Combine Harvesting in Sweden and Related Research at JTI

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Combine harvested crops in Sweden 2011

Acreage: 1 100 000 hectares

- Wheat: 39%
- Barley: 31%
- Oat: 17%
- Rye: 11%
- Oilseed: 2%
Estimated average moisture content (%) at combine harvesting of winter wheat:

- Sweden: 17-23
- France: 14-16
- Germany: 16-18
Narrow harvesting window: 1 month
Combine Harvesting with Stripper Header (1989-1990)
The stripper header from Shelbourne Reynolds Engineering

1) Rotor
2) Conveyor belt
3) Feeding auger
4) Hood
Combine harvesting of winter wheat with Claas Dominator 68, header and thresher losses at varying feed rates.
Chopping Length Capability and Wear for two Types of Straw Chopper Knives at Combine Harvesting

Field trials in Uppsala, Sweden and Bietikow, Germany (2001)
Ploughless tillage increases the demands regarding crop residue handling
Seedbed preparation starts with the combine harvesting!!
Straw chopper knives design (Rekordverken)

Smooth

Serrated
28 smooth knives were mounted on the left hand side of the straw chopper and 28 serrated knives on the right hand side
Average (mass median) lengths for straw chopped with smooth and serrated knives respectively for all measurement occasions.
Cumulative length distribution for straw chopped with smooth and serrated knives respectively. Data compiled from all measurement occasions.
Weight of new knives and decrease during the harvest season, average g

New: 243 +/- 1,5
Decrease = 2.02

241 +/- 1,5
Decrease = 2.02
CONCLUSIONS

1) Similar performance was achieved for smooth and serrated knives with respect to -chop length -wearing

2) No performance impairment due to wear during the harvest season was observed
Combine Harvesting of Winter Rape Seed with Extended Headers (2006-2007)
Earlier trials in winter rape: header losses ≥5 %
Firm header extensions

Biso

Zürn
Conveyor-assisted headers

Massey-Ferguson Power Flow

Premium Flow (Zürn)
Telescopic header

New Holland
Field trials with Claas 570 & 580 equipped with Claas Vario telescopic header
Three header lengths
Collecting trays 8*95 cm
Distribution of collecting trays
Header losses at different header lengths during 2007

Distance from centre of the combine harvester, m

Losses, kg/ha

Crop divider  Centre  Vertical knife

63 cm  83 cm  113 cm
Header losses when crop only on the right hand side, average during 2006 & 2007

<table>
<thead>
<tr>
<th>Header length, cm</th>
<th>From each header segment, kg/ha</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knife only</td>
<td></td>
</tr>
<tr>
<td>63 (normal)</td>
<td>73</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>Header centre</td>
<td></td>
</tr>
<tr>
<td></td>
<td>69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Header right side</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>kg/ha</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>% of yield</td>
<td>4.4</td>
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<tr>
<td>83</td>
<td>25</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Header centre</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Header right side</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>kg/ha</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>% of yield</td>
<td>2.0</td>
</tr>
<tr>
<td>113</td>
<td>12</td>
<td>36</td>
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<tr>
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<td>Header centre</td>
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<tr>
<td></td>
<td>13</td>
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<tr>
<td></td>
<td>Header right side</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>kg/ha</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>% of yield</td>
<td>1.0</td>
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</table>
To sum up:
The investigation showed that headers specially adapted for rapeseed harvest can:

1) Decrease the losses with about 100 kg per hectare
2) Increase the harvesting capacity
Conclusions
1) Use vertical knife in order to decrease losses as well as stoppages

2) At large acreages investments in longer headers should be considered:
   - For an existing combine harvester, firm header extension
   - By purchase of a new combine harvester, telescopic or conveyor-assisted header
Simultaneous Harvesting of Straw and Chaff (2009)
The crop residues from the cleaning shoe is normally left close to the ground. If collected, the total amount of harvested residues would theoretically increase with 30% (wheat).
Rekordverken Combi System:
The chaff can be distributed across the working width of the combine harvester as well as be admixed into the straw.

Straw chopper: Turned on

Turned off

Available to: Sampo Rosenlew, New Holland (model CX) and John Deere (models W and T).
Chaff handling

Wide spread

Admixed
Field drying, variety Olivin

<table>
<thead>
<tr>
<th>Date</th>
<th>Moisture content, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combine harvesting</td>
<td>19</td>
</tr>
<tr>
<td>19 Aug</td>
<td>30.1</td>
</tr>
<tr>
<td>20 Aug</td>
<td>10.3</td>
</tr>
<tr>
<td>Straw harvesting</td>
<td>22.2</td>
</tr>
<tr>
<td>20 Aug</td>
<td>11</td>
</tr>
</tbody>
</table>
Crop residue yield

Winter wheat, variety

Olivin
Straw: 3630 kg/ha
Straw & chaff: 4500 kg/ha

Kranich
Straw: 3770 kg/ha
Straw & chaff: 4150 kg/ha
Simultaneous harvesting of straw and chaff, conclusions

1) Reduced initial moisture content in the swath behind the combine.
2) Bale density and weight was not affected
3) The total yield of crop residues increased by 14 %
4) The ash content increased by 1 percentage unit.
5) No significant change in net calorific value or ash melting behavior
Reduced Fuel Consumption at Combine Harvesting by Adaption of the Straw Cutting Rate - New Technique of Measurement (2013)
Power demand, Rekord straw chopper at John Deere S690iHM

Source: Rekordverken Sweden AB
Power demand of the straw chopper. Design of measurement hub developed at University of Hohenheim (Schwarz et al 2011)
John Deere T 660 equipped with measuring system for the straw chopper power demand.

Straw chopper: Rekord Maxi Spreader
Collecting of chopped straw for analysis of chopping length
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Thanks for kind listening!

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