CURRENT VETIVER SYSTEM RESEARCH, DEVELOPMENT AND APPLICATIONS AT GELITA APA, AUSTRALIA

Cameron Smeal
GELITA Australia, Beaudesert, Queensland, Australia

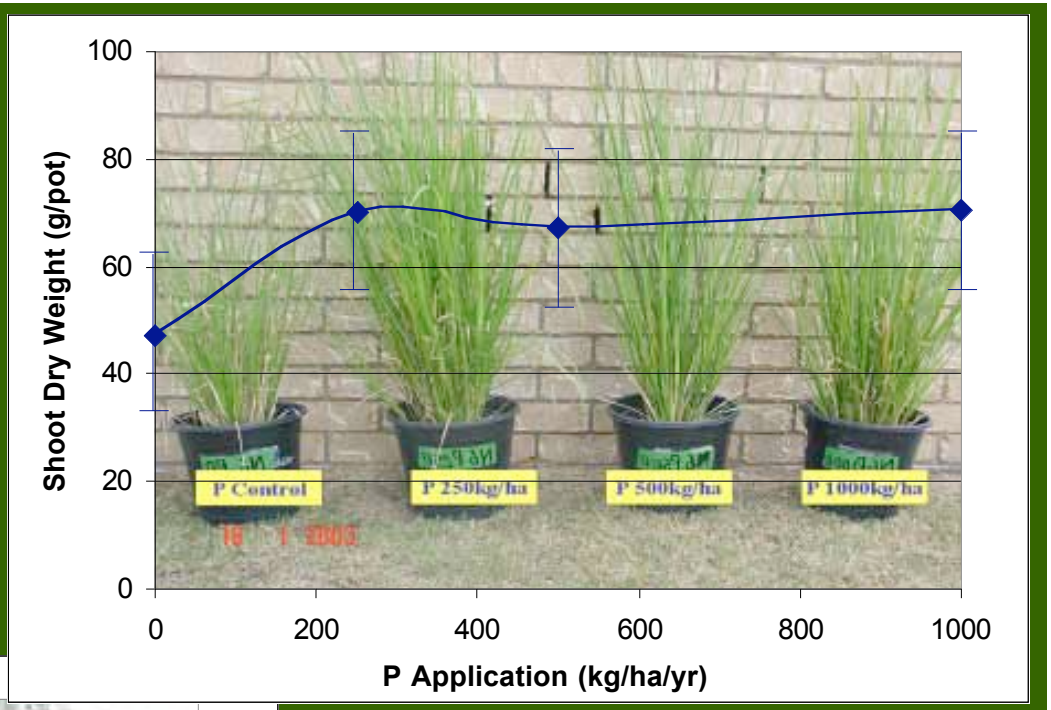
Paul Truong
Veticon Consulting, Brisbane, Queensland, Australia

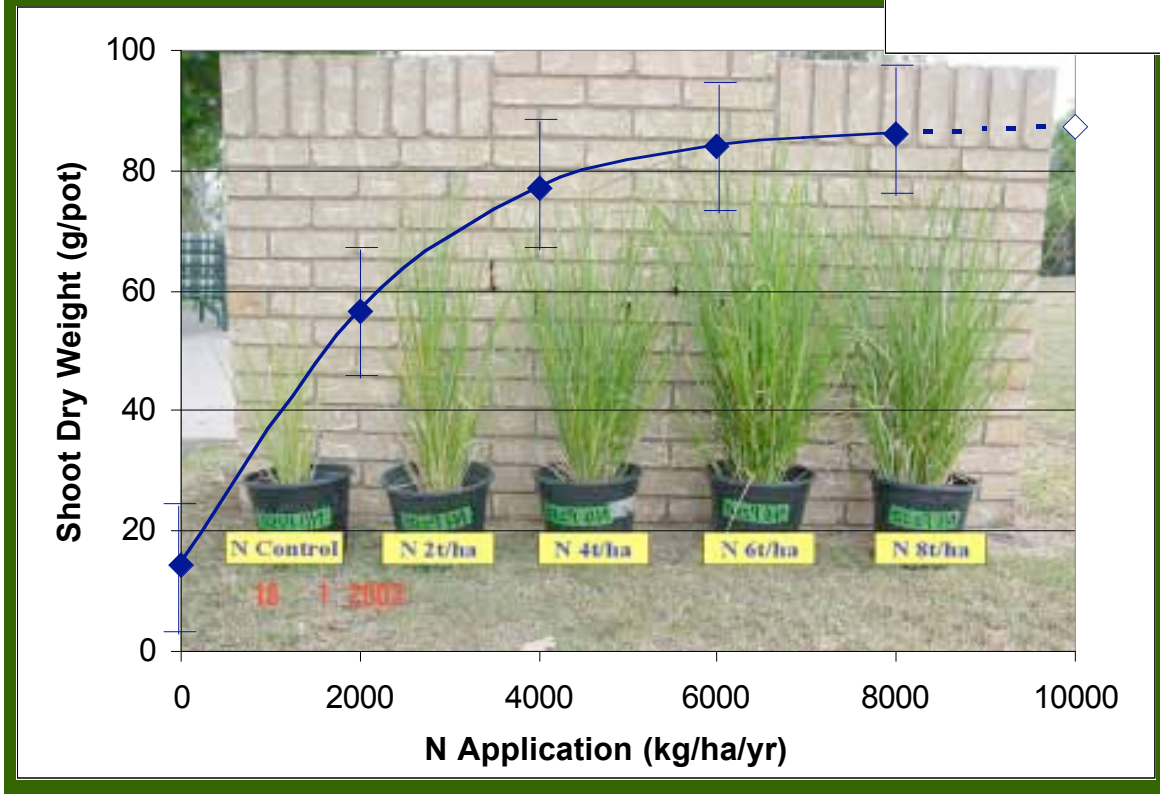

Cooktown
Mackay
Alice Springs
Emerald
Australia
Brisbane
Sydney
Perth
Canberra
Melbourne
Beaudesert

Previous findings

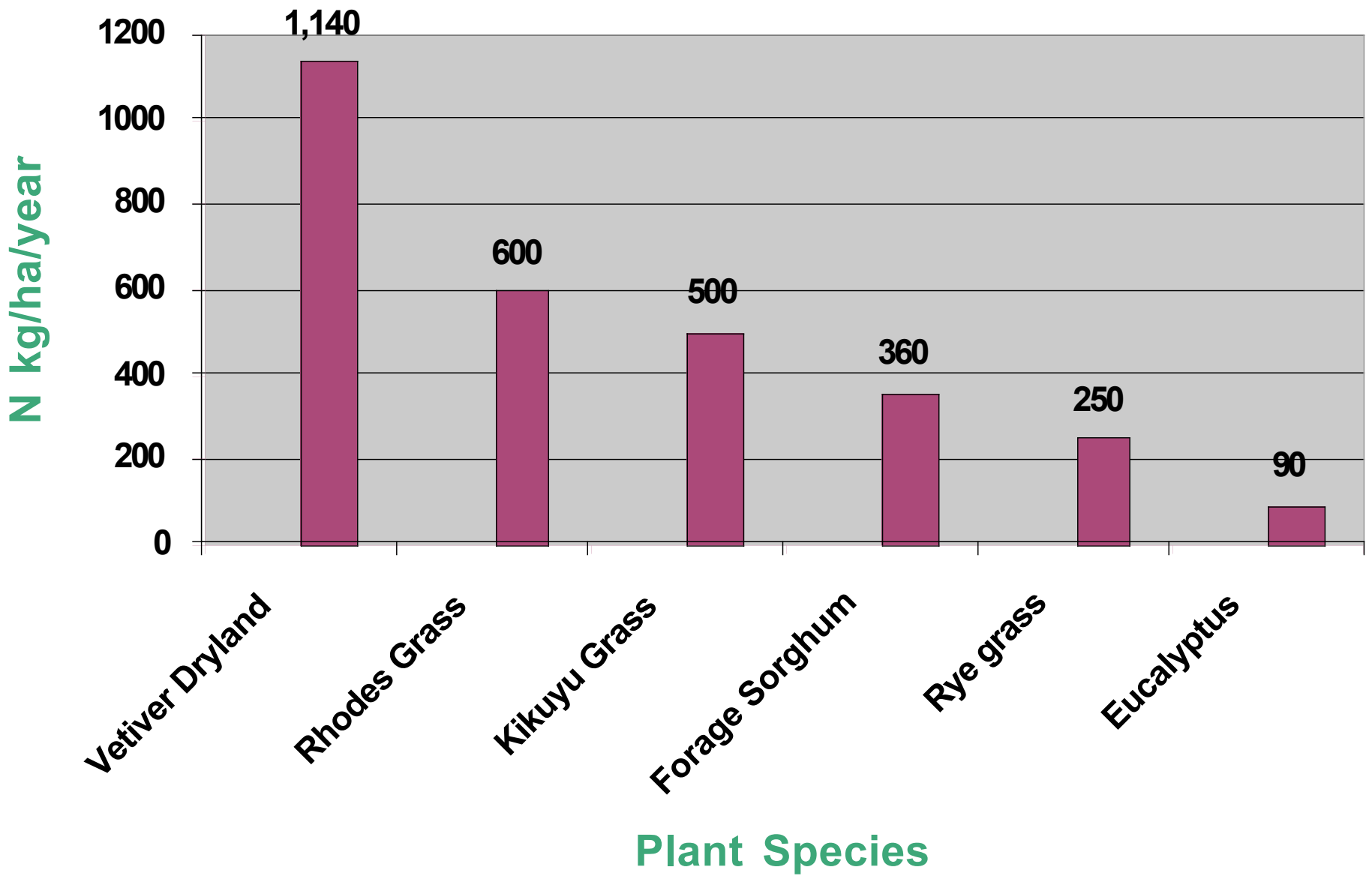
- Very high tolerance of vetiver to nitrogen/phosphorus
- More than 8 t/ha N, 800kg/ha P
- Extremely high nutrient uptake capacity
- Very high biomass generation, approximately 130 t/ha
- Younger shoots palatable to stock

Tolerance to extremely high levels of nutrients

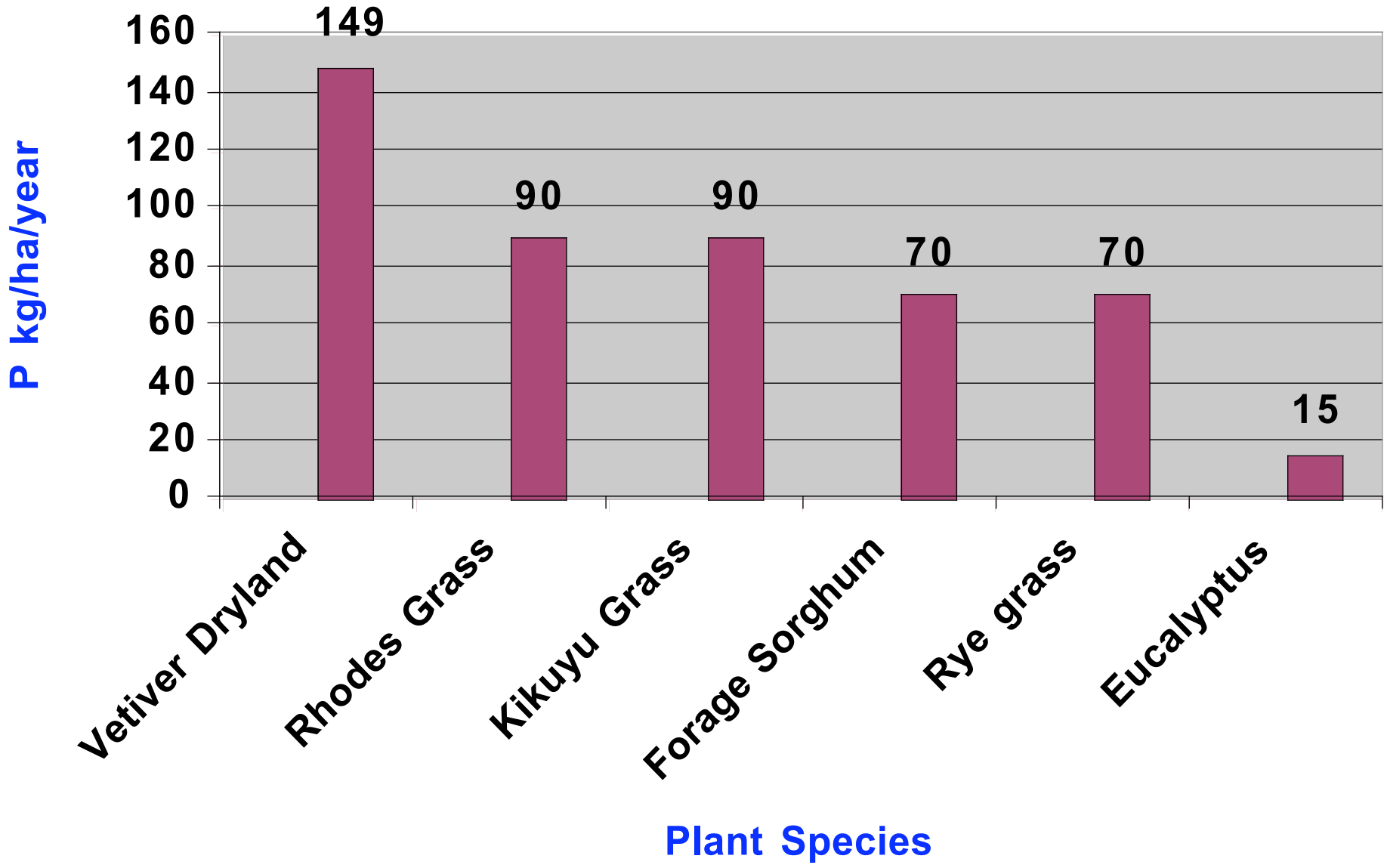




NITROGEN UPTAKE



PHOSPHORUS UPTAKE



SOME VETIVER SYSTEM APPLICATIONS IN AUSTRALIA

- **Industrial effluent disposal**
- **Domestic effluent disposal**
- **Landfill leachate disposal**
- **Wetland**
- **Floating pontoons**

Industrial effluent disposal at GELITA

Domestic Effluent disposal in Brisbane.

Six months after planting this stand of 100 plants absorbs all the discharge from the toilet block

Landfill leachate disposal in NSW, Australia

Wetland to treat municipal sewage effluent

Hydroponic treatment of municipal sewage effluent

CURRENT VETIVER RESEARCH, DEVELOPMENT AND APPLICATIONS AT GELITA

- **Soil Based Reed Beds**
- **Agrochemical Retention and Disposal**
- **Evapo-transpiration of Vetiver Grass**
- **Vetiver Essential Oil for Pest Control and Pharmaceutical Uses**
- **Effects of Vetiver Grass on Some Soil Physical and Chemical Properties**

SOIL BASED REED BED

OBJECTIVES

GELITA Australia initiated this field research to:

- **Demonstrate the suitability of vetiver grass for use in the SBRB system to treat nitrogen rich industrial effluent**

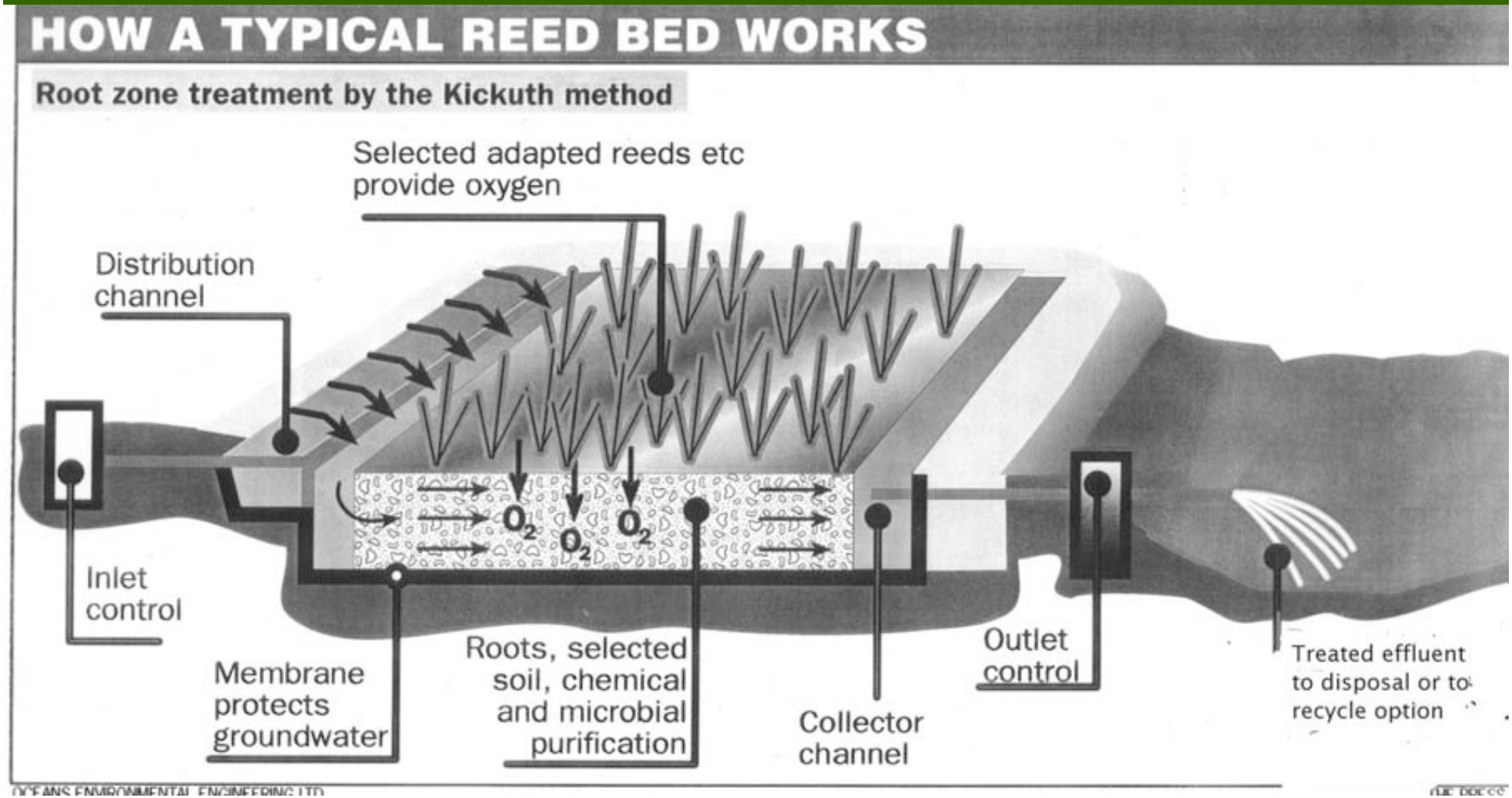
- **Use the research findings in order to develop and establish a SBRB system that is capable of purifying GELITA's wastewater to a satisfactory level**

- **Develop a SBRB system using vetiver grass suitable for the treatment of high strength wastes both in Australia and world wide.**

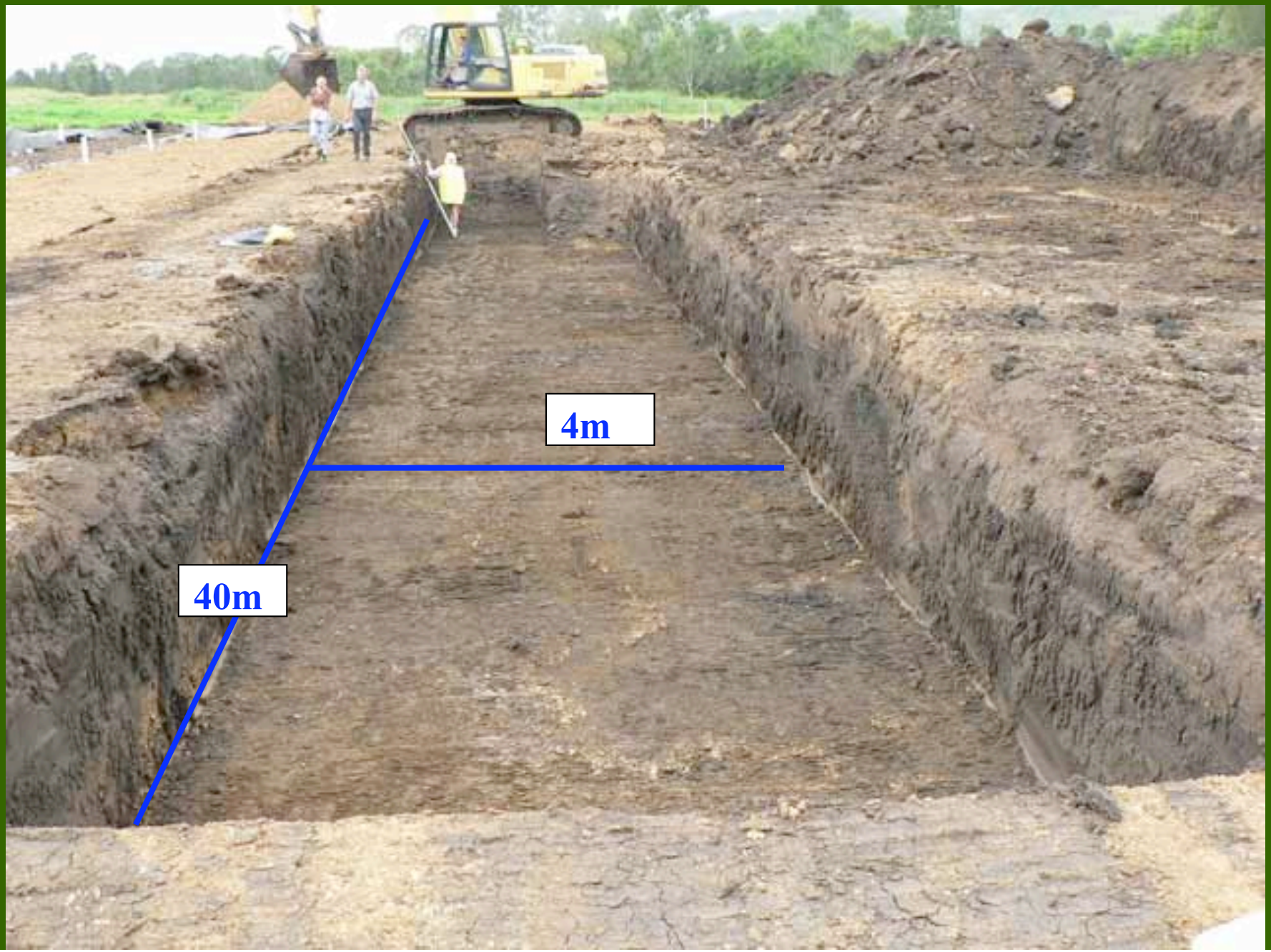
Soil Based Reed Beds

The SBRB system has three simple components:

- **A shallow bed of soil , sand or gravel**
- **A suitable wetland plant**
- **Micro-organisms (fungi and bacteria)**



Reed bed construction at GELITA, Australia



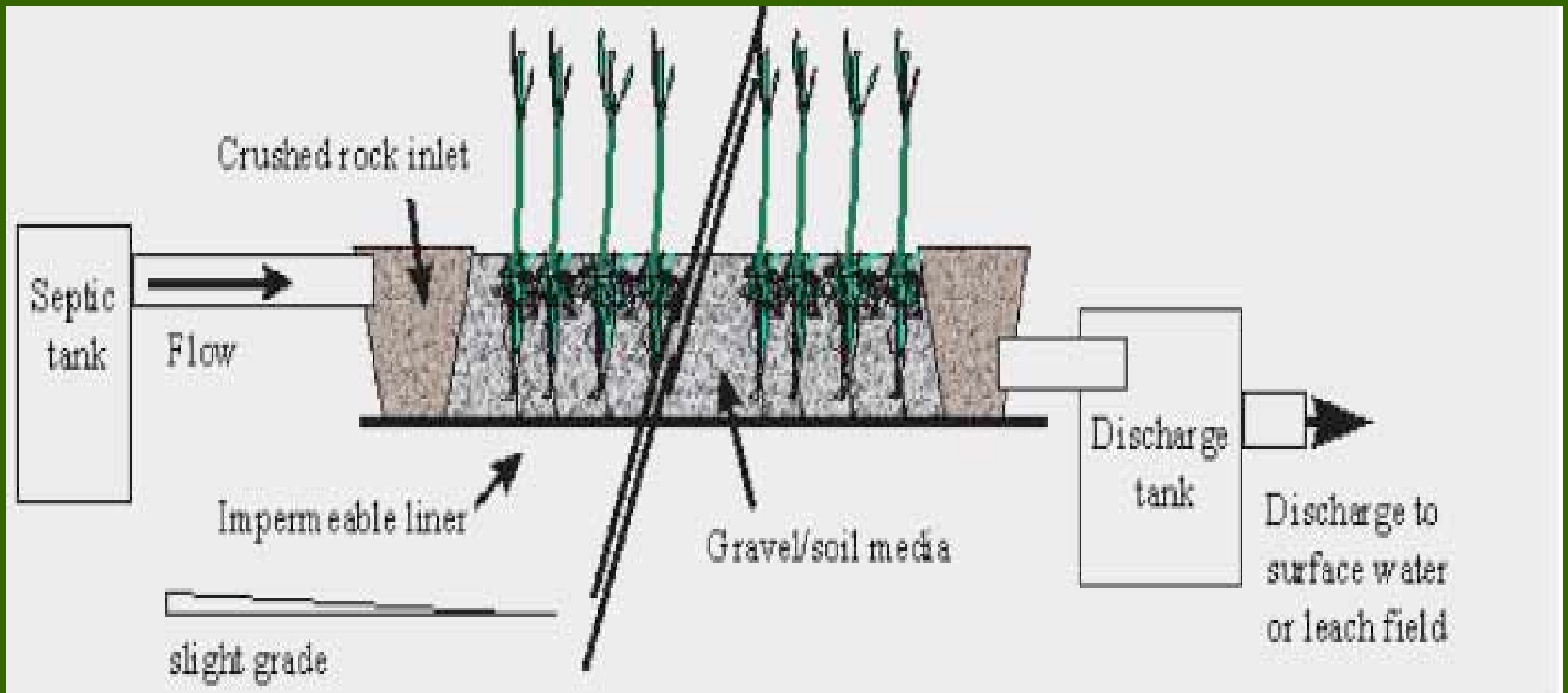


Figure 1-3: Common reed bed design in the treatment of domestic wastewater (diagram sourced from Leady 1997).

New planting on sand bed

Performance of Reed Beds and Single Pass Sand Filters with Characterisation of Domestic Effluent:

Plate 3-5: Poor productivity of *Phragmites australis* observed during the sampling period.

Soil Based Reed Beds with clay, sand and gravel beds at GELITA

AGROCHEMICAL RETENTION AND DISPOSAL

OBJECTIVES

- To demonstrate the benefits of vetiver grass filter strips on farms in reducing herbicide movement into the aquatic environment

- To develop a simple system suitable for easy adoption by the farming community to improve water quality

- To promote the adoption of the Vegetative Buffer Strip for Soil Erosion & Deposition model developed by Griffith University, Brisbane, Australia

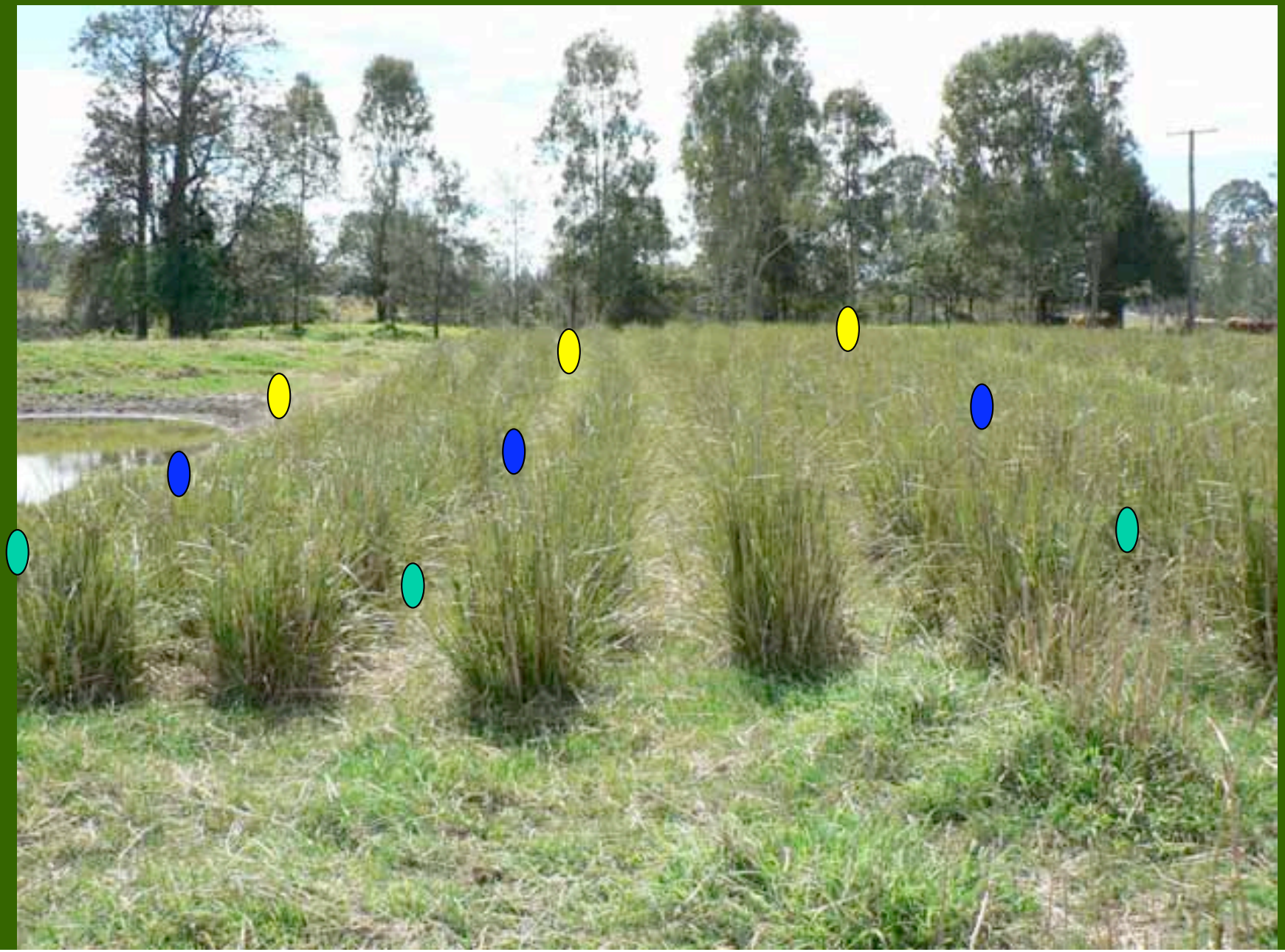
Atrazine Capture and Retention Project

Atrazine Capture and Retention Project

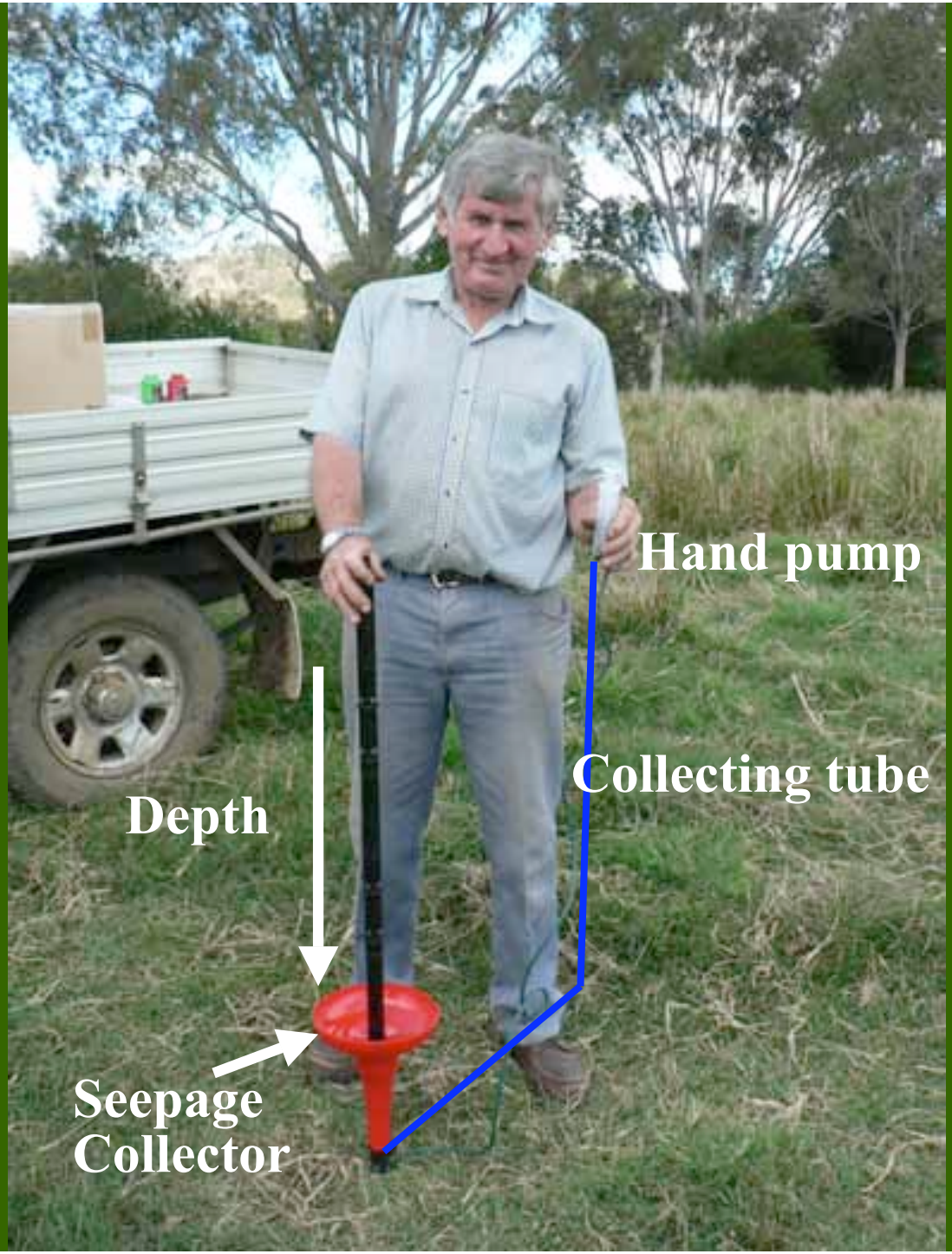
18 month old vetiver ready for treatment

Atrazine Capture and Retention Project ready for trial

Nine sets of sampling points, each at 3 depths: 20cm, 50cm and 100cm



Boring for installation of monitors



FullStop subsoil seepage monitor

A set of sampling point with 3 collectors at 20cm, 50cm and 100cm depth

EVAPO-TRANSPIRATION OF VETIVER GRASS

OBJECTIVES

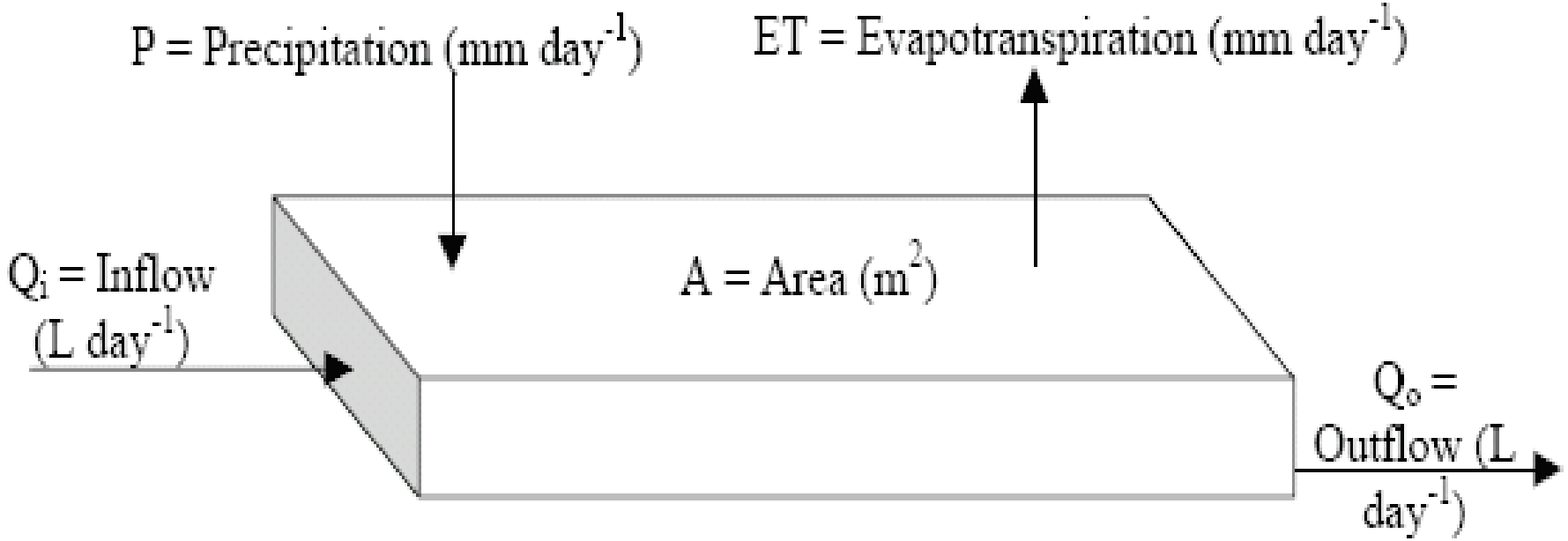
The principal objective is to determine accurately the transpiration rates

The evapo-transpiration rate of vetiver reported in the literature varied from 3.8 mm/day in summer and 1.9 mm/day in winter under field conditions to 43 mm/day under effluent treatment conditions. These are up to 4-10 times greater than normal rates.

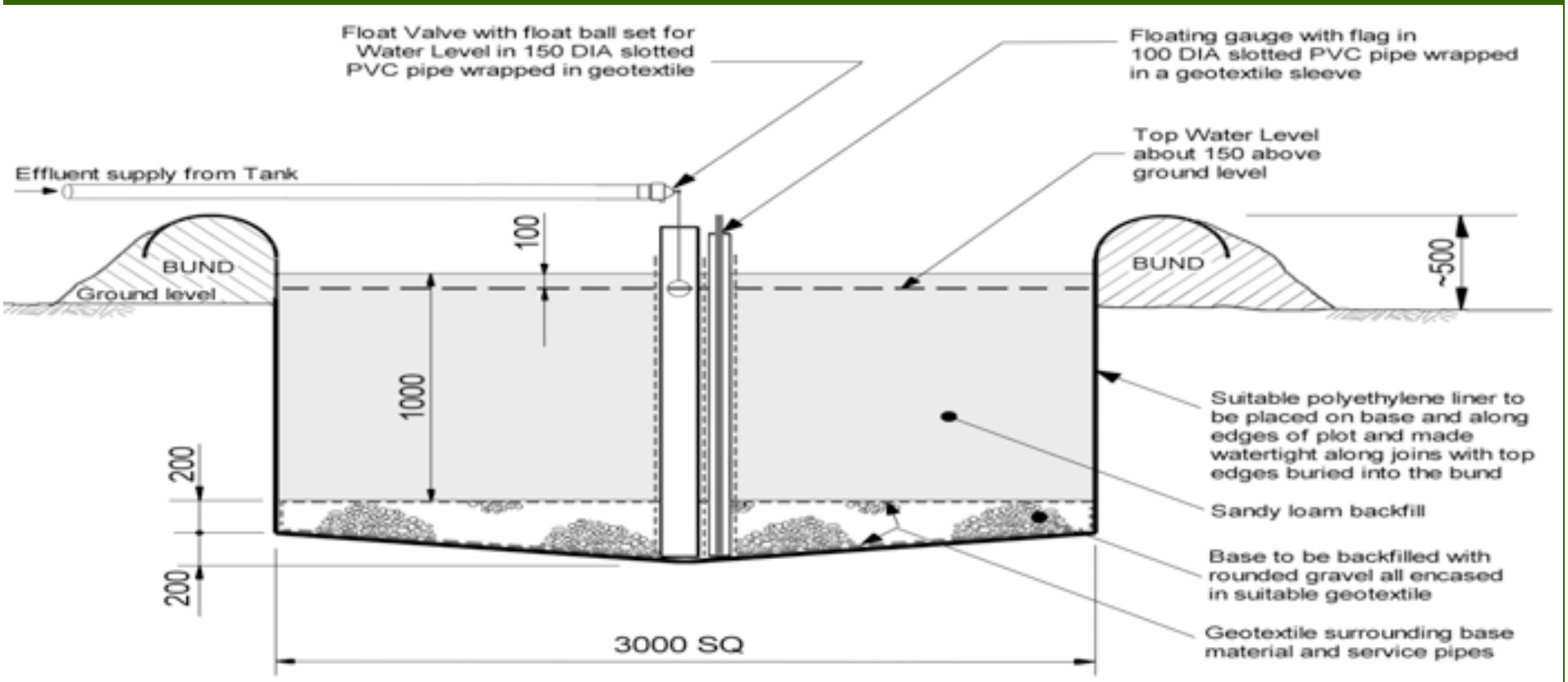
If such extreme claims are incorrect, environmental damage could result from undersized effluent irrigation schemes.

Evapotranspiration

$$ET = P + (Q_i - Q_o)/A \qquad (3\text{-}1)$$



Plot Design for Transpiration Study (A. Vieritz)



Experimental Design

Experimental Design

- 12 bays of 3m _ 3m in area, 1.45 m deep and 4m apart, orientated perpendicular to the predominant wind direction.
- 4 treatments _ 3 replicates

Treatments

1- Vetiver (*Chrysopogon zizanioides)*
2- Kikuyu *(Pennisetum clandestinum*) a pasture grass
3- Broad leaf Cumbungi *(Typha orientalis)* – a wetlands species endemic to the area
4- Control (bare ground)

3m x 3m x 1.45m deep bay lined with heavy waterproof membrane


Sampling outlet
Inlet
19 7 2006

Twelve bays all set ready for planting

VETIVER ESSENTIAL OIL FOR PEST CONTROL AND PHARMACEUTICAL USES

OBJECTIVES

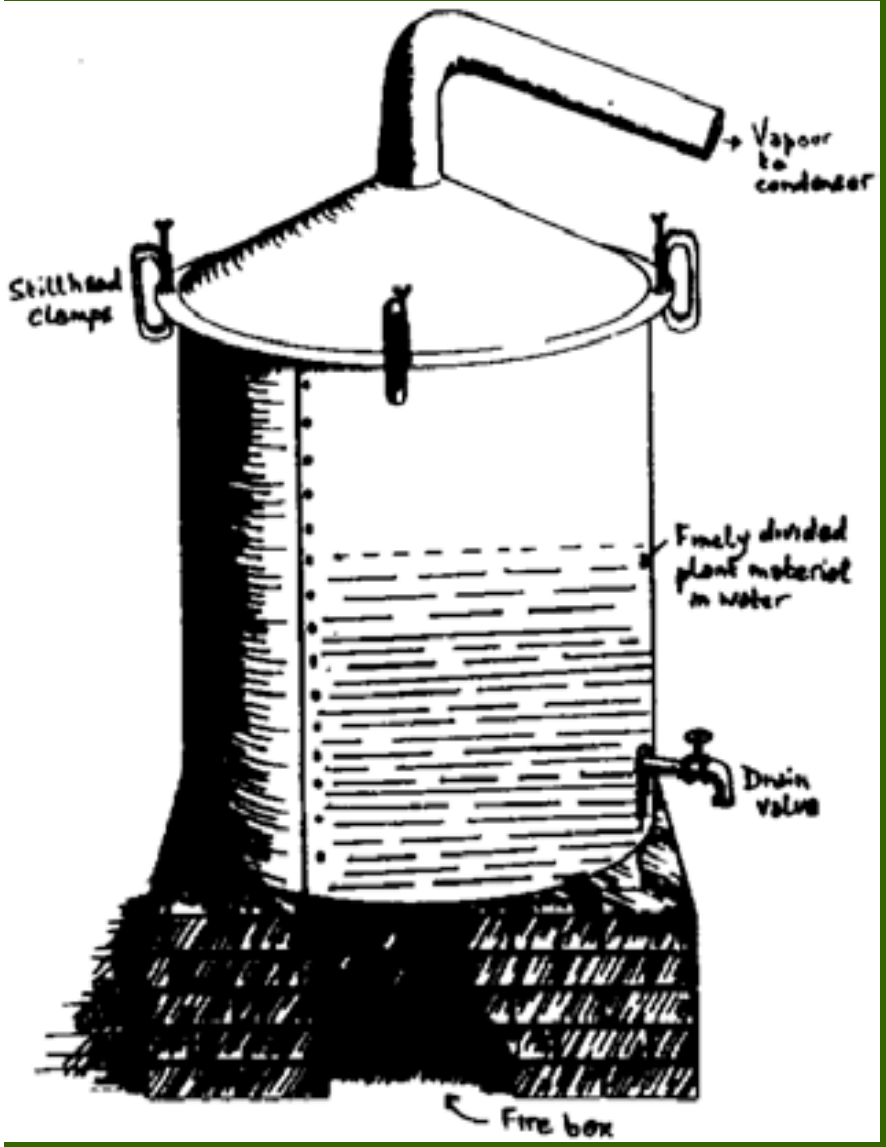
Literature search has indicated that vetiver essential oils (VO) have Antibacterial, Antifungal, Antioxidant and Anti-inflammatory attributes.

The aims of this project are to:

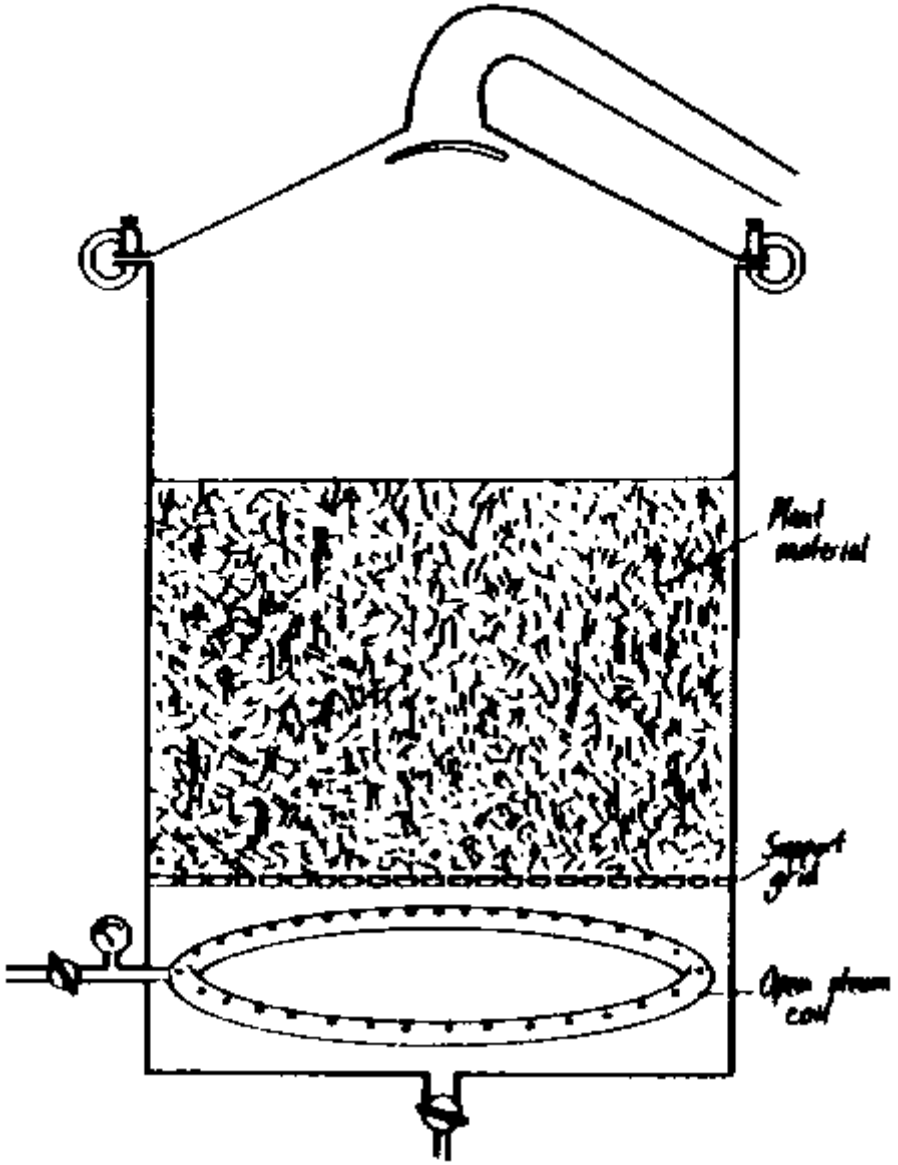
- **Determine the best extraction methods for _-vetivone and _-vetivone and possibly other components as well.**
- **Determine which Vetiver species has highest content of α-vetivone and β-vetivone at which stage of growth.**
- **Determine whether VO can be extracted from leaves**
- **Whether heavy metals and other chemicals will affect the quality and quantity of VO**
- **Whether VO contains heavy metals and other chemicals when used for phytoremediation**

Extraction Methods

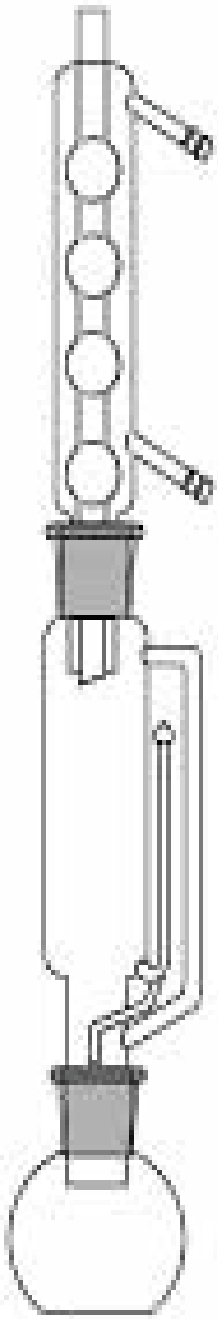
Hydro distillation

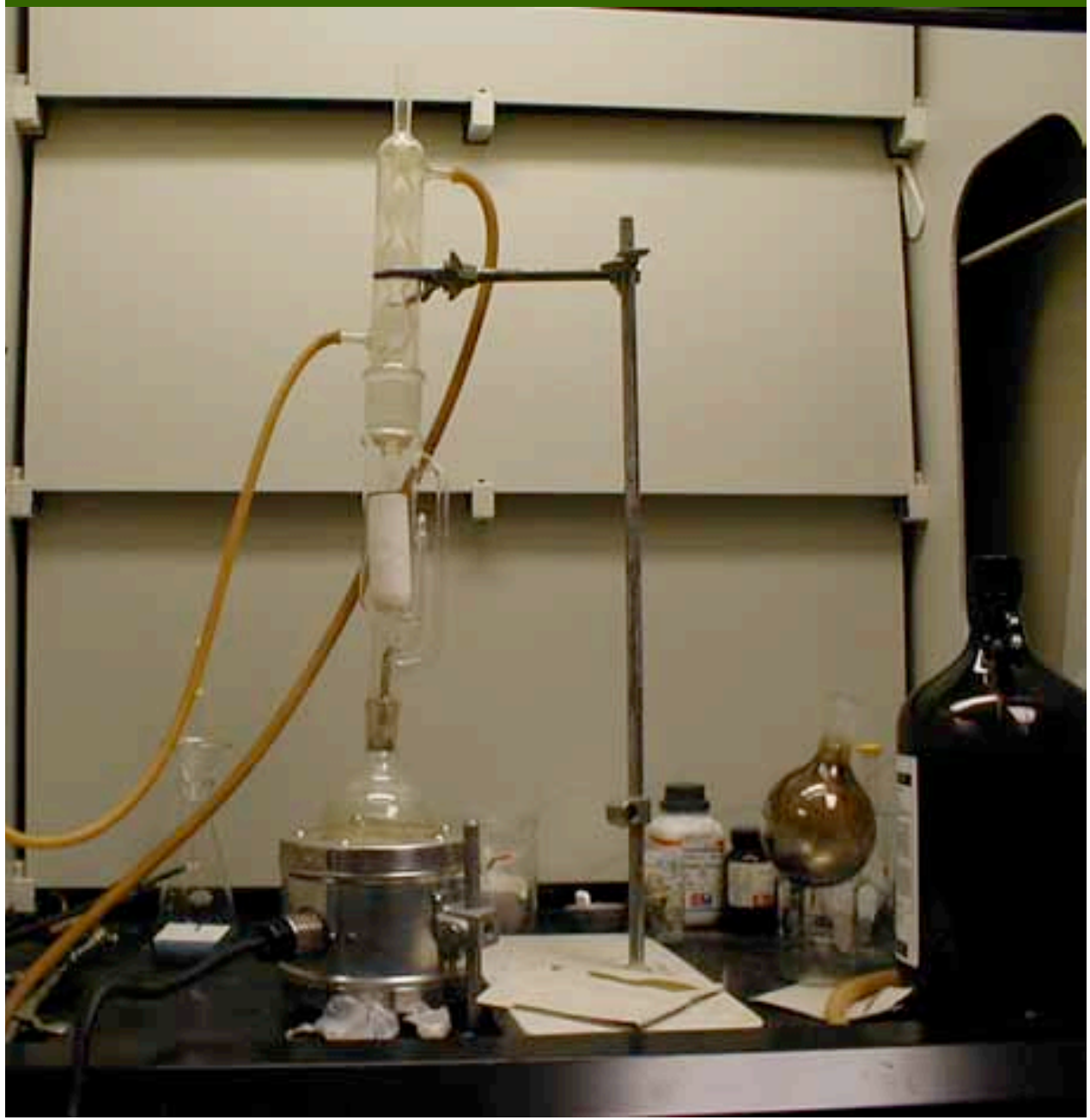


Steam distillation



Solvent extraction





EFFECTS OF VETIVER GRASS ON SOME SOIL PHYSICAL PROPERTIES

OBJECTIVES

Due to its extensive, deep and penetrating root system, it is expected that some soil physical and chemical parameters would be improved under vetiver cultivation

The aims of this project are to:

- **Monitor the changes in hydraulic conductivity and soil bulk density**
- **Monitor the changes in salinity and soil chemistry on various soils within the GELITA property**
- **Provide soil-water parameters, which will determine appropriate irrigation management and monitoring programs**

Determining saturated hydraulic conductivity

Testing Guelph Permeameter

Guelph Permeameter in the field

Variation in root growth by soil type

700mm


Thank
You