Maximizing Productivity from Wastewater:
Irrigation, Soil, and Crop Management Strategies

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Wastewater: Opportunities for Crop Production

- **Stable source of water** with reliable availability of water for irrigation amid water scarcity

- **Savings on fertilizer use** (wastewater contains nutrients), i.e. cheap source of nutrients with no or little amount of fertilizer needed
Wastewater: Risks for Crop Production

- Salinity/sodicity
- Specific-ion toxicity
- Suspend solids

Salinity/sodicity

Clogged drippers

Boron toxicity
How can we maximize agricultural productivity and benefits from wastewater?

Some on-farm wastewater management strategies to maximize productivity and minimize risks
Irrigation, soil, and crop management strategies for wastewater use in agriculture

**Crop selection** based on
- Market value
- Irrigation requirement
- Diversification
- Stress tolerance

**Irrigation management** for
- Water quality
- Irrigation method
- Irrigation scheduling
- Irrigation rate

**Soil management** based on
- Soil characteristics
- Pollutant control
- Amendment needs, if any
- Nutrient management

**Other related aspects**
- Harvesting measures
- Human health protection
- Farmers’ awareness about best practices

Crop Selection based on

- Market value/demand
- Crop/crop rotation irrigation requirement inline with water availability
- Crop diversification/restriction where untreated wastewater is used for irrigation
- Stress tolerance for salts, heavy metals, boron, etc.
Crop Selection based on Stress Tolerance

<table>
<thead>
<tr>
<th>Tolerance to salinity of some cultivated crops (Adapted from FAO, 1985)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical Conductivity of irrigation water (dS/m, and mg/l)</strong>.</td>
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<tr>
<td>&lt;2</td>
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<tr>
<td>&lt;1280</td>
</tr>
<tr>
<td>Citrus</td>
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<tr>
<td>Apples</td>
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<tr>
<td>Peach</td>
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<td>Grapes</td>
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<td>Strawberry</td>
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<td>Potato</td>
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<td>Pepper</td>
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<tr>
<td>Carrot</td>
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<td>Onion</td>
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</table>

Relative tolerances of plants to boron in irrigation water (Adapted from Ayers, 1977)

<table>
<thead>
<tr>
<th>Sensitive (1mg/l)</th>
<th>Semitolerant (2 mg/l)</th>
<th>Tolerant (3 mg/l)</th>
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<tbody>
<tr>
<td>Citrus</td>
<td>Bean</td>
<td>Carrot</td>
</tr>
<tr>
<td>Avocado</td>
<td>Bell pepper</td>
<td>Lettuce</td>
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<tr>
<td>Apricot</td>
<td>Tomato</td>
<td>Cabbage</td>
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<td>Peach</td>
<td>Corn</td>
<td>Onion</td>
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<tr>
<td>Cherry</td>
<td>Olives</td>
<td>Sugar beet</td>
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<tr>
<td>Grapes</td>
<td>Radish</td>
<td>Date palm</td>
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<tr>
<td>Apple</td>
<td>Pumpkin</td>
<td>Asparagus</td>
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<tr>
<td>Pear</td>
<td>Wheat</td>
<td>Turnip</td>
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<tr>
<td>Plum</td>
<td>Potato</td>
<td></td>
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<tr>
<td>Strawberries</td>
<td>Sunflower</td>
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</tbody>
</table>
Irrigation Management for

- **Water quality**: Level of wastewater treatment – no treatment to tertiary treatment

- **Irrigation method**: flood irrigation (low cost and low WUE), manual irrigation with watering cans, furrow irrigation, sprinkler irrigation, and drip irrigation (high cost and high WUE)

- **Leaching and drainage**
Irrigation Management for

- Irrigation scheduling/frequency
- Irrigation rate
- Conjunctive use such as cyclic or blended application with good-quality water
Soil management based on

- Soil characteristics such as texture and structure
- Soil contamination/pollution level and its control
- Soil amendment needs, such as use of gypsum in case of using highly sodic wastewater
- Fertilizer management considering nutrient content of wastewater and soil nutrient availability status
Some Selected Publications on the Subject

- *SAFER IRRIGATION PRACTICES FOR REDUCING VEGETABLE CONTAMINATION IN SUB-SAHARAN AFRICA: AN ILLUSTRATED GUIDE FOR EXTENSION OFFICERS*

- *Wastewater Irrigation and Health: Assessing and Mitigating Risk in Low-income Countries*

- *On-farm practices for the safe use of wastewater in urban and peri-urban horticulture: A training handbook for farmer field schools*
Conclusions

- Recovery of water and nutrients from wastewater offers multiple opportunities for crop production.

- These opportunities can translate into increased productivity and income for farmers if appropriate irrigation, crop, and soil management strategies are implemented.