ENVIRONMENTAL, ECONOMICS AND EQUITY ASPECTS OF VETIVER IN SOUTH INDIA

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ABSTRACT

Vetiver (*Vetiveria zizianoides*) is an important grass widely used throughout tropical world for soil conservation, perfumery from its essential oil and for handicrafts. In south India, especially western coastal districts of Karnataka and Kerala thousands of hectares of land is under the cultivation of vetiver; besides it is widely used in soil conservation programmes in plantation areas and also in semi-arid tropical regions of south India. A model is proposed wherein vetiver can be cultivated for environmental protection, economic gain and equity in the target populations of south India. A few case studies are presented to show soil management aspects, distillation of vetiver roots, alternative uses of vetiver and involvement of women in such enterprises. Since vetiver oil is highly valued in perfume and fragrance industry, this plant can be economically exploited for enhancement of rural livelihoods and at the same time with appropriate soil management and agrotechnologies it is possible to protect environment and also this crop acts as a good agent for gender equity in rural areas.

1. INTRODUCTION

Vetiver is an important tropical grass used widely for environmental protection, flavours and fragrances, handicrafts etc in different parts of the world. Since vetiver has a strong root system and is perennial in nature, it has been considered widely for conservation of soil against erosion of top soil in various parts of the world. Also, vetiver has been a candidate plant for phytoremediation of polluted soils. Vetiver oil obtained after steam distillation of its roots is unique oil and has no synthetic substitute. Vetiver oil is a perfume by itself and it is an indispensable product in several flavours and fragrances appreciated widely through out the world. Vetiver being a multipurpose crop is also used for making mats, handicrafts and such utility items besides being used to cover roofs of dwellings in tropical parts of the world. Vetiver has many medicinal uses such as it is carminative, stimulant, diaphoretic, refrigerant, for lumbago, rheumatism, sprains etc.

South India is traditionally known for the cultivation of *Vetiveria zizianoides* in different states. This is different from the wildly grown *khus* of north India. It is believed that more than 3000 ha of vetiver are under cultivation for extraction of vetiver oil in south India. The use of vetiver for environmental protection and for extraction of roots for its oil for other economic products is seen as a contradiction. Environmental protection should go hand-in-hand with

economics. Therefore, strategies have to be evolved to harmonise economic production of vetiver oil maintaining soil and environmental health and also taking care of social and gender equity.

Knowledge based management of vetiver can potentially help in all the facets of vetiver use. The various issues involved for vetiver oil production are:

- Superior genotypes
- Good agronomy
- Efficient distillation methods
- Translation of science to practice
- Community participation and support from government policies
- Industry's participation in value chain

2. SOME CASE STUDIES AND EXPERIMENTAL RESULTS

Some case studies and experimental results are presented in this paper which highlights the vetiver growing conditions and also appropriate agronomic methods in coastal areas of Karnataka. The soils in these areas are typically lateritic, hilly, acidic in pH (4.5-5.5), high in organic carbon (2-5%), and low in available P and exchangeable K. Also these soils are subject to erosion losses if proper conservation methods are not adopted. The knowledge based strategies should help in increasing the productivity of vetiver in the cultivated areas so that the area under vetiver cultivation and extraction of its roots can be modulated to satisfy the demand of industry and at the same time improve the economics of the farmers. Such a strategy will help proper use of vetiver for environmental conservation in other areas. Superior genotypes have to be developed which give high yields of acceptable quality e.g. KS-1, Dharani, Gulabi and Kesar developed by CIMAP, India. The different agronomic issues that need attention for economic production of vetiver are:

- Crop duration
- Crop geometry and planting methods
- Soil test based manure/fertiliser application
- Harvest (digging) methods
- Maintenance of soil organic matter –recycling of biomass

Vetiver can be included in the agro-forestry systems where shade levels are 25% or less and also it is advisable to adopt crop rotations which will facilitate economic production as well as in conservation of soil and soil fertility. For example, cashew plantations are taken up after harvest of vetiver in some coastal districts of Karnataka. Since the soil pH is very low, application of lime will greatly help in higher production of vetiver roots. Efficient nutrient management will help in higher biomass yields. Generally, vetiver is cultivated as a rainfed crop in these regions, therefore irrigation is not considered necessary. However, in regions where rainfall may be low, appropriate methods of irrigation have to be adopted for higher water use efficiency.

For deriving good yields of roots, planting vetiver on the ridges which are alternated with furrows has given higher yields than planting in flat beds (Table 1).

Table 1. Effect of methods of planting on vetiver root yields and regeneration

Method	**Root yield** (t/ha)	**Production of slips/ha (million)**
Flat bed	2.0	0.44
Ridges & furrows	2.6	1.00

Nutrient management forms a key in deriving higher yields of aromatic crops in south India (Prakasa Rao, 1993). Harvesting of roots is a costly operation for vetiver farmers. Some studies conducted at CIMAP, Resource Centre, Bangalore have indicated that use of tractor with single disc for digging roots is more economical (Table 2).

Table 2. Cost of different digging methods of vetiver roots (Rs/ha)

Manual	40,000/-
Tractor with single disc	25,000/-
Earth mover	55,000/-

Age of the crop is an important factor in production of vetiver oil. Some studies conducted at CIMAP, Resource Centre, Bangalore have indicated that harvesting of vetiver after 12 months has good yields with optimum oil content and chemical composition (Table 3).

Table 3. Yield, oil content and chemical composition of vetiver oil depending on age of crop

Crop Age (months)	**Root yield** (gms/plant)	**Oil content** (%)	**Chemical composition** (%)		
			Khusimol	β-vetivone	α-vetivone
12	321	2.1	17.2	4.3	3.1
13	332	1.9	13.8	3.8	4.0
14	295	2.2	27.8	9.0	4.9
15	305	2.0	11.4	3.8	4.1
16	329	1.95	17.9	1.1	1.0
17	314	2.1	11.5	2.4	2.9
18	326	2.12	21.3	1.5	7.6

Therefore, vetiver can be successfully cultivated as an annual crop in these regions. Continuous cultivation of vetiver depletes soil organic matter. Maintenance of soil organic matter through recycling of biomass, additions of organic manures would be a critical input in vetiver growing areas. Organic matter from soil samples collected from two typical villages in Karnataka, south India where vetiver is traditionally cultivated is shown in Table 4.

Table 4. Effect of vetiver cultivation on soil organic matter

	Organic C (%)	
	Virgin Soil	**Vetiver Cultivated Soil**
Village 1	3.00	1.80
Village 2	3.03	2.28

3. POST HARVEST METHODS AND DISTILLATION

Generally, the vetiver roots are harvested and stored for some period before they are distilled at the field levels due to the working convenience of the farmers. Studies conducted have shown that the vetiver roots can be air-dried up to one month without loss of oil or change in the chemical composition (Table 5).

Table 5. Drying vetiver roots on oil content and composition

	Oil (%)	**Oil composition** (%)		
		Khusimol	β-vetivone	α-vetivone
Fresh	2.05 (2.97)*	17.3	3.7	3.9
Dry (air dried for 1 month)	2.68 (3.10)*	18.4	2.7	4.6

* oven dry weight

Traditionally, vetiver oil is distilled in these regions by crude methods. Long distillations ranging from 72-96 hours is a practice in the farmers' fields. This may be due to low steam generating capacity of the boilers, lack of proper condensers, crude methods of oil separation etc. It is possible to reduce the distillation period to nearly 18 hours if proper designs of the distillation unit and distillation methods are adopted. Shorter distillations also save fuel which is generally 18 hours and this helps to conserve the environment.

CIMAP, Resource Centre, Bangalore has been working on the capacity building of the small and marginal farmers of vetiver in Karnataka through good science and technology for vetiver cultivation and production. The opportunities that exist for the rural population, women and different sections of the society in various activities such as cultivation, oil production, making handicrafts etc. are enormous. Also, it is necessary to provide linkages in the value chain of vetiver oil production in these regions starting from good genotypes, agronomic methods, distillation methods and quality assessment and marketing. These efforts will link farmers, distillers and industry in synergistic way to make vetiver oil production economical and environmental friendly with a good social equity. Thus, providing knowledge based inputs and community participation, it is possible to grow vetiver to help environmental, economic and equity issues in south India.

4. REFERENCES

Prakasa Rao, E.V.S. (1993). Nutrient management in some important tropical aromatic crops - present and future. *Indian Perf*. **37(1)** : 35-39.