Global perspectives
Role of pulses in providing nutrition security in a sustainable future food supply

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Healthy Life for Present and Future Generations (incl nutritionally adequate & safe)

Optimise Human & Natural Resources

Low Environment Impact (incl biodiversity, ecosystems)

Stable Food System

Available

Utilisation (incl health & culture)

Accessible (incl affordability, fair trade)

Sustainable Diets

Adapted from Johnstone et al Adv Nutr 418-429: 2014

FAO Sustainable diets & biodiversity: directions & solutions for policy, research & action, 2012

What is a megatrend?

• Global trends over 20 year horizon
  • Major shifts in geopolitical, environmental, economic, social or technology conditions that substantially changes the way people live
  • Confluence or intersection of several more specific trends

1. More from less
2. Planetary pushback
3. Silk Highway
4. Forever young
5. Digital immersion
6. Porous boundaries
7. Great expectations

• Eventually – major outcomes, disruptive changes
  • New business models
  • Changed social structures
  • Different cultural paradigms

Stefan Hajkowicz, Jason Crowther
CSIRO, 2015
1.0 More from less
8.5B in 2030, nearly 10B in 2050
The food demand challenge – looking forward to 2050

Food demand (kcal/year x 10^{15})

1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050
A “mega-wedge” of new food demand?

Balancing food supply and demand

Reducing the Demand
Filling the Production Gap – improve efficiencies
Sustaining productive capacity

1.1 More food from less resources

Potential consequences if we don’t

• Future food and nutrition security under threat

Some opportunities for innovation

• Increased energy, water efficiencies eg through sustainable greener processes
• Less waste, loss conversion – 30% food loss is edible
• Innovative food products and processing
  • Fermentation, sprouting, foam
  • Stabilization technologies
  • Longer shelf-stability
• Novel food (protein) sources eg insects, jellyfish
• Engineered foods
  • GM – potential for open-source food genetics
  • Simulated foods - potential for open-source foods
• Net waterless factories, food production of the future
2. Planetary pushback

Changes in the global climate system

- **INCREASED** Middle atmosphere temperature
- **INCREASED** Water vapour
- **DECREASED** Net decrease in global sea-ice extent
- **DECREASED** Net decrease in glacier volumes
- **DECREASED** Polar ice sheets
- **INCREASED** Air temperature over ocean
- **INCREASED** Sea level
- **INCREASED** Sea-surface temperature
- **INCREASED** Ocean heat content

Indicators of a consistent pattern:

1. With regional variations (some melting, some gaining)
2. With regional variations (some melting, some gaining)
2.1 Foods for a healthier planet

Potential consequences if we don’t do something
- Starvation

Some opportunities for innovation
- GM foods – nutrition, efficient production, ↓allergen
- Greater use of algae
- Greener processes – reduce emissions
  - limit use fossil-derived C resources
  - Produce more foods with lower environmental impact
- Process food waste before it goes to landfill
- Tissue engineering
- Reduce food miles – local, seasonal
- Shaping consumer behaviour/acceptance
- Food sharing
- Better biodegradables
3.0 The silk highway

There are more people living inside this circle than outside of it.

The map was created by Valerie Pieris, who shared it on Reddit last year. The Washington Post did the math here.
Silk highway...
The Asian Century – estimates for the year 2050 (pop’n ≥60 years)

JAPAN
41%
(up 28% from 2012)

CHINA
34%
(up 162% from 2012)

VIETNAM
31%
(up 244% from 2012)

AUSTRALIA
29%
(up 45% from 2012)

Silk highway...
Population growth
• China, India

Growing middle class
• 1.5B in China & India by 2020

Increasing chronic diseases of aging
• Diabetes, obesity

Increases in ASEAN
• Fruit & vegetables
• Meat
• Cereals

Recognised opportunity for Australia food industry (Livingstone, Mckinsey 2014, Deloitte 2013)
Megacities & mega-regions
3.1 Foods for the Asian century

What if we don’t do anything
Food insecurity in Asian region
Missed growth opportunity - India and China food export opportunities, followed by South America and Africa

Potential opportunities for innovation
• Growing middle class (2B)
• Assured food safety for ensured market access
• Clean and with provenance (trusted food supplier)
• Rapidly growing & aging population with rising chronic diseases
  • Foods for health
• Novel foods & ingredients with high nutritional value
  • Eg fermented dairy, pulses; novel protein sources eg insects
  • High protein for elderly
  • Foods for premium exports
• Novel food production and distribution systems for megacities
4.0 Forever young
Forever Young?

Trends in the population age 65 and older as a percentage of the population age 15–64, by region, 1990–2030.

- AFR
- AMR
- SEAR
- EUR
- EMR
- WPR
- High-income OECD

Population age 65 and older (% of population age 15–64)

- 0
- 5
- 10
- 15
- 20
- 25
- 30
- 35
- 40
- 45

1990 2000 2010 2020 2030
**Overweight & obese**

- **Overweight (BMI>25)**
  - Increasing
  - 15-27% low income
  - 52-62% high income

- **Obesity**
  - Increasing – 640M
  - Now
    - **11% men, 15% women**
    - >30% high income English speaking countries
  - Predicted >20%

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*WHO Global Report Diabetes 2016*

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*Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants*  
*Lancet 2016; 387: 1377-96*
Diabetes

Diabetes is on the rise. 422 million adults have diabetes. That’s 1 person in 11.

3.7 million deaths due to diabetes and high blood glucose.

1.5 million deaths caused by diabetes.
Non-communicable diseases

- NCDs kill 38M people each year
  - 28M in low and middle-income countries
- 4 key NCDs
  - Cardiovascular* (17.5M)
  - Cancers* (8.2M)
  - Respiratory diseases (4M)
  - Diabetes* (1.5M)
- Key risk factors
  - Obesity
  - Tobacco use
  - Physical inactivity
  - Harmful use of alcohol
  - Unhealthy diets*

* Intake of pulses provides some benefits

http://www.who.int/mediacentre/factsheets/fs355/en/
Malnutrition

• Undernourished
  • ~800 million chronically undernourished
  • 159 million children under 5 years of age are stunted.
  • ~50 million children under 5 years are wasted
  • >2B people suffer from micronutrient deficiencies

• Overnourished
  • 1.9 billion people are affected by overweight of which over 600 million are obese.

• UN Decade of Action on Nutrition from 2016 to 2025
Pulses: nutrition

• More commonly used as food in least developed countries
  • But may be increasing in developed
• Low source of energy
• 11% of protein/person/day in least developed countries
  • 2% in developed countries
• High in lysine, low in methionine
  • Complements with cereals, tradition
• High in fibre, CHO
  • Resistant starch
• Source of iron, zinc
  • Bioavailability consideration
  • Global malnutrition
• Some associations with reducing risk of NCDs
• Anti-nutritional factors
  • Preparation, cooking and breeding

Based on data from FAOSTAT database – http://www.fao.org
Pulses: sustainability - environmental

Environmental Impact – pre and post farm-gate

- Water use* – irrigation
- Use of fossil fuels for cultivation
- Fertiliser, pesticide*
- Land use*
- Soil*
- Crop diversity* – N fixation*
- Eutrophication
- Ecotoxicity
- GHGE – pre-farmgate*
- Adaptability to climate change

- Use of fossil fuels for processing, transport & home preparation
- Water use - processing
- Food loss from food processing & retail
- Materials for packaging
- Consumer food waste
- GHGE – post-farmgate*

Full lifecycle greenhouse gas emission (GHGE) from common proteins and vegetables

* Pulses may be more sustainable

Estimated post harvest loss of pulses

<table>
<thead>
<tr>
<th>Stages</th>
<th>Losses (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting</td>
<td>1.0-3.0</td>
</tr>
<tr>
<td>Handling</td>
<td>1.0-7.0</td>
</tr>
<tr>
<td>Threshing</td>
<td>0.5-5.0</td>
</tr>
<tr>
<td>Drying</td>
<td>1.0-5.0</td>
</tr>
<tr>
<td>Transport</td>
<td>0.5</td>
</tr>
<tr>
<td>Primary Processing</td>
<td>1.0</td>
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<tr>
<td>Storage</td>
<td>5.0-10.0</td>
</tr>
<tr>
<td>Milling</td>
<td>15.0-20.0</td>
</tr>
<tr>
<td>Total</td>
<td>25.0-50.0</td>
</tr>
</tbody>
</table>

Relative environmental impacts to produce 1kg edible protein - compared to kidney beans

Sabate et al. The environmental cost of protein food choices. Public Health Nutrition 2014; 18(11) 2067-2073
http://www.iipr.res.in/pdf/postbulletins2may13.pdf
How can the global food system deliver better nutritional outcomes (to address malnutrition & NCDs) to a rapidly growing global population at reduced environmental cost?
Conclusion

• Feeding 9B people nutritiously and sustainably is the challenge
  • Increasing NCDs + malnutrition will co-exist
  • Resource constraints + healthy planet
  • Nutrient quality + sustainability
• Food choices and diets can impact
  • Address expectations – ethical, taste etc
• Complex multi-disciplinary system approach still evolving to measure
• Pulses have a role to play
  • Nutrient quality
  • Consumed as a protein source and a vegetable – Mediterranean diet
  • Linked with health benefits – CHD, cancer, gut health, diabetes
  • Lower environmental impact compared to other protein sources
  • Rotation crops
Thank you

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