Weed control in maize

Current & future challenges of physical and cultural weed control in economic and sustainable maize production

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Presentation outline

- Setting the scene
- Influence herbicide reduction on maize yield
- Experiences in long-year experiment in Lelystad
NL maize production—setting the scene

- Challenges!
  - ...to maintain organic matter content and soil quality
  - ...to prevent runoff and leaching of pesticides (mostly herbicides)
  - ...to increase (soil) biodiversity
  - ...to maintain yield level (quantity & quality)

- So drivers to produce more, with less input, within narrower boundaries
The dairy farmer’s focus is on the cow, not the land
Maize production outsourced to contractors
However increasing awareness for challenges addressed
So, research and extension work to do to implement several sustainability issues in every day practice
  • Demonstrate possibilities
  • Test new approaches
Possibilities to influence farmer’s demand?

- Towards farmers: focus on the wins!
  - Short term; easy money
  - Longer term;
    - Relation soil quality and yield potential
    - Anticipate on stricter guidelines and regulations
- Contractors will adjust to new realities, and easier to create impact
Selectivity trial herbicides - background

- Maize production outsourced to contractors
- Herbicide cocktail often fits-all for an area
- Herbicides often applied in single pass, c. 6 leaf stage; deemed efficient and most cost-effective
- However possible crop influence if applied late
Selectivity trial herbicides - options

- Compose tailor-made herbicide cocktail
- Apply as early as possible
- Split applications
- Implement mechanical control
Selectivity trial herbicides - treatments

Starting point of each treatment was a “clean” result

A. Practice late; 1 treatment, 6-8 leaf stage
   1245 g a.i./ha

B. Soil herbicide before emergence + ⅓ rate 2-3 leaf stage
   524 g a.i./ha

C. Low rates split application; ⅓ rate 2-3 + 4-6 leaf stage
   967 g a.i./ha

D. “Cross compliance”; harrowing + ⅓ rate 4-6 leaf stage
   483 g a.i./ha

E. Untreated: mechanical weed control; harrowing + hoeing
Selectivity trial herbicides - dates

Sowing date: 18 May

A. Spraying: 24 June
B. Spraying: 26 May + 16 June
C. Spraying: 6 + 16 June
D. Harrowing: 26 + 27 + 30 May
   Spraying: 16 June
E. Harrowing: 26 + 27 + 30 May
   Hoeing + finger weeding: 9 + 16 June
An impression
Crop height on two dates, relative to practice

LSD ras DS: 0.7
LSD ras VEM: 0.8
Interacties: n.s.
Dry matter and feeding quality (VEM), relative to practice

LSD ras DS: 0.7
LSD ras VEM: 0.8
Interacties: n.s.
Conclusions selectivity trial

- All weed control strategies delivered the clean result desired
- All test strategies showed improved crop development and higher yield than “late practice”
  - Reduction of input is well possible
  - Savings on herbicide compensate for labour cost
- So financial benefit!
  - This case only?
Long-term experiment maize, since 2009

- Main treatments, 3 replicates, grassland previous crop
  - A. Plough Spring
  - B. Non inversion tillage (NI)
  - C. Ridge till (RT)
  - D. No till (of topsoil; NT)
  - E. Strip tillage (ST)

- Sub treatments
  - 5 green manure crops in fallow
  - 2 weed control strategies

- In total 180 plots, trial surface c. 2 hectare

- Marine loam soil, c. 25% clay
Challenges – for us researchers

- Implementing experimental systems
  - New systems for NL
  - New systems at all
  - New combinations
- Which machines
- How to adjust them
- ???
Basic approach weed control

- Use flex-tine harrow as much as possible
  - High working capacity
  - Control weeds in germination phase; very little effort needed
- Followed by hoe + finger or torsion weeder
Plough and NI - basic approach

- Works quite well for ploughing system, despite 40% clay soil
- Equal or even better results at non-inversion tillage
NI tillage system
NI tillage system
RT – different approach

Theory...

**Figure 1**

Ridge tillage conserves soil and protects water quality

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>November to April</td>
<td>Harvest and dormant period</td>
<td>- Roughness/residue controls wind/water erosion</td>
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<tr>
<td>April – May</td>
<td>Ridge top removal and planting</td>
<td>- Herbicide banded on ridge</td>
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<tr>
<td></td>
<td></td>
<td>- N banded in ridge</td>
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<td></td>
<td></td>
<td>- Bare row warms up sooner</td>
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<tr>
<td>May</td>
<td>Emergence</td>
<td>- Stem flow and biopores only in row</td>
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<tr>
<td></td>
<td></td>
<td>- Residue controls erosion</td>
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<tr>
<td>June - July</td>
<td>Side dress N application and nodding</td>
<td>- Leaf drip between rows</td>
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<tr>
<td></td>
<td>Leaf canopy directs more water</td>
<td>- Stem flow in row</td>
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<tr>
<td></td>
<td></td>
<td>- N banded in shoulder is separated from water flow</td>
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<tr>
<td>August to October</td>
<td>Maturity</td>
<td>- Degradation and uptake depletion of chemicals</td>
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<td>- Burned residue decomposes</td>
</tr>
</tbody>
</table>

Modified from Porcelli and Lindstrom, 1989
RT – different approach

- Theory...
- Practice...

**Figure 1**
Ridge tillage conserves soil and protects water quality

- Roughness/residue controls wind/water erosion
- Herbicide banded on ridge
- N banded in ridge
- Bare row warms up sooner
- Stem flow and biocores only in row
- Residue controls erosion
- Leaf drip between rows
- Stem flow in row
- N banded in shoulder is separated from water flow
- Degradation and uptake deplete agrochemicals
- Burned residue decomposes

Modified from Porcella and Lindstrom, 1980
RT – different approach

- Theory...
- Practice...
RT – different approach

- Theory...
- Practice...
RT – conclusion

- Crop development OK 😊
- Weed development OK too 😞 😞
  - Extra passes needed to make the system successful
  - System deleted from trial after 2015
NT – conflicting mechanical control
How to apply mechanical weed control in a system based on application of chemicals?

- Pre-emergence hoeing in-row
- Try harrowing
- But still...

Successful cover crops reduce weed pressure

- But still...
ST – different approach

- System based on glyfosate treated grassland
ST – different approach

- But, can we keep the grass?
  - Would serve as cover crop after the maize
- How to manage the grass?
  - Mowing?
ST – different approach

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  - Flaming?
ST – different approach

- But, can we keep the grass?
  - Would serve as cover crop after the maize
- How to manage the grass?
  - Mowing?
  - Flaming?
  - Herbicide?
Remarks long-term trial so far

- Reducing tillage = increasing non-chemical weed control challenge
- Possibilities cover crops to control weeds whilst maintaining crop yield level need more exploration
- Every systems need optimisation of mechanisation!
One last experiment...

- System tried by sunflower grower in Austria
- 3 passes with hoe only
- Effects in 2015 and 2016 encouraging
Thank you! any questions?