Investigating glyphosate use and weed patterns in German arable farming

Koning, L.A.¹, Wiese, A.², Schulte, M.², Steinmann, H.-H.², Gerowitt, B¹

¹University of Rostock, Germany
²Georg-August-University, Göttingen, Germany

Project funding provided by
Outline

- Glyphosate Herbicides
- Hot Topic in Germany
- German Farmer Questionnaire
- German Weed Monitoring
- Outlook
Glyphosate Herbicides

• Non-selective, broad spectrum, systemic, post-emergence herbicide

• Genetically modified crops (GMCs)
  – e.g. in USA, Brazil, Argentina
  – Apply glyphosate product anytime in growing season

• Germany forbids GMCs
  – Perennial crops application
  – Annual crops at stubble, pre-sowing, pre-harvest stages

Photo: http://monsantoblog.com/2010/03/03/better-weed-control-for-farmers/
Current Glyphosate Debate in Germany

- Threat to public health?
- Danger of herbicide resistance?
- Should glyphosate use be prohibited?

Increase of Glyphosate-Resistant Weeds Worldwide

http://www.bund.net/aktiv_werden/aktionen/glyphosat_verbieten/

http://weedscience.org/
Downloaded 04.06.2015
Farmer Questionnaire (2014/15)

Questionnaire responses from each German county

- 0
- 1-10
- 11-20
- 21-30
- 31-40
- 41-52

Total of 2026 Responses
# Glyphosate Use on Important Arable Crops (n=2026)

<table>
<thead>
<tr>
<th>Application</th>
<th>Stubble</th>
<th>Pre-Sowing</th>
<th>Pre-harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>German arable farming</td>
<td>22,70%</td>
<td>12,80%</td>
<td>2,40%</td>
</tr>
<tr>
<td>% of crop area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>4,40%</td>
<td>21,80%</td>
<td></td>
</tr>
<tr>
<td>Winter wheat</td>
<td>18,00%</td>
<td>11,00%</td>
<td>1,80%</td>
</tr>
<tr>
<td>Winter barley</td>
<td>15,90%</td>
<td>9,50%</td>
<td>7,40%</td>
</tr>
<tr>
<td>Winter oilseed rape</td>
<td>60,60%</td>
<td>9,20%</td>
<td>1,60%</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>1,20%</td>
<td>46,70%</td>
<td></td>
</tr>
<tr>
<td>Legumes</td>
<td>8,70%</td>
<td>15,80%</td>
<td>2,00%</td>
</tr>
</tbody>
</table>
Main Drivers for Using Glyphosate

- Conservation tillage
- Time-saving weed management
- Intermediate crop and soil erosion hazard
- Avoiding selective herbicide resistance

Major German Arable Weeds

% of 2026 farmers

Alopecurus myosuroides
Apera spica-venti
Galium aparine
Elymus repens
Echinochloa/Setaria/Digitaria
Matricaria spp.
Bromus spp.
Atriplex spp.
Cirsium spp.
Polygonum spp.
Suspect Loss of Glyphosate Efficacy?

% of 2026 farmers

- Fully disagree
- Disagree
- Partly
- Agree
- Fully agree
Species with Suspected Loss of Glyphosate Efficacy (n=162)

- Elymus repens
- Cirsium arvense
- Convolvulus arvensis
- Rumex spp.
- Geranium spp.
- Alopecurus myosuroides
- Equisetum arvense
- Others

0% 5% 10% 15% 20% 25% 30% 35%
# Weed Monitoring

## Frequency of Glyphosate Use on Field in the Past

<table>
<thead>
<tr>
<th>Organic Fields</th>
<th>Conventional Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>No herbicides</td>
<td>No Glyphosate</td>
</tr>
<tr>
<td></td>
<td>Low Glyphosate</td>
</tr>
<tr>
<td></td>
<td>Medium Glyphosate</td>
</tr>
<tr>
<td></td>
<td>High Glyphosate</td>
</tr>
</tbody>
</table>

Weed Monitoring

- Winter wheat fields
- Two monitoring periods:
  - pre-harvest and stubble
## Major Weeds in Winter Wheat

<table>
<thead>
<tr>
<th>Pre-harvest</th>
<th>Stubble</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equisetum arvense</td>
<td>Brassica napus</td>
</tr>
<tr>
<td></td>
<td>Capsella bursa-pastoris</td>
</tr>
<tr>
<td></td>
<td>Matricaria chamomilla</td>
</tr>
<tr>
<td></td>
<td>Polygonum aviculare</td>
</tr>
<tr>
<td></td>
<td>Fallopia convolvulus</td>
</tr>
<tr>
<td></td>
<td>Stellaria media</td>
</tr>
<tr>
<td></td>
<td>Viola arvensis</td>
</tr>
</tbody>
</table>
Outlook

• On-going data collection and analyses
• Further strongly politically-motivated restrictions on glyphosate use in Germany very probable

Our project’s contribution to the glyphosate discussion:

Where is a reduction of glyphosate use advisable?
• Specific crops?
• Specific forms of application?
• Specific weed situations?

Weed community management proposals
Thank you

ARMIN WIESE, Georg-August-University, Göttingen, Germany

FARMERS in Mecklenburg-West Pomerania, Germany

EWRS Travel Grant