

A report on the comparative study of the durability of corn sieves in Kombinat Rolny Kietrz

1. PURPOSE OF RESEARCH

The aim of the research is to compare the durability of two structural solutions in premium version in order to implement them into serial production.

2. RESEARCH ASSUMPTIONS

The durability of the sieves is tested in the Kombinat Rolny Kietrz. The CLAAS Lexion 780 combine was selected for the tests because two identical sieves are placed next to each other in the sieve box. This solution allows to compare the durability of sieves with different structures, because both sieves work in identical conditions. The sieves for harvesting corn with lamella CZ3m from OSKO-PLAST Ostrzyżek, Kostyra Sp. j . were used for the research. The choice of corn sieves was dictated by the fact that they are more loaded than grain sieves, so the wear process will take place faster.

The first sieve has the lamella rotation axes placed in calibrated holes [Photo 1]; the second sieve in slide bearings made of plastic, resistant to acids and alkalis [Photo 2].



Photo 1 – The method of placing the lamella rotation axes in the calibrated hole



Photo 2– The method of placing the lamella rotation axes in slide bearing

The parameter to be assessed will be the clearance between the opening in the frame and the axis of rotation of the lamellas. The measurement points were permanently marked on both sieves and are measured with a time sensor [Photo 3].



Photo 3- The method of measuring the clearance with a time sensor

The measurement results were collected in appropriate tables and statistically analyzed.

Measurement clearances in brand new sieves are presented in Table 1 and Table 2.

Below the tables, mean clearances and standard deviation are given.

YEAR 2018

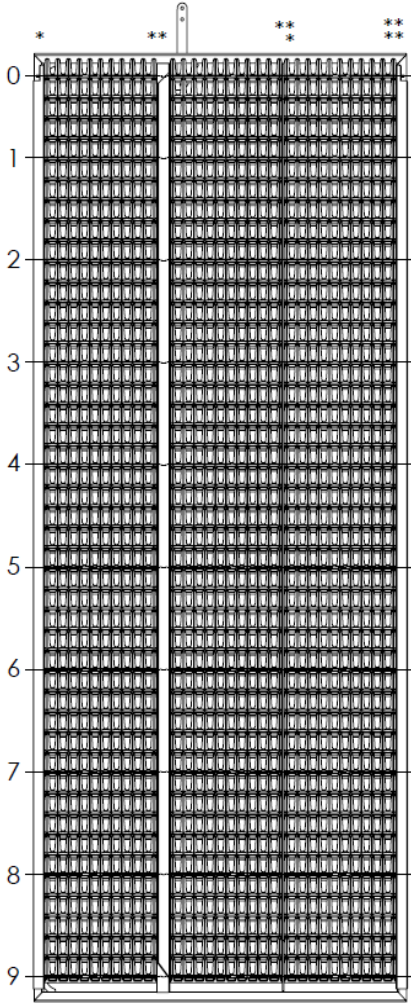


Table 1 – Clearance value [mm] in a brand new sieve with calibrated holes.

Measurement number	●	●●	●●●	●●●●
0	0,01	0,03	0,06	0,01
1	0,02	0,04	0,06	0,02
2	0,02	0,06	0,05	0,02
3	0,01	0,05	0,02	0,01
4	0,01	0,05	0,06	0,01
5	0,01	0,04	0,07	0,03
6	0,01	0,05	0,07	0,02
7	0,02	0,05	0,05	0,01
8	0,03	0,06	0,07	0,02
9	0,04	0,03	0,06	0,03

Medium clearance in a row: 0,018 0,046 0,057 0,018

Medium clearance over the entire surface: 0,03475 [mm]
Standard deviation: 0,020505 [mm]

Table 2 – Clearance value [mm] in a brand new sieve with slide bearings

Measurement number	●	●●	●●●	●●●●
0	0,02	0,00	0,02	0,04
1	0,01	0,02	0,02	0,01
2	0,03	0,05	0,01	0,02
3	0,02	0,04	0,03	0,02
4	0,03	0,04	0,01	0,01
5	0,03	0,03	0,03	0,02
6	0,02	0,02	0,02	0,02
7	0,04	0,02	0,02	0,02
8	0,04	0,03	0,05	0,02
9	0,03	0,03	0,03	0,03

Medium clearance in a row: 0,027 0,028 0,024 0,021

Medium clearance over the entire surface: 0,025 [mm]
Standard deviation: 0,010849 [mm]

3. FIRST YEAR OF OPERATION

In the first year of operation (2019), the combine harvested corn from an area of about 700 ha. The mowing conditions were very good due to the prevailing drought. The grain was dry (humidity 27-31%), the plants were moderately grown (height 2-2.5 m), the yield per hectare was between 12-14 tons / ha. Under such conditions, both sieves worked without any problems. After the end of the season, the sieves were sent back to the OSKO-PLAST company for clearance measurement.

The results of measurements and calculations are presented in Table 3 and Table 4. Then the sieves were sent to the Kombinat Rolny Kietrz for further testing in 2020.

YEAR 2019

Table 3 - Clearance value [mm] in a brand new sieve with calibrated holes after first year of operation

Measurement number	●	●●	●●●	●●●●
0	0,05	0,03	0,10	0,02
1	0,04	0,07	0,08	0,04
2	0,03	0,07	0,11	0,04
3	0,07	0,06	0,08	0,05
4	0,08	0,06	0,10	0,07
5	0,03	0,05	0,10	0,05
6	0,03	0,06	0,10	0,06
7	0,03	0,08	0,10	0,05
8	0,05	0,08	0,09	0,05
9	0,04	0,03	0,08	0,04

Medium clearance in a row: 0,045 0,059 0,094 0,047

Increase of medium clearance: 0,027 0,013 0,037 0,029
Medium clearance over the entire surface: 0,06125 [mm]
Growth of clearance: 0,0265 [mm]
Standard deviation: 0,024723 [mm]

Table 4 - Clearance value [mm] in a brand new sieve with slide bearings after first year of operation

Measurement number	●	●●	●●●	●●●●
0	0,03	0,05	0,05	0,04
1	0,03	0,10	0,07	0,06
2	0,04	0,07	0,07	0,07
3	0,03	0,06	0,04	0,06
4	0,03	0,02	0,06	0,05
5	0,03	0,06	0,05	0,05
6	0,04	0,07	0,04	0,06
7	0,04	0,10	0,10	0,06
8	0,05	0,06	0,10	0,06
9	0,03	0,05	0,05	0,05

Medium clearance in a row: 0,035 0,064 0,063 0,056

Increase of medium clearance: 0,008 0,036 0,039 0,035
Medium clearance over the entire surface: 0,0545 [mm]
Growth of clearance: 0,0295 [mm]
Standard deviation: 0,020248 [mm]

4. CONCLUSIONS

The analysis of the clearance after the first year of operation does not give any grounds to indicate which structure gives hope for greater durability.

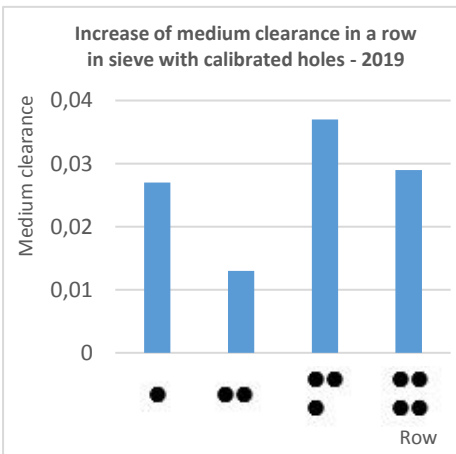


Diagram 1

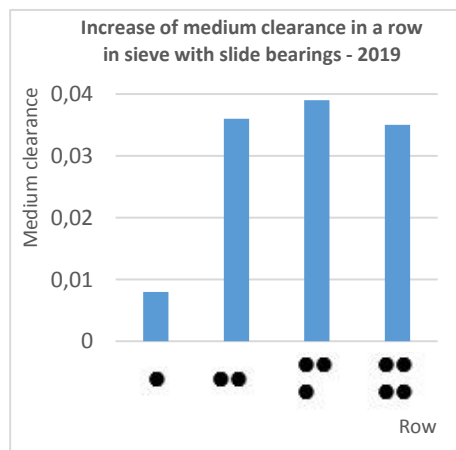


Diagram 2

5. SECOND YEAR OF OPERATION

In 2020, the combine harvested corn from an area of 552 ha. The mowing conditions were a bit more difficult than in 2019, because the grain humidity ranged from 28 to 34%, and the yield per hectare oscillated between 14 - 15 tons. During the corn harvest, there was one foggy day and one rainy day. The sieves worked properly in all weather and terrain conditions (mowing uphill and downhill). The only drawback was the sudden forward jerks - then the losses behind the sieve appeared. The values of the clearances at the checkpoints were measured and summarized in Tables 5 and 6, and the mean value of the increment of backlash in a row is shown in Diagrams 3 and 4.

YEAR 2020

Table 5 - Clearance value [mm] in a brand new sieve with calibrated holes after second year of operation

Measurement number	●	●●	●●●	●●●●
0	0,06	0,05	0,10	0,02
1	0,05	0,08	0,12	0,05
2	0,06	0,08	0,13	0,05
3	0,08	0,1	0,09	0,06
4	0,08	0,1	0,11	0,08
5	0,04	0,1	0,13	0,05
6	0,03	0,1	0,13	0,07
7	0,04	0,1	0,12	0,05
8	0,05	0,13	0,13	0,06
9	0,06	0,08	0,12	0,05

Medium clearance in a row: 0,055 0,092 0,118 0,054

2020-2018 Increase of clearance in a row: 0,037 0,046 0,061 0,036

Medium clearance over the entire surface: **0,07975** [mm]
Increase of clearance: **0,07975** [mm]

Table 6 - Clearance value [mm] in a brand new sieve with slide bearings after second year of operation

Measurement number	●	●●	●●●	●●●●
0	0,03	0,05	0,08	0,04
1	0,03	0,1	0,09	0,07
2	0,04	0,07	0,08	0,07
3	0,03	0,07	0,08	0,07
4	0,04	0,08	0,08	0,07
5	0,04	0,07	0,1	0,06
6	0,04	0,08	0,05	0,06
7	0,05	0,10	0,08	0,06
8	0,05	0,12	0,12	0,07
9	0,04	0,05	0,06	0,06

Medium clearance in a row: 0,039 0,079 0,082 0,063

2020-2018 Increase of clearance in a row: 0,012 0,051 0,058 0,042

Medium clearance over the entire surface: **0,06575** [mm]
Increase of clearance: **0,066** [mm]

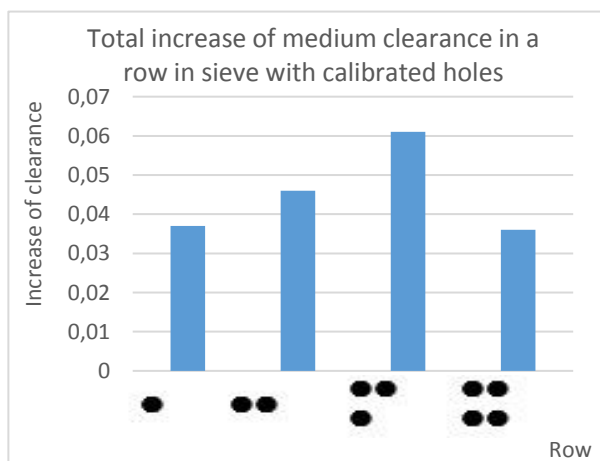


Diagram 3

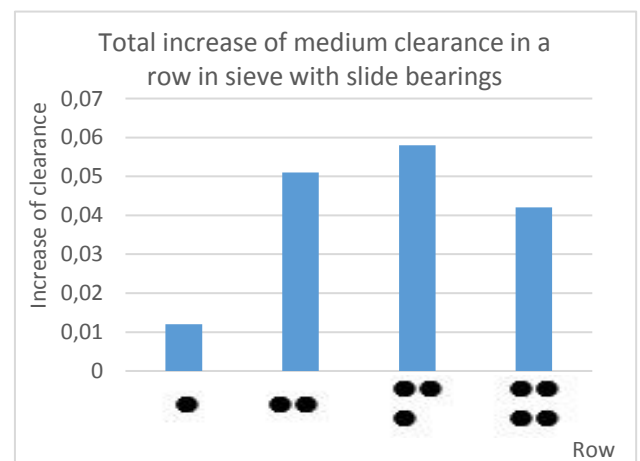


Diagram 4

6. CONCLUSIONS AFTER SECOND YEAR OF OPERATION

The analysis of the clearances in the row and the diagrams 3 and 4 still does not allow for an unequivocal indication which sieve will have the greater durability. We noticed, however, that the average amount of clearance between the axis of rotation of the blades and the opening in the frame is smaller than between the axis of rotation of the blades and the opening in the partition. After the 2021 season, we will present the next measurement results and conclusions resulting from them.