MONTO VETIVER GRASS for WETLAND CONSTRUCTION

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SPECIAL PHYSIOLOGICAL CHARACTERISTICS

• Tolerant high levels of herbicides and pesticides

• Fast growing with very high water consumption

• Very high capacity for N and P uptake under Dryland, Wetland or Hydroponic conditions
### Nitrogen Uptake

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>N kg/ha/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vetiver Dryland</td>
<td>1,140</td>
</tr>
<tr>
<td>Rhodes Grass</td>
<td>600</td>
</tr>
<tr>
<td>Kikuyu Grass</td>
<td>500</td>
</tr>
<tr>
<td>Forage Sorghum</td>
<td>360</td>
</tr>
<tr>
<td>Rye grass</td>
<td>250</td>
</tr>
<tr>
<td>Eucalyptus</td>
<td>90</td>
</tr>
</tbody>
</table>
NITROGEN UPTAKE

Plant Species

- Vetiver Hydroponic: 13,500 N kg/ha/year
- Vetiver Dryland: 1,140 N kg/ha/year
- Rhodes Grass: 600 N kg/ha/year
- Kikuyu Grass: 500 N kg/ha/year
- Forage Sorghum: 360 N kg/ha/year
- Rye grass: 250 N kg/ha/year
- Eucalyptus: 90 N kg/ha/year
PHOSPHORUS UPTAKE

Plant Species

- Vetiver Dryland
- Rhodes Grass: 149 P kg/ha/year
- Kikuyu Grass: 90 P kg/ha/year
- Forage Sorghum: 90 P kg/ha/year
- Rye grass: 70 P kg/ha/year
- Eucalyptus: 70 P kg/ha/year
- Other: 15 P kg/ha/year
PHOSPHORUS UPTAKE

P kg/ha/year

Vetiver Hydroponic: 1,026
Vetiver Dryland: 149
Rhodes Grass: 90
Kikuyu Grass: 90
Forage Sorghum: 70
Rye grass: 70
Eucalyptus: 15

Plant Species
**ABSORBING POLLUTANT:** Much higher capacity for N and P absorption as compared with other plants

<table>
<thead>
<tr>
<th>Plant species</th>
<th>Nitrogen (kg/ha/year)</th>
<th>Phosphorus (kg/ha/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vetiver hydroponic</td>
<td>13,688</td>
<td>1,026</td>
</tr>
<tr>
<td>Vetiver pot trials</td>
<td>2,040</td>
<td>153</td>
</tr>
<tr>
<td>Vetiver field trial</td>
<td>1,142</td>
<td>149</td>
</tr>
<tr>
<td>Rhodes grass</td>
<td>600</td>
<td>90</td>
</tr>
<tr>
<td>Kikuyu</td>
<td>500</td>
<td>90</td>
</tr>
<tr>
<td>Green Panic</td>
<td>430</td>
<td>70</td>
</tr>
<tr>
<td>Forage sorghum</td>
<td>360</td>
<td>70</td>
</tr>
<tr>
<td>Bermuda grass</td>
<td>280</td>
<td>30-35</td>
</tr>
<tr>
<td>Eucalypts trees</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>Rye grass</td>
<td>200-280</td>
<td>60-80</td>
</tr>
<tr>
<td>Wheat (6)</td>
<td>23-208</td>
<td>3-27</td>
</tr>
</tbody>
</table>
WETLAND RESEARCH AND CONSTRUCTION
RESULTS OF WETLAND RESEARCH IN QUEENSLAND

• Vetiver used more water than other common wetland plants such as Typha, Phragmites and Schoenoplectus.

• Vetiver used approximately 7.5 times more water than Typha.

• Total water use for a period of 14 days was approximately 2.4 litres per pot containing a single plant.

• Water use by vetiver grass was not affected by exposure to either Diuron or Atrazine at concentrations up to 2000 µg/L, levels which are likely to occur only in situations of accidental spillage or direct application to waterways.
CONVENTIONAL WETLAND

- Young vetiver does not thrive under flooded conditions

- Mature vetiver grows better in shallow water

- This problem can be overcome by:
  - using mature plants or
  - establish vetiver first before flooding
Constructing wetland at Superior Soil at Yatala
Poor Growth with repeated flooding
Poor Growth with repeated flooding
Vetiver was eventually overgrown by weeds
Mature plants trial
Six weeks later
One year after planting
Vetiver in a wetland in China
Wetland in Guangzhou, southern China
Six month old under hydroponic conditions

Twelve month old under hydroponic conditions
A wetland system specially designed to treat sewage effluent from a small country town, Toogoolawah, Esk Shire, Queensland

- The effluent N loading is at 13mg/L and 5.5mg/L for P; and daily discharge is 0.5ML.
- These loadings exceed the standards set out by the ANZECC of 10mg/L for N and 1mg/L for P.
Treatment Strategy

- Pre treating effluent in storage pond with vetiver pontoons and pond edges
- Vetiver Semi Wetland to treat the main body of effluent to ANZECC recommended level of 10mg/L for N and 1mg/L for P.
Vetiver roots thrive in high N and P sewage effluent and polluted water
Bare storage pond edges is ideal for vetiver planting to reduce both volume and nutrient loads of effluent.
Six months after planting
Vetiver planting for effluent treatment also controls weeds
Treatment Strategy

- Vetiver Cyclic Wetlands to treat the main body of effluent to ANZECC recommended level of 10mg/L for N and 1mg/L for P.
Wetland site preparation: Grazing land
Planting on contour lines at 6 plants/m and space in between lines at 5 plants/m²
Two months after planting
Three months after planting
Ten months after planting
Ten months after planting, left half
Ten months after planting, right half
<table>
<thead>
<tr>
<th>Tests</th>
<th>Plant Influent</th>
<th>Previous Results 2002/03</th>
<th>New Results (Effluent) 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH (6.5 to 8.5)</td>
<td>7.3 to 8.0</td>
<td>9.0 to 10.0</td>
<td>7.6 to 9.2</td>
</tr>
<tr>
<td>D. Oxygen (2.0 minimum)</td>
<td>0 to 2 mg/L</td>
<td>12.5 to 20 mg/L</td>
<td>8.1 to 9.2 mg/L</td>
</tr>
<tr>
<td>5 Day BOD (20 - 40 mg/l max)</td>
<td>130 to 300 mg/L</td>
<td>29 to 70 mg/L</td>
<td>7 to 11 mg/L</td>
</tr>
<tr>
<td>Suspended Solids (30 - 60 mg/l max)</td>
<td>200 to 500 mg/L</td>
<td>45 to 140 mg/l</td>
<td>11 to 16 mg/l</td>
</tr>
<tr>
<td>Total Nitrogen (6.0 mg/l max)</td>
<td>30 to 80 mg/L</td>
<td>13 to 20 mg/L</td>
<td>4.1 to 5.7 mg/L</td>
</tr>
<tr>
<td>Total Phosphorous (3.0 mg/l max)</td>
<td>10 to 20 mg/L</td>
<td>4.6 to 8.8 mg/L</td>
<td>1.4 to 3.3 mg/L</td>
</tr>
</tbody>
</table>
Cyclic Wetland Management

• The difference between conventional and cyclic wetland is in its operation, the cyclic wetland is allowed to dry out between flooding.

• At Toogoolawah the cycle is 2 day flooding and 2-3 day drying. This operation maximizes vetiver growth, hence nutrient removal.

• The major advantage of this system is that vetiver can be harvested and removed, ie nutrients are exported from the wetland. Whereas under conventional wetland nutrients can not be exported and gradually built up.
Treating piggery effluent

Thank You