Production and use of potassium fertilizers
Potassium deposits are usually deep in the earth
Potassium

- Mostly comes from natural deposits of potassium chloride (KCl)
- Or from high K water such as the Dead Sea
- The salts of potassium are mined, crushed, purified and recrystallized.
- Potassium sulfate and potassium nitrate are sometimes mined or...
- Manufactured by reacting acids on KCl
Potassium form

- KCl is the most common form of potassium
  - It makes up around 85% of the K fertilizers

- The other forms
  - KSO₄
  - KNO₃
  - Are primarily used
    - on high value crops
    - for chloride sensitive crops
## Composition of straight potassium fertilizers

<table>
<thead>
<tr>
<th>Potassium form</th>
<th>Chemical formula</th>
<th>Full name</th>
<th>Content (%)</th>
<th>N</th>
<th>K₂O</th>
<th>K</th>
<th>MgO</th>
<th>S</th>
<th>Cl</th>
</tr>
</thead>
<tbody>
<tr>
<td>KCl</td>
<td></td>
<td>Muriate of potash (MOP)</td>
<td></td>
<td>-</td>
<td>60 – 62</td>
<td>50 – 51.6</td>
<td>-</td>
<td>0</td>
<td>47-50</td>
</tr>
<tr>
<td>K₂SO₄</td>
<td></td>
<td>Sulfate of potash (SOP)</td>
<td></td>
<td>-</td>
<td>50 – 52</td>
<td>41.6 – 43.3</td>
<td>-</td>
<td>18</td>
<td>-</td>
</tr>
<tr>
<td>K₂SO₄•MgSO₄</td>
<td></td>
<td>Sulfate of potassium &amp; magnesium (SOPM)</td>
<td></td>
<td>-</td>
<td>22</td>
<td>18.3</td>
<td>11.5</td>
<td>23</td>
<td>1.5</td>
</tr>
<tr>
<td>KNO₃</td>
<td></td>
<td>Nitrate of potash (NOP or KN)</td>
<td></td>
<td>14</td>
<td>45</td>
<td>37.5</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>
Plant use of potassium

- Regulates
  - Water balance in cells
  - Water loss through transpiration

- Involved in
  - Production and transport of sugars
  - Enzyme activation
  - Protein synthesis

- Provides tolerance to
  - Pests & diseases
  - Frost
  - Drought

- Improves
  - Color
  - Flavor
  - Storability
  - Of fruits and vegetables
Potassium deficiency symptoms

- K is very mobile in the plant
  - Therefore oldest leaves show symptoms

- Plants grow slowly
  - Are weak in the stalk and so tend to lodge

- Leaf margins show scorching as spots which then develop into large patches

- Crops use water less efficiently
Potassium deficiency symptoms

Maize  
Rice  
Sugarcane
Potassium deficiency symptoms

Cotton

Potato

Tobacco
The main points in SOP’s favour

- Used on chloride-sensitive and high-value crops
- Advantageous in saline and arid soils
- Salt index of 116 for MOP compared 43 for SOP
- Efficient sulfur source in areas where deficiency is a growing issue
- Improves taste, starch and sugar content, quality, shelf life and crop yield
Production of potassium containing YaraMila Compound fertilizers come from Porsgrunn – Norway
Fertiliser
1 & 2
Nitric Acid
Power Plant
Waste Water
Ammonia Terminal
Harbour
Bulk Storage
Packing
Raw Materials
Maintenance
Office
Laboratory
Phosphoric Acid (Closed 1991)
Sulphuric Acid (Closed 1982)
Nitric Acid
Ammonia Terminal

... or from Uusikaupunki, Finland

Laboratory
Nitric acid

Fertilizers

Domestic, Site to site, Sea containers (export)

Production & Delivery Processes in Uusikaupunki

Export

Raw-materials
Nitric acid
Fertilizers

PC
Production of K containing fertilizers: YaraMila

- Rock Phosphate (crushed)
- Nitric or Sulfuric acid
- Potassium salts (MOP or SOP)

Melt

YaraMila

YaraLiva
YaraMila is made into prills

Smooth and round
OR it is made into granules
YaraMila comes as ....

Prills

Granules
### Potassium removal and uptake for one ton of harvest

<table>
<thead>
<tr>
<th>Crop</th>
<th>Removal by harvest (kg K$_2$O/T)</th>
<th>Total uptake by above-ground biomass (kg K$_2$O/T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Rice</td>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>Cassava</td>
<td>3</td>
<td>5.5</td>
</tr>
<tr>
<td>Potato</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Tomato</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Leafy veg.</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Tea</td>
<td>25</td>
<td>79</td>
</tr>
<tr>
<td>Coffee</td>
<td>33</td>
<td>85</td>
</tr>
<tr>
<td>Tobacco</td>
<td>69</td>
<td>137</td>
</tr>
<tr>
<td>Cotton</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>1.4</td>
<td>2</td>
</tr>
</tbody>
</table>
Potassium levels in soils under coffee per district

Figure 5: Average potassium (K) levels by District

Ref. Cordingley, J (2010)
# YaraMila NPK in Tanzania

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Formula</th>
<th>K from MOP (%)</th>
<th>K from SOP (%)</th>
<th>Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>YaraMila Tobacco</td>
<td>10 - 18 - 24 + 0.5 MgO + 7 S + 0.1 B</td>
<td>6</td>
<td>18</td>
<td>tobacco</td>
</tr>
<tr>
<td>YaraMila Winner</td>
<td>15-09-20 + 3.8S + 1.8MgO + 0.02Zn + 0.02B + 0.02Mn</td>
<td>13</td>
<td>7</td>
<td>coffee, tea, potato, tomato, fruit trees, leafy vegetables, sugarcane</td>
</tr>
<tr>
<td>YaraMila Java</td>
<td>22-06-12 + 3S + 1MgO + 0.2B + 0.2Zn</td>
<td>-</td>
<td>12</td>
<td>coffee, tea</td>
</tr>
<tr>
<td>YaraMila Cereal</td>
<td>23-10-05 + 3S + 2MgO + 0.3Zn</td>
<td>-</td>
<td>5</td>
<td>maize, rice</td>
</tr>
</tbody>
</table>
THANK YOU FOR YOUR ATTENTION