Can robots contribute to food security?

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Modern farming ≠ food security

Too heavy machines:
→ soil compaction, loss of fertility

Too many chemicals:
→ harmful for humans and nature

Too much fossile energy:
→ oil dependent, climate harmful

Too big farms & machines:
→ loss of independence for farmers
Towards sustainable agriculture

Reduce:
- Chemicals
- Energy
- Fertilizers
- Machine weight
- Cost of ownership

Precise Application
- Many smaller, simpler machines
- Renewable energies

Sensors & actuators
- Autonomous machines
- Self-powered, lightweight

Robotics
Machine learning
Field robots – two approaches

« robotize « existing machines

- : flexibility, experience
- : few advantage except labour costs
→ heavy works

Develop specialized robots

+ : more specific tasks, efficiency
- : acceptance, flexibility
→ light works
Potential applications for specialized robots

### Annual culture cycle

<table>
<thead>
<tr>
<th>Activity</th>
<th>Tilling</th>
<th>Fertilizing</th>
<th>Seeding</th>
<th>Weeding</th>
<th>Harvesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Energy</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Required Accuracy</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>M/High</td>
</tr>
<tr>
<td>Mass to transport</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

Ecorobotix
Case study: robot weeder from ecorobotix

- Detects & sprays >90% of weeds
- With 20 times less chemicals
- Solar powered: unlimited autonomy
- Fully autonomous 7d/7, 12h/24
- Lightweight: no compaction, safe
- Simple: easy to deploy & fix
- For row crops, wheats & pastures
- Herbicide-free tool for organic crops in development
How does it work?
Other weeders on market / in development

Carré (FR), hoeing

Swarmpfarm (AU) spraying

Bosch (DE), mech weeding

Blue River tech (US), spraying

Rippa (AU), various tasks

Naio (FR), hoeing
Potential of robot weeders

- Row crops: soybean, sunflower, rapeseed, corn, sugarbeet...
- Vegetables: onions, carrots, lettuces, beans...
- Weeding of dicotyledons in wheat, barley...
- Weeding of perennials in grasslands and intercultures
- Potential of > 2 millions of machines worldwide
- Can cut herbicide usage by 50% (>1 million tons/year) in 2030
- Can help reduce costs of organic farming
Ag robots & food security : concluding remarks

Robots can help preserve soil and reduce intrants BUT
- They shall replace less performant systems
- They must show social benefits to farmers
- They do not solve all problems (« the tech mirage syndrome »)
- They shall be produced with an environment-responsible way
Thank you for your attention