

Hydroponic paddy nursery for healthy seedlings

Compatible for mechanical transplanting

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Paddy (Oryza sativa) is one of the most important cereal crops in India for food security. In the world market of 15 to 18 million tonnes (mt) of rice traded annually, basmati rice accounts for almost 10%. However, basmati rice generates three times higher returns (US\$ 800-1,200 per tonne) than non-basmati rice (\$ 200-400 per tonne) in both domestic market and international. However, the maximum permissible residue level (MRL) plays a crucial role in export. European Union (EU) cut the maximum residue limit for Tricyclazole from 0.10-0.01 ppm on 31 December 2017. Thus, it drastically affected the fate of 70,000-90,000 tonnes of rice exported per month. We have to evolve new agriculture technologies, methods to boost our export. Since healthy nursery is the basis of healthy crop, Ayurvet Research Foundation (ARF) had been raising the nursery through hydroponics (Soilless) agriculture and no chemical/pesticide/insecticide/fertilizer are used. Rice exporters are facing the problem of pesticide residue in the recent past, so starting with healthy, chemical-free nursery will lay the foundation for healthy, chemical-free rice.

Keywords: Export, Hydroponics paddy nursery, Mechanical transplanting, Water conservation

THE nursery is transplanted through mechanical transplanter in order to solve labour crisis. Farmers generally grow Pusa Basmati-1121, NABARD had supported this novel initiative in Sonipat district. Hydroponic Paddy nursery was transplanted in 200 farmer's field during 2017-19 and demonstrated to 3,000 farmers. Farmers had witnessed the success of crop and now willing to adopt the hydroponics Paddy nursery technology. In *kharif* 2020, 100 farmers had adopted the technology in Sonipat

Paddy Rice for Food Security

Global rice demand is expected to rise from 496 mt (milled rice) in 2020 to 555 mt in 2035. Asian rice consumption is projected to account for 67% of the total increase. In India, rice is the staple food for more

than half of the total population and hence a key pillar for food security. With the support of state governments, India has embarked on various rice development schemes such as the Special Rice Development Program (SRPP), National Food Security Mission (NFSM) and Promotion of Hybrid Rice etc. The Indian government carries out domestic price support, procurement, and the distribution program in rice. The Indian government implemented several policies to boost rice production. Numerous subsidies, ranging from fertilizer to irrigation, electricity, seeds, machinery, and food, are available. The government subsidizes agricultural inputs to keep farm costs low and increase production. The major rice-growing states are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu,

Odisha, Bihar, and Chhattisgarh, which together contribute about 72% of the total rice area and 75% of total rice production in the country.

Rice Export Scenario in India

15 to 18 mt of rice traded annually in the world market, basmati rice accounts for less than 10%. However, basmati rice generates three times higher returns (US\$800-1,200 per tonne) than non-basmati rice (\$200-400 per tonne) in both international and domestic markets. From a small beginning in 1978-79, when India exported 67,000 tonnes of basmati rice, earning modest foreign exchange of ₹ 3,200 million, an upward swing continued and 1997-98 witnessed the highest volume of basmati rice exports with record foreign exchange earnings of ₹ 16,749 million. Superfine long-grain (>6.61 mm long), a characteristic pleasant aroma,



Fig. 1. Paddy nursery through hydroponics

extra elongation on cooking (>1.8 times) and the soft texture of cooked rice are the typical features of basmati rice. Non-basmati rice has also become a major item for export promotion, registering a steady upwards trend in recent years.

European Union (EU) Norms and its Impact

The EU has specified MRL (Maximum permissible residue level) values of fungicides and pesticides for a year. European Union (EU) cut maximum residue limit for Tricyclazole from 0.10 to 0.01 ppm on 31 December 2017. As a result, Saudi Arabia rejected a few shipments of Indian rice. Additionally, new requirements that demand DNA testing of basmati with up to 93% purity were brought into force. Thus, it drastically affected the fate of 70,000-90,000 tonnes of rice exported per month. In the case of MRL for Tricyclazole, rice-importing countries do not have uniform tolerance limits. The US and Japan have fixed MRL at 3 ppm. However, the US does not allow the presence of pesticide residue like Isoprothiolane beyond 0.01 ppm.

Way forward

Healthy nursery: Basis of healthy crop

Good crop success starts at the nursery. The importance of establishing a proper paddy nursery in traditional rice cultivation cannot be overstated. The performance and yield of a rice crop are strongly affected by its early stages. Using

unhealthy seedlings can reduce yield by at least 10%. Transplanting the seedlings at an appropriate time is also very crucial in getting optimum yield. Pre-germinated seeds are broadcasted on a soil that is thoroughly puddled and levelled. Indian farmers encounter several problems in establishing proper paddy nursery, transplanting survival, diseases, etc. Additionally, the traditional mat-type nursery requires cumbersome, labour-heavy land preparation. It also needs higher agrochemical input and regular watering. They also observed more incidences of contamination, yellowing of leaves, and tip burning because of the open field nursery preparation. Hydroponics may be one solution to the many problems currently affecting paddy growers in India such as adverse climate and diminishing land and water.

Raising paddy nursery through hydroponics

In the conventional system, for each 100 m area of nursery bed, 1 kg nitrogen (N), 0.4 kg phosphorous (P) and 0.5 kg potash (K) are usually provided. The fertilizers are mixed with soil before sowing. Seedlings are ready for transplanting in 21-30 days after sowing (Fig. 1). The hydroponics system grows plants without soil and their roots grow in a nutrient solution. Because the nutrients are available at the root zone, the plants flourish rapidly and the seedlings are ready for transplanting in seven days using approximately 5% water of

conventional nursery i.e. saving of approximately 1.5 lakhs liters of water is saved for raising nursery to be transplanted in one acre.

Mechanical transplanting

To solve the issue of labour shortage for transplanting, Ayurvet Research Foundation introduces mechanical transplanter by collaborating with Agri-equipment manufacturers. Ayurvet Research Foundation (ARF) had initiated raising hydroponic paddy raising on the request of the farmers in year 2010. The farmers were facing problem due to uncertainty of the monsoon and sometimes their nursery could not survive after transplanting due to adverse climatic condition like high temperature or waterlogging. The minimum required for raising conventional nursery varies between 21-30 days. Hydroponic paddy nursery came as a readymade solution for them (Fig. 2). After an incubation period of 7 days, they can get 3-4 acres nursery per day as per capacity of the hydroponic machine. After making successful research trials Ayurvet Research Foundation with support of NABARD reached the farmer's field in villages of Sonipat District.

Paddy nursery produced in Ayurvet Pro-Green hydroponic machine growing at temperature of 32°C with 70-80% humidity. It requires little amount of water and land against the conventional system and also the nursery was prepared just in 7 days whether the conventionally this growth requires



Fig. 2. Mechanical transplanting

about 28 days so fast and most economical nursery production is observed under Ayurvet Pro-Green hydroponic machine forming best mode of nursery germination.

Paddy Nursery Production under Conventional Method

Previously most of the farmers from Sonapat and Panipat district were following conventional method for paddy (PB-1121) nursery, they were raising the nursery for 25-30 days. They were regularly taking care by giving irrigation, weeding and other measures. The water provided in nursery raising for one acre varies between 1.4-1.5 Lakhs liters. Farmers have to engage labours for up-rooting the nursery.

Ayurvet Proggreen Hydroponics Machine Raised Nursery

Ayurvet Research Foundation

conducted trial on 200 Farmer's field in Sonipat District. The Ayurvet Pro-Green hydroponic machine raised seven days old hydroponic paddy nursery was transplanted mechanically in different villages of Sonipat District of Haryana. The observed variation was favourable to farmers' welfare as the hydroponically raised nursery was transplanted just after seven days of germination and performance was very much effective over conventional method. The mortality during nursery raising and

transplanting was about negligible (5-7 %) and the chance of infestation through disease and pest was not observed during nursery raising.

- Saves about 18 -23 days in nursery days. Water saved in hydroponics nursery is 95% of conventional paddy nursery. The irrigation charges for 1.5 Lakhs liter is approx. ₹ 500.
- Saved land can be used for other crop for green manuring which will save ₹ 500.
- Saving in No. of initial spray,

Table 1. Comparative advantages of hydroponics nursery over conventional nursery raising

Parameter	Units	Conventional	Hydroponics	Savings	Tangible benefit
Days	Number	25-30	7	18-23	Farmer can engage himself for other economic activities
Land	Acre	0.066	0.005	0.06	₹ 500 on the basis of green manuring
Water	Litres	160,000-243,000*		2,100	159, 000-240, 000* ₹ 500 @ ₹ 100/Hr.

pesticides, fertilizer which can range between INR 250-400/ acre

- The hydroponic nursery established successfully in the field
- The nursery is only 7 days old however the yield is higher by 5-10%.
- This technology is also suitable for late sown condition.
- Even if monsoon is delayed, the nursery can be produced in just 7 days and early harvesting provides good availability of market at demanding prices with difference up to ₹ 250 to 300 per quintal with low competition.

Other Benefits

This technique is most efficient for

early nursery raising as it is time saving i.e., nursery raised just in 7 days (saving up to 23 days), no infestation chances at nursery stage and up to 95 % water saving. Low input with higher yield and early harvesting creates greater opportunity to market.

Technique Implementation and extension

Ayurved Research Foundation (ARF) had implemented the project with the support of NABARD in Sonipat District. The hydroponic paddy nursery was raised and mechanically transplanted at 200 Farmer's field. The demonstration was given to 3,000 farmers. The

success of this project encouraged farmers to adopt this technology. In this *kharif* 2020, 100 farmers had adopted the technology. The organisation is planning to extend this technique through SHGs and Kisan Club in coming years. By promoting the wider use of hydroponics paddy nursery, the government can help Indian rice farmers to save significant amounts of water, land, labour, time, and other resources.

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HANDBOOK OF INTEGRATED PEST MANAGEMENT

To reverse the loss of environmental resources and also to reduce biodiversity loss, the Government of India has Integrated Pest Management (IPM) as part of the National Agricultural Policy. Integrated Pest Management



emphasizes the growth of a health crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. IPM is not new – mechanical, cultural and biological tactics were used by farmers for hundreds of years before chemical pesticides became available. Besides, there are IPM techniques that have been developed more recently and are effective in suppressing pests without adversely affecting the environment.

The task of spreading the message of IPM across is tough due to poor awareness about the subject among people in line-departments as also among the farmers. The information on integrated pest management as a whole is scattered. This *Handbook* comprehensively deals with all the aspects of integrated pest management in field crops, horticultural crops under traditional, protected systems. Information on basic strategies and tactics of different methods of management including mass production of biocontrol agents, IPM policy and pesticide registration is provided in comprehensive form.

The *Handbook of Integrated Pest Management* comprises 82 chapters which are well written in lucid language with crispy sentences by the renowned scientists. The role of IPM is elucidated with different pests like *Trichogramma*, *Bacillus thuringiensis*, *Nomuraea rileyi* etc. and agricultural crops like rice, wheat, maize, sorghum, pearl millet, pulses, soybean, rapeseed mustard, groundnut, minor-oilseed crops, sugarcane, cotton, jute and mesta, potato, vegetable crops, fruits, grapes, citrus, banana, pomegranate, coconut etc. This *Handbook* will provide information of available useful technologies to educate on how to reduce or judiciously use chemical pesticides, safeguard ourselves from chronic poisoning, save the National environment while also reducing input costs and raise farmers' income. This compilation will be useful to teachers, students, trainers, line-department personnel and policy makers.

TECHNICAL SPECIFICATIONS

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