

COLEUS FORSKOHLII

ORIGIN AND BOTANICAL TRAITS

Family	Although these plant are a member of the nettle family, they are a mint. They do not have the stinging properties of the nettle.
Botanical name	Coleus Forskohlii-Labiatae
Alternate name	Pashanbad

Coleus plant is a naturally occurring tuber crop and perennial plant.

It is durable and easy to grow.

Although they are technically a "tender perennial" (even the slightest frost will cause them to wither), they are most often considered to be an annual plant by growers and seed producers.

Most Coleus plants will survive full sun exposure. The foliage colour however is often enhanced when they are grown in the shade.

They are best known for their bright colours and variety of foliage forms.

Common Names

Sanskrit	Pashan Bhedi
Hindi	Patharchur
Kannada	Makandiberu
English	Coleus
Gujarati	Garmalu
Marathi	Maimnul

Botanical trait

Members of the genus Coleus have square stems, branched, the nodes are often hairy.

The entire plant is aromatic (whether fresh or dried).

Corolla	The pale blue corolla is bilabiate, the lower lobes are elongated and concave.
Height	30 cm to 62 cm
Tubers	The roots are thick, tuberous, fasciculated, upto 20 cm long and 0.5-2.5 cm thick Conical, fusiform, straight and strongly aromatic.
Leaves	Usually pubescent, narrowed into petioles.
Flowers	Very showy bluish to pale lavender coloured flowers Racemes are perfect, the calyx is fine toothed and deflexed in the front.
Ovary	Four parted

Pollination	Cross pollinated by means of wind or insects.
Odour	The leaves and tubers have quite different odours, the latter being reminiscent of but quite different from ginger.

Nature of plant : A perennial, branched, aromatic herb

Garden plant :

Coleus will make a nice house plant as long as it receives sufficient light and food.

Coleus plants can be grown in the garden in bright, indirect light or in partial shade.

Coleus are also quite striking when they are planted in a container and grown as a house plant.

The most common colour combination that is found in coleus are burgundy, chartreuse, red and green.

A variety like 'Rustic Orange' with deep-burnt orange leaves and a saw-toothed edge, can be a bit more difficult to blend with more traditional coleus colours.

By removing the flower spikes as they develop keeping the plant pinched back, the Coleus can be kept in a perennial state for several seasons.

The lower growing dwarf varieties (6-12 inch) will create a colourful border or one can use the taller (three foot) types as a dramatic background planting.

Varieties

Today, there are more than 500 varieties of coleus in cultivation all over the world

Most Coleus will grow 18 to 24 inches tall. But some will grow taller, especially the big-leafed varieties like 'Atlas' and 'Florida Sunrise', which have topped 4 feet in the garden.

Others such as ducksfoots(their leaves do look like tiny ducks feet)'India Frills', 'Ducksfoot Red" and 'Ducksfoot Purple', rarely reach 12 inches.

Mangani Peru - Grown in Belgaum district in Karnataka. The size of the Tuber is big and is upto 30 cm length.

Karmai- Grown in Gujarat . Roots of medium size.

APPLICATION

In traditional Ayurveda systems of medicine, Coleus has been used for a variety of purposes, including treating asthma, bronchitis, insomnia, epilepsy and angina.

Coleus forskohlii has also been proposed as a treatment for psoriasis, because that disease appears to be at least partly related to low levels of cyclic AMP in skin cells.

The roots are also used in treatment of worms. The root parts is claimed to allay burning in festering boils. When mixed with mustard oil, the root is applied to eczema and skin infections. The plant is also used for veterinary purposes.

In Egypt and Africa the leaves of *C. barbatus* are used as an expectorant, emmenagogue and diuretic while its foliage is employed in treating intestinal disorders and it has been used as a condiment in India for a long time

Forskohlin, the alkaloid extracted from the tuberous roots of *Coleus forskohlii* are being developed as a drug for hypertension, glaucoma, asthma, congestive heart failures and certain types of cancers.

The tuberous roots are found to be a rich source of Forskohlin

Forskohlin

Coleus forskohlii contains the active substance forskolin.

Coleus forskohlii (forskolin) has been shown to increase the “biological amplifying system” by increasing the synthesis of the 3',5'-cyclic ester of AMP (cAMP). cAMP is generated from ATP by the action of adenylyl cyclase that is coupled to hormone receptors by G-proteins, a binding protein. GH-RH acts via cAMP to promote the synthesis and release of hGH from pituitary glands.

Forskolin is a powerful substance that acts as a “biological amplifier.” This means that it influences substances that dramatically influence subsequent actions.

The extensive research into this compound shows that forskolin influences the 3',5'-cyclic ester of AMP generated from adenylyl cyclase.

Adenylyl cyclase is the enzyme involved in many reactions including increasing basal metabolic rate and hGH release. This is an example of how the body has millions of interrelated metabolic actions and affecting one may effect many other systems down the line.

Safety issues

The safety of *Coleus forskohlii* and forskolin has not been fully evaluated, although a few significant risks have been noted in studies performed thus far. It should be avoided in people with ulcers, because it may increase stomach acid levels.

It is said that caution should be exercised when combining this herb with blood-pressure medications and "blood thinners." Safety in young children, pregnant or nursing women, or those with severe liver or kidney disease has not been established.

If one would be taking blood pressure medications such as Beta-blockers, Clonidine, or Hydralazine, or Blood-thinning drugs such as Coumarin (warfarin), Heparin, Plavix (clopidogrel), Ticlid (ticlopidine), or Trental (pentoxifylline), *Coleus forskohlii* should only be used under the supervision of a physician.

The animal studies on forskohlin indicate an extremely low order of toxicity for forskohlin.

Clinical trial

Phase I clinical trials of this compound for antihypertensive activity has been completed.

Rating

Rating	Health Concerns
**	Asthma(Forskohlin) Glaucoma(Forskohlin)
*	Cardiomyopathy(Forskohlin) Congestive heart failure Hypetension(Forskohlin) Obesity Psoriasis

** Contradictory, insufficient or preliminary studies suggesting a health benefit or minimal health benefit.

* A herb is primarily supported by traditional use, or the herb or supplement has little scientific support and/or minimal health benefit.

Scientific evidence

There is a opinion in some quarters that scientific evidence for the herb *Coleus forskohlii* as treatment for any disease is weak. What is known relates to the substance forskolin rather than the whole herb.

CULTIVATION PRACTICES

Cultivation Regions in India

A member of the mint family, *Coleus forskohlii* grows wild on the mountain slopes of Nepal, India and Thailand

It is mostly cultivated in Tamil Nadu, Gujarat and Karnataka.

Highlights

Soil Type	Red Soil
Soil Formation	Ridges and Furrow
Planting Season	January to March July to September.
Planting	Between Ridges-2 feet Plant to Plant-1.5 feet Number of Plants-12500 per acre.
Watering	Weekly Twice
Base Fertiliser	Farm Yard Manure/Spent Mushroom compost. App. 5 to 6 tonnes per acre.
Weeding	On actual growth of weeds.
Harvesting	160 to 180 days.

Soil Conditions

Coleus forskohli thrives best in red, sandy loam soils which are porous and well drained with a P_H ranging from 5.5 to 7.

It does not require very fertile soils and can be economically grown on soils with marginal fertility.

Water logging should be avoided.

Climate

Coleus is a crop of the tropics and is found growing well on barren hills at an altitude of about 2400 m, under tropical and subtropical conditions.

Humid climate with a Relative Humidity ranging from 83% to 95% and a temperature of 10 to 25 deg.C is ideal for the crop such as in Belgaum (the Sahayadri mountain range of Karnataka) and in Gujarat

The required annual rainfall is 100cm to 160 cm, mainly between June-September.

The crop is also found to perform well in less humid and warmer regions of South India like Salem/Coimbatore, where it is grown as an irrigated crop.

Land Preparation

15 tonnes of organic manure is required per hectare.

Cultivation

Propagation: Coleus can be propagated by seeds as well as by stem cuttings.

However, propagation through seeds is little difficult and slow and should be used only for the breeding of new varieties.

Propagation by cuttings is easy and economical to raise this crop on a large scale.

Vegetatively, the crop is propagated through terminal cuttings.

Normally, 10 to 12 cm long cuttings, comprising of 3 to 4 pairs of leaves, are sown in already prepared nursery beds and regular care about shading and watering has to be taken.

Coleus seeds are small. They should be sown onto a layer of moistened, sterile potting soil in a shallow tray and then covered with a thin layer of fine soil.

In about 15 to 20 days, the germination is completed.

When the seedlings are 45 days old and have attained about 8-10 cm height, they are ready for transplanting.

Nursery raising: The viability of the seeds being very poor (8-10%), a sufficient quantity of fresh seeds has to be sown in well prepared nursery beds to obtain good germination.

The cuttings establish well in the nurseries and there is no problem in their rooting. After about a month's time, when the cuttings have produced sufficient roots, they are transplanted to the main field.

Plant should be planted at the interval of 60 cm.

Planting period between June/July and September/October

37000 plants are recommended for every hectare

Feed monthly with a liquid all purpose (10-10-10) fertilizer.

Pinch the center stems out when the plants are 4 to 6 inches tall to induce bushier growth and be sure to pick off the flower spikes as they form.

Regular care about watering, weeding and plant protection of the nursery should be taken.

If the soil is allowed to dry out, the foliage will wilt, but normally will recover quickly when additional water is provided.

Manures and fertilisers

Organic manure is required to the level of 140 kgm on 30th day and 45th day of planting.

Studies conducted at TNAU, Coimbatore, to standardise the nutritional requirement of this crop have shown that it responds well to the application of N, P and K.

A combination of 40 kg N, 60 kg P₂O₅ and 50 kg K₂O per ha was found to be optimum for obtaining the maximum fresh (120 t/ha) and dry (3.982 t/ha) tuber yield from this crop.

Half the dose of N, the whole P and whole K may be applied as the basal dose followed by the remaining half N, 30 days after planting as top dressing.

Irrigation

The first irrigation is given immediately after transplanting, if there are no rains.

During the first two weeks after planting, the crop is irrigated once in three days and, thereafter, weekly irrigation is enough to obtain good growth and yield.

Weeding

Due to the frequent irrigations during the initial stages, there would be growth of weeds.

In order to obtain economic yields, frequent weeding during the early growth period is desirable.

Pests and Diseases

Pests: The leaf eating caterpillars, mealy bugs and root knot nematodes are the important pests that attack this crop.

Diseases: Among the diseases, bacterial wilt is the major one.

Harvesting and Yield

Flowers, if any, should be nipped off during the growing period to obtain more biomass of roots.

The crop is ready for harvest 4 1/2 to 5 months after planting.

The plants are loosened, uprooted, the tubers separated, cleaned and sun dried.

Yield

On an average, a yield of 800 to 1000 kg/ha of dry tubers may be obtained.

However, if proper cultivation practices are applied, a yield of upto 1500 to 2000 kg/ha of dry tubers can be easily obtained.

Optimisation of Cultivation Technology

Mutation induced variability and crop improvement in *Coleus forskohli* .

Improvement of *Coleus forskohli* crop by artificial induction of mutation assumes special importance due to the fact that the available cultivars are poor in tuber yield and forskohlin content, the two main traits which determine the market rate to the farmers cultivating this crop.

Rooted cuttings and in vitro developed plantlets of *Coleus forskohlii* were subjected to gamma radiation (1-7 kR) and the regenerated M₁ plants were examined for induced variation.

Observations were recorded and analysed on various quantitative and qualitative traits including tuber yield and forskohlin content. Some promising mutants were identified, which out crossed the parent lines. The mutants are under further evaluation for their stability analysis.

EXTRACTION PROCESS

Coleus extracts standardised to 10 to 18% forskolin is available.

Parts used: Aerial part and root.

Forskohlin, an adenylate cyclase activating drug, is extracted from crop and is supplied in well dried form either as dried roots or ground powder depending on the buyer's specifications.

Green tuber should be cut and dried in sunlight. It takes one week for drying adequately.

The wetness in the dried tuber should be around 8% maximum.

Such dried tuber is used for further processing.

Herb manufacturers have begun to offer extracts of coleus forskohli that have been specially manufactured to contain high levels of forskohli.