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Highway Median Plantation Strategies across Diverse Indian Agro-Climatic Zones

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ABSTRACT

Increasing air pollution demands effective and sustainable solutions. Plantation of indigenous and native small to medium-sized plants in highway medians offers a practical way to absorb particulate matter and gaseous pollutants, thereby improving roadside air quality. This review highlights suitable native species for highway medians across India's agro-climatic zones, emphasizing plant size and adaptability, along with limitations associated with median plantations. It also discusses the ecological impacts of planting non-indigenous species in such settings.

Keywords: Highway medians, Indigenous plants, Air purification, Pollution control, Small and medium trees, Limitations, Invasive species

INTRODUCTION

Air pollution poses a serious environmental threat requiring urgent mitigation. One viable approach is planting native and indigenous plants along highways, especially in medians. However, median strips have limited width and space, so large or wide-canopy trees are unsuitable due to safety concerns like obstructed driver visibility and interference with infrastructure. Thus, plantation strategies must focus on small to medium-sized shrubs and trees with manageable root systems and compact canopies. Indigenous species are preferred for their resilience to local climate, pollution tolerance, and minimal maintenance needs.

Role of Plants in Pollution Reduction

Plants act as natural biofilters, trapping particulate matter (PM), nitrogen oxides (NOx), sulfur dioxide (SO2), carbon monoxide (CO), and ozone (O3). Studies have shown that vegetation along roadsides can reduce pollution by up to 30% [1]. Small and medium-sized native species effectively absorb pollutants without creating safety hazards in medians.

Fig. 1 Purification of air by indigenous trees

Recommended Indigenous Plants for Highway Median Plantation

The following species are ideal for highway medians due to their size, pollution tolerance, adaptability, and native status in India:

- *Cassia fistula* (Golden Shower): Medium-sized tree with bright yellow flowers; drought and pollution tolerant. Requires pruning to maintain compact form.
- *Ixora coccinea* (Jungle Flame): Small shrub with bright red flowers; thrives in various soil types and tolerates pollution.
- *Nyctanthes arbor-tristis* (Parijat): Small tree/shrub with fragrant white flowers; drought tolerant and resilient in urban conditions.
- *Murraya koenigii* (Curry Leaf): Small aromatic shrub; pollution tolerant and fast-growing, suitable for narrow medians.
- *Aegle marmelos* (Bael): Small tree with medicinal value; hardy and drought resistant, suitable for limited space.
- *Hibiscus rosa-sinensis*: Widely naturalized in India and often considered native; medium shrub with colorful flowers, effective in absorbing airborne toxins.

Impact of Planting Non-Indigenous Species in Highway Medians

While many non-native species such as *Bougainvillea glabra*, *Callistemon citrinus*, and *Plumeria* are popular for their ornamental value and pollution tolerance, their widespread use along highways can cause ecological and management issues:

- Invasive potential: Some non-native species can become invasive, outcompeting native flora and reducing local biodiversity.
- Ecological imbalance: Non-indigenous plants may not support local fauna, such as pollinators and birds, disrupting native ecosystems.
- Maintenance challenges: Exotic species might require more water, fertilizers, or pesticides, increasing maintenance costs and environmental footprint.
- Soil and water impact: Some non-native species have aggressive root systems that may alter soil structure or water availability, potentially harming native plants.
- Long-term sustainability: Native species are generally better adapted to local conditions, ensuring long-term survival and ecological balance without excessive intervention.

Limitations of Highway Median Plantation

- Space constraints: Median strips are often narrow (1-3 meters wide), limiting root expansion and canopy growth. Large trees with wide roots or broad canopies pose risks by obstructing driver visibility and damaging pavements.
- Maintenance challenges: Plants in medians require regular pruning to keep size manageable. Neglect can lead to overgrowth, blocking signage or impairing traffic safety.
- Environmental stress: Median plants endure harsh conditions—heat, dust, vehicle emissions, limited soil volume, and poor water retention—which limit species choices to hardy and drought-tolerant types.
- Safety considerations: Tall or dense plants can restrict sightlines, cause driver distraction, or become collision hazards in accidents.
- Infrastructure conflicts: Plants with invasive or aggressive roots can damage underground utilities, road surfaces, or drainage systems.
- Limited biodiversity: Due to the narrow space and environmental stress, species diversity in medians is usually low, which may reduce overall ecological benefits.

Environmental and Practical Benefits

Despite limitations, small to medium indigenous plants in highway medians contribute to air purification, dust suppression, soil conservation, and roadside beautification. Their deep root systems help reduce soil erosion and improve water infiltration. Additionally, they provide shade and microclimate regulation benefits without compromising traffic safety.

CONCLUSION

For highway medians, prioritizing small and medium-sized indigenous plants is crucial to balance ecological benefits with road safety and maintenance feasibility. Species such as *Cassia fistula*, *Ixora coccinea*, *Nyctanthes arbor-tristis*, and *Murraya koenigii* show great promise for pollution mitigation in narrow median strips across diverse Indian agro-climatic zones. Careful consideration must be given to avoid planting non-indigenous species that may cause ecological imbalances. Recognizing and addressing limitations like space, maintenance, and safety will ensure successful long-term plantation programs.

REFERENCES

[1] Reshma V S, Kumar P, Chaitra G S. 2017. Significant role of ornamental plants as air purifiers - A review. Int. J. Curr. Microbiol. App. Sci, 6(8):2591-2606.

[2] Muhammad A, Huwaishli N, Muhammad Ali S and Jabeen R. 2019. Use of Bougainvillea glabra plants in minimizing vehicular pollution in Jazan area of Saudi Arabia. Biosc. Biotech. Res. Comm. 12(3).

[3] Gong, C., Xian, C., Wu, T. et al. 2023. Role of urban vegetation in air phytoremediation: Differences between scientific research and environmental management perspectives. npj Urban Sustain 3, 24 (2023). https://doi.org/10.1038/s42949-023-00105-0

[4] Seyyednjad SM, MajdianK, Koochak H, Niknejad M. 2011. Air pollution tolerance indices of some plants around industrial zone in South of Iran. Asian J of Biolog Sci. 4:300-305.

[5] Singh M. 2021. Documentation of multipurpose avenue tree plantation of urban roadside of National highway 930 Purur to Dallirajhara dist- Balod. International Journal of Creative Research Thoughts, 9:c429-c437.

[6] Sharma S, Sharma Y. 2020. Bougainvillea (Commerson and Jussieu): A pollution and drought tolerant plant. International Journal of Plant and Environment 6(2):103-109.

[7] Sharma A. 2019. Air purifying plants: A boon of nature. International Journal of Trend in Scientific Research and Development, 3:1807-1811.