



Success Story of Harminder Singh: Tree Based Farming

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The Bundelkhand region of central India is characterized as a semi-arid tropical zone. Due to its vulnerability to climate change and scarcity of resources, agricultural productivity in this area is notably low, leading to heightened production risks. The significant biotic pressure exerted on forests and communal lands, coupled with a decline in vegetation cover, has resulted in a shortage of fodder and fuelwood, which negatively impacts livelihood security. Low productivity in both crop and livestock sectors presents a considerable challenge in dryland environments. In this context, agroforestry—defined as the integration of trees within agricultural landscapes—has emerged as a viable and sustainable land-use strategy. This approach has the potential to yield both tangible benefits, such as additional income, food, fuel, and fodder for farmers, as well as intangible benefits, including the reclamation of degraded land, enhancement of biodiversity, conservation of natural resources, and contributions to climate mitigation. Overall, agroforestry is reported to enhance the livelihoods and food security of rural households, presenting significant opportunities for scaling up its implementation. In 2023, a tree-based food production system was implemented in the region; however, the enthusiastic and engaging character of Harminder Singh serves as a model and inspiration for numerous individuals Harminder Singh to engage in the agroforestry movement. This paper presents a detailed account of the achievements of, a forward-thinking farmer who advocates for a farmer-to-farmer approach.

Introduction

Harminder Singh, an innovative farmer from the semi-arid Bundelkhand region of Uttar Pradesh, has engaged in tree-based agriculture for over two decades, benefiting from the consultation and technical assistance provided by ICAR-CAFRI, Jhansi. He has successfully rehabilitated and utilized degraded land by cultivating 200 distinct species of trees and herbs on his farm. ICAR-CAFRI has equipped him with practical training in grafting and pruning of ber (*Ziziphus mauritiana*) as well as the top working of karonda (*Carissa caranda*). As a result, he now generates an annual income exceeding ₹0.10 million solely from the tree component of his farming system. Demonstrating a strong commitment to agroforestry, he actively promotes this practice in his community by distributing tree saplings and providing training in ber grafting and karonda top working to fellow farmers. His relentless efforts and accomplishments in adopting tree-based farming warrant documentation to enhance societal awareness and assist policymakers and relevant stakeholders in developing appropriate programs and projects aimed at fostering agroforestry-based sustainable production systems in semi-arid regions such as Bundelkhand.

Early Struggles

Harminder Singh, aged about 66 years is the educated only up to class 6 and is a dynamic and progressive farmer of Bundelkhand region of Uttar Pradesh. He owns 12

bighas (7.43 acres) of land in Ganeshgarh village of Babina block of Jhansi and has 40 years of experience in farming. During the last two decades he has been actively involved in practicing agroforestry to this. Through his own initiative, as well as with the technical assistance of the ICAR-Central Agroforestry Research Institute in Jhansi, he has successfully introduced over 200 species of trees and herbs (see Table 1) on his farm. His dedication and advocacy for a tree-based sustainable production model serve as a noteworthy example for resource-constrained and ecologically vulnerable areas such as Bundelkhand, making it an appropriate framework for farmer-to-farmer extension initiatives.

As an enterprising farmer, Harminder Singh has recognized the challenges faced by Bundelkhand, a region characterized by poor soil fertility, hard rock geology, and undulating topography typical of semi-arid tropical climates, where agricultural productivity is frequently hindered by severe climatic conditions. It is further acknowledged that high temperatures, coupled with inconsistent and inadequate rainfall, often result in crop failures in this area, thereby driving rural inhabitants to migrate to urban centers in search of sustainable livelihoods. In response to the need for resilient agricultural production, he promptly...

It has been established that tree-based systems represent a viable nature-based solution for the region. Harminder Singh has emerged as a role model for fellow farmers in the area. With the compelling advantages of tree-based farming systems, he continues to investigate additional potential woody perennials for integration into agroforestry practices in the Bundelkhand region. Since 2003, he has maintained a collaborative relationship with ICAR-CAFRI in Jhansi to enhance his expertise in tree-based farming. His enthusiasm for agroforestry has also motivated him to travel to other states, including Rajasthan, Uttarakhand, and Kerala, to acquire planting materials for his agricultural endeavors. Harminder Singh's profound understanding and commitment to sustainable livelihoods and income security serve as an exemplary model for future generations interested in tree farming. As he articulates, "By cultivating trees alongside crops, we can ensure the security and sustainability of our livelihoods for the next four generations"

Turning points

Tangible and Intangible benefits: Through the introduction of arboreal species on his farm, Harminder Singh has successfully marketed tree-derived products in local markets such as Babina and Jhansi, while simultaneously fulfilling his family's consumption needs. According to our estimates he generated an average annual income exceeding ₹0.10 million solely from the tree component during the fiscal year 2021-22. In addition, he utilizes the foliage of various tree species, including *Melia dubia*, *Leucaena leucocephala*, and *Ailanthus excelsa*, as fodder for his livestock. Furthermore, he reported employing bamboo and karonda as biofencing materials to safeguard his farm from cattle and other wildlife, particularly Nilgai (Bluebuck). Consequently, through the implementation of tree-based agricultural practices, Harminder Singh has effectively transformed his rocky and degraded land into a productive asset, yielding substantial financial returns. Figure 1 illustrates that more than 20% of his total income is derived from the tree component.

Recognition and Awards: Harminder Singh has been awarded "appreciation letters" from numerous public and private organizations in recognition of his dedicated efforts to promote sustainable production systems in the Bundelkhand region. In addition, he was honored by ICAR-CAFRI, Jhansi, in 2017 for his development of a farm that exemplifies an agroforestry model suitable for semi-arid tropical regions.

Technology Diffusion: The tree-based agricultural practices implemented by Harminder Singh are significantly influencing other farmers in the village, prompting them to initiate the planting of trees, at a minimum, along the bunds of their fields. Harminder Singh continues to

educate his fellow farmers about the role of tree-based products as a form of insurance against crop failures, particularly during the kharif season. Furthermore, he provides tree saplings at no cost to farmers in nearby villages, including those in Jhansi and select villages in Madhya Pradesh, such as Hirapur and Baroda. He serves as a master trainer, offering instruction on techniques such as ber grafting, pruning, and top-working of karonda to his peers (see Fig. 2), as these agricultural practices enhance both fruit yield and quality. The relentless efforts of Harminder Singh are commendable, as they not only secure the livelihoods of his fellow farmers but also promote climate resilience through the adoption of tree-based farming solutions in the region.

Summary and Conclusion

Agroforestry is a recognized agricultural practice that enhances climate resilience and promotes regeneration, demonstrating significant potential for sustaining the livelihoods of rural populations, rehabilitating degraded lands, and mitigating the adverse impacts of climate change, particularly in the ecologically vulnerable semi-arid regions of India. Consequently, bolstering farmer-to-farmer extension services, complemented by skill development training inspired by the case study of Harminder Singh, could facilitate increased outreach and inform policy planning aimed at promoting agro forestry throughout the semi-arid tropics, which encounter challenges analogous to those faced by the Bundelkhand region in the country.