Oilseeds World Production 2013/2014.
Focus: Sunflower and Rapeseed

EU-27 SF RS
- World No: 3
- Prod. mio.t.: 8.53
- Growth 2012: +21.6%
- Growth 2011: +8.2%

Russia SF
- World No: 2
- Prod. mio.t.: 10
- Growth 2012: +25.6%
- Growth 2011: +4.1%

Canada RS
- World No: 2
- Prod. mio.t.: 18
- Growth 2012: +29%
- Growth 2011: +22%

USA SB
- World No: 3
- Prod. mio.t.: 88.66
- Growth 2012: +7.3%
- Growth 2011: +5.2%

Ukraine SF
- World No: 1
- Prod. mio.t.: 11.5
- Growth 2012: +27.7%
- Growth 2011: +9.5%

Argentina SB SF
- World No: 3
- Prod. mio.t.: 88.0
- Growth 2012: +10.5%
- Growth 2011: +35.9%

Brazil SB
- World No: 2
- Prod. mio.t.: 54.5
- Growth 2012: +10.5%
- Growth 2011: +35.9%

India RS SB
- World No: 4
- Prod. mio.t.: 7.0
- Growth 2012: +2.9%
- Growth 2011: +7.6%

Brazil SB
- World No: 2
- Prod. mio.t.: 11.8
- Growth 2012: +2.6%
- Growth 2011: +7.2%

China SB RS
- World No: 4
- Prod. mio.t.: 12.2
- Growth 2012: -6.9%
- Growth 2011: -15.8%

World Wide Production

<table>
<thead>
<tr>
<th></th>
<th>Prod. mio.t. 2012</th>
<th>Prod. mio.t. 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybeans</td>
<td>284,94</td>
<td>+6.2% +19.3%</td>
</tr>
<tr>
<td>Rapeseed</td>
<td>69,97</td>
<td>+11.0% +13.6%</td>
</tr>
<tr>
<td>Sunflower</td>
<td>42,43</td>
<td>+16.5% +5.3%</td>
</tr>
<tr>
<td>Total oilseeds*: 502,27</td>
<td>+5.8% +13.8%</td>
<td></td>
</tr>
</tbody>
</table>

*Includes: Soybeans, Rapeseed, Cottonseed, Sunflower, Peanut, Palm kernel, Copra

Source: USDA
Sunflowerseed Production

Market Outlook

- Growth of sunflowerseed production in Europe and Eastern Europe

- Demand for high valuable products like animal feed and vegetable oil due to growth of world population and increase of living conditions

- Especially important:
  - High yields of oil (low oil residues and low oil losses)
  - High content of protein in meal
  - Digestibility of meal due to less fiber content
Sunflower Preparation Processes

- **Dehulling**
  - beating by impactors
  - OR
  - crushing by corrugated roller mills

- **Separation**
  - separation of hulls & kernels
  - by oscillating sieves
  - aspiration of hulls by air

- **Hull Control**
  - sifting of hulls and kernels

- **Flaking**
  - flaking of kernels to open oil cells

Sunflower Seed → Dehulling → Hulls + Kernels (fine) → Separation → Kernels + Hulls → Hull Control → Kernels (fine) → Flaking → Flaked Seed → Hulls

Kernels + Hulls → Hulls
Dehulling
Key Preparation Technology

Corrugated Roller Mill

Capacities
Sunflower up to 260 - 320 t/24h

Vertical Impact Dehuller

Capacities
Sunflower up to 150 - 180 t/24h

Horizontal Impact Dehuller

Capacities
Sunflower up to 150 - 180 t/24h

* All capacities and performances values are depending on raw material specifications & conditions.
Dehulling
Corrugated Roller Mill

For high capacity multi-seed crushing

- Suitable for multi-seed processes
- High capacity
- Limited dehulling efficiency

The roller miller assures flexible processing of multiseeds.
Dehulling
Working Principles of Corrugated Roller Mill

- level controlled feeding device
- feeder allows consistent distribution over entire roll width
- permanent magnet removes ferrous particles in feed
- individual roll gap adjustment
- scraper knives cleans rolls from seed residues
Dehulling
Vertical Impact Dehuller

For efficient multi-seed impact dehulling.
- Suitable for multi-seed dehulling
- Smooth dehulling for low fines content
- Quiet, clean and safe operation

The versatile dehuller adapts to your requirements.
Dehulling

- Feeder screw for even feed
- Level indicator (top/bottom) avoids choking
- Permanent Magnet
- Grooved rotor for controlled, fines avoiding product impact
- Dehulling degree adjustment through adjustable impact cone (spacers)
Dehulling
Especially Suited for Multi-Seed Oil Mills.

Main advantages:

- Applicable for dehulling of various oilseeds incl. sunflower, cotton seed, and soybeans
- High process safety due to screw feeder, magnet and level probes
- Continuously adjustable screw and rotor speed allow perfectly controlled process
- Alternative impact cone surface characteristic (smooth, fluted) for optimized dehulling
- Efficient especially with higher moisture content

1. Rotor
2. Wear plates
3. Impact paddles

Impact cone characteristics
Smooth: Sunflower
Fluted: Soy, cotton seed
**Dehulling**

*Horizontal Impact Dehuller*

For state-of-the-art sunflower dehulling.

- Smooth dehulling for low fines
- Long machine lifetime
- Easy maintenance of key parts

Applied in the sunflower seed processing industry exclusively.
Dehulling

- Feeder roll with integrated frequency converter
- Magnet
- Wear resistant and adjustable impact chest
- Only applicable for sunflower seeds
Dehulling
Simple Way of Dehulling.

Main advantages:
- Simple and fast adjustment of impact chest and thus excellent dehulling quality
- No aspiration required
- Simple and easy accessible and exchangeable wear parts
- Efficient especially with lower moisture content

Permanent magnets
Impact chest adjustment

Impact rotor
Impact chest
# Dehulling System Comparison.

<table>
<thead>
<tr>
<th></th>
<th>Corrugated Roller Mill</th>
<th>Vertical Dehuller</th>
<th>Horizontal Dehuller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehulling Efficiency</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Sunflower Suitability</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Other oilseeds</td>
<td>++</td>
<td>+</td>
<td>N/A</td>
</tr>
<tr>
<td>End Product Quality</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Integrated Safety Features</td>
<td>+</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Aspiration</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Throughput (t/h)</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Efficiency (kWh/t)</td>
<td>++</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>Space requirement</td>
<td>0</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Serviceability</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
</tbody>
</table>

* ++ ... very good;  + ... good; 0 ... acceptable;  N/A ... not applicable
## Dehulling

### Technical Data - Overview.

<table>
<thead>
<tr>
<th>Impact Dehuller</th>
<th>Corrugated Roller Mill</th>
<th>Vertical Dehuller</th>
<th>Horizontal Dehuller</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimensions (mm)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>2.920</td>
<td>2.110</td>
<td>2.923</td>
</tr>
<tr>
<td>Width</td>
<td>1.900</td>
<td>550</td>
<td>2.003</td>
</tr>
<tr>
<td>Height</td>
<td>1.130</td>
<td>1.820</td>
<td>1.925</td>
</tr>
<tr>
<td><strong>Rotor / Roll diameter (mm)</strong></td>
<td>300</td>
<td>600</td>
<td>800</td>
</tr>
<tr>
<td><strong>Rotor / Roll length (mm)</strong></td>
<td>1.600</td>
<td>-</td>
<td>2.150</td>
</tr>
<tr>
<td><strong>Aspiration needed (m³/min)</strong></td>
<td>20</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td><strong>Motor power (kW)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeder drive</td>
<td>0.75</td>
<td>0.37 (FC optional)</td>
<td>0.33</td>
</tr>
<tr>
<td>Main drive</td>
<td>18.5</td>
<td>15-22 (FC optional)</td>
<td>18</td>
</tr>
<tr>
<td><strong>Weight (kg, net)</strong></td>
<td>3.690</td>
<td>825</td>
<td>2'640</td>
</tr>
<tr>
<td><strong>Beaters / Throw paddles / Rolls</strong></td>
<td>2</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td><strong>Throughput (t/24h)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower</td>
<td>260 – 320</td>
<td>150 - 180</td>
<td>150 - 180</td>
</tr>
<tr>
<td>Soybean</td>
<td>500 - 800</td>
<td>120 - 150</td>
<td>-</td>
</tr>
<tr>
<td>Cotton seed (max. 4% lint)</td>
<td>230 – 260</td>
<td>120 - 150</td>
<td>-</td>
</tr>
</tbody>
</table>
Separation
Hull Separator

Efficient sifter for hull separation.

- Optimal separation of oilseed kernels from hulls
- High throughput capacities
- Easy operation and maintenance
- Designed especially for oilseed separation

Applied in the oilseed processing industry for the dehulling of sunflower seeds and soya.
Separation
Key Preparation Technology

Hull Separator SMA 203-3 OL

1. Proven main hull aspiration system
   - Easy adjustable, powerful suction nozzles

2. Proven post hull aspiration system
   - Multi-tunable aspiration channel
   - Large control window for optimal setting
Separation
Working Principle and Technical Data

Cleaning

Impact Dehuller

backflow of undehulled seed
coarse hulls

fine hulls

fine seed to flaker

dehulled seed to 2nd stage or to flaker

hulls to sifter
Separation
Working Principle and Technical Data

Impact Dehuller

backflow of undehulled seed

fine seed to flaker

dehulled seed to 2nd stage or to flaker

hulls to hull control
Sunflower Preparation Processes

**Objective**
- reduction of fiber content in meal by hull removal
- increase of final protein content
- highest oil yield

**Different Dehulling Processes**

- 2-stage Dehulling: Hull Removal from 26% to 10%
- 1-stage Dehulling: Hull Removal from 26% to 14 – 12%

- Differentiation through the rest of hull content and amount of kernel loss by efficient hull controls

*additional 2.5-3% botanical oil content in hulls*
Sunflower Preparation Processes
2-stage Dehulling with Total Hull Control

10% rest hull
1.0-1.2% oil loss with hulls*

1. Dehuller
2. Separator
3. Filter/Cyclone
4. Hull Sifter
5. Hull Drum Sieve
6. Hull Separator

* additional 2.5-3% botanical oil content in hulls
Sunflower Preparation Process.
1-stage Dehulling with Total Hull Control

12% rest hull
0,9-1,1% oil loss with hulls*

➢ dehulling results
➢ low kernel/oil losses
➢ high investment

1. Dehuller
2. Separator
3. Filter/Cyclone
4. Hull Sifter
5. Hull Drum Sieve
6. Hull Separator

* additional 2,5-3% botanical oil content in hulls
Sunflower Preparation Process.
1-stage Dehulling with Partial Hull Control

14% rest hull
1,0-1,2% oil loss with hulls*

1. Dehuller
2. Separator
3. Filter/Cyclone
4. Hull Sifter

* additional 2,5-3 % botanical oil content in hulls
### Sunflower Preparation Process

#### Yields

<table>
<thead>
<tr>
<th>SUNFLOWER INPUT SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moisture content</strong></td>
</tr>
<tr>
<td><strong>Oil content</strong></td>
</tr>
<tr>
<td><strong>Crude fiber content</strong></td>
</tr>
<tr>
<td><strong>Protein content</strong></td>
</tr>
<tr>
<td><strong>Hull content</strong></td>
</tr>
<tr>
<td><strong>Impurities</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YIELDS AFTER DEHULLING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEHULLING</strong></td>
</tr>
<tr>
<td>Rest hull content in dehulled fraction</td>
</tr>
<tr>
<td>Capacity prior to dehulling</td>
</tr>
<tr>
<td>Capacity prior to expeller pressing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>YIELD</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total hulls removed</td>
</tr>
<tr>
<td>Additional oil loss*</td>
</tr>
<tr>
<td>Extraction meal</td>
</tr>
<tr>
<td>Protein content</td>
</tr>
<tr>
<td>Crude fiber content</td>
</tr>
<tr>
<td>Oil content</td>
</tr>
<tr>
<td>Expeller crude oil</td>
</tr>
<tr>
<td>Extraction crude oil</td>
</tr>
</tbody>
</table>

* based on seed input; all figures determined with Bühler Oil Balance calculation
## Sunflower Preparation Process.

### Performance Figures

<table>
<thead>
<tr>
<th>SUNFLOWER INPUT SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content</td>
</tr>
<tr>
<td>Oil content</td>
</tr>
<tr>
<td>Crude fiber content</td>
</tr>
<tr>
<td>Protein content</td>
</tr>
<tr>
<td>Hull content</td>
</tr>
<tr>
<td>Impurities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dehulling Stages</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-stages</td>
</tr>
<tr>
<td>Rest Hull Content</td>
</tr>
<tr>
<td>10 %</td>
</tr>
</tbody>
</table>

| Protein Content               |
| 44,5 %                        | 41%               | 42,5 %           |

| Loss of Oil                   |
| 1,2 – 1,0 % based on Hulls    |
| 0,9 – 1,1 % based on seed input |

| Loss of Oil                   |
| 0,2 - 0,3 % based on seed input | 0,15 – 0,2 % | 0,17 – 0,2 % |
Flaking is Key in Achieving Low Rest Oil in Meal.

State of the art features

- Flake thickness adjustment during operations
- Easy access for regular maintenance
- Correct roll type and surface

Optimal Sunflower throughput

(at 0.4mm flake thickness, cold, 8% H2O)

- Capacities of approx. 400 t/24h
Bühler’s High Performance Flaking Mill OLFB.

Bühler’s state-of-the-art flaking mill.

- High performance flaking mill
- Flake thickness adjustment during operations
- Compact and efficient
- Easy maintenance, safe operation