K EFFECTS ON YIELD QUALITY

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- Why quality?
- Where is the link between K and quality?
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Why quality?

... K effects on yield quality
... Why quality?
... because urbanisation is advancing
... Why quality?

... because urbanisation is advancing, that is more urbanites and less rural people - also in Brazil
... Why quality?

... the society is also rapidly ageing like in the OECD countries
... Why quality?

... with income and ageing the food habit changes

food type

packed/processed food, emphasis on quality, safe/bio/functional food

more meat, vegetables, fruits, quality comes into picture

subsistence food like cereals, fats, oils,

Income

after KERN, 2000
... why quality?

... less cereals and more fruits and vegetables ...

Change in the diet in Brazil compared to EU-15

- Brazil cereals
- Brazil fruits & vegetables
- EU-15 cereals
- EU-15 fruits & vegetables

Supply kg/cap/year

... why quality

... less cereals and more fruits and vegetables ...
... why quality?

... and more vegetable oil with raising income ...

Relationship between per capita GDP and consumption of vegetable oil

(FAO/CIA 2004)

\[ y = 0.5406x + 6.3747 \]

\[ R^2 = 0.8866 \]
... why quality?

... and customers look first for quality when selecting food

Relative importance of product attributes in product choice
after TRAILL, 1999

- Quality: 26%
- Price: 17%
- Reputation: 14%
- Freshness: 9%
- Guarantee: 9%
- 9 others: 25%
Why quality?

What is quality?
... what is quality?

Quality is

... *an intrinsic property of food by which it meets predefined standard requirements.* Determinants of food quality can be grouped into several properties. Food quality therefore refers to the value, which is subjectively or objectively attached to food with respect to quality properties...

(Alabaka, 1999)
What is quality?

FOOD QUALITY

- Nutritional properties
- Functional properties
- Organo-leptic properties
- Hygienic properties
- Environmental compatibility
- Safe food
… K effects on yield quality

Why quality?
What is quality?

**Where is the link between K and quality?**
... Where is the link between K and quality?

... for example, in N metabolism ...

Model for the circulation of potassium in relation to nitrate and malate transport (after MARSCHNER, 1995)
... Where is the link between K and quality?

... for example, in sugar transport
... Where is the link between K and quality?
... for example, in sugar transport

Effect of K status of cane on sugar transport
(exposure 4 hrs)
(after HARTT, 1969)
... Where is the link between K and quality?

... unless excessive Cl⁻ affects sucrose storage in cane stalks

Exchange processes of Cl⁻ and sucrose in sugarcane (KRAUSS, 1992)
... Where is the link between K and quality?

... unless excessive Cl affects sucrose storage in cane stalks


Exchange processes of Cl and sucrose in sugarcane (KRAUSS, 1992)

... Where is the link between K and quality?
... Where is the link between K and quality?

... for example, in water utilization

Wilting of sugar beets as affected by K supply
... Where is the link between K and quality?

... K regulates stomata aperture
Where is the link between K and quality?

K is the insurance for quality formation even under climatic conditions.

From CAKMAK, 2003
... Where is the link between K and quality?
... or biotic stress

Unbalanced high N

- sugar
- Krebs cycle
- soluble org N compounds
  - secondary compounds
    - Phenols
    - Quinones
  - organic N

balanced N

- sugar
- Krebs cycle
- soluble org N compounds
  - secondary compounds
  - Phenols
  - Quinones
  - organic N

Synthesis of pathogen repellents in plants as affected by the level of N supply (after GRAHAM, 1983)
Why quality?
What is quality?
Where is the link between K and quality?

What can we prove?

... K effects on yield quality
... What can we prove?

... adequate K improves the nutritive value

- for instance in wheat - higher protein content and better appearance
... What can we prove?

... adequate K improves the nutritive value

- with higher oil content, more people can get their daily need from the same field

<table>
<thead>
<tr>
<th>Yield (t/ha)</th>
<th>Oil Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-K</td>
<td>2.6</td>
</tr>
<tr>
<td>+K</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Yield and quality of oilseed rape in China as affected by K

![Graph showing yield and oil content comparison between -K and +K treatments](image-url)
... What can we prove?

... adequate K affects the functional property

- with higher sugar content, less cane is required for the same sugar output and thus, less energy for transport and extraction
What can we prove?

adequate K affects the functional property

the same applies to potato and starch production

tuber yield and quality of potatoes in Poland

<table>
<thead>
<tr>
<th></th>
<th>tuber t/ha</th>
<th>% starch</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP</td>
<td>15.4</td>
<td>15.4</td>
</tr>
<tr>
<td>NPK</td>
<td>15.6</td>
<td>15.6</td>
</tr>
<tr>
<td>NPK+Mg</td>
<td>16.2</td>
<td>16.2</td>
</tr>
</tbody>
</table>

- tuber yield
- starch content
What can we prove?

K is involved with organo-leptic properties

Amino acids are important components for tea quality...

Impact of balanced fertilization with K and Mg on quality of tea (China)
... What can we prove?

... K is involved with organo-leptic properties

... and potato crisps keep a bright colour when the tubers are fed with adequate K because it lowers the content of reducing sugars
... What can we prove?

... K controls hygienic properties

... mouldy fruits, cracked tomatoes from K deficient plants are disliked by consumers ...
... What can we prove?

... K controls hygienic properties

... also black spots in potato tubers can be controlled by adequate K ...
... What can we prove?

... K enhances the content of functional compounds

... Vitamin C and antioxidant contents are improved by adequate K ...

Balanced fertilization increased yield and improved quality of cabbage in Russia

Effect of K on isoflavones in soybean seeds
(BRUULSEMA*, 2002)
... What can we prove?

... K keeps plants healthy and hence the food
... What can we prove?

... K improves the appearance and shelf-life of many crops
... What can we prove?

... K improves the appearance and shelf-life of many crops
... What can we prove?

... K use meets the environmental requirements

... because at balanced fertilization, N use efficiency is improved

Impact of Farmer's practice, FP and Site specific nutrient management, SSNM on recovery efficiency of N fertilizers, REN, of rice in SE Asia

Residual NO₃ in the subsoil (kg/ha) as affected by fertilization in China

<table>
<thead>
<tr>
<th>Farmers Practice</th>
<th>Residual NO₃ (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive N</td>
<td>140</td>
</tr>
<tr>
<td>High N</td>
<td>120</td>
</tr>
<tr>
<td>Balanced NPK</td>
<td>100</td>
</tr>
</tbody>
</table>

Impact of Farmer's practice, FP and SSNM on grain yield and REN % of rice in SE Asia

<table>
<thead>
<tr>
<th>Practice</th>
<th>Grain Yield</th>
<th>REN %</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP (111-18-17 kg/ha N-P-K)</td>
<td>36</td>
<td>38</td>
</tr>
<tr>
<td>SSNM (120-22-66 kg/ha N-P-K)</td>
<td>34</td>
<td>36</td>
</tr>
</tbody>
</table>
growth limitation of the shoot e.g. at K deficiency signals to the roots to refrain from further N uptake, so, the plant cannot be forced to absorb N above its needs ...
... K effects on yield quality

In conclusion:

Producer
- globalisation
- trade liberalisation
- competition
- selective and critical consumers
- ...

Consumer
- healthy food
- cheap food
- plenty food
- protection of the environment
- safeguarding natural resources
- ...

- legislative measures
- trade barriers
- gaps in knowledge
- agric. practice
- quality auditing
- confidence of consumers
- ...

...
... K effects on yield quality

... Thank you