

Zero-waste farming with *bichu ghaas*: A circular approach to environmental sustainability

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Hill agriculture in Uttarakhand and Himachal Pradesh faces persistent challenges such as fragile soils, limited land availability, rising input costs and increasing climate variability. These conditions require farming approaches that are low-input, resource-efficient and environmentally sustainable. Zero-waste farming offers a practical approach by promoting effective utilisation of locally available biological resources and reducing dependence on external inputs. Stinging nettle (Bichu Ghaas), a naturally occurring plant traditionally used by hill communities, remains underutilised in organised farming systems. This article highlights the potential of stinging nettle in supporting circular and resource-efficient hill agriculture. By linking indigenous knowledge with practical extension approaches, nettle can contribute to food and nutritional security, soil health improvement, biomass recycling and livelihood support, thereby strengthening farm resilience and environmental sustainability.

Keywords: Circular agriculture, Hill farming systems, Indigenous plant resources, Underutilised plant

AGRICULTURE in the Himalayan hill regions of India is strongly influenced by steep slopes, shallow erosion-prone soils, fragmented landholdings and high dependence on rainfall. In states such as Uttarakhand and Himachal Pradesh, farming systems that rely heavily on external inputs often become economically and environmentally difficult to sustain. Traditionally, hill communities depended on locally available plant resources to support food security, soil fertility and rural livelihoods. However, changing agricultural practices and declining use of indigenous knowledge have led to the underutilisation of many such resources.

Zero-waste farming has emerged as a practical approach for improving resource efficiency in these fragile ecosystems. By promoting reuse and recycling of on-farm biomass, it helps reduce waste generation, improve soil

health and lower dependence on external inputs. Such approaches are increasingly important in hill agriculture, where climate variability and limited resource availability continue to affect farm sustainability.

Among the naturally occurring plant resources in the Himalayan region, stinging nettle (*Bichu grass*) (*Urtica dioica*) holds considerable potential. Although commonly

regarded as a weed because of its stinging hairs, nettle has traditionally been used by hill communities for food and household purposes. Reports also indicate that nettle leaves contain minerals and dietary fibre, adding to their local importance. Its natural abundance, low-input growth habit and multiple on-farm uses make it suitable for integration into resource-efficient and circular farming systems.



Natural growth of stinging nettle in Himalayan hill region

Stinging nettle in Himalayan agro-ecosystems

Stinging nettle commonly grows along forest edges, irrigation channels, field boundaries, abandoned terraces and moist slopes. The plant thrives naturally under temperate conditions and prefers slightly moist, nutrient-rich soils typical of hill agro-ecosystems. Its rapid regeneration after harvesting and ability to grow without irrigation, fertilisers or plant protection chemicals makes it suitable for low-input farming systems.

Soil conservation: In hill agriculture, naturally occurring vegetation plays an important role in maintaining ecological stability. Stinging nettle contributes by providing ground cover that helps reduce soil exposure and erosion, particularly during the monsoon season when runoff and soil loss are major concerns on sloping lands. Since nettle grows naturally without tillage or external inputs, it supports resource conservation while minimising soil disturbance.

Efficient resource: Nettle occupies spaces that are generally left unused, such as field margins, terrace edges and fallow patches. When managed properly, these areas can serve as valuable biomass sources for hill farmers. Selective harvesting at suitable growth stages allows farmers to utilise nettle for household and farm purposes without affecting its natural regeneration. Such utilisation supports efficient recycling of locally available biomass in hill farming systems.

Biodiversity conservation: Stinging nettle also supports biodiversity by providing habitat for insects and other organisms involved in nutrient cycling and ecological balance. The conservation of such native plant species within agricultural landscapes is increasingly considered important for climate-resilient hill farming. Recognising the ecological and farm-level importance of stinging nettle can therefore support its wider integration into sustainable hill agriculture systems.

Indigenous and traditional uses of stinging nettle

Indigenous communities in the Himalayan regions of Uttarakhand and Himachal Pradesh have traditionally utilised *bichu ghaas* as part of their food and household practices. Despite its stinging nature, local communities developed simple methods to safely handle and process the plant for regular use. This traditional knowledge reflects efficient utilisation of naturally available plant resources within hill farming systems.

Young nettle shoots and tender leaves are generally harvested during early spring, when the availability of cultivated vegetables remains limited in many hill areas. Blanching or boiling is commonly practiced to neutralise the stinging hairs before consumption. Such traditional practices not only supported food availability during lean periods but also improved dietary diversity in remote villages with limited market access. Nettle leaves are also reported to contain minerals and dietary fibre, contributing to their nutritional importance in local diets.

In addition, stinging nettle has been associated with traditional household and wellness-related practices. Simple preparations from leaves or roots for general well-being reflects the perceived functional value of the plant within hill communities. These uses are generally based on experience and emphasise minimal processing and complete utilisation of available plant material.

In some Himalayan areas, nettle stems were historically used for making coarse fibre, ropes and household items. Although

such practices have declined over time, they demonstrate the multi-purpose nature of the plant. Unused biomass is often composted or left to decompose naturally, helping return organic matter to the soil. Reviving and documenting these indigenous practices through extension support can strengthen resource-efficient and low-input farming systems in hill regions.

Zero-waste farming system

Zero-waste farming is based on efficient reuse and recycling of on-farm resources so that minimal waste is generated within the farming system. Such approaches are particularly important in hill agriculture, where external inputs are often costly and ecological conditions remain fragile. By improving utilisation of locally available biomass, zero-waste farming can support soil health, reduce input dependence and strengthen farm resilience.

Stinging nettle fits well within this approach because of its multiple on-farm uses. The plant can be utilised for food, fodder supplementation, composting and biomass recycling, allowing farmers to derive value from naturally available vegetation growing along field margins and non-cropped areas. When managed properly, nettle functions as a useful farm resource rather than an unwanted weed.

In a zero-waste farming approach, utilisation of stinging nettle does not require complete removal of the plant. Selective and periodic harvesting allows continuous regeneration while maintaining sustained availability.



Traditional household consumption of stinging nettle leaves in hill communities



Circular utilisation of stinging nettle in zero-waste hill farming systems

Young leaves are collected for household consumption, whereas mature plant parts and remaining biomass can be utilised for composting and other farm purposes. This helps maximise resource use without disturbing the natural growth cycle of the plant. Since nettle commonly grows along field margins and non-cropped areas, its use does not interfere with primary crop production.

The role of stinging nettle in resource recycling is further strengthened through composting of unused biomass. Organic residues returned to fields contribute to soil organic matter buildup, improved moisture retention and better nutrient availability. Organic biomass recycling helps improve soil health and long-term farm sustainability in low-input systems. An important advantage of this approach is that farmers can adopt it gradually without major changes in existing cropping practices. This makes nettle-based resource utilisation particularly suitable for small and marginal hill farmers seeking practical and low-cost farming solutions.

Food, fodder and biomass utilisation in zero-waste systems

One of the major strengths of stinging nettle in hill farming systems is its diversified utilization.

It supports food use, fodder supplementation and biomass recycling within the same farming system, making it suitable for low-input hill agriculture. In many hill communities, nettle-based foods are consumed fresh or preserved in dried form for later use, especially during periods when market vegetables are less available. Dried leaf powder can also support seasonal food availability and reduce post-harvest losses. Nettle leaves are reported to contain minerals and dietary fibre, adding nutritional value to local diets.

Besides food use, processed or wilted nettle biomass can be used as supplementary fodder during periods of limited fodder availability. In mixed farming systems, this helps improve overall resource efficiency while reducing pressure on cultivated fodder crops. Mature leaves, stems and residual

biomass can be effectively processed to composting. Compost prepared from nettle biomass contributes organic matter to the soil, improves moisture retention and supports microbial activity. Application of such compost in fields and kitchen gardens can help improve soil fertility under low-input conditions.

These uses complement one another within the farming system. Food use generates limited waste, fodder reduces surplus biomass and composting returns remaining plant material back to the soil, supporting efficient resource recycling in hill agriculture.

Environmental benefits of integrating stinging nettle in hill agriculture

Integrating stinging nettle into hill farming systems offers several environmental benefits that are particularly relevant to the ecologically fragile Himalayan regions. In hill agriculture, steep slopes and intense rainfall frequently result in soil erosion and nutrient loss. Naturally growing nettle patches along field margins, terrace edges and fallow areas help reduce surface runoff and protect topsoil, particularly during the monsoon season.

Stinging nettle also supports soil health through recycling of organic biomass. Compost prepared from nettle residues contributes organic matter and nutrients that improve soil structure, moisture retention and microbial activity. Another advantage of nettle integration is reduced dependence on synthetic inputs. Since the plant grows naturally without fertilisers or pesticides, its use within farming systems supports environmentally responsible production practices

Table 1. Role of stinging nettle in a zero-waste hill farming system

Plant component	Traditional use	Modern extension use	Contribution to circular farming
Young leaves	Seasonal leafy vegetable	Dried leaf powder, herbal preparations	Enhances food security, reduces market dependence
Mature leaves	Traditional wellness preparations	Compost input	Nutrient recycling and soil enrichment
Stems	Fibre for local crafts	Biomass for composting	Waste reduction and organic matter addition
Residual biomass	Field disposal	On-farm compost	Supports soil health and closes nutrient loops

Table 2. Environmental and livelihood benefits of integrating stinging nettle in hill farming

Sustainability dimension	Observed benefit	On-farm implication	Long-term impact
Soil health	Improved organic matter	Better moisture retention	Enhanced resilience to climate stress
Resource efficiency	Full biomass utilisation	Reduced waste generation	Lower input dependency
Biodiversity	Retention of native plants	Ecological balance	Sustainable land use
Livelihood support	Value-added products	Supplemental income	Diversified farm economy

and lowers the risk of soil and water contamination.

From a broader ecological perspective, conserving native plant species within agricultural landscapes supports biodiversity and ecological balance. Nettle patches provide habitat for beneficial insects and other organisms associated with nutrient cycling. Together, these benefits contribute to resource-efficient and environmentally sustainable hill agriculture.

Practical suggestions for farmers

- Harvest young leaves using gloves during the early growth stage.
- Blanch or boil leaves before household consumption.
- Dry surplus leaves under shade for seasonal storage and leaf

powder preparation.

- Utilise mature biomass and residual plant material for composting.
- Maintain nettle patches along terrace edges and non-cropped areas to support natural regeneration.

Extension efforts should encourage the integration of nettle along field margins and terrace edges rather than promoting it as a separate crop. Such an approach allows gradual adoption without affecting existing cropping systems. These practices also align with programmes promoting sustainable agriculture, including Natural Farming, Paramparagat Krishi Vikas Yojana (PKVY) and climate-resilient hill farming initiatives. Documentation and dissemination of local success stories can further

improve awareness and encourage wider adoption of nettle-based resource utilization practices.

SUMMARY

Stinging nettle (*Bichu ghaas*) is an underutilised but valuable plant resource for strengthening resource-efficient farming in the Himalayan hill regions of Uttarakhand and Himachal Pradesh. Traditionally used for food and household purposes, this naturally growing plant has considerable potential in supporting soil health improvement, biomass utilisation and reduced dependence on external inputs. Its integration into hill farming systems can contribute to low-input and environmentally sustainable agriculture while improving on-farm resource efficiency. By combining indigenous knowledge with practical extension support, stinging nettle can be repositioned from a neglected weed to a useful component of resilient hill farming systems. Promoting its farmer-friendly utilisation can support climate-resilient and sustainable hill agriculture.

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TECHNICAL ASPECTS

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