Mechanization of white asparagus harvest – overview and perspectives –

Martin Geyer
• White asparagus is the most important vegetable crop in Germany

Koch: Gemüse 4/2017
Introduction

- White asparagus is the most important vegetable crop in Germany

- Hand harvest of white asparagus is very arduous, labor and cost intensive
Introduction

• White asparagus is the most important vegetable crop in Germany

• Hand harvest of white asparagus is very arduous, labor and cost intensive

• Since more than 60 years growers and manufacturers contemplate to facilitate this process.
Harvesting principles

• Hand harvest with basket
• Hand harvest supported by harvesting aids
• Nonselective harvest
• Selective harvest
Harvesting principles

- Hand harvest with basket
- Hand harvest supported by harvesting aids
- Nonselective harvest
- Selective harvest
Manual harvesting: time for one spear

- Blind
- Half-blind
- Trained digging
- Untrained digging
- Untrained digging on heavy soil

Seconds / Spear

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>7</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

ATB
Hand harvest with basket

3 – 4 workers per ha
Hand harvest with basket; working distance

In total the workers walk about 15 km to harvest one ha.
Hand harvest with push carriages and improved film handling
Single row electric driven harvest aids with automatic handling of the film and transport of the spears

Asparagus spider, Engels Innovatietechniek BV, Panningen, NL
Single row electric driven harvest aids

• Battery performance should last one day
• Long „arc“ with enough height
• Ease of use
• Simple stop and go function by hand or by optical sensors
• Fast gear for periods with low yield
Same harvest aid with double film handling; black/white film + tunnel

Supports

Engels Innovatietechniek BV, Panningen, NL
Single-row combustion engine driven harvesters with sitting harvest position (about year 2000)

Böckenhoff GmbH, Raesfeld, German)
Two-rowed harvester (Engels, NL)

Performance problems in periods with low yield because of waiting times without spears
Three-row harvesting aid
Sitting position in the center of the harvester (about 2000)
5-row harvesting aid with sunscreen; deposition in boxes
The film is lifted, the asparagus are pre-cut, pre-washed and pre-sorted on the machine and stored at the back, to be unloaded in one single movement.

(Strauss, Buxtehude Germany)
Comparison of different harvesting systems

The harvesting time depends on yield, mechanization and work organization.
Improving the use of one-row harvesting aids by shift operation (Allofs 2015)

Harvesting period: 35 days

<table>
<thead>
<tr>
<th>Workers</th>
<th>System 1</th>
<th>System 2</th>
<th>System 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 + harvest aid</td>
<td>1 + harvest aid</td>
<td>3 + carriage</td>
</tr>
<tr>
<td>Working hours</td>
<td>8 h</td>
<td>10 h</td>
<td>10 h</td>
</tr>
<tr>
<td>(per worker &amp; day)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>3703 spears</td>
<td>3110 spears</td>
<td>2213 spears</td>
</tr>
<tr>
<td>(per worker &amp; day)</td>
<td></td>
<td>(2500 / 8 h)</td>
<td>(1770 / 8h)</td>
</tr>
<tr>
<td></td>
<td>463 / h</td>
<td>311 / h</td>
<td>221 / h</td>
</tr>
<tr>
<td>(per worker &amp; h)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harvested area</td>
<td>0.8 ha</td>
<td>0.67 ha (-16%)</td>
<td>0.48 ha (-40%)</td>
</tr>
<tr>
<td>(per worker &amp; day)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary harvest aids

• Today electric driven single row harvesting aids are predominantly used for white asparagus

• The amount of workers per ha can be reduced to less than 1

• Harvesting performance can be improved by two workers for one harvester in shift operation
Harvesting principles

- Hand harvest with basket
- Hand harvest supported by harvesting aids
- Nonselective harvest
- Selective harvest
Nonselective harvest, principle

In the early fifties of the last century american engineers started with this harvesting principle for the can industry (Kepner and O`Brian 1967)

The whole ridge has to be cut with a cutting unit

The spears were separated from the soil with a sieve belt (900 m³ soil / ha)

Manual removal from a horizontal belt

Restore the ridge
Many open questions

Reaction of the asparagus plant
Harvest frequency
Yield, grade, quality etc.

Moisture distribution in the ridge
Heat distribution in the ridge
Phytosanitary questions

Economy
ATB – Prototype of the harvester
ca. 1998


separating conveyor (sieve belt)

cutting unit, special hardened knives of an asparagus-fern-chopper
Unfavorable distribution of the spear length
Other manufacturer:
Christiaens Agro Systems, Neer (NL) [www.christiaensagro.com](http://www.christiaensagro.com)
Results Kirpy

Kirpy 2009
Daily yield in 2003

(About 15 raw spears per kg)
Harvesting principles

- Hand harvest with basket
- Hand harvest supported by harvesting aids
- Nonselective harvest
- Selective harvest
Selective harvest of white asparagus

Asparagus Panther
(It should replace up to 10 workers in shift operation)

www.ai-solution.de

Photos: ai-solution Agrarmaschinen
Selective harvest of white asparagus; Brabantse Wal

Machine decreases wage costs by 40% (Juni 2008)

Brabantse Wal presents first full-automatic asparagus harvester in the world  http://www.freshplaza.com/news_detail.asp?id=24250
AutoSpar (Strauss, Buxdehude)

AutoSpar
"Development of an automatic harvesting system for white and violet Asparagus"

Two color cameras with background illumination
Machine speed: In ‘auto’ mode and ‘find target’: 0,5 m/s
               In ‘manual’ mode: from 0 – 1,5 m/s
Harvesting efficiency: Up to 5 asparagus stalks per minute

http://www.autospar.net/index.html
Cerescon selective harvester (2017)

Source:
http://www.cerescon.com/NL/home
Conclusion

• All in all, development of white asparagus harvest mechanization is not completed

• Most growers are still waiting for a selective white asparagus harvesting robot

• It should be fast, inexpensive and gentle to the produce to limit the labor costs and the high number of workers in the vegetable companies
Many thanks for your attention