Plant growth and microbiological safety of plants irrigated with greywater

Lumka Salukazana, S. Jackson, N. Rodda, M. Smith, T. Gounden, N. Macleod and C. Buckley





### Introduction

Domestic wastewater
 Toilet waste (black water)
 Non-toilet waste (greywater)

In low-income dense peri-urban and rural communities served by on-site sanitation

 Toilet waste contained and treated on-site
 Greywater not addressed

### Greywater represents an environmental problem

- Unpleasant odours
- Health hazards
- Soil erosion
- Pollution of surface water by runoff
- Mosquito breeding
- Peri-urban, informal and rural settlements are associated with low income, low food security
- Greywater re-use simultaneously addresses environmental and social needs
  - Pilot trials by eThekwini successful and accepted by communities



 Semi field greywater irrigation trials conducted to investigate:

Effect of greywater on plant growth

Microbiological safety of produce

# **Experimental design**

- Eight households were selected from nearby community based on
  - Number per household
  - Age
  - Gender
  - Washing application (bathing, laundry *etc*.)
- Three treatments
  - Tap water (negative control)
  - Nutrient solution (positive control)
  - Greywater (experimental treatment)
- Both leafy (above ground) and root (below ground) crops were selected
  - 25 replicates per treatment
  - Above ground spinach and green pepper
  - Below ground potatoes and madumbes







### **Plant growth monitoring**

Weekly measurements taken of

- Stem height and diameter
- Number of leaves
- Leaf area
- Number of fruits

Fresh weights at harvest

### **Microbiological analysis**

- Conducted on both surface and interior of plants at harvest for:
  - E. coli
  - Total coliforms
  - Staphylococcus spp.
  - Coliphage
  - Ascaris spp.

#### **Nutrient solution**

### Greywater

### Tap water













#### Nutrient Solution

#### Greywater

#### lap water











## **Stem heights**

Spinach







## **Stem heights**

#### **Potatoes**

#### Madumbes







# **Microbiological Results**

#### Spinach

#### Pepper





**Potatoes** 



# **Commercial crops**

#### Spinach





# Conclusions

 Greywater provided nutrients for both leafy and below-ground plants

 No significant difference in microbial quality of greywater irrigated crops relative to controls and commercial crops

 Greywater represents a potential resource for food production

# **Acknowledgements**

This research was funded by

 eThekwini Municipality
 National Research Foundation
 University of KwaZulu-Natal