Vetiver Grass Model for Long term Carbon Sequestration and Development of Designer Genotypes for Implementation

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Abstract

Vetiver [*Vetveria zizaniodes* (L) Nash. syn. *Chrysopogon zizaniodes* (L.) Roberty] is a perennial densely tufted C_4 grass native to India, sporting deep penetrating tufted fibrous roots. Its roots hold initial growth potential of 3cms per day reaching upto 2.5 meters in just six months. The grass is now grown all across the globe from tropical to Mediterranean climate and can tolerate wide range of temperature and soil conditions. It is an important candidate to address current environmental concerns and human well being. This grass traditionally used for extraction of essential oil, has attracted world attention as a natural inexpensive and practical means for its multifarious environmental applications, including conservation and detoxification of degraded soil and water, flood and landslide disaster mitigation.

Lately, we proposed a "vetiver grass model" for sequestration of atmospheric carbon into subsoil horizons to mitigate global warming. However, for successful implementation of Vetiver grass for environmental applications it is desirable that such plantations meet the specific environmental objectives without any threat of becoming weedy through seed dispersal and trespassing the target areas. As such, the ideal plant type should have non-seeding habit suitable for eco-friendly plantations. To realise these objectives we first identified a fast growing low seed forming clone from natural habitats that meet other standard pre-requisites for its utilization for carbon sequestration and soil conservation, and then subjected the pre-selected clone to artificial polyploidization to realize its "autotetraploid" clone to enhance its root growth and thickness, and to realise low seed fertility accrued as a consequence to chromosomal disturbances in the sexual reproductive system. Further to facilitate vetiver based carbon credit and eco-plantation regime necessary empirical data on the carbon sequestration potential were generated.

The autotetraploid clone offers enhanced opportunities for its utilization in mitigating global warming through photosynthetic capture of atmospheric carbon dioxide and its long-

term sequestration in sub-soil horizons through its fast growing deep penetrating roots, and as such tremendous utility in ecological plantations for (a) mitigation of global warming, (b) earning carbon credit, (c) environmental conservation. The said autotetraploid clone is seed infertile, therefore does not pose any problem of becoming weedy due to seed dispersal and is ideally suited for controlled plantations. Strategic plantation of this autotetraploid clone in crop fields, tree lines, river, road and rail-line embankments as hedgerows could potentially contribute to carbon sequestration vis-à-vis eco-technological management of land and soil, and as a resource for biomass and bioenergy with no threat of becoming weedy in unattended plantations. Owing to its fast growing deep penetrating root system the developed clone could potentially sequester atmospheric carbon (through photosynthetic capture) into sub-soil horizons likened to forest trees, with least risk of carbon being recycled into atmosphere.

Keywords: Vetiver, Polyploid vetiver, Carbon Sequestration, Climate Change, Ecological plantations, Social forestry