

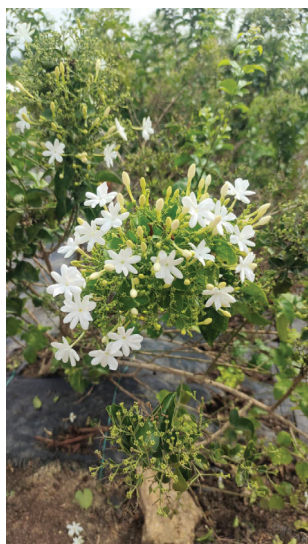
Scientific cultivation of Jasmine: A potential avenue for women-led Entrepreneurship

Floriculture is slowly transitioning from a low-return farming practice to a very profitable agricultural company as demand for flowers grows in the area and the ability to export them grows. Jasmine cultivation is now a profitable industry, and this article talks about the scientific cultivation, year round production, value added product, profits earning and the business as a whole. Jasmine flowers all year long, and the weather in India is always changing, which is perfect for it. The flower will still be in high demand even when the economy is down because it is important for religious events, festivals, and weddings. Beyond fresh flowers, it is chiefly used in cosmetics, essential oils, pharmaceuticals, and perfumes. Small-scale farmers and business owners in India, especially women's groups, can become financially independent by adopting jasmine cultivation as entrepreneur. The adoption of scientific technologies including right choice of *Jasminum* species, timing of planting to harvesting, postharvest and its processing led to become a modern-day gold mine.

Keywords: Floriculture, Jasmine, Postharvest, Processing, Women

JASMINE, ‘Queen of Flowers’, native to India, most significant and profitable crops are deeply associated in the Indian culture and customs. It is used in every occasion ranging from religious ceremonies to hair adornments and garlands. India is the global leader in jasmine production, cultivating almost 27.08 thousand hectares to yield roughly 273.91 thousand metric tonnes annually. The main cultivation hubs are in states like Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Gujarat and West Bengal. Tamil Nadu is the epicentre of this industry and home to small-scale jasmine oil

extraction industries, with key cultivation areas including Madurai (known as the ‘Jasmine City of India’), Dindigul, Tirunelveli, Kanyakumari and Coimbatore. The flower’s appeal comes from its strong, captivating fragrance and diverse uses. The flowers are in high demand for a variety of purposes like making garlands and floral decorations, religious and ceremonial uses, extraction of essential oil for perfumes and cosmetics and export especially to the Middle East and European Union countries. This consistent demand of jasmine flowers offers profitable crop for Indian farmers especially the women farmers



Jasmine flowers



Different types of jasmine flowers

and SHGs/FPOs

Popular jasmine species: Different species are cultivated for specific purposes. The delicate loose flowers are grown for garlands and adornments and the robust ones are for essential oil extraction. Some of the which are listed hereunder.

Loose Flower (Garlands & Adornment)

Jasminum sambac (Mogra/Arabian jasmine): It has double-petalled, intensely fragrant white flowers with important varieties of like ‘*Gundumalli/Irvatchi*’ which is highly fragrant and the most common commercial variety and ‘*Khoya*’ with double-flowered type but with a long shelf-life. It also has varieties like ‘*Ramu*’ which is single-petalled, bears flowers in clusters and is also considered good for oil.

Jasminum auriculatum (*Juhi*): Known for its smaller, highly fragrant flowers that stay fresh for a long time, it is a favourite choice for making long-lasting garlands.

Oil extraction

Jasminum grandiflorum (Spanish jasmine/ Pitchi/ Chameli): It is the most important species for the perfume industry for its large, white, single-petalled flowers which yield a rich, complex and highly prized absolute (a type of essential oil). It is primarily cultivated in the states of Tamil Nadu and Karnataka for this purpose. It has high-yielding varieties like ‘*CO1 Pitchi*’ and ‘*CO2 Pitchi*’ developed by TNAU, Coimbatore, bred specifically for oil content.

Jasminum auriculatum (*Juhi*): This versatile species is also used for oil extraction, producing a warm, sweet fragrance.

Jasminum humile (Yellow jasmine) and ***Jasminum mesnyi*** (Primrose jasmine) possess characteristics of diurnal nocturnal blooming of yellow jasmine. Primarily grown in garden for its cheerful, bright yellow flowers and hardy nature having aroma of noticeably different-lighter, fresher and less intense than the heady aroma of ‘Sambac’ or

‘grandiflorum’. It is sometimes used in aromatherapy and niche perfumery for its unique sunny and uplifting note.

Ideal cultivation conditions: Jasmine requires warm summer, mild winters and plenty of sunshine. It is mostly grown in the tropical and subtropical climates. It requires an ideal range of temperature of 20–30°C along with moderate rainfall (800-1000 mm) and grows well up to 1200m altitude. This crop requires sandy loam or red loamy soil with good drainage and a high amount of organic matter.

Cultivation practices: Jasmine is often propagated by layering or semi-hardwood cuttings. Cuttings treated with rooting hormone and planted in sand will root more readily. During the monsoon season or February–March, mother plants are cut and layered. A mixture of soil, farmyard manure (FYM)/vermicompost, and coarse sand is used to fill pre-made pits. The monsoon season is usually the ideal time of year to plant.

Planting: After the land has been ploughed, pits of roughly 30 cm x 30 cm x 30 cm sizes are prepared and filled with top soil and 15-20 kg FYM/ vermicompost. The species determines the planting distance, which is often done during the monsoon season. Planting is done at 1.25 x 1.25 m to accommodate 6,400 plants/ha.

Table 1. Planting distance of different jasmine species

Species	Planting distance	No. of plants/ha
<i>Jasminum sambac</i>	1.2 m x 1.2 m	6,944
<i>Jasminum auriculatum</i>	1.8 m x 1.8 m	3,086
<i>Jasminum grandiflorum</i>	2.0 m x 1.5 m	3,333

Nutrient and water management: Jasmine plants are heavy feeders and require a balanced dose of NPK fertilizers. Drip irrigation is a highly efficient method for consistent watering.

Table 2. Fertilizer schedules for jasmine species

Nutrients	<i>J.sambac</i> & <i>J. auriculatum</i>	<i>Jasminum grandiflorum</i>
Organic Manure (FYM)	10–15 kg/plant/year during the pre-monsoon period (May–June)	15–20 kg/plant/year during the pre-monsoon period (May–June)
Recommended NPK Dose (g/plant/year)	120:80:120	150:100:150
Nitrogen (N)	Applied in 3 equal splits At pruning/planting • 45 days after pruning • At onset of flowering	
Phosphorus (P)	Entire dose applied as basal at pruning/planting	Entire dose applied as basal at pruning/planting
Potassium (K)	Applied in 2 equal splits: • Basal (at pruning) • At onset of flowering	
Micronutrient application	Generally not required under normal conditions	Foliar spray at bud initiation 0.5% Zinc sulphate 0.3% Boric acid
Special Notes	Fertilizers should be applied in a circular trench (20-30 cm away from plant base)	Foliar application improves flower yield and quality

Pruning: Pruning is a critical practice that stimulates new growth and flower bud formation. It is done after the main flowering season.

Flowering and harvesting: Jasmine plants usually start flowering within 6–12 months of planting, depending on the variety. Flowers are harvested in the early morning at unopened mature bud stage when they are fresh and fragrant. Fully opened flowers are harvested for oil extraction for maximum oil recovery. Daily picking during the blooming season ensures maximum yield. Following planting, the crop will produce an economically viable yield for up to 10-12 years, provided it is maintained with good agricultural practices.

Yield : Flower and oil yield varies according to the different species and cultural practices followed.

Disease and pest management strategies: For an effective and successful Disease and Pest management, the following steps to be taken strictly.

Prevention: The most effective method to manage diseases is to prevent its establishment. Concentrate on

Table 3. Region-specific purging details of different jasmine species

Region	Species	Time of Pruning	Type of Pruning	Pruning details
South-Tamil Nadu, Karnataka	<i>Jasminum sambac</i> , <i>Jasminum grandiflorum</i> , <i>Jasminum auriculatum</i> , <i>Jasminum nitidum</i>	Late October–November Last week of December	Hard pruning	<i>Sambac</i> are pruned higher 1m from ground level Plants are cut back to 30–45 cm from ground level after the main kharif flowering flush
	<i>Jasminum multiflorum</i>	September	Hard pruning	Plants are cut back to 60 cm from ground level after the main kharif flowering flush
West-Maharashtra, Gujarat	<i>Jasminum sambac</i> , <i>Jasminum auriculatum</i>	November–December	Light pruning	About 1/3 of shoot length is removed, especially in <i>Jasminum sambac</i>
Bihar, West Bengal, Uttar Pradesh	<i>Jasminum sambac</i> , <i>Jasminum grandiflorum</i>	February–March	Hard pruning	Removal of weak, diseased, and crossing branches along with cutting back to 45–30 cm

Table 4. Yield of jasmine

Species	Flower yield (t/ha)	Concrete Yield (% from flowers)	Concrete Yield (kg/ha)
<i>Jasminum sambac</i>	8-10	0.20-0.30%	16-30
<i>Jasminum grandiflorum</i>	10-12	0.25-0.35%	25-35
<i>Jasminum auriculatum</i>	8-10	0.20-0.30%	16-30

fostering a healthy growing environment through cultural practices by i). Selecting robust planting material, ii). Soil should be well-drained soil to reduce the risk of soil borne disease iii). Practicing appropriate spacing and pruning to facilitate optimal air circulation, iv). Implementing field

Table 5. Flowering time of different species of jasmine

Jasmine species	South India (Tamil Nadu, Karnataka, Andhra Pradesh)	North India (UP, Delhi, Bihar)	West India (Maharashtra, Goa, Gujarat)	East India (WB, Odisha, Assam)
<i>Jasminum sambac</i> ,	Year-round flowering, peak Mar-Oct	April-October, peak May-August	March-October	April-September
<i>Jasminum grandiflorum</i>	May-Nov,(Peak June-Sept),extend to December	June-October	May-October	May-September
<i>Jasminum auriculatum</i>	May-September	June- September	May-September	May-August
<i>Jasminum officinale</i>	May-September	May-September	May-September	May-September
<i>Jasminum multiflorum</i>	October-March	February-April	November-February	December-March
<i>Jasminum nitidum</i>	Year Round, peak April-September	April-October	May -October	-----

Table 6. Pests of jasmine and their control

Pest	Symptoms	Control Methods
Budworm (<i>Hendecasis duplifascialis</i>)	The caterpillar eats the interior contents of the flower bud and creates holes in it. Flowers with the infestation become violet and fall off. When the infestation is severe, silken thread is used to web adjacent flower buds together.	Collect and destroy the infested buds. Use light trap to attract and kill the adult moths Foliar application of NSKE 5%. Carbofuran treatment at the base @ rate of 40 g/plant Appropriate bush pruning and sanitary upkeep.
Gallery worm (<i>Elasmopalpus jasminophagus</i>)	Caterpillars create silken tunnels on the outside of buds, often accompanied by excreta	Destroy damaged buds and tunnels. Use light traps to kill moths. Spray NSKE 5%
Leaf web worm (<i>Nausinoe geometralis</i>)	Caterpillars web leaves and branches together with silk. They scrape off green tissue (parenchyma), skeletonizing the leaves.	Collect/ destroy webbed leaves; use light traps. Spray NSKE 5% or Imidacloprid 2 ml/L
Jasmine eriophyid mite	Mite feeding leads to a hairy, felt-like growth, called erineum, on the leaves, stems, and buds. This growth is a visible symptom of their presence and feeding activity. Plant growth is stunted, and flower production drops.	Remove and destroy affected plant parts. Grow resistant varieties like 'Parimullai'. Spray Dicofol 18.5EC 3 ml/L, Wettable Sulphur, or Abamectin 0.5 ml/L
Flower thrips (<i>Thrips orientalis</i>)	Feed on flower petals, leaving silvery scratch marks. Infested flowers may fall off prematurely, and pollen is often destroyed.	Use insecticidal soap or neem oil to manage the infestation
Whitefly (<i>Dialeurodes kirkaldyi</i>)	Nymphs and adults both suck the sap from the underside of the leaves and cause yellowing leaves, wilting, and sticky honey dew.	Yellow sticky traps; insecticidal soap; neem oil; encourage natural predators like parasitic wasps. Foliar spray methyl demeton 25 EC 2 ml/L
Blossom midge (<i>Contarinia aculipennis</i>)	Maggots enter the buds, causing swelling of base of the buds. Ultimately it causes drying of the buds.	Foliar spray of Thiamethoxam 2.5% WG (0.75 g/L)

Table 7. Diseases of jasmine and their control

Disease	Symptoms	Control methods
Cercospora leaf spot (<i>Cercospora jasminicola</i>)	Circular or irregular brown to black spots on leaves, often with a yellowish halo. Severe infection causes yellowing and premature leaf drop.	Remove infected leaves. Improve air circulation. Spray Mancozeb (2 g/L) or carbendazim (1g/L).
Alternaria leaf blight (<i>Alternaria jasmini</i> , <i>A. alternata</i>)	Dark brown, concentric rings on leaves, resembling a target. Spots often start on older leaves and can cause blighting.	Avoid overhead watering. Destroy plant debris. Spray Mancozeb (2 g/L) or Chlorothalonil (2 g/L).
Root rot – (<i>Sclerotium rolfsii</i>)	Symptoms begin with the yellowing of older leaves, which then progresses to younger leaves, ultimately killing the plant. The roots show black discoloration, and the infected tissues are covered with white, thread-like fungal growth (mycelia) and mustard-seed-sized resting bodies (sclerotia).	Heavy application of FYM with <i>Trichoderma viride</i>
Phyllody – <i>Phytoplasma</i> sp.	The most dramatic symptom: floral parts (petals, stamens) turn into small, green, leaf-like structures. Plants become stunted and bushy.	Remove and destroy infected plants immediately. Control leafhopper vectors. Spray insecticides like Dimethoate to control leafhoppers

sanitation measures (removal of infected plant debris), and v). Avoid overhead irrigation to reduce moisture leaf wetness.

Use eco-friendly options: Focus should be given on biological or botanical methods before considering chemical pesticides. This approach is more environmentally responsible and supports long-term sustainability.

Jasmine entrepreneurial venture: Jasmine cultivation offers a profitable and exceptional opportunity for women farmers to adopt it as commercial avenue because of :

a). **Strong demand and stable market:** Jasmine flowers are in high demand both at domestic and abroad, and this demand will persist for a long time. This guarantees that farmers always have a place to sell their goods and earn money. b). **Versatility:** Jasmine is hardy crop that flourishes in a range of climates, especially in the tropical and subtropical regions of India. It can be cultivated in various soil types, provided they are well-drained and abundant in organic matter. c). **Perennial crop:** being a perennial

crop and economic yield upto 12-13 years once planted, offers one time investment. This cut down input cost only require maintenance cost. d). **Employment generation:** The process of cultivating jasmine is not only rewarding but also labour-intensive, especially during the bustling harvest season. This opens up an opportunity, particularly empowering women in rural communities. e). **Value-added products:** There are several value-added product in addition to selling loose by making garland, veni, floral jewellery, and other processed like essential oil, absolute, cosmetic items, and dried product like potpourri, that fetch good price.

Average economics of jasmine cultivation

Average economics of jasmine cultivation (*Jasmine sambac*) per hectare from the second year onwards.

For *J. grandiflorum* grown for oil extraction, the economics are even more attractive. With a flower yield of 10 t/ha and a concrete recovery of 0.27%, approximately 27 kg of concrete is obtained per hectare per year. At

Table 8. Average economics of jasmine

Particulars	Value	Particulars	Value
Average flower yield	7,000 kg/ha	Harvesting and transportation	₹30,000
Average market price (wholesale)	₹150/kg	Total Cost of Production	₹1,15,550
Gross Income	₹10,50,000	Net Profit	₹9,34,450/ha
Total recurring cost of cultivation	₹85,550	Benefit: Cost Ratio	9.08:1

the current rate of ₹60,000–80,000/kg for concrete, the total revenue generated from oil extraction can soar to ₹16–22 lakh/ha, transforming it into a lucrative venture for women farmers who are linked to processing facilities or have agreements with fragrance enterprises.

Major challenges in oil extraction

The foremost challenges limiting large-scale commercial extraction is the staggering expense.

a) **Requirement of large quantity of flowers:** To extract 1 kg of absolute, nearly 1.5–2.0 tonnes of flowers are essential.

b) **Labor-intensive harvesting:** The flowers are harvested at mature bud stage that would be open in next 10–12 hrs in early morning hours. This needs a lot of workforce.

c) **Perishable raw material:** The flowers start withering and losing their delicate fragrance soon after they are plucked. They have to be processed within hours, so the extraction plant has to be located near the fields.

Indian Jasmine Absolute is one of the most luxurious essential oils in the world. The risk involved in its production make it very expensive, and it can cost between 150,000 and 250,000/kilogram, and sometimes even more depending on the season and the quality of the product.

Commercial extraction process

The procedure is intricate and necessitates substantial capital investment in apparatus.

i). **Harvesting and Collection:** The flowers are harvested by female laborers between the hours of 4 AM and 8 AM, placed into baskets designed to facilitate air circulation in order to avert overheating and subsequent spoilage. They are promptly transported to the processing facility.

ii). **Pre-processing:** The flowers are systematically arranged and scrutinized for the presence of stems, leaves, and other contaminants. They are ‘not washed’ purposely as water exposure can degrade and remove aromatic constituents.

iii). **Solvent extraction:** Jasmine cannot be distilled by steam because the jasmine fragrance is very delicate. It gives a poor output and ruins the scent profile. So, the solvent extraction is an efficient method by using hexane as a solvent. The flowers are put into large extraction vessels. The solvent is then made to pass through the flowers, dissolving aromatic compounds, waxes and pigments. The result is a waxy semi-solid mixture called ‘jasmine concrete’.

iv). **Production of absolute:** The concrete is not usable as such in perfumery, being too waxy. It is then subjected

to a second process:

a). **Alcohol washing:** The concrete is mixed with pure ethyl alcohol (ethanol) and cooled. The aromatic compounds dissolve in the alcohol. The waxes and non-aromatic materials solidify.

b). **Filtration and vacuum distillation:** The alcohol solution is filtered to remove waxes. The alcohol is then evaporated off gently under vacuum (low pressure) at low temperatures, so as not to destroy the fragrance, leaving the pure jasmine absolute.

Market and economics

Domestic consumption: A very small fraction of the absolute is consumed in the domestic market for premium attars (traditional perfumes), agarbattis (incense sticks), and niche personal care products. The cost is too high for mass market products. Its premier locations are in France, Switzerland, the United States and the United Kingdom, where it is considered an important ingredient of luxury perfumes.

Challenge/Competition: India faces stiff competition from Egypt and Morocco for ‘*Jasminum grandiflorum*’, and from China for ‘*Jasminum sambac*’. However, the Indian absolute is demanded due to its peculiar intricate aromatic characteristics.

SUMMARY

Commercial jasmine cultivation in India is a high-value, low-volume industry that thrives on the exceptional quality of its produce. It is not a mass-market agricultural activity but a precision-oriented, capital-intensive process catering almost exclusively to the local consumption and global luxury perfume industry. While India is a giant in jasmine flower production, converting that into oil remains a challenging and niche enterprise due to immense cost pressures, making the resulting jasmine absolute a true “liquid gold”. Some of Government institutes involved in research for breeding and improvement in jasmine cultivation and extraction process, viz. CSIR-CIMAP, Lucknow, The Fragrance & Flavour Development Centre (FFDC), Kannauj (Uttar Pradesh), TNAU, Coimbatore and National Horticulture Board (NHB), Gurugram and State Agriculture Departments. Regional demands is the key for area expansion in both fresh flower and oil extraction trade in a cluster mode supported by government schemes. This sector can be the game changer for several women SHGs and FPOs having huge entrepreneurial avenues. Farmers, researchers, garden lovers can purchase rooted cutting of jasmine species from different genuine sources, like Tamil Nadu Agriculture University, Coimbatore, IIHR, Bangalore, BCKV, West Bengal and from private nursery.

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