HGCA

PROJECT REPORT No. 11

OPTIMISING THE SETTINGS OF A CEREAL STRIPPER HEADER

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FREE

HOME-GROWN CEREALS AUTHORITY

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Optimising the Settings of a Cereal Stripper Header

by

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AFRC INSTITUTE OF ENGINEERING RESEARCH

OPTIMISING THE SETTINGS OF A CEREAL STRIPPER HEADER

Report of work done by AFRC Institute of Engineering Research for the Home-Grown Cereals Authority

Ideally, stripping of the grain from the straw should be done at the 9 or 10 o'clock position on the rotor and within the space between the rotor and the hood. If this is achieved, then the trajectory of the grain stripped is upward and header losses should be low.

The variable settings that have been investigated relative to header losses are:-

1. The rotor speed
2. The height of the rotor relative to the ground and crop
3. The gap between the hood inlet and the circumference of the stripping rotor (this setting is not available on stripping headers manufactured by Shelbourne Reynolds Engineering)
4. The height of the hood inlet relative to the crop and rotor axis
5. The forward speed of operation.

Some of these variables have a greater effect on header losses than others. If the variables are set so that the grain stripping process is carried out at a point in line with, or above the rotor axis, and within the space between the rotor and the hood, then the trajectory of the grain is upward and header losses should be minimal. Items 1, 2 and 3 can be set in relation to the crop and the conditions. Item 5 can be set relative to the separation losses of the combine, but Item 4 has to be continually assessed and adjusted by the machine operator relative to the crop height. If the hood is not set at the correct position, grain losses can increase significantly.

The range of settings that have been used during the development work are as follows:-

1. Setting of the rotor speed

In cereal crops the rotor speed should be between 500 and 800 rev/min. In laboratory and field work, a speed of 710 rev/min has produced the lowest losses. However, in some conditions, speeds as low as 500 rev/min can be used provided that header losses are acceptable or cannot be reduced by using a higher rotor speed.

Once the optimum rotor speed has been selected it is not necessary to make further adjustments until the particular crop condition or variety changes. However, it is important that the chosen rotor speed is maintained and therefore belt tension in the driveline to the header should be correct.

2. Setting of the rotor height relative to the ground

In standing crops of wheat, oats, rye, triticale etc., a rotor height of about 100-200 mm above the ground, has given the best results. The height may be judged by putting the stripping rotor axis at about 100 mm below the ear height. This allows the ears to be stripped at the 10 o'clock position on the rotor. In well necked barley crops and other laid crops the rotor may be set as near to the ground as possible. No changes in rotor height need to be made unless crop conditions change dramatically.
The header skids should be set such that a rotor minimum height above the ground of between 40 and 50 mm can be maintained if necessary. Although the stripping elements on the rotor are unlikely to be damaged by occasional contact with the soil, this should be avoided as much as possible.

3. Setting of the gap between the hood inlet and the stripping rotor circumference

The clearance between the hood inlet edge and the circumference of the grain stripping rotor needs to be set so that the crop has time to recover a little after it has been deflected downwards by the inlet deflector. It is usually set at between 100 and 150 mm from the tip of the stripping teeth. A larger clearance is preferable to a narrow clearance, but upward transfer of the crop is reduced if the clearance is larger than 200 mm. The clearance has a relatively small effect on header loss levels, and has not been provided on the commercial machines manufactured by Shelbourne Reynolds Engineering.

4. Setting of the stripping rotor hood height

The hood height should be positioned so that the ears of the crop are deflected downwards by the inlet deflector. After passing under the hood inlet, the clearance between the hood inlet and the rotor tip should allow time for them to recover so that they enter the stripping rotor above the height of the hood inlet. This means that stripping takes place within the hood enclosure. The position of the hood needs to be continually assessed relative to the ear height of the crop, and adjusted so that the ears are always deflected downwards. Header losses can increase considerably if the hood is set too low or too high in standing crops.

The best results have been obtained when the hood has been set between 100 and 150 mm below the average ear height. In a tall crop, the hood would be nearer to 150 mm below ear height and in a short standing crop, it would be at about 100 mm. Unfortunately, in most standing crops there are always some ears that are lower than the average height of the crop. These ears tend to be stripped at a point much lower on the stripping rotor circumference than the others, and consequently the trajectory of grain is lower. It is thought that these can be a major cause of header losses.

In laid crop conditions the hood can be set very low so that laid corn is still compressed by the inlet deflector. The same applies to badly necked barley crops.

5. Setting of the forward speed of operation

Header losses are reduced as the forward speed of travel is increased. Speeds of 8 km/h or faster should be maintained if the separation losses from the combine allow it. If the speed of operation is limited to less than 8 km/h, it can be expected that header losses will be slightly higher than the optimum. Forward speed is therefore an important setting for the proper operation of the stripper harvester header.

Harvesting laid crops

The same general considerations that are applied to standing cereal crops are also applied in the laid crop situation. Rotor speed can be set as slow as possible but with regard to complete stripping of the grain from the straw. The stripping rotor must be set as near as possible to the ground level in order to salvage as much of the crop as possible. The stripping rotor hood still needs to be set in such a way that it is able to slightly compress the crop as it passes beneath the hood inlet. Having passed below the inlet edge some recovery may take place and the lift from the stripping rotor is able to raise the grain level such that stripping is carried out within the envelope of the stripping hood and the stripping rotor. In general terms, the performance of the stripping header has been found to be at least as good as the performance of a cutterbar fitted with crop lifts and a properly set pick-up reel, and in many conditions it has performed better. However, the limitations that apply to a cutterbar in terms of the direction in which the machine travels, can also apply to the stripping harvester. The forward speed of operation should be as fast as possible, but this is not likely to be equivalent to that used in standing crops.

Header loss sensing

Progress has been made at the Institute of Engineering Research, to devise a method of assisting the stripper harvester driver to operate the stripping header at the minimum loss level. Because it is not possible to sense the amount of grain that is being lost on the ground, the sensing system has to be of an indirect type. Development work carried out so far suggests that it will be possible to have an indirect method of assessing the grain loss level and this will enable the operator to be able to find the correct position of the hood height by using a visual aid in the driving cab. When this system is fully developed it will be possible for the information from the header sensors to be fed into a micro-processor which will carry out the automatic setting of hood height.

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REFERENCE

1. N V NGUYEN; O D HALE. 1988 Header loss sensing and computer modelling of the grain stripping process. AFRC Institute of Engineering Research Contract Report No. CR/314/88/8612