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Peepoo

- a sanitation solution addressing the urban poor

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Sanitation challenges

- 62 % improved sanitation
- 40 % sanitation including treatment
- Spread of disease
- Health burden from nutritional deficiencies higher than from unsafe water, sanitation and hygiene
- Valuable nutrients are wasted

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Sanitation challenges

Sanitation system often requires:

- Large infrastructural system
- Complex investments
- Institutional changes

How to reach the people in overcrowded, informal settlements?

Peepoo – a new approach to an old problem





- Peepoo is a self-sanitizing single-use biodegradable toilet that after use turns faeces into safe valuable fertilizer
- Targeting slums, schools and emergencies
- Health improvement
  - Preventing disease dissemination
  - Nitrogen enriched fertiliser

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Peepoo – technical brief

- Biodegradable-plastic (EN13432)
- 150 ×380 mm, 25 µm, two layer extrusion
- 800 ml urine and faeces
- Weight 11 gram of which 6 g is urea

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How to use Peepoo

Initial Launch Project Kibera

- Started in 2010
- Peepoople Kenya established
- First market introduction in an urban slum

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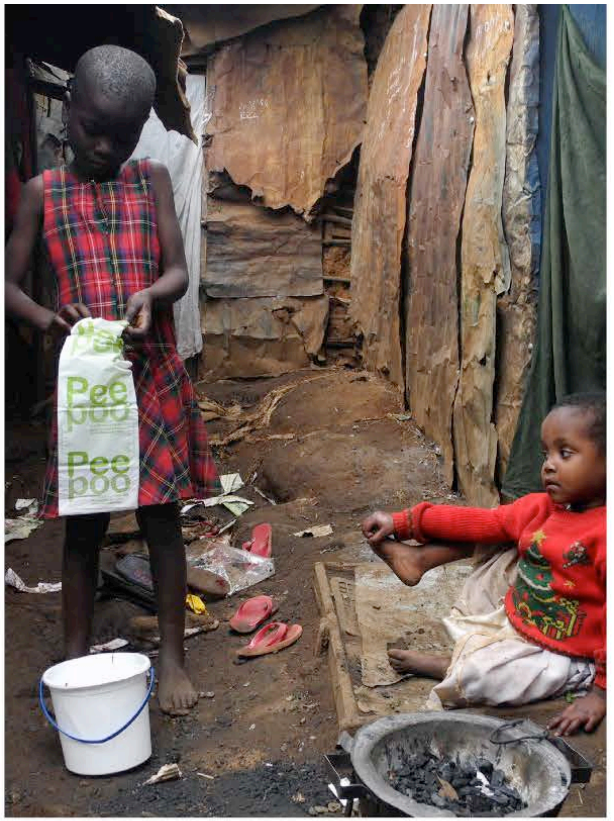
Objectives for ILP Kibera



Objectives for ILP Kibera

- Demonstrate the Peepoo sanitation system
- Develop the full value chain
  - Distribution
  - Collection
  - Reuse of Peepoos
- Test financial feasibility of the business
- Validate the business model
- Create a sustainable sanitation model that is easily scaleable which can be duplicated and launched

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Kibera

- In Nairobi 5 km from city centre
- 2 km^2
- 250 000 – 1 000 000 inhabitants
- 250-300 per toilet

ILP Kibera today

- 20 000 customers
- 10 000 school children in 63 schools
- Peepoos sold door-to-door, in kiosks and by school attendants
- Sold for 3 Euro cent – 1 Euro cent in refund when handing in used Peepoo at drop point
- Today 4 drop points in 4 villages
- Average daily collection: 5 000 Peepoos = 1 ton
- Intermediate storage area in Kibera
- Brought to Kirinyaga county to be used as fertiliser

Peepoo school programme

- Provide sanitation:
  - Training
  - Hand washing units
  - Privacy cabins
  - Urine soak pits

- Vision: Child to community information

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Collection and fertiliser reuse ILP Kibera

Used by Customers

Smell free for 24 h
for storage at home

Drop-point

Staffed and open from
6am-4pm

Transportation

Hand cart and bakkie

Sanitation in Big bag

2-4 weeks depending on
pathogens and temperature

Processing

Mixing or drying for production
of a bagged fertiliser

Fertiliser use

kale, spinach and leek

Maize and other crops

Coffe, tea, eucalyptus
and gravillea

Drop point: open between 6 am – 4 pm

Daily transport from drop points

Conclusions ILP Kibera

- Elders and informal leaders acceptance of project before start is of high importance
- Avoid giving out anything for free to fight the “NGO syndrome”.
- Introducing new unconventional products take time
- Informal schools lack funding

Sanitising faeces with urea

- Urea decomposes upon contact with enzymes in faeces
- Ammonia and carbonates inactivates pathogens
- Individual stools treated with 6 gram urea
- Analysed after 2 and 4 weeks at 24 °C

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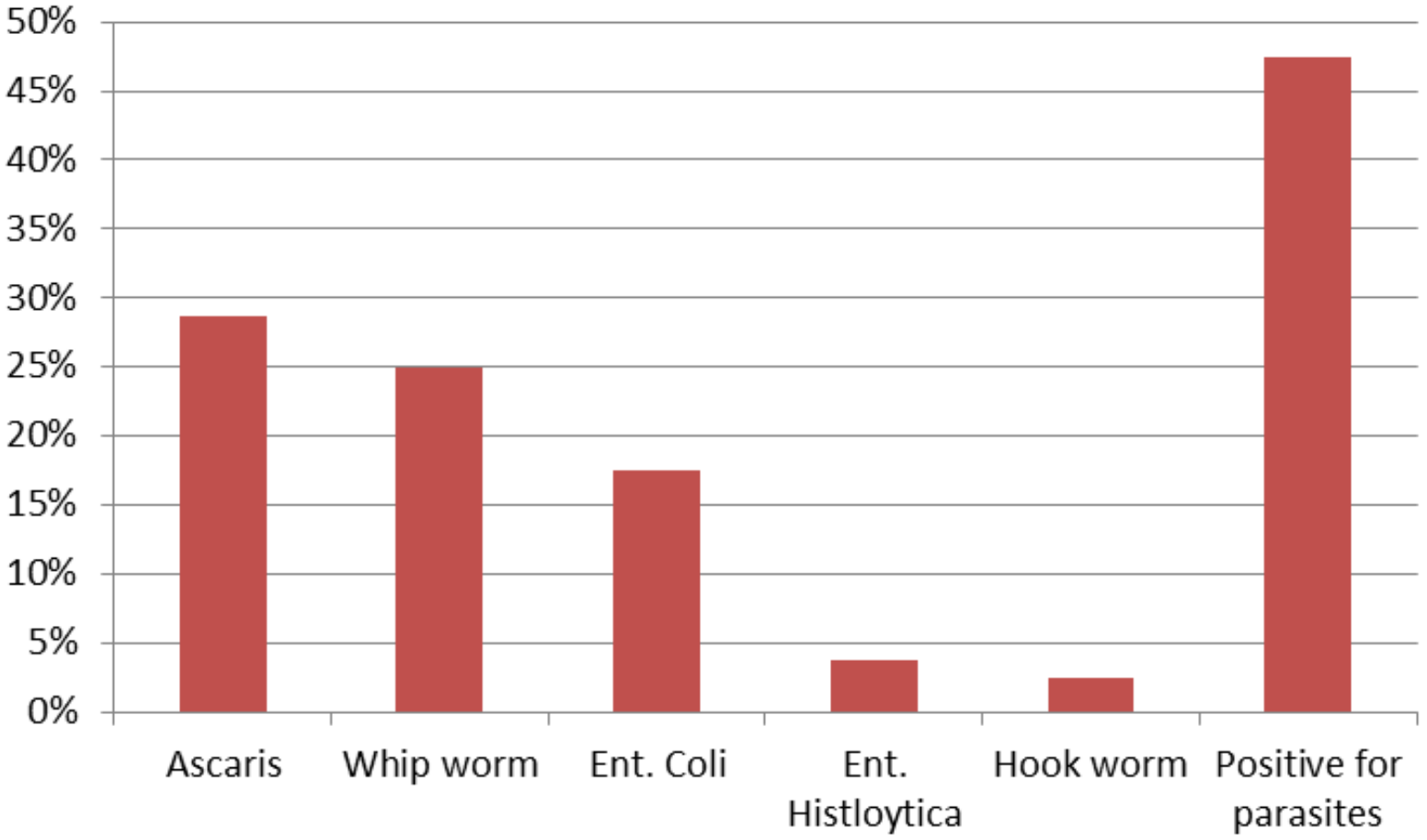
Parasite infections (n=80)



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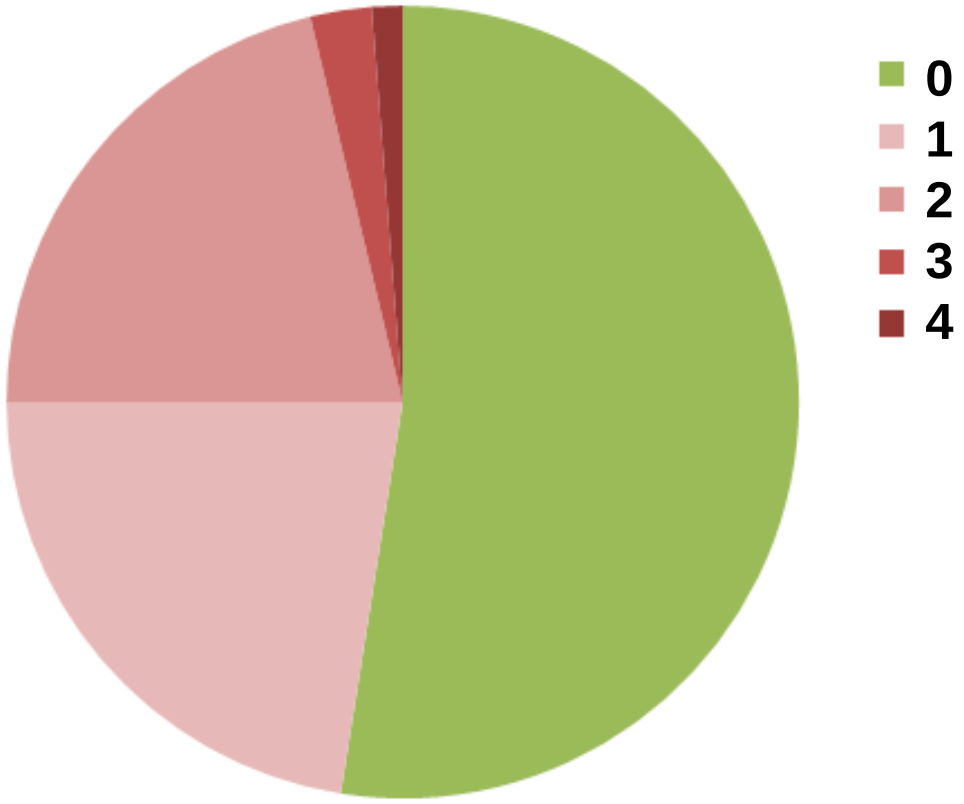
Number of infections (n=80)



Sanitisation

- Total thermo tolerant coliform bacteria 10^5-10^9 cfu g^{-1} faeces
  - Not detected after 2 weeks (<10 cfu/ gram faeces)
- Entamoebas cysts and Hook worm eggs
  - Not detected after 2 weeks
- Whip worm
  - After 2 weeks eggs detected but not viable
- Ascaris
  - After 2 weeks viability reduced 40 %
  - After 4 weeks - no viable eggs
- Ascaris a conservative indicator for ammonia sanitisation

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Bag garden experiments

- Bag gardens 90 kg
- 0, 25, 50, 75 and 90 Peepoos/sack
- Seedlings (16/sack)
  - kale or spinach
- Soil samples
  - Soil nutrients
  - Water holding capacity

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The pH and soil nutrients for soil from bag gardens constructed with Peepoo

Soil characteristics	Application rate (no. Peepoo per bag-garden)			
	0	50	75	90
pH (unitless)	5.2	5.5	6.2	6.7
Total N (mg kg-1)	1000	3000	2000	2000
Extr. P (mg kg-1)	0.30	310	150	96
K (mg kg-1)	380	1300	640	860

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Conclusion soil nutrients

- Nutrient content significantly increased
- Not a linear increase
- May be explained by the crop yield
  which were a parameter that was not analysed

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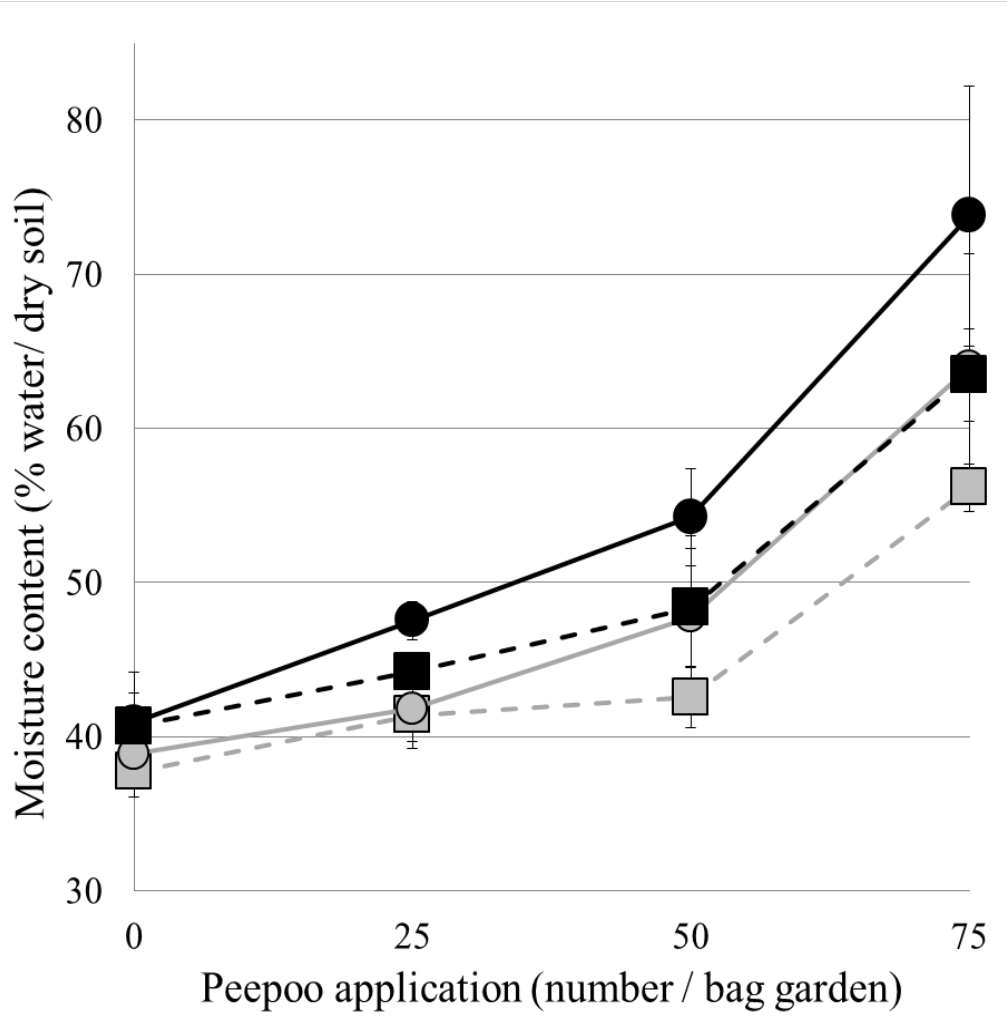
Water holding capacity

Soil gravimetric moisture content in relation to Peepoo application rates

- gravel centred (squares) pipe centred (circles)
- depth 0-15 cm (grey)
- Depth 15-30 cm (black)



Conclusions water holding capacity

- Increased with increased Peepoo application rate

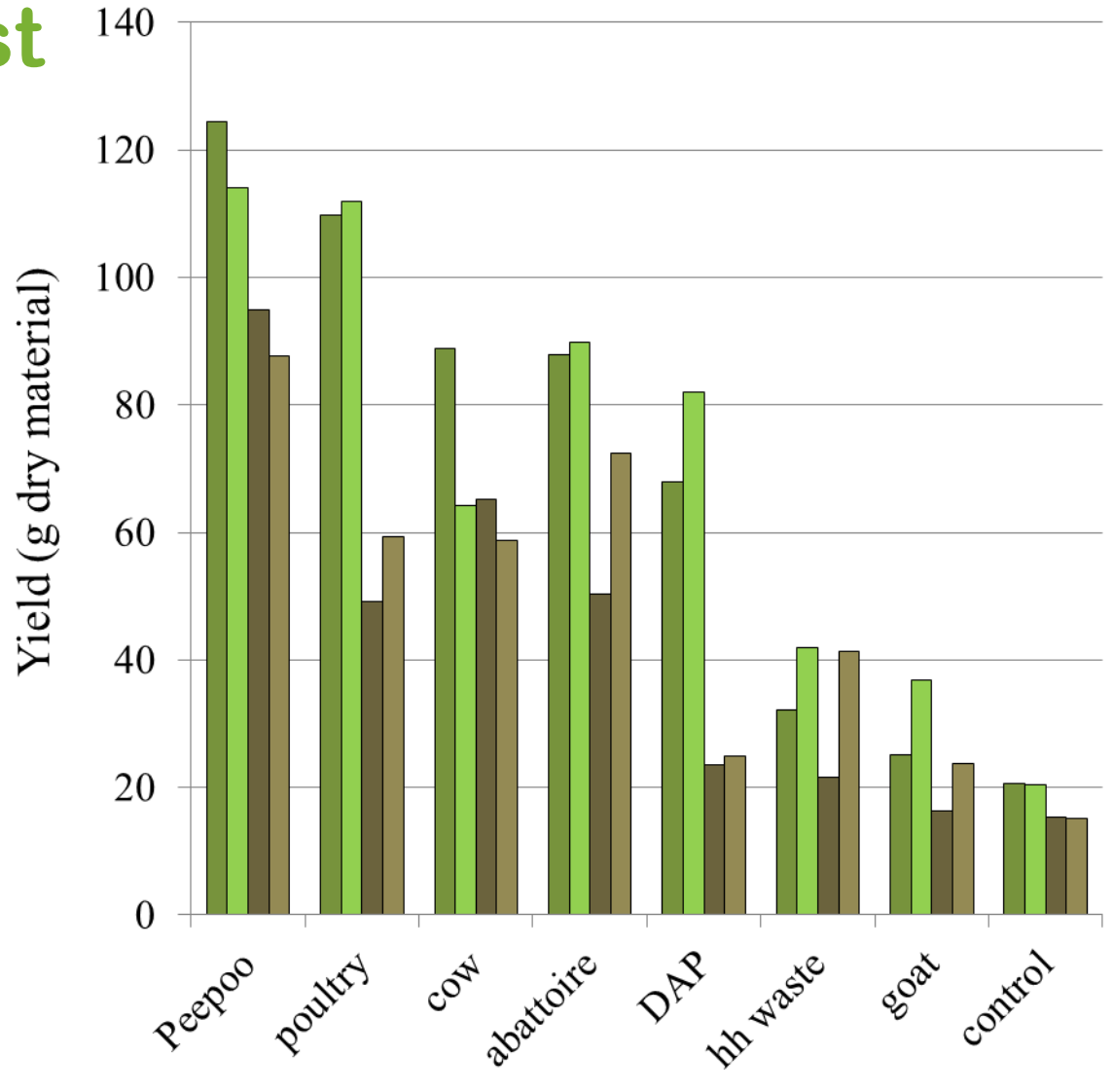
- Higher water holding capacity deeper down in sacks
  - Less decomposition of carbon
  - Evaporation after field capacity was meet may have occurred in surface

Crop response test – pot experiment

- Dry material derived from Peepoos burried in ground for 1 year
- Compared to:
  - Compost (abattoir waste or house hold waste)
  - Manure (cow, goat or poultry)
- Diammonium phosphate (DAP)
- Organic fertilisers 5 and 10 t ha^{-1}
- DAP 60 and 30 kg N ha^{-1}
- Maize variety Duma 43
- Harvested 9 weeks after crop emergence

Crop response test

The maize shoot and root yield (g dry matter) after high (dark) and low (light) application of fertilisers



Crop response test

- Yield and fertiliser did not correlate
- Peepoo produced tassle and silk earliest
- Poultry manure gave the greenest plants
- Cow manure and abbatoire waste showed nutrient deficiencies

Conclusions Peepoo fertiliser

- Peepoo fertiliser the highest in Mn and Fe
  but not in NPK

- Probable qualities
  - Balance between macro and micro nutrients
  - Direct and slow release of nutrients

- A poor soil - high effect from fertilisers

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We are all Peepoople