STANDARD CULTIVATION PROCEDURE FOR TULSI (OCIMUM SANCTUM) IN ODISHA

Introduction: → Tulsi is native to India, where it enjoys a religious attachment and liked to be grown in shrines and homes as an aromatic perennial shrub. The botanical name of Tulsi is Ocimum sanctum. Tulsi is known for its medicinal values, antimicrobial and antiviral properties which helps in purifying the air. Drugs obtained from Tulsi are used to cure stress, fever, decreases inflammation and increases stamina. It is an annual shrub with average height of 2 to 4 feet. Flowers are small and purple in color. It is also grown as temperate climates; the natural habitat of tulsi varies from sea level to an altitude of 2000 m. It grows naturally in moist soil all over the globe. Commercial production of Tulsi has much significance due to valuable aroma chemicals extracted from the essential oil of tulsi.

Tulsi leaves contain a bright yellow volatile oil which is useful against insects and bacteria. The principal constituents of this oil are eugenol, eugenol methyl ether and carvacrol. The oil is reported to possess anti-bacterial properties and acts as an insecticide. It inhibits the in vitro growth of Mycobacterium tuberculosis and Micrococcus pyogenes. Tulsi is used in treating low energy, ulcers, vomiting and diarrhea or as an overall tonic. The powder of the dried root, taken in milk, ghee or as decoction, is recommended to treat malarial fever as an analgesic application to the bites and string of insects and also to increase sexual stamina and prevent premature ejaculation. The herb improves resistance to stress and has a normalizing influence on blood pressure and blood sugar imbalances.

CLIMATIC CONDITIONS FOR TULSI CULTIVATION

It is a plant that grows under sub-tropical and tropical climate. It requires moderate annual rainfall with humid conditions for better yield.

Temperature	Rainfall	Sowing Temperature	Harvesting Temperature
14^0 to 30^0 C (Ideal)	800 to 1200 MM (with at least some source of Irrigation)	15^0 to 25^0 C (Ideal)	25^0 to 35^0 C (Ideal)

SOIL CONDITION

It is grown in vast array of soil. The type of soils suitable for Tulsi cultivation should be done in rich loam, poor laterite, saline, and alkaline soil. Avoid cultivation in highly saline, alkaline or water logged conditions are not good for its yield. It gives best result when grown under well drained soil with good organic matter. Soil ranging from pH 5.0 to 7.5 suits best for its growth.

STEP BY STEP CULTIVATION PROCESS

Soil Testing: → As this crop requires high nutrition (about 120 KG Nitrogen, 60 KG Phosphorous and 60 KG of Potash per Ha) during various phases of cultivation, it is advised to test the soil to determine the exact quantities of nutrients and micronutrients those prevail in the soil and this has to be done during the months of February to March.

Soil Preparation: → For Tulsi plantation, it required well pulverize and leveled soil. To bring soil to fine tilth, ploughing and harrowing is to be done. The land should be deep ploughed during the 1st to 2nd week of April and left under sun for minimum 15 days so that soil generated pathogens and bacteria will get destroyed. During the Khariff 2nd ploughing to be done just after the onset of 1st Pre-Monsoon Showers with 6 Tones of

FYM and 1 to 2 Tons of Green Manure per hectare along with 25 to 30 KG of Neem Cake Powder as per the need.

Planting Material & Seed Variety: →In India more than 5 varieties of Tulsi are found and mostly 3 varieties of Tulsi being cultivated as given below due to their high aromatic and medicinal values.

Sl. No.	Variety	Availability	Characteristics	Planting Material	Planting Material Requirement per Hectare
1	Krishna Tulsi (Ocimum sanctum)	Almost all regions of India,	• High in Vitamin A, C, K & Beta-carotene, Magnesium, Calcium, Iron & Potassium • Oil Quantity is quite high & used as mosquito repellent & anti-malarial drug.	Seed	• 300 Gram
2	Kali Tulsi (Ocimum canum)	West Bengal, Some parts of Odisha, Bihar & Southern States	• Stem is purple & Leaves are green in color and highly aromatic • High medicinal value & used in antifungul, antibacterial and immune enhancer	Seed & Stem Cuttings	• 300 Gram Seed • 25000 Stem Cuttings
3	Vana Tulsi (Ocimum gratissimum)	Himalayan, Sub-Himalayan Region & Plains of India	• Attains maximum height • Leaves are spicy having complex fragrance resembling to clove • High medicinal value & used as stress reliever, immune system stimulant, improving resistance to stomach ulcers	Seed	• 300 Grams

Propagation: → Though Tulsi can be cultivated both by seed and vegetative propagation techniques, considering the mortality factor it is advised to cultivate tulsi through seeds under raised nursery and transplanting the seedlings in the main field with a plant to plant spacing of 60 CM x 60 CM. It is advised not to increase the spacing between the plants more than 1 meter as it would drastically reduce the plant density thus minimizing the yield.

Nursery Management & Transplantation of Seedling: → Nursery beds having size 4.5 x 1.5 x 0.5 Ft is prepared in the 3rd week of February to 2nd week of March. Seeds are sown at depth of 2cm by spreading a thin layer of FYM and soil mixture on the seed. Prior to seed sowing in the nursery beds it is always advised to soak the seeds in 5% Pot Compost Tonic solution for 4 hours, which will enhance the germination process as well as remove various diseases from the crop. The irrigation to these beds are done with sprinkler hose.

After the onset of monsoons when the seedlings will be six to seven weeks old, the transplantation is done in the main field during the last week of June. Prior to uprooting the seedlings from the nursery beds, the beds must be socked with water so that the seedlings could be easily uprooted and transplant related shock could be minimized.

SOIL HEALTH & NUTRITION MANAGEMENT

Nutrition Requirement during the whole cropping cycle: → The following table depicts the nutritional requirement during the whole cycle of cropping. At the time of Land Preparation 6 Tones of well decomposed FYM and 1 to 2 tons of Green Manure per hectare is applied which more or less equivalent to 50% of the basal dose as is specified below. Apart from this 25 to 30 KG Neem Cake Powder to be applied to soil during the ploughing to minimize the attack of soil borne pathogens.

Nitrogen (KG / Ha)	Phosphorous (KG / Ha)	Potash (KG / Ha)
120	60	60

Nutritional Requirement in between the Cropping Cycle: :→ The Balance of basal doses to be applied in the form of of Amrit Jal (60 ltrs to be diluted with 300 ltrs of water per Hectare) or application of Amrit Ghol (100 ltrs to be diluted with 300 ltrs of water per Hectare) followed by flooded irrigation after each application. These applications are to be done in 3 times after completion of each weeding and intercultural activities. The 1st weeding and intercultural activity to be done after 30 days of seedling transplantation, the second activity to be done three to four weeks of the completion of the 1st one and the third and last activity to be performed after 2 months of the completion of 2nd weeding and intercultural activities.

Care should be taken not to over-fertilize the plants otherwise there would be fertile vegetal growth, but the flavor of the leaves is reduced. Fertilizing the plants moderately will produce good quality leaves.

Irrigation: → Regular irrigation or rain is definitely required by the plants throughout the entire growing period. Irrigation should be provided through sprinklers or drip irrigation system. A drip system of irrigation helps prevent foliar diseases in the plants. Water has to be provided to the plants based on the season and soil condition. It is very essential to water the field after transplanting for the survival and establishment of the plants. The second irrigation must be done after the seedlings established; i.e., in between 5 to 7 days irrespective of season. Irrigation should be avoided during rainy season. But during any period of time if the Rain stops for more than 14 days, then it is advised to irrigate the crop for proper growth of plants. In summer season it is advised to irrigate the standing crop in every 7 to 10 days depending upon the water-holding capacity of the land. In a year on an average 12 to 15 number of irrigations required for Tulsi cultivation. So as to help water retention in the soil, it should be mulched properly and contaminated water should never be used in the farm area.

PLANT PROTECTION & PEST MANAGEMENT

Tulsi plant is not prone to serious pests and diseases, but some commonly occurring pests are beetles, slugs, leaf miners, caterpillars, grasshoppers, thrips, white fly, etc. The plant can be infected by some fungal organisms, bacterial pathogens, and nematodes. The control measures recommended during Tulsi farming to avoid the occurrence and spread of pests and diseases are:

Sl.	Name of	Cause	Symptom	Treatment

No.	Disease			
1	Leaf Rollers	Caterpillars feed themselves on leaves, buds and crops	Caterpillars seal the surface of leaves and make them roll or fold	❖ Immediately spray 70% Neem Oil solution. Then after each 7 Days spray 50% Neem Oil Solution to the whole crop for 5 times. ❖ Spray 1% Bordeaux Solution to the whole crop for 3 times at an interval of 14 days.
2.	Tulsi Lace Wing	Nymphs feed on leaves and leave excreta on leaves and whole plant	In initial stages leaves get curls and its excreta leaves dark black spot on which this nymphs feed on and then whole plant gets dried	❖ Immediately spray 70% Neem Oil solution. Then after each 7 Days spray 50% Neem Oil Solution to the whole crop for 5 times. ❖ After this spray a mixture of 100% Neem Tea solution and 50% Neem Oil solution. Then after each 7 Days spray 40% Neem Oil Solution to the whole crop for 5 times. ❖ Spray 1% Bordeaux Solution to the whole crop for 3 times at an interval of 14 days.
3.	Powdery Mildew	Fungus	Fungus that produces powder on leaves and ultimately leading to death of Plants	❖ Immediately spray 70% Neem Oil solution. Then after each 7 Days spray 50% Neem Oil Solution to the whole crop for 5 times. ❖ If the problem still persists then spray a mixture of 50% Neem Tea solution and 30% Neem Oil solution. Then after each 7 Days spray 40% Neem Oil Solution to the whole crop for 5 times.
4.	Seedling blight	Fungus	Seed buds or Seedlings die prematurely	❖ Before planting the seeds it is always advisable to disinfect the seeds with Neem Tea solution or 5% Fresh Cow Urine solution by soaking for 4 hours. ❖ During the buds releasing phase always spray a mixture of 30% Neem Tea solution and 30% Neem Oil solution in each 14 days duration till the seedlings mature
5.	Rot Root	Improper Drainage / not following	The roots of the plant get rot because of poor	❖ Before planting the seeds it is always advisable to disinfect the

		Phytosanitary Methods	drainage system., thus damaging the crop	seeds with Neem Tea solution or 5% Fresh Cow Urine solution by soaking for 4 hours. ❖ Spray 1% Bordeaux Solution to the seeds during the early budding stage in every 7 days.

HARVEST & POST HARVEST MANAGEMENT

Extreme care is needed while harvesting Tulsi so as to avoid contamination at this stage. Sterilize the equipment and use it for harvesting and also maintain the collecting bins or baskets clean. The time of harvest is an important factor on which the quality and quantity of oil production depend. High oil is obtained during sunny days and so harvesting is done during bright sunny days. When the plant is in full bloom period, i.e. after 90-95 days of planting, it is then harvested. No harvesting should be done during the rain or if it has rained just one or two days before the harvesting. Sickles are used for harvesting and different parts of the plants are harvested differently. The flower tops are harvested to produce flower oil, which is superior quality oil and the leaves are harvested to produce herb oil. Subsequent harvest is done after 65-75 days from the previous harvest. Generally, the entire plant is harvested leaving only 15 cm of the stem from the ground level. The floral harvest is done from the top of the plant and usually, 3-4 floral harvests are obtained from each crop.

Maintaining appropriate procedures of the harvest decides the end quality of the aromatic substance. Leaves are washed and cleaned thoroughly after harvest; the weeds and extraneous materials are removed from the leaves or herbage. The harvest is then allowed to wilt for almost 2 to 4 days (at 40˚C) such that the moisture content and bulkiness are lowered. Hydro-distillation or steam distillation is done to obtain the oil from the young inflorescence or the whole herb. Steam distillation takes less time to process the leaves and is mostly preferred practice.

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