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Jalkund (Low-Cost Rainwater Harvesting Structure): Boon for Marginal Farmers in Enhancing Winter Vegetable Production

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Abstract

This article is an attempt to analyze the impact of Jalkund which is a simple, low cost water harvesting structure. The state of Meghalaya receives abundant rainfall during monsoon season but faces water scarcity during the dry winter months starting from November to March leading to monocropping practice by farmers. The solution to this problem is the construction of low-cost water harvesting structures by using UV-resistant polyethylene films. These films are durable, have high tensile strength, can withstand external pressures, prevent seepage, percolation losses and affordable for the small and marginal farmers. The introduction of Jalkund technology under NICRA project in Shri Nickseng D. Sangma's field at Norangre, West Garo Hills district led to a more increase in income generation by diversifying and improving the productivity of crops. Thus, Jalkund plays a crucial role in addressing water security challenges for both agricultural and domestic use in remote and resource-scarce areas.

Keywords: Jalkund, Monocropping, Rainwater harvesting, Vegetable production

Introduction

Northeastern Indian agriculture, especially in Meghalaya, confronts severe difficulties because of traditional farming methods, minimal input use and scarce water supplies during the dry season (Devi *et al*., 2017). The majority of the territory is mountainous and hilly; less than 30% of Meghalaya is made up of valley regions and more than 70% of the state has moderate to severe slopes (Choudhury *et al*., 2022). Blessed with an abundance of water resources, the region enjoys a monsoonal climate that ranges from tropical to temperate due to its location in India's greatest rainfall zone. While there is a lot of rainfall between April and November, there is very little precipitation throughout the dry winter months of November through March (Layek *et al*., 2020). In order to support crops and livestock in organic farming systems during the dry season, it is essential to build water collection facilities in mountainous terrain. Due to the lack of such structures, farmers are now only able to engage in one cropping cycle each year, which results in low cropping intensity and limited revenue generation (Layek *et al*., 2020).

Water conservation is especially difficult in hilly settings since traditional agricultural ponds have significant water losses from seepage, percolation and infiltration. The use of UV-resistant polyethylene films, like Silpaulin (200 GSM or higher), for lining these ponds and prevent seepage, and percolation losses is a workable solution to this problem. These films can tolerate external pressures, are strong and have a high tensile strength. Small and marginal farmers depend on these lined water harvesting structures, known as "Jalkunds," to sustain their winter vegetable cultivation. These structures have the capacity to retain 30,000-45,000 L of water (Samuel and Satapathy, 2008; Layek *et al*., 2020). Within 1-2 months following the end of the rainy season, unlined ponds can lose up to 55 liters of water $m^{-2}day^{-1}$ as a result of seepage and evaporation. Non-permeable lining materials must be used, in order to retain water during the dry season, which runs from November to March. For building Jalkund, low-density polyethylene (LDPE) sheets, also known as Agrifilm, have shown themselves to be a cost-effective and practical choice.

Article History

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Table 1: Economic analysis of Jalkund from a marginal farmer's perspective

Activity	Winter vegetables (During 2019)	Income generated (Rs.)	Total	Increase in income (%)
Pre-intervention	Only few plants of cabbage (100 nos.) were grown during rabi season	Rs. 1,500.00	Rs. 1,500.00	> 100%
Post-intervention	Cabbage var. Rareball; Area = 50 m^2, Spacing = 45×45 cm, No. of plants = 250, Avg. wt. of $plant^{-1}$ = 1.5 kg, Yield (kg) = 375, Selling price kg^{-1} = Rs. 10.00	Rs. 3,750.00	Rs. 11,300.00	
	Cauliflower var. Swati; Area = 30 m^2, Spacing = 45×45 cm, No. of plants = 150, Avg. wt. of $plant^{-1}$ = 1.0 kg, Yield (kg) = 150, Selling price kg^{-1} = Rs. 10.00	Rs. 1,500.00		
	Broccoli var. Indame pirate; Area = 25 m^2, Spacing = 45×45 cm, No. of plants = 125, Avg. wt. of $plant^{-1}$ = 0.80 kg, Yield (kg) = 100, Selling price kg^{-1} = Rs. 20.00	Rs. 2,000.00		
	Tomato var. US-1080; Area = 25 m^2, Spacing = 50×50 cm, No. of plants = 125, Avg. no. of fruits $plant^{-1}$ = 15, Avg. wt. of $plant^{-1}$ = 1.5 kg, Yield (kg) = 190, Selling price kg^{-1} = Rs. 15.00	Rs. 2,850.00		
	Chilli var. NS-1101; Area = 20 m^2, Spacing = 50×50 cm, No. of plants = 100, Avg. wt. of $plant^{-1}$ = 0.15 kg, Yield (kg) = 15, Selling price kg^{-1} = Rs. 80.00	Rs. 1,200.00		

Steps for Constructing Jalkund

In Northeast India, a Jalkund is built by first choosing a location with sufficient catchment runoff, then excavating a rectangular or circular pit that is 1.5-2.0 m deep and has the capacity to hold 30,000-45,000 L of water. Due to their durability, affordability and ability to hold water throughout the dry season, UV-resistant polyethylene sheets, such as Silpaulin (200 GSM or higher) or LDPE sheets (Agrifilm), are used to line the excavated pit and prevent seepage and percolation losses. Sand or geotextiles are used to secure the pit as a protective layer, enhancing durability and preventing liner damage. In order to reduce evaporation and contamination, the Jalkund is frequently covered with locally produced materials like bamboo mats or plastic sheets. Rainwater is absorbed into the structure through either natural slopes or artificial channels. Farmers in hilly areas can increase cropping intensity and household income by efficiently using stored water for dry-season vegetable growing when Jalkund is built and maintained properly.

Benefits of Jalkund

1. Jalkund is a potential low cost water harvesting structure mainly beneficial in addressing water security for both agricultural and domestic use during rabi season in remote and resource-scarce areas.

2. Their affordability, ease of construction and adaptability to local conditions make them an invaluable tool for small and marginal farmers in the region thereby promoting resilience

against climate variability and enhancing livelihoods.

3. During rainy season starting from May-June excess runoff water can be harvested, stored and used for different purposes rather than getting lost in the ground and causing soil erosion.

4. During dry months conserved water can be used efficiently to provide life saving irrigation to crops.

5. Farmers of West Garo Hills can be greatly benefitted by utilizing harvested water from Jalkund for agricultural and domestic purposes.

6. Jalkund mainly restricts the potential loses of water through infiltration, percolation, seepage flow and evaporation to a great extent.

7. As Jalkund is a low cost water harvesting structure farmers facing water scarcity can take up nutrition gardening as well as Jalkund simultaneously so that nutritious vegetables can be cultivated and consumed alleviating malnutrition and enhancing livelihood.

Thus, Jalkunds represent a practical, eco-friendly solution to water management in the challenging hilly landscapes of Northeast India (Figure 1).

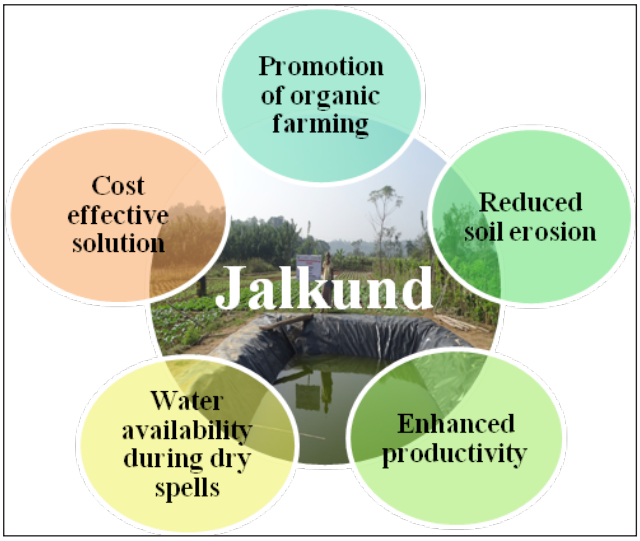

Figure 1: Jalkund and its benefit on small and marginal farmers

Success Story of Jalkund from Marginal Farmer's Perspective

Shri Nickseng D. Sangma, a progressive farmer resident of Norangre village has been growing winter vegetables since 10 years. However, the productivity of vegetables is decreasing every year due to scarcity of irrigation water. There is no source of irrigation water for *Rabi* vegetable crops although the village receives high rainfall during monsoon season. Thus, KVK, Tura scientific personnel had visited and conducted a group discussion with Shri Sangma to solve the problem regarding the cultivation of winter vegetables. After assessing, Krishi Vigyan Kendra, Tura imparted a training programme on low cost rainwater harvesting structure (Jalkund). An intervention was taken up at Shri Sangma's field to popularize low cost rain water harvesting structure 'Jalkund' under NICRA project with silpaulin size 5 m × 4 m × 1.5 m of 300 GSM having a storage capacity of 30,000 litres of water. The structure was constructed in an elevated uncultivable area of his farm so that he could irrigate the crops using flexible rubber pipes with the gravitational flow of water thereby reducing the input cost for irrigation. After construction of Jalkund, Shri Nickseng D. Sangma cultivated broccoli, cauliflower, cabbage, chilli and tomato in his farm (Figure 2). Income generated after the intervention of Jalkund in his farm is presented in table 1. The local neighbouring farmers were convinced with the technology and showed keen interest on low cost rainwater harvesting structure.

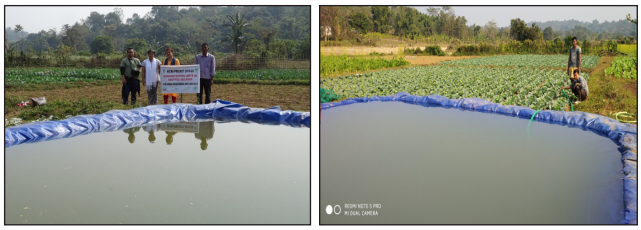

Figure 2: Jalkund for winter vegetable production at farmers' field

Conclusion

The farm ponds in North Eastern Hill Region are prone to water losses due to seepage, evaporation, high rate of infiltration and percolation. The local farmers of the region faced problem in storing of rain water for farm due to undulating topography and hilly terrain. The introduction of Jalkund technology has demonstrated its potential to transform agricultural practices in the hilly terrains of Northeast India, particularly Meghalaya. By addressing the critical issue of water scarcity during the dry season, Jalkunds enable farmers to cultivate high-value winter vegetable crops during the *Rabi* season, thereby increasing cropping intensity and significantly enhancing household incomes. The technology introduced and guided by KVK, West Garo Hills to Shri Nickseng D. Sangma has proved economically viable by cultivating winter vegetables in his farm and significantly contributing to his household income. The farmer was convinced by the easily adoptable technology of Jalkund which ensures water security leading to his expansion of land for cultivation of vegetables. Now, he is able to generate employment of himself and his four daughters who are engaged in the farm throughout the year. Many farmers and rural youths of the village visit his farm to learn the technology of water harvesting though him. Shri Sangma's success has inspired the local neighbouring farmers to adopt the profitable technology leading to overall benefit of the village.

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