Challenges to sustainable food production

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Sustainable food production

A production that fulfills *this generation’s needs* without harming the fulfillment of *future generations’ needs*
Overview

1. Future Challenges
   1. Environmental impacts of agriculture
   2. Changing natural environment
   3. Changes in supply and demand

2. Strategic solutions and the market

3. The possible importance of Crop.Sense in this context
Environmental impacts of agricultural production

- Release of nutrients
- Release of greenhouse gases
- Land conversion
- Soil degradation
- Salination on (some) irrigated lands
- Pollution by biocides
- Depletion of essential resources (phosphate)

Increasing societal pressure on agricultural production
Changing natural environment

- Increasing pressure from diseases and insects
- Increasing resistance to biocides
- Increasing levels of ozone
- Increasing water scarcity
- Increasing temperatures
- Loss of agricultural land

Increasing environmental pressure on harvests
Increasing demand

- Population growth to 9 billion people
- Increased meat consumption in emerging economies

→ Cereal demand grows faster than population
Fig. 1 Cereal production targets.

M Tester, and P Langridge Science 2010;327:818-822
Limits to growth

- expansion on more marginal land
- marginal return to intensification
- loss of crop land
- changed natural conditions
- environmental concerns
Changes in yield growth

Figure 5 | Trends in grain yield of the three major cereal crops for selected regions since the start of the green revolution in the 1960s.

Grassini et al, 2013
The concept of a safe operating space
Possible solutions

Efficiency strategy: less input per unit of output
  • increasing actual yield (land efficiency)
  • increasing water and nutrient efficiency

under Environmental Constraints: reduced land clearing, minimized use of biocides

Sufficiency strategy: 
  • changing diets
  • reduced waste
The role of prices

- Increasing demand increases food prices
  - 11 to 22% till 2050 predicted
  - Higher output prices increase production and demand for inputs

- Scarcity of inputs increases input prices

- Higher input prices due to environmental concerns, depletion

  Increasing interest in efficiency gain
A role for breeding

- Yield increase under adverse conditions includes increased stress tolerance
- Increased stress tolerance increases efficiency
- Changing natural conditions will increase importance of tolerance to different stressors: drought, salinity, higher temperature, diseases

⇒ High throughput phenotyping can help in identifying promising cultivars
A role for precision agriculture

- Precision agriculture allows to apply
  - water,
  - nutrients,
  - biocides
  only when and where they are needed.

⇒ Detecting stress early allows
  - to identify plants that need resources
  - to prevent crop losses with fewer resources
Conclusion

- Plant phenotyping is an interesting field of research.
- It can reduce resource constraints via efficiency gains.
- It may be one pillar in sustainably feeding the world.