DLG-Test Report 7437

CLAAS Selbstfahrende Erntemaschinen GmbH

# Forage Harvester Jaguar 960

## Functionality and quality of work in silage maize

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CLAAS FORAGE HARVESTER JAGUAR 960
✓ Functionality and quality of work in silage maize
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## Overview

A test mark “DLG-APPROVED for individual criteria” is awarded for agricultural products which have successfully completed a scope-reduced usability test conducted by the DLG according to independent and recognized evaluation criteria. The test is intended to highlight a particular innovation and key criteria of the test object. The test may contain criteria from the DLG test scope for overall tests, or focus on other value-determining characteristics and properties of the test subject. The minimum requirements, test conditions and procedures, as well as the evaluation bases of the test results will be specified in consultation with an expert group of the DLG. They correspond to the recognized rules of technology, as well as specific and agricultural knowledge and requirements. Successful testing is concluded with the publication of a test report, as well as the awarding of the test mark, which is valid for five years from the data of awarding.

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**CLAAS FORAGE HARVESTER JAGUAR 960**
✓ **Functionality and quality of work in silage maize**
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The Claas Jaguar 960 forage harvester was subjected to the DLG partial test “Functionality and quality of work in silage maize”. This test involved a number of field tests during which the work rates and corresponding fuel consumption rates were measured. These measurements were used to compute throughputs [t/FM/h] and specific fuel consumption rates [l/t FM] of the machine. The tests also included measurement of the technical quality of chop. All test parameters were measured with the machine set to three different chop length settings (4 mm, 7 mm, 12 mm). For this purpose, samples were taken from the crop flow of the forager in each test variant and subjected to a particle size distribution analysis and the CSPS index (Corn Silage Processing Score) was determined to describe the degree of grain processing. The tests were carried out in Hungary.

Other criteria were not tested in the test presented here.

## Assessment in brief

The Claas Jaguar 960 forage harvester (model year 2023) in the tested specification achieved throughputs of up to 236 tonnes of fresh mash per hour (at a nominal 12 mm LOC), demonstrating that it was able to deliver its potential in the prevailing test conditions. The fuel rates per operating hour did not change significantly when the LOC setting were changed. The specific fuel consumption rates dropped when throughput increased. All measurements show overall low rates of 0.47 to 0.53 litres per tonne of harvested material.

The test shows clearly that preselecting a different length of cut on the forager has a clear effect on the chop length distribution in the harvested material. The chop length proportions shift accordingly. Regardless of the moisture contents of the material, overlengths (> 33 mm and > 19 mm) accounted for only a small portion. Comparatively high weight fractions of fine particles(< 3 mm) are found in both dry matter content levels. According to the recommendations of the Germany Society for Nutritional Physiology (GfE), the desired upper limit of 3 % by weight for the determine portions of ultra-fine particles (< 1.18 mm) is not exceeded in the lower dry matter content level and is slightly exceeded in the higher dry matter content level. This is due to the degree of maturity of the crop (DM content up to 53 %).

In this DLG test, the V-Max drum was compared with the new V-Flex drum. The V-Flex drum (compared to the V-Max drum) tended to produce higher proportions of desired chopped particles, lower proportions of overlengths and higher proportions of fine and ultra-fine particles.

According to MERTENS (2005) and LUFA NRW, very good kernel preparation rates are achieved across all chop length presettings.

Based on these good test results, the Claas Jaguar 960 forage harvester is awarded the “DLG APPROVED” quality mark for the individual test criterion “Functionality and quality of work on silage maize”.

*Table 1:*
*Overview of results*

| DLG QUALITY PROFILE | Evaluation* |
|---|---|
| Functionality and quality of work in silage maize | ✓ |

* Evaluation range: requirements fulfilled (✓) / requirements not fulfilled (✗)

## The product

### Manufacturer and applicant

CLAAS Selbstfahrende Erntemaschinen GmbH Mühlenwinkel 1, 33428 Harsewinkel, Germany

Product:
Claas Jaguar 960 forage harvester

Contact:
https://www.claas.de/

### Description and technical data

The specifications of the tested Claas Jaguar 960 forage harvester are listed in Table 2.

The Claas Orbis 900 header with 12 rows (9 m working width) with four large and four small gathering rotors was used in the DLG test. Figures 2 and 3 show the chopping rotors used one after the other on the test machine.

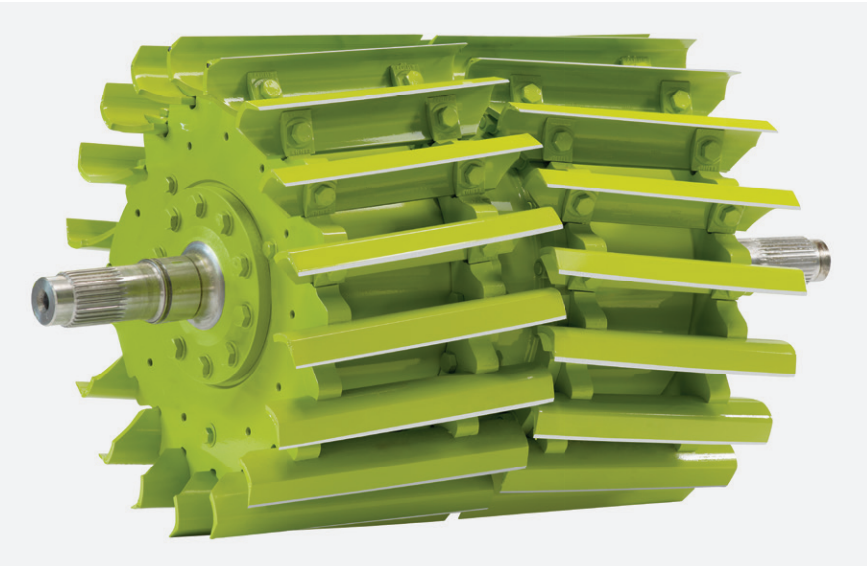

*Figure 2:
Claas V-Max drum
with 36 knives*

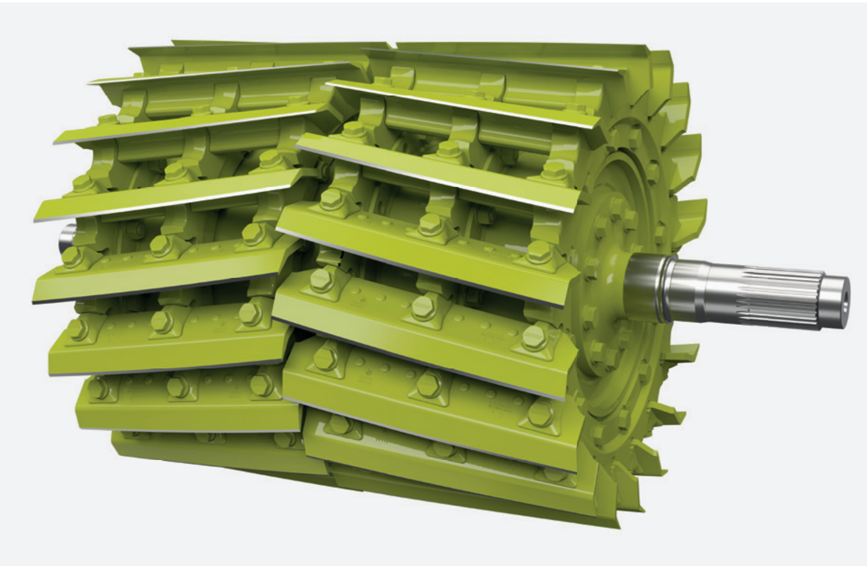

*Figure 3:
Claas V-Flex drum
with 36 knives*

*Table 2:*
*Specifications of the tested Claas Jaguar 960 forage harvester (model year 2023)**

| **Engine** | **Mercedes-Benz** |
|---|---|
| kW/hp | 480 kW/653 hp |
| Displacement | 15.6 l |
| Engine speed (during harvesting) | 1,550-1,650 rpm |
| No. of pre-compression rollers | 4 |
| Feeder house | 730 mm wide house |
| Chopping drum of tested machine | V-Max drum and V-Flex drum with 36 knives each |
| LOC band (with no. knives named above) | 3.5-14.5 mm |
| Kernel processor | Claas Multi Crop Cracker MCC L (125/125 teeth) with 40 % speed difference |
| Selected kernel processor gap | 1 mm |

* Manufacturer's specifications

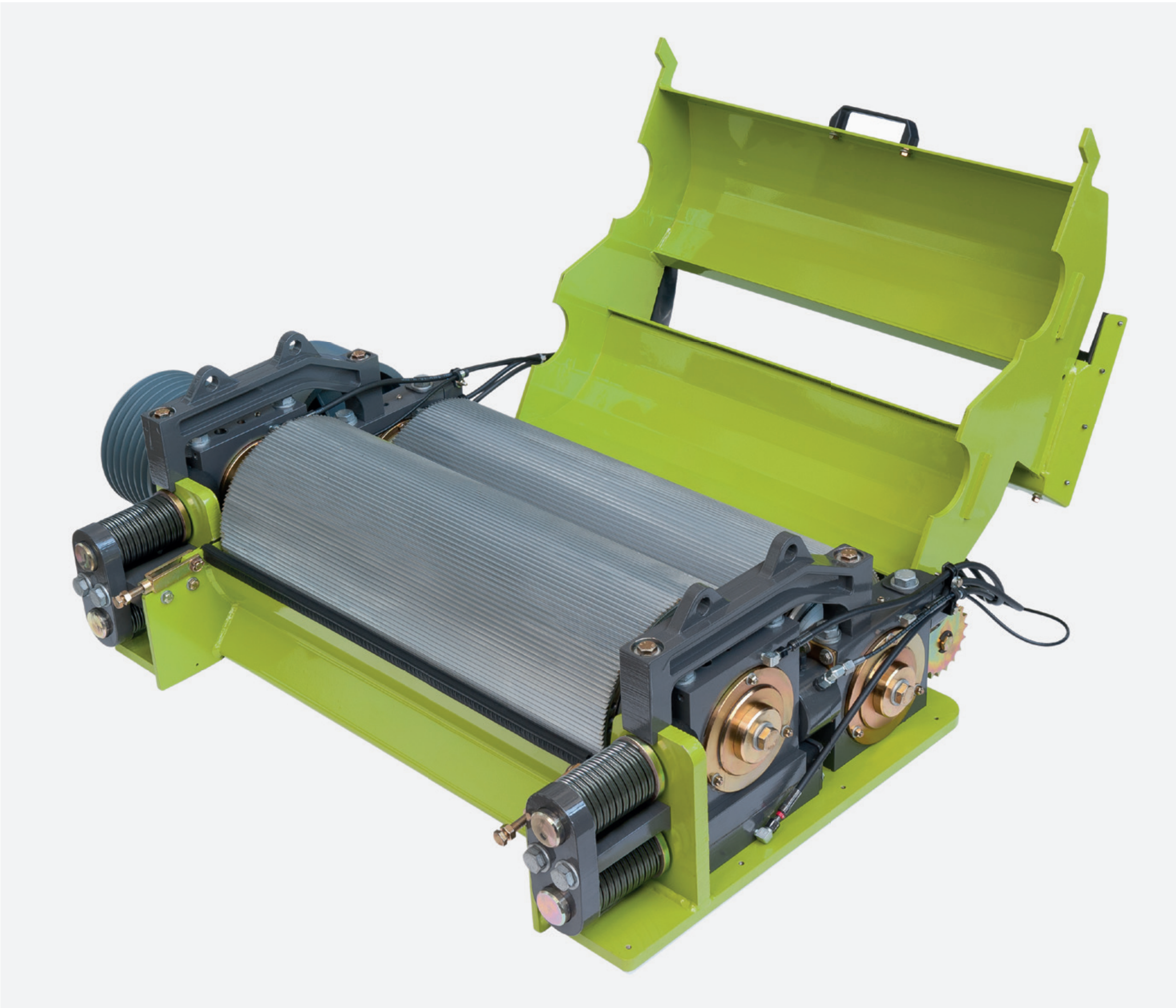

*Figure 4:*
*Claas Multi Crop Cracker MCC L kernel processor (125/125 teeth)*

## The method

The DLG partial test “Functional test in silage maize” applies to self-propelled forage harvesters (SFH) put to a field test. For this purpose, different test variants are carried out on selected silage maize areas that are as homogeneous as possible at standard driving speeds and chop length settings (4 mm, 7 mm, 12 mm). In the DLG functional test, the base settings on the forager are made on site and to prevailing harvest conditions. The tests focus on the overall machine efficiency. This is determined by measuring its throughput (t/h) and specific fuel consumption (l/t). Accompanying analyses are also conducted to describe the technical chop quality of the crop produced at two different dry matter content levels (27 % DM to 32 % DM and 37 % DM to 43 % DM).

### Throughput

The throughput capacity of the forager is determined for all three required chop lengths. In each test run, the forager fills a representative number of trailers while the filling time is recorded. Then the harvested quantities are weighed and the throughput [t FM/h] as realized in the prevailing test conditions is determined.

### Fuel consumption

In the test, fuel consumption [l/h] is measured as the forager is filling the trailer running alongside using suitable, external and calibrated measuring technology or by reading out the CAN bus data. In the latter case, the CAN bus data is verified in advance by carrying out reference measurements using suitable, external measuring technology.

### Specific fuel consumption per tonne of harvested material

The throughputs [t FM/h] and fuel rates [l/h] measured in each test version are used to compute the specific fuel rates per tonne of harvested crop [l/t FM].

### Technical quality of chop

The technical quality of chop is determined by sampling the material as it flows from the spout. This is done by means of the DLG sampler (see Figure 5) in each of the test versions. These samples are then used to obtain representative sub-samples for determining the dry mass content, the particle size distribution and the level of kernel processing.

*Moisture content*

The moisture content is determined by weighing the material into smaller samples, deep freezing and storing these until the field trials are completed. Then moisture is determined with the oven-drying method.

Another quick method for determining the moisture contents is the field are NIRS sensors, the accuracy of which was verified and found to be sufficient by the DLG before these tests.

*Particle size distribution*

The particle size distribution is carried out using the DLG cascade sieve system.

*Table 3:*
*Kernel processing results according to MERTENS (2005) and LUFA NRW*

| Kernel processing level | very good | good | poor |
|---|---|---|---|
| CSPS | > 70 % | 50 % bis 70 % | < 50 % |


*Figure 5:*
*The silage stream from the spout is sampled. The sample is analysed for the technical quality of chop.*

For sieving silage maize, the DLG cascade sieve is equipped with the sieve set “33 mm – 19 mm – 13 mm – 8 mm – 5 mm – 3 mm – remainder” (round hole sieves). If a weight fraction of more than 5 % is found in the sieve fraction < 3 mm (= remainder = “fine fraction”), the sample is additionally re-sieved with the 1.18 mm sieve in the sieve tower and the proportion of “fine fraction” (< 1.18 mm) is also determined. This fine fraction is not to account for more than 3 % of the total sample.

*Measuring kernel processing*

The level of kernel processing is assessed by analysing sub-samples that are taken during each test version. The analysis is carried out at the lab and assessed for the so-called CSPS index (Corn Silage Processing Score according to USDA Forage Research Center).

## Detailed account of the test results

### Throughput and fuel economy

The test was carried out in Hungary in September 2023. During the measurement, the dry matter contents of the crop measured with the NIR sensor on the forager to determine throughput and fuel consumption ranged from 29.3 % to 35.0 %. Growth heights in the test averaged 3.15 m (“Konsens” variety from KWS).

The test results are illustrated in Figures 6 to 8 and Table 4.

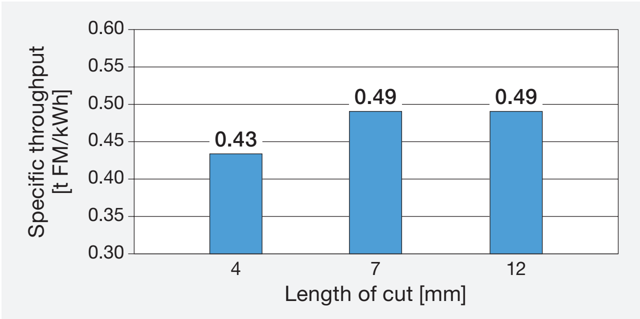


*Figure 7:*
*Specific throughput in t FM/kWh*

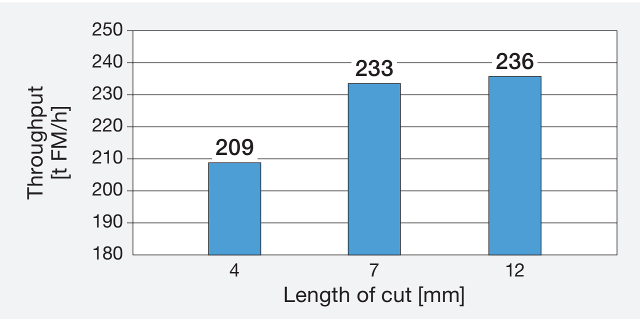


*Figure 6:*
*Throughput in t FM/h*

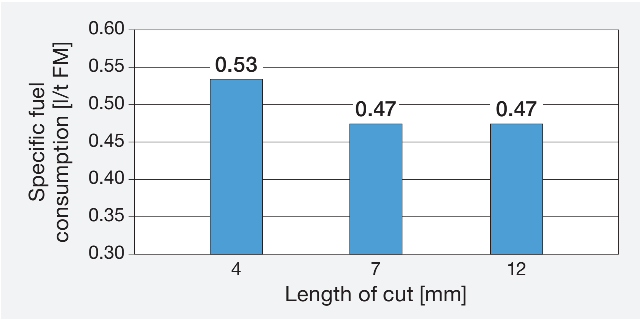


*Figure 8:*
*Specific fuel consumption in l/t FM*

*Table 4:*
*Throughput and fuel economy*

| Nominal length of cut [mm] | Throughput [t FM/h] | Fuel consumption [l/h] | Specific fuel consumption [l/t FM] | Specific throughput [t FM/kWh] |
|---|---|---|---|---|
| 4 | 209 | 111 | 0.53 | 0.43 |
| 7 | 233 | 111 | 0.47 | 0.49 |
| 12 | 236 | 111 | 0.47 | 0.49 |

As the theoretical chop length increased from 4 mm to 7 mm, the fresh mass throughput increased from 209 to 233 tonnes of fresh mass per hour. As the chop length increased from 7 mm to 12 mm, there was a further increase in throughput by 3 tonnes per hour to 236 tonnes of fresh mass per hour. As the chop length increased from 4 mm to 7 mm, the specific throughput [t FM/kWh] increased from 0.43 to 0.49 tonnes

FM/kWh and remained at this level for a chop length of 12 mm (Figures 6 and 7). The fuel consumption rates of 111 litres per per operating hour were unchanged for all pre-set chop lengths. Therefore, the specific fuel consumption tends to drop when throughput increases. This lies between 0.47 and 0.53 litres per tonne of harvested fresh mass - which is low on the whole (Figure 8).

### Technical quality of chop

The test runs for determining the technical quality of chop were also carried out on test fields in Hungary in September 2023. Dry matter contents in the lower DM content level ranges from 34.1 % and 34.7 % and in the higher content level from 47.8 % to 52.5 %.

*Particle size distribution (V-Max drum)*

The results of the particle size distribution test (using the V-Max drum) are shown in Figures 9 and 10.

The graph shows clearly that preselecting a different length of cut on the forager has a clear effect on the chop length distribution in the harvested material. Changes in the settings on the forager result in significant shifts in the weight fractions of the different sieve fractions in the desired direction.

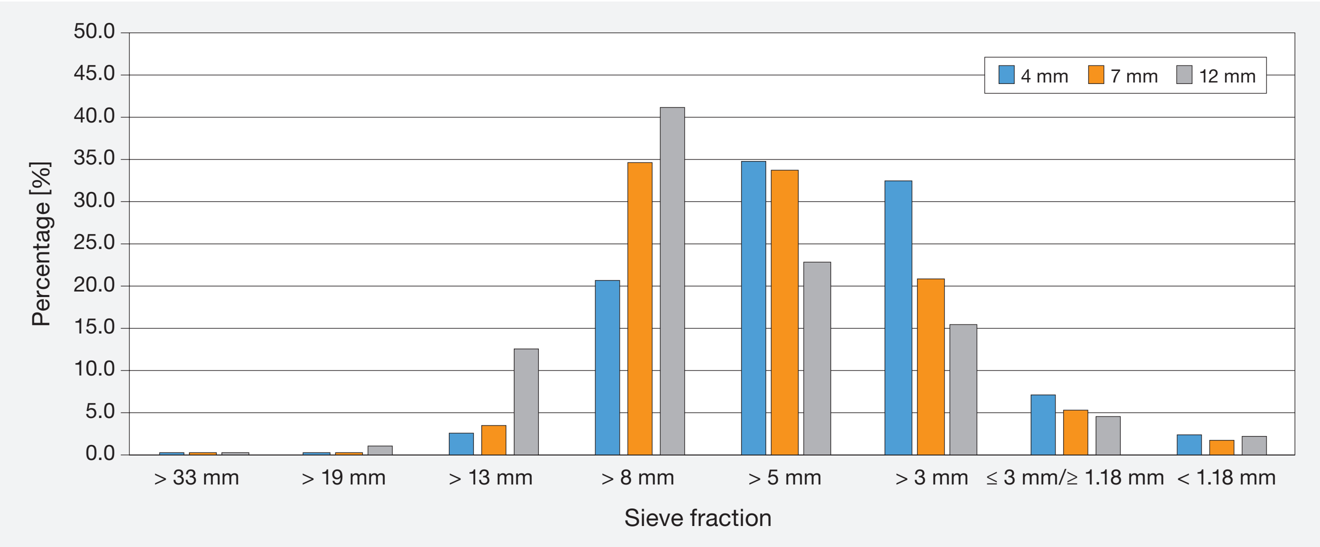


*Figure 9:*
*Particle size distribution in the lower dry matter content level (30.1-31.1 % DM) using the V-Max drum and 125/125 kernel processor (40 % speed difference)*

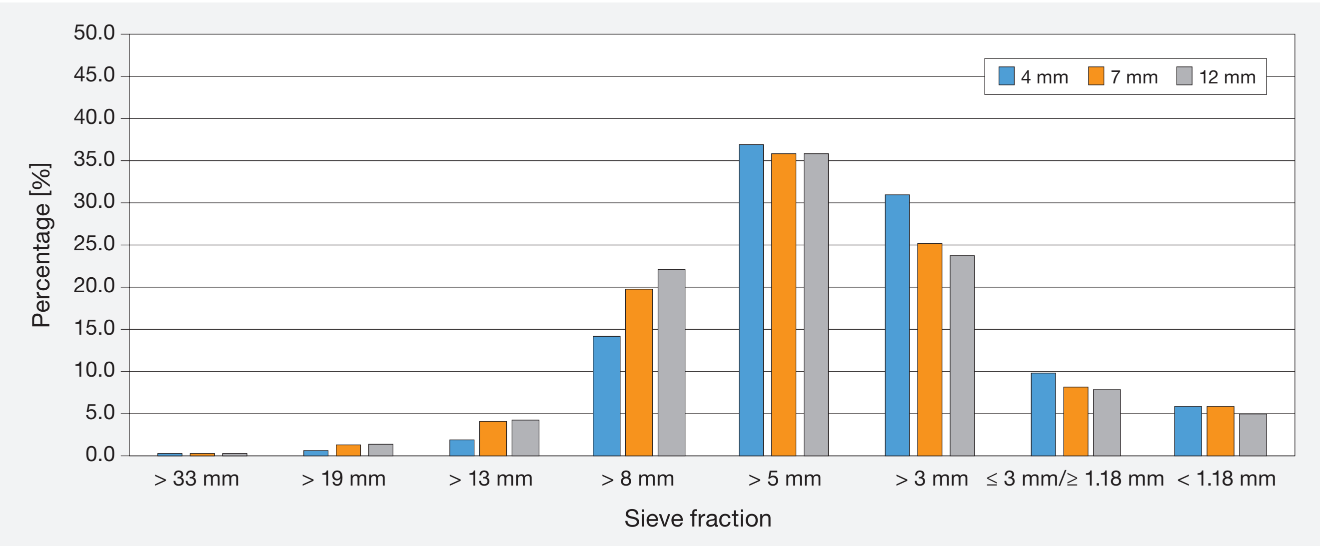


*Figure 10:*
*Particle size distribution in the higher dry matter content level (47.8-52.5 % DM) using the V-Max drum and 125/125 kernel processor (40 % speed difference)*

With a preselected theoretical chop length of 4 mm, nearly 68 % by weight is found in the two sieve fractions > 3 mm and > 5 mm. When the LOC is increased, the total number of particles in these two sieve fractions decrease as desired. For example, with the LOC set to 7 mm, this percentage dropped to 55 % and the accumulated > 5 mm and > 8 mm became the largest fractions at around 68 %; the setting effects are therefore pronounced. The setting effect when comparing the preselected chop lengths of 7 mm and 12 mm is clearly evident in the lower dry matter content level. With the setting to a theoretical chop length of 12 mm, the proportion in the sieve fraction > 13 mm increases significantly. The effect is less pronounced in the higher dry matter content level.

Regardless of the dry matter content level of the material, the percentages in the sieve fractions between > 19 mm and > 33 mm accounted for only a small portion (0.0 % to 1.3 %). Comparatively high weight percentages of fine particles (< 3 mm) are found in both dry matter content levels. In the higher dry matter content level, this can be attributed to the comparatively high dry matter content of the crop (up to 53 %). In the lower dry matter content level, at 5.6 percent by weight, lower percentages of fine particles are found than in the higher dry matter content level, at 8.5 percent by weight.

According to the recommendations of the Germany Society for Nutritional Physiology (GfE), the desired upper limit of 3 % by weight for the determine portions of ultra-fine particles (< 1.18 mm) is not exceeded in the lower dry matter content level and is slightly exceeded in the higher dry matter content level. As already mentioned above, this is due to the degree of maturity of the crop (DM content up to 53 %).

*Particle size distribution (comparison of V-Max drum to new V-Flex drum)*

Furthermore, during the DLG test, the V-Max drum was compared with the new V-Flex drum in terms of chop quality with a higher dry matter content. The results of the chop quality produced when using the V-Flex drum are shown in Figure 11.

The new V-Flex drum produced a higher proportion of desired chopped particles when the two chop lengths of 7 mm and 12 mm were preselected. With a chop length of 4 mm, no differences were found between the two drums with regard to the desired particle length.

At the set chop lengths of 4 mm and 7 mm, the proportions of overlengths (> 33 mm and > 19 mm) were lower for the V-Flex drum (compared to the V-Max drum). With a set chop length of 12 mm, the overlengths of the two drums compared were at the same level.

At the set chop lengths of 4 mm and 12 mm, the proportions of fine (< 3 mm) and ultra-fine fractions (< 1.18 mm) were higher for the V-Flex drum (compared to the V-Max drum). With a set chop length of 7 mm, the fine and ultra-fine fractions were at a uniform level.

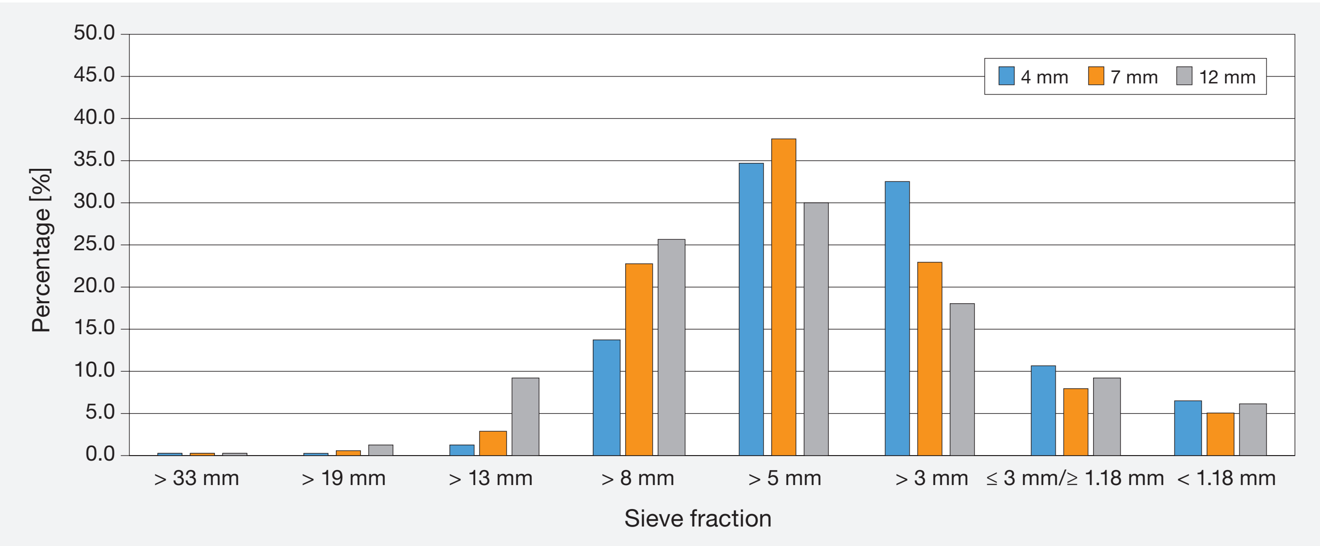


*Figure 11:*
*Particle size distribution in the higher dry matter content level (46.9-53.0 % DM) using the V-Flex drum and 125/125 kernel processor (40 % speed difference)*

**CSPS (Corn Silage Processing Score)**

The CSPS index for the samples was determined in the laboratory to describe the degree of kernel preparation (Figure 12).

In this test, the higher CSPS values were achieved at the higher dry matter content level. An influence of the preselected chop length on the CSPS value cannot be determined.

According to MERTENS (2005) and LUFA NRW, very good kernel preparation rates are achieved across all chop length presettings in both dry matter content levels.

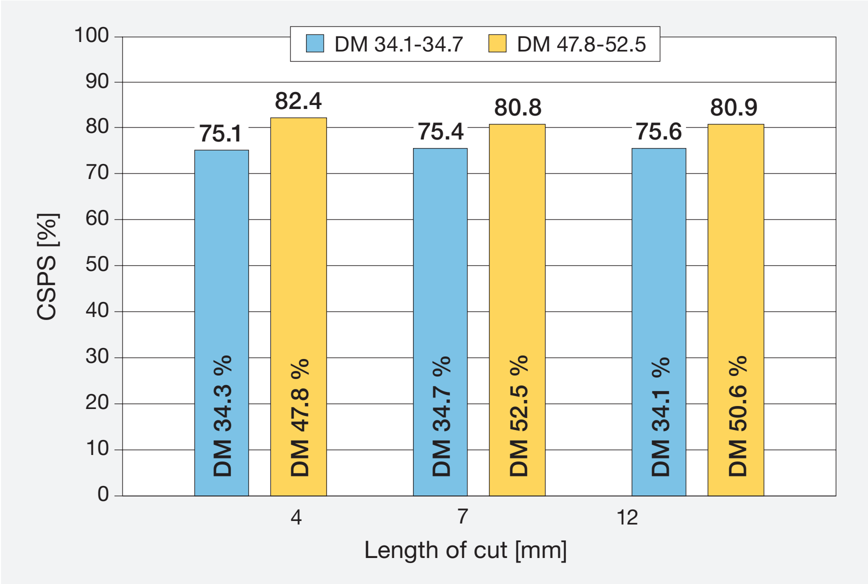


*Figure 12:*
*CSPS index for describing efficacy of kernel processing*

## Summary

In the DLG test, the Claas Jaguar 960 forage harvester (model year 2023) in the tested specification achieved a throughput of 236 tonnes of fresh mass per hour at a theoretical chop length of 12 mm and 209 tonnes of fresh mass per hour at a theoretical chop length of 4 mm. At the same time, specific fuel consumption in litres per tonne of harvested fresh mass was at a low level across all setting variants, with values between 0.47 l/t (12 mm) and 0.53 l/t (4 mm).

The test shows clearly that preselecting a different length of cut on the forager has a clear effect on the chop length distribution in the harvested material. The chop length proportions shift accordingly. Regardless of the moisture contents of the material, overlengths (> 33 mm and > 19 mm) accounted for only a small portion. Comparatively high weight percentages of fine particles (< 3 mm) are found in both dry matter content levels. According to the recommendations of the Germany Society for Nutritional Physiology (GfE), the desired upper limit of 3 % by weight for the determine portions of ultra-fine particles (< 1.18 mm) is not exceeded in the lower dry matter content level and is slightly exceeded in the higher dry matter content level. This is due to the degree of maturity of the crop (DM content up to 53 %).

In this DLG test, the V-Max drum was compared with the new V-Flex drum. The V-Flex drum (compared to the V-Max drum) tended to produce higher proportions of desired chopped particles, lower proportions of overlengths and higher proportions of fine and ultra-fine particles.

According to MERTENS (2005) and LUFA NRW, very good kernel preparation rates are achieved across all chop length presettings.

Based on these results, the self-propelled Claas Jaguar 960 forage harvester is awarded the “DLG APPROVED” quality mark for the individual test criterion “Functionality and quality of work on silage maize”.

## Further information

### Testing agency

DLG TestService GmbH, Groß-Umstadt location, Germany

The tests are conducted on behalf of DLG e.V..

### Department

Agriculture

### Division head

Dr. Ulrich Rubenschuh

### Test engineer(s)

Dipl.-Ing agr. Georg Horst Schuchmann*

### Photos and graphics

DLG and Claas

* Author

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As one of the leading organisations in the agricultural and food market, DLG organises international trade fairs and events in the specialist areas of crop production, animal husbandry, machinery and equipment for farming and forestry work as well as energy supply and food technology. DLG's quality tests for food, agricultural equipment and farm inputs are highly acclaimed around the world.

For more than 130 years, our mission has also been to promote dialogue between academia, farmers and the general public across disciplines and national borders. As an open and independent organisation, our network of experts collaborate with farmers, academics, consultants, policymakers and specialists in administration in the development of future-proof solutions for the challenges facing the agriculture and the food industry.

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Internal DLG test code: 2307-0027



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