Fertilizer application

- Recommended dose of fertilizers (NPK): 80:40:40
- Full dose of PK and 25% of N is applied as basal before transplanting, 50% N at maximum tillering stage and rest 25% at panicle initiation stage

Water management

- Maintain 3-5 cm water throughout (transplanting to physiological maturity)
- Water should be drained occasionally before spraying of herbicides or other pesticides to increase their efficiency
- Water should be drained when the crop attains physiological maturity i.e. about 7 to 10 days before harvesting

Weed management

- Choice of herbicides or mechanical control of weeds should be done on the basis of severity of weed infestation
- Herbicide options include application of early post emergence (PoE) herbicide viz., Bispyribac sodium @ 30 g a.i./ha or late PoE viz., Fenoxaprop-p-ethyl @ 60 g a.i./ha or Cyhalofop butyl @ 100 g a.i./ha
- If the weeds are not controlled by application of early post emergence herbicide, then mechanical weeding or late post emergence should be applied at 20-30 days after transplanting depending n the severity of weed infestation

Yield and Economics

On station trials conducted at ICAR-National Rice Research Institute, Cuttack, recorded yield up to 5.5 t/ha in non puddled transplanted rice. Average grain yield of non puddled transplanted rice was about 4.5 t/ha during five years of experiment.

There is economic gain in non puddled transplanted rice as there is substantial saving on labour and fuel. The B:C ratio is higher in non-puddled transplanted rice than the conventional methods of land preparation and establishment viz., conventional DSR, TPR and mechanical TPR. The B:C ratio is about 2.01 in non- puddled transplanted rice as compared to 1.93 in mechanical transplanted rice and 1.66 in conventional transplanted rice.

Other benefits of zero tillage transplanting

- Less soil erosion due to reduced tillage and residue cover of previous crop
- Better soil aggregate stability
- Cycling of nutrients- remains of the previous crop add nutrients to the soil
- Carbon build up in soil
- Less greenhouse gas emissions
- Reduced soil compaction helps in germination of succeeding crop
- Soil moisture is conserved
- Better soil microbial activities

Up scaling strategies

- ✓ Non puddled transplanting in untilled soil is highly recommended in those areas where transplanting is invariably delayed, particularly due to labour shortages at peak planting period, and farmers are compelled to transplant old seedlings.
- ✓ This technology is recommended in areas where rice is cultivated in soils with high clay content (>30%). In these soils, non puddled transplanting can be easily done with the help of transplanters. Further, these soils require very high energy for puddling which inflates the tillage costs which makes tillage impracticable.
- ✓ This technology is applicable with certain preconditions, mainly, availability of irrigation water as well as drainage facility.
- ✓ Non puddled transplanting is advisable and more preferable if it is done mechanically. Manual transplanting in zero tillage non-puddled condition is environmentally sustainable but may not be remunerative. Therefore, this technology is recommended for those farmers who can afford mechanical transplanting using their own transplanters or hired transplanters.
- ✓ With irrigation facilities available, non puddled transplanted rice can be cultivated in wet as well as dry season depending on the choice of crop rotation.

Zero-tillage rice transplanting: A Resource Conservation Technology

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TechNRRI

Zero-tillage rice transplanting: A Resource Conservation Technology

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The inherent problem of rice based cropping system is the practice of puddling. The main disadvantages of puddling are excessive water use, and difficulty of regenerating soil structure for the subsequent crop following puddled rice. Soil aggregates are destroyed in the process of puddling. Capillary pores are broken and clay particles get dispersed which contributes in formation of an impermeable clayey layer on the surface of soil called the plough pan. The plough pan impedes root penetration of the succeeding crop after the harvest of rice. Besides physical damage, loss of nitrogen (de-nitrification) under anaerobic condition is a big disadvantage of puddling. Tillage operations become extremely cumbersome and expensive as repeated cultivation is required to break the large clods produced by dried puddled layer and to get a fine textured soil for the next crop. Pre-puddling and puddling tillage are costly in terms of fuel consumption, labour and machinery wear and tear, and account for about 10-15% of the cost of rice production. Additionally, soil disturbance by conventional tillage makes the soil serve as a source rather than a sink of atmospheric green house gases and thus is not sustainable and environment friendly.

CA in rice based cropping system: Solution to puddling woes

Lately, attention is drawn towards sustainable intensification of crops based on the principle of conservation agriculture (CA). The principles of CA have emerged as important management strategies to address many of the above mentioned challenges related to tillage and puddling in the intensive rice based cropping systems. The principles of CA involve minimum soil disturbance and permanent soil cover combined with appropriate crop rotation.

ICAR National Rice Research Institute, Cuttack has developed and validated a simple zero puddled rice transplanting technique in untilled soil for lowland rice.

Details of technology for zero tillage non-puddled rice transplanting

Various experiments were conducted since 2015 at ICAR National Rice Research Institute to develop and standardise the management practices for cropping system, zero-puddled rice- zero tillage green gram.

Preconditions for non puddle transplanting

1. Non puddled transplanting of rice is highly recommended for soils with high clay content (>30%). In these soils, non puddled transplanting can be easily done with the help of transplanters. Zero tillage non puddled transplanting of rice is recommended for irrigated medium and lowland ecosystem with good drainage.
2. Weeds should be adequately suppressed before implementation of non puddled transplanting, preferably through stale bed technique. Stale bed technique involves application of total killers viz., Glyphosate @ 1.20 kg ai/ha for control of weeds before transplanting of rice. Herbicide is applied two to three times depending on the severity of weed infestation.

Management of zero tillage non-puddled transplanted rice

Seed treatment

Seed should be treated with carbendazim @ 2 g/kg seed for control of fungal diseases and Imidacloprid 70 WS @ 5 g/kg seed for control of sucking pests and termites

Pre-transplanting weed management

Apply Glyphosate @ 1200 g ai/ha or 6 ml/l of water for 500 l spray volume two times before transplanting. Under severe weed infestation, it may be applied for the third time. Last application is done 7 days before transplanting. Soil should be saturated each time before spraying of herbicide to effectively kill the weeds. Moist soil also helps the escaped weeds/ weed seeds to regenerate or germinate which can be controlled by the subsequent spray of herbicide.

Field preparation

The field is kept ponded for at least 2 days before transplanting. The ponded water is drained and soil is kept at saturation before transplanting.

Transplanting method

Mechanical transplanter is recommended for transplanting in non puddled soil. Any of the ride-on type or walk- behind type transplanters can be used. However, ride-on type transplanters are easy to handle and take lesser time for transplanting compared to walk-behind type transplanters.

For mechanical transplanting, mat nursery is required, which can be prepared following the steps given below (Fig 1):

1. Nurseries are prepared on tray (size vary with type of transplanter)
2. Mixture of soil and compost layer to a height of 1.5 - 2 cm is placed on it
3. Sprouted seeds are then spread to a density of 700-1000 g/m^2
4. Water is sprinkled as and when required to avoid water stress. Seedlings are ready for transplanting in 14 days

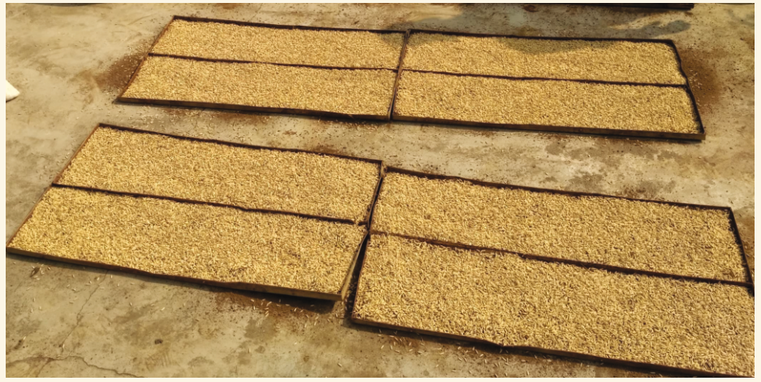

Fig. 1 Sprouted seeds spread over a mixture of soil and compost

Fig 2. Seedlings on mat nursery placed on transplanter for transplanting

Fig. 3(a) Mechanised transplanting with walk-behind type transplanter

Fig. 3(b) Mechanised transplanting with ride-on type transplanter