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Promoting Worker Comfort and Efficiency in Vegetable Transplanting Practices in Northeast India

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ABSTRACT

The manual vegetable transplanter is a low cost and easy to use device that can enhance the process of transplanting vegetables in the terraced and hilly fields of the Northeast region of India. This equipment can overcome difficulties associated with hilly landscapes and lack of access to mechanized machinery, which makes it applicable to small farmers. It minimizes physical burden and repetitive movements, increases the comfort of the worker and minimizes musculoskeletal disorders; it contributes to sustainable farming methods such as organic agriculture. The transplanter enhances the establishment of crops by providing proper placement of the seedlings, spacing, and resulting in high yields and optimization of resources. It also gives women farmers power by cutting labour intensity and gender equity in agriculture. Although it has these benefits, the adoption issues like awareness, availability and the necessity of locally modified designs. Wider acceptance requires government support, training, and improvement in technologies. Overall, this device may enhance worker productivity, farming sustainability, and livelihoods improvement in Northeast India's unique agricultural landscape.

Keywords: Manual vegetable transplanter, Northeast India, sustainable farming, ergonomics

INTRODUCTION

The region of Northeast India has a lot of potential in terms of farmlands since it contains the fertile landscapes and has the abundance of biodiversity. The valley lands and foothills of Northeast India have a major agricultural activity, which is vegetable cultivation because of the fertile soils and favourable climate of the area. These regions favour the production of all types of vegetables like potatoes, tomatoes, beans, peas and greens. The old convention of farming coupled with organic agriculture is a contributing factor to the quality of produce. Terrace farming is common among the hilly areas where farmers aim to control the soil erosion and water run-offs. Moreover, there are a wide range of agro-climatic conditions that enable the year-round cultivation, thus securing constant

supply of vegetables to the local population and markets. Farming methods that are sustainable are being embraced more to increase production and maintain ecological balance. There are, however, some special problems within the region such as the hilly nature of the area and inadequate accessibility to modern farming tools and machines. In this respect, the use of manual vegetable transplanting tool has become a major innovation, which is likely to improve productivity and sustainability in the production of vegetables in the region.

Understanding the Manual Vegetable Transplanter

A manual vegetable transplanter is a simple, but effective device that can be used to perform transplanting of vegetable seedlings. It is usually comprised of a handle with operating mechanism, seedling delivery tube, a jaw mouth to make holes and plant the seedlings into the soil. It can be of two types (single row and double rows). The double row manual transplanter has an extra seedling carrying unit. The prototype feasibility testing (PFT) of this device was conducted at research farm of ICAR-Research Complex for NEH Region Umiam and later at farmers field in Ri Bhoi District and East Khasi Hills District of Meghalaya under AICRP on FIM Project of the institute. The device has a field capacity of about 0.021 ha/hr against with 180-200 seedlings per hour as compared to 0.015 ha/hr with 130 seedlings per hour in farmers' practice (Traditional manual method). The performance of the manual vegetable transplanter was found satisfactory in foothills and terraced land under Meghalaya condition. Due to stooping work posture and repetitive hand movement for long duration, transplanting operation in traditional method (farmers practice) involves excessive drudgery. This transplanter helps in reducing drudgery involved in vegetable transplanting and thereby improving overall occupational wellness among the vegetable farmers in Meghalaya and the region as a whole.

This device is especially beneficial in small-sized farms, where farmers cannot purchase and use costly machinery or have access to it. Their usefulness is not merely confined to economic issues since they also consider ergonomic factors in agricultural activities, which are labour intensive in hilly areas where activities such as transplanting usually cause a lot of physical pressure to the labourers. Additionally, the transplanters provide a feasible solution to the issues related to the problem of uneven landforms and the discontinuous land boundaries inherent to the northeastern Indian farmland. Moreover, the use of manual transplanters can greatly decrease the laborious attribute of transplanting thus improve operational efficiency and probably eliminate musculoskeletal illnesses that are common among the agrarian workers in such areas as the Northeast India. The new device is in line with the existing approach to organic farming in the Northeast of India that is based on sustainable practices such as crop rotation, organic waste, and biological pest control, without the use of chemical fertilizers.

Figure 1: Vegetable transplanting on terrace
(a. Transplanting by hand and b. Transplanting by manual transplanter)

Benefits for Northeast India

Cost-Effective Solution: The biggest benefit of hand vegetable transplanters is that they are cheaper. This is because in a region where most farmers are subsistence farmers, it is not always possible to invest in expensive tools. This manual transplanter is cheap and offers a feasible alternative to increasing the efficiency of planting without the need to pay a huge amount of money (Kumar & Raheman, 2008). This affordability will enable a larger fraction of the agricultural community to embrace better farming methods, and in the process, increase the overall productivity and economic sustainability of agriculture in the area. Moreover, the lower capital expenditure that comes with such transplanters allows farmers to invest more wisely in other important farming inputs like quality seeds and organic fertilizers which adds more strength in crop yields and sustainability.

Worker comfort & Efficiency: The manual transplanter has also greatly minimized the physical exertion on the farmers since they are able to transplant the seedlings faster and more effectively (Kumar & Raheman, 2008). This increased the total area that could be planted within a specific time, but it also removes the tedious nature of manual labour and, as a result, farming becomes a more sustainable profession (Singh et al., 2022).

Suitability for Hilly Terrain: The topology of Northeast India is mainly hilly, and thus heavy machinery would be difficult to utilize. The convenience of having light and portable manual transplanters fitted in such terrains enables the farmers to go through the slopes and uneven grounds easily. This flexibility is a major limitation in which bigger machines with more complex designs cannot be used on fragmented and terraced plots that occupy most of the area (Singh et al., 2020, 2022; Singh and Karmakar, 2021).

Improved Crop Establishment: Hand transplanters help in enhancing crop establishment by maintaining a high level of accuracy in the position of seedlings and the level of spacing. This

accuracy reduces the level of damage to seedlings and improves the growth environment resulting in healthier plants with increased yield. Such uniformity is important towards the later mechanization operations and generally field management. Such uniformity in planting also contributes to the ideal use of resources, including water and nutrients, and, therefore, a higher total agricultural production (Singh et al., 2022). Additionally, transplanters will result in significant labour and operating economy savings, and vegetable farming will become more cost-effective to smallholders (Islam, 2018).

Empowering Women Farmers: The manual vegetable transplanter is user-friendly and can empower women farmers because it cuts down the physical labour incurred in the traditional transplanting systems, thus enhancing gender equity in the agricultural practices (Gupta, 2025; Singh et al., 2006). This does not only enhance their efficiency but also makes them be willing to continue engaging in the agricultural activities hence developing the region sustainably. Occupational safety and health issues are also addressed in this technological intervention because manual transplanting is less manual, making it less burdensome and heavy work and is prone to musculoskeletal disorders (Singh et al., 1985). Moreover, the transplanter can prevent the occurrence of work-related injuries and fatigue because of the reduced duration of stooping and repetitive movements, which will eventually promote the overall well-being and productivity of the workers in a farming environment (Saiyed et al., 2018).

Challenges and Considerations

Though the manual vegetable transplanter has many advantages, it is not adopted without difficulties. To create awareness about the proper use and maintenance of the tool, training and awareness programs must be conducted to educate the farmers about the tool. Also, it will be important to ensure that the quality transplanters are made affordable to enable large acceptance. Future studies of designs that are locally adaptable might also contribute to higher rates of acceptance and support the unique needs of the regions so that the technology becomes accessible and efficient to all kinds of agricultural communities. Additionally, even though more automated transplanters are available to different types of crops, the topographical and socioeconomic realities of the region of Northeast India require that attention remain on manual and semi-automated systems to suit the area-specific agricultural operations (Singh et al., 2020). The fact that some of the agricultural processes still require manual approach, especially those that have repetitive and monotonous tasks, such as the process of weeding, shows that ergonomic solutions were and continue to be needed in small-scale farming settings (Borah and Borah, 2020). This is in line with the overall aim of minimizing physical workload and musculoskeletal diseases that is related to the conventional farming methods being experienced in harvesting rice and fruits hence enhancing the overall well-being and efficiency of the agricultural labourers.

Therefore, a holistic solution is to be proposed to enhance the use and maximization of the benefits of manual vegetable transplanters, such as the policy support, technological optimization, and training of farmers. Subsidies and incentives provided by the government can decrease the financial boundary in small-scale farmers and cooperation between the agricultural research institutions, and the local manufactures can lead to more powerful and situational transplanter models. In addition, new training programs and extension services would be very significant in enhancing skills and

knowledge of farmers on how to use and maintain them, which will form the engine in advancing the agricultural operations and production. In addition to this, these efforts must be accompanied by more broad-based approaches to sustainable agriculture, such that the introduction of manual transplanters not only can lead to the high yields but also be the ecological stability and the food security in the region in the long term. This descriptive strategy would help in preventing the low adoption of the other farm implements that are mechanized due to factors like high prices of acquisition and lack of knowledge. Such a holistic would also need to take into consideration the socio-economic status of farmers and barriers to the use of modern tools and techniques that exist because this would significantly influence the success of agricultural interventions. Further investment in light weight, ergonomically designed instruments that have been adapted to fit hilly areas would do much in alleviating the physical challenges of agricultural work in such strenuous conditions in improving operations and reducing the fatigue levels by the farmers.

CONCLUSIONS

The manual vegetable transplanter is a farmer-friendly and simple tool with high potential of mechanizing the transplanting practice in the foothills and terrace lands in Northeast India. It has the potential to enhance the crop yields, enhance food security, and livelihoods by meeting the unique farming needs of the region. Ergonomically, the tool minimizes the bending and repetitive load, reduces fatigue and both men and women farmers can comfortably use it even when old. The transplanter would be a significant move towards sustainable and labour efficient farming in the area with the help of government agencies, NGOs and the extension services.

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