Field Lab AgroEcology and Technology

Research demonstration and dialogue for plant production systems of the future

Hilfred Huiting – Brussels 23 January 2020
Concerns

Societal concerns about pesticides

Biodiversity decline

Soil quality and compaction
Sector on the move

Vision documents

- Ministry of agriculture
- Dutch farmers organisation
- Interbranch Organisation Arable crops
Vision
Minister of Agriculture, Nature and Food Quality

- “Dutch farming, horticulture and fisheries are constantly innovating, making our country a global leader in these sectors. However, current production methods are not without cost. The Netherlands faces serious social and ecological challenges”

- “We need to prevent depletion of soil, freshwater supplies and raw materials, halt the decline in biodiversity and fulfil our commitments to the Paris climate agreement”

- “Circular agriculture is the answer”
3 important goals:

1. Economic position of farmers
2. Appreciate food more
3. Innovation of production methods
Dutch Federation of Agriculture and Horticulture
LTO Nederland

- Healthy plants
- Healthy environment
- Economic perspective
Dutch Federation of Agriculture and Horticulture
LTO Nederland

- Integrated approach
- No emissions
- Nature-inclusive
- Biodiversity
- Economic position
Interbranch Organisation
Arable Crops

To switch to a resilient cultivation system in which the basis is formed by healthy and robust crops and a vital soil, which will reduce the amount of crop protection agents needed.

#1

To reduce impact on the environment with the tailored administration of crop protection agents through the use of precision farming methods and a greener range of agents.

#2

To contribute to increasing biodiversity and helping to actively shape an attractive landscape.

#3

To make environmental performance more transparent for the market.

#4
Challenges & Solutions

- 1 problem, 1 solution → system approach
- Reactive ↔ pro-active: prevention
- Biodiversity poor ↔ biodiversity rich

Ecology meets technology
meets agronomy
Proeftuin
Agroecologie & Technologie
Experimental site can contribute to many issues

Proeftuin Agroecologie & Technologie
Agroecologische bouwstenen, ondersteund door technologie
Voor een toekomstbestendig, regeneratief landbouwsysteem.

Bouwstenen

<table>
<thead>
<tr>
<th>Landscape elements &amp; akkerranden</th>
<th>Groenbemesters</th>
<th>Organische stof aanvoer</th>
<th>Stokenteelt</th>
<th>Robuuste rassen</th>
<th>Gereducierde grondbewerking</th>
<th>Agroforestry</th>
<th>Inzet van kleine, lichte machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mengteit</td>
<td>Gezonde rotatie en bouwplan</td>
<td>Vaste rijpaden systeem</td>
<td>Vlinderbloemigen (voor stikstofbinding)</td>
<td>Slimme gewasbescherming, IPM 2.0</td>
<td>Vogels, bestuivers &amp; natuurlijke vijanden</td>
<td>Beslissingsondersteuning &amp; ICT</td>
<td>Detectie &amp; monitoring met sensoren</td>
</tr>
</tbody>
</table>

Agro-ecosysteem
integratie van agroecologische bouwstenen

In toenemende mate meer divers, weerbaar en regeneratief
Diversity as a base

- Higher Resource use efficiency
- Higher Land Equivalent Ratio
- Potentially lower disease and pest pressure
- Larger biodiversity
- Better soil quality

But with current technology economically less efficient and increase in complication
Strip cultivation

Foto: Dirk van Apeldoorn
Green Crop Protection: vision for 2030
Goals Green Crop Protection

- Redesign farming system
  - Without Candidates for Substitution
  - Use natural enemies and biocontrol where possible
  - Use of guided control and prediction models
  - Economically viable
Field experiment

- Temporal Crop diversification
- Varieties resistant or tolerant to pests and diseases
- Biological, Green Control or reduced chemical control based on DSS
- Monitoring & Evaluation
- Functional Agrobiodiversity strips

<table>
<thead>
<tr>
<th>4 year rotation</th>
<th>8 year rotation</th>
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<tbody>
<tr>
<td>Potatoes</td>
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<tr>
<td>Onions</td>
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<tr>
<td>Sugar beets</td>
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<td>Cereals</td>
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<td>Sugar beets</td>
<td>Cabbage</td>
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<td>Cereals</td>
<td>Carrots</td>
</tr>
</tbody>
</table>
Start 2018

17 ha marine loam soil
Strategies for insects, weeds, nematodes and fungi

**Above-ground insect pests & vectors of diseases**
- **IIM**
  - Crop diversification (within and across time)
  - Spatial diversity
  - Temporal diversity
- **INC**
  - Yield quantity & quality
  - Knowledge Infrastructure
  - Systems - Evaluation, and regional
- **IFC**
  - Spatial scales
  - Crop diversification
  - Cultural practices

**Reducing impact of insects**
- Natural control
- Sowing date
- Intercropping
- Companion plant
- Resistance
- Tolerance

**Reducing populations**
- Scouting
- DSS
- Crop rotation
- Pest establishment
- Sowing date
- Field soil management

**Supportive tactics**
- Cover crops
- Intercropping
- Rotation
- Field margin management

**Reducing impact of weeds on crop**
- Diverse cropping systems (in space and time)
- Cultivar choice
- Rotation
- Mulching alive

**Prevent establishment**
- Cover crops
- Intercropping
- Rotation

**Weeds**
- Winter wheat
- Fall armyworm
- Winter barley
- Weeds

**Nematodes**
- Root knot
- Stem nematodes
- Foliar nematodes

**Fungi**
- Fungal spores
- Fungal pathogens

**Crop rotation**
- Sequencing
- Frequency
- Frequency

**Fungicide selection**
- Tolerance
- Transplanting
- Resistance
- Harvest date
- Sowing date

**Fungicide application**
- “Fungicides”
- Targeted control
- Spatial scales

**Field soil management**
- Weed control
- Residue
- Volunteer control
- Nutrient management

**Field soil management**
- Cover crops
- Intercropping
- Rotation
- Field margin management

**Reducing impact of fungi**
- Seed rate
- Harvest date
- Mulching alive

**Prevent establishment**
- Seed rate
- Harvest date

**Supportive tactics**
- Cover crops
- Intercropping
- Rotation
- Field margin management

**Nutrient management**
- Nutrient management
- Soil quality

**Stable management**
- Fumigants
- Granular nematicides
- Field scale Distortions

**Field scale Distortions**
- Sampling
- Scouting
- Spore traps

**DSS / Akkerweb Fungi scheme Damage thresholds**
- DSS
- Akkerweb

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Approach Targeted Control

- Use of DSS
  - Blight app *P. infestans*
  - Degree day models

- Weakly monitoring of pests, diseases and weeds
  - Replace handwork by monitoring tools

- Biocontrol where possible
- Chemical control
- Mechanical control
Example: *P. infestans* control in Potato

1. Use of a variety with R genes (SarpoMira)
2. Only treat when necessary:
   - Monitoring of *P. infestans* (presence of virulent *P. infestans*)
   - Prediction of infection based on weather and virulence
3. Comparison with traditional variety:
   - Fungicide reduction of 40-97% depending on year
   - Equal yields
Precise application
Robot platform with sensors and tools
Results: spray schedule Late Blight

- **Plus systeem:**
  - 8 bespuitingen
    - 4x biologisch
    - 4x chemisch

- **Standaard:**
  - 13 bespuitingen

Diagram showing the spray schedule with dates and specific treatments.
Yields

rel. opbrengst net/ha

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Farmers are the key to system change

What's going on here?

What can I do?

What should I do?

What would I like to do?

Weather
Soil
Crop
Weed
Financial means
Cost-benefit
Efficacy
Time investment
Technological means
World view
Flexibility
Experience
Individual
Public perception

Biophysical
Economic
Technological
Socio-cultural

www.IWMPRAISE.EU
Many visitors and activities

Symposia

Policy

Field visits of farmers: >1000

Visit of water boards, LTO, provinces

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Thanks for your attention

Thanks are due to:


& Financiers:

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