Vetiver Review

Vetiver is a warm-season perennial grass mentioned as a possible producer of renewable biomass fuels. This report will address the life history, and utilization of vetiver grass.

Vetiver (*Vetiveria zizanioides* (L.) Nash.) is a member of the subfamily of grass called Panicoideae, the tribe Andropogoneae and the subtribe Sorghinae. Vetiver is a Tamil word, meaning "root that is dug up". Zizanioides means "by the riverside".
Vetiver is known by many common names including "Khus" or "Khus Khus" (Vietmeyer 1993).

Vetiver is described by Bailey and Bailey as – robust to 8 ft., unbranched, densely clustered; 1f. sheaths glabrous, blades stiff, long, 5/16 in. wide or less, glabrous but rough on edges, odorless; panicles large, erect, to 12 in. long, slender, the brs. whorled, ascending, naked at base; spikelets awnless, muricate.

Vetivera is native to a lowland swampy area north of New Delhi India. However, it occurs in many countries throughout the world. The following is a partial list:

Africa

Algeria
Angola
Burundi
Comoro
Central African Republic
Ethiopia
Gabon
Ghana
Kenya
Madagascar
Malawi
Mauritius
Nigeria
Rwanda
Reunion
Seychelles
Somalia
South Africa
Tanzania
Tunisia
Uganda
Zaire
Zambia
Zimbabwe

Asia

Bangladesh
Burma
China
India
Indonesia
Japan
Malaysia
Nepal
Pakistan
Philippines
Singapore
Sri Lanka
Thailand

Americas

Argentina
Brazil
Colombia
Costa Rica
French Guiana
Guatemala
Guyana
Honduras
Paraguay
Suriname

Caribbean

Antiqua
Barbados
Cuba
Dominican Republic
Haiti
Jamaica
Martinique
Puerto Rico
St. Lucia
St. Vincent
Trinidad
Virgin Islands

Pacific

American Samoa
Cook Islands
Fiji
New Caledonia
New Guinea
Tonga
Western Samoa

Others

France
Italy
Spain
USA

(Vietmeyer 1993)

Vetiver has the C_4 photosynthesis pathway. Therefore, it is very well adapted to the warmer regions of the world. However, it displays a very wide area of adaptation. It ranges from the Monsoonal Tropics to the rainforests of Kerala, the deserts of Rajasthan, and the frost zones of the Himalaya foothills. It occurs in coastal areas growing in the path of salt spray. It thrives under very wet (>3000 mm precipitation) conditions and very dry (<300 mm precipitation) conditions. It can survive in Rajasthan, where temperatures reach as high as +46°C and in Fujian, China, where winter temperatures have reached −9°C. However, the greatest restriction of vetiver grass is by cold temperatures. It can also grow under a wide range of soils. It can survive acidic to basic soil conditions. In Sri Lanka some vetiver even grows in bauxite, a material toxic to almost every other vascular plant.

Vetiver has a massive fibrous root system. Roots have been measured at depths of over three meters. It has been observed that the roots grow almost straight down, therefore, reducing the chance of interference with crop plant roots (Vietmeyer 1993). This observation was supported by a study in Kerala. It found 92% of vetiver roots were found within a horizontal radius of 20 cm from the plant. Approximately 88% of the roots occurred within a 40 cm depth (Salam et al. 1993). Vetiver roots can grow extremely fast. Slips planted in Malaysia produced roots 60 cm deep in just three weeks.

The crown of the plant is generally a few centimeters below the surface of the ground. It is a dome of dead material, debris, and growing tissue, much of it a tangled knot of very short rhizomes.

Vetiver tillers have a very erect habit, which keeps its leaves up off the ground. Tillers are very strong and stiff because they contain a high level of lignification; therefore, there is very little lodging in this plant. Tiller growth of 5 cm per day for more than 60 days has been measured in Malaysia. Even under ordinary conditions, plants often reach 2 M in height after a few months of growth.

Vetiver grows so densely that, at least according to various informants, it can block the spread of weeds, including some of the world's worst creeping grasses; couch, star, kikuyu, and Bermuda. In Zimbabwe, for example, tobacco farmers reportedly plant vetiver around their fields to keep kikuyu grass from creeping in. In Mauritius, sugarcane growers rely on vetiver to prevent Bermuda grass from penetrating their fields from adjacent roadsides (Vietmeyer 1993).

However, very little dry matter yield information is available. This type of production data will have to be obtained before the potential use of vetiver, as a biomass fuel can be determined.

Vetiver tillers and leaves are so tough and coarse at maturity even with vast amounts of cattle roaming the Indian countryside, the plant is never destroyed.

Inflorescences usually are brown or purple in color and can grow to 1.5 m long. Different vetiver germplasms can produce either fertile or infertile seed (Vietmeyer

1993). Lal et al. (1997) found fertile vetiver line heritability estimates were over 90% indicating selection was possible. Some vetiver germplasms produce many viable seed and seedlings and have invasive characteristics in the Southeastern United States.

A USDA-NRCS line called 'Fort Polk' has been released (Englert et al. 1999).

Vetiver is remarkably free of disease. However, *Fusarium* (the most widespread cause of rotting in fruits and vegetables) reportedly attacks it, notably during rains.

Perhaps of greater import is the leaf blight caused by *Curvularia trifolii*. This disease of clover and other crops may attack vetiver also during the rainy season.

In Malaysia, a detailed investigation of vetiver has located yet more fungal species. These had little effect on the plant itself, but they might eventually prove troublesome in crops grown near vetiver hedges. They include the following species:

- *Curvularia lunata* (causes leaf spot in oil palm)
- *C. maculans* (causes leaf spot in oil palm)
- *Helminthosporium halodes* (causes leaf spot in oil palm)
- *H. incurvatum* (causes leaf spot in coconut)
- *H. maydis* (causes leaf blight in maize)
- *H. rostratum* (causes leaf disease in oil palm)
- *H. sacchari* (causes eye spot in sugarcane)
- *H. stenospilum* (causes brown stripe in sugarcane
- *H. turcicum* (causes leaf blight in maize)

Termites sometimes attack vetiver, but seemingly only in arid regions. Except where the termite mound covers the whole plant, only dead stems in the center of stressed plants are affected. In at least one location in India, grubs of a beetle (*Phyllophaga serrata*) have been found infesting vetiver roots. Perhaps the most serious pest threat comes from stem borers (*Chilo spp.).* These were found in vetiver hedges in Jianxi Province, China, in 1989. In Asia and Africa, some of these moth larvae are severe cereal pests (for example, the rice borer of Southeast Asia and the sorghum borer of Africa.) Until this potential problem is better understood, vetiver plantings should be carefully monitored in areas where stem borers are a problem.

Vetiver has outstanding resistance to root knot nematodes. In trials in Brazil, it proved "immune" to *Meloidogyne incognita* race 1 and *Meloidogyne javanica*.

Vetiver is difficult to kill by fire, grazing, drought, or other natural force. However, if necessary, it can be eliminated by slicing off the crown. Because the crown is close to the surface, it can be cut off fairly easily with a shovel or tractor blade. Also, although the plant is resistant to most herbicides, it succumbs to those based on glyphosate (Vietmeyer 1993).

Vetiver has been utilized for medicine, mat and basket production, hedgerows, firebreaks, insect repellent, scented oils, perfumes, and soaps, but it has primarily been used to prevent soil erosion.

Data from India showed vetiver reduced silt loss from 25 tons a hectare to 6 tons a hectare. In Maharashtra State of India, lines of vetiver trapped 25 cm of silt in two months. On the black soils of Karnataka, silt started forming behind a three-month-old hedge, and soil loss dropped from 11 tons per hectare to 3 tons per hectare. In Louisiana, within ten months, sediment .5 m high was built up behind rows of vetiver. It has been used in many more areas for erosion control including Malaysia, Thailand, Laos, Indonesia, Sri Lanka, China, Nepal, Virgin Islands and Puerto Rico (Vietmeyer 1993). Current erosion studies are being conducted by Fort Valley State University in Georgia (personal communication – Dr. Mark Latimore, Fort Valley State University).

In Tamil Nadu, India vetiver retained between three and nine percent more moisture than other plants. Another test in India determined that first year hedges of vetiver held back 30% more rainfall runoff than graded banks (Vietmeyer 1993).

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