

Mechanical transplanting of paddy

A profitable occupation and sustainable solution

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Paddy is the main kharif crop in India occupying nearly 44 million ha area with average yield of 2.6 t/ha. The paddy transplanting/sowing operation is mostly done manually, which involves a lot of labour, time and human drudgery. Mechanization can be the solution to these problems as well as opportunity for rural youth as custom hiring. Previously, the paddy was transplanted by labour or to some extent with mechanical transplanters and direct seeded rice drills.

Keywords: KVK, Mat nursery, Mechanical transplanting, Paddy

THE Punjab Agricultural University (PAU) Krishi Vigyan Kendra (KVK), Jalandhar has been training farmers towards mechanical transplanters and direct seeded rice drills to tackle with labour problem and for better crop establishment, growth and yield as well as saving of natural resources from long time. This year owing to shortage of labour, increased labour wages and keeping in mind good results of mechanical techniques of sowing/transplanting of paddy, farmers have stepped forward for mechanized techniques like mechanical

transplanter, direct seeded rice (DSR) drills. The main requirements for direct seeding of rice are as follows:

- Inclined plate planter
- Medium to heavy soils
- Laser leveled fields
- 8-10 kg seed per acre
- Paddy seeds soaked in water for 12-14 hrs and dried in shade for 2 hrs (prior to sowing) and seed treatment
- Optimum field moisture at the time of planting
- Sowing depth of seed between 20-30 mm
- The timely spray of Pendimethalin

sprays (immediately after sowing and preferably in evening time)

- Skilled machine operator (can get training from KVK experts).

Similarly, the main requirement for mechanical transplanters is healthy mat type nursery seedlings and skilled machine operator. Mechanical transplanters are of basically three types namely walk behind, riding and float type. Variation in these is basically row to row spacing (20-30 cm) and plant to plant spacing (12-21 cm) and type of driving system. In walk behind type person has to walk in puddle field along with machine



Fig. 1. Progressive farmer Shri Hardev Singh, Shri Pawandeep Singh and Shri Major Singh applying mat type nursery and mechanical transplanter on custom hiring basis with a systematic approach.

Table 1. Material for raising mat type nursery

Particular	Specification
Field	Laser leveled
Seed (kg/acre)	10-12
¾" x ¾" section frame	10 feet × 2 feet (lxb)
One section size	2 feet × 8 inch or 2 feet × 11 inch (width of mat according to machine make and model or fingers spacing)
50-60 gauge perforated polythene sheet	270 g/acre
Soil sieving equipment	2-3 No.
Scraper (to remove extra soil)	2-3 No.
Manual water sprayers	3-4
Labours	3-4
Machinery Operator	Skilled
Irrigation	Motor required near mat nursery raising location

operation to guide the direction and in ride on and float type the person operates the machine in sitting position which is a comfortable one. The nursery required for this machine is raised on perforated polythene sheet (50-60 gauge) with 1-2 mm size holes. Sheet is used to stop penetration of roots in soil and perforations are provided so that plants can absorb some moisture from these holes. The soils should be preferably free from stones, gravels and location of nursery plot should be away from trees, shades and should be near a permanent water source. Soil is put in frames from both sides and then leveled with a scraper. Then pre-germinated seed is put on these frames with the help of seeder. Water is sprinkled to make them wet and frames are lifted by shaking lightly from both ends by two persons. In this way mats of nursery are prepared and then after 20-22 days of germination, it is cut with the help of manual cutters/sickles/blades with proper machinery frame size tray or markings and placed in machine for mechanical transplanters. The fingers in mechanical transplanter cuts the seedlings (2-3) and transplants in soil at proper depth. The optimum plant population and spacing enhances crop yield due to better aeration, good sunlight exposure and decreased diseases as compared with manual transplanting method. The mat type nursery should be regularly given water so that mat never gets dried.

The water shock can lead to failure of this type of nursery as there is polythene sheet beneath. The detail of material and other requirements required for raising mat type nursery is given in Table 1.

Some progressive farmers who have been associated with KVK for a long time and taken trainings from KVK Jalandhar are now running DSR drills and mechanical transplanters on custom hiring basis. Shri Amandeep Singh from village Bandala, has covered 200 acres under DSR drills and 250 acres under mat nursery seeder machine. He told that he is charging ₹ 2,000-2,500/acre for DSR drills depending upon distance and ₹ 2,500/acre for raising mat nursery with mat nursery seeder machine from various mechanical transplanters owners and other farmers. Similarly, Shri Trilochan Singh from Udopur has covered around 200 acres area with four wheel drive mechanical transplanter on custom hiring basis. Another farmers group Shri Pawandeep Singh, Shri Hardev Singh, Shri Major Singh have raised mat type nursery of around 700 acres

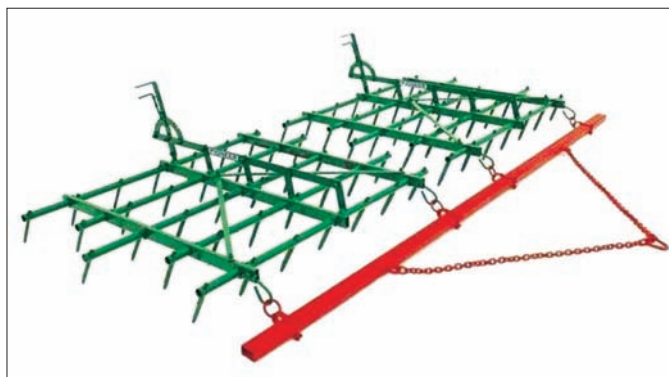


Fig. 2. Manual Spike tooth harrow (soil crust breakers)

area and transplanting with mechanical transplanters (Four wheel drive and walk behind type). Similarly, Shri Gurmej Singh from Mao Sahib (200 acres) with 8-row floating type mechanical transplanter, Shri Sukhdeep Singh with 6 row yanmar transplanter (100 acres) and Shri Kulbir Singh from Shadipur with 6-row walk behind yanmar transplanter (100 acres), Shri Gurmeet Singh from Nagar village with 4-row with walk behind kubota transplanter (100 acres), Shri Hardeep singh village dullewal with 6-row walk behind yanmar transplanter (100 acres), all have raised mat type nursery for their own and custom hiring basis.

Shri Hardev Singh and Shri Pawandeep Singh said that they are charging villagers around ₹ 6,000 for raising mat type nursery and its mechanical transplanting depending upon field distance and paddy variety. The farmers pick the cut mats of nursery from their farm in their own conveyance. This reduces their transportation burden. Moreover they have two machines (one 4WD and one walk behind) to perform transplanting operation without any delay and give their customers advantage of enhanced paddy yield due to timely transplanting.

PAU Tractor operated Mat type nursery seeder machine

Another successful trial of mat type nursery seeder machine was done at KVK farm and on the fields of Shri Hardev Singh Farm at Mehsampur. This machine is developed by Deptt. of Farm machinery & Power Engineering (FM&PE), Punjab Agricultural University, Ludhiana.

This seeder mechanism includes, sheet roller, soil picking auger unit, sieving unit and seeder. It performs simultaneously operations of laying polythene sheet, picks soil from both sides, puts it on polythene sheet, then seeder places seed on it. Thus, the operations of mat type nursery seeder are performed in a one go operation which otherwise takes more time. The



Fig. 3. Promotion of PAU developed low cost spray attachment for zero till drill at village Rasoolpur and adjoining villages PAU low cost spray attachment for DSR/Zero till drills

Weedicide management

Weedicide	Time of Application	Dose/Quantity
Stomp /Bunker 30 EC (Pendimethalin)	Within two days of sowing (in moist soil)	1 litre per acre in 200 liters of water
Nominee Gold/Wash out/ Macho/Taarak 10 SC (bispyribac) against paddy mothas including gandi wala motha and broadleaf weeds	20-25 days after sowing	100 ml per acre in 150 litres of water
Ricestar 6.7 EC (fenoxaprop) against gurt madhana, leptochloa (chini) gha, chiri gha and takri gha	20 days after sowing	400 ml per acre in 150 litres of water

farmers were also satisfied with its performance. This machine will help increase the operational area under mechanical transplanter as it mechanizes the mat type nursery sowing operation which to till date is done manually.

Some tips for DSR technique

Seed Treatment: To ensure health and uniform crop stand, farmers should have proper seed treatment of

heavy seed with Sprint 75 WS (carbendazim + mancozeb) by making slurry of 3 g fungicide formulation in 10-12 ml water for one kg seed (i.e. 24 g fungicide in 80-100 ml water for 8 kg seed) before sowing.

Farmers should go for DSR, preferably in medium to heavy textured soils because in light textured soils severe iron deficiency occur, which can drastically lower the crop yields. In case of iron deficiency,

which is observed as chlorosis among the seedlings in the youngest leaves. Under such conditions, firstly apply irrigation and keep water standing in the field and give 2-3 foliar sprays of 1% cent ferrous sulphate solution at weekly intervals (1 kg of ferrous sulphate in 100 litres of water per acre). It is of utmost importance to follow a proper weedicide and fertilizer management approach in DSR.

Fertilizer management

Farmers should go for need based fertilizer application so that there is better crop growth and lower incidence of insects and diseases on the crop. Urea (130 kg urea/acre) should be applied in three equal splits at 4, 6 and 9 weeks after sowing. Apply Phosphorus and potash only if soil is deficient in these nutrients. Do not apply phosphorous if already applied to the preceeding wheat crop.



Fig. 4. Shri Gurmej Singh and Shri Sukhdeep Singh custom operators from Village Mao Sahib: view of mat type nursery preparation



Fig. 5. Shri Tasvir Singh from village Lohgarh, Phillaur and modification of Happy seeder for DSR sowing at village Medha

Irrigation Scheduling

The sowing should be done in optimum moisture. If sowing is done in irrigated land at optimum soil moisture then next irrigation should be done after 5-7 days and then next irrigations should be planned between 5-10 days intervals depending upon soil type. If rainfall occurs immediately after sowing then soil crust may be formed which can be broken by using manual spike tooth harrow or by applying light irrigation so that paddy germinates uniformly in the field.

The Krishi Vygyan Kendra Jalandhar team is continuously guiding farmers about machine aspects, fertilizer, iron deficiency, weedicide sprays time, irrigation schedule and all other aspects required for these techniques. In

various farmers, custom operators etc. The approximate capacity of DSR drill is 12-15 acres/day and paddy transplanter is 4-5 acres for walk behind and 8-10 acres/day for ride on type transplanter.

Another low cost spray attachment was developed by Department of Farm Machinery and Power Engineering, PAU Ludhiana. It was fitted at zero till drill by farmer Shri Mandeep Singh from village Rasoolpur (Phillaur), who has covered around 50 acres area under DSR with this attachment.

Along with this, the KVK has given DSR drill to farmers of various blocks in Jalandhar and has covered around 200 acres with this. Another success story is of farmer Shri Tasvir Singh from village Lohgarh who has taken DSR drill from KVK and sown

2020, the expected area under direct seeded rice and mechanical transplanting was around 25-30 % and 5-10 % respectively and it will prove beneficial for farmers in coming years also. There are around 80 DSR drills and 60 Paddy transplanters purchased by



Fig. 6. View of Direct seeded rice drill in operation which was provided to farmers of various blocks of Jalandhar by Krishi Vygyan Kendra, Jalandhar

1.5 acres in his field with this drill in previous year. Now its impact is that around 50 % area in village is under DSR technology this year and many farmers have purchased new drills this year. Similarly, the KVK adopted village Kara Ram Singh, area under DSR increased upto 20% and also in village Gakhal Kala (approx. 125 acres). Along with this, KVK scientists are continuously monitoring villages like Medha, Kara Ram Singh, Talwandi Madho, Billi Chaharmi (Block Lohia), Mohem, Ajtani, Tandaura, Dalla, Talwan, Sanghe Khalsa, Ramewal (Block Nurmahal), Parzia Kala, parzia Khurd, patto



Fig. 7. Manual seeding on beds (2 lines on each bed) and Manual transplanting on beds (2 lines on each bed)

Kala, Bagga, Bhadma (Block Shahkot), Shadipur, Kandola Kala, Mehsampur, Goraya, Mao Sahib, Lohgarh, Rasoolpur (Block Phillaur), Shankar, Nakodar, Gakhal, Chahr Ke where there is increase in mechanical transplanting and DSR area. They are given technical knowledge about overcoming iron deficiency in paddy, fertilizer, weed management and irrigation scheduling, etc. There is saving of underground water to the tune of 15-20 % owing to laser leveled fields. Moreover there is no need of puddling in DSR technique which saves lot of water. Additional benefit of no puddling with rotavator is, lesser hardpan formation and thus there will be more infiltration of surface/rainwater to deeper aquifer

layers which can help underground water recharging to some extent. While mechanical transplanting farmers should puddle the field and keep only 3-5 cm of water level in field while transplanting. The mats base should be moistened with field water before placing in mechanical transplanter for easy and smooth movement of mats in machine.

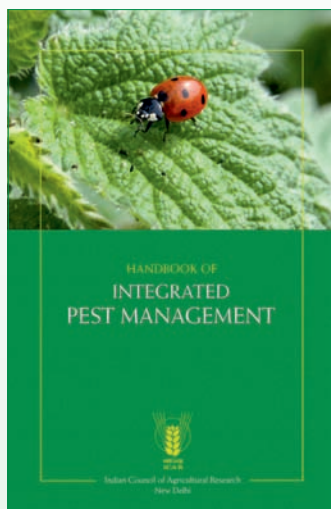
Further some farmers have adopted ridge/bed sowing techniques. Farmers have sown 2 lines of paddy manually on raised bed or transplanted two lines of paddy seedlings on raised bed at 20 cm spacing and ridge lines distance of 30 cm. This technique can help conserve water to the tune of 15-20 % specially for irrigated lands as compared with

flat transplanting in Northwest India. Moreover this technique can also help underground water recharging due to more infiltration of surface/rainwater to deeper aquifer layers. There is hope that area under mechanized sowing/transplanting techniques of paddy will increase on custom hiring basis which will benefit especially small and marginal farmers to a great extent in coming time. Farmers of various zones can take knowledge about all these techniques and machines from their respective zone KVKS, SAU and Agriculture Department.

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