Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 05 (SEP-OCT, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Cultivation of Vetiver (*Chrysopogon zizanioides* (L.) Roberty): A Versatile Medicinal and Aromatic Plan

(Dr. C. Venkatesh, *M. Bavadharani and K. Divyasriritha)
J.K.K. Munirajah College of Agricultural Science, T.N. Palayam, Gobi, Erode
*Corresponding Author's email: bavadharanim3007@gmail.com

Vetiver (*Chrysopogon zizanioides*) is a versatile medicinal and aromatic plant mainly used for soil and conservation purposes. It is a perennial grass species with a densely tufted enormous root system that grows up to two meters long. The fibrous roots are highly aromatic and used for extraction of essential oils used in high-grade perfumes as a base or fixative for their long-lasting characteristic odor. The fragrant dry roots are traditionally used for water purification in south India. Besides, the consumption of vetiver-treated water has cooling properties and refreshes the body and mind. It also acts as a deodorant and stimulant, aids digestion, and has carminative, colic, anthelmintic, and antioxidant properties. It is a very hard grass, suitable for growing in wastelands, arid regions, and hill slopes with the least maintenance. The worldwide demand for vetiver oil was estimated at around 408.8 t/year in 2019, and the growth was reported to increase at a CAGR of 7.8 % from 2020-2027. India consumes 100 tons of vetiver oil annually; the domestic production is only 20 tons, and the remaining 80 % of the oil is imported. Hence, there is a lot of scope for increasing the vetiver area in India and globally. Looking at its vast utilization and demand, an attempt has been made to present the improved cultivation practices of vetiver based on the literature survey and experience.

Keywords : Vetiver ,medicinal plant, essential oil- yield;medicinal crops.

Introduction

Vetiver (Chrysopogon zizanioides) is a perennial grass native to India and widely cultivated in tropical regions around the world. It belongs to the Poaceae family, the same family as other grasses like wheat and rice. Vetiver is primarily grown for its roots, which are highly valued for their essential oils, widely used in perfumes, cosmetics, and aromatherapy due to their calming and grounding properties. Vetiver has long, narrow leaves that can grow up to 1.5 meters tall, with deep and strong root systems that can extend several meters underground. Its deep roots make it an excellent plant for soil conservation, slope stabilization, and preventing erosion.

Origin of Vetiver: Vetiver (Chrysopogon zizanioides) is native to India, particularly in the southern regions of the Indian subcontinent. It has been used in India for centuries, especially in traditional medicine **(**Ayurveda) and for making fragrant products. The name "vetiver" itself comes from the Tamil word "vetti ver", meaning "root that is dug up."

Distribution of Vetiver: Over time, vetiver has been widely distributed across tropical and subtropical regions worldwide due to its valuable environmental and commercial uses.

Asia: Besides India, vetiver is cultivated in other countries like Thailand, Sri Lanka, Indonesia, and China. In these regions, it is used both for its aromatic properties and for controlling soil erosion.

Africa: Vetiver has been introduced to Kenya, Ethiopia, Madagascar, and other African countries, mainly for soil conservation and water management in agriculture.
Latin America and the Caribbean: Vetiver is grown in countries like Haiti, Brazil, and Mexico, primarily for preventing erosion, stabilizing riverbanks, and supporting agroforestry systems.
Australia and the Pacific Islands: Australia uses vetiver in various environmental conservation projects, while it is also grown in the Pacific Islands for similar ecological purposes.
United States: In the southern U.S., particularly in Florida and Louisiana, vetiver is grown for soil erosion control and environmental management, although it is not as widely known for commercial essential oil production in this region.
Naturalization and Expansion: Due to its adaptability to different soils and climates, vetiver has successfully naturalized in many regions outside its native habitat. Its robust root system and low maintenance needs make it ideal for environmental protection and agricultural applications worldwide. In all these regions, vetiver's reputation as an eco-friendly plant continues to grow, especially for combating soil degradation and water scarcity.

Botanical Classification of Vetiver
Scientific Name: *Chrysopogon zizanioides*
Family: Poaceae (Grass family)
Subfamily: Panicoideae
Order: Poales
Common Names: Vetiver grass, Khus (India)

Botanical Characteristics
Growth Habit: Vetiver is a perennial bunchgrass, meaning it grows in dense clumps.The plant can grow to a height of 1.5 to 2 meters.It is non-invasive as its clumps spread vertically rather than horizontally, ensuring that it doesn't overrun surrounding areas.
Leaves: The leaves are long, narrow, and rough to the touch. They resemble other grasses in appearance, growing from the base of the plant in an upright position.Leaves can grow upto 75 cm to 1 meter in length.The color is usually light to medium green, with a prominent midrib.
Stems: The stems are tough, fibrous, and erect, with little branching. These stems are responsible for the plant's height.
Vetiver stems can grow up to 2 meters tall, making the plant visible from a distance.
Roots:
Deep Root System: The root system of vetiver is its most significant botanical feature. It can grow up to 3 to 4 meters deep into the soil, anchoring the plant and making it highly drought-resistant and ideal for erosion control.The roots grow vertically downwards rather than horizontally, which helps the plant stabilize soil without spreading uncontrollably.
Fragrant Roots: The roots produce essential oils, known for their earthy, woody fragrance.
Flowers: Vetiver flowers in late summer, producing small brownish-purple flowers in spike-like clusters (inflorescences).The flowering stalks rise from the center of the clump and are less significant in comparison to the leaves.The seeds of vetiver, particularly Chrysopogon zizanioides, are often sterile, which prevents the plant from becoming invasive.
Seeds:Vetiver produces very few viable seeds in many regions (especially non-native regions), which contributes to its non-invasive nature.In tropical regions, where it originates, seeds may be more viable, but the plant primarily reproduces through vegetative means (dividing clumps).

Culms: The culms (stems) of vetiver are stout and erect, and they support the upright, tufted growth of the leaves.

Soil and climate: Vetiver can be grown on a wide variety of soils, from heavy clay to light sandy soils, even in barren or wastelands with poor soil fertility. It can be grown even in saline and alkaline soils with a pH range of 8.5 to 10.0. However, well-drained sandy loam and red lateritic soils rich in organic matter are considered to be ideal for its cultivation. It also grows in acidic soil and is tolerant to frost, drought, and waterlogging. But not suitable for shade conditions. The plants are used to recline mined areas and heavy metal- affected soils and wastelands. Roots grown in light soils are reported to contain less oil than heavy or fertile soils Khus grass prefers warm and humid climates for better growth and development. It grows luxuriantly in places with a mean annual rainfall of 1000 2000 mm, an average temperature ranging from 21-44°C, with a moderately humid climate. It can also be grown in low rainfall areas, which receive 200-500 mm. However, irrigation and humidity enhance the essential oil content in the roots.

Cultivation

Plant propagation: Vetiver is mainly propagated by rooted slips in South India as well as from seeds in North India. Wild types of vetiver are mostly shown to be distributed by self-sown seeds. But for commercial cultivation in the South, dense clumps around the plants are uprooted, and individual tillers are separated along with roots and, known as rooted slips. Only the lower 15-20 cm leaf portion is retained with the slip, and the top portion of the shoot is pruned off.

Varieties: There are two different types of vetiver in India. The one that grows in North India is mainly wild, and it tends to produce flowers and seeds profusely. In south India, improved varieties have been cultivated, and they are primarily non- flowering types and do not plant viable seeds. The North India type produces superior quality oil even though the oil content in roots is less. South Indian types yield more than 1.5 -2.0% oil in roots, and the oil quality was found to be inferior compared to wild types

Initially, during 1982, the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow has developed two superior clones, KS- 1 and KS-2, from a collection from Bharatpur (North Indian type). These are reported to have a high oil yield and the best quality oil at that time.

Sugandha: It is a superior tetraploid genotype over its diploid parents with marked higher root biomass and oil percentage developed by CIMAP Lucknow. The variety has the potential to produce 1.4% oil in the fresh root (46% free moisture) and 21.2 q roots/ha.In 1998, CIMAP Lucknow released three high- yielding varieties of vetiver, namely, Kesari, Gulabi, and Dharini

Kesari: The variety is suitable for dry regions and marginal land. The plant grows to medium height with light green thin leaves producing greenish/white inflorescence. It produces Saffron note essential oil, which has a dry root yield of 29 q/ha and yields 30 kg/ha of essential oil.

Gulabi: The variety is adaptable to wide soil types alkaline and waterlogged areas and is suitable for dry and poor soils. It is a late flowering type that produces purple inflorescence. It has long fibrous roots containing the essential oil of rose notes. Potential dry root yield: 28 q/ha and oil yield: 34 kg/ha.

CIMAP Khus 22: Dry root yield: 18-20 q/ha; oil yield: 28-30 kg/ha and oil content: 1.8%.

CIMAP-Khus 15: Dry root yield: 9-22 q/ha; oil

CIMAP-KHUS 40 (2n= 4x=40) is a tetraploid with leaves having larger stomata and fast-growing deep penetrating roots. It has seed infertility, which prevents it from spreading as a weed.

Other varieties of vetiver: NBPGR, New Delhi, has been involved in developing vetiver hybrids. Among them, hybrids 26, 7, and 16 perform better in saline and alkaline soils with high root and oil yield.

Hybrid-8: Grows to a height of 2 m with long medium roots having a large number of rootlets per plant containing high essential oil. It possesses 70-85% vetiverol content. This variety produces profuse tillering under light soil texture, is suitable for south Indian conditions, and gives a high root yield of 12-15 q/ha.

Hybrid-26: The variety gives a higher yield of roots (14.58q/ha) with an oil content of 1.5%.

Nilambore: It is a popular South Indian variety that produces 3.8 t/ha of fresh roots and 15-22 kg. oil in well-managed fields.

A vetiver clone ODV-3 developed at the Lemon Grass Research Station, Odakkali, is reported to have a good root and oil yield in Kerala.

Land Preparation: The land is prepared by deep plowing to a depth of 20-25 cm for 2-3 times, and the soil is mixed with the recommended dose of manure and fertilizers for commercial planting.

Planting: Rooted slips can be directly planted during the rainy season (June-August), or they can be planted in nursery bags and transplanted from March to April if the irrigation facility is available. Vetiver is planted at 45 x 30 cm distance in moderately fertile soils; where are in irrigated condition, it has to be planted at a row spacing of 60 cm with a plant-to-plant distance of 45 cm. Two to three slips are planted in each pit of 5-8 cm depth, and the soil is pressed around the hole. In high-density planting, 60 x 25 cm spacing is recommended to accommodate 60,000 plants/ha

Manures and Fertilizers: Even though vetiver comes up very well in poor and moderate soils, the application of manures and fertilizers helps to increase root yield and oil content. Application of 10t farmyard manure (FYM) and 25:25:25 kg nitrogen, phosphorous, and potash fertilizers per hectare is recommended in vetiver. The entire dose of recommended FYM, phosphorous, and potash is applied during planting. Half of the nitrogen (12.5 kg) is used as a basal dose, and the remaining half of the nitrogen fertilizer is top-dressed six months after planting .

Irrigation and Interculture: Vetiver does not need supplemental irrigation for its growth in coastal and high rainfall areas with high humidity. However, about 8-10 irrigations will be required in drier areas to get the optimum yield. One or two inter-cultivation or hand weeding helps to keep the plantation weed-free in fertile soils.

Pests and Diseases: There are no serious pests noticed in vetiver, in fact, vetiver repels termites. Sometimes, in high rainfall areas, the plant is attacked by Fusarium sp. It can be controlled by drenching the roots with carbendazim @2g/l. Leaf blight caused by Curvularia trifolii is controlled by spraying copper oxychloride @3g/l .

Harvesting and yield: Generally, vetiver roots will be ready for harvesting in 18 months after planting, depending on the variety. The grass planted in July will be ready for harvesting in February of next year to get maximum oil content. The harvesting time is crucial as the root yield and oil content vary from winter to rainy season. Cool, dry winter or summer season crops yield better quality oil than rainy season crops . The major expenditure in vetiver cultivation is the harvesting process. It is not easy to harvest the densely tufted roots manually. Hence, the harvesting is done by pulling out the plants by excavation using JCB. After harvesting, the roots are separated from the stem, cleaned, and dried under shade for a couple of days before distillation. Root yield in vetiver varies from 30-40 q/ha and contains around 1% essential oil in south India. In north India, the yield of roots was much lesser (14-18 q/ha) due to collection from the wild .

Essential Oil Extraction: Conventionally, the essential oil from the vetiver was extracted using steam or hydro distillation Process from both fresh and dry roots. Generally.It takes 12-

14 hours for hydro distillation of dryRoots of north Indian types, whereas steam Distillation takes a bit less time. Even though The average yield of the North Indian variety is between 0.15 to 0.2 percent, whereas the average yield of the South Indian variety is 1 percent. The aging of extracted essential oil for six months improves the odor of the oil substantially. The characteristic harsh and green odor disappears gradually on storage of essential oil and develops a sweeter, heavier, and earthy aroma. Now a days Supercritical fluid extraction (SFE) is followed to extract vetiver essential oil . SFE has been demonstrated to be a rapid extraction method compared to steam or hydro distillation, and it takes around 2 hours for the complete extraction of vetiver essential oil.

Conclusion

Vetiver grass is a hardy tufted perennial grass used in soil and water conservation besides medicinal and aromatic properties. However, the area under vetiver cultivation is reducing drastically due to its long duration, dependency on mechanical harvesting, and difficulty in traditional distillation processes. Hence, using short-duration varieties, improved oil extraction techniques, such as the supercritical fluid extraction method, and high demand for vetiver essential oil make its cultivation more viable and necessary for the hour.

References

1. Greenfield, J. C. 1989. Vetiver grass (Vetiveria spp.): The ideal plant for vegetative soil and water conservation. Washington, DC: The World Bank.
2. Cultivation of vetiver.available at https://agritech.tnau.ac.in.
3. Vetiver extraction.available at https://vetiver.org.