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Research Paper

Hydroponics Rice Nursery: A Novel Approach To Rice Cultivation In India

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I. INTRODUCTION

Soil-based agriculture is now facing major challenges due to urbanization, industrialization and environmental degradation etc. Among different problems, the most important one is the decline in per capita land availability (Debangshi, 2021). Hydroponic rice nurseries are currently a popular approach to grow rice in India. Rice is considered as one of the most water-intensive crops. Because of the continual decrease in clean water supplies as a result of global warming and contamination of previously existing water sources, this high use will become a major concern. As a result, rice's economic viability will be determined by the advancement of hydroponic technology. In traditional rice production, the necessity of constructing a proper paddy nursery 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% (Saxena and Upadhyay, 2019).Transplanting seedlings at the right time is also critical for achieving the best yield. Indian farmers face a number of challenges, including constructing a healthy paddy nursery, transplanting survivability, disease, and so on. Additionally, the traditional mat-type nursery requires cumbersome, labour-heavy land preparation. It also requires more agrochemicals and more frequent watering. Because of the open field nursery preparation, they also noticed greater pollution, yellowing of leaves, and tip burning. Hydroponics could be one solution to the myriad challenges that paddy growers in India are now facing, such as harsh weather and limited land and water.

Figure 1: Hydroponically grown rice seedlings

NEED FOR HYDROPONICALLY GROWING RICE

The conventional method of Rice cultivation necessitates a hot, wet, and humid climate. Farmers must water the plants and attend weddings on a regular basis. This results in a significant amount of freshwater waste. On the other hand, hydroponics uses 85% less water for growing.With respect to conventional system One kilogramme of paddy seed require 3000-5000 litres of water. On top of that, farmers must spend hours knee-deep in stagnant water to tend to their crops. As a result, farmers are at risk of contracting water-borne diseases. In a nutshell, the process appears to be unsustainable(Debangshi, 2021).

Figure 2: Hydroponically grown seedlings being transported to farmer's field.

ADVANTAGES

- Reduce the nursery making area required for conventional farming (It uses 20% less space for growing with respect to conventional system) (Debangshi, 2021).
- The crops are grown under a controlled environment
- Compared to traditional farming methods, this farming model can produce 7 to 14 times more growth cycles (Debangshi, 2021).
- The temperature, light, water, and nutrition can be fully adjusted to optimum conditions
- Seedlings grown in a hydroponics paddy nursery establish well in the field and can be useful, especially during delayed monsoon rains.
- Farmers do not have to battle vicious weeds and pests, and the crops are grown in a controlled environment protected from the harsh environment. This means that yields will be not only larger, but also much healthier and of higher quality.
- Apart from the reduced water usage, farmers do not have to battle vicious weeds and pests.
- Hydroponics-grown seedlings recover fast (It only takes seven days for the rice seedlings to reach 15 cm), produce tillers vigorously, mature uniformly, and have higher yield gain (Tasaka, 1999)
- Crops mature earlier leading to early harvesting and better returns
- Uses 80-90% less water
- Suitable for late delayed monsoon conditions
- Land for nursery can be used for other purpose

STEPS OF NURSERY GROWING

Step 1: Outline of nursery device

The nursery bed fixed horizontallyon the ground comprised 4-6 nursery trays. A nursertray (6.5 m long, 28 cm wide and 6 cm deep) madeof stainless steel was developed. The height of thenursery tray from the ground surface was set at 60cm to work without bending the waist. Liquid fertilizercirculates in the tank and on the tray of the nursery device through a pump(Tasaka, 1999).

Step 2: Soaking of seeds

After the soaked rice seeds have dried for 24 hours, they can be germinated in a bucket. A mix of soil and compost, then filled with water, would be an accessible medium. Plant the seeds in the bucket and they should sprout in two weeks. The seeds ranged in mass from 100 to 250 g per unit area.

Step 3: Seeding method

Eradicate the soil from the roots to avoid problems and for easier nutrient uptake. The roots should be in contact with the system's nutrient solution to guarantee growth. Adjust the temperature to around 77°F to encourage the rice's quick development (Sambo *et al.*,2019).

Step 4: Germination of seeds

Allow the seeds to germinate for up to two weeks. Keep in mind that the higher the temperature, the quicker they will germinate. After removing any remaining soil from the roots, place them in the hydroponic pot. Check that the roots are in contact with the nutrient solution.

Step 5: Supply of fertilizer and air temperature in the vinyl house

After sowing, water without fertiliser was cycled in the nursery device for several days.

In the composition of the nutrient solution, appropriate concentrations of nitrogen, potassium, phosphorus, calcium, magnesium, and sulphur, as well as lower amounts of other elements, are necessary. On the fifth day after seeding, commercially available fertiliser is dissolved in water in the liquid fertiliser tank.

Step 6: Rolling up of seedlings

Rolling up of 6 m longmat were conducted for transfer to the paddy fields and loading on a rice transplanter.It takes about 20-30 days to mature.

Figure 3: Farmers at an on-site demonstration for transplanting hydroponically grown rice seedlings.

GROW RICE IN AQUAPONICS

Rice can be grown using aquaponics. In fact, the only difference between aquaponics and hydroponics is that aquaponics uses nutrients from fish waste to supply the plant instead of the traditional human-made nutrient solution used in hydroponics. However, using aquaponics instead of hydroponics is more complicated. (Horkey et al, 2021). But aquaponics somehow solved the reduced economic viability of hydroponic rice. By growing fish with rice, the final output will be nearly doubled as a result of the relatively high price of fish.

Figure 4: Rice in aquaponics

PROTOCOL OF HYDROPONICS PADDY NURSERY

The Ayurvet Research Foundation was one of the first in the country to develop rice hydroponics technology. The commercial test report for the Ayurvet Pro Green Hydroponics machine was issued by the Indian Ministry of Agriculture. The company has been working on the technology for the past ten years, and the machine structure and procedure have been granted a patent. Since 2009, the Ayurvet Research Foundation has performed studies and field trials with 2,500 paddy farmers in 50 villages, including Orrisa in Western Uttar Pradesh and Sonipat and Panipat in Haryana (Saxena and Upadhyay, 2019). Regular training and demonstration sessions were organized for the farmers for making them aware of the technology. To date, a total of 81 hectares have been transplanted with rice seedlings grown using the hydroponics paddy nursery.

Figure5: Ayurvet Pro Green hydroponics paddy nursery (Photo: Ayurvet Research Foundation)

BOTTLENECKS

- However, it is not very cost effective. The entire hydroponic procedure requires a lot of money. It requires a significant investment.
- Because the water is constantly circulated throughout the system, infections can quickly spread throughout the entire growing system, affecting the entire collection of plants
- Power outages can be hazardous for hydroponic systems, which require constant monitoring and micromanagement
- If disease appears, it will affect all plants in the system
- Because the water is constantly circulated throughout the system, infections can quickly spread throughout the entire growing system, affecting the entire collection of plants

II. CONCLUSION

The government can assist Indian rice producers in saving considerable amounts of water, land, labour, time, and other resources by supporting the use of hydroponics paddy nursery. Free training for farmers in various sections of the country would raise their awareness of the technology and its benefits, empowering them. It will also provide them with information on how to create new sources of income.

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