The food of tomorrow

Andreas Baumann
Do we really have a protein challenge?

Farm

525 mio t primary proteins

Fork

7.4 billion people

40%

45%

15%

losses, wastes

animal conversion

average consumption 78.5 g/person/day
Until 2050 we need to increase our protein production by 50%. 

![Graph showing protein sources (2013) and primary protein production from 1960 to 2050. The graph indicates a significant increase in protein production, with a target of 790 million tonnes by 2050. The graph also highlights the allocation of protein sources between feed (65%) and food (35%).]
Especially in animal feed we need to rethink protein supply.
It will need sustainable, alternative protein sources

Challenges:
- Population
- Meat demand
- Arable land
- Protein prices

Strategies:
- Plant-protein consumption
- Alternative feed
- Closing loop on waste

Solutions:
- Pulses
- Algae
- Insects
Why pulses?

compared to cereals
less fertilizer & water
more protein
lower yield
Pulses are staple foods in several regions.
Industrial processing solutions for pulses are available.

Process Quality

Energy Yield

Taste Health

Staple pulses
Ingredients
Ready-to-Eat

not convenient
beany taste
digestive issues
More and more pulse products can be found on the market.

- **pasta**
  - pea + wheat

- **snacks**
  - lentils + rice

- **bakery**
  - chickpea + rice

- **meat analogs**
  - pea + rice

**Diagram:**
- Pulses: methionine (red), lysine (green)
- Cereals: methionine (green), lysine (red)

**Ingredients:**
- Pea + wheat
- Lentils + rice
- Chickpea + rice
- Pea + rice
Bühler has proprietary technology for structuring proteins.
For some applications it needs different processing solutions.

### Wheat Pasta
- Intact starch granules in a protein network

### Pulse Pasta
- Protein patches in gelatinized starch

<table>
<thead>
<tr>
<th>Wheat</th>
<th>Pulses</th>
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<tbody>
<tr>
<td>12 – 14% protein</td>
<td>15 – 35%</td>
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<tr>
<td>5 – 15% albumin/globulin</td>
<td>60 – 80%</td>
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<td>70 – 90% prolamin/glutelin</td>
<td>10 – 30%</td>
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≈ 80% insoluble protein

≈ 70% soluble protein
It will need sustainable, alternative protein sources

Challenges
- Population growth
- Meat demand increase
- Decrease in arable land
- Increasing soybean prices

Strategies
- Plant-protein consumption
- Alternative feed
- Closing loop on waste

Solutions
- Pulses
- Algae
- Insects
Cost-wise cultivation of “green” algae is still a challenge.

sunlight + CO₂

open systems

closed systems

indoor systems

glucose

ponds

photobioreactor

fermenters
Today, only few algae products are available for food/feed.
A bead mill is a cost-effective device to open the algae cells.

advantages
- robust and scalable
- gentle disintegration
- suitable for most algae
- reasonable energy input

consortium project (→ total value chain approach)

- cultivation
- cell disruption
- separation
- application
It will need sustainable, alternative protein sources

Challenges
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Strategies
- Plant-protein consumption
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Solutions
- Pulses
- Algae
- Insects
Insects are able to recycle nutrients from organic wastes.
Insects are suitable as animal feed, but also human food.
Currently we adapt existing equipment for insect processing.

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<th>Cleaning, Grading</th>
<th>Grinding</th>
<th>Sifting</th>
<th>Mixing</th>
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<td>Kneading</td>
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<td>Coating</td>
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<td>Decontamination</td>
<td>Pelleting</td>
<td>Cooling</td>
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</tbody>
</table>

- **Grain**
- **Cleaning, Grading**
- **Grinding**
- **Sifting**
- **Mixing**
- **Packing**
- **Flour**
- **Pasta**
- **Aquafeed**
- **Cereals**
- **Ingredients**
- **Feed**
It will need sustainable, alternative protein sources

Challenges
- Population
- Meat demand
- Arable land
- Protein prices

Strategies
- Plant-protein consumption
- Alternative feed
- Closing loop on waste

Solutions
- Pulses
- Algae
- Insects
The food of tomorrow.

- pea-enriched wheat bun
- dressing with algae protein
- meat analog from insects
www.buhlergroup.com
Back-up
Today’s protein system is not sustainable.

Farm

525 mio t
primary proteins

Fork

25%
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45%

7.4 billion
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