Greywater Use for Agricultural Irrigation in Urban and Peri-urban Areas

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Introduction

Water crisis in South Africa

- Average rainfall 450mm/year
- 60% total water demand is for agricultural use
- Increased fresh water demand

Alternative sources need to be investigated

→ Wastewater reuse

Toilet waste (black water)

Non-toilet waste (greywater)

Grey water represents an environmental problem

- Unpleasant odours
- Health hazards
- Soil erosion
- Pollution of surface water by runoff
- Mosquito breeding

Benefits of grey water reuse

- Reduce water shortage
- Reduce environmental degradation, eutrophication and health hazards
- Reclaim wasted nutrients
- Alleviate food shortages and poverty

Greywater re-use simultaneously addresses environmental and social needs

Preliminary community trials by eThekwini Municipality were promising

- community acceptance
- good yield of above-ground crops

Aims

Semi-field greywater irrigation trials were conducted to investigate:

- Effect of greywater on plant growth and yield
- Plant growth patterns over different seasons
- Microbiological contamination of the produce

Experimental design

Eight households selected from nearby community contributed greywater daily, pooled on site

Three treatments

- Tap water
- Nutrient-amended water solution
- Greywater (experimental treatment)

Both leafy (**above ground**) and root (**below ground**) crops represented

- 25 replicates per treatment for
- Above ground:
  spinach and green pepper
- Below ground:
  carrots and beetroot

Results from **crop cycles 2-4 of 6 crops** cycles presented

- 1st crop cycle: pest problems
- crop cycles 5 and 6: results still being analysed

Plant growth and yield monitoring

Weekly growth measurements

- Plant height and stem diameter
- Number of leaves
- Leaf area
- Number of fruits

- *Results for plant heights presented here*

Yield measurements on crops

- Fresh weight
- Dry weight

- *Fresh weights presented here*

Nutrient solution

Greywater

Tap water

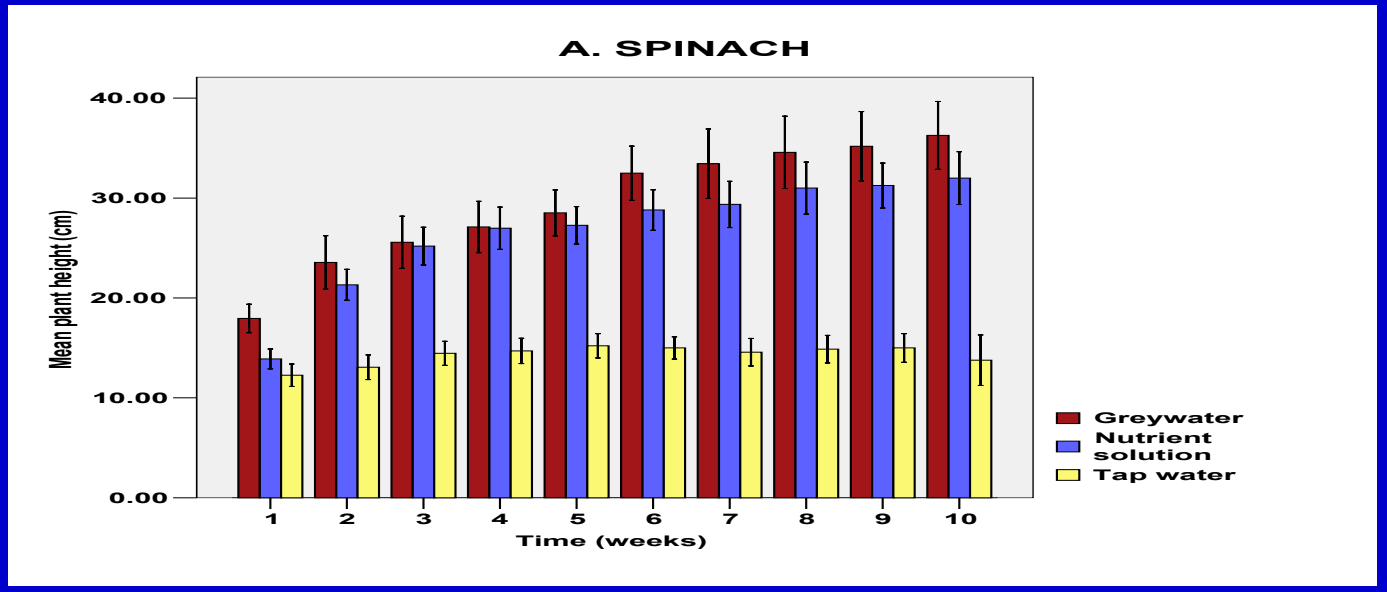
Nutrient solution

Greywater

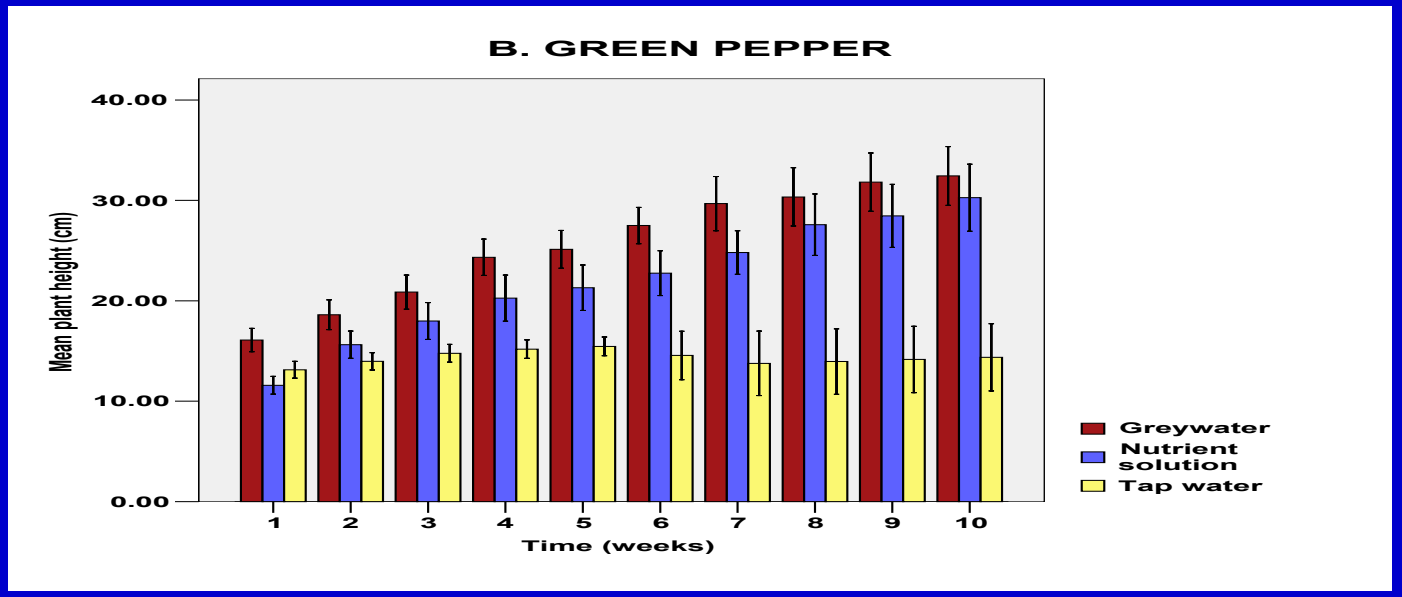
Tap water

Plant heights, above-ground crops
Crop cycle 2

Spinach

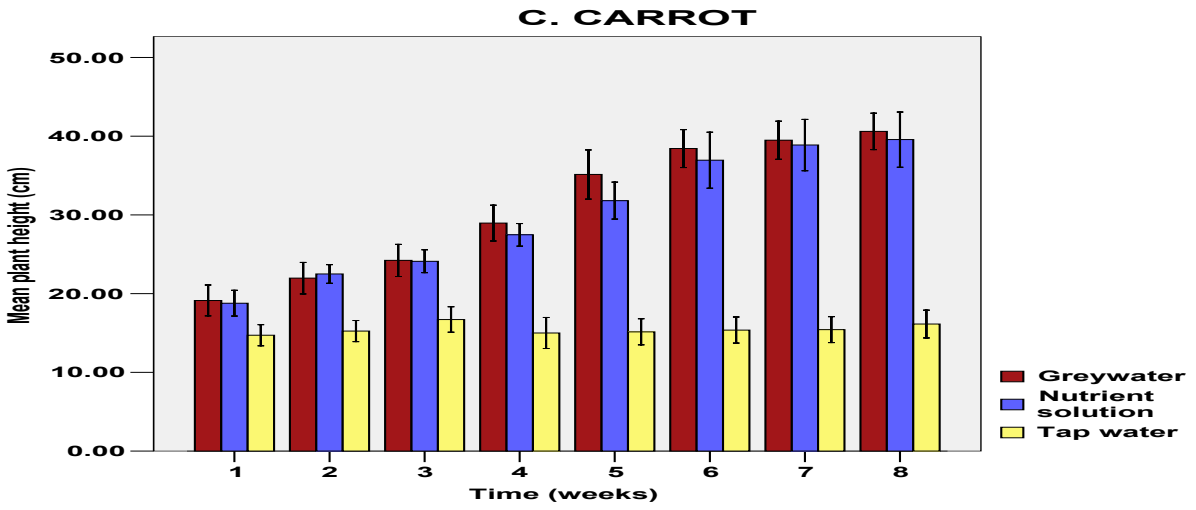


Peppers

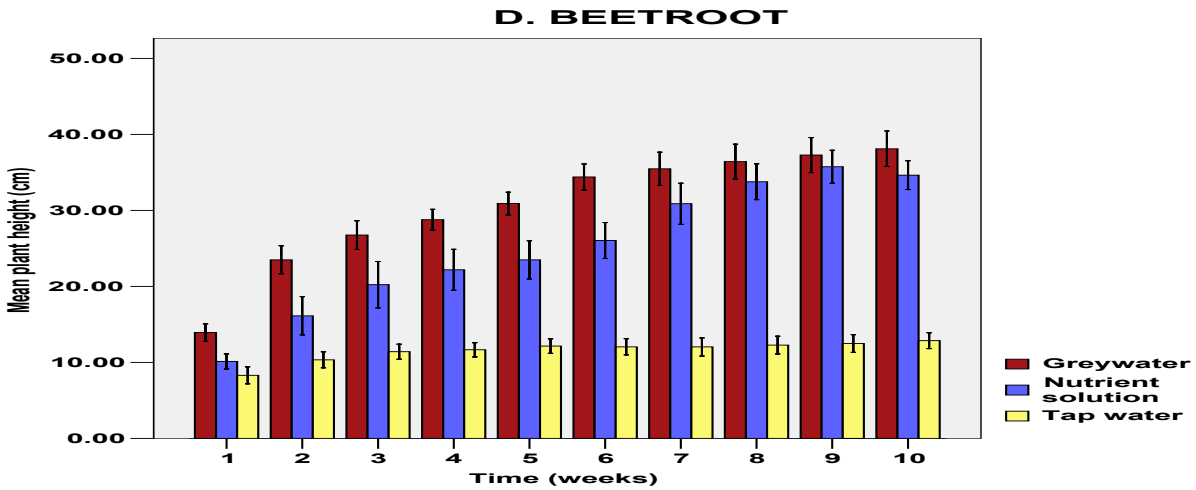


Plant heights, below-ground crops
Crop cycle 2

Carrots

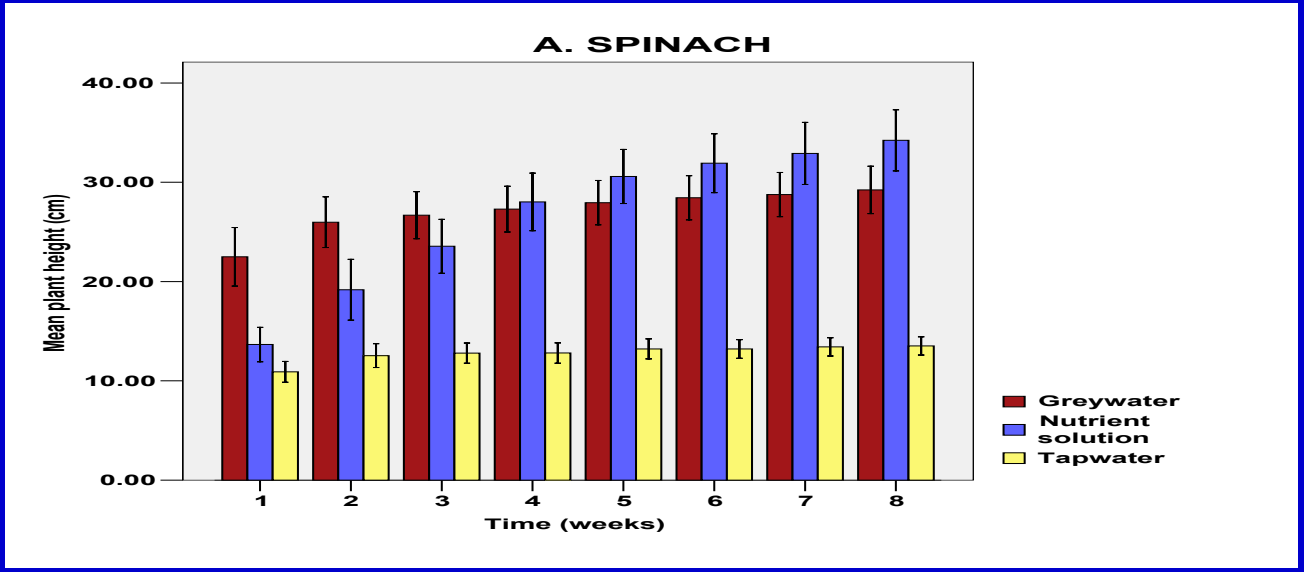


Beetroot

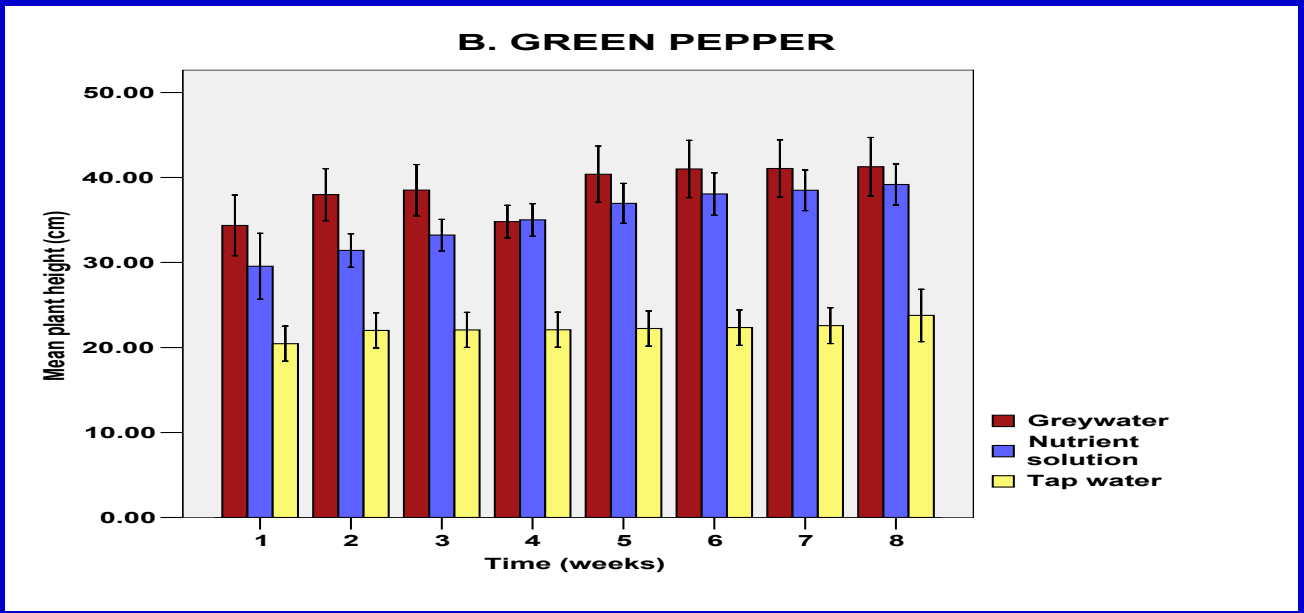


Plant heights, above-ground crops
Crop cycle 3

Spinach

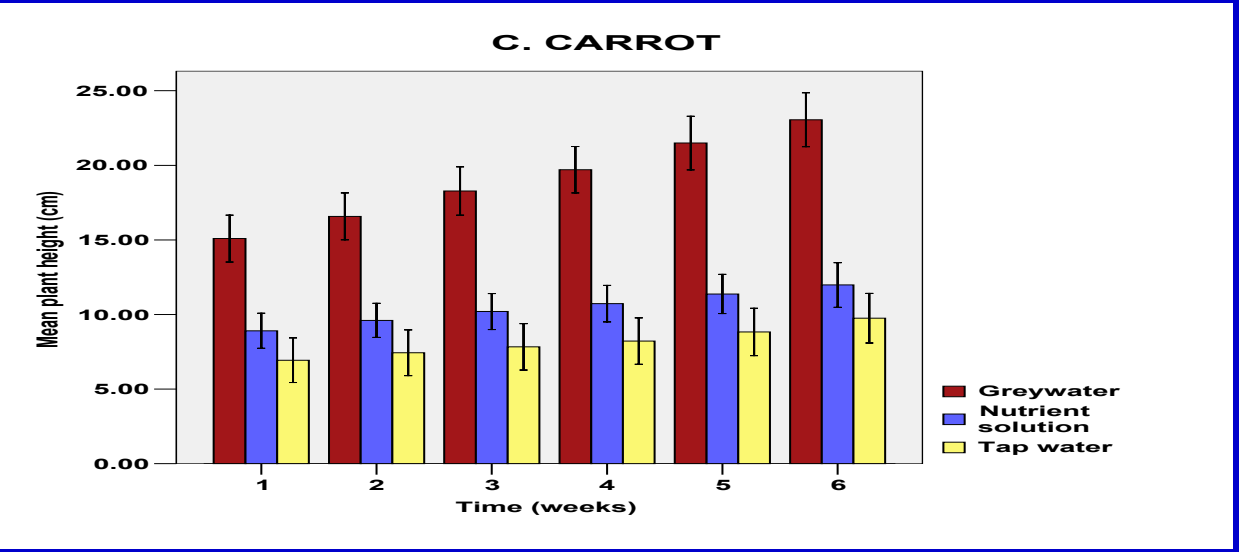


Peppers

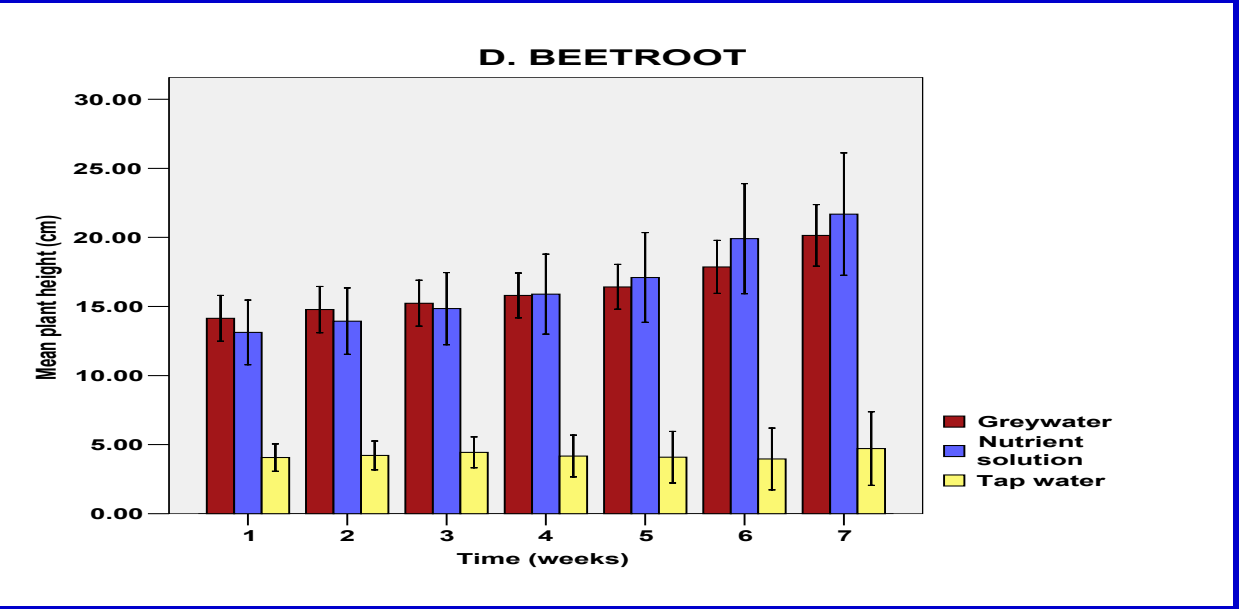


Plant heights, below-ground crops
Crop cycle 3

Carrot

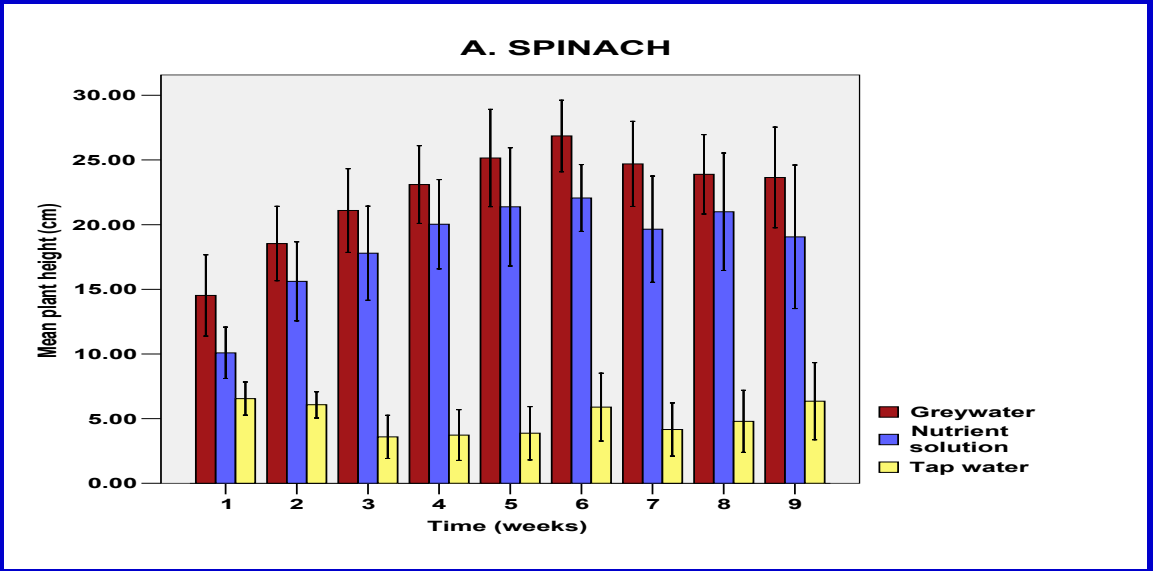


Beetroot

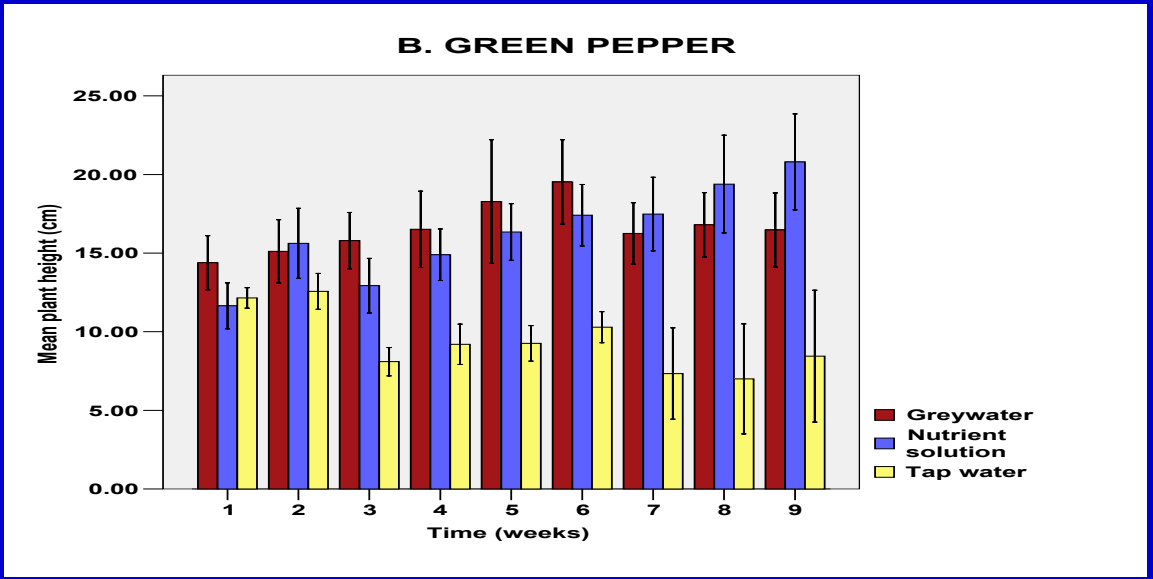


Stem heights, above-ground crops
Crop cycle 4

Spinach

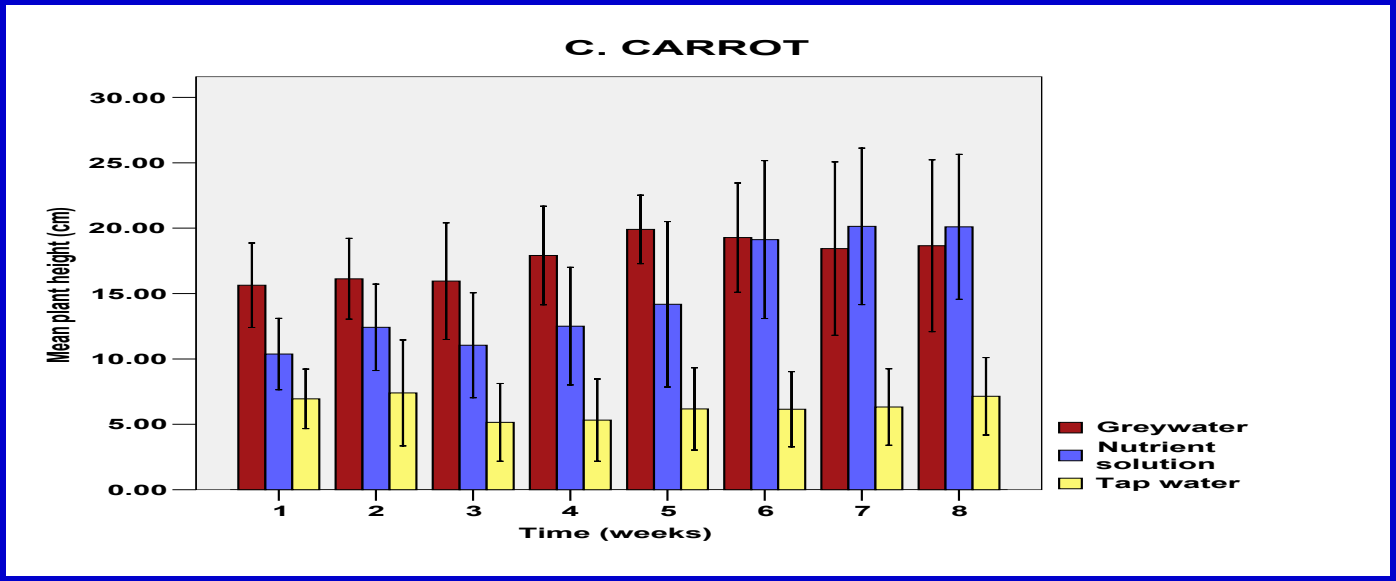


Peppers

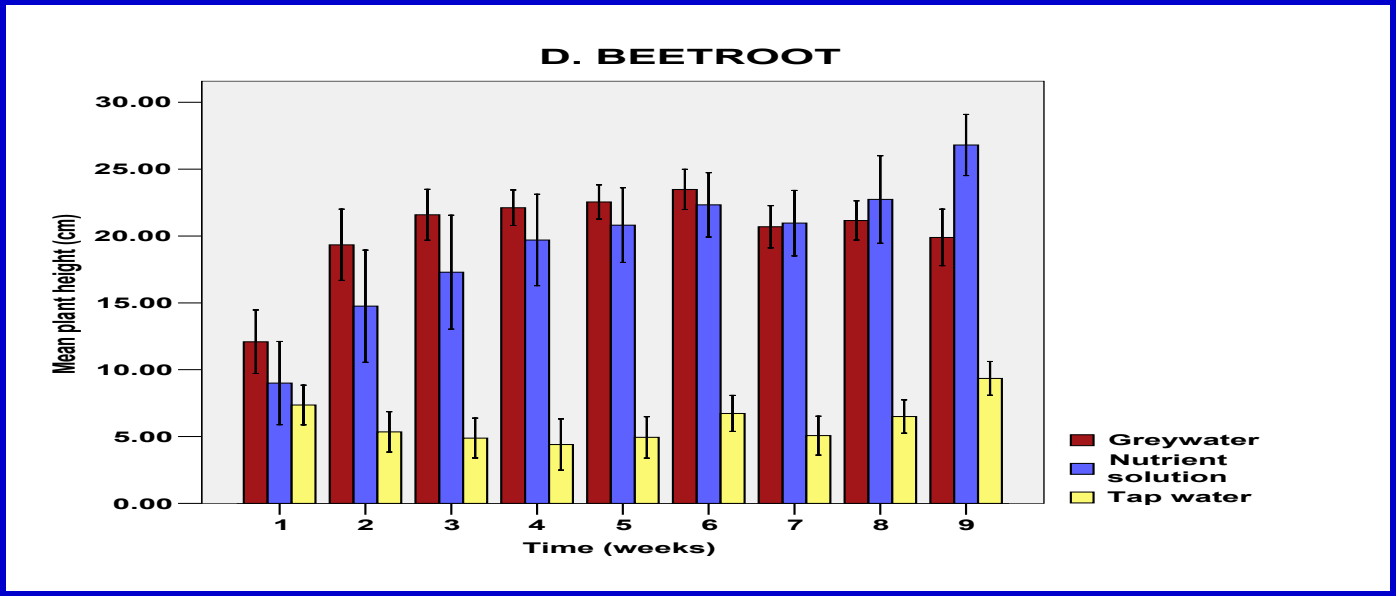


Plant heights, below-ground crops
Crop cycle 4

Carrot

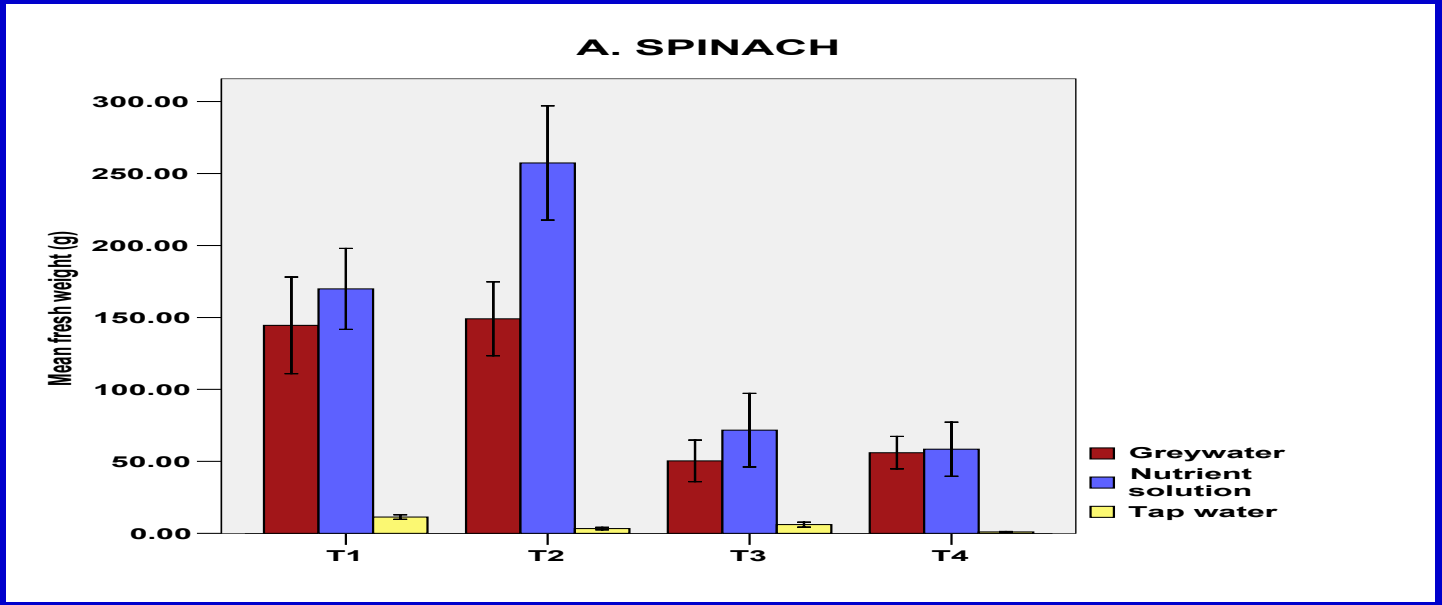


Beetroot

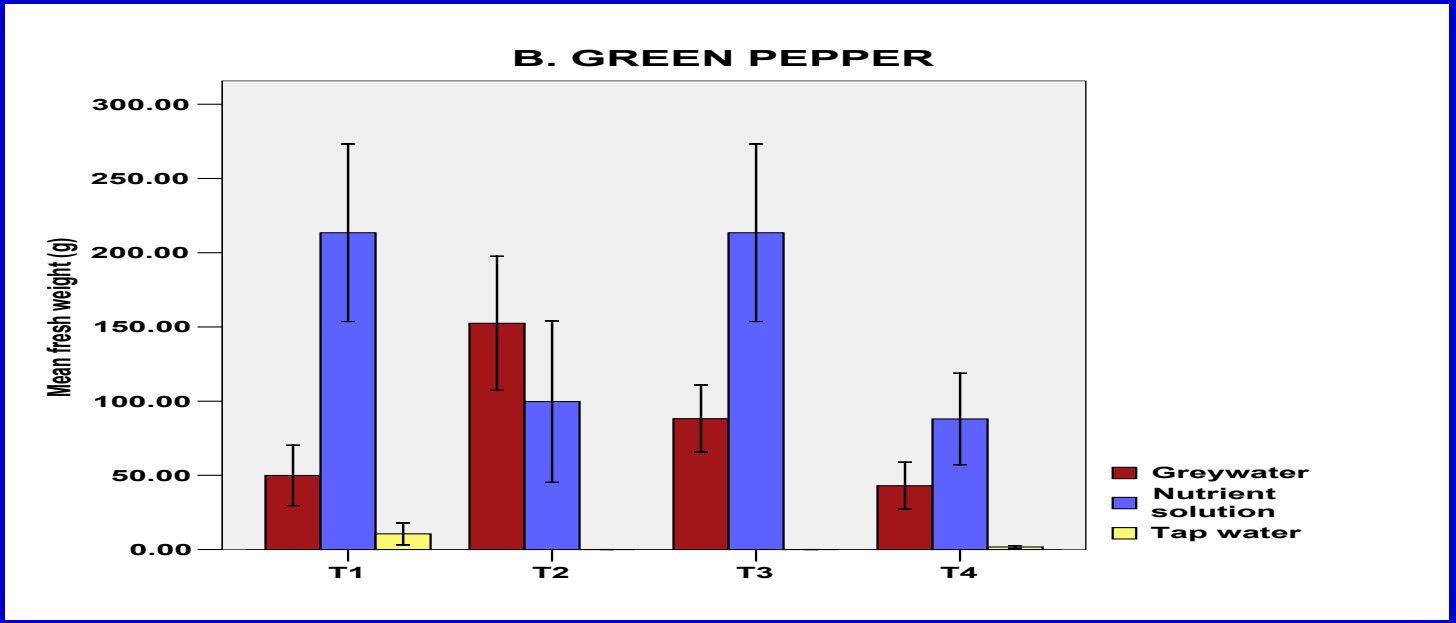


Total Yield

Spinach

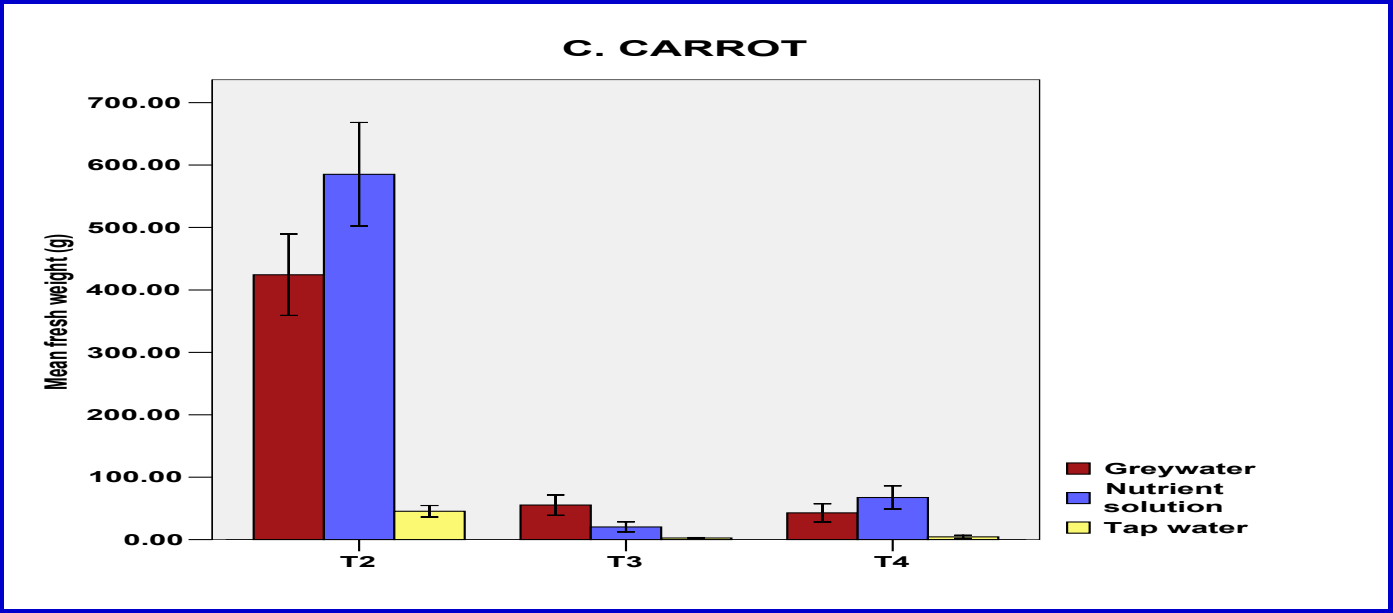


Peppers

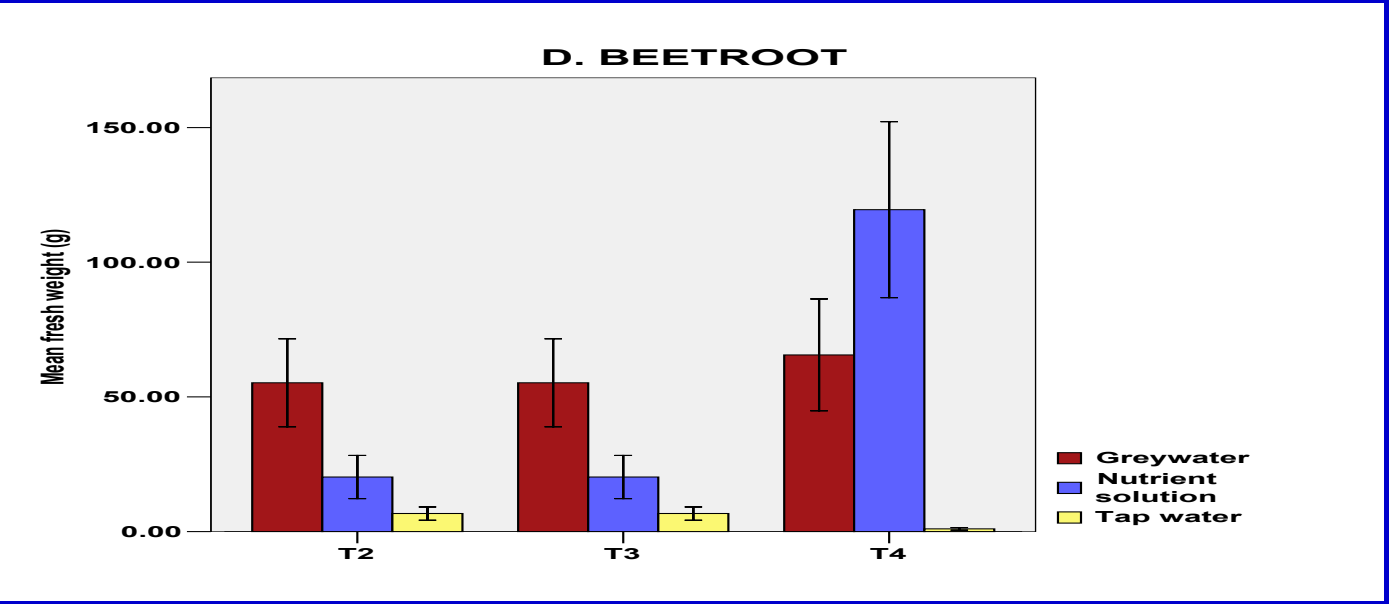


Total Yield

Carrot



Beetroot



Conclusions

- Using greywater as a nutrient source produced increased plant heights and yields similar to that obtained when using chemical fertilizers.
- Grey water represents a potential resource for food production – but safety and site-specific factors must be investigated on a site by site basis.
- Greywater irrigated produce is likely to be safe for human consumption (based on microbiological analyses).

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