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## Future of Medicinal and Aromatic Crops in India

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India has long been recognized as a cradle of traditional medicine and a global leader in biodiversity, with more than 7,000 species of medicinal and aromatic plants (MAPs) documented. Indian subcontinent is one of the World's 12 leading biodiversity centres, encompassing 16 different agro-climatic zones, 10 vegetation zones, 25 biotic provinces and about 426 habitats of specific species. It has been estimated that about 45,000 plant species (nearly 20% of the global species) occurs in the Indian Sub-continent. About 3,500 species of both higher and lower plant groups are of medicinal values. More than 80 percent of medicinal and aromatic plants (MAP) are collected from 17 million hectares of Indian forest land. However, many of these, due to over-exploitation have become rare (*Rheum emodi*, *Aconitum deinocephalum*), threatened (*Rauvolfia serpentina*, *Berberis aristata*), or endangered ones (*Sassurea lappa*, *Dioscorea deltoidea*).

Medicinal crops such as Ashwagandha, Aloe vera and Sarpagandha and aromatic crops like lemongrass, mint, and sandalwood are deeply embedded in Indian heritage and healthcare systems. Their importance extends beyond health, as they provide livelihood opportunities, contribute to exports and connect traditional wisdom with modern industries such as pharmaceuticals, nutraceuticals and cosmetics.

With increasing consumer preference for natural remedies, organic products, and holistic healthcare, the demand for MAPs is surging both domestically and internationally. However, issues of sustainability, quality control and technological adoption remain major challenges. This essay explores the trajectory of medicinal and aromatic crops in India from their historical significance to their prospects, highlighting opportunities, constraints, and the roadmap ahead.

### Historical and Traditional Significance

Medicinal and aromatic crops have played a central role in India's cultural and healthcare practices for millennia. Ayurveda, Siddha and Unani systems relied extensively on plants such as tulsi (*Ocimum sanctum*), neem (*Azadirachta indica*), turmeric (*Curcuma longa*) and brahmi (*Bacopa monnieri*). Classical texts like Charaka Samhita and Sushruta Samhita recorded hundreds of herbal formulations, many of which are still in use today.

Aromatic crops such as sandalwood, vetiver and patchouli were not only used for spiritual rituals but also formed part of India's trade with ancient civilizations. The Silk Route and maritime spice trade established India's reputation as a supplier of high-value medicinal and aromatic commodities. This historical foundation provides India with a unique advantage in positioning itself as a modern hub for MAPs.

### Current Scenario in India

Today, India is among the world's largest producers of medicinal and aromatic crops (MAPs), cultivating more than 500,000 hectares under MAPs. In India production area of major crops include Mentha (252,000 ha), lemongrass (3,000 ha), Aloe vera (512 ha) and Ashwagandha (10,780 ha) are located mainly in Uttar Pradesh, Assam, Karnataka, Rajasthan, Gujarat and

Madhya Pradesh. India also remains a significant exporter of raw herbs (100 MT), essential oils (2,396 MT) and herbal products (128,738 MT), with the herbal export sector valued at more than USD 800 million annually and growing steadily.

Government initiatives such as the National AYUSH Mission, the Aroma Mission of CSIR-CIMAP, and schemes of the National Medicinal Plants Board (NMPB) have encouraged cultivation, processing, and marketing of MAPs. Domestically, the herbal medicine, wellness, and cosmetic industries are expanding rapidly, creating demand for high-quality plant material. Globally, the herbal market is projected to exceed USD 100 billion in the coming years and India is well placed to capture a larger share.

### **Economic Importance and Market Potential**

The economic potential of medicinal and aromatic crops is immense. Their value chain extends from small farmers to multinational companies. Cultivation provides employment to rural households, especially in semi-arid and marginal lands where conventional crops may not be profitable. For example, In Uttar Pradesh, mentha cultivation involves around 600,000 to 700,000 farmers, predominantly small and marginal cultivators, across India along with 9,000-10,000 primary distillation units operate, providing work for 50,000-60,000 farm workers engaged in steam distillation of mentha herbage, while Sandalwood plantations in southern India are emerging as lucrative agroforestry ventures. One report estimates that with an initial investment of around Rs.1.25 to 1.50 lakh per acre, farmers can reap gross returns of Rs.2.25 crore per acre over a 12-15 year period translating to a net profit exceeding Rs.2 crore per acre.

The export market presents a major growth opportunity. Indian herbs, oils and extracts are in demand in the USA, EU and Middle East, particularly in the pharmaceutical, nutraceutical, and personal care sectors. According to the Ministry of Ayush total Ayush export of India is around 1.54 billion dollar (Rs. 11,400 crore) in its recent report on the progress of the sector from 2014-2024. In fiscal Year 2023-24: India exported 651.17million dollar worth of Ayush and herbal products, marking a 3.6% increase from the previous year. Although, in 2023-24, India exported approximately 10.63 crore kilograms (106,300 metric tons) of Ayush and herbal products, a decrease from 12.25 crore kilograms in the previous year. Growing trends in aromatherapy, organic cosmetics and plant based foods offer new avenues for expansion. However, to fully realize this potential, India must strengthen its supply chain, ensure consistent quality, and invest in branding and global positioning.

### **Challenges in the Sector**

Despite its strengths, the MAP sector faces multiple challenges:1)Overexploitation of wild resources has led to depletion of species like Sarpagandha and sandalwood.2)Quality control issues such as adulteration, contamination and inconsistent active ingredient levels hinder global competitiveness.3)Post-harvest losses and lack of value-addition infrastructure reduce profitability for farmers.4)Market volatility often discourages farmers, as prices of herbs and essential oils fluctuate sharply.5)Climate change poses a threat to productivity, altering growing regions and pest-disease dynamics.6)Addressing these challenges is critical for ensuring the sustainable future of MAPs in India.

### **Research and Technological Advances**

Research institutions like CSIR-CIMAP, ICAR-DMAPR and universities have been pivotal in developing high-yielding varieties, disease-resistant strains, and improved processing technologies. Biotechnological approaches such as tissue culture enable mass propagation of elite varieties of Ashwagandha, Aloe vera and Stevia.

Advances in metabolic engineering and synthetic biology are opening new avenues, such as microbial production of artemisinin (anti-malarial drug) and other phytochemicals. Precision farming, AI-driven crop monitoring, and blockchain-enabled supply chains are gradually being adopted, ensuring traceability and efficiency. In the future, integrating digital technologies with traditional cultivation will enhance productivity and quality assurance.

## Policies, Regulations and Quality Standards

Strong policy support is crucial for the growth of MAPs. The National AYUSH Mission has expanded herbal cultivation, while the Aroma Mission promotes aromatic crop-based entrepreneurship. Regulatory frameworks such as Good Agricultural and Collection Practices (GACP), WHO guidelines, and pharmacopoeia standards are being introduced to ensure global acceptance of Indian products.

However, gaps remain in implementation, certification and international compliance. For instance, the European Union's strict quality norms have restricted India's herbal exports in some cases. Strengthening regulatory systems, establishing accredited testing labs and promoting certifications such as organic and GI tags will enhance India's credibility in global markets.

## Future Prospects and Opportunities

The future of MAPs in India is bright, supported by global trends towards natural products and holistic wellness. Some key opportunities include: **1)** Expansion of cultivation area into semi-arid and degraded lands using climate-smart practices. **2)** Start-ups and rural enterprises focusing on herbal teas, nutraceuticals and essential oils. **3)** Women empowerment through household-level processing and value addition. **4)** Export diversification to new markets such as ASEAN, Africa and Latin America. **4)** Growth of herbal nutraceuticals (turmeric capsules, moringa powders), aromatherapy products and natural cosmetics (aloe vera gels, neem-based skincare).

With the right strategies, India can position itself as a global hub for safe, standardized, and sustainable herbal products.

## Conclusion

Medicinal and aromatic crops represent India's unique intersection of tradition, biodiversity and economic opportunity. From their roots in Ayurveda and folk medicine to their current role in pharmaceuticals, nutraceuticals, and cosmetics, they have remained central to India's identity. The global surge in demand for natural and plant-based products positions India to lead the herbal revolution of the 21st century.

However, achieving this requires a delicate balance: economic growth must align with conservation, quality assurance, and global standards. By investing in research, sustainable cultivation, regulatory strengthening, and farmer empowerment, India can transform its rich herbal heritage into a globally competitive and sustainable industry. The future of medicinal and aromatic crops in India lies not only in preserving ancient wisdom but also in harnessing science, innovation, and entrepreneurship to create a healthier world.

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