

# **Cultivation of vetiver as an annual crop for its essential oil to realize high return and industrial sustainability**

**H S Chauhan, H P Singh, V K S Tomar, A K Singh, H N Singh, Awadh Bihari, R K Lal and R P Bansal**

**CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow , 226015, INDIA**

# Introduction

- **Vetiver or Khus (*Chrysopogon zizaniodes* L. Nash) is an important aromatic plant belongs to family Poaceae, rich source of vetiver oil**
- **It is native to India**
- **Grown world over for essential oil, conservation of soil and other natural resources**
- **Vetiver oil is obtained from continuous hydro- distillation of roots about 18-24 hours**

# Uses

**Widely used in flavor, fragrance. Cosmetic, soft drinks etc. industries world wide**

# Demand

- **With the improved economy in the country, the oil demand has increased manifold because of its unique quality/chemical profile**
- **It imparts unique odour to be used in flavor and fragrance industry and can never ever be substituted and synthesized/ reconstituted**

# Oil production

- The present global annual production of oil is approximately 300 tones
- Haiti and Indonesia produces about 70% of the total oil production of the world
- Indias contribution is only 20-25 tones of oil

# **Better perfumery value oil**

- The oil produced in North and South India differs a lot in respect to quality**
- North Indian type vetiver oil has better perfumery value than South Indian type and hence fetches a higher price**
- Vetiver oil produced in North India is considered to be the best in the world**

# Status of vetiver oil

- **In North India, Uttar Pradesh is the main oil producing state, where the major quantity of oil is produced from roots collected from wild sources**
- **With the depletion of wild resources, oil production in North India has declined very fast**
- **Up to 2004, the oil production of vetiver oil has come down to few hundred kilos, whereas in the past it was in tones**

# Reason for depletion

- Traditionally the vetiver slips are planted monsoon and harvested in next year winter after 18-20 month
- This practice had intent problem of long gestation period due to which marginal farmers were not inclines to adopt the cultivation
- Further low oil content/ yield, high cost of manually spade digging, return after a long duration etc were the other limiting factors in adoption/ popularization of vetiver cultivation
- In order to meet the challenges, cultivation of vetiver is now inevitable



# Varietal development and improved cultural practices

- In order to make the vetiver cultivation attractive to the growers, CSIR-CIMAP developed high yielding (30-35 oil kg/ha), short duration (10-12 month) genotype (CIM-Vridhi).
- Improved cropping and cultural practice for early return for sustaining the same
- Thus, the efforts of CSIR-CIMAP bore the fruit and vetiver crop emerged as most suitable and viable crop option in normal and adverse conditions for cultivation in India



# Evaluation of vetiver crop age on root and oil yield( Calvengers basis)

<b>Crop age(month)</b>	<b>Root yield(q/ha)</b>	<b>Oil content(%)</b>	<b>Oil yield(kg/ha)</b>
<b>8</b>	<b>13.65</b>	<b>1.30</b>	<b>17.75</b>
<b>9</b>	<b>14.31</b>	<b>1.60</b>	<b>22.90</b>
<b>10</b>	<b>14.96</b>	<b>2.30</b>	<b>34.41</b>
<b>11</b>	<b>15.00</b>	<b>2.50</b>	<b>37.50</b>
<b>12</b>	<b>15.12</b>	<b>2.65</b>	<b>40.07</b>
<b>13</b>	<b>15.23</b>	<b>2.60</b>	<b>39.60</b>
<b>14</b>	<b>15.25</b>	<b>1.85</b>	<b>28.21</b>

# Performance of vetiver elite clone CIM-Vridhi on 50 kg tank basis

<b>Elite clone</b>	<b>Root yield (q/ha)</b>	<b>Oil content (%)</b>	<b>Oil yield (kg/ha)</b>
<b>Gulabi</b>	<b>16.47</b>	<b>1.49</b>	<b>24.52</b>
<b>Dharni</b>	<b>12.98</b>	<b>1.10</b>	<b>14.28</b>
<b>CIMAP- KS- 1</b>	<b>10.49</b>	<b>1.02</b>	<b>10.69</b>
<b>CIM- Vridhi</b>	<b>18.60</b>	<b>1.52</b>	<b>28.30</b>
<b>C.D.5%</b>	<b>0.76</b>	<b>0.11</b>	<b>2.01</b>

# **CSIR-CIMAP vetiver mission**

- **Initiations for khus bio-village based commercialization of vetiver cultivation in Northern plains**
- **The khus bio-village programme has been successfully implemented in normal and problem soil (salinity) areas**
- **Sitapur, Barabanki, Raibareilly, Unnao, Sultanpur, Lucknow, Pratapgarh, Behranch and Basti district in U. P. and Madhubani, Vashali and Siwan districts of Bihar**

# Technology dissemination

- Genetically pure planting material and technical know-how for vetiver cultivation were provided to the selected farmers of their bio-village and thus large area was brought under cultivation.
- The feedback of oil production from farmers indicated that average yield ranges from 15-20 kg oil/ha





# Commercialization

<b>year</b>	<b>No. of farmers</b>	<b>Area ha</b>
<b>2005-2006</b>	<b>5</b>	<b>0.2</b>
<b>2006-2007</b>	<b>45</b>	<b>5.0</b>
<b>2007-2008</b>	<b>180</b>	<b>17.0</b>
<b>2008-2009</b>	<b>415</b>	<b>46.0</b>
<b>2009-2010</b>	<b>850</b>	<b>75.0</b>
<b>2010-2011</b>	<b>1125</b>	<b>155.0</b>



# Oil production

<b>year</b>	<b>Oil production through cultivation kg</b>	<b>Rate of oil/kg cultivated vetiver Rs</b>
<b>2005-2006</b>	<b>5.0</b>	<b>10,000-11,000</b>
<b>2006-2007</b>	<b>110.0</b>	<b>10,000-11,000</b>
<b>2007-2008</b>	<b>375.0</b>	<b>11,000-12,000</b>
<b>2008-2009</b>	<b>970.0</b>	<b>11,000-13,000</b>
<b>2009-2010</b>	<b>1700.0</b>	<b>11,000-14,000</b>
<b>2010-2011</b>	<b>2650.0</b>	<b>12,000-16,000</b>

# Comparison of cropping system

<b>Cropping system</b>	<b>Net profit Rs/ha/year</b>
<b>Paddy-wheat</b>	<b>40,000-50,000</b>
<b>Maize-mustered</b>	<b>35,000-40,000</b>
<b>Maize-mustered- M.arvensis</b>	<b>60,000-70,000</b>
<b>Paddy-potato- M.arvensis</b>	<b>80,000-90,000</b>
<b>Sugarcane</b>	<b>1,25,000-1,50,000</b>
<b>vetiver</b>	<b>1,30,000-1,60,000</b>

# Vetiver intercropping system

- The khus cultivation significantly enhanced the farm income of the farmers to grow *M. piperita*, *M. arvensis*, *Ocimum basilicum* as intercrop during February- June with vetiver

Intercrop	Oil yield (kg/ha)
<i>M. piperita</i>	60-75
<i>M. arvensis</i>	125-150
<i>Ocimum basilicum</i>	60-80



# **Vetiver intercropping with food crops**

- **October planted vetiver intercropped with wheat produced both the commodities is more profitable with reduced cost of cultivation**
- **Moreover, during the early part of the vetiver crop farmers advised to utilize inter space for some other pulse crops**
- **Generated additional revenue and helped the farmers in better utilization of resources**





## Bihar





## Bihar







## Bihar







## Bihar





## Bihar







## Bihar





## Uttar Pradesh







## Uttar Pradesh





## Uttar Pradesh







## Uttar Pradesh



# Conclusion

- **Being a annual crop, it provides an opportunity to employ higher number of labour than traditional crop**
- **It is not affected by wild animal and adverse climate.**
- **A large volume of root bio mass is converted into oil through nearby field distillation units and marketed as per convenience**



## Contd.

- These features of vetiver cultivation have attracted the grower and entrepreneurs in North India and Bihar for the cultivation and distillation of vetiver and adopting it as a cash crop
- Income from vetiver and intercropping with *Mentha* spp, kalmegh, wheat and pulses is much higher than other crops