Vetiveria zizanioides (Linn.) Nash

Synonyms : *V. odorata* Virey, *Andropogon muricatus* Retz.
Family : Poaceae
Group : Eye diseases
Parts Used : Root
Vernacular Names
English : Vetiver
Malayalam : Ramacham
Hindi : Khas
Sanskrit : Usirah
Bengali : Khas-khas
Gujarathi : Valo
Kannada : Vattiveru
Tamil : Vettiver
Telungu : Vattiveru

Distribution and habitat: Indigenous to India, Pakistan, Bangladesh, Sri Lanka and Malaysia. Haiti, Indonesia, Guatemala, India, China and Brazil are the main producers. It is cultivated in states of Rajasthan, Uttar Pradesh, Karnataka, Tamil Nadu, Kerala and Andhra Pradesh.
Botany: A densely tufted perennial grass, with aromatic roots and rhizomes.

• ***Leaves*** **:** Narrow, linear, erect, sheath compressed, ligules reduced to a scarious rim, midribs slender, lateral nerves close.

• ***Flowers*** **:** Spikelets grey, green or purplish in a panicle of numerous slender racemes, sessile spikelets linear lanceolate, glabrous, pedicelled spikelets two flowered.

• ***Fruits*** **:** Oblong, grains slightly oblique at the apex.

• ***Seeds*** **:** There are seeding and non seeding cultivars. North Indian types are usually seeding and generally possess better aroma. Its rooting tends to be shallow, especially in damp ground. South Indian types are mostly non-seeding. Yield of South Indian type is higher and it is a densely tufted, wiry, glabrous perennial grass with a thicker stem, with less branching roots and wider leaves and it is the cultivated type. This is distributed throughout tropics and probably a selection from wild type. It is non- flowering, non- spreading, reproduced by vegetative propagation and it is the type suitable for erosion control.

Chemical constituents: Aroma chemicals such as vetiverol, vetiverone and vetiveryl acetate are prepared from its volatile oil.
Properties: Root is cooling, bitter, alexiteric, stomachic, carminative, astringent
Uses:

• Roots are often kept along with clothes to repel insects. Root stimulates immune system, promotes menstruation, useful in headache, burning sensations, ulcers, rheumatism and diseases of blood.

• Vetiver oil is used in snake bites, cancer and microbial infections..

• It helps in maintaining soil moisture, absorbs toxic substances in chemical fertilizers and pesticides and improves physical characteristics of soil.

• Dry roots are used for making mats, fans, screens, pillows, baskets, incense sticks and sachet bags. Roots after oil extraction are used as a raw material for making cardboard, paper etc.

• Young leaves are used as fodder and also as bedding material for horses and cattle.

• Dry leaves are used for thatching purposes and for making brooms.

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Agrotechnology

Soil and climate**:** Vetiver prefers warm humid tropical and subtropical climate. It grows in areas with an annual rainfall of 600-2000 mm with moderately humid climate, up to an altitude of 1000 m, in a temperature range of 21°C to 44°C. It is mainly cultivated as a rainfed crop in hill slopes. It can also be grown as an irrigated crop in places of scanty rainfall. Plant requires plenty of sunlight and long day condition. Vetiver grows on almost all types of soils but a rich and well drained sandy loam is the best. It grows in saline and sodic soils, sandy soils, riverine soils, marshy areas and tolerates high degree of water logging and moisture stress. Roots from crops grown in light soils yield very low percentage of oil whereas roots obtained from red lateritic soils with abundant organic matter are thick and contain more essential oil. Heavy soils make harvesting of roots difficult, with a loss of finer roots which contain most of oil.

Propagation: The grass can be propagated either through seeds or slips, but slips are commonly used. The cultivated accessions propagated through vegetative means show limited variation. Seed propagation is limited to breeding of new varieties. In North Indian types, profuse seedling occurs and natural regeneration occurs from self sown seeds. Pure germinating seed yield varies between 400-650 kg/ha. Freshly collected spikelets show dormancy and require an after-ripening period of about 3 months. Removal of caryopsis from enclosing husk facilitates germination. Dormancy can also be broken by treating with gibberellic acid or potassium nitrate.

In South Indian types, most spikelets are not subject to fertilization and seeds, In these non-seeding types, slips separated from clumps of previous crops with rhizome portion intact having 15-20 cm of aerial portion is used. Slips thus obtained should be kept moist and stored in shade. Dry leaves are removed from slips to avoid chances of spread of diseases.

Varieties: ODV-3, ODV-7(Bhoomika), KS1, CIM-Dharni, CIM-Vridhi

Planting**:** The most suitable time for planting is early June to early August with onset of monsoon. In South Indian conditions, where diurnal variation in temperature is not significant and monsoon sets in early, optimum planting time is February to April. While planting slips, fibrous roots and leaves should be trimmed off. With onset of monsoon, land is prepared by 2-3 deep ploughings and after removing perennial weeds, farm yard manure or compost is applied at 5 t/ha. In sloppy areas, pits are taken across contour. Slips from healthy and disease free clumps are planted during June-July with onset of monsoon vertically about 10 cm deep at a spacing of 60x30 cm, 60x45 cm or 60x60 cm based on soil fertility status, climate, variety and irrigation facility. Plant population varies from 27800 to 1,10,000 plants/ha. Late planted crop yields coarse roots and inferior quality oil.

Manures and fertilizers: Normally, fertilizer application is not practiced in fertile soils. On poor soils, N, P2O5 and K2O may be applied each at 25-50 kg/ha of which N may be applied in 2-3 split doses. Application of 60 kg P2O5/ha is suggested for vetiver cultivation in Central Uttar Pradesh.

Harvesting**:** Roots are harvested after 15-24 months of planting but for maximum oil yield of good quality at 18 months. Earlier harvesting gives higher yield of oil, but of low specific gravity and lacking in the valuable high boiling constituents. If roots stay in ground for over two years, oil quality improves but yield diminishes considerably and oil becomes very viscous with a dark colour. Crop is generally harvested during December-February by digging out clump along with its roots. A tractor drawn mould board plough can be used for digging out roots upto 35 cm depth. Mechanical harvesting gives 15% higher roots recovery over manual digging. Length of roots varies from 10-35 cm. Roots are washed and dried under shade for 1-2 days which improves olfactory quality of essential oil. Prolonged drying in sun reduces oil yield. On an average, root yield is 3-4 t/ha from a two year old plantation. In sandy and sandy loam soils, root yield is about 2-2.5 t/ha and in salt affected areas about 1-1.5 t/ha.

Pest and diseases

Vetiver is a very hardy crop. Infestation by diseases and pests is not of serious concern. In dry areas termites are seen damaging vetiver. Grubs of beetle *Phyllophaga serrata* have also been reported infesting vetiver roots. These can be controlled by broadcasting lindane dust at 25 kg/ha before final ploughing. Stem borer, *Chilo sp.* is also a threat to commercially grown vetiver. *Fusarium* blight is seen during rainy season. Leaf blight disease caused by *Curvularia trifolii* is another important disease in rainy season.

Leaf blight caused by *Curvularia trifolii* and *Fusarium* disease is controlled by repeated spraying and drenching with copper oxychloride or 1% Bordeaux mixture. Scale insects are kept under check by the application of metasystox (0.4%) or chlorpyriphos at 2.5 l/ha. Root infesting beetles *Phyllophaga serrata* is controlled by broadcasting lindane dust at 25 kg/ha before final ploughing.

Processing**:** Roots are crushed, powdered and oil is extracted through hydro or steam distillation. Both fresh and dry roots can be distilled. Roots are shade dried and chopped into small pieces. About 15-16 hours are required for distillation. Generally the South Indian varieties require a longer time. Its oil has low volatility and high boiling point. Two distinct fractions one lighter than water and other heavier than water are obtained from vetiver. Heavier the oil better the quality. These fractions should be collected separately and later mixed together. Water content is totally removed by exposing to sun in an open container or by using a centrifuge. Roots must be distilled for a prolonged period ranging from 24 to 48 hours since the most valuable quality constituents are contained in high boiling fractions. Oil obtained from stored roots is more viscous and possesses a slightly better aroma than that obtained from freshly harvested roots. To obtain maximum oil yield and to shorten time of distillation, roots should be distilled when fresh. Oil recovery from fresh roots is 0.3-0.8% and from dried roots is 0.5-3.0% depending up on duration of distillation. On an average, oil recovery is around 1% only on dry weight basis and 10-30 kg oil is obtained per hectare per crop.