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Commercial application of *Chrysopogon zizanioides* (Linn) a perennial grass in east Vidarbha India

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Abstract
Chrysopogon zizanioides is a persistent bunch grass of the family Poaceae, inherent to India, known as *vetiver*. It is identified as *khas* or *khusgrass* in the Vidarbha region. It is also recognized as useera and veera in Sanskrit and vala in Marathi. It founds in wetlands, margin of water bodies, particularly on the riverbanks and in rich marshy soil. It has been considered a source of high-class perfume. Two species of *Chrysopogon* are found in India, of which *C. zizanioides* is the common source of the well-known oil, which is used in medicine, in perfumery, and also recognized for conservation of soil and making a broom. Another species *C. nemoralis* is not effective as compared to *C. zizanioides*. The roots used for cooling purposes and for the extraction of the oil are obtained from the wild stock. *Khas* grass plays a chief role in the socio-economic life of rural India. In India, since olden times, the roots have been used for manufacturing screens, hand fans, cooler pans, mats, and baskets. Oil is useful in perfumery, cosmetics, and soaps and for flavorings sherbets (Indian cold drinks). The dried roots are also helpful in making perfumed linen clothes. Cattle and sheep feed on young leaves. Dried culms are useful for making brooms and thatching of huts. The pulp is suitable for manufacturing paper and strawboard. Details of *khas* grass availability and uses of roots in east Vidarbha are recorded in this study. Its commercial cultivation is recommended for the conservation of species.

Keywords: *Chrysopogon zizanioides*, *vetiver*, perennial, roots

Introduction
Chrysopogon zizanioides (L.) Roberty, synonymously known as *Vetiveria zizanioides* (L.) Nash, of Family-Poaceae is widely cultivated perennial grass in the tropical regions of the world. This grass cultivates in a wide variety of ecological habitats casing all bio-geographic provinces of India. *Khas* grass grows wild in many states of India namely Maharashtra, Haryana, Uttar Pradesh, Rajasthan, Gujarat, Bihar, Orissa, Madhya Pradesh, Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh. It is systematically cultivated in the North Indian states of Rajasthan, Uttar Pradesh, and Punjab similarly in South Indian states of Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh. Though it originates in India, *C. zizanioides* are widely cultivated in tropical regions of the globe. The major *vetiver* producing countries are Haiti, India, Indonesia, and Thailand (Archana Pareek and Ashwani Kumar, 2013) [2].

Chrysopogon zizanioides is an evergreen grass growing up to 1.8 m (6ft) height at a fast rate. This tufted grass grows up on elevation up to 2,500 m. having a wide ecological amplitude. The grass grows luxuriantly in areas with an annual rainfall of 1000-2000 mm and temperature ranging from 22 to 43ºC. It suitably grows in sandy and loamy soils as well as acidic, neutral and alkaline soils. Marshy riverbeds with sandy loam are best for this grass (Anon, 1976) [1]. It can rise in semi-shade (well-lit woodland) or no shade. It prefers moist or wet soil and can tolerate drought and flood (Rao *et al*, 2000) [6]. The plant can tolerate strong winds but not oceanic exposure.

The plant has short rhizomes (1 cm or less) having finely structured and very strong roots. Stems are erected and taut, can survive under deep water if flow up to two months. It stays in clumps and does not spread across the land. It sometimes becomes so huge that it has to be pulled out of the ground with a strong pointed tool and roots cut with a sickle (Fig.1, 2 & 4). The valuable adventitious roots have aromatic properties and grow 20-30 cm deep in medium-textured marginal soil. There is substantial diversity in the pattern of development, orientation, and thickness of roots as well as the occurrence of secondary roots. In the situation of sediment deposition, new roots can grow out of covered nodes. With these features, the *vetiver* plant is greatly drought-tolerant and can help to protect soil against erosion (Greenfield, 2008). Wild grass propagates itself by small offsets instead of underground stolons.

The leaves are linear, narrow, erect, grassy, and glabrous with rough margins. The inflorescence is a panicle up to 15 to 45 cm long, bearing numerous racemes in a whorl on a central axis (Fig: 3). One floret in spike is bisexual, sessile, and produces fruits as oblong grains. The other florets are pedicilate and staminate. The lower spikelets are reduced to the lemma. No wonder that it is one grass that has been extensively used by almost all the tribes for different purposes. Its diverse uses, cultivation, and how this species can be exploited for the socio-economic development of peoples are discussed in this comment.

Materials and Methods
The samples of selected perennial grass were collected from different parts of east Vidarbha with a range of 20.83N to 21.38N latitude and 79.89E to 79.80.01E longitude. There are 350 approximately water bodies, canals, and marshy areas having a source of plant material in the study area. To acquire detailed knowledge of plant resources and its utilization, information collected from old and experienced persons, village heads, and farmers. The species is identified with the help of relevant literature and google lens.

For the study of commercial applications of native grass frequent visits were made to sites like lakes, ponds, puddles, ditches, canal, swamps, etc. During the visit, geotag photographs and videos were prepared. Their nature of growth, habit, habitat, and commercial applications are noted from skilled local, rural, and tribal peoples (Fig: 1, 6, 7 & 8).

Results and Discussion

As there is no systematic cultivation of the grass in this region, several villagers and rural folk collect the roots of the grass in large quantities from the wild-growing places like water bodies, canals, waste agricultural land, etc. Three to four months of livelihood of many rural families are sustained comprehensively by the sale of roots of this grass, which thus plays a significant role in the socio-economic lives of village and rural folk of East Vidarbha. The grass and the root system of *Vetiver* can produce up to 100 tons/hectare of biomass (dry weight). If the only roots are harvested for commercial purpose and grass is left in the ground it causes heavy loss of natural wealth. *Vetiver* roots are used for the manufacturing of desert coolers pan. Roots are also used for making screens (curtain), mats, hand fans, and baskets. The screens are hanging down (drooped) like curtains in the houses and when sprinkled with water, impart a fragrant coolness to the air; they are in great demand during the summer. The culms and leaves are widely used by the communities and villagers for thatching their huts, mud walls, etc. In many districts of Kerala, the roots are woven along with bamboo splits and made into flat mattresses for use as under-beds to give a cooling effect. The roots have found increased use in electric room-coolers also (Rao *et al*, 2000) [6].

The viable and social utility of this plant was first recognized on account of its aromatic roots and lately overcome by environmental applications of the plant as such as varied industrial practices of above-ground plant parts. It is well known as an eco-friendly plant that prevents soil erosion and rehabilitates metalliferous polluted land (Sripen *et al*, 1996) [7]. It is cultivated for the production of a commercially important essential oil used in perfumery and aromatherapy (Truong *et al*, 2008) [10].

Vetiver oil has various beauty benefits, controls moisture in dry and dehydrated skin and innovation effect on mature skin, as well as cuts, wounds, irritated and inflamed skin and prevents stretch marks after pregnancy (Oshunsanya, 2013) [4]. The oil strengthens the central nervous system and is helpful in overcoming depression, insomnia, anxiety, stress, tension, and nervousness (Pinthong, 1998) [5]. *Vetiver* oil is also useful in the treatment of several diseases, including mouth ulcers, inflammation, fever, headache, and gastritis (Suarau *et al*, 2017) [8]. A major portion of oil consists of sesquiterpene alcohol (Thakur *et al*, 1989) [9]. Sesquiterpene alcohol is a volatile compound that gives an earthy taste and musty odor in drinking water and the characteristic odor on a rainy day. Also, these medicinal properties of the plant, the dried culms of the plant are useful as brooms and to thatch roofs. The pulp of the plant is recycled to prepare straw boards and paper. Cattle and sheep feed on young leaves. The present study, revealed the various uses of this grass other than the commercial application of root tufts only.

The root bundles (Fig: 5) of *vetiver* used to sell commercially in different areas like Nagpur, Chandrapur, Wardha, Amaravati, Raipur, Bilaspur, Indor, and a catchment area of other many more cities. Stockiest of this area pertains to the preparation and sale of mats/screens for windows, doors, and desert coolers during summer months when the temperature goes up to as high as 40ºC. They wholesale the root mats and also the loose roots (for fragmenting water) to city residents. Such temporary establishments of *khas* root traders are prepared these materials at home and carry by trains or sometimes they prepared common sight along most roads in cities (Fig: 6, 7 & 8). In view of its tremendous use and also in view of its declining wild populations, the authors strongly recommend the development of small-scale industries and systematic cultivation of this grass in the plains, wasteland, and water bodies of this region.

Conclusion

The eco-friendly grass *Chrysopogon zizanioides* has wide ecological amplitude and this trait of the species must be exploited for economic development in Vidarbha regions. The grass with its tuft-forming habit and thick root system greatly helps in checking soil erosion and feed for cattle. It can be recommended for grown on uncultivated areas and waste places including sodic (sodium-rich) soils. This will not only enhance the economic conditions of local farmers but also develops soil ecology. Small-scale industry based on the extraction of *vetiver* oil through distillation, for the manufacture of strawboard and handmade paper from pulp of the aerial parts of the grass also is a future plan in this area. It can reduce to some extent the stress on bamboo resources. It would also help in the conservation and socio-economic development of poor people in this region. In view of its tremendous use and also in view of its declining wild populations, the authors strongly recommend the large-scale systematic cultivation of this grass for multiple uses in this region of India.

Plate-1

Fig 1: Natural habitat of *C. zizanioides*

Fig 2: Single plant of *C. zizanioides*

Fig 3: Inflorescences of *C. zizanioides*

Fig 4: Commercial Roots of *C. zizanioides*

Fig 5: Collected root bundles for marketing

Fig 6: Livelihood work at commercial level

Fig 7: Handicap person making cooler pans

Fig 8: Old mother making door curtain

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