



Environmental, Economic & Equity Aspects of Vetiver in south India

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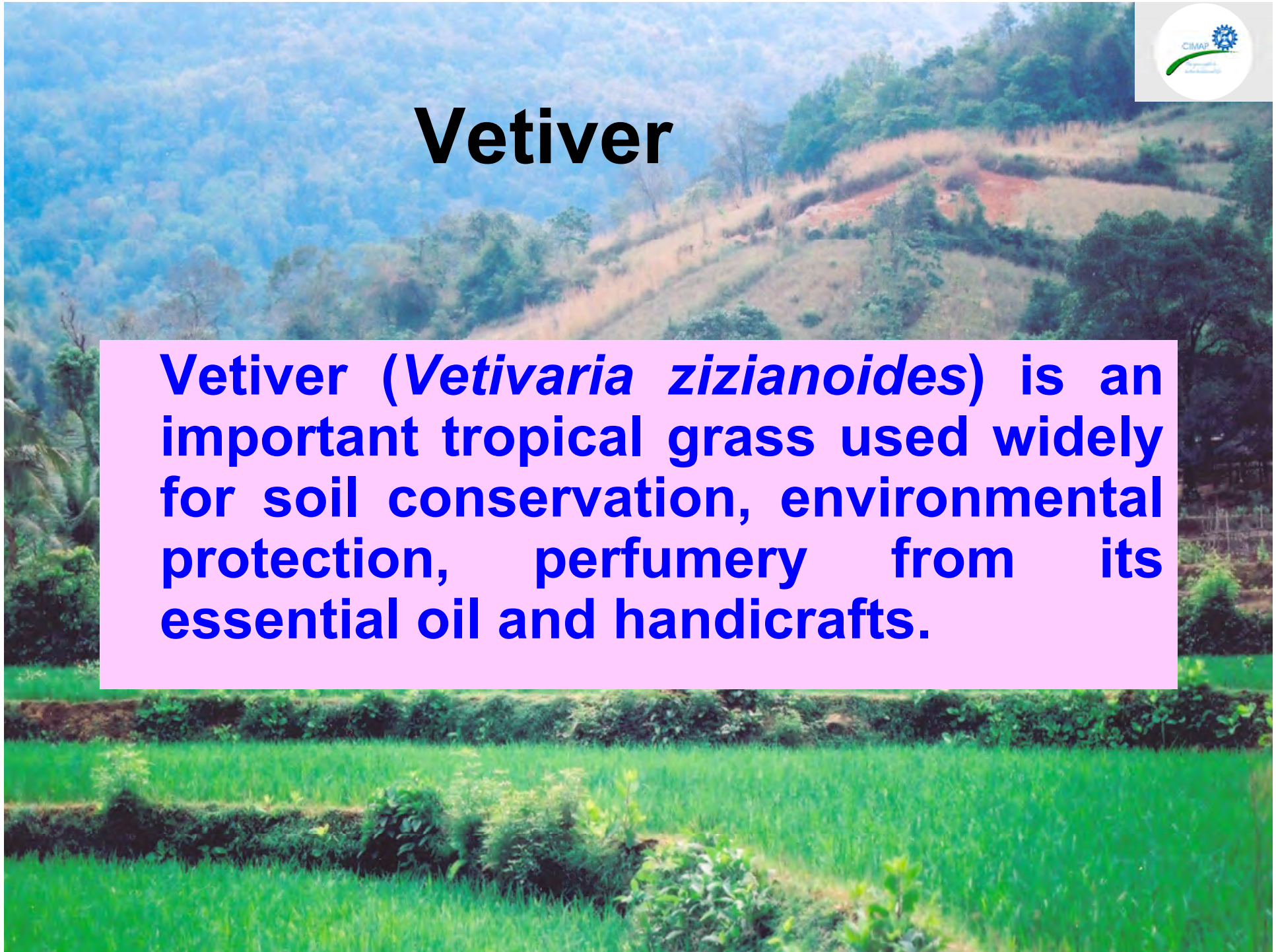
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Vetiver

Vetiver (*Vetivaria zizianoides*) is an important tropical grass used widely for soil conservation, environmental protection, perfumery from its essential oil and handicrafts.







Uses of Vetiver

Environmental and soil protection	Perennial nature, strong root system Use in phytoremediation
Perfumery & flavours	Vetiver oil is unique; there is no synthetic substitute
Handicrafts	Several articles of utility and decoration
Shelter	Thatching roofs; makeshift houses
Other uses	Traditional drinks, fodder etc.



**Environmental protection
and uses of vetiver roots –
are they in contradiction?**



Three Es of Soil Health

Economic Viability

*Environmental
Quality*

Equity

(E.V.S.Prakasa Rao, Indian Science Congress, Visakhapatnam, 3-7 Jan. 2008)




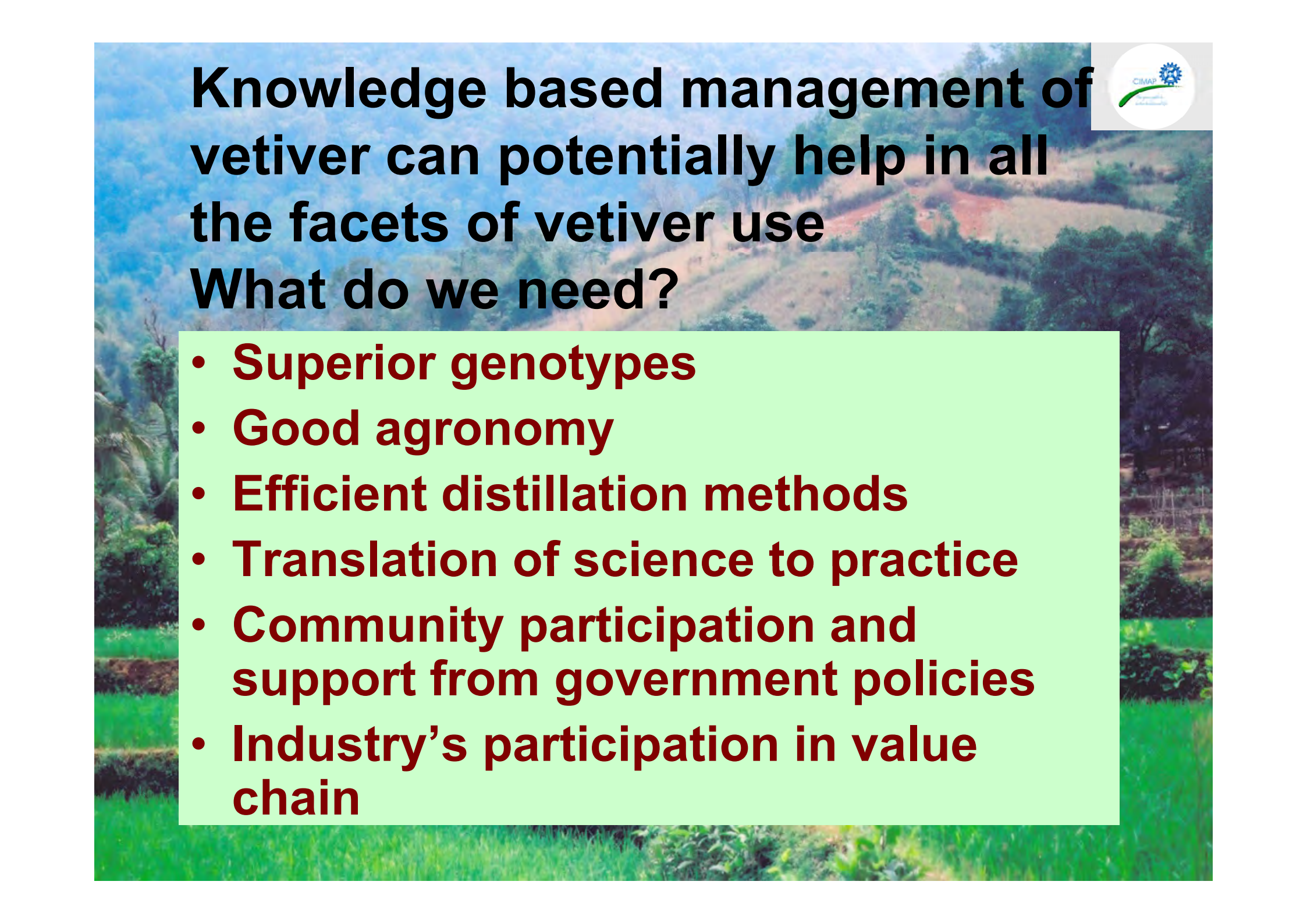
Vetiver in south India

South India is traditionally known for the cultivated variety of *Vetiveria zizanioides*. More than 3000 ha vetiver is cultivated in all the south Indian states; especially coastal districts of Karnataka and some parts of Kerala.

Typical agro-climatic conditions of vetiver growing areas of south India



- **Rainfall : 3000-3600 mm/yr**
- **Soils : Lateritic**
 - pH : Acidic : 4.5-5.5**
 - Organic C : 2-5%**
 - Available P : Low**
 - Exchangeable K : Low**



Knowledge based management of vetiver can potentially help in all the facets of vetiver use

What do we need?

- **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**



Some superior genotypes developed by CIMAP

- ❖ **KS – 1**
- ❖ **Dharani**
- ❖ **Gulabi**
- ❖ **Kesar**

Agronomy of Vetiver



Different issues that need attention :

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

Method of planting

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







Effect of vetiver cultivation in soil organic matter

	Organic C (%)	
	Virgin soil	Cultivated soil
Village 1	3.00	1.80
Village 2	3.03	2.28

Note : Soil samples collected from two typical villages of Karnataka, south India where vetiver is traditionally cultivated.

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













Different digging methods and cost (Rs/ha)

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



Scope for intercropping/crop rotation

- **Vetiver can be included in agroforestry systems where shade levels are 25% or less.**
- **It is advisable to rotate the crop; eg : cashew plantations are a practice in coastal Karnataka.**



**Vetiver in
Moringa
plantation**

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

(Figures in parentheses are on oven dry weight basis)



Efficient distillation methods

Proper design aspects and distillation parameters can bring down the traditionally long distillation durations (72-96 hrs) to nearly 18 hrs. This reduces cost of distillation and improves economics.







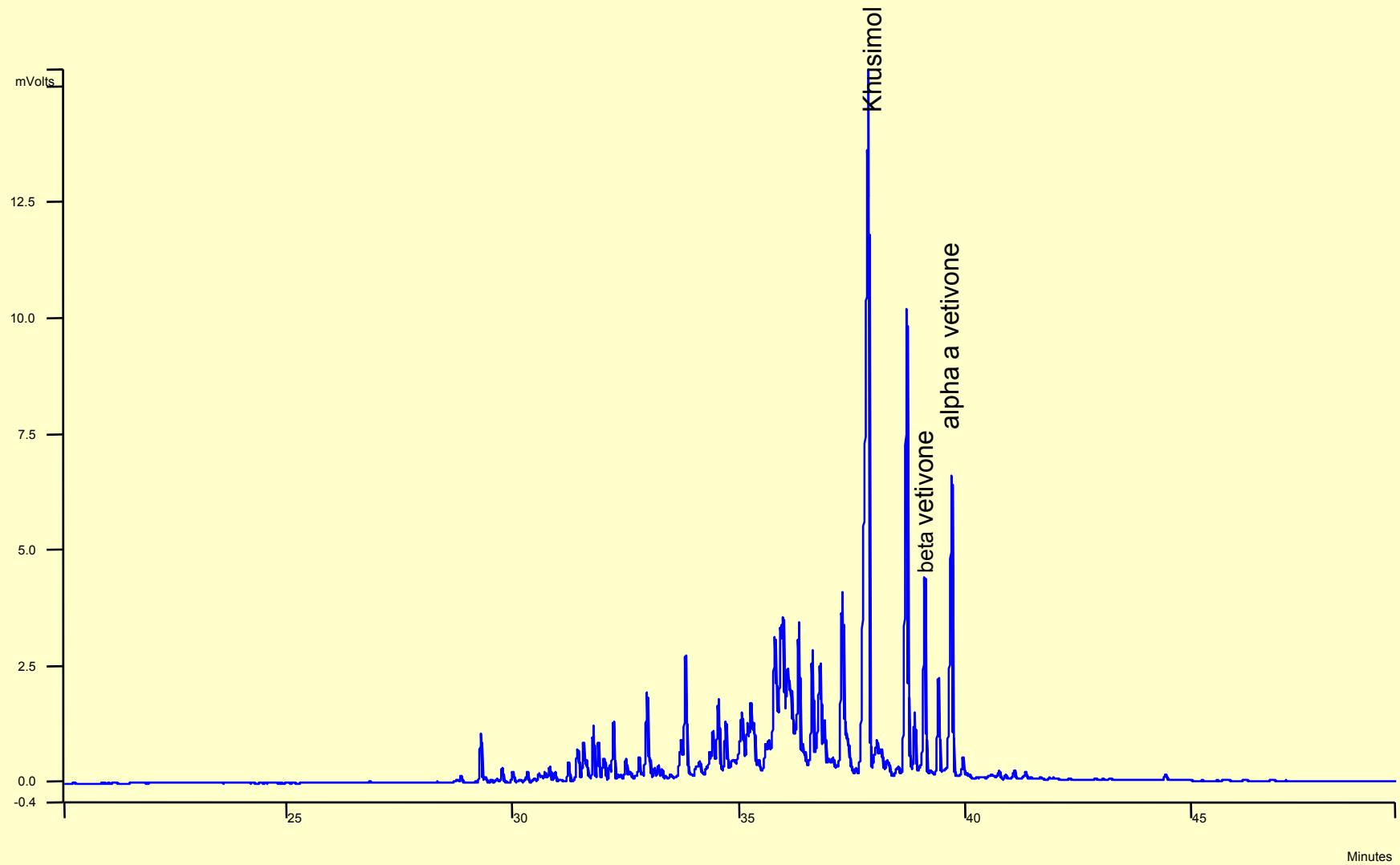


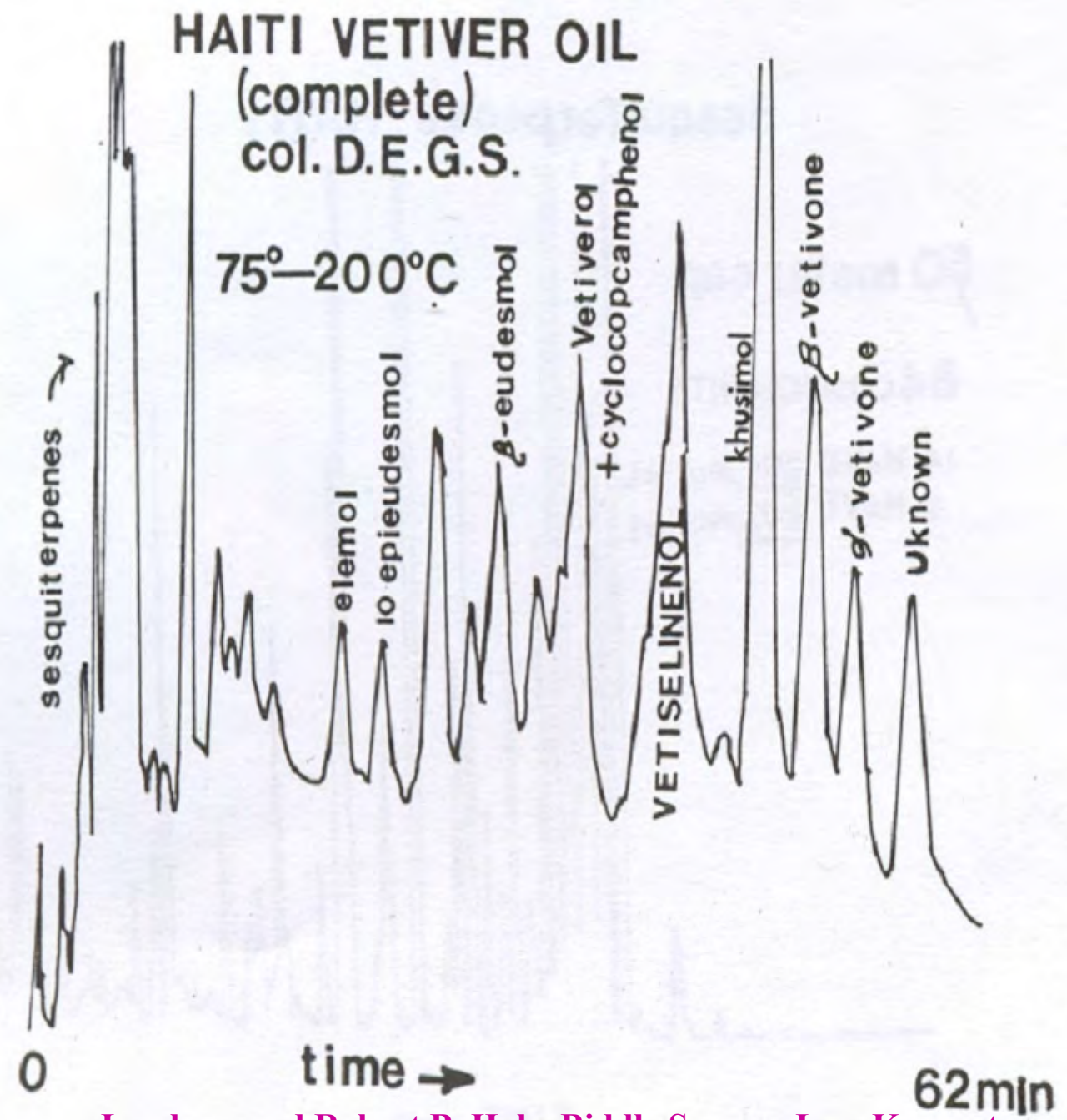
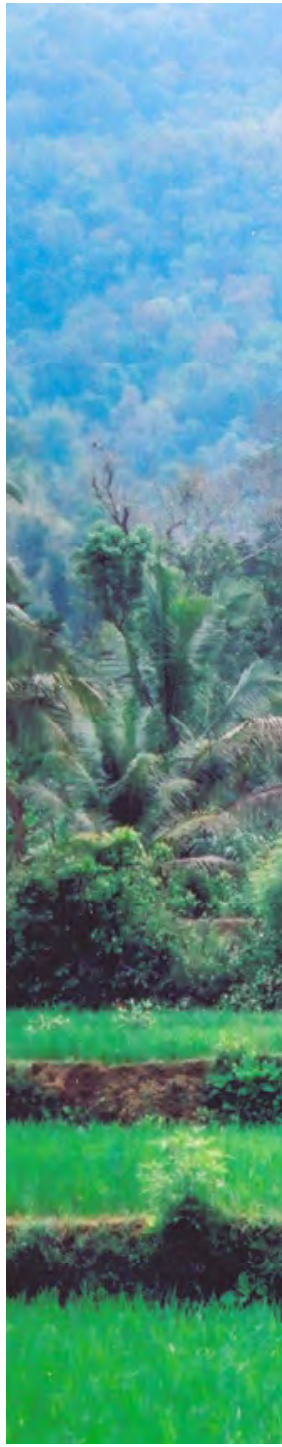
BIS for Vetiver oil

Sl. No	Characteristic	<u>Requirements</u>
1.	Appearance and colour	Brown to reddish brown viscous liquid
2.	Odour	Characteristics and persistent woody aroma
3.	Relative density at 27°C	0.985 – 1.020
4.	Refractive index at 27°C	1.515 – 1.525
5.	Optical rotation, D	+15° to 35°
6.	Acid value, <i>Max</i>	35
7.	Ester value	5-16
8.	Ester value after acetylation	110-165
9.	Free alcohols, percent, <i>Min</i>	30
10.	Combined alcohols, percent	8 - 25
11.	Total alcohol (<i>Max wt 220</i>) percent (ix + x)	46
12.	Carbonyl value (percent, ketones, Mol wt 218)	23 – 68 (9 – 26.5 percent)
13.	Miscibility in 80 percent (V/V) ethanol (vols)	1-2 vols slight opalescence may appear sometimes

(Source : BIS, IS : 1177 : 1996, p. 2)

GC profile of South Indian Vetiver oil





(Seymour Lemberg and Robert B. Hale, Biddle Sawyer, Inc., Keyport, NJ, Perfumer & Flavorist 23 (3), Feb/March 1978)



Percentage composition of Khusimol-Vetivones

Origin	Khusimol (%)	Unknown + Beta vetivone (%)	Alpha vetivone (%)	Unknown ketone (%)
Haiti	13.4	5.2	3.2	5.3
Reunion	21.5	3.2	5.8	10.5
Angola, Reunion Type	21.8	4.5	4.7	14.8
Angola	27.9	4.6	5.1	15.3
Guatemala	21.4	2.6	1.5	1.1
China	20.0	4.1	5.2	7.3
Brazil	21.7	4.6	4.9	14.7
Java	13.6	2.8	4.0	7.1
South Indian vetiver (CIMAP, RC, B'lore)	12-17	1-4	2-6	--

(Seymour Lemberg and Robert B. Hale, Biddle Sawyer, Inc., Keyport, NJ, Per. & Flav. 3 : 23-27, 1978)

Quality of vetiver oil from farmers/distillers



Location	Khusimol	β -vetivone	α -vetivone
Bhatkal Taluk, Karnataka	15.3	1.4	1.4
Gokak, Karnataka	13.7	1.9	3.6
Hubli, Karnataka	14.8	2.2	4.8
Kundapur, Karnataka	14.2	4.2	3.5



CIMAP in its Vetiver Mission programme is reaching out to the farmers growing vetiver in remote areas of Karnataka and neighbouring states in south India. Efforts on capacity building through good science and technology of vetiver cultivation and production has been started.



CIMAP's survey and training programmes are set to provide linkages in the value chain of vetiver.

Farmers – distillers – industry.











Vetiver provides livelihoods to rural people and creates gender equity. Women participate in handicrafts, oil production, education of children in vetiver growing areas.











Thank you