Standard Operating Procedure (SOP)

Cultivation & Marketing of medicinal plants

NMHS Project: Promotion of High Value-Low volume crops based enterprises in Higher Himalayas of Uttarakhand

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Agriculture is mainstay of the people living in mountains. However, agriculture pattern varies with change in altitude, slope aspects and socio-economic priorities. In this region, accessible villages irrespective of migration pattern are based on cash crop dominated agriculture, while inaccessible villages show a subsistence-based agriculture. This project will promote High Value-Low Volume (HVLV) cash crops so as to diversify livelihood enterprises leading to strengthening livelihoods of farming communities of remote/marginalized villages: a case study of Dewal block of Chamoli district, Uttarakhand. Awareness programs along with skill and enterprise training will to effectively deliver about the Agri-BDS to enhance production and quality of farm crops. The project falls in the Broad Thematic Groups (BTGs) Awareness and Capacity Building under the National Mission on Himalayan Studies (NMHS). Local communities and business entrepreneurs (approx. 100) remain the main beneficiaries of the project where employment for women is also increased through promotion of high value - low volume crop.

Crop – Kutki(*Picrorhiza kurrooa* Royal ex Benth)
Part Use- Root and Rhizome.

Why Cultivate Kutki?

- Sustainable Market Demand Sustainable high market demand for long term.
- Good opportunity to get good rates of value added form like dry roots, powder and extracts.
- Is less prone to wild animal attacks.
- Can be cultivated in wasteland or fallow land.

Uses of Kutki

- Kutki is an anti-pyretic, anthelmintic, carminative, stomachic, hepatoprotector, anti-malarial, and laxative in small doses but cathartic in large doses.
- It is useful for asthma, cold, and cough, and also administered in liver complaints, anemia, and jaundice.
- It improves appetite and stimulates gastric secretions.
- The plant is used as a substitute or adulterant of Gentiana kurroa.

Cost Benefit Analysis

Content	Min	Max	Remark
Estimated production(kg)	12	22	
Estimated market price(Rs)	600	1000	
Cultivation cost(Rs)	2000		
Estimated income(Rs)	7200	13200	@ Selling price of Rs 600
Estimated income(Rs)	12000	22000	@ Selling price of Rs 1000
Estimated net profit(Rs)	5200	11200	(2.3 month or 18th month after)
Estimated net profit(Rs)	10000	20000	(2.3 month or 18th month after)

How to Cultivate Kutki?

Step 1: Selection of Land (Ideal)

- It grows at altitudes of 1800-3500 m.
- The plant grows well in cool and moist climate in sandy-clay textured porous soil layers with organic materials.
- The plant prefers sufficiently moist, cool and shaded locations.
- Sites rich in organic carbon with a thick layer of humus or litter and high moisture content are needed for its cultivation.
- Soil with pH 5.5 – 7.0 (slightly acidic to neutral).

Step 2: Land Preparation

The land should be tilled, and made friable and porous by repeated ploughing in order to facilitate horizontal spreading of the rhizomes underneath. Field is left open for a week for solarisation. Forest leaf litter or well-decomposed FYM (Farm Yard Manure) is mixed with the soil as per need at least 15 days before transplantation.

Step 3: Selection of Planting Material / Sowing Process

1. Kutki can be propagated through seeds and through root/stolon cutting.
2. About 2,200 stem cuttings are required per nali
3. Vegetative propagation is found most successful for multiplication as well as for higher production within short period than cultivation through seedlings.
4. Each offset or fragment of rhizome must have two to three internodes for better establishment in the field. Stolon and offsets are also suitable for propagation under controlled cultivation conditions with or without hormonal treatment.
5. Offset / stolon cuttings are transplanted in nursery beds in April-May for rooting that become ready for planting in July. It is more successful method with higher yield.
6. Planting is done in rows which are 30–45cm apart. A spacing of 30–45 cm between the plants in a row is recommended.
7. Approximately, 2200-3000 plants are required for one nali of plantation.

Step 4: Follow Intercultural Practices

1. Irrigation: The field should be kept sufficiently moist at all times. Beds need to be watered or irrigated excessively to decrease the mortality rate at the time of transplantation. Field should be irrigated on alternate days during summer, and as and when required during winter. In case of heavy rains, the plots should be drained by digging channels across the fields.

2. Weeding and Hoeing

a) Weeding depends on the condition of the soil and the presence of weeds.

b) Manual weeding should be done frequently at an interval of 5-7 days during the first growing season. At later stages, weeding along with hoeing at an interval of one month is recommended.

c) Weeding is generally done weekly during the first year of cultivation. During the second and third years, it is done monthly at both altitudes (Temperate - Sub Alpine).

3. Manure Application: Use organic manures like Farm Yard Manure (FYM), Vermi-Compost, Green Manure, Forest Litter etc. as per requirement

4. Disease Control: To prevent diseases, bio-pesticides could be prepared (either single or mixture) from Neem (kernel, seeds & leaves), Chitrakmool, Dhatura, Cow's urine etc. Botanicals viz., are often combined and sprayed periodically for controlling the pests.

5. Intercropping: Intercropping with saunf gives a better yield, providing suitable microclimate for growing plants of kutki. Intercropping with potato (Solanum tuberosum L.) and saunf (Foeniculum vulgare Mill.), are regarded most applicable. Intercropping with foxglove (Digitalis purpurea L.), Rosemary and Kuth is also suggested. At 1800-2200 m altitudes levelled ground with a slight slope gives the maximum production.

Step 5: How to Harvest Kutki?

- If propagated through stolon cutting, Kutki can be harvested in 2-2.5 years.
- The roots and rhizomes are manually harvested during October–November when the shoots or the aerial parts begin to wither and dry.
- Harvest during bright sunny day for good yield and quality.
- If there was rain the previous day, do not harvest. Wait for a dry day.
- Separate root/stolon from the main plant and store in shade.

Step 6: How to Prepare Processed Kutki?

- The harvested stolons and roots are washed to remove the soil particles and are then dried, cut into small pieces.
- Sundry or rapidly dried as possible without overheating within the range of about 35-40◦C under shade
- Spread the roots on clean floor or use any clean surface (free from dirt) Note: The area should be plain to ensure proper drying
- Dried stolon are best stored in gunny bags/bamboo baskets.
- Store the gunny bags in dry, airy and shady place

Step 7: Quality Assurance of Kutki

- Check for any crushed / broken stolon. Reject the damaged stolon if you see any.
- Ensure hygiene Note: Foreign elements like hair, grass, grain, dust, etc. should be avoided.
- Stolon should not be black or fungus affected.
- Moisture level should not be more than 10%.

Step 8: Economy of Scale

- Rate per Kg (Green) Kutki Roots : Rs. 112 – Rs. 172
- Rate per Kg (Dry) Kutki Roots : Rs. 586 – Rs. 845
- Minimum Quantity required from Cluster : 15-20 qt (dry)
- Minimum Quantity required for Pick-up : 15-20 (dry)
- Logistics Cost (Transportation, Collection, Aggregation etc.)-25-30Rs/Kg(Approx)

Step 9: Legal Steps

- Cultivation should be organic in nature (medicinal plants have to be grown without chemical fertilizers and use of pesticides)
- Harvesting should be done in a timely fashion
- HRDI Certification/Registration Required: Yes
- Transit Pass Required: Yes

Crop – Rosemary (*Rosmarinus officinalis*)
Part Use-Leaves.

Why Cultivate Rosemary?

- Sustainable Market Demand
- Can be sold as fresh leaves, dried leaves, powder or in form of oil
- Is less prone to wild animal attacks
- Is less prone to plant diseases
- Can be cultivated in wasteland or fallow land and any type of soil
- Is a perennial crop (3-14 years) with seasonal outputs as dried leaves and cuttings (3-4 months)

Uses of Rosemary

- Rosemary is uses in cosmetics, perfumery and culinary purposes.
- Rosemary is memory booster.
- Rosemary helps relieving stress, improves mood, boosting immune strength, soothing stomach, relieving pain and stimulating blood flow.
- It used as breath freshener.
- Rosemary has anti-ageing properties; hence it is good for skin
- It helps in flushing out body toxins and anti-inflammatory properties.

Cost Benefit Analysis (dry leaves per nali)

Content	Remark
Estimated production(kg)	12-22 kg
Estimated market price(Rs)	Rs. 150 – Rs. 250
Cultivation cost(Rs)	Rs. 800 – Rs. 1,000
Estimated income((After Sale))	Rs. 7200 – Rs. 13,200
Estimated net profit(Rs)	Rs. 52000 – Rs. 11,200

How to Cultivate Rosemary?

Step 1: Selection of Land (Ideal)

- Rosemary requires Mediterranean type of climate with moderately cool winter free from frost and mild summer (temperature not exceeding 35◦C).
- South facing field is good. It thrives in sunny, arid climates, well-drained location.
- It can be grow into 1000-1500 m altitude.
- Rosemary requires a well-drained loamy soil or sandy loam soil with rich humus with a pH of 5.5 to 7.0. When the pH is below 5.0 apply organic manure. However, it can be grown in clay loam soil which has less than 25% of clay. It cannot tolerate the soils having heavy clay percentage (not more than 25%).Rosemary grows best in light, rather dry soil.

Step 2: Land Preparation

The land is brought to fine tilth and laid out into plots of convenient sizes for irrigation. It is preferable to add 30 kg of farm yard manure per nali during the preparation of land and mixed well in the soil

Step 3: Selection of Planting Material / Sowing Process

1. Rosemary is propagated through Seed, Stem cutting, division of root. Stem cutting process is best and efficient way to propagate.
2. Nursery preparation season (raising the rooted cutting) is Feb to Mar and October to November.
3. Roots start farming after 3-4 weeks. For better root formation, a mist bed with a heated floor should be used.
4. Rosemary rooted cuttings can be planted during the months of June-July and September-October under rain fed conditions. Or plant can transplanted in February and November and fields are irrigated soon after transplanting.
5. 1000 plants/nail are required.
6. Plant to plant distance between 50 cm and row to row 50 cm.

Step 4: Follow Intercultural Practices

1. Irrigation: Irrigate the field after transplanting (if there is no rain 2 weeks after transplanting). No irrigation is required once the monsoon starts.

2. Weeding and Hoeing
a) Do first weeding and hoeing one month after transplanting
b) Do second weeding and hoeing one month after the first (or 2 months after transplanting)

3. Manuring: Use organic manures like Farm Yard Manure (FYM), Vermi-Compost, Green Manure, Forest Litter etc. as per requirement

4. Disease and Pest Control: To prevent diseases, bio-pesticides could be prepared (either single or mixture) from Neem (kernel, seeds & leaves), Chitrakmool, Dhatura, Cow's urine etc. Botanicals viz., extracts of garlic, Vitex negundo, Lantana camera, Clerodendron inerme, Calotropis gigantean are often combined and sprayed periodically for controlling the pests

Step 5: How to Harvest Rosemary?

- Rosemary can be harvested 2-3 times in a year. Under hill conditions, the first harvest is obtained in month of June while second harvest can be obtained in November.
- First harvest is generally obtained after 8 months of transplanting. While subsequent harvests are performed at 5-8 months interval. The crop gives relatively low yield during the first year and optimum yield is obtained during 2nd and 3rd year.
- Harvest during bright sunny day for good yield and quality
- If there was rain the previous day, do not harvest. Wait for a dry day
- Separate branches from the main stem and store in shade Note: 150-200 kg (green), 20-40 kg (dried) can be obtained per nail.

Step 6: How to Prepare Processed Rosemary?

- Wash the freshly harvested Rosemary (leaves intact on branches) under running water for any dirt and other foreign particles
- Spread the leaves / harvested plant on clean floor or use any clean surface (free from dirt) Note: The area should be plain to ensure proper drying
- The leaves should be dried under shade. Note: Use electric fan for drying for uniform drying
- When the leaves attain 10% moisture level, remove it from the branches Note: While trying to separate the leaves from the branches, if leaves do not easily separate from the branch, let it dry for some more time. It usually takes 4-5 days of shade dry to attain 10% moisture level
- Use LDPE plastic (food grade) bags for storing of dried leaves
- Store the bags in dry, airy and shady place Note: 20 – 40 kg of dry leaves can be obtained per nail.

Step 7: Quality Assurance of Rosemary

- Check for any crushed / broken leaves. Reject the damaged leaves if you see any
- Ensure hygiene Note: Foreign elements like hair, grass, grain, dust, etc. should be avoided
- Leaves should not be black, brown, white or fungus affected Note: If you see leaves are black. Take some leaves in your fist and lightly press it. If you see smoke, it means leaves are rotten or damaged
- Check for dark green color and aroma Note: If leaves crush easy, meaning it has required (10%) moisture level

Step 8: Economy of Scale

- Rate per Kg (Green) Rosemary Leaves: Rs. 4 – Rs. 10
- Rate per Kg (Dry) Rosemary Leaves: Rs. 100 – Rs. 200
- Minimum Quantity required from Cluster: 100 kg (dry)
- Minimum Quantity required for Pick-up: 1,500 kg (dry)
- Logistics Cost (Transportation, Collection, Aggregation etc.)-18-21 Rs/Kg(Approx)

Step 9: Legal Steps

- Cultivation should be organic in nature (medicinal plants have to be grown without chemical fertilizers and use of pesticides)
- Harvesting should be done in a timely fashion
- HRDI Certification/Registration Required: No
- Transit Pass Required: No

Crop – Kapoor Kachri (*Hedychium spicatum*)
Part Use-Rhizome.

Why Cultivate Kapoor Kachri?

- Sustainable Market Demand Sustainable high market demand for long term
- Good opportunity to get good rates of value added form like dry roots, power and extracts
- Is less prone to wild animal attacks
- Can be cultivated in wasteland or fallow land
- Can cultivate in wasteland supported by MGNREGA

Uses of Kapoor Kachri

- Rhizome of Kapoor kachri is aromatic, acidic, bitter, pungent, carminative, stomachic, stimulant, expectorant, anti-asthmatic, antiseptic, and anti-inflammatory.
- It is useful in asthma, bronchitis, vomiting, dyspepsia, and inflammations.
- It has insect repellent properties, and is also used as a dye and perfume for making 'abir' powder used in 'Holi'.

Cost Benefit Analysis

Content	Min	Max	Remark
Estimated production(kg)	100	200	After 2 Years
Estimated market price(Rs)	70	150	
Cultivation cost(Rs)	1000		
Estimated income(Rs)	7000	14000	@ Selling price of Rs 100
Estimated income(Rs)	15000	30000	@ Selling price of Rs 150
Estimated net profit(Rs)	6000	13000	(2 Year)
Estimated net profit(Rs)	14000	29000	(2 Year)

How to Cultivate Kapoor Kachri?

Step 1: Selection of Land (Ideal)

- It is distributed in sub-tropical Himalaya in the state of Assam, Arunachal Pradesh, Himachal Pradesh, and Uttarakhand at an altitude of 1000-2500 m.
- Kapoor Kachri prefers shady and rocky slopes rich in forest biomass and black soil.
- Water logging in the soil is fatal due to rotting of rhizomes
- Sub-temperate to temperate climate with annual precipitation of 1000–1500 mm, and welldrained, deep sandy loam, and humus-rich soil with good moisture retaining capacity are most suitable for its cultivation.
- Soil with pH 5.5 – 7.0 (slightly acidic to neutral).

Step 2: Land Preparation

A minimum of three ploughings are recommended. If the crop is to be raised through rhizomes, first ploughing is done in June with soil-turning plough. The field should be left fallow for 15–20 days so that the crop residues buried in the soil get rotten and the soil also receives an appropriate sunlight. Before second ploughing, well-decomposed FYM (farmyard manure) should be spread uniformly and mixed properly in the field. Second ploughing should be done in the end of June and third ploughing should be done with first showers of monsoon. Planking and harrowing should be done after second and third ploughing to break the clods and make the soil friable with good tilt. When the crop is raised through seeds, the preparation of land should be deferred by about one month.

Step 3: Selection of Planting Material / Sowing Process

1. Kapoor Kachri can be propagated through seeds or through rhizome
2. About 25-30 kg rhizome are required to raise planting Rhizome for one nali of land.
3. Seeds are sown 10 cm apart during October-November in the nursery beds. Germination takes place within 30-45 days and is more than 60 per cent.
4. The Rhizome are planted in the field during April to June 15th before rainy season (under irrigation), after stop rain September last to March.
5. The plant spacing should be 100 cm x 25 cm. The rhizomes are planted in furrows at a depth of 10– 12 cm, at an optimum spacing of 45 cm × 30 cm.
6. Approximately, 1200-1500 plants are required for one nali of plantation.

Step 4: Follow Intercultural Practices

1. Irrigation: Since the crop is grown in areas with well spread-out rainfall, it requires no irrigation, except in the case of rainfall deficiency or during long spells of no rain. Sufficient moisture should always be maintained but there should be no water logging.

2. Weeding and Hoeing

a) Manual weeding is recommended for the crop. Three weeding are sufficient.

b) First weeding is done 15-20 days after completion of sprouting.

c) Second and third weeding are done with the first and second hoeing operations.

3. Manuring: Use organic manures like Farm Yard Manure (FYM), Vermi-Compost, Green Manure, Forest Litter etc. as per requirement

4. Disease and Pest Control: In rhizome rot, leaves of the affected plant become pale and the affected rhizomes become soft and pulpy, and ultimately rotten. Rhizome rot can be controlled by dipping the rhizomes in cow urine for 25˜ minutes followed by shade - drying before planting. To make the cultivation disease free it is recommended to spray diluted cow urine in case of any symptoms of leave damage during growing season.

5. Intercropping: Kapoor kachri can be cultivated under the shade of apple, citrus, and Walnut trees along with other species of medicinal plants i.e., Tagar and Bada Satwa.

Step 5: How to Harvest Kapoor Kachri?

- The crop is biennial when planted through rhizomes, and hence, matures in second season during October–November, depending upon the elevation.
- Dried leaves and stalks are removed after they turn yellow, while rhizomes are left in soil for about 20–25 days for ripening before being dug out.
- If there was rain the previous day, do not harvest. Wait for a dry day
- Separate Rhizome from the main plant and store in shade.
- The crop gives good yield when harvested in the second year, i.e., 70-100 kg/nali of fresh Rhizome mass.

Step 6: How to Prepare Processed Kapoor Kachri?

- Wash the freshly harvested Rhizome under running water for any dirt and other foreign particles, Small roots and rootlets are also removed.
- Cut into small pieces/chips with manually or Machine.
- Sundry or rapidly dried as possible without overheating within the range of about 35-40◦C under shade
- Spread the roots on clean floor or use any clean surface (free from dirt) Note: The area should be plain to ensure proper drying
- Dried rhizomes are best stored in gunny bags/bamboo baskets.
- Store the bags in dry, airy and shady place.

Step 7: Quality Assurance of Kapoor Kachri

- Check for any crushed / broken Rhizome. Reject the damaged Rhizome if you see any.
- Ensure hygiene Note: Foreign elements like hair, grass, grain, dust, etc. should be avoided.
- Chips should not be black and fungus affected.
- Chips should be properly dried. When you try to break it, it's easily broken and creates a sound like stick broken. Chips look yellow white in colour.
- Moisture level should not be more than 10%.

Step 8: Economy of Scale

- Rate per Kg (Green) Kapoorkachri Rhizome: Rs. 5 – Rs. 10
- Rate per Kg (Dry) Kapoorkachri Rhizome: Rs. 70 – Rs. 150
- Minimum Quantity required from Cluster: 15-20 qt (dry)
- Minimum Quantity required for Pick-up: 15-20 (dry)
- Logistics Cost (Transportation, Collection, Aggregation etc.)-18-20Rs/Kg(Approx)

Step 9: Legal Steps

- Cultivation should be organic in nature (medicinal plants have to be grown without chemical fertilizers and use of pesticides)
- Harvesting should be done in a timely fashion
- HRDI Certification/Registration Required: Yes
- Transit Pass Required: Yes

Crop – Tulsi (*Ocimum basilicum*)
Part Use-Leaves – in form of fresh and/or dried leaves, **Branches** – for making Dhoop / Hawan Samagri, **Stem** – for making Tulsi Mala.

Why Cultivate Tulsi?

- Sustainable Market Demand
- Can be sold as fresh leaves, dried leaves or in form of oil
- Is less prone to wild animal attacks
- Is less prone to plant diseases
- Can be cultivated in wasteland or fallow land and any type of soil
- Is a short duration crop (4-5 months)

Medicinal uses of Tulsi – Against

- Fever, Cold, Cough, Sore Throat, Respiratory (Breathing) Problems , Dysentery and Dental Problems

Cost Benefit Analysis (dry leaves per nali)

Content	Remark
Estimated production(kg)	18-28 kg
Estimated market price(Rs)	Rs. 70 – Rs. 200
Cultivation cost(Rs)	Rs. 800 – Rs. 1,000
Estimated income((After Sale))	Rs. 1260 – Rs. 5,600
Estimated net profit(Rs)	Rs. 460 – Rs. 4,600

How to Cultivate Tulsi?

Step 1: Selection of Land (Ideal)

- Slightly sloppy (<1%) land where the soil (preferably sandy loam) has well internal draining and chances of water logging are minimum. Note: Water logged condition can cause root-rot and result in stunted growth
- Open area which receives ample sunlight Note: Partial shaded conditions results in poor oil content and quality
- Tropical or Sub-Tropical area with at an altitude up to 900m (approx. 3,000ft) Note: Long days with high temperature (average >30°C) have been found favorable for plant growth and oil production
- Area which receives fairly high rainfall (>7.6mm per hour) and has humid conditions
- Soil with pH 5.5 – 7.0 (slightly acidic to neutral)

Step 2: Land Preparation

The land is brought to fine tilth and laid out into plots of convenient sizes for irrigation. It is preferable to add 30 kg of farm yard manure per nali during the preparation of land and mixed well in the soil

Step 3: Selection of Planting Material / Sowing Process

1. Tulsi is grown by seeds (40 – 50 gm per nali)
2. Seeds are shown on nursery and later transplanted on field
3. The nursery can be raised in the 3rd week of March and transplanting is generally started in first week of May (requires water for initial irrigation)
4. Prepare raised seed beds of 15 inch x 4 ft 9 inch size
5. Add 0.5 kg farm yard manure or forest litter
6. Mix seeds in ratio of 1:4 (meaning every 10 gm seed require mix of 40 gm sand) Note: Sand should be well dried
7. Sow seed 2 cm below in the nursery beds Note: The seed germinates in 8-12 days
8. Irrigate (sprinkle) the nursery lightly once after the sowing Picture of Planting Material, Nursery and Sowing Method
9. Transplant the seedlings in about 6 weeks' time (4-5 leaf stage) at 40 cm x 40 cm or 40 cm x 50 cm to get high herbage (leaves) and oil yield productivity Note: The spacing will give you approx. 1,000 – 1,250 plants per nali

Step 4: Follow Intercultural Practices

1. Irrigation: Irrigate the field after transplanting (if there is no rain 2 weeks after transplanting). No irrigation is required once the monsoon starts

2. Training and Pruning: The tips of plant should be removed from the top in order to inhibit flowering stage of Tulsi and enhance vegetative growth. This will also allow plant to grow horizontally rather vertically thus giving a bushier look for more herbage

a. When the tulsi plant attains 4-6 pair of leaves or develop flowers, pinch the top part/flower
b. Use your thumb and finger to pinch
c. Make a clean pinch and do not pull it by force
d. You can also use secateurs for easy and clean cut
e. Regularly remove old wilted leaves and flowers from the standing plant

3. Weeding and Hoeing

a) Do first weeding and hoeing one month after transplanting
b) Do second weeding and hoeing one month after the first (or 2 months after transplanting)

4. Manuring: Use organic manures like Farm Yard Manure (FYM), Vermi-Compost, Green Manure, Forest Litter etc. as per requirement

5. Disease and Pest Control: To prevent diseases, bio-pesticides could be prepared (either single or mixture) from Neem (kernel, seeds & leaves), Chitrakmool, Dhatura, Cow's urine etc. Botanicals viz., extracts of garlic, Vitex negundo, Lantana camera, Clerodendron inerme, Calotropis gigantean are often combined and sprayed periodically for controlling the pests

Step 5: How to Harvest Tulsi?

- Harvesting begins 100-120 days (3.5 months) after transplanting (usually September - October)
- Start harvesting once the crop attain full bloom stage
- Harvest during bright sunny day for good oil yield and quality
- If there was rain the previous day, do not harvest. Wait for a dry day
- Cut whole plant during harvesting like wheat or rice
- Separate branches from the main stem and store in shade
- **Note:** 200 kg of fresh herbage (8kg oil) can be obtained per nali

Step 6: How to Prepare Processed Tulsi?

- Wash the freshly harvested Rosemary (leaves intact on branches) under running water for any dirt and other foreign particles
- Spread the leaves / harvested plant on clean floor or use any clean surface (free from dirt) Note: The area should be plain to ensure proper drying
- The leaves should be dried under shade. Note: Use electric fan for drying for uniform drying
- When the leaves attain 10% moisture level, remove it from the branches Note: While trying to separate the leaves from the branches, if leaves do not easily separate from the branch, let it dry for some more time. It usually takes 4-5 days of shade dry to attain 10% moisture level
- Use LDPE plastic (food grade) bags for storing of dried leaves
- Store the bags in dry, airy and shady place Note: 20 – 40 kg of dry leaves can be obtained per nail.

Step 7: Quality Assurance of Tulsi

- Check for any crushed / broken leaves. Reject the damaged leaves if you see any
- Ensure hygiene Note: Foreign elements like hair, grass, grain, dust, etc. should be avoided
- Leaves should not be black, brown, white or fungus affected Note: If you see leaves are black. Take some leaves in your fist and lightly press it. If you see smoke, it means leaves are rotten or damaged
- Check for dark green color and aroma Note: If leaves crush easy, meaning it has required (10%) moisture level

Step 8: Economy of Scale

- Rate per Kg (Green) Tulsi Leaves: Rs. 4 – Rs. 5
- Rate per Kg (Dry) Tulsi Leaves: Rs. 70 – Rs. 200
- Minimum Quantity required from Cluster: 100 kg (dry)
- Minimum Quantity required for Pick-up: 1,500 kg (dry)
- Logistics Cost (Transportation, Collection, Aggregation etc.)-18-21 Rs/Kg(Approx)

Step 9: Legal Steps

- Cultivation should be organic in nature (medicinal plants have to be grown without chemical fertilizers and use of pesticides)
- Harvesting should be done in a timely fashion
- HRDI Certification/Registration Required: No
- Transit Pass Required: No

Crop – Tagar, Samoya (*Valleriana jatamansi*)
Part Use- Whole part/Root and Rhizome.
Root – for making Dhoop / Hawan Samagri

Why Cultivate Tagar?

- Sustainable Market Demand Sustainable high market demand for long term
- Good opportunity to get good rates of value added form like dry roots, power and extracts
- Is less prone to wild animal attacks
- Can be cultivated in wasteland or fallow land

Uses of Tagar

- Rhizomes and roots of tagar have antipyretic and diuretic properties, and are used as hepatic and nervine tonic.
- They are cooling, stimulant, hypotensive, and sedative.
- They are useful in epilepsy, hysteria, hypochondriasis, nervous unrest, and skin diseases.
- Essential oil industries

Cost Benefit Analysis

Content	Min	Max	Remark
Estimated production(kg)	30	50	2nd year
Estimated market price(Rs)	150	300	
Cultivation cost(Rs)	1000		
Estimated income(Rs)	4500	7500	@ selling price of Rs 300
Estimated income(Rs)	9000	15000	@ selling price of Rs 300
Estimated net profit(Rs)	3500	6500	(2nd year after)
Estimated net profit(Rs)	8000	14000	(2nd year after)

How to Cultivate Tagar?

Step 1: Selection of Land (Ideal)

- It grows at altitudes of 1200-2500 m in north-western Himalayas and between 1200 m and 1800 m in Assam and North-East India Open area which receives ample sunlight
- The plant mostly grows randomly in steep areas, on moist, rocky, undisturbed grassy slopes, or on stones with coarse sandy loam soil
- Soil with pH 5.5 – 7.0 (slightly acidic to neutral)

Step 2: Land Preparation

A minimum of three ploughings are recommended. If the crop is to be raised through rhizomes/root suckers, first ploughing is done in June with soil-turning plough. The field should be left fallow for 15–20 days so that the crop residues buried in the soil get rotten and the soil also receives an appropriate sunlight. Before second ploughing, welldecomposed FYM (farmyard manure) should be spread uniformly and mixed properly in the field. Second ploughing should be done in the end of June and third ploughing should be done with first showers of monsoon. Planking and harrowing should be done after second and third ploughing to break the clods and make the soil friable with good tilth. When the crop is raised through seeds, the preparation of land should be deferred by about one month.

Step 3: Selection of Planting Material / Sowing Process

1. Tagar can be propagated through seeds or through root-stock
2. About 2.5–3 kg seeds are required to raise planting stock / propagules for one hectare of land.
3. The Nursery is prepared during April–May. Germination of seeds takes place during 15–20 days. The seedlings are ready for planting in about three months' time.
4. New suckers should be planted in the nursery in July or with the onset of monsoon.
5. Rooted suckers taken from mother nursery are planted in the field in rows at a depth of 4–5 cm.
6. The rooted propagules are planted in the field during July–August. Seedlings should be transplanted when they attain a height of 8–10 cm.
7. Planting is done in rows which are 40–50 cm apart. A spacing of 20–30 cm between the plants in a row is recommended.
8. Approximately, 1, 00,000-1, 10,000 plants are required for one hectare of plantation.

Step 4: Follow Intercultural Practices

1. Irrigation: Irrespective of whether the crop is raised through seeds or rhizomatous suckers, fresh plantings need irrigation almost daily till they are established. Subsequently, depending upon the slope and water holding capacity of the soil, irrigation interval may vary between one and two weeks.

2. Weeding and Hoeing

a) Do first weeding and hoeing one month after transplanting

b) Manual weeding is recommended at an intervalof 25-30 days. Once established, the plant shows good resistance against weed invasion, and because of its vigorous upright growth and dense foliage, weeds are smothered under its canopy.

3. Manuring: Use organic manures like Farm Yard Manure (FYM), Vermi-Compost, Green Manure, Forest Litter etc. as per requirement

4. Disease: To prevent diseases, bio-pesticides could be prepared (either single or mixture) from Neem (kernel, seeds & leaves), Chitrakmool, Dhatura, Cow's urine etc. Botanicals viz., extracts of garlic, Vitex negundo, Lantana camera, Clerodendron inerme, Calotropis gigantean are often combined and sprayed periodically for controlling the pests

5. Intercropping: It can also be grown with Hedychium spicatum (Kapurkachari), Amomum subulatum (Large cardamom), Paris polyphylla (Bada satwa) etc under the shade of Citrus sps (Orange) and Juglans regia (Walnut) plantations etc. V. officinalis (exotic European spp) has good international demand especially in European countries, so this species can also be tried along with V. jatamansi.

Step 5: How to Harvest Tagar?

- If propagated through seedlings, Tagar can be harvested in 30 months (usually October-November.
- Start harvesting once the crop attain full bloom stage
- Harvest during bright sunny day for good oil yield and quality
- If there was rain the previous day, do not harvest. Wait for a dry day
- Separate root from the main plant and store in shade.
- The crop gives good yield when harvested in the second year, i.e., 70-75 quintals/hectare of fresh root mass and 20-25 quintals/hectare of dry rhizomes and roots.

Step 6: How to Prepare Processed Tagar?

- Wash the freshly harvested roots under running water for any dirt and other foreign particles, cut into small pieces.
- Sundry or rapidly dried as possible without overheating within the range of about 35-40◦C under shade
- Spread the roots on clean floor or use any clean surface (free from dirt) Note: The area should be plain to ensure proper drying
- Dried rhizomes are best stored in gunny bags/bamboo baskets.
- Store the bags in dry, airy and shady place

Step 7: Quality Assurance of Tagar

- Check for any crushed / broken root. Reject the damaged root if you see any
- Ensure hygiene Note: Foreign elements like hair, grass, grain, dust, etc. should be avoided.
- Roots should not be black or fungus affected.
- Moisture level should not be more than 10%.

Step 8: Economy of Scale

- Rate per Kg (Green) Tagar Leaves: Rs. 12 – Rs. 42
- Rate per Kg (Dry) Tagar Leaves: Rs. 158 – Rs. 285
- Minimum Quantity required from Cluster: 15-20 qt (dry)
- Minimum Quantity required for Pick-up: 15-20 (dry)
- Logistics Cost (Transportation, Collection, Aggregation etc.)-25-28 Rs/Kg(Approx)

Step 9: Legal Steps

- Cultivation should be organic in nature (medicinal plants have to be grown without chemical fertilizers and use of pesticides)
- Harvesting should be done in a timely fashion
- HRDI Certification/Registration Required: Yes
- Transit Pass Required: Yes