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**ICAR-Indian Institute of Rice Research**  
(formerly Directorate of Rice Research)  
(Indian Council of Agricultural Research)



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**Dr S.R.Voleti**

Director

DO/PD/ CA 05/RTI /2020  
19<sup>th</sup> August, 2020.

Dear Khageswara Bhoi,

**Sub: "RTI-Information about the step by step procedure of rice farming in India with photos and brief explanation" - Regarding.**

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With reference to RTI Request dated 31<sup>st</sup> July, 2020 on the above subject, Please find the enclosed required information.

  
S.R.Voleti

## **RTI Questions - Registration No. DORRE/R/E/20/00004**

Give me the information about the step by step details procedure of rice farming in India with photos and and brief explanation of each step for the following 4 methods of rice farming

- 1- Broadcasting method
- 2- Drilling method
- 3- Transplantation method
- 4- Japanese method

Give the yield details for above 4 method of each method and suitable condition, climate.

Please find the information enclosed - **Annexure I**

## Details of the methods of crop establishment

### I. Puddled rice situation:

#### M-1: Manual Transplanting Method:

1. This method is practiced in areas of fertile soil, abundant rainfall and plentiful supply of labour. To begin with, seeds are sown in nursery and seedlings are prepared. After 4-5 weeks (better make it 3-4 weeks, younger seedlings are necessary for high yields) the seedlings are uprooted and planted in the field which has already been prepared for the purpose. The entire process is done by hand. It is, therefore, a very difficult method and requires heavy inputs. But at the same time, it gives some of the highest yields.



2. **Land preparation:** Plow, harrow, puddle, and level the land; construct channels at regular intervals to facilitate easy drainage
3. **Optimum sowing time:** For TPR, complete the nursery sowing before the onset of heavy rains; early to mid-June for IGP
4. **Seed preparation & sowing:** pre-germinate the seeds by soaking for 24 h in water or 1% KCl solution and incubating for 24-36 h and then broadcast or drum-seed
5. **Water management:** Keep a water level of 2-3 cm for the first 10 days after transplanting (DAT) to make the transplanted seedlings recover fast from the transplanting shock and establish well. Then, follow **AWD irrigation during the vegetative phase** (10-45

- DAT); maintain **3-5 cm water level during the reproductive phase** (45-75 DAT); drain the field after physiological maturity (75-90 DAT); 30-40% water saving from reduced deep drainage, seepage & runoff in transplanted rice.
6. **Integrated Weed mgt:** cultural, mechanical & herbicides; the water level in the field determines the level of weed infestation.
  7. **Fertilizer mgt:** Incorporate all organic matter or manure into the soil during plowing; apply 14-18 kg/ha P and first dose of 20 kg/ha K before last harrowing & leveling; apply 90-120 kg/ha N in 3 splits – 33% basal just before transplanting, 33% at tillering, and 33% at Panicle Initiation (PI).
  8. **Pest and disease control:** Follow IPM

#### **A. Protocol for effective weed management in IPM Special trial (in IPM treatment)**

- 1) Nursery
  - i. Maintain water level to avoid weeds
  - ii. In weed intense areas, apply Butachlor @25ml/250 m<sup>2</sup> nursery area or Pretilachlor+ safener @ 60ml/250 m<sup>2</sup> nursery area application at 8-10 days after sowing seed in nursery beds
  - iii. Raising nursery in strips of 1 m wide and leaving water canal of 0.25 m in between will help in intercultural operations
- 2) Main field: Immediately after transplanting within a week

\* Liquid formulation of new herbicides can be applied by mixing with sand or by foliar spray, respectively, within first week after transplanting by following the procedure outlined hereunder.

\* Required quantity of herbicide (Pretilachlor @1250-1500 ml/ha or Anilophos 1250-1500 ml/ha or Metsulfuron methyl+chlorimuronethyl (Almix)@20g/ha) mixed with fine sand (50kg/ha) and broad casted. Or mixed in 500 liters water/ha and spray by flat Z type nozzle uniformly within 3 to 7 days after transplanting. It is necessary to maintain standing water (2-3 cm water) in the field.

Do not remove water at least 48 hours after application of herbicide.

\* Note that under thorough land preparation and proper water management conditions this step may not be required. Take a decision on 2nd day after transplanting based on land leveling and water supply status.

Post-emergence application:

\*Broad spectrum weed control – Bispyribasodium @ 250ml/ha at 2-3 leaf stage of weeds- spot application or Chlorimuron + Metsulfuron-methyl (Grasses, Sedges and Annual BLW) at 20-25 DAT @ 20 gm/ha

\* If Broad leaf weeds predominate, apply 2, 4-D Na salt @ 1250-1500 g/ha at 20-25 DAT

\* If grasses predominate, apply Cyhalofbutyl @1000 m/ha at 15-20 DAT or Fenoxaprop p ethyl @ 800-1000ml/ ha at 25-30 DAT.

Fertilizer management: Apply top dressing nitrogen based on Leaf Color Chart (modified IIRR -LCC) supplied by IIRR. The instructions to use LCC are given on backside of LCC.

## **D. Operational guidelines for implementing IPM (Special) trial**

It is envisaged that IPM (special) trial may be implemented in ‘On-line real-time’ mode. Hence it is essential that all the team leaders of the concerned AICRIP centre’s are in touch with IIRR team and coordination unit on almost daily basis.

IPM is obviously a knowledge intensive technology and its impact depends on timely and informed decisions. Periodic surveillance at weekly interval is the core activity of the Trail and needs to be religiously followed. It is desirable that entire team of scientists visit the experiment site together, as often as possible, during this surveillance. If not, at least a representative of the scientist may accompany the team. .

During any of the surveillance, if the pest damage crosses threshold, IPM interventions need to be decided within 24 h in consultation with the IIRR team. If response is not available from IIRR within this time, local decision may be taken and IIRR be informed of this. Impact of such specific intervention needs to be monitored through subsequent surveillance visit.

## **M-2: Mechanised transplanting**

### **Methodology : Raising seedling for Transplanter**

Trays (60cm x 28 cm) are filled with sieved soil (2.5 cm soil depth). Seeds are uniformly placed (100 g/tray) on soil, covered with thin soil layer and water through rose cans. Use 15-day old seedlings. Foliar spray of 2% nitrofoska (19:19:19) may be given.

**{OR}**

Prepare a 10 cm raised bed. Level it. Place a thick polythene sheet on the bed. Make small holes on the sheet. Spread 2.5 cm soil on the polythene sheet. Place or sow seeds uniformly on the soil without overlapping. Cover the seeds with a thin soil layer. Cover the soil with straw mulch. Water the beds with rose can for 3 days. Remove the straw mulch after 3days. Open a channel around the beds and let in water into a channel to keep seedbed moistened. Use 15-day old seedlings.

SM SRI – Transplanting with a transplanter and follow the other practices of SRI (water management, weed management by conoweeder).



Follow the principles the same as above: b-h

- a) **Weed control:** Use a cono weeder in both directions to uproot and incorporate the weeds into the soil and most importantly, aerate the soil.
- b) **Water management:** No standing water during the growth period. Intermittent wetting and drying until panicle initiation (saturation field condition). After panicle initiation. 1-2 cm of water is kept for about three weeks.
- c) **Nutrient management:** Use straw, green manure and animal manure to enrich populations of earthworms, microorganisms and to facilitate nutrient availability. Use reduced amounts (less than 50%) of chemical fertilizer to assess the requirement. Mention the dosage of nutrients applied for the trial (75% RDF through organic form and 25% through inorganic form or chemical fertilizers)

### **Japanees Rice cultivation:**

The main features of the Japanese method of rice cultivation are:

- (i) Use of better quality seeds. ( High Yielding Varieties)
  - (ii) Sowing of seeds in raised nursery beds.
  - (iii) Transplanting of seedlings in rows especially by high speed mechanical transplanters
- and also increased use of irrigation.



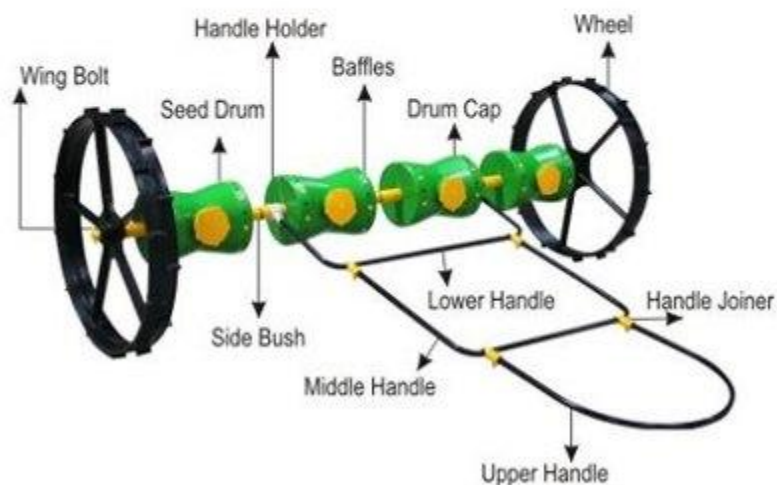
### 3- Wet direct-seeded rice using Drum seeders

- ❖ **Rice varieties:** with early seedling vigor, rapid growth, weed suppressive ability –
- ❖ **Seed quality & seed rate:** **High yielding fine grain variety 30-40 kg/ha & coarse grain 45-60 kg/ha** of clean, quality seed to ensure uniform germination & good crop stand (150-200 plants m<sup>-2</sup>); high seed rates reduced weeds by 41-48%
- ❖ **Land preparation:** Plow, harrow, puddle, and level the land; construct canals at regular intervals to facilitate easy drainage
- ❖ **Optimum sowing time:** sowing on the same day as nursery sowing for TPR; complete the sowing before the onset of heavy rains; early to mid-June for IGP
- ❖ **Seed preparation & sowing:** pre-germinate the seeds by soaking for 24 h in water or 1% KCl solution and incubating for 24-36 h and then broadcast or drum-seed
- ❖ **Use drum seeder for line seeding or planting**
- ❖ **Water management:** For the first 10-15 DAS, **flush irrigate the field** to keep the soil saturated but not flooded to enhance seedling emergence, root development & anchorage; follow **AWD irrigation during vegetative phase** (15-60 DAS); maintain **3-5 cm water level during reproductive phase** (60-90 DAS); drain the field after physiological maturity (90-105 DAS); 30-40% water saving from reduced deep drainage, seepage & runoff in DSR
- ❖ **Integrated Weed mgt:** cultural, mechanical & herbicides; high seed rates reduced weeds by 41-48%
- ❖ **Fertilizer mgt:** Incorporate all organic matter or manure into the soil during plowing; apply 14-18 kg/ha P and first dose of 20 kg/ha K before last harrowing & leveling; apply 90-120 kg/ha N in 3 equal splits 1/3<sup>rd</sup> at 10-15, 1/3<sup>rd</sup> at 25-30, & 1/3<sup>rd</sup> at 45-50 DAS
- ❖ **Pest and disease control:** Follow IPM



## KSNM / DPS 20

### PARTS OF DIRECT PADDY SEEDER



#### M4- Wet direct-seeded rice by Broadcasting

- ❖ Same as above except Broadcasting of the seeds uniformly as per the seed rate
- ❖ Seed quality & seed rate: High yielding fine grain variety 30-40 kg/ha & coarse grain 45-60 kg/ha of clean, quality seed to ensure uniform germination & good crop stand (150-200 plants  $m^{-2}$ ); high seed rates reduced weeds by 41-48%

#### Unpuddled system ( Dry system) :

#### Protocol of the crop establishment methods:

**Dry direct seeded rice on unpuddled soil / line sowing by hand in furrows, drill seeding by Happy seeder / Line sowing behind the plough)**

Sowing of dry (primed) seeds is done in dry soil conditions with sowing behind the plough / or drill seeding by Happy seeder/ Line sowing by hand

**Land preparation:** Plough, harrow, & level the land to prepare a smooth seedbed; no-tilling to strip-tilling for zero-till or reduced till fields, with or without residues on surface

- ❖ **Optimum sowing time:** sowing on the same day as nursery sowing for TPR; complete the sowing **before the onset of heavy rains; early to mid-June** for IGP
- ❖ **Seed preparation & sowing:** Treat the seeds with water or 1% KCl solution (priming) to induce drought tolerance, dry the seeds in shade, sow by broadcasting or line sowing by hand in furrows, or drilling in rows by machine; use zero-till seeder or planter to drill the seeds at optimum depth (3-5 cm) in zero-till or reduced till fields
- ❖ **Water management:** For the first 10-15 DAS, flush irrigate the field to keep the soil saturated but not flooded to enhance seedling emergence, root development & anchorage; follow AWD irrigation during vegetative phase (15-60 DAS); maintain 4-5 cm water level during reproductive phase (60-90 DAS); drain the field after physiological maturity (90-105 DAS); 30-40% water saving from reduced deep drainage, seepage & runoff in dry DSR
- ❖ **Integrated Weed mgt:** cultural, mechanical & herbicides; high seed rates → 41-48% less weeds
- ❖ **Fertilizer mgt:** Incorporate all organic matter or manure into the soil during plowing; apply 14-18 kg/ha P and the first dose of 20 kg/ha K before last harrowing & leveling; apply 90-100 kg/ha N in 3 equal splits, 1/3<sup>rd</sup> at 10-15, 1/3<sup>rd</sup> at 25-30, & 1/3<sup>rd</sup> at 45-50 DAS or LCC-based N management
- ❖ **Pest and disease control:** Follow IPM

## **Dry direct-seeded rice on unpuddled soil (Broadcasting)**

Broadcasting dry (primed) seeds under dry soil conditions.

- ❖ **Land preparation:** Plow, harrow, & level the land to prepare a smooth seedbed; strip-tilling for reduced till fields, with or without residues on surface
- ❖ **Optimum sowing time:** sowing on the same day as nursery sowing for TPR; complete the sowing **before the onset of heavy rains; early to mid-June** for IGP
- ❖ **Seed preparation & sowing:** Treat the seeds with water or 1% KCl solution (priming) to induce drought tolerance, dry the seeds in shade, sow by broadcasting on fully tilled field and strip-tilled field
- ❖ **Water management:** For the first 10-15 DAS, flush irrigate the field to keep the soil saturated but not flooded to enhance seedling emergence, root development & anchorage; follow AWD irrigation during vegetative phase (15-60 DAS); maintain 4-5 cm water level during reproductive phase (60-90 DAS); drain the field after physiological maturity (90-105 DAS); 30-40% water saving from reduced deep drainage, seepage & runoff in dry DSR
- ❖ **Integrated Weed mgt:** cultural, mechanical & herbicides; high seed rates → 41-48% less weeds
- ❖ **Fertilizer mgt:** Incorporate all organic matter or manure into the soil during plowing; apply 14-18 kg/ha P and the first dose of 20 kg/ha K before last harrowing & leveling; apply 90-100 kg/ha N in 3 equal splits, 1/3<sup>rd</sup> at 10-15, 1/3<sup>rd</sup> at 25-30, & 1/3<sup>rd</sup> at 45-50 DAS or LCC-based N management
- ❖ **Pest and disease control:** Follow IPM

## **Aerobic Rice on unpuddled soil**

1. **Land preparation:** Initially plough the field in dry condition 2 – 3 times and pulverize. After that, plough the field and level

it to bring the soil to a fine tilth to facilitate proper sowing of seeds and to provide favorable conditions for germination.

2. **Seed & sowing:** Use high yielding medium duration rice variety (115 – 120 days). The seed rate is as per the recommended package of the location (30-35 kg /ha). Treat the seeds with carbendazim (2 g/seed) and soak in water for 10 hours followed by incubation for 12 hours. Before sowing, treat the seeds with Azetobacter @ 10 g/kg seeds. Sow the seed by drill seeder or **by hand** in lines 20 cm **apart**. Follow the uniform seed rate. Location-specific hybrids may be utilized for the trials.
3. **Thinning and gap-filling:** These operations should be done 15 days after sowing. Maintain optimum population in all plots (150 to 200 plants per square meter).
4. **Irrigation:** Irrigate the plot immediately after sowing and provide protective irrigation 3 days after sowing. Irrigate the field as and when required preferably at IW/CPE ratio of 1.0. Maintain the plot near saturation without stagnation of water. Consider the effective rainfall also. **The number of irrigations must be mentioned in the datasheet.**
5. **Fertilization:** Use recommended doses of phosphorus, potash and zinc. Apply a half dose of nitrogen, a full dose of phosphorus, 75% of potash and full dose of zinc as basal and remaining dose of N in two splits (25% N at active tillering and 25% N along with 25% potash at panicle initiation).
6. **Weed management:** Apply Pendimethalin (PE) @ 1.0 kg a.i./ha at 3 days after sowing and hand weeding at 40 days after sowing or mechanical weeding at 20 and 40 days after sowing.
1. The selected plot should be made weed free following Stale Seed Bed Method i.e., spraying Glyphosate weedicide @ 0.75-1.00 kg a.i./ha 10 – 12 days prior to opening the fields, followed by ploughing once, allow germination of left over

weed seed, and then prepare the field for sowing rice by shallow ploughing to fine tilth and levelling of the field.

2. Soil from the experimental area must be analyzed initially for texture, bulk density, soil fractions, pH, OC, EC, CEC, available nutrients N, P, K, Zn, S and soil moisture characteristics at saturation, field capacity and wilting point.
3. After dry ploughing making the soil into a fine tilth, proper levelling, main blocks are laid with provision for double irrigation channels,
4. For aerobic rice, dibble 2 – 3 seeds per hill in a well-prepared and levelled field maintaining spacing of 20 x 10 cm and irrigated and ensure proper crop stand.
5. Weed control (recommended weedicide – pendimethalin @ 0.75 to 1.0 kg a.i./ha, 2 to 3 days after sowing, followed by application of 2, 4 D Na salt 80 WP @ 0.80 kg a.i. / ha at 20-25 days after sowing or Nominee gold @ 30-35 g a. i./ha at 4-6 leaf stage of weeds and one manual weeding , if required.
6. Since water input has to be quantified in each treatment
7. Apply fertilizer as per the treatments.
8. In case of occurrence of Fe deficiency, the problem may be corrected by suitable spray schedule (0.50%  $(\text{NH}_4)_2 \text{Fe} (\text{SO}_4)_2$  in water at pH 5.0) after recording observations on the intensity of deficiency.
9. All weed management practices are to be followed to keep the plots weed free in all the plots.



#### **M-4- Semi-dry rice (unpuddled )**

- Semi Dry rice cultivation is followed in uplands or rainfed lowlands where there is less possibility for water stagnation in early stages of crop growth.
- Uplands or rainfed lowlands are characterized by aerobic soil in which attempt is made to impound water.
- Upland rice is grown on both leveled and sloppy fields those are not banded and are prepared well for dry seeding.
- The rice crop solely depends upon rainfall for its water requirement.
- This system of cultivation is followed in many parts of the world, however, mainly confined to tracts that don't have adequate irrigation facilities.

Manual transplanting is a labour-intensive operation comprising nursery raising, uprooting of the seedlings, transporting and transplanting the uprooted seedlings in the main field, with a total labour requirement of about 280-350 man-hrs/ha. High labor demand during the peak periods adversely affects the timeliness of operation, thereby reducing the crop yield. The steady drift of agricultural labour to industrial sector is adding more to the woes of the rice farmer. Because of drudgery and notion that the farm operations are below the dignity, labour availability, in general, has decreased considerably in farm operations.



*Chinese design of Paddy Transplanter*

To offset these problems, mechanical transplanting is the solution. Many transplanters were developed in the past involving the use of traditionally grown paddy nursery for mechanical transplanting. However, several on-farm attempts made with different models of transplanters using the traditional root washed nursery were not

successful because of the machine-related problems to use the nursery. This called for the necessity of raising the nursery in a special way, called mat nursery technique. Among the existing commercially available designs suiting mat nursery, Chinese model of paddy transplanter is found to have great promise.

### Features of the Machine

- Available with its own source of power of 3-4 hp diesel engine.
- Covers eight rows at a time with a row to row spacing of 23 cm.
- Provision to vary the plant to plant spacing by 10 and 12cm.
- Provision for cage wheel for field use and rubber wheel for transport.

### Features of the Mat Nursery

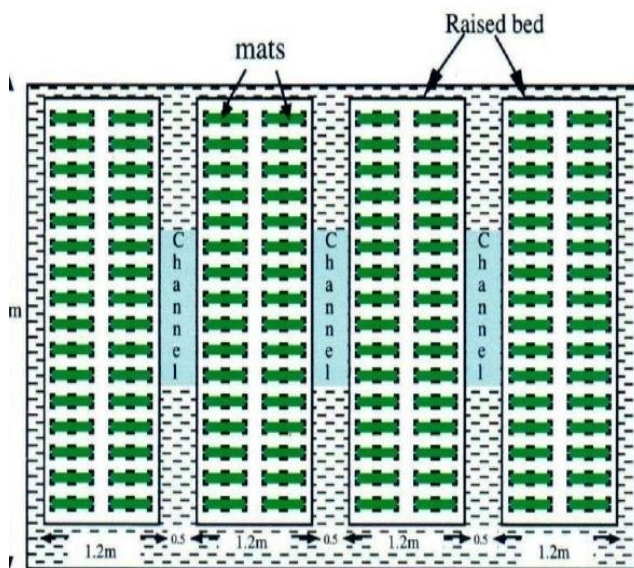
#### Seed preparation

- Soak the seeds for one day
- Incubate the seeds for one day
- Apply a seed rate of 50 kg/ha

#### Mat preparation

- Choose the suitable site for mat nursery raising (preferably within or nearer to the main field) and puddle the selected site.
- Raise the puddled soil bed to a level of about 5 cm and level it properly. To lay more than two rows of mats, select each bed width as 1.2 m. To cover one hectare of land, selected plot should be of size of about 20 x 7.5 m with provision of channels of width of 0.5 m (See the figure of mat layout).

- Spread the plastic sheet evenly on the levelled and raised beds.
- Mix the soil with FYM and water to prepare slurry.
- Keep the DRR designed mat frame (having dimensions of 19 x 50 x 2 cm of each block) on the plastic sheet and spread the slurry mixture in each block of the frame.
- After proper settling, lift the frame to leave the mats behind.
- Take 100-110 g of sprouted seed and spread it evenly on the prepared mats and press them gently. One hectare of main field needs 500-600 mats.
- Sprinkle with rose can on all the mats everyday to keep the mats moist.
- After a week when the nursery looks green, provide water through channels to the level just below the mats.
- Apply fertilizer@30 g of DAP / litre of water and sprinkle on the mats with hand sprayer after 7-10 days of the nursery.
- The nursery will be suitable for transplanting after 15-20 days when the plant reaches a height of 12-15 cm.



*Layout of Mat Nursery (for 1 ha)*

- The procedure is repeated to prepare all the mats. Spread either grass or plastic sheet on the mats overnight and take it out in the morning. Do not uncover if there is rain during the first week of mat raising.



*Mat Nursery*

### **Paddy Transplanter Operation**

For efficient operation of transplanter the land preparation and knowledge of the mechanical provisions incorporated with the transplanter are essential to be known.

### **Land preparation**

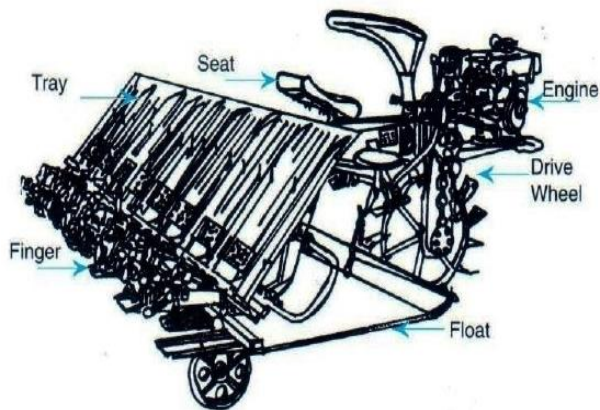
- Puddle the land, level it and remove the water after 24 hours (for clay soil) or 12 hours (for sandy/loamy soil) before the transplanting. In black or clayey soils the settlement is critical as the loosened soil can bury the seedlings planted.



- Just before the operation of transplanter, a thin film of water is necessary to ensure the free movement of transplanter and avoid adhering of soil to the moving parts of the transplanter.

### Operation of the transplanter

- Check oil level in gear box, fuel tank and grease the specified parts.



*Line diagram of transplanter*

- While operating observe for any missing hills in any particular row and diagnose the problem immediately. The missing hills can be due to presence of stones/foreign matter that would have obstructed the fingers that pick the seedlings from the tray.
- Choose the right speed of operation for a plant hill to hill distance of 10 or 12 cm.

- Observe the number of plants per hill and adjust to the requirement using the lever operating the finger movement.
- Observe the depth of planting with the lever and adjust accordingly.



*Plant stand with transplanter*

### Performance

There will be a net saving of about 45 per cent over the manual transplanting. It can transplant about one hectare in a day of 8 hours. The transplanter performs with missing hills of 2-3 per cent. The machine costs about Rs.1,25,000 and is marketed by VST Agro Inputs, Mahadevpura, Whitefield Road, Bangalore-560 048