Cost of Production for Maize & Rice in Kenya, 2017

Presented by Tim Njagi
Fairveiw Hotel, 5th October, 2017
Maize production

- Maize is the most important cereal grain in the country
  - 65% of staple food calories (Mohajan, 2014)
  - 40% of total crop area in Kenya (ERA, 2015)
  - Produced by a large majority of smallholder farmers

Source: KNBS
Key points

• Kenya is a net importer of major cereals

• Challenges in production include:
  – Low productivity
  – Declining soil quality
  – Crop diseases
  – Weak linkages btw research-extension-farmers
  – Low technology uptake
  – High production costs
  – Limited access to affordable credit
  – Low market participation
  – Declining land sizes
  – Limited access to water for irrigation
  – Climate change
Rice Production

• About 80% of rice is produced under irrigation in public irrigation schemes
• However, about 80% of total consumption is imported
• Key constraints include:
  – Restricted investment in irrigation infrastructure & area under rice
  – Low uptake of upland rice
  – High capital requirement and high costs of credit

Source: KNBS
Research Questions

• What is the cost of maize and rice production in 2017?
• What explains these costs?
  – What opportunities exist for improving competitiveness and incomes for maize and rice producers?
• What are the policy options for the government?
Methodology

• The survey was carried out in six counties, purposively selected because of their importance in the production of maize & rice in the country.

• Data collection
  • Individual maize farmers
  • FGDs
  • Key informant interviews
# Maize Production Systems and Areas

<table>
<thead>
<tr>
<th>Small-scale Maize Farmers</th>
<th>Large-scale Maize Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cultivate less than 10 acres of maize</td>
<td>• Cultivate above 50 acres of maize</td>
</tr>
<tr>
<td>• Have monocrop and two seasons a year</td>
<td>• Have a monocrop and one season a year</td>
</tr>
<tr>
<td>• Average of 83% level of commercialization</td>
<td>• Average of 99% level of commercialization</td>
</tr>
<tr>
<td>• Main buyers are traders</td>
<td>• Main buyers are NCPB and millers</td>
</tr>
<tr>
<td>• Source of fertilizer is mainly commercial</td>
<td>• Source of fertilizer is mainly subsidy</td>
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</tbody>
</table>

- **Areas of study;** Kakamega, Trans Nzoia, Uasin Gishu, Nakuru
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Findings
## Large-scale Maize Farmers

<table>
<thead>
<tr>
<th></th>
<th>Trans Nzoia</th>
<th>Uasin-Gishu</th>
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</thead>
<tbody>
<tr>
<td>Maize Yields (90 Kg-bags/acre)</td>
<td>19</td>
<td>20</td>
<td>20</td>
<td>19.7</td>
</tr>
<tr>
<td>Sale price (Ksh/90 Kg-bag)</td>
<td>2,700</td>
<td>2,400</td>
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<td>2,533.3</td>
</tr>
<tr>
<td>Land preparation</td>
<td>5,800</td>
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<td>3,000</td>
<td>4,767</td>
</tr>
<tr>
<td>Planting</td>
<td>2,000</td>
<td>1,510</td>
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</tr>
<tr>
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</tr>
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<tr>
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<td>Harvesting and handling</td>
<td>8,073</td>
<td>8,102</td>
<td>5,184</td>
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</tr>
<tr>
<td>Working capital</td>
<td>2,050</td>
<td>1,941</td>
<td>1,316</td>
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<td><strong>Production costs</strong></td>
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<td>Production costs per bag</td>
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<td>Production cost plus 30% margin</td>
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<td>1,928</td>
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<td>Breakeven yield</td>
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<td>8</td>
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<td>Production cost/bag as % of sale price</td>
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<td>10,000</td>
<td>11,333</td>
</tr>
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<td>Total production costs (with land rent)</td>
<td>43,332</td>
<td>41,662</td>
<td>30,120</td>
<td>38,371</td>
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<tr>
<td>Total production costs per bag (with land rent)</td>
<td>2,281</td>
<td>2,083</td>
<td>1,506</td>
<td>1,957</td>
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<tr>
<td>Total production cost plus 30% margin</td>
<td>2,965</td>
<td>2,708</td>
<td>1,958</td>
<td>2,544</td>
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<td>Breakeven yield</td>
<td>16</td>
<td>17</td>
<td>12</td>
<td>15</td>
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<tr>
<td>Profit /bag</td>
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<td>317</td>
<td>994</td>
<td>576</td>
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<td>Production cost/bag as % of sale price</td>
<td>110</td>
<td>113</td>
<td>78</td>
<td>100</td>
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<tr>
<td>ROI</td>
<td>0.18</td>
<td>0.15</td>
<td>0.66</td>
<td>0.29</td>
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What affects the cost of production?

- Productivity
- Inputs
- Farming technology
### Simulation: Good year harvest & prevailing prices

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<td>Maize Yields (90 Kg-bags/acre)</td>
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<td>30</td>
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<td>Sale price (Ksh/90 Kg-bag)</td>
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<td>27,038</td>
</tr>
<tr>
<td>Production costs per bag</td>
<td>1,306</td>
<td>1,186</td>
<td>671</td>
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<td>Production cost plus 30% margin</td>
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<td>1,542</td>
<td>872</td>
<td>1,335</td>
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<tr>
<td>Land rent</td>
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<td>10,000</td>
<td>11,333</td>
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<tr>
<td>Total production costs (with land rent)</td>
<td>43,332</td>
<td>41,662</td>
<td>30,120</td>
<td>38,371</td>
</tr>
<tr>
<td>Total production costs per bag (with land rent)</td>
<td>1,806</td>
<td>1,666</td>
<td>1,004</td>
<td>1,492</td>
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<tr>
<td>Total production cost per bag plus 30% margin</td>
<td>2,347</td>
<td>2,166</td>
<td>1,305</td>
<td>1,940</td>
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## Simulation: Without fertilizer subsidy

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<tr>
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</thead>
<tbody>
<tr>
<td><strong>Maize Yields (90 Kg-bags/acre)</strong></td>
<td>19.7</td>
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<td>2,533.3</td>
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<td><strong>Land preparation</strong></td>
<td>4,767</td>
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</tr>
<tr>
<td><strong>Planting</strong></td>
<td>1,670</td>
<td>1,670</td>
</tr>
<tr>
<td><strong>Seed</strong></td>
<td>1,810</td>
<td>1,810</td>
</tr>
<tr>
<td><strong>Fertilizer</strong></td>
<td>5,750</td>
<td>8,916</td>
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<tr>
<td><strong>Pesticides</strong></td>
<td>1,487</td>
<td>1,487</td>
</tr>
<tr>
<td><strong>Weeding (including herbicide costs &amp; labour)</strong></td>
<td>2,667</td>
<td>2,667</td>
</tr>
<tr>
<td><strong>Harvesting and handling</strong></td>
<td>7,120</td>
<td>7,120</td>
</tr>
<tr>
<td><strong>Working capital</strong></td>
<td>1,769</td>
<td>1,990</td>
</tr>
<tr>
<td><strong>Productions costs</strong></td>
<td>27,038</td>
<td>30,425</td>
</tr>
<tr>
<td><strong>Land rent</strong></td>
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<td>2,544</td>
<td>2,760</td>
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<tr>
<td><strong>Breakeven yield</strong></td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td><strong>Profit /bag</strong></td>
<td>576</td>
<td>410</td>
</tr>
<tr>
<td><strong>Production cost/bag as % of sale price</strong></td>
<td>1.00</td>
<td>1.09</td>
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<tr>
<td><strong>ROI</strong></td>
<td>0.29</td>
<td>0.19</td>
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</tbody>
</table>
Breakdown of cost components
Trans Nzoia

- Land rent: 28%
- Hiring machinery: 23%
- Transport: 3%
- Labour: 14%
- Seeds: 4%
- Fertilizer: 16%
- Pesticides: 3%
- Herbicides: 2%
- Other (gunnies & sisal twine): 2%
- Working Capital: 5%
- Working Capital: 5%
- Working Capital: 5%
Overall

- Hiring machinery: 25%
- Land rent: 29%
- Fertilizer: 15%
- Seeds: 5%
- Labour: 11%
- Herbicides: 3%
- Pesticides: 3%
- Other (gunnies & sisal twine): 1%
- Working Capital: 5%
- Transport: 3%

- Hiring machinery: 25%
- Land rent: 29%
- Fertilizer: 15%
- Seeds: 5%
- Labour: 11%
- Herbicides: 3%
- Pesticides: 3%
- Other (gunnies & sisal twine): 1%
- Working Capital: 5%
- Transport: 3%
Cost components comparison

- Hiring machinery, total cost
- Transport, total cost
- Labour, total cost
- Seeds, total cost
- Fertilizer (basal + topdressing + other ingredients), total cost
- Pesticides, total costs
- Herbicides, total costs
- Others (gunnies)

- Trans Nzoia
- Uasin-Gishu
- Nakuru
- Overall
Small-Scale Farmers
## Small-scale

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<tr>
<td><strong>Maize Yields (90 Kg-bags/acre)</strong></td>
<td>14</td>
<td>17</td>
<td>14</td>
<td>20</td>
<td>16.3</td>
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<tr>
<td><strong>Sale price (Ksh/90 Kg-bag)</strong></td>
<td>2,000</td>
<td>2,400</td>
<td>2,200</td>
<td>2,200</td>
<td>2200.0</td>
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<td>4,500</td>
<td>5,000</td>
<td>2,600</td>
<td>3625</td>
</tr>
<tr>
<td><strong>Planting</strong></td>
<td>750</td>
<td>2,000</td>
<td>1,500</td>
<td>2,400</td>
<td>1663</td>
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<tr>
<td><strong>Seed</strong></td>
<td>1,800</td>
<td>1,850</td>
<td>1,830</td>
<td>1,800</td>
<td>1820</td>
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<tr>
<td><strong>Fertilizer</strong></td>
<td>5,600</td>
<td>6,800</td>
<td>6,800</td>
<td>4,550</td>
<td>5938</td>
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<td><strong>Pesticides</strong></td>
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<td><strong>Weeding (including herbicide costs &amp; labour)</strong></td>
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<tr>
<td><strong>Harvesting and handling</strong></td>
<td>4,850</td>
<td>6,383</td>
<td>6,450</td>
<td>5,252</td>
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</tr>
<tr>
<td><strong>Working capital</strong></td>
<td>1,491</td>
<td>1,843</td>
<td>1,735</td>
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<tr>
<td><strong>Productions costs</strong></td>
<td>22,791</td>
<td>28,176</td>
<td>26,515</td>
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<td>25483</td>
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<td><strong>Production cost/bag as % of sale price</strong></td>
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<td>8250</td>
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<tr>
<td>Total production costs (with land rent)</td>
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<td>33,011</td>
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<tr>
<td>Total production costs per bag (with land rent)</td>
<td>1,963</td>
<td>2,287</td>
<td>2,658</td>
<td>1,651</td>
<td>2,065</td>
</tr>
<tr>
<td>Total production cost plus 30% margin</td>
<td>2,552</td>
<td>2,973</td>
<td>3,456</td>
<td>2,146</td>
<td>2,685</td>
</tr>
<tr>
<td>Breakeven yield</td>
<td>14.1</td>
<td>16.2</td>
<td>16.9</td>
<td>15.0</td>
<td>15.3</td>
</tr>
<tr>
<td>Profit /bag</td>
<td>37</td>
<td>113</td>
<td>-458</td>
<td>549</td>
<td>135</td>
</tr>
<tr>
<td>Production cost/bag as % of sale price</td>
<td>1.28</td>
<td>1.24</td>
<td>1.57</td>
<td>0.98</td>
<td>1.22</td>
</tr>
<tr>
<td>ROI</td>
<td>0.02</td>
<td>0.05</td>
<td>-0.17</td>
<td>0.33</td>
<td>0.07</td>
</tr>
</tbody>
</table>
# Comparison with/without fert subsidy

<table>
<thead>
<tr>
<th></th>
<th>Without Fert Subsidy</th>
<th>With Subsidy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize Yields (90 Kg-bags/acre)</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Sale price (Ksh/90 Kg-bag)</td>
<td>2,200</td>
<td>2,200</td>
</tr>
<tr>
<td>Land preparation</td>
<td>3,625</td>
<td>3,625</td>
</tr>
<tr>
<td>Planting</td>
<td>1,663</td>
<td>1,663</td>
</tr>
<tr>
<td>Seed</td>
<td>1,820</td>
<td>1,820</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>7,800</td>
<td>4,950</td>
</tr>
<tr>
<td>Pesticides</td>
<td>1,813</td>
<td>1,813</td>
</tr>
<tr>
<td>Weeding (including herbicide costs &amp; labour)</td>
<td>3,225</td>
<td>3,225</td>
</tr>
<tr>
<td>Harvesting and handling</td>
<td>5,734</td>
<td>5,734</td>
</tr>
<tr>
<td>Production costs</td>
<td>26,021</td>
<td>23,171</td>
</tr>
<tr>
<td>Working capital</td>
<td>1,821</td>
<td>1,622</td>
</tr>
<tr>
<td>Production costs</td>
<td>27,842</td>
<td>24,793</td>
</tr>
<tr>
<td>Production costs/ bag</td>
<td>1,740</td>
<td>1,550</td>
</tr>
<tr>
<td>Land rent</td>
<td>8,250</td>
<td>8,250</td>
</tr>
<tr>
<td>Total Production costs (with land rent)</td>
<td>36,092</td>
<td>33,043</td>
</tr>
<tr>
<td>Total Production costs per bag (with land rent)</td>
<td>2,256</td>
<td>2,065</td>
</tr>
</tbody>
</table>
Cost comparison by activity
Findings

- Production costs have increased slightly from 2016 costs
- Production costs affected by
  - Declining yields
  - Input costs (subsidized vs commercial fertilizer)
  - Technology choices (manual labour vs mechanization)
- Low response to fertilizer application
- Costs are still high and so production not competitive
Recommendations for policy

- To reduce costs and improve competitiveness:
  - Improve productivity
  - Lower cost of inputs
    - Fertilizer cost reduction programme
    - Use labor-saving technologies/mechanization
  - Fertilizer use to be guided by soil nutrient requirements
    - Soil testing
    - ISFM and good agricultural practices
    - Information on soil quality & required nutrients
    - Agronomic practices
    - Revamp extension systems
Findings

Rice
## Rice Production Systems and Areas

<table>
<thead>
<tr>
<th>Rice production</th>
<th>Out grower/non-scheme farmers</th>
<th>Irrigation scheme farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acreage under rice</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Seeds kg/acre</td>
<td>100</td>
<td>75</td>
</tr>
<tr>
<td>Variety</td>
<td>IR</td>
<td>Basmati</td>
</tr>
<tr>
<td>Fertilizer source</td>
<td>NAIAAP</td>
<td>Commercial</td>
</tr>
<tr>
<td>Planting fertilizer kg/acre</td>
<td>100</td>
<td>75</td>
</tr>
<tr>
<td>Top dress fertilizer kg/acre</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>Level of commercialization</td>
<td>93%</td>
<td>96%</td>
</tr>
<tr>
<td>Areas of study</td>
<td>Ahero</td>
<td>Mwea</td>
</tr>
</tbody>
</table>
Non-scheme farmers
Cost of production

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice yields (Kg/acre)</td>
<td>1440</td>
</tr>
<tr>
<td>Sale price (Ksh per kg)</td>
<td>40</td>
</tr>
<tr>
<td>Total revenue (per acre)</td>
<td>57,600</td>
</tr>
<tr>
<td>Nursery</td>
<td>500</td>
</tr>
<tr>
<td>Land preparation</td>
<td>10,900</td>
</tr>
<tr>
<td>Planting</td>
<td>3,000</td>
</tr>
<tr>
<td>Planting fertilizer + additives</td>
<td>0</td>
</tr>
<tr>
<td>Topdressing fertilizer</td>
<td>0</td>
</tr>
<tr>
<td>Seed</td>
<td>1,600</td>
</tr>
<tr>
<td>Weeding</td>
<td>3,500</td>
</tr>
<tr>
<td>Pesticides &amp; fungicides</td>
<td>350</td>
</tr>
<tr>
<td>Harvesting</td>
<td>7,200</td>
</tr>
<tr>
<td>Post-harvest</td>
<td>2,760</td>
</tr>
<tr>
<td>Other labor</td>
<td>4,000</td>
</tr>
<tr>
<td>Working capital</td>
<td>2,367</td>
</tr>
<tr>
<td>Production costs</td>
<td>36,177</td>
</tr>
<tr>
<td>Production costs per kg</td>
<td>25</td>
</tr>
<tr>
<td>Land rent</td>
<td>10,000</td>
</tr>
<tr>
<td>Total production costs (with land rent)</td>
<td>46,177</td>
</tr>
<tr>
<td>Total production costs per kg (with land rent)</td>
<td>32</td>
</tr>
</tbody>
</table>
## Profit analysis

<table>
<thead>
<tr>
<th>Profit analysis</th>
<th>Without land rent</th>
<th>With land rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakeven yield (90kg bags)</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Profit per bag</td>
<td>1,339</td>
<td>714</td>
</tr>
<tr>
<td>Profit per kg</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Prod cost/bag as % of sale price</td>
<td>63%</td>
<td>80%</td>
</tr>
<tr>
<td>ROI</td>
<td>59%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Costs per activity

- Nursery costs: 1.5%
- Land preparation: 32.2%
- Planting costs /acre: 8.9%
- Fertilizer: 0.0%
- Seed: 4.7%
- Weeding (including herbicide cost & labour): 10.4%
- Bird scaring: 8.9%
- Irrigation water: 0.0%
- Post harvest costs: 8.2%
- Pesticides: 1.0%
- Harvesting: 21.3%
- Other labor (fertilizer application): 3.0%
Cost components

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Labour</td>
<td>66.2%</td>
</tr>
<tr>
<td>Transport</td>
<td>2.4%</td>
</tr>
<tr>
<td>Seed</td>
<td>4.7%</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>0.0%</td>
</tr>
<tr>
<td>Pesticide</td>
<td>1.0%</td>
</tr>
<tr>
<td>Herbicide</td>
<td>0.0%</td>
</tr>
<tr>
<td>Hired machinery</td>
<td>23.7%</td>
</tr>
<tr>
<td>Irrigation water</td>
<td>0.0%</td>
</tr>
<tr>
<td>Gunny bags</td>
<td>2.0%</td>
</tr>
</tbody>
</table>
Labour components

- Nursery preparation: 2.2%
- Clearing drainage: 0.4%
- Clearing field: 12.5%
- Planting: 13.4%
- Weeding: 13.4%
- Spraying insecticide: 0.0%
- Spraying herbicide: 2.2%
- Fertilizer application: 4.5%
- Bird scaring: 13.4%
- Stooking: 16.1%
- Threshing: 16.1%
- Drying: 0.0%
- Dust, bagging, weigh: 5.7%
Scheme farmers
## Cost of production

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice yields (Kg per acre)</td>
<td>2,250</td>
</tr>
<tr>
<td>Sale price Ksh per kg</td>
<td>60</td>
</tr>
<tr>
<td>Total revenue</td>
<td>135,000</td>
</tr>
<tr>
<td>Nursery costs</td>
<td>500</td>
</tr>
<tr>
<td>Land preparation</td>
<td>8,200</td>
</tr>
<tr>
<td>Planting costs</td>
<td>4,900</td>
</tr>
<tr>
<td>Planting fertilizer + additives cost /acre</td>
<td>2,370</td>
</tr>
<tr>
<td>Topdressing fertilizer</td>
<td>5,400</td>
</tr>
<tr>
<td>Seed</td>
<td>1,500</td>
</tr>
<tr>
<td>Weeding</td>
<td>6,250</td>
</tr>
<tr>
<td>Pesticides &amp; fungicides</td>
<td>600</td>
</tr>
<tr>
<td>Harvesting</td>
<td>7,000</td>
</tr>
<tr>
<td>Post-harvest</td>
<td>4,875</td>
</tr>
<tr>
<td>Other labor</td>
<td>9,250</td>
</tr>
<tr>
<td>Other intermediate</td>
<td>3,200</td>
</tr>
<tr>
<td>Working capital</td>
<td>3,783</td>
</tr>
<tr>
<td>Production costs per acre</td>
<td>57,828</td>
</tr>
<tr>
<td>Production costs per kg</td>
<td>26</td>
</tr>
<tr>
<td>Land rent</td>
<td>50,000</td>
</tr>
<tr>
<td>Total production costs (with land rent)</td>
<td>107,828</td>
</tr>
<tr>
<td>Total production costs per kg (with land rent)</td>
<td>48</td>
</tr>
</tbody>
</table>
## Profit analysis

<table>
<thead>
<tr>
<th>Profit analysis</th>
<th>Without land rent</th>
<th>With land rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakeven yield (90 kg bags)</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Breakeven yield (kgs)</td>
<td>990</td>
<td>1800</td>
</tr>
<tr>
<td>Profit per bag</td>
<td>3,087</td>
<td>1,087</td>
</tr>
<tr>
<td>Profit per kg</td>
<td>34</td>
<td>12</td>
</tr>
<tr>
<td>Prod cost/bag as % of sale price</td>
<td>43%</td>
<td>80%</td>
</tr>
<tr>
<td>ROI</td>
<td>133%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Costs by activity

- Nursery costs, 0.9%
- Land preparation, 15.2%
- Planting costs /acre, 9.1%
- Fertilizer, 14.4%
- Harvesting, 13.0%
- Post harvest costs, 9.0%
- Irrigation water, 5.6%
- Bird scaring, 16.7%
- Seed, 2.8%
- Weeding (including herbicide cost & labour), 11.6%
- Other labor (fertilizer application, ), 0.8%
Cost components, scheme..
Labour components

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery preparation</td>
<td>0%</td>
</tr>
<tr>
<td>Clearing drainage</td>
<td>1.6%</td>
</tr>
<tr>
<td>Clearing field</td>
<td>1.6%</td>
</tr>
<tr>
<td>Planting</td>
<td>4.5%</td>
</tr>
<tr>
<td>Weeding</td>
<td>15.8%</td>
</tr>
<tr>
<td>Spraying insecticide</td>
<td>17.8%</td>
</tr>
<tr>
<td>Spraying herbicide</td>
<td>1.3%</td>
</tr>
<tr>
<td>Fertilizer application</td>
<td>0.8%</td>
</tr>
<tr>
<td>Bird scarifying</td>
<td>0.8%</td>
</tr>
<tr>
<td>Stooking</td>
<td>29.1%</td>
</tr>
<tr>
<td>Threshing</td>
<td>11.3%</td>
</tr>
<tr>
<td>Drying</td>
<td>11.3%</td>
</tr>
<tr>
<td>Dust, bagging, weighing</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

Percentages are indicative of the labor components in various agricultural activities.
Findings

• Production systems and costs are different in the two study areas
• Large difference between producer and consumer prices (eg. Ksh 85 vs 200/kg for Pishori)
• Labour contributes the highest proportion of cost
  • There are still opportunities of saving costs by mechanization
• Bird scaring is an expensive activity in rice production
• Rice production is a profitable enterprise even where land is hired despite high land rates
• Possibility of improving irrigation infrastructure to non-scheme rice farmers in view of the difference between non-scheme and scheme rice farmers
Recommendations for policy

- There is an increasing demand for rice but costs of production are high
- Enhance uptake of innovations to reduce costs
  - System of rice intensification
  - Use nets for bird control
- Enhance bird surveillance and control
- Increase rice production & productivity
  - Expand area under irrigated rice
  - Explore opportunities for upland rice
  - System of rice intensification
- Explore credit facilities for farmers/youth if they are to engage in rice production-high capital requirement