu* season**

| Stage of fertilizer application | Name of fertilizers | Fertilizer application (kg/bigha) | | | | Application method |
|---|---|---|---|---|---|---|
| | | *Boro*/early *Ahu* | | *Sali* | | |
| | | Through DAP | Through SSP | Through DAP | Through SSP | |
| Basal | DAP* | 9 | - | 6 | - | Broadcast & incorporated in soil at the time of field preparation |
| | SSP | - | 25 | - | 17 | |
| | MOP | 7 | 7 | 9 | 9 | |
| | $ZnSO_4$ | 3 | 3 | 3 | 3 | |
| 15 days after crop emergence | Urea | 2 | 6 | 3 | 6 | Broadcasting |
| Maximum tillering after first weeding | Urea | 6 | 6 | 6 | 6 | Broadcasting |
| Panicle initiation, after second weeding | Urea | 6 | 6 | 6 | 6 | Broadcasting |
| Additional fertilizer 5-7 days after flood water recedes | Urea | -- | | 6 | | Broadcasting |
| | MOP | -- | | 4.5 | | |

** Apply through seed-cum- fertilizer drill*

**Note**:

- Restrict urea topdressing, in case bacterial blight symptoms appear.
- Apply $ZnSO_4$ in soils deficient in zinc, once in three years.
- Never use urea in seed-drill while seeding, otherwise it will hamper seed germination and corrode the instruments.
- As far as practicable, drain out standing water before top-dressing of fertilizer.

## Weed management

Keep the field weed-free, especially early in the crop season. Weeds adversly affect the crop growth in the early crop stage, but control is also important in the later stage to prevent seed setting by the weeds.

## Hand weeding

With the increasing scarcity of the farm labor, manual weeding is becoming uneconomical. However, wherever farm labors are available or the family member are available, hand weeding should be preferred as per the requirement of weeding in the crop. Ideal time for hand weeding is as follows

- First weeding with paddy weeder or hoe, 3 weeks after sowing
- Second weeding with paddy weeder or hoe, 6 weeks after sowing

## Herbicide Use

**Herbicide selection:** Herbicides should be selected based on present and even previous weed pressure in the field. Field history plays a very important role in weed management and herbicide selection as well.

**Herbicide application:** Given their superior effectiveness, herbicides should only be applied using booms fitted with multiple flat-fan nozzles. While spraying, the new spray-swath should always overlap 30 % of the previous spray-swath margin to ensure uniform application.

**Pre-emergence (PE) herbicides:** Most PE herbicides require moisture at the soil surface at the time of application. Without sufficient moisture, the PE herbicide will not be so effective. Pre-emergence herbicides supplemented with one hand weeding will be more effective to take care of skipped off weeds, and the weeds that emerge later in the season.

**Post-emergence (PoE) herbicides:** Ensure that there is no standing water in the field, however, the field should have moisture at time of PoE herbicide application. PoE herbicides, if needed, should be applied between 15-25 DAS, when weeds attain 2-4 leaf stage.

**Spray volume:** Use spray volume of 300 liters/ha in all herbicide applications.

**Herbicide Safety**

- Read the label carefully prior to use to understand both the toxicity level and the safety measures required.
- Plastic gloves, goggles or face shield, and full clothing should be worn while mixing and during application of the herbicides.
- Post-application, all clothes need to be washed separately from the family's laundry.

**Select suitable and need-based herbicide(s) from the table given below**

| Sr. No. | Technical name | Dose (a.i./ha) | Product dose (ml or g /ha) | Time of application | Remarks |
|---|---|---|---|---|---|
| **Pre-emergence** | | | | | |
| 1 | Pretilachlor with safener 30.7% EC | 500 | 1629 ml | Apply within 0-3 days after seeding using 300 litre/ha water volume. Good soil moisture is important for its efficacy | It may be used in rainfed ecology conditions. |
| 2 | Oxadiargyl 80% WP | 90 | 112.5 g | | |
| **Post - emergence** | | | | | |
| 1 | Bispyribac-sodium 10% SL | 25 | 250 ml | Spray 15-25 days after emergence using 300 litre water/ha when weeds are 2-4 leaf stage<br><br>Note: Field should not be flooded at the time of herbicide application, however it should not be too dry (There should be sufficient soil moisture for better efficacy of the applied herbicide) | Weak on sedges |
| 2 | Pyrazosulfuron ethyl 10% WP | 20-25 | 200-250 g | | Only controls sedges |
| 3 | Metsulfuron methyl 10 % WP + Chlorimuron ethyl 10% WP | 4 (2+2) | 20 g | | Effective mainly on broadleaf weeds |
| 4 | Ethoxysulfuron 15% WG/ WDG | 18 | 120 g | | It controls post-emergent broad leaf weeds and sedges. |
| 5 | Bispyribac-sodium 10% SL + Pyrazosulfuron ethyl 10% WP | 25 +20 | 250 ml + 200 g | | Grassy weeds and sedges. |
| 6 | Fenoxaprop-ethyl with safener 6.9 EC (6.7% w/w) + Ethoxysulfuron 15% WG/WDG | 90 + 18 | 1300 ml + 120 g | | |

## Irrigation

In *Sali* season, in the absence of rain, application of 3-5 cm irrigation water 3 days after disappearance of ponding water is recommended in medium and heavy soils. Depth of irrigation is subjective to levelling of the plot.

## Major insect-pests and diseases

### Plant protection measures

If pest population crosses economic threshold levels in the field, apply plant protection measures as per state recommendations.

**Economic Threshold Level (ETL) of common rice pests in Assam**

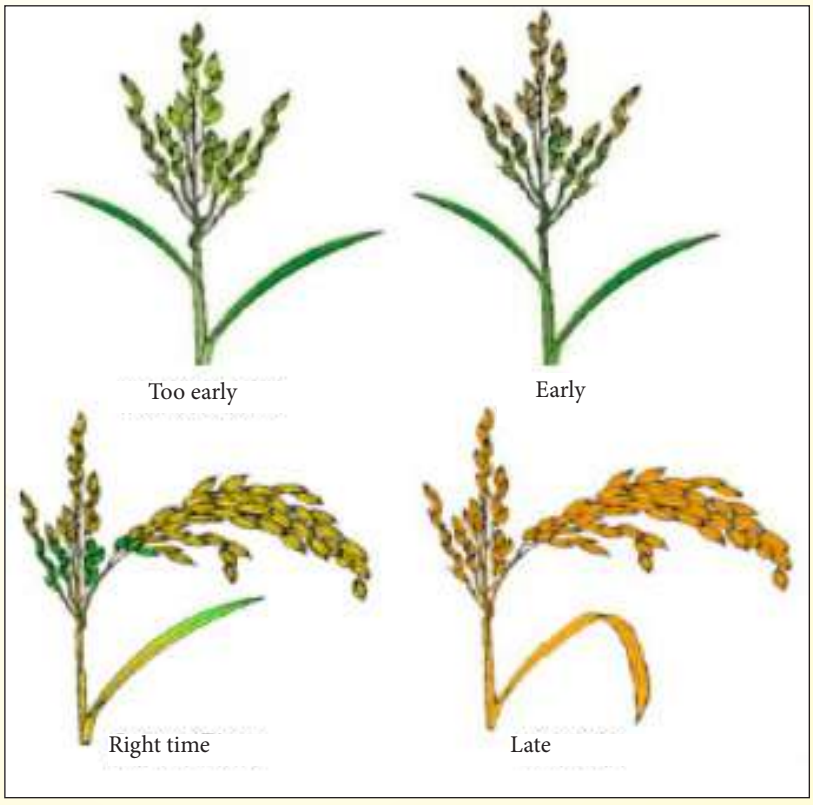
| Sl. | Crop Stage and Pest | Economic Threshold Levels (ETLs) |
|---|---|---|
| **A.** | **Pre-tillering** | |
| 1 | Green leafhopper | 1-2 insects/ $m^2$ |
| 2 | Gall midge | 1 silver shoot (gall)/ $m^2$ |
| 3 | Stem borer | 1 moth/ 1 egg mass/ $m^2$ |
| 4 | Leaf folder | 1 freshly damaged leave/hill or 10% damaged leaves/ $m^2$ |
| 5 | Yellow stem borer | 5-10% dead hearts or two egg mass or two moth/ $m^2$ |
| 6 | Gall midge | 1 gall/ $m^2$ in endemic areas or 10% silver shoots/ $m^2$ |
| 7 | Brown plant hopper | 5 to 10 insects/ hill |
| 8 | Rice leaf hopper | 10 or more insects/ hill |
| 9 | White backed plant hopper | 10 or more insects/ hill |
| 10 | Rice hispa | 2 adults or 2 damaged leaves/ hill |
| **B.** | **Mid tillering** | |
| 1 | Leaf folder | 1-2 freshly damaged leaves/ hill |
| 2 | Stem borer | 5-10% dead hearts or 2 egg mass or 2 adult / $m^2$ |
| 3 | Gall midge | 5-10% silver shoot |
| 4 | Brown plant hopper | 5 - 10 insects/ hill |
| 5 | Green leaf hopper | 10-20 insects/ hill |
| 6 | Hispa | 1 adult or 1-2 damaged leaves/ hill |
| **C.** | **Panicle initiation to booting** | |
| 1 | Stem borer | 2 egg mass/ moth/ $m^2$ |
| 2 | Leaf folder | 1-2 freshly damaged leaves/ hill or 10% damaged leaves/ $m^2$ |
| 3 | Green leaf hopper | 20 insects/ hill |
| 4 | Brown plant hopper | 5 - 10 insects/ hill |
| 5 | White backed plant hopper | 5 - 10 insects/ hill |
| **D.** | **Flowering and after** | |
| 1 | Brown plant hopper | 5 - 10 insects/ hill |
| 2 | Climbing cutworm | 4-5 leaves/ $m^2$ |
| 3 | Gundhi bug | 1 or 2 bugs/ hill |

**Table 4: Economic Threshold Level (ETL) of common diseases in Assam**

| Sl. | Crop Stage and Disease | Economic Threshold Levels (ETLs) |
|---|---|---|
| A. | **Mid tillering** | |
| 1 | Blast | Light (5-10% disease severity) |
| 2 | Bacterial leaf blight | Light (2 to 5% disease severity) |
| 3 | Sheath blight | 5% or more affected tillers |
| 4 | Tungro | 1 affected hill/ $m^2$ |
| B. | **Panicle initiation to booting** | |
| 1 | Blast | 2-5% leaf area damage |
| 2 | Bacterial leaf blight | Light to moderate (2-5% disease severity) |
| 3 | Sheath blight | 5% or more tillers affected |
| C. | **Flowering and after** | |
| 1 | Blast | 5% leaf area damaged or 1 to 2% neck blast |
| 2 | Sheath rot/ brown spot | 2-5% tillers affected |
| 3 | Sheath blight | 5% or more tillers affected |

## Harvest and post-harvest

- Harvest when 80-85% of the grains attain physiological maturity i.e., visually straw colored.
- Minimize the time during which the harvested plants remain in the field, and avoid field drying. Make sure that the panicles stay dry.
- Thresh and dry within two days after harvesting. Sun drying is best on a mat or plastic sheet, keeping the thickness of the grain layer at 3 to 5 cm.




- Clean thoroughly by winnowing. Store the rice in a cool, dry, and clean area.

Harvesting too early results in a larger percentage of unfilled or immature grains. Harvesting too late will lead to excessive losses from shattering and deterioration of grain.

# Machines for direct seeding

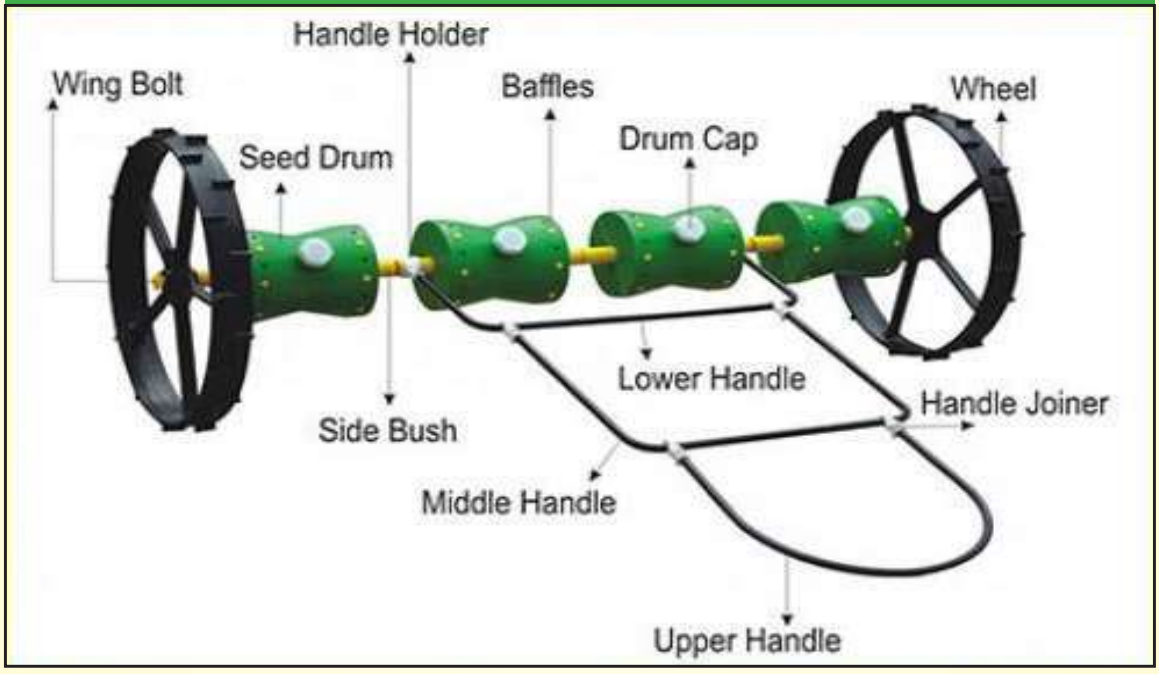
## The drum seeder for wet direct seeding of rice (Wet-DSR)

**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 or back-breaking 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 at a time. The plastic frame of the drum seeder makes its working easy.

### Parts of the drum seeder

1. The seed drum is hyperboloid in shape with 200 mm diameter. There are sixteen seed metering holes of 9 mm diameter in each row of drum seeder. Baffles are provided inside the seed drum between the seed holes to ensure the uniform seed rate in operation as well as to ensure hill dropping of the seeds. Each seed drum has two rows of planting, and 4-6 drums are assembled to form 8-12 rows of planting at single stretch.
2. Wheels are provided at both ends. These wheels are made up of plastic material to provide floating characteristics. Wheel diameter is 2 feet.
3. One handle base and 4-6 seed drums are assembled with the square shaft. The handle is meant to pull along.

**Parts of a drum seeder**



## Preparation for seeding

1. Field should be well prepared and leveled.
2. Water should be drained out at least 24 hours before sowing to form a hard slurry pan of the puddled soil.
3. At the time of seeding, a thin layer of water should be maintained in the puddled field.
4. Only just sprouted seeds packed within a gunny bag should be used.
5. Water should be flooded in the puddled field once in every 2-3 days after sowing. This practice should continue for 12 days. Thereafter, depending upon the height of the seedlings, water should be allowed to stand in the field.

## Field preparation

- Field must be well puddled and leveled.
- Water must be drained out at least 24 hrs before sowing to form a hard slurry pan of puddled soil.
- At the time of sowing, only paper-thin of water should be maintained in the puddled field.

## Operation procedure

- Once assembled, fill the drums with pre-germinated seeds. Remember only two-third of the drum is to be filled at a time.
- Close the mouth with the knob provided.
- Pull the seeder manually at a normal walking speed (1 km/h).
- The wheel impression in the first pass will serve as a marker.
- In the second pass, one of the wheels should pass on the same wheel impression of the previous pass to maintain the row-to-row spacing of 20 cm.
- Occasionally, watch the dropping of the seeds through the holes of the drums.
- Refill the drum when it reaches one fourth capacity.
- Continue the seeding operation.

## Salient features

- Labor cost is reduced drastically.
- Uniformity in seed sowing and plant population.
- Continuous drilling of seeds is eliminated.
- Reduction in seed rate and thinning cost.
- Crop matures 7-10 days earlier than transplanted paddy.
- Light in weight and easy to handle.
- An area of 1 hectare can be sown in a day.
- Under rainfed ecologies of Assam, where dry-DSR is having limited scope, wet-DSR is a cost-effective alternative solution for crop establishment

## Specifications

| | |
|---|---|
| Power source | Hand-operated |
| Row to row spacing | 20 cm |
| Shape of the seed drum | Hyperboloid |
| Number of rows | 8-12 rows |
| Diameter of the drum | 20 cm |
| Diameter of the seed metering hole | 8-9 mm |
| Weight of the unit | 10 kg |
| Type of ground wheel | Lugged wheel |
| Diameter of the ground wheel | 60 cm |
| Operating speed | 1 kmph (Walking speed) |
| Level of filling the seed drum | Half or 2/3 |
| Capacity of seed drum | 600 grams |
| Material used | Polypropylene copolymer (PP CP) |

## Multi-crop planter (DSR-drill) for dry direct seeding of rice

Multi-crop planter fitted with inclined plate seed metering device and fertilizer dropping attachment distributes the seed and fertilizer uniformly and is ideal to be used under dry conditions at a controlled seed rate. Also seed placement can be adjusted through depth control wheels, which are pre-fitted with the machine.

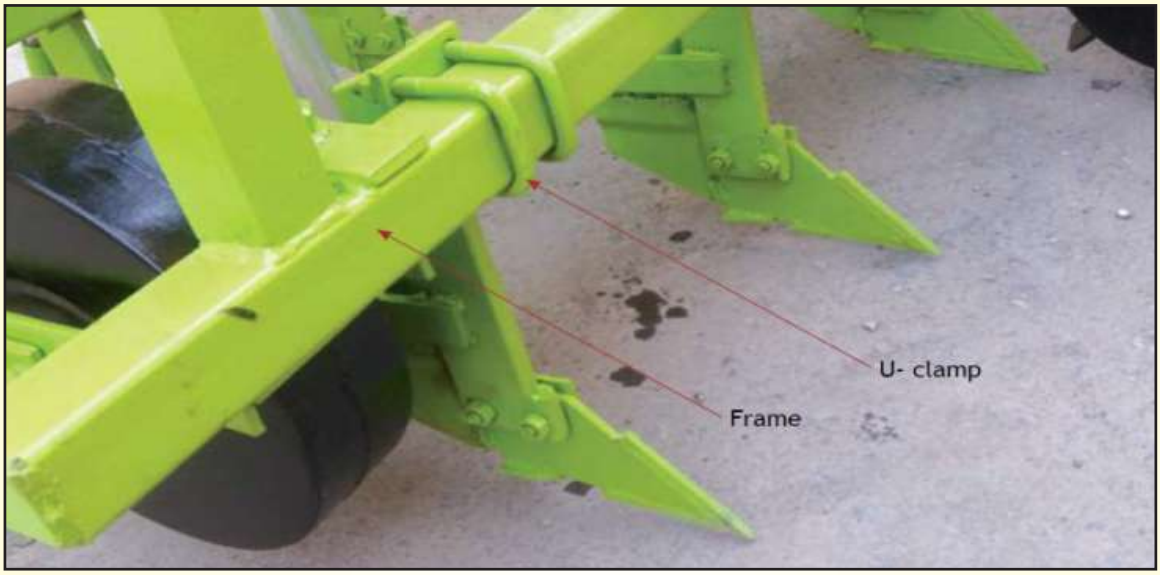
### Major components

**Parts of the machine**


1. Frame
2. Furrow openers
3. Tyne
4. Fertilizer box
5. Seed box
6. Transmission unit
7. Drive wheel
8. Depth control wheel
9. Fertilizer delivery pipe
10. Seed pipe
11. Fertilizer rate adjusting nut
12. Seed rate adjusting strip

**Frame**

The frame is usually made of angle iron with suitable braces and rackets. It works as a body in the multi-crop planter. Tynes are attached with the frame by clamps/bolts.




**Seed box**

It may be made of mild steel sheet or galvanized iron with a suitable cover. A small agitator is sometimes provided to prevent clogging of seeds.


**Fertilizer box**

Made of the same material as seed box (fertilizer box in front and seed box in the rear). For 9-tyne multi-crop planter, the length would be around 180 cm.

**Drive wheel**

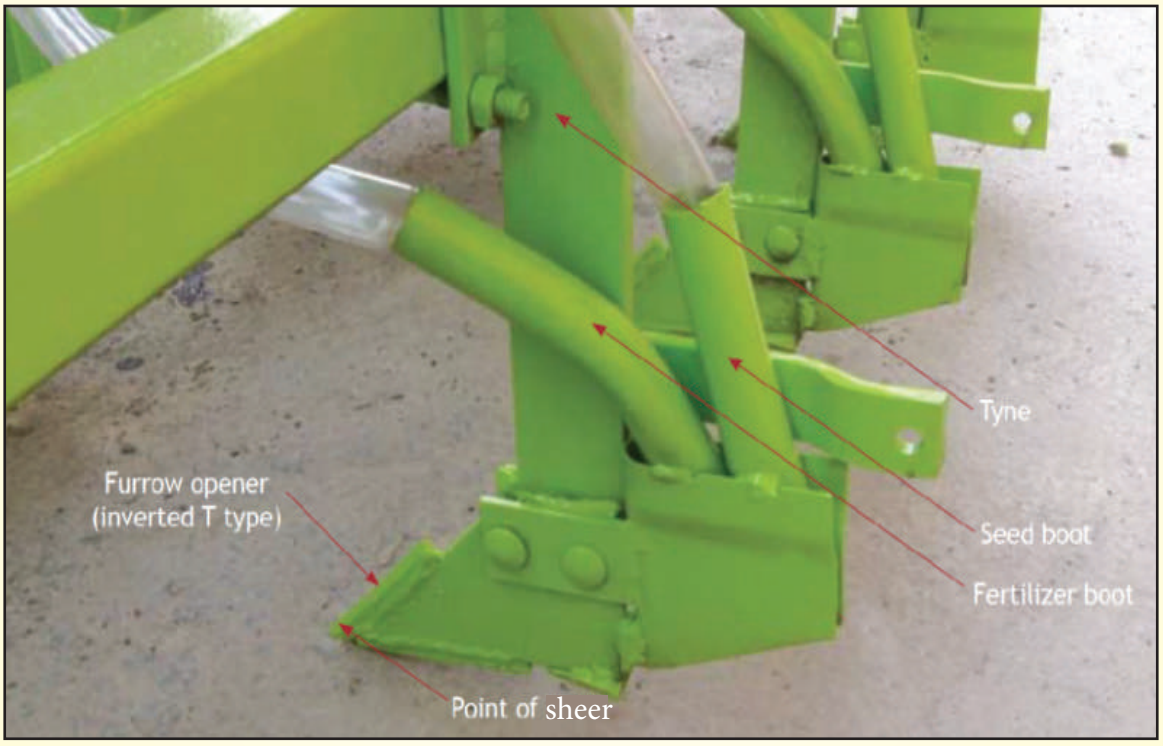
Drive wheel is attached in the middle of the front bar of the frame. It transmits power to the seed and fertilizer metering gears. Chains are attached to the driving shaft. Lugs on the circumference of the wheel minimize slippage.

**Depth control wheel**

There are two side-wheels fitted on the main axle. The depth control wheels are essential for placement of seeds and fertilizer at the right depth. The depth of seed and fertilizer placement can be increased and decreased with the help of depth adjusting screws by tightening and loosening these, respectively.

**Furrow openers**

The design of furrow openers of multi-crop planter (DSR-drill) varies to suit the soil conditions of a particular region. Most of the multi-crop planters are provided with pointed tools (inverted T-tynes) to form a narrow slit in the soil for seed deposition and these are most suited.




**Seed covering device**

It is a device to cover/plug an open furrow after the seed and fertilizer have been placed into it. Covering of seeds is usually done by plankers, flappers, chains, drags, packers, rollers or spring-loaded press sizes and wheels, designed in various shapes.


## Seed metering mechanism

**Inclined plate:** Inclined plate with cell type metering mechanism picks and drops individual seed or a hill of seeds depending on design of cell on the plate.

**Fluted roller:** Fluted rollers are attached to the shaft. When the shaft rotates, the fluted roller also rotates and seed is delivered to the seed delivery pipe through the flow control tongue.

**Groove roller:** The vertical rollers have grooves which guide the seed and drop it into the seed pipes.

**Seed dispenser tubes and seed metering strip**

**Inclined plate metering system**


## Calibration of multi-crop planter (DSR-drill)

### Workshop calibration

It is done by rotating the drive wheel manually to 10 full rotations and collecting seed/fertilizer from each delivery tube separately in attached polythene bags below each tyne.

### Steps to be followed

- Measure circumference of the drive wheel

  = 2 x 3.14 x radius of wheel i.e., 2 π r
- Measure width of the drill (No. of tynes x distance between tynes).
- Rotate the drive wheel manually to 10 full rotations.
- The quantity of seed and fertilizer collected in each pipe is then measured in grams separately.

## Workshop calibration of the drill

### Calculation

Calculate the seed/fertilizer rate by the formula given as under

$$\text{seed/fertilizer rate} = (\text{kg/ha}) \quad \frac{\text{Wt. of seed/fertilizer in 10 rotations (g)}}{\text{Circumference of drive wheel (m) x Width of drill (m)}}$$

If the seed or fertilizer rate is not equal to the recommended rate, then accordingly set the indicator/setting lever at higher or lower rate and again follow the procedure of calibration.

### Field calibration

Run the seed drill to a distance of 20 m in the field. Collect the seed/fertilizer from the delivery tubes in attached polythene bags from each pipe.

**Steps to be followed**

- Run the multi-crop planter to a distance of 20 meters in the field.
- Collect the seed/fertilizer from the delivery pipes in polythene bags from each pipe.
- The quantity of seed/fertilizer collected in bags through each delivery pipe in 20 meters run is then measured in grams.

**Calculation**

Calculate the seed/fertilizer rate by the formula given as under

- One hectare (ha) = 10,000 $m^2$
- Distance = 20 m

$$\text{Seed rate or fertilizer rate (kg/ha)} = \frac{10{,}000 \times \text{Weight of seed or fertilizer (g)}}{\text{Width of drill (m)} \times \text{Distance (20 m)} \times 1{,}000}$$

If the seed or fertilizer rate is not equal to the recommended rate then accordingly set the indicator/ levers at higher or lower rate and again follow the procedure of field calibration.

Make it sure that the weight of seed/fertilizer collected in different pipes is nearly equal to each other.

## Setting procedure of the multi-crop planter

### 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 thoroughly cleaned, dried and properly stored.

### Machine parking

- For storing 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.

## Troubleshooting

| Problem | Cause | Remedy |
|---|---|---|
| Seed not placed at desired depth | Adjustment of depth control wheel is not proper | Properly adjust the depth of furrow openers with the help of depth control wheel |
| | | Put the machine on a fairly level ground and then level all the furrow openers with the help of top link |
| | Improper three-point linkage balancing | Tightening the top link will deepen the front furrows and uplift the rear furrows and vice-versa |
| Unequal depth of seeding among different rows | Improper setting of furrow openers | Balance the drill end-to-end with the help of right lower link of the tractor |
| | | Refill the seed/fertilizer box or distribute the material uniformly across boxes during operation |
| | | Clean the mud out of the opener and/or seed/fertilizer delivery tubes or change the pipes if old/distorted |
| | | Clean the fluted rollers |
| | | Lower down the hitch to ensure that the drive wheel touches the ground/ replace drive wheel with proper sized lugs |
| Seed/ fertilizer is not dropping from furrow opener | The seed/fertilizer box is empty or the material has gathered to one side of the boxes | Ensure that chain is at the right position |
| | The furrow opener or seed/fertilizer delivery tube is blocked by soil/mud or fertilizer/ seed delivery pipes distorted | |
| | Seed/fertilizer fluted roller is blocked | |
| | The drive wheel does not touch the ground/ or otherwise lugs are worn out | |
| | Broken chain/sprocket | Change the broken part |

# Setting Procedure of Seed-cum-Fertilizer Drill

## How to set the tynes?

- Keep the seed drill on a fairly level ground.
- Make sure all the tynes are set at the same level.
- The tynes can be adjusted to the same level simply by moving them up or down through 'U' clamps.
- The desired row to row spacing can also be adjusted by sliding tynes on the axle to the left or right by loosening the 'U' clamps.

**1** Measure the width of the seed drill by placing one end of measuring tape at middle of first tyne and other at middle of last tyne and note the width in a note pad. Add 20cm (row to row spacing) to the width of seed drill to arrive at effective width of seed drill (or multiply no. of tynes by row spacing to arrive at effctive width of seed drill).

**2** Adjust the seed metering indicator in the appropriate delivery notch. The major changes in the seed rate are achieved by changing the seed rate gear.

**3** Take the seed pipes out from the boot of the furrow openers and tie a poly bag at the end of each outlet. Before tying up polybags make sure that seed flow has started. This can be attained either by rotating the drive wheel manually, keeping the drill in up-stadning position or by moving the drill from a point 4-5 feet behind the marked starting point.

## Calibration of Seed Drill

**4** In case of flutted roller type/ groove roller type mechanism fill the seed box atleast up to a level so that the seed metering system is fully covered with seed while operating it. For inclined plate metering system fill the seed in each hopper to about 1/3 to 1/2 of the inclined plate to prevent over dropping of seeds. The seed rate can also be varied in inclined plate type by adjusting the inclination of seed box through grooved blades attached downside (6-8 holes). For example, seed box adjusted at third and fourth hole from downward end of grooved blade will drop rice seeds at approximately 10 and 8 kg per acre respectively.

**5** Measure 20 m distance starting from the front end of either back or front set of furrow opener and mark the point where the same set of furrow touches 20m distance.

**6** Run the tractor in a straight line to cover 20 m distance. Drive the tractor slowly (limited to 3-5 km/hr.).

**7** Keep checking whether the seed is falling freely in the poly bags or not.

**8** Measure the weight of seed collected in each bag separately and compare. The weight should be similar in all. If not, then check the metering system particularly the tongue (flutted roller), brush (inclined plate) and seed pipes again.

**9** Seed rate (kg/acre) =

$$\frac{4000 \times \text{Total weight of seed (g)}}{\text{Effective width of seed drill (m)} \times 20\text{m} \times 1000}$$

**10** If this seed rate is not equal to the desired seed rate then go to Step 2 and change the seed rate setting accordingly and follow the full procedure again till the desired rate is achieved.

* Fertilizer calibration can also be done in a similar way.

## How to set the seeding depth?

- Keep the seed drill on a fairly level ground.
- Measure the gap between ground surface and lower surface of depth control wheel. For example, it should be 2-3 cm for DSR.
- Adjust the depth with the help of depth adjusting screw. Tighten the screw to increase the depth and vice-versa. Also make sure that both depth setting wheels are at same level from the ground.

## How to balance the seed drill properly?

- All front and rear tynes must be at the same level. This can be attained by adjusting the length of top link. Also the drill should be at same level (balanced) from left and right. This can easily be adjusted through setting side arms/links of three point linkage before starting actual operation in the field.

## Advantages of dry direct seeded rice (Dry-DSR) using multi-crop planter (DSR-drill)

- Requires lower seed rate
- Optimum seeding depth
- Maintains spacing between the rows
- Uniform seed rate throughout the field
- Good soil and seed contact, improved germination
- Facilities for drilling the basal application of granular fertilizers
- Conducive for intercultural and plant protection measures
- Better yield and more profitable than broadcast sowing
- Labor saving (as compared to transplanting)
- Environment friendly
- Brings opportunity to run business as 'service provider'
- Also leads to positive impact on the productivity of succeeding crop.

# Common issues in DSR

| Topics | Issues | Suggestions |
|---|---|---|
| **Land preparation and laser land leveler** | Most of the farmers do not level their field properly and hence seed establishment is not proper at some locations | Raising awareness about the importance and benefits of leveled land for successful establishment of DSR using multi-crop planter |
| **Seed treatment** | Very few farmers use treated seeds | Need to generate more awareness on proper seed treatment |
| **Row to row spacing** | Narrow row to row spacing hinders intercultural operations | Spacing can be adjusted to 25-30 cm |
| **Date of sowing** | Poor germination due to early seeding when not a problem in Assam(during May) | Preferable sowing date should be from 15 May to 25 June |
| **Rice variety** | Due to stagnant water in the field till October, farmers may face difficulty in harvesting the crop if early maturing varieties are used | In the low-lying areas, either long duration varieties (Ranjit-Sub1 and Bahadur-Sub1) should be sown or late sowing of Swarna-Sub1 should be done |
| **Lack of availability of seed drills and trained operators** | Some operators are not well-trained, hence the sowing process is not that perfect. Also machines are not available on time | Need more training for seed drill operators. Good quality seed drills are required |
| **Weed management** | Improper and untimely application of herbicides | Need more trainings and awareness on weed management |
| **Fertilizer management** | Farmers apply mainly urea. There is misunderstanding that DAP, if applied as basal, will damage the seed or will be fixed in the soil. So DAP is applied very late, around 20-25 days after sowing | Need to promote timely and balanced application, besides emphasizing on importance and benefits of fertilizer management |
| **Insect-pest management** | Mealy bug and brown plant hopper are the main insects found in the field | Timely application of insecticide will be beneficial |

# Knowledge Management Committee

| Sl. No | Name | Designation | Department |
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| 2 | Dr. Mrinal Saikia | Assoc. Director of Research | Directorate of 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 |
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| 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 |
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| 12 | Dr. Sanjay Kumar Chetia | Chief Scientist | RARS, Titabor, AAU |
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| 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 | |


*Round table meeting on policy invertention for scaling of farm mechanization in Assam*

*Hand - on traning on seed cum fertilizer drill*


ASSAM AGRI-BUSINESS AND RURAL TRANSFORMATION PROJECT (APART)
(A WORLD BANK SUPPORTED PROJECT)
DEMONSTRATION ON WET DIRECT SEEDED RICE
VARIETY : Bahadur-sub 1
AREA : 1 ha
LOCATION : JUGLONI
DATE OF SOWING : 01/07/2022
KRISHI VIGYAN KENDRA, SONITPUR
ASSAM AGRICULTURAL UNIVERSITY
Napam,Tezpur-784028(Assam)
Grievance Redressal Mechanism(GRM), E-mail : grievances@arias.in
Toll Free Helpline Number : 1800-102-0338
IRRI


ASSAM AGRI-BUSINESS AND RURAL TRANSFORMATION PROJECT(APART)
(A World Bank Supported Project)
Wet Direct Seeded Rice
Demonstration on summer paddy
Location: Hakama
Date of sowing: 19/02/2020
Organized by:
KRISHI VIGYAN KENDRA, DHUBRI
ASSAM AGRICULTURAL UNIVERSITY
In collaboration with:
IRRI


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