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STUDY OF MEDICINAL, FOOD AND HEALTH BENEFITS OF USIRA - VETIVER [*CHRYSOPOGON ZIZANIOIDES* (L.) ROBERTY]

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Abstract - *Chrysopogon zizanioides* (L.) Roberty (Vetiver) plant known more commonly as Usira or Khus, balances the elements of Pitta and Kapha in Ayurvedic treatment. It can treat stress, headaches, skin conditions, gastrointestinal issues, calms mood, and fever as a cooler. It also helps to cleanse your blood, moisturize your body, and wash away harmful chemicals. The present study aimed at evaluating the screening of vetiver. Vetiver is a fragrant, evergreen tussock grass that is highly valued for its aromatic essential oil and medicinal properties. Khusimol, vetiverols, isopropenyl, and several other flavonoids, phenols, and phytochemicals are the primary ingredients of this plant. These have potent antibacterial, anti-inflammatory, antioxidant, tonic, and skin-rejuvenating qualities. For generations, traditional medicine has utilized the ancient plant vetiver as a means of healing and cleansing. Vetiver use it topically as well as drink it as a tea for general health advantages.

According to Ayurveda, the Vata, Pitta, and Kapha Tridoshas, or life energies, govern how your body operates. Diseases in the body are brought on by imbalances in these dosha levels. In Ayurvedic medicine, vetiver is utilized as a plant to balance the vata and pitta. As a coolant, it can cure fever, gastrointestinal problems, and skin conditions. It also helps to flush out dangerous poisons, purifies your blood, and moisturizes your body. Vetiver, or Khus as it's more often called, is a plant that balances Pitta and Kapha. This makes it perfect for sensitive, acne-prone, and inflammatory skin types. Due to its cooling effect, big pores that lean toward oiliness seem better. Skin moisture is enhanced by it. Vetiver correcting complexion, pita balancing effect slows down skin aging. In addition to its many skin advantages, vetiver essential oil is also valued for its minimal allergen profile. A popular summertime treat, vetiver makes a delicious sherbet. On the Indian subcontinent, vetiver's cooling qualities offer a moment of relief and have internal health advantages. Medicinal and health benefits of Vetiver as food additive, flavoring syrups, fragrance in foods, aromatic products, cosmetics, ice cream, beverages and for food preservation. In summary, it maintains the integrity of the metabolic system, revitalizes the body, provides vigor, and enhances immunity. The findings of screening the *Chrysopogon zizanioides* supported the therapeutic value showed in traditional medical treatments.

Keywords: *Vetiver, Usira, Tridoshas, Treatments in Ayurveda, Vata, Pitta, and Kapha*

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1.1.Introduction

Everyone experiences stress in some way in the fast-paced, cutthroat world of today. Each experiences stress differently, and stress affects the body, mind, and behavior in a variety of ways. It has an adverse effect on a wide range of medical issues and can cause several ailments. Reducing stress can help shield you from some diseases. A healthy diet, yoga, meditation, and the use of Ayurvedic principles can all assist to effectively reduce stress. *Shiro pichu* is among the best methods for relieving stress¹.

Several studies have shown that women experience higher levels of stress and frequently report more physical and physiological symptoms than males. India has been using Ayurveda, the oldest medicinal science, for thousands of years. The profession has been governed by its own core concepts, which include sickness prevention, health maintenance, and life span promotion. The primary tenet of Ayurveda is that, in terms of preserving health, prevention is better than cure. As a result, it's critical to successfully stop the harmful effects of stress^{2,3}.

It has been demonstrated in the past that stress poses one of the largest risks to human wellness. Ayurvedic stress management strategies not only maintain mental and bodily equilibrium but also progressively raise an individual's level of inner serenity and joy. Ayurveda helps people achieve maximum health and mental clarity by managing stress in a natural way⁴.

In Ayurveda, *Shiro pichu* is considered to be one of the best treatments for relieving emotional tension. *Shiro pichu* is the practice of administering medicine on the Shiro (head). *Shiro pichu* is one of the four types of *Murdhani tailam*. It belongs to the Bahya-Snehana Karma category. *Shiro pichu* is a type of relaxation that releases tension, opens subtle channels, rebalances the nervous system, and creates a happy state in both the body and the mind⁵.

A few research have shown that *Shiro pichu* offers therapeutic benefits, including as anti-anxiety, anti-hypertensive, sleep-inducing, and stress-reduction properties. Numerous studies conducted worldwide have revealed stress as one of the factors that contribute to psychosomatic disorders. *Shiro pichu* is a traditional Ayurvedic therapy technique that balances the body, mind, and spirit to enhance general well-being. Therefore, the goal of this study was to investigate the use of *Shiro pichu* in the preventative stress management method⁶.

Long-term stress has also been connected to a variety of diseases and disorders, including neurological disorders like Alzheimer's disease, cardiovascular diseases, metabolic disorders like obesity, metabolic syndrome, and type 2 diabetes mellitus, sleep disorders like insomnia and restless legs syndrome, and several cancers.

You're stressed if you're not sleeping well, losing your appetite, feeling irritable and upset over minor issues, having trouble focusing, losing your temper more frequently, and feeling anxious all the time.

Any change that necessitates adjustment or response triggers stress in the body, which responds with physical, mental, and emotional reactions. Life is full with stress. However, if it goes on for a long period, it may result in negative stress reactions that cause symptoms such as headaches or migraines, upset stomachs, high blood pressure, chest discomfort, lack of sleep, difficulty concentrating, anger, concern, frustration, despair, and many more. Numerous hormones, notably the hormone adrenaline, are produced when the human body is under stress. Early-stage stress might have specific symptoms including a lump in the throat, palpitations, anxiety, and discomfort. However, if stress is unmanaged for an extended length of time, it may have a very negative impact on your health. Physical, psychological, mental, and even emotional symptoms are all possible⁷.

Stress can cause a variety of side effects, such as tense muscles, insomnia, anxiety, irritability, melancholy, and digestive issues. Additionally, there are several chronic disorders linked to stress, such as heart disease, vascular disease, and cancer. Stress may be problematic if it is

not effectively handled, but it can also have certain benefits if it is managed well. It's crucial to make sure you can effectively regulate and handle your stress.

Disorders linked to stress are becoming more widespread in society. Ayurveda is a holistic medical system that prioritizes prevention and stress reduction in addition to the growth of mental health. *Shiro pichu* is the practice of administering medicine on the Shiro (head). *Shiro pichu* is one of the four types of *Murdhani tailam*.

The *Shiro pichu* method appears to have a calming impact. *Shiro pichu* improves circulation via modifying brain circulation. *Shiro pichu* has a relaxing and cooling effect on the brain and the overall neurological system, which helps to release accumulated tension and anxiety. It strengthens the body and the mind.

People are fighting a variety of pressures and working very hard to get over them. It can provide a good work-life balance and lead to improvements in wellbeing, health, and job satisfaction.

The term *Shiro pichu* refers to an Ayurvedic therapy procedure where a sterile cotton pad, swab, or cloth is dipped in medicinal oils. The phrases "head" and "Picchu" form the foundation of this approach. The Ayurvedic treatment of *Shiro pichu* is categorized as a *Murdhani Taila*. It is a highly effective Ayurvedic therapy that is suggested for the management and prevention of many psychosomatic conditions⁸.

Murdhani tailam is the application of herbal oils to the head for a specific duration, based on the dosha that has to be balanced. Applying *Shiro pichu* involves putting a cotton pad into hot herbal oil and quickly applying it to the top of the head⁹.

In Ayurveda, the head is considered a major marma (energy point) and uttamangam (one of the body's basic organs). The head contains all of the indriyas, or sense organs. Applying oil to the head nourishes prana vayu and the pancha indriyas, or five sense organs.

1.2 Nervous System Disorder

The Nervous System is one of the most intricate systems in charge of controlling the human body. The nervous system is the body's network of neurons, which send impulses to every region of the body. It organizes the billions of cells that make up our body and controls how the outside environment interacts with the inside system.

According to Ayurveda, the vata dosha is the primary dosha that governs the nerve system. Declaring this does not lessen the significance of the other doshas because they are interrelated and interact with one another. For instance, the kapha dosha lubricates the food, the pitta dosha facilitates digestion, and the vata dosha moves food into the digestive tract when we eat.

Vata is regarded as being extremely significant to the neurological system. The prana vayu, one of the five types of vata that live in the head and control thinking, learning, creativity, information receipt, interpretation and response to signals, and awareness, is associated with the vata dosha, which stands for movement. Anxiety is one of the main signs of vata imbalance in sensitive individuals¹⁰.

Our ability to be creative and attentive might be severely hindered by anxiety. Anxiety that is not addressed can develop into persistent, crippling stress. For Vata to work well, stability and mobility must be balanced. The primary goals of all Ayurvedic therapies, unless a separate dosha governs the illness, are to stabilize and restore the vata dosha's equilibrium. This helps someone let go of their worry, which makes room for greater creativity and serenity.

Nervous system diseases can be effectively treated by regular practice of dantha dhavana, mukha prakashalana, gandoosha, abhyanga, vyayam, pratimarsha nasyam, dhoomapanam, nidra, etc. In addition, panchakarma is crucial for regaining vigor and health. Many ENT problems, depression, hair loss, headaches, migraines, and *shirotharpana*, *nasyam*, *shirodhara*, *Shiro pichu*, etc. can be effectively treated with these remedies.

Doshas (body humors), dhatus (tissues), and malas (waste) are the fundamental components of the human body, according to Ayurveda's "Dosha Dhathu mala moolam hi sareerem" theory. All our troubles stem from imbalances in the dosha, dhatu, and mala, which are brought on by our bad lifestyle and eating choices.

Maintaining a balanced lifestyle and eating habits is essential to balancing the doshas. Also, undertaking cleansing therapies often helps the body get rid of the toxins that tend to accumulate in the body owing to various internal and external factors. This aids in bringing harmony and tranquility back to the body and mind, along with yoga and meditation.

1.2.1 Headache

Any discomfort felt anywhere in the brain is generally referred to as a headache (Shirahshool). It is seen as a symptom in the majority of illnesses. According to Ayurveda, conditions where headache is the primary symptom are referred to as shiroroga ¹¹.

Many conditions, including insomnia, hypertension, glaucoma, sinusitis, hunger, anemia, mental stress, and digestive issues, can cause headaches. Tension-related headaches are the most prevalent kind. Though it frequently extends forward from the occipital area, the pain is typically continuous and widespread. It is typified by a tense or dull aching sensation. It usually starts out less acute in the morning and gets worse as the day goes on. The primary cause of this headache is emotional tension and worry, which leads to an excessive contraction of the head and neck muscles.

1.2.2 Migraine

Headache linked to visual disruption, photophobia, and vomiting are the hallmarks of migraine. Although the precise etiology of migraine is uncertain, several theories include strain, psychological stress, ingestion of unsuitable foods, exposure to loud sounds, excessive alcohol or smoking usage, hormone imbalances, inactivity, and allergic responses. Usually, the side of the head and forehead are first affected, then the discomfort progressively gets worse. In addition to various discomforts, the development of a migraine might be accompanied by sadness, sleeplessness, mood swings, constipation or diarrhoea, and muscular stiffness ¹².

Ayurveda says the issue arises from vitiation of the tridoshas (Vata, Pitta, and Kapha). But the main cause of problems is the pitha dosha, which is connected to fire. Heat accumulates in the blood arteries as a result of pitha dosha vitiation. The blood vessels widen as a result, applying pressure to the neurological system. That's the cause of migraines.

1.2.3 Vertigo

Vertigo is a neurological condition characterized by a tendency for dizziness, spinning sensations, or lightheadedness. Most often, vertigo is accompanied with nausea. Additionally, it could result in ringing in the ears. Vertigo, also known as "Brahma" in Ayurveda, is brought on by the vitiation of both the pitha and vatha doshas ¹³.

The major causes of vertigo include rapid changes in head position that result in spinning, imbalance in the ear brought on by inner ear inflammation, and variations in ear fluid volume. It may also be brought on by inadequate rest or sleep, extreme exhaustion, stomach problems, vision problems, frequent migraine attacks, poor blood circulation, recurrent epileptic episodes.

1.2.4 Manasika rogas / Depressive disorders / Anxiety

The majority of individuals who are sick physically go through periods of psychological disturbance, although these are often transient and not very upsetting. In many instances, the psychological effects of disease are severe enough to lead to mental conditions that require specialized medical care. Numerous aspects come into play here, such as the patient's personality, social situation, type of therapy needed, and the nature of their medical ailment in the wake of an extremely traumatic occurrence. Some patients who have never had psychiatric treatment before experience a recognizable pattern of symptoms, such as anxiety, rage, sadness, overactivity, and withdrawal.

Anxiety is a common human emotion that only becomes medically significant when it is out of proportion to outside events or when it continues long after the circumstances that caused it have passed. Trembling, sweating, palpitations, chest discomfort, dyspnea, headache, disorientation, diarrhoea, frequent micturition, sleeplessness at first, difficulty concentrating, and depersonalization are among the symptoms^{13,14,15}.

1.2.5 Stroke

The most frequent stroke symptom is hemiplegia, which is a neurological deficiency affecting one or both sides of the body's face, limbs, and trunk.

It may be connected to pakshaghata in Ayurveda. An exacerbated vata dries out the body's srotas and snayu, or tendons, blood vessels, and nerves, impairing the affected part's ability to function and producing loss of feeling¹⁶.

1.2.6 Syncope

An abrupt decrease in blood flow to the brain is what causes syncope. This may occur if your heart rate drops suddenly, your blood pressure drops, or there are variations in the volume of blood in different parts of your body. Numerous syncope kinds exist, including neurologic syncope, postural orthostatic tachycardia syndrome, situational syncope, postural syncope, and Vasovagal syncope. A person experiencing syncope may experience headaches, lightheadedness, dizziness, fainting, changes in vision, tunnel vision, or seeing spots¹⁷.

1.2.7 Motor Neuron Disease (MND)

The nerves in the spine and brain gradually lose their ability to operate due to a kind of progressive neurodegeneration. Patients impacted by these conditions are primarily those over 40. Common MNDs include spinal muscular atrophy, primary lateral sclerosis, amyotrophic lateral sclerosis (ALS), and progressive muscular atrophy.

Ayurveda and MND do not directly correlate. However, based on the signs and features of the condition as well as the neurological system that is impacted, MNDs may be connected to the "Shosha" of nerve cells in the brain and spinal cord. Vata is the element that makes the neurological system work. Ayurveda says that faulty vata function is the cause of Shosha. Therefore, the major goals of the treatment plan are to rejuvenate and nourish the nerve cells while also calming down the overactive vata dosha^{18,19}.

1.2.8 Epilepsy

This illness is characterized by aberrant brain activity that can result in seizures, odd behavior, sensations, and even unconsciousness. The intensity of seizures varies based on the individual and the reason. Various factors can lead to epilepsy or seizures, including head injuries, brain disorders like stroke or tumors, illnesses like meningitis or encephalitis, birth trauma or brain damage during the perinatal period, and developmental disorders like autism or cerebral palsy²⁰.

1.2.9 Low back pain (neurological causes)

Radiculopathy caused by compression, inflammation or damage to the spinal nerve root. Pain, numbness, tingling, or other altered feeling that spreads to the nerve's serviced body parts are the results of pressure on the nerve root. When the nerve root is compressed by spinal stenosis or a herniated or ruptured disc, radiatopathy may result. Sciatica caused by compression of sciatic nerve. Another possible cause of the ailment is a tumor or cyst pressing on the sciatic nerve root. Spinal stenosis is a narrowing of the spinal column that compresses the spinal cord and nerves, resulting in pain, numbness, weakness, impaired sensation, and other symptoms. The condition known as cauda equina syndrome is brought on by disc debris that compresses the bundle of lumbar and sacral nerve roots inside the spinal canal, impairing bladder and bowel function. Permanent brain damage may result from untreated neurological conditions. Damage to the nerve root: This may develop as a side effect following lumbar surgery. There will be irreversible brain damage, resulting in things like foot drop, lower limb sensory loss, and loss of control over bowel and urine motions. These circumstances cannot be changed ²¹.

1.2.10 Cervical Radiculopathy

Compression of a nerve root in the cervical spine can result in damage to nerve function. Depending on where the damage roots are placed, this can cause discomfort and loss of feeling throughout the nerve's journey into the arm and hand. Depending on how serious the reason is, there may be muscle weakness, numbness, tingling, altered feeling, loss of coordination, etc.

Carpal tunnel syndrome: Symptoms include tingling, discomfort, and stiffness in the fingers, as well as numbness. It is caused by pressure on the median nerve in the wrist as a result of the carpel bones ²².

1.3 Treatments in Ayurveda

1.3.1 Headache Treatments in Ayurveda

According to Ayurveda, weak digestion and a sensitive nerve system are the main causes of headaches. The body's energy is affected by and diminished by a sensitive nervous system. Reduced energy also results in a decreased body's capacity to combat issues. Toxins may build up in the mental pathways as a result, which may lead to headaches. The pitha dosha, which is associated with fire, is vitiated by an improper diet and lifestyle.

Digestive impurities are produced when the pitha dosha is aggravated, which affects the digestive system. Headaches arise from the accumulation of these pollutants in the mental pathways. Ayurvedic remedies address the underlying cause of pain in addition to its symptoms. Treatments aim to improve the digestive system to balance the pitha dosha and stop the build-up of toxins, as well as to calm the nervous system and restore the vatha dosha.

1.3.2 Ayurvedic Remedies for Migraines

Restoring the body's pitha dosha equilibrium and reviving the body and mind's energy are the primary goals of the Ayurvedic treatment of migraines. The goal of the Ayurvedic remedies is to eradicate the illness entirely. The body is cleansed and detoxified using a variety of techniques to heal the digestive tract. In order to strengthen and soothe the nervous system, a variety of therapies, including internal and external drugs, are also used. In addition to medical interventions, the physicians provide a customized food and lifestyle plan based on the body type and underlying reason of each patient's condition.

1.3.3 Vertigo Treatments with Ayurveda

The main way to cure vertigo is to address its underlying cause, which can be caused by a variety of reasons. Treatment for any middle ear infection that may be the source of the vertigo should focus on controlling the infection. It may also result from hypertension or a consequence of some psychosomatic conditions, such as anxiety neurosis, etc. tension headaches, etc. Dizziness can even be brought on by anemia.

Three other factors can also contribute to Bhrama, according to Ayurveda: eating foods that are incompatible with oneself and adhering to Rajo guna Ahara. Aharas vitiates mana (thinking), which results in Majjadhatu dhushti, which in turn generates bhrama roga. Second, consuming foods and diets that are vitiated by pitta, which results in the production of ama in the body and vitiated ahara rasa, which causes majja dhatu dushti, which causes Bhrama. Last but not least, the causes of Rakta dhatu Kshaya result in Majjadhatu Kshaya and Bhrama. The goal of treatment should be to strengthen and calm the body as well as the mind by balancing the vata and pitta doshas.

1.3.4 Ayurvedic Medicine for Nervousness

Manas is crucial for healthy people since it is one of the three foundations of our existence, along with atma and sareera. Due to excess shoka (sad), Krodha (rage), chinta (thinking), bhaya, lobha etc. Consuming virudha aharas aggravates the doshas of Thamas and Rajas, leading to Manasika vikaras.

Treatment includes

- Consulting / speaking with the patient
- Nidana parithyaga (avoid all causative factors)
- Samshodhana therapy includes vamana, virechana, vasti, nasyam
- Shirodhara, Shirovasti, thalapodichil are also beneficial.
- Intake of shamana oushandhis.

1.3.5 Syncope Treatment with Ayurveda

The cause of the syncope will determine the available treatment choices. Syncope is referred to as "Murchha" in Ayurveda. According to Ayurveda, the primary cause of murchha is the vitiation of the pitta dosha in combination with the other doshas. Ingesting alcohol, being poisoned, or smelling or seeing blood might also set it off. In these situations, treatments such as *Shirodhara*, *Thakradhara*, *Shropichu*, and *Shirolepam* can be administered. This will restore the tridosha (vata, pitta, and kapha) to normality and calm the pitta dosha, which is mostly vitiated. Warm milk, a cold bath, and sprinkling cold water on the face can all be beneficial. Sirodhara, Snehapana, and other Panchkarma treatments can be utilized to soothe vitiated thridoshas and heal murcha, which is caused by worry, fear, depression, etc.

1.3.6 Ayurvedic Medicine for Stroke / Heart Attacks

In order to ensure that every part of the body performs as it should, treatment for paralysis must target its underlying cause as well as improve the neurological system. Prioritizing care should be given to conditions including hypertension, diabetes, dyslipidemia, heart disease, etc. Since vata is the primary cause of the illness, treating the vata dosha should be the goal. The primary therapy for paralysis, or pakshaghata, is vasti. Particularly recommended for pakshaghata are abhyangam, pizhichill (oil bath), pathrapinda swedam, and shashtika pinda swedam (njavara kizhi). It is best to offer Nasya, which is brimhana (nourishing). It also indicates shirovasti, shirodhara, and so on.

1.3.7 Treatment for Motor neuron disease (MND) with Ayurveda

It is recommended to do sodhana chikitsa, or purificatory treatments similar to panchkarma, with vasti serving as the primary therapy. The following should be completed: *abhyangam*, *pizhichill*, *patra pinda sweda*, *shashtika pinka*, *swedam*, *nasyam*, *sirodhara*, *siropichu*, and *shiro lepam*. The goal of internal medications should be to support and strengthen the cranial and spinal nerves.

1.3.8 Treatment for Epilepsy in Ayurveda

Ayurveda divides apasmara into four categories based on the dosha that predominates: vata, pitta, kapha, and tridoshaja. Apasmara can be caused by a combination of hereditary, congenital, incompatible dietary consumption, worsened vata dosha, brain trauma, and psychological elements such as excessive anger, fear, worry, sadness, etc. An exaggerated dosha travels throughout the body via the blood vessels and nerves, resulting in epileptic fits that appear as convulsions or violent jerks.

Treatment for epilepsy that results from external circumstances upsetting the patient's mental equilibrium should concentrate on soothing the patient's mind using techniques like mantras, yoga, meditation, counseling, and so on. Panchkarma treatments like vamana, virechana, vasti, nasya, etc. should be used appropriately in cases of apasmara caused by vitiated doshas. It is advised to use *siropichu*, *sirolepam*, *thakradhara*, and *rododhara* to energize and fortify the neurological system. The disrupted electrical impulses between the neurons that are producing seizures can be restored by *sirodhara*. It is recommended to use anjanam (collyriums/kohl) every day to stop additional seizure attacks. There are many different Ayurvedic medications that may be used internally to nourish and regenerate brain cells.

1.3.9 Treatment for Low back pain with Ayurveda

Low back discomfort is referred to as Katigraha or Katishula in Ayurveda. frequently brought on by an intensified vata dosha, which results in asthi and mamsa dhatu kshaya, or weak bones and muscles. It is necessary to do abhyangam, pizhichil, pathra pinda, swedam, lepam, pichu, etc. In this case, kati vasti is especially advised. The patient is given vasti (snehavasti and kashayavasti) to strengthen the lumbar muscles and nerves.

1.3.10 Treatment for Cervical Radiculopathy with Ayurveda

The goal of Ayurvedic treatment is to repair nerve root injury. Greevavasthi is recommended in particular for this illness. Treatments for abhyangam, pizhichil, swedanam, lepam, and potali are carried out.

1.4 Vetiver / Usira / Sugandhimula / □□□□□

Vetiver, often referred to as Usira or Khus, is a fragrant, evergreen tussock grass that is highly valued for its aromatic essential oil and medicinal properties. Khusimol, vetiverols, isopropenyl, and several other flavonoids, phenols, and phytochemicals are the primary ingredients of this plant. These have potent antibacterial, anti-inflammatory, antioxidant, and skin-rejuvenating qualities. For generations, traditional medicine has utilized the ancient plant vetiver as a means of healing and cleansing. Vetiver use it topically as well as drink it as a tea for general health advantages²³.

According to Ayurveda, the Vata, Pitta, and Kapha Tridoshas, or life energies, govern how your body operates. Diseases in the body are brought on by imbalances in these dosha levels. In Ayurvedic medicine, vetiver is utilized as a plant to balance the vata and pitta. As a coolant, it can cure fever, gastrointestinal problems, and skin conditions. It also helps to flush out dangerous poisons, purifies your blood, and moisturizes your body. Vetiver, or Khus as it's more often called, is a plant that balances Pitta and Kapha. This makes it perfect for sensitive, acne-prone, and inflammatory skin types. Due to its cooling effect, big pores that

lean toward oiliness seem better. Skin moisture is enhanced by it. In addition to correcting complexion, pita balancing effect slows down skin aging. In addition to its many skin advantages, vetiver essential oil is also valued for its minimal allergen profile. A popular summertime treat, vetiver makes a delicious sherbet. On the Indian subcontinent, vetiver's cooling qualities offer a moment of relief and have internal health advantages²⁴.

Table no 1.1: The medical properties of vetiver

Rasa (Taste)	Tikta and madhura (bitter and sweet)
Guna (Quality)	Rooksha and laghu (dry and light)
Veerya	Sheeta (cold potency)
Vipaka (post-digestive effect)	Katu (pungent)

1.5 *Chrysopogon zizanioides* (L.) Roberty²⁵

- Botanical Name: *Chrysopogon zizanioides*
- Formerly known as: *Vetiveria zizanioides* (L.) Nash
- □□□□□□□□□□ □□□□□□□□□□
- Family: Poaceae.
- Common Name: Vetiver, Khus, Khas, Vetiver grass
- Ayurvedic: Ushira □□□□□ , □□□□□
- Sanskrit: Veerana, Abhaya, Ranapriya, Virataru, Haripriya, Lamajjaka, Sugandhamula □□□□□□□□
- Marathi: □□□□ Vala
- Hindi : Khas / Usheer / khus
- Height : Vetiver grows to 150 centimetres (5 ft) high and forms clumps as wide
- Root Length: Roots grow downward, two to four metres (7–13 ft) in depth.
- Origin: India, Thailand, Tropical Asia
- Plant part used: Root



Fig no 01: *Chrysopogon zizanioides* (L.) Roberty

Chrysopogon zizanioides (L.) Roberty (formerly known as *Vetiveria zizanioides* (L.) Nash, commonly known as vetiver. Vetiver, also known as khus (*Vetiveria zizanioides*), is a tall, perennial grass that grows wild in arid regions of western and north-central India that are regularly flooded. It develops a root structure that is spongy, highly branching, and has fine rootlets. The roots contain a fragrance oil that may be used as a stand-alone perfume. Because

the wet product releases a pleasant, cooling perfume for an extended duration, the dry aromatic roots are often used to produce fans, curtains, carpets, and other beautiful items. The oil is a useful fixative for combining fragrances and cosmetics, as well as for scenting soaps. In Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, and to a lesser degree in Uttar Pradesh, it is mostly grown on small farms. The north Indian kind of vetiver oil has a considerable potential for export, given the superior quality of oil produced in India as compared to Indonesia, Pakistan, Senegal, Sri Lanka, Brazil, and Haiti. It also emphasizes the use of vetiver as MAP in Thailand, which includes its application in pest control, traditional medicine, and scented materials.

Native to India, vetiver has been used for its fragrant oil made from the roots since ancient times. Since ancient times, its hedges have also been used to preserve contours. Though vetiver grass has an extraordinary ability to withstand extreme sodicity and alkalinity, it can also help improve soil fertility and facilitate ground water recharge. In 1956, the National Botanical Garden, Lucknow (a national lab of CSIR, now known as National Botanical Research Institute) launched planned efforts to rehabilitate usar soils using vetiver plantations and organic soil amendments. Since then, sporadic attempts have been undertaken in some regions of India with the assistance of state governments to use vetiver plantations for soil reclamation and conservation^{26, 27}.

In order to systematically develop Vetiver Grass Technology (VGT), also known as the Vetiver System (VS), for watershed management, soil conservation, and slope stability, the World Bank launched a number of programs in India in the 1980s. Nevertheless, even though vetiver has the potential to create technology for a wide range of uses, industrialists in its native country continue to choose it for its lucrative root oil²⁸.

In India, the wild form of vetiver grows over tropical and subtropical plains, especially on riverbanks and across marshy areas. Its natural range includes sandy seacoasts, wetlands, plains, foothills, and hilltops in the Kumaun highlands of Uttar Pradesh, up to a height of 800 meters.

It is hypothesized that the south Indian peninsula is the region of its primary center of origin, from which it has diverged in two directions: (i) towards the north in the warm and dry northwest and the warm and humid east-central Indian plains, and (ii) towards south-east Asia and other parts of the world, based on detailed chromosomal evolutionary parameters and geographical distribution patterns. It is said that cultivars of vetiver that are found outside of south-east Asia come from south India and have minimal or no seed-setting qualities.

Two different morphological complexes of vetiver are found to live in geographically distinct areas of India: one in the south, along the east and west coasts of the Indian peninsula in the states of Andhra Pradesh, Kanataka, Tamil Nadu, and Kerala, and the other in the north, along the Indo-gangetic plains and adjacent areas, primarily in the states of Rajasthan, Madhya Pradesh, Uttar Pradesh, and Bihar. The two races are not at all same. The cultivated varieties in the south of India are low or late flowering, low or non-seed-setting, with wider leaves that produce lower quality dextrorotatory root oil (vetiver oil), while the wild varieties in the north of India are abundantly flowering, high seed-setting, and have narrow leaves that produce superior quality laevorotatory root oil (ruh-khus or khus oil)²⁹.

The Indian Agricultural Research Institute, New Delhi, the Central Institute of Medicinal and Aromatic Plants, Lucknow, CS Azad University of Agriculture and Technology, Kanpur, and Kerala Agricultural University's research station at Oddakali have all conducted extensive work on the evaluation of genetic diversity, genetic analysis, and genetic improvement of Indian vetiver. Many excellent clones, north-south hybrids, and artificial polyploids have been identified for their high essential oil output and valuable fragrance notes, which range from saffron to rose. Between laevorotatory and dextrorotatory oils, there may be a four-fold price difference depending on the oil quality and free vetiverols.

As was previously mentioned, there are two main uses for vetiver: (i) for the perfumery industry, where genotypes with high concentrations and superior quality of essential oil in their roots are needed; and (ii) for a variety of environmental applications, such as reducing carbon emissions, where plant types with low or almost no oil in their roots—which discourages local root diggers—and fast-growing, ideal root physiography that is appropriate for the intended use are needed.

Given the significant advancements in the use of Vetiver System ecotechnology, it is imperative that the creation of designer genotypes appropriate for certain uses receives the attention it deserves. To prevent soil carbon loss and carbon recycling to the atmosphere, it is also preferable that no-dig cultural practices be established if roots are to be collected for essential oil.

The only nation where vetiver forms copious seeds in its native environments is India, the birthplace of vetiver. Progenies grown from seeds have enormous potential for using genetic diversity to separate plant genotypes appropriate for certain uses. Tetraploidy may be used to turn the genotypes that were so carefully chosen into triploids, which would have noninvasive characteristics and no seed production in order to comply with international responsibilities. In the author's laboratory, efforts are being made in this regard.

A perennial bunchy herbaceous plant in the Poaceae family, vetiver grows in practically any type of soil and may reach elevations of up to 2000 meters. However, well-drained sand is thought to be the ideal subsoil for vetiver's development. Vegetable tufted grass has stiff stems that may grow up to two meters in height. Originally from India, vetiver spread over the world about a century ago and is now extensively grown for a variety of uses in tropical climates (current notable producers include Haiti, India, Indonesia, and Reunion Island).

Nearly every component of the plant is used in traditional medicine; it is said to have emmenagogue, diuretic, carminative, and diaphoretic properties. It is also a well-known anthelmintic and parasite agent. Many traditional treatments use vetiver as an alexiteric agent, such as a preservative against poisons and venoms. For example, a paste made from fresh roots is recommended to treat scorpion stings and snakebite injuries. In Trinidad, vetiver tea is an effective treatment for pleurisy, nausea, colic, and the flu. Gallstones are dissolved by consuming the root's decoction in Thailand and the Philippines.

A pleasant beverage made from ground roots is suggested as a remedy for stomach ailments and fevers. In the event of skin burns, topical vetiver formulations are advised to reduce discomfort. It has been claimed that rheumatism, lumbago, and sprains can be relieved by topically applied leaf paste. Tribes in West Bengal also utilize stem decoction to treat urinary tract infections.

Vetiver is a very drought-tolerant plant with a huge vertical root system that is finely organized and extremely robust, typically reaching heights of over 3 meters. This plant may also stabilize soils by preventing sheet erosion. The plant, which is incredibly resistant to weeds and other pests, also shields fields from mice and other pests^{30,31}.

The multipurpose species is grown primarily for its essential oil (EO), but it is also used as a food additive and flavoring, mattress stuffing, animal bedding, animal feed, mulch (used to control weeds in coffee, cocoa, and tea plantations), and phytoremediation agent for soils contaminated with metals. Vetiver essential oil (EO), which is extracted by distilling dried roots, is highly prized for use in aromatherapy, cosmetics (such as soaps and deodorants), and fragrances (both as base notes and as a fixative for scents). There are two primary types of vetiver: a sterile, non-seeding variety grown outside of India and a fertile version produced in India that is commonly referred to as khus oil. Both types provide essential oil.

The plant needs humid to subhumid growing conditions in order to produce essential oils. Because of its molecular complexity, vetiver essential oil (EO) exhibits nice, heavy, earthy-woody notes that are incredibly persistent and cannot be replicated synthetically. Because of its strength, EO is often used in both feminine and masculine current scent formulas.

Additionally, vetiver oil is widely utilized in contemporary aromatherapy, particularly for its calming effects and skin-balancing/regulatory properties.

In this sense, vetiver oil is a vital component of the perfume and cosmetics industries. However, because to the swift and frequent alterations in individual preferences, vetiver oil's widespread appeal may swiftly wane, necessitating the discovery of new channels for distribution in order to fully utilize this precious resource. In reality, the importance of this item is shown in the present estimated 250 tons of EO traded annually worldwide, valued at \$20–200 million.

Over 50,000 families in Haiti are entirely and directly dependent on vetiver for their subsistence, making it the country that exports the most vetiver worldwide. A close reading of the literature reveals that while vetiver essential oil's chemical makeup has been well studied, nothing is known about its biological characteristics. Moreover, considering the variability of the findings from this kind of investigation, a report has to be prepared and additional research is required to evaluate the bioactivities of vetiver EO³².

In order to avoid the public's and the perfume industry's eventual disinterest in this fragrance and to further expand its range of applications, this article reports on the investigation into vetiver oil's potential use in cosmetics as an active ingredient per se with cosmeceutical significance, e.g., with whitening, antioxidant, anti aging, anti inflammatory potencies, or presenting antimicrobial activity³³.



Fig no 02: Vetiver root

Vetiver has two main uses: (i) for its essential oil extracted from the roots, which is used in the fragrance business. To do this, genotypes with large concentrations and excellent quality essential oil in their roots are required. (ii) for a variety of environmental uses, such as reducing carbon emissions, for which we want plant varieties that: (a) create little to no oil in their roots, discouraging local root diggers; and (b) develop quickly and have perfect root physiography that is appropriate for the intended use.

Basic ideotype characteristics appropriate for particular uses. The following requirements are worth taking into account for the construction of certain genotypes for particular purposes, keeping in mind fitness with "root-ideotype."

- Essential Oil - Well developed phloem, Smooth-thick vertically growing roots with minimum branching
- Land / Slope Stabilization / Bioengineering - Profusely branching, spreading type with least essential oil
- Water and Soil Reclamation - High absorption potential for soluble N, P, nitrates and pesticidal residues
- Soil and Water Detoxification and Pollution Mitigation - High absorption potential and tolerance to heavy metals
- Management of Waterlogged areas - Spongy roots with schizogenous cortex
- Carbon sequestration - Deep penetrating faster growing roots with low essential oil and thick vascular cylinder and suberised epiblema

1.6 Vetiver Essential Oil³⁴

Vetiver oil: Expensive edible oil in the Chinese market and also been used in India

Uses: Food additive, Flavoring syrups, Ice cream, Beverages, Food preservation

Uses: Aromatherapy, Incense, Perfumery industry, Flavor agent

Biological activities: Antioxidant, Antibacterial, Anti-inflammatory properties

1.6.1 Description of oil

Property: Volatile oil

Type of Oil: Essential Oil

Color: Golden-brown to amber-brown, Dark Brown

Aroma: Strong

Odor: Strong, Earthy and Woody aroma, Smokey

Obtain: 18 to 24-month old roots

Composition: >150 identified components

Isolation: Hydro-distillation, Steam Distillation

1.6.2 Distillation Process

The essential oil is collected from the roots by steam distillation. When roots are distilled, freshly collected roots yield more oil than stored roots, which gradually lose oil yield over time. Before distillation, the roots are steeped in water for 18 to 20 hours to soften the root material and aid in the release of oil. Cutting new roots into 2.5–5 cm lengths speeds up the healing process^{35,36}.

The roots must be distilled for a lengthy time—between 20 and 24 hours—because the highest boiling fractions contain the most desirable quality ingredients. Varieties from North India generate between 0.4 and 0.8 oil. There are two fractions produced by distillation: lighter and heavier oils. A significant portion of the extremely volatile lighter fraction may escape during the first phase before it cools and condenses into the liquid phase. After cleaning, a piece of markin cloth is attached at the delivery outlet in the shape of a swelled balloon in the receiver, keeping it immersed in water, to prevent this loss.

The fabric would contain the lighter percentage that is most likely to escape along with the steam, gas, or flowing distillate water. The heavier fraction will settle in the cloth as the distillation process proceeds, while the lighter fraction will flow through the fabric and collect in the receiver. Once the distillation process is complete, the cloth is pressed to extract the oil. We utilize this piece of fabric till it tears off. To recover the sticking oil, the cloth can be cleaned with diethyl ether, a solvent, before discarding it. This procedure aids in improving oil recovery.

Since vetiver oil reacts with free copper to produce a bluish color that is more valuable in the perfumery market, copper vessels with S.S. condensers are traditionally thought to be beneficial for vetiver. Even if recovery is relatively poor, historically distilled oil, also known

as "Ruhe khus," produced in Kannauj style "Deg Vopka," commands the greatest price in the fragrance market.

1.6.3 Medicinal and Health Benefits of Vetiver Essential Oil³⁷

Vetiver essential oil has anti-inflammatory, anti-septic, aphrodisiac, cicatrisant, nervine, sedative, tonic, and vulnerary qualities, which are responsible for its health effects.

These are a few of the many therapeutic qualities of this essential oil, which are also quite popular in aromatherapy.

1.6.3.1 Anti Inflammatory

This essential oil's incredibly calming and cooling properties help to soothe and pacify a variety of inflammations. However, it works especially well to relieve inflammations of the neurological and circulatory systems. Research indicates that it is a suitable remedy for inflammations brought on by sunstroke, dehydration, and loo (the term for very hot, dry winds that are common in the summer months in the arid parts of India and a few neighboring countries).

1.6.3.2 Anti Septic

Microbes and germs proliferate quickly in tropical nations like India and its neighbors because of the favorable hot and humid environment that exists there. Then it becomes clear that because there are so many germs in these areas, your wounds are most prone to develop septic. However, Mother Nature is incredibly generous and has already supplied the cures in those exact locations.

This vetiver and the essential oil that was extracted from it is one such cure. This oil effectively inhibits the growth of *Staphylococcus Aureus*, the septic-causing bacteria, and gets rid of them, which helps heal septic and provides protection from it. This oil is completely safe and may be used topically or topically to prevent infections in wounds and internal organs.

1.6.3.3 Aphrodisiac

This oil has an aphrodisiac effect when used as a flavoring component in sorbets and drinks. It arouses and increases libido. Since sex is more psychological (brain-related) than physiological, the brain is the source of treatment for the majority of sexual illnesses, including frigidity, impotence, and lack of desire. When specific parts of the brain are stimulated by this oil, the issues go away.

1.6.3.4 Cicatrisant

A substance's ability to accelerate the removal of scars and other markings from the skin is known as its cicatrisant property. It helps provide a uniform appearance by encouraging the creation of new tissues in the damaged areas to replace the dead and discolored tissues. Additionally, this helps with burns, postpartum stretch scars, fat cracks, and pox aftereffects.

1.6.3.5 Nervine

A nervine, such as our Essential Oil of Vetiver, is a tonic for the nerves. It fosters and preserves the health of the nerves. It also restores nerve damage caused by shock, fright, tension, etc. Additionally, it aids in the elimination of nerve diseases, ailments, hysteric and epileptic episodes, nervous and neurotic illnesses including Parkinson's disease, and loss of limb control.

1.6.3.6 Sedative

One well-known sedative is vetiver essential oil. In addition to helping patients with sleeplessness, it calms down nerve irritations, ailments, convulsions, and emotional outbursts including rage, anxiety, hysteric and epileptic episodes, restlessness, and anxiousness.

1.6.3.7 Tonic

A tonic's impact on the body is comparable to a car's after overhaul and service. Every bodily system that functions, including the immunological system, endocrine system, digestive system, respiratory system, circulatory system, excretory system, neurological system, and neurotic system, is toned up by a tonic. In summary, it maintains the integrity of the metabolic system, revitalizes the body, provides vigor, and enhances immunity.

1.6.3.8 Vulnerary

This characteristic of vetiver essential oil aids in wound healing by encouraging the formation of new tissue where it is injured. It also protects the area from infection by preventing the growth of bacteria and encouraging the concentration of leucocytes and platelets there.

1.6.3.9 Healing

Vetiver essential oil is used to eliminate stains, markings, and scars from the skin as well as to aid in the development of new tissue, speeding up the healing process and recovery of skin wounds. Additionally, we used to fix the skin's creases and cracks brought on by various conditions including dieting, burns, allergies, and pregnancy.

1.6.3.10 Calming

Together with a variety of gourmet and aphrodisiac drinks, vetiver essential oil is used to make a calming infusion that helps people unwind and recuperate from extreme stress. Assist in overcoming instances of shock, anxiety, tension, and panic.

1.6.3.11 Other Benefits

The use of vetiver essential oil has been shown to provide additional advantages, such as bone strengthening, rheumatism, gout, arthritis, muscular pains, dryness, cramps, and dry skin.

Vetiver is widely used in many different places because of its amazing mass of deep, strong, fibrous roots and dense thatch of stiff leaves. Nurse crop: In severely deteriorated regions, vetiver stabilizes and replaces nutrients. Native flora are invited back at restored areas. Privacy barrier: Vetiver grows into a tall, thick wall that blocks out prying eyes and produces a tranquil, lush haven. It makes a lovely, cost-effective border for tiny, city property. Vetiver systems are used by both private businesses and local governments to restore and preserve damaged ecosystems. Vetiver roots clean water by absorbing impurities. For even the most determined tagger, a strip of vetiver growing up against a hollow tile or concrete wall can keep them away from your "canvas." Vetiver hedges are so sturdy that surveyors use them to demarcate property boundaries and as a grass wall.

Farmers may produce crops that gain from the buildup of silt and plant nutrients in between thin rows of vetiver. The vertical roots of vetiver support nearby crops. Maturity yields long-lasting, absorbent mulch, making mature leaves an ideal batch material. that promotes the accumulation of mycorrhizae and lowers evaporation. As a bioswale, A visually appealing substitute for conventional concrete drainage ditches, vetiver grass channels efficiently filter and reduce runoff from rainfall. It is possible to arrange and plant vetiver hedges at key locations to redirect water and reduce the speed of precipitation flow.

Vetiver is a man-made wetland that is used as a leach field to absorb nutrients from pig farms, dairy farms, and poultry farms. Vetiver removes smells from wastewater and clarifies it.

Vetiver has a nutritional value comparable to that of Napier grass (*Pennisetum*) when fed to animals. 1940s: Vetiver for cows in the area. The cows were not fond of it. However, they also didn't like for Napier grass. As a carbon sink: 44,500 acres of land shielded by vetiver hedges will act as a sink for carbon dioxide, absorbing the equivalent of one hundred thousand automobiles' worth of carbon emissions per year, which is concerning given the state of global warming and CO₂ emissions.

Dry biomass outputs for biofuels surpass 370 t/ha annually. Harvested three or four times a year, with an average yield each harvest of 120–130 t/ha. Generally, an annual yield with four harvests is 10–20% greater.

The main chemical components of vetiver leaves are hemicellulose (about 38%) and cellulose (about 27%). Vetiver leaves have a high cellulose content. With an alkali pretreatment, enzyme hydrolysis, and yeast fermentation, vetiver leaves may be utilized as a substrate for the synthesis of ethanol. This process yields an ethanol yield of 13% after a single cycle of column distillation. As a food additive: In the United States, people use vetiver in their baking and tea infusions.

Vetiver leaves and roots are used by artisans to make a wide variety of exquisite woven handicrafts. Vetiver would seem to be a good choice for making soft, long-lasting fabric, much like its sister plant, bamboo, which produces exquisite fabrics. A lovely decorative plant for patios, decks, and gardens is vetiver. The vetiver plant's bush is so big that it may conceal ugly constructions. When planted closely together in a straight row as a hedge, it creates a thick, even, and visually pleasing hedge in tropical and subtropical regions. Additionally, it creates a visually stunning screen to hide an ugly image.

1.7 Activities Associated with Agriculture

1.7.1 Mulch

Mulching is one of the most crucial conservation techniques in tropical nations with heavy and prolonged rainfall. Similar to other mulching materials, vetiver leaves provide the plot shade, which lowers the temperature while also preserving moisture and controlling weed growth. Vetiver leaves make great mulch because they are hardy and persistent. Vegetable plots, fruit tree bases, and field crop plots can all benefit from the use of vegetable mulch.

1.7.2 Composition

Vetiver leaves and culms degrade entirely, turning them from dark brown to black in color and becoming mushy and dissolved. Major nutrients from the decomposition process, such as N, P, K, Ca, and Mg, are present in veterer compost, which has a pH of 7.0. Furthermore, humic acid from vetiver compost improves soil fertility.

1.7.3 Animal feed

Mature vetiver leaves cannot be utilized for livestock or fish feed due to their high silica content and low nutritional value compared to other grasses. However, young vetiver leaves can be pulverized and fed to fish. Additionally, the investigation showed that vetiver has a lower crude protein level than other grasses that are fed to animals.

Vegetables are grown along field boundaries in the Indian state of Karnataka and harvested for fodder every two weeks or less. When compared to native grass and rice straw, it was shown that the structural carbohydrates in vetiver were comparatively greater. However, it also included ideal amounts of crude protein, which is thought to be sufficient to optimize absorption and digestion of the vetiver fodder. It was determined that vetiver may be utilized as ruminant feed provided it is blended with other excellent quality feed and forages.

1.7.4 Mushroom Cultivation

Certain mushrooms may feed on the cellulose, hemicellulose, lignin, and crude protein found in the leaves of vetiver plants, in addition to other minerals. Using vetiver as the growing medium, several researchers have successfully cultivated mushrooms. Among the mushrooms that may be grown utilizing tiny bits of vetiver as a substrate are oyster, shiitake, and straw.

1.8 Vetiver (*Chrysopogon zizanioides*) Uses³⁸

- Agriculture: Prevent soil erosion and is used in the treatment of metalliferous-polluted ground due to its tolerance to heavy metals
- Industrial applications: The production of the commercially and medicinally valued volatile oil- distilled from its root
- *C. zizanioides* essential oil: Functional ingredient and fragrance in foods, aromatic products, and cosmetics
- Food additive: Flavoring syrups, ice cream, and beverages and for food preservation
- Treatment of syndromes: Gastritis, fever, headache, mouth ulcers, toothache, chronic inflammation
- Activity: Anti-inflammatory activity, Antiseptic, Aphrodisiac, Nervine, Sedative, Tonic, and Vulnerary substance
- Antioxidant activity
- Calms mood

1.9. Botanical Pesticides

1.9.1 Insecticides

Given the lack of significant insect pests found in vetiver, it is clear that insects detest vetiver, as demonstrated by the following cases: According to Levy's (1940) observations, vetiver plants planted next to sugar cane can significantly reduce the amount of insects, including cane borer, that attack the crop.

Similarly, a Louisiana farmer stated that no insects of any type ever approached a crop patch when vetiver was applied as mulch. Additionally, it has been shown that the tops of vetiver, together with the leftover roots, provide an impenetrable barrier against insects that may harm strawberries cultivated in the southern United States.

Maistrello and Henderson (1999) discovered recently that vetiver roots contain a class of chemicals, including nootkatone, that can alter termite physiology and behavior when they come into close touch with the plant, swallow it, or inhale its fumes. Additionally, they discovered that termites that consume wood treated with vetiver oil or nootkatone gradually starve their colony due to the protozoa's inability to digest the wooden food, which in turn causes the termites' colony to gradually decline.

1.9.2 Fungicides

Fungal infestations on vetiver mulched plants have almost completely vanished in New Zealand, and there doesn't appear to be any additional pest activity surrounding the host plants.

1.9.3 Agaricides

10% vetiver oils of various ecotypes were shown to be varyingly effective in controlling cow ticks in Thailand, both during the larval and adult stages. Additionally, a dry root extract proved more effective in controlling adult ticks than larval ones.

1.9.4 Allelopathy

It has been seen that a few other plants are growing close to the clusters of vetiver. Certain compounds released by the vetiver plant were thought to have allelopathic effect, which is the ability to prevent the growth of other plants. Vegetable substances from the roots and stems may prevent soybean seeds from sprouting. The study indicated that the germination of seeds from any plant growing nearby is inhibited by the allelopathic impact of vetiver extract found in vetiver oil.

It was further proposed that this may be used to manage weeds on agricultural plants without requiring the application of chemical pesticides.

1.9.5 Weed control

Whole or dried vetiver leaves provide a dense mat that covers the ground and keeps weeds from growing. On tea plantations in India and coffee and cocoa farms in the Central Highlands, vetiver mulch effectively suppresses weeds.

1.9.6 Perfumery

Vetiver oil has a strong, earthy, nut-like scent and is thick, light brown in color. Vetiver oil is used diluted to add a pleasant tone and a calming, cooling effect. It has been used as a raw material for a variety of scented goods, including lotions, soaps, deodorants, perfumes, and cosmetics. Vetiver oil is a special resource for perfumers due to its complex chemical makeup, oily smell, and great solubility in alcohol, which enhances its miscibility with other materials.

Many nations, particularly in Asia, have long employed vetiver as an aromatic and therapeutic herb. It has gained significant reputation recently as the perfect plant for protecting the environment and conserving soil and water. However, farmers claim they receive no direct advantage (i.e., economic return) from planting vetiver, which has made it difficult to promote vetiver cultivated as hedgerows for soil and water conservation. On the other hand, there is a claim that the farmers might reap significant indirect advantages.^{39,40}

The fundamental goal of planting vetiver, its implications for the ecology, socioeconomic factors, and industrial possibilities are discussed as it comes to a close. Given the widespread push to "go back to nature," there is a lot of room for growth in the commercial production of pharmaceutical goods using vetiver as a medicinal plant. Growing vetiver as a plant that generates cash is a novel idea that the Royal Project Foundation of Thailand has just introduced. This strategy is intriguing since, if produced primarily for its roots, vetiver generates a substantial revenue for the farmers.

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