

Ergonomic Interventions in Manual Harvesting: Enhancing Health and Productivity

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Introduction

Farming in India, particularly in smallholder and marginal holdings, continues to be heavily reliant on manual labour. A large proportion of agricultural activities—from sowing to harvesting—are performed manually, with harvesting being one of the most physically demanding. While modern agriculture talks about drones, AI tools, and automation, the reality in rural India remains rooted in traditional practices, especially during harvesting seasons when time is short, labour is intense, and physical tolls are high.

Manual harvesting, by its very nature, involves continuous bending, squatting, cutting, lifting, and carrying. These actions, when performed repetitively and without ergonomic support, cause pain, fatigue, injuries, and long-term health issues. Most of these impacts are borne by rural women, who make up a significant share of India's agricultural workforce. Despite contributing significantly to food security, their drudgery remains invisible in policy discourses.

Ergonomics—the science of designing work environments that fit human capabilities—offers viable and low-cost interventions to reduce physical strain and improve efficiency. Yet, despite the proven benefits of ergonomic tools in enhancing productivity and worker health, their adoption in Indian agriculture remains limited. This article explores the importance of ergonomic interventions in manual harvesting, the risks of traditional practices, examples of successful tool innovations, and the pathways for ensuring wider access and adoption.

Ergonomics in Agriculture

The term "ergonomics" might sound technical or industrial to many farmers, but it simply refers to practices and tools that make work easier, safer, and more productive. In agriculture, ergonomics is about designing implements, tools, and workflows that reduce the load on the human body while enhancing work efficiency.

A farmer cutting paddy for eight hours a day using a blunt sickle without a proper grip is bound to

suffer wrist pain, backache, and fatigue. A woman bending down to harvest groundnuts or vegetables for hours experiences neck and knee stress. Ergonomic interventions focus on making these tasks less taxing by improving tool design, posture, rest cycles, and awareness.

While mechanization is an ideal goal, it's not always practical in small or fragmented landholdings, hilly terrains, or where crops like millets, pulses, or vegetables are grown in mixed patterns. Here, ergonomics becomes a more accessible and sustainable solution.

Health Risks Faced by Manual Harvesters

Before discussing interventions, it's crucial to understand the nature of the health hazards that manual harvesting poses. A majority of these issues fall under musculoskeletal disorders (MSDs). These include injuries or pain in joints, muscles, and nerves, often caused by repetitive motion, awkward posture, or forceful exertion.

Common ergonomic risks in manual harvesting

1. **Prolonged Bending and Squatting:** Paddy, wheat, and groundnut harvesting require farmers to remain bent for long hours. This leads to strain in the lumbar spine, knee joints, and thigh muscles.
2. **Repetitive Arm Movements:** Using traditional sickles or knives without a break can cause shoulder and wrist pain, tennis elbow, or carpal tunnel syndrome.
3. **Forceful Cutting Actions:** Without sharp or serrated blades, more pressure is required for cutting, leading to finger numbness or blisters.
4. **Head Load Carrying:** Farmers, especially women in hilly regions, often carry harvested produce on their heads. This leads to neck pain, spinal curvature issues, and fatigue.
5. **Climatic Exposure:** Working in open fields under the sun or rain without protective gear accelerates dehydration, exhaustion, and thermal stress.

6. **Extended Work Hours Without Rest:** During peak harvesting time, rest breaks are limited. Continuous physical work without recovery leads to cumulative fatigue and a higher chance of injury.

A study by Nag and Nag (2004) in rural West Bengal revealed that over 60% of women farmers experienced lower back pain and knee discomfort linked directly to postural strain during harvesting. Similar studies by TNAU in Tamil Nadu, and ICAR-CIAE in Bhopal, corroborate the widespread physical distress faced by agricultural workers.

Gender Dimensions in Ergonomic Challenges

Women constitute around 60–70% of the manual workforce in harvesting activities in many parts of India. However, most tools in the market are designed with male anthropometric dimensions. This mismatch leads to further discomfort, injuries, and inefficiencies for women. For instance:

- Standard sickles have wide handles and blade sizes designed for larger male hands.
- Load carriers are often too tall or too heavy for women to use comfortably.
- Cultural roles restrict women from using carts or wheeled tools, increasing their burden.

Involving women in participatory tool design—where their feedback, hand sizes, height, strength levels, and comfort are considered—can transform the usability and acceptance of ergonomic innovations.

Successful Ergonomic Interventions in Harvesting

Numerous simple and locally adapted interventions have been developed by agricultural universities and rural innovators. Below are some widely tested and farmer-approved tools that enhance comfort and productivity:

1. Ergonomic Serrated Sickles

These are improved versions of traditional sickles, with sharper serrated blades and ergonomically designed handles. Their features include:

- Reduced force requirement during cutting
- Better grip with non-slip materials
- Curved blade allowing natural hand motion
- Reduced wrist twist

A field trial by CIAE found that such sickles reduced wrist pain by 40% and increased cutting efficiency by 25–30%.

2. Low-Cost Harvesting Stools

For crops like brinjal, chili, and groundnuts, farmers can use small foldable stools to avoid continuous bending. These stools are lightweight, portable, and easy to maintain. TNAU reported that the use of such stools reduced fatigue and back pain among women farmers by **60%** in pilot areas.

3. Supportive Gloves and Arm Guards

Protective gloves with padded grips reduce finger injuries, and cotton-lined gloves prevent sweating. For sugarcane and banana harvesters, arm guards protect against cuts and friction.

4. Shoulder and Backpack Load Carriers

Instead of traditional headloading, improved load carriers distribute weight across the shoulders and back, protecting the spine and neck. These are particularly useful for women in Uttarakhand and Himachal Pradesh working on terraced farms.

5. Knife with Arm Support (for Sugarcane)

Specialized knives with armrests allow force to be distributed along the arm instead of only the wrist. This tool helps in reducing fatigue during heavy-duty cutting in crops like sugarcane.

Field Experiences and Impact Stories

Madhya Pradesh: Women's Collective in Paddy Fields

In Betul district, a group of 30 women farmers introduced serrated sickles during the kharif season. Initially skeptical, the women reported a notable reduction in hand pain within a week. They found the cutting easier, which allowed them to harvest an additional plot by the end of the season. With increased output, their daily income rose by 20%.

Tamil Nadu: Brinjal Harvesting with Stools

A village near Coimbatore adopted low stools for vegetable harvesting, especially for women above 45 years who faced chronic knee pain. The women reported better energy levels even after 6 hours of work and demanded more such tools in the next season.

Himachal Pradesh: Load Carriers for Apple Harvesters

Women apple pickers in Shimla started using backpack-based fruit carriers instead of baskets on their heads. These carriers, with soft padding and weight distribution, reduced neck stiffness and improved post-harvest sorting speed.

Why Adoption Remains Limited

Despite visible success and documented benefits, the spread of ergonomic interventions has not been rapid. Some key challenges include:

- **Lack of Awareness:** Many farmers accept body pain as part of farming and are unaware that better tools can reduce it.
- **Cost Factor:** Even though tools like ergonomic sickles cost only Rs. 80–150, marginal farmers are hesitant without demonstrations.
- **Limited Access:** Many such tools are only available in university outlets or city-based agro-stores.
- **Cultural Inertia:** In several communities, traditional methods are seen as a rite of passage, and changing them faces resistance.
- **Gender Barriers:** Male family members often purchase tools, ignoring the needs of women who perform the work.

What Can Be Done: The Way Forward

1. Field Demonstrations and Awareness Camps

Demonstration days organized by Krishi Vigyan Kendras (KVKs) or NGOs can showcase ergonomic tools in action. Seeing is believing for most rural communities.

2. Integration into Government Schemes

Ergonomic tools should be included under subsidies in schemes like PM-Kisan, NRLM, and ATMA. Special incentives can be given for women-headed farms or SHGs.

3. Promoting Rural Tool Entrepreneurs

Local youth can be trained to manufacture and repair such tools, ensuring availability and generating rural employment.

4. Policy Advocacy for Ergonomic Literacy

Just like sanitation and nutrition, “ergonomic literacy” should become part of rural development training modules. Extension workers should be trained to teach proper postures and tool use.

5. Women-Led Design Innovation Hubs

Colleges of Home Science and Agricultural Engineering can work with SHGs to co-develop, test,

and modify tools that are culturally and ergonomically suited.

Conclusion

Agriculture will always require physical work. But suffering and drudgery are not inevitable parts of farming. Ergonomic interventions—whether a better sickle, a small stool, or a well-designed glove—are not luxuries but essentials for a dignified and productive rural life. When we reduce fatigue, we increase efficiency. When we reduce injury, we increase livelihood security. And when we design for women, we empower the majority of India’s rural workforce.

The need of the hour is to make agricultural ergonomics a mass movement—where farmers don’t merely adjust to their tools, but tools are built to serve the farmers. In doing so, we create not just better crops, but better lives.

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