

Exploring *Canna indica* as a Catalyst for Economic Growth and Ecological Balance in Rural India

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Abstract

Canna indica, known for its ability to thrive in marginal and nutrient-poor soils, is especially valuable in rural Indian settings where resources for large-scale infrastructure are limited. It flourishes in degraded, waterlogged, and nutrient-deficient soils, making it ideal for low-input cultivation. Its unique phytoremediation properties enable it to absorb pollutants and purify stagnant wastewater, providing an effective, low-cost solution for improving rural sanitation and public health. Beyond its ecological advantages, *Canna indica* holds significant economic potential. Its colorful flowers are suitable for ornamental purposes, enhancing the aesthetic value of landscapes and offering potential market value through floriculture. Encouraging its cultivation and utilization can enhance livelihoods, ecological resilience, and create a more sustainable rural economy.

Introduction

Canna indica can play a crucial role in empowering rural India by providing an affordable, eco-friendly solution to water pollution through natural phytoremediation. Its cultivation requires minimal resources, making it accessible to small farmers and village communities. By creating job opportunities and enhancing local environmental health, *Canna indica* fosters both economic growth and ecological balance in rural areas.

Canna indica, locally known as "Indian shot" or "Canna Lily," is a fast-growing, tropical plant that flourishes in varied climates and poor soils. It is a robust, perennial herb that reaches heights of 2-3 meters. It features broad, banana-like leaves (Karungamye, 2022) and vibrant flowers in shades of red, orange, yellow, and pink (Figure 1). The plant thrives in wetlands, marshes, and moist soils, tolerating a wide range of climatic conditions. While it has long been cherished for its aesthetic appeal in gardens and landscapes, recent scientific explorations have begun to unravel its tremendous potential in sustainable development (Table 1). It is now gaining

attention for its ability to purify wastewater, prevent soil erosion, and provide biomass for compost and energy generation. This article delves deep into the multifaceted uses of *Canna indica*, emphasizing its ecological and economic benefits. From phytoremediation and bioenergy to wastewater treatment and livelihood generation, *Canna indica* stands out as a resilient and versatile plant species capable of addressing pressing global challenges related to climate change, pollution and rural poverty.

Table 1. Some characteristic features of *Canna indica*

Feature	Advantage
Hardiness	Tolerates waterlogging, drought, and poor soils
High Biomass Production	Allows for greater pollutant uptake and regular harvesting
Aesthetic Value	Enhances the visual appeal of treatment sites, which is important for public acceptance
Low Maintenance	Grows without the need for fertilizers or pesticides
Rhizome Propagation	Easy to multiply and distribute in rural areas
No Edibility Risk	Non-edible parts reduce the risk of pollutants entering the food chain

Ecological potential of *Canna indica*

Canna indica is more than just a decorative plant. It plays several important ecological roles that contribute to environmental sustainability, especially in rural and semi-urban ecosystems (Figure 2). Its adaptability, fast growth and physiological characteristics make it highly beneficial for restoring, maintaining and enhancing natural ecological processes.

1. Phytoremediation: *Canna indica* is widely used in constructed wetlands and wastewater treatment

systems (Singh *et al.*, 2016). It absorbs and accumulates pollutants such as nitrates, phosphates and heavy metals (eg, lead, cadmium and chromium) from contaminated water and soil. It significantly reduces biochemical oxygen demand (BOD) and chemical oxygen demand (COD) in domestic and industrial wastewater (Pinninti *et al.*, 2021).



Fig. 1. *Canna indica*

It offers significant advantages in phytoremediation due to its robust growth, extensive root system and high pollutant absorption capacity. It efficiently removes heavy metals, excess nutrients and organic contaminants from wastewater and polluted soils, making it a versatile and eco-friendly option for environmental cleanup. Its ability to support beneficial microbial communities in the root zone enhances biodegradation processes. Additionally, *Canna indica* is low-cost, requires minimal maintenance, and provides aesthetic and economic benefits, making it especially suitable for sustainable wastewater management in rural and resource-limited areas.

2. Soil Conservation and Erosion Control

Its dense and fibrous root system binds soil particles, reducing soil erosion, especially on slopes or near water bodies. It can be planted as a natural barrier along drainage channels, bunds or degraded hillsides to prevent runoff and land degradation.

3. Habitat Enhancement and Biodiversity Support

The flowers of *Canna indica* attract pollinators such as bees, butterflies and hummingbirds,

contributing to local biodiversity. It provides shelter and habitat for insects, amphibians and small birds, particularly in wetland or riparian areas.

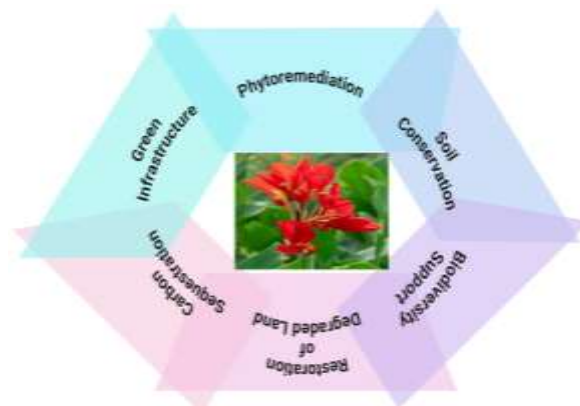


Fig. 2. Ecological potential of *Canna indica*

4. Carbon Sequestration and Biomass Generation

Being a fast-growing plant, *Canna indica* has high biomass productivity, contributing to carbon fixation and reducing atmospheric CO₂. The plant can be harvested regularly for use in bioenergy (biogas, bioethanol) or converted to biochar, improving soil health while locking carbon in the soil.

5. Restoration of Degraded Land

It grows well in nutrient-poor and waterlogged soils, making it suitable for the rehabilitation of degraded or marginal lands. Its robust nature helps reclaim contaminated sites, such as abandoned mining areas or urban brownfields.

6. Green Infrastructure and Aesthetic Landscaping

Canna indica can be used in urban green belts, bioswales, rain gardens and along roadsides to enhance ecological functions like water purification, air filtration, and microclimate regulation. Its aesthetic value promotes public awareness of ecological restoration and beautification of public spaces with functional benefits.

Economic Benefits of *Canna indica*

Canna indica is an economically valuable plant for rural communities due to its low cultivation cost and easy propagation. It helps reduce expenses related to wastewater treatment by naturally cleaning polluted water. Additionally, its biomass can be used for compost, fodder or bioenergy, offering extra income opportunities. The cultivation and maintenance of *Canna indica* also create local employment, making it a sustainable option for both environmental and economic benefits.

1. Low-Cost Wastewater Treatment

Canna indica is highly effective in phytoremediation, the natural purification of wastewater. Unlike conventional wastewater treatment systems that require heavy investment and technical maintenance, *Canna indica* offers a natural, low-cost solution (Chaudhari *et al.*, 2023). Reducing the spread of waterborne diseases (malaria, dengue, diarrhea), it lowers the medical costs for rural households and health departments.

2. Employment Generation

Activities such as land preparation, planting, watering, maintenance and harvesting generate rural employment, especially for women and landless labourers. Workers gain knowledge in nursery management, plant care, and wastewater handling, which can later be monetized through self-employment or group enterprises.

3. Income from Ornamental Use

Canna indica is valued for its colourful, vibrant flowers, making it an attractive ornamental plant for roadside beautification, landscaping in tourism zones and sale in local flower markets, temples, and for decorative use. Flowers can be harvested and sold, and plantlets can be propagated and marketed, generating supplementary income for rural women's self-help groups (SHGs).

4. Reuse of Treated Water for Irrigation

After phytoremediation, treated wastewater can be safely reused for irrigating kitchen gardens, horticultural crops, or fodder plots. This reduces the dependency on freshwater sources, promoting sustainable agriculture and lowering irrigation costs.

5. Promotion of Rural Eco-Tourism

When planted in scenic clusters around ponds, streams, or community spaces, *Canna indica* enhances aesthetic appeal. Such beautification efforts attract tourists, contributing to rural tourism revenue.

6. Medicinal and Ethnobotanical Uses: *Canna indica* is used in traditional medicine for treating fevers,

menstrual disorders, and skin infections. With increasing demand for herbal and natural remedies, the plant could be explored for commercial medicinal product development.

Conclusion

Canna indica act as a natural filter, soil stabilizer, carbon sink and biodiversity supporter, making it an ideal candidate for eco-restoration, sustainable landscaping and green technology applications. From wastewater management to biomass utilization and rural crafts, this resilient plant can significantly contribute to income generation, cost savings, and sustainable rural development. Integrating *Canna indica* into environmental management strategies not only supports ecological balance but also aligns with global goals for sustainability and climate resilience.

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