Integrated agro and process technology of Rose-scented geranium (*Pelargonium graveolens* L'Her.)

The genus *Pelargonium* encompasses 283 species, among which *Pelargonium graveolens* L'Her. is one of the most commercially significant species for essential oil production. *P. graveolens*, also referred to as rose-scented geranium, is a perennial aromatic bushy shrub (family Geraniaceae) cultivated throughout the world, particularly in China, Algeria, Russia, and India. The primary constituents of the commercial geranium oil are, geraniol, citronellol, isomenthone and linalool. The essential oil is used in pharmaceutical, flavor and cosmetic industries.

Market potential

The annual demand for Rose-scented geranium essential oil is currently estimated at 600 MT and the market is expected to reach over USD 100 million by 2030, with a CAGR ranging between 4-8%.

Salient features of CSIR-Technology

- Higher citronellol (45-50%), Geraniol (10-15%)
- Higher essential yield (55-60 kg/ha)
- Essential oil content (0.15-0.18%)
- Bourbon type cultivar

Contribution of CSIR-IHBT

- Standardized agro and process technologies for mid hill conditions and higher rainfall areas.
- Quality planting material
- Organic and inorganic cultivation practices

Improvement in Agrotechnology of Aromatic Marigold (*Tagetes minuta*)

Tagetes minuta L., commonly known as aromatic marigold, is an aromatic annual herb native to South America has become naturalized in the Himalayan and sub-Himalayan regions of India at elevations of 1000–2500 m. The essential oil extracted from the aerial parts of *T. minuta*, including leaves and flowers, is highly valued for its distinct aroma and beneficial properties. The major components are (*Z*)-*β*-ocimene, dihydrotagetone, (*Z*)&(*E*)tagetone, (*Z*)&(E) tagetenone, (*Z*) & (*E*) ocimenone. The essential oil, in high demand, is extensively utilized in the flavour and perfumery industries, particularly in high-grade perfumes and as a flavouring agent in products like ice creams, candies, liquors, puddings, and gelatins.

Market potential

The global aromatic marigold essential oil market is experiencing steady growth, valued at approximately USD 203.85 million in 2025 and projected to reach USD 327.34 million by 2032, growing at a CAGR of 7.0%.

Salient features of CSIR-Technology

- Higher biomass yield potential (150-175 q/ha)
- Higher essential oil content (0.35-40%)
- Higher (Z)-ß-ocimene (> 50%)

Contribution of CSIR-IHBT

- Improved agronomic practices
- Organic and inorganic cultivation practices for higher biomass yield and essential oil content
- Training on agro and processing technology

Organic nutrient Management in *Hypericum perforatum* L.

Hypericum perforatum L., commonly known as St. John's Wort, is an important medicinal plant widely used in temperate regions. Traditionally, its flowering aerial parts are utilized in herbal medicine to treat mild to moderate depression, anxiety, and inflammatory conditions. *H. perforatum* also exhibits antioxidant, wound-healing, and antiviral effects. The plant's bioactive compounds include hypericin, hyperforin, flavonoids, and tannins, which contribute to its pharmacological activities. In addition to traditional applications, extracts of *H. perforatum* are used in pharmaceutical preparations and nutraceuticals, and as a source for the development of novel therapeutic compounds.

Market potential

H. perforatum extract market is expected to reach between USD 350 million by 2032-2033, growing at a Compound Annual Growth Rate (CAGR) of 6.5% to 6.8%.

Salient features of CSIR-Technology

- Higher specialized metabolites, *viz.*, pseudohypericin, hypericin, and hyperforin.
- Higher *Hyperici herba* dry biomass yield (1.5-1.6 t/ha)

Contribution of CSIR-IHBT

- Organic cultivation practices.
- Quality planting material
- Training in cultivation & processing