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Prospect of Drip Irrigation in Rice Cultivation

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Abstract

Rice is cultivated in large area in the state of West Bengal as well as in India. The prevailing rice cultivation practice water requirement is very high and threat to groundwater reserve and environment. It is felt necessary to find out a suitable irrigation practice which could considerably reduces the irrigation water requirement and connect to best management practices for better yield & economy. Drip irrigation proved its advantage in terms of yield and economy over conventional method of rice cultivation. As the initial cost of drip system is very much high, farmers have unwillingness to adopt this new technology. But the Central and State Government both are tried to bring more land under the drip system by giving subsidy to the farmers.

Introduction

According to the United State Department of Agriculture (USDA), out of total rice area in India, 47% is irrigated that uses up to 45% of country's water withdrawal for irrigation as rice is a water loving crop. Average water efficiency per kilogram of rice is 3500 litres in India as compared to 1750 litres in China. Recent researches proved that 600 litres of water is enough for production of one kilogram of rice. Among the irrigation system, drip irrigation helps in maintaining the optimum soil moisture in soil root zone with increased yield and water use efficiency. Efficient use of water is highly critical to sustain agricultural production, more particularly in the context of declining per capita land and water availability. Drip irrigation is precise irrigation technology and it gives an opportunity to meet crop water requirements in an optimum way. Along with reducing water-use, drip irrigation can also reduce the methane footprint. Essentially, stagnant water creates a conducive environment for the formation of methane, a greenhouse gas (GHG). Methane absorbs the heat in the atmosphere and sends some of it back to the earth's surface, posing a major concern for climate change.

Success Stories by Adopting the Drip Irrigation in Rice Cultivation

Sonit *et al.* (2015) observed that drip irrigation at 1.4 and 1.2 IW:CPE ratio saved 63 and 59% of irrigation water respectively over flooding, indicating that cropped area under summer rice can be doubled with same quantity of available water by using drip irrigation without sacrificing grain yield. It has been observed that rice grain yield (6950 kg/ha) was significantly increased by drip irrigation method compared to flood irrigation (6225 kg/ha) method. Rao *et al.* (2017) found that the system of rice intensification methods adapted with drip irrigation emitters spaced 2.0 cm apart gave the highest number of productive tillers at maturity (264.75 /m^2),

also the highest number of grains per panicle (161.75), longest panicle length (27.52 cm), and highest panicle weight (3.41 g). Drip irrigation maintained a competitive grain yield and water productivity, and greatly reduced pollution risk to the environment. Considering the conservative amount of fertilizer application, less than the amount of fertilization in normal paddy field, the yield potential of rice could be improved by increasing the amount of fertilizer as top application in drip irrigation system. Various experiment showed that grain yield 7.34–8.01 and 6.63–7.60 t/ha with 860 and 1455 mm water in drip and flood irrigation respectively; water saving by 40-42%; WUE 0.81-0.88 and 0.42-0.52 kg/m^3 in drip and flood irrigation respectively. Various researchers reported that the rice yields under drip irrigation ranged from 4.50 to 8.20 t/ha among the varieties; indicating an increase in yield of 17-22% over from conventional floods irrigation treatment. The water saved in drip method was around 50-61%. Highlighting that drip method of irrigation results in high water use efficiency, it was recorded that the water productivity of rice from 0.365 kg/m^3 to 0.714 kg/m^3 among the varieties tested. The water productivity obtained in flood method of irrigation varied from 0.097 to 0.224 kg/m^3. The main reasons for higher water saving under drip irrigation are due to reduced crop duration of 10-12 days across the varieties and precise use of water (Nagaraju *et al.,* 2014). The literature published on drip irrigation systems in rice across the world were collected, studied and synthesized. Results the dominant system of rice production is transplanting or direct-seeding of rice and keeping the fields flooded with 5 to 10 cm water throughout the growing season. In such systems, it was estimated that farmers use around 15000 liters of water to produce one kg of rice while the maximum requirement is around 4000 liters. A 10% reduction in water use of irrigated rice would free 150000 million m^3, which can be used for other needs or for bringing additional land under irrigated crop production. The major hindrance for the wide adoption of drip irrigation system by irrigated rice farming community is the initial investment cost.

Conclusion

Considering its many benefits, drip irrigation may be the "need of the hour", but its implementation poses a few critical challenges. The capital cost of drip irrigation is a major concern. Installing a drip irrigation system can cost between Rs. 30,000.00 to 60,000.00 per acre. With 86% of Indian farmers being marginal landholders, a majority of them cannot afford this. They are usually reliant on zero-cost technologies or subsidies (90% for drip irrigation in Karnataka) offered by the Centre and State. Furthermore, there is low willingness to make the switch. Conventional approaches like flood irrigation have been a practice for years and replacing them with an "unfamiliar" technology like drip irrigation is met with resistance and also, there is a huge mindset issue among farmers. They find it difficult to imagine growing paddy without standing water. Various government initiatives like "More crop per drop" and "*Har Khet Ko Pani*" aim to address the barriers to large scale adoption of drip irrigation. One can hope for change as the government shifts its focus towards enhancing agricultural water-use efficiency. Perhaps, not long from now, rice too will be grown, one drop at a time.

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