

## REDUCED LOSSES AND INCREASED CAPACITY BY COMBINE HARVESTING OF WINTER RAPE SEED

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### Summary

With the aim of meeting the growing demand for energy crops from agriculture there is great interest in methods for increasing the outcome from rapeseed cultivation. Such a development is however partly restrained due to problems encountered with combine harvesting, such as large header losses and frequent interruptions.

During 2006 and 2007 field trials were carried out in Sweden with the aim improving combine harvester performance for rapeseed harvest by using specially adapted headers as well as by desiccating the crop.

The harvests were carried out with a combine harvester equipped with a header where the length, i.e. the distance between the cutterbar and the feeding auger, was adjustable (Claas Vario model). Measurements of header losses and harvesting capacity were carried out with three different header lengths: 63, 83 and 113 cm.

The investigation showed that headers specially adapted for rapeseed harvest can reduce the losses with about 100 kg per hectare. Furthermore the capacity is increased. This suggests that all combine harvesters used for winter rape to some extent should be equipped with a vertical side knife in order to reduce losses and harvest interruptions. By larger acreages of winter rape investments also in longer headers should be considered.

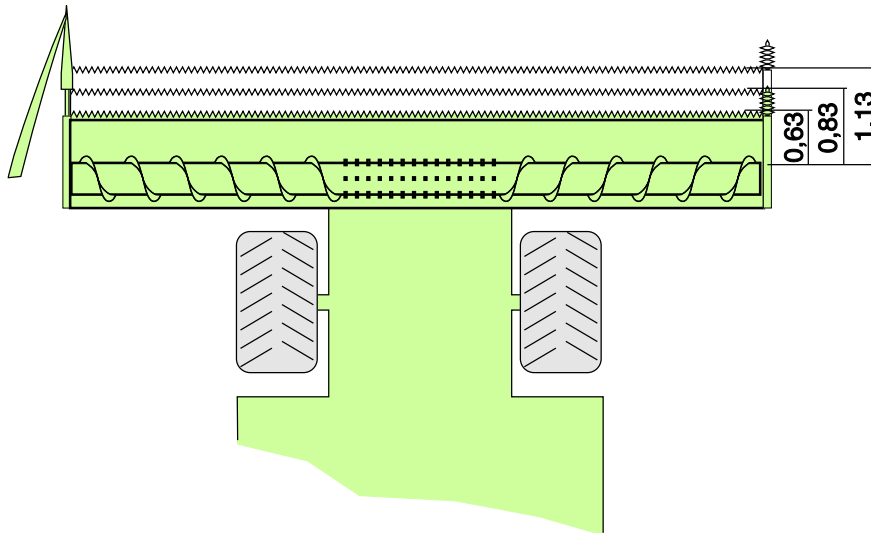
### Background

With the aim of meeting the growing demand for energy crops from agriculture there is great interest in methods for increasing the outcome from rapeseed cultivation. Such a development is however partly restrained due to problems encountered with combine harvesting, such as large header losses and frequent interruptions.

### Methods

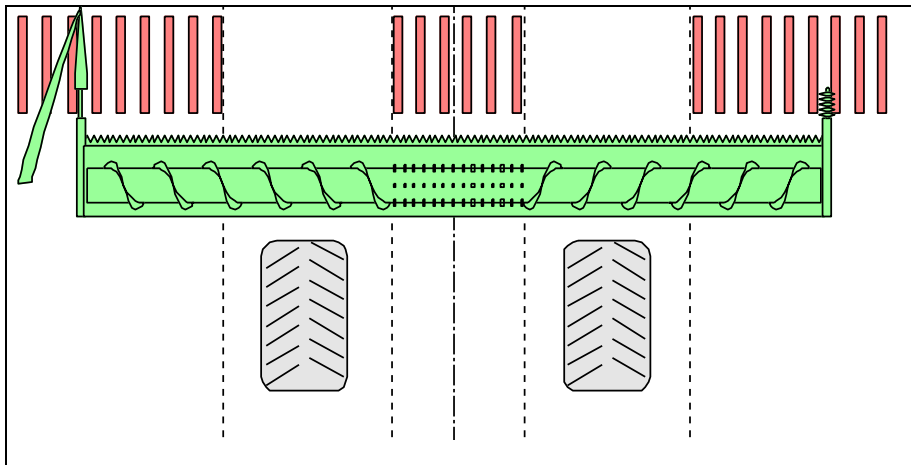
During 2006 field trials started in Sweden with the aim improving combine harvester performance for rapeseed harvest by using specially adapted headers as well as by desiccating the crop. Rape seed crops were harvested on two farms. At one of the farms, the crop was desiccated with glyphosate two weeks before the harvest.

The harvests were carried out with the Claas Lexion 580 model combine harvester. It was equipped with a header where the distance between the cutterbar and the feeding auger was adjustable (Claas Vario model). Measurements of header losses and harvesting capacity were carried out with three different header lengths: 63, 83 and 113 cm, as shown in figure 1.



**Figure 1.** Field trials were carried out with three header lengths: 0,63 (normal), 0,83, and 1,13 m. The header length was defined as the horizontal distance between the fingers (the points) of the cutterbar and the envelope of the feeding auger. In most cases the header was equipped with a crop divider on the left hand side and a vertical knife on the right hand side.

The losses were measured with collecting trays with dimensions 8x95 cm placed between the rows of the rape crop as shown in figure 2.



**Figure 2.** The collecting trays were distributed across the whole working width of the combine harvester with exception for the wheel tracks. Disposition at field trials during 2006 with the combine harvester Claas Lexion 580.

## Results

With the shortest header (63 cm) losses amounted to 133 kg per hectare. For each step the header was extended the losses were reduced by 50 %. Extending the header length by 50 cm and equipping it with a vertical knife on the right hand side instead of crop divider, losses decreased by 75 % to only 33 kg per hectare.

Work studies were carried out for each header concept. In these studies the speed of the combine harvester was between 4 and 6 km per hour. All observed stoppages were caused by accumulations of plant parts at the crop dividers, while this was never observed with vertical knife. In the desiccated crop no stoppages at all were observed.



Figure 3. The field trials were conducted during favourable weather conditions and with heavy crops.

Further field trials were carried out in 2007. As before a 7,6 m wide header was used but on this occasion mounted to a Claas Lexion 570 model combine harvester. Also during this season improved performance through extended header and vertical knife was confirmed. Extension of the header by 50 cm reduced losses from 180 to 40 kg per hectare i.e. by 80 %. Furthermore it was observed that harvester speed could be increased from 5 to 6-6,6 km/h without compromising the evenness of the material flow into the combine harvester. The header loss measurements from 2007, which is shown in figure 4, confirm the results from 2006 - an extended header increase the rape harvest through reduced losses.

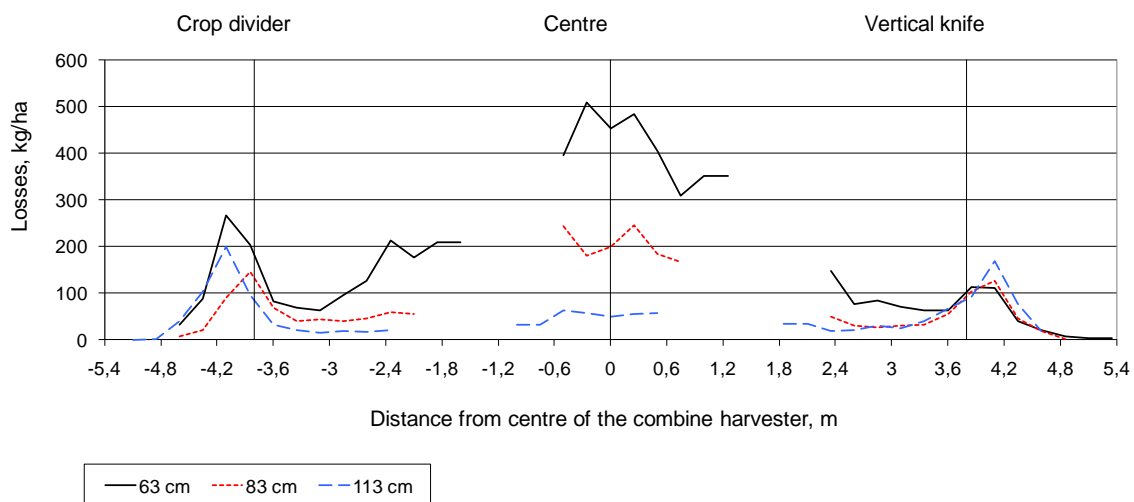


Figure 4. Results from 2007 field trials. The distribution of the header losses across the working width varied according to the length of the header (63, 83 and 113 cm). Each dataset shows an average from three combine harvester crossings. The vertical lines show the centre and the sides of the header respectively. A crop divider was used on the left hand side of the header and vertical knife on the right hand side.

Table 1. Losses at different header lengths for combine harvesting during practical circumstances (uncut crop only on the right hand side of the header). Average of field trials with winter rape carried out in 2006 and 2007, with yield of about 3600 kg per hectare. Combine harvester models Claas Lexion 580 and 570 respectively, cutting width 7,6 m. In the table the losses from different sections of the headers are given. The lateral extension of these sections was defined as follows: "Header centre" = the width of the feeding conveyor. "Header right hand side" = 0,5 m on either side of the right hand crop divider/vertical knife. "Knife only" = Remaining parts of the cutting width except "Header centre" and "Header right hand side". As the segments of the header had different lateral extension the varying loss levels across the working width (see the diagram in figure 2) had correspondingly different impacts of the total header loss. For example the moderate losses shown for "knife only" section had the same overall effect on the total header losses as the relatively larger losses for the "header centre" section.

Header length, cm	Header losses				
	From each header segment, kg/ha			Sum	
	Knife only	Header centre	Header right side	Kg/ha	% of yield
<b>63 (normal)</b>	<b>73</b>	<b>69</b>	<b>14</b>	<b>156</b>	<b>4,4</b>
<b>83</b>	<b>25</b>	<b>31</b>	<b>14</b>	<b>70</b>	<b>2,0</b>
<b>113</b>	<b>12</b>	<b>13</b>	<b>11</b>	<b>36</b>	<b>1,0</b>

### Application to practice

The investigation showed that headers specially adapted for rapeseed harvest can decrease the losses with about 100 kg per hectare. Furthermore the capacity is increased. This suggests that all combine harvesters used for winter rape to some extent should be equipped with a vertical side knife in order to reduce losses and harvest interruptions. By larger acreages of winter rape investments also in longer headers should be considered.

### Acknowledgements

The investigation was financed by the Foundation for Swedish Oil Plant Research and the Swedish Farmers' Foundation for Agricultural Research.