Guidelines on use of urine and faeces in crop production

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Mass balance over human body

+ Correct ratio NPKS+micro – food stuffs removed
+ Small chemical risk – heavy metals – hormones, pharmaceuticals
+ Small volumes – can sanitise, decrease hygienic risk
+ Decrease pollution, BOD, N, P, pathogens
Nutrients contributions

- N, g/pd: 11
- P, g/pd: 2.4
- K, g/pd: 0.9
- S, g/pd: 0.7

Urine and Faeces contributions:

- Urine: 1.5, 0.9, 2.4, 0.17
- Faeces: 0.9, 0.5, 0.17
Urine = NPK+mikronutrients

N - ammonium, P – phosphate, K – potassium-ions, S – sulphate

Essentially same effect as ammonium chemical fertiliser

- **Field experiments**
  - barley, 3 years, Sweden (Johansson et al., 2001)
  - barley, Germany (Simons & Clemens, 2004)
  - ley, Germany (Simons & Clemens, 2004)

- **Greenhouse experiments**
  - grass, (Simons & Clemens, 2004)
Urine = NPK+mikronutrients

N - ammonium, P – phosphate, K – potassium-ions, S - sulphate

<table>
<thead>
<tr>
<th>Crop</th>
<th>Urine</th>
<th>Where/who</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinach (Swiss Chard)</td>
<td>6.7</td>
<td>Zim (P. Morgan)</td>
</tr>
<tr>
<td>Covo</td>
<td>4.0</td>
<td>Zim (P. Morgan)</td>
</tr>
<tr>
<td>Lettuce</td>
<td>2.9</td>
<td>Zim (P. Morgan)</td>
</tr>
<tr>
<td>Onion</td>
<td>2-3</td>
<td>Zim (P. Morgan)</td>
</tr>
<tr>
<td>Maize</td>
<td>(≤35)</td>
<td>Zim (P. Morgan)</td>
</tr>
<tr>
<td>Leeks</td>
<td>3</td>
<td>Sweden (Båth)</td>
</tr>
<tr>
<td>Tomato</td>
<td>3.6</td>
<td>Zim (P. Morgan)</td>
</tr>
</tbody>
</table>
Urine - recommendations

- Unique – quick non-chemical N-fertiliser - for N-demanding crops paying well.
- Apply from prior to sowing until 2/3-3/4 through vegetation period.
- Apply neat or diluted, on soil & incorporate or water down.
- Do not soak whole root – some plants (seedlings) sensitive.
- Total amount applied important - apply all at once or in parts.

👍 apply urine from one person during one full day to one m²
or better use recommendations for chemical N-fertilisers

- Suffices to 300-600 m²/pers, yr
Faeces=PK+mikronutrients

Soil amendment – poor soil ⇒ good result

Relative yield - faecal compost fertilised/no fertiliser (P. Morgan)

<table>
<thead>
<tr>
<th>Plant, top soil type, growth period</th>
<th>Relative yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinach on Epworth, 30 days.</td>
<td>7.6</td>
</tr>
<tr>
<td>Covo on Epworth, 30 days.</td>
<td>8.0</td>
</tr>
<tr>
<td>Covo 2. on Epworth, 30 days.</td>
<td>4.4</td>
</tr>
<tr>
<td>Lettuce on Epworth, 30 days</td>
<td>7.5</td>
</tr>
<tr>
<td>Onion on Ruwa, 4 months</td>
<td>2.8</td>
</tr>
<tr>
<td>Green pepper on Ruwa, 4 months</td>
<td>4.7</td>
</tr>
<tr>
<td>Tomato on Ruwa, 3 months</td>
<td>10.1</td>
</tr>
</tbody>
</table>
Faeces = PK + mikronutrients
soil amendment – good soil ⇒ poor result

Cereals, field experiment 1999-2002

Yield (kg/ha, yr)

≈ 1.2 times
Faeces - recommendations

- Improves pH and buffering capacity of soil.
- Improves structure & water retention.
- Mix into/cover by soil before cultivation.
- Dose as P-fertiliser ↔ soil improver (low – no - risk of toxic effects at high dosages).
- Suffices to 1.5-300 m²/person, year.
- Follow hygiene guidelines - faeces sanitised before use and not used to crops consumed raw.

Photo: Peter Morgan
Urine & faeces fertilisers

- **Complement** each other
  - Urine N-rich and quickly available
  - Faeces slow, rich in P, K and organics
- **Unpolluted** – mass balance over body
  - Pharmaceuticals – safer in fertiliser than water
- Both **complete fertilisers** – macro + micro
  - Decreased need of soil analysis
- Reuse **eliminates pollution** & enables **sustainable crop production**
Thank you!

- **Reference group**: Peter Morgan (Zimbabwe), George Anna Clark (Mexico), Sidiki Gabriel Dembele (Mali), Jan Olof Drangert (Sweden), Gunder Edström, Almaz Terefe (Ethiopia), Bekithemba Gumbo (Zimbabwe/South Africa), Li Guoxue (China), Edward Guzha (Zimbabwe), Li Guoxue (China), Edward Guzha (Zimbabwe), Watana Pinsem (Thailand), Caroline Schönning (Sweden), Almaz Terefe (Ethiopia), Liao Zongwen (China).

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