DLG Test Report 7093

Amazonen-Werke H. Dreyer GmbH & Co. KG

6-row precision drill Amazone Precea 4500-2CC Super

with the Precis fertiliser metering system

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Overview

A test mark „DLG-APPROVED for individual criteria“ is awarded for agricultural products which have successfully fulfilled a scope-reduced usability testing conducted by DLG according to independent and recognised evaluation criteria. The test is intended to highlight particular innovations 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 DLG. They correspond to the recognised rules of technology, as well as scientific and agricultural knowledge and requirements. The 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 date of awarding.

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AMAZONEN-WERKE
PRECEA 4500-2CC SUPER
✓ **Working quality incl. crosswise fertiliser distribution**
DLG Test Report 7093

In 2020, the 6-row Amazone Precea 4500-2CC Super maize drill complete with the Precis fertiliser metering system was subjected to the DLG partial test on “Working quality including crosswise fertiliser distribution”. The test comprised a lab test and a field test. In each test version the machine drilled three maize varieties and DAP fertiliser.

The lab test tested the distribution of seeds along the rows (accuracy of seed placement and distribution) and the distribution of fertiliser across the rows on the stationary machine, simulating forward speeds between 6 km/h and 12 km/h.

The field test was carried out on 29 July 2020. The field was flat and the forward speeds ranged between 6 km/h and 12 km/h. The seedbed was described as sufficiently consolidated. The distribution of plants along the rows (accuracy of eventual crop spacing, accuracy of seed distribution) and field emergence were evaluated on 11 August 2020 by using the DLG-owned mobile spacing meter. These measurements were subsequently evaluated statistically.

Apart from these tests, further measurements were taken at forward speeds of 15 km/h both at the lab and in the field without assessing these results.
At 15 km/h the machine produced the minimum quality of work for obtaining the DLG test seal in the field test yet not in the lab test.

No further criteria came to the test

Assessment in brief

The lab test

In the lab test, the standard deviations that were computed from the seed spacing measurements were found to be "good" and "satisfactory".

The percentages of doubles and gaps were found to be "very low".

The distribution of fertiliser across rows in all 20 test variants was rated as "very good" to the DLG evaluation grid. The deviation of the actual fertiliser rate from the set (target) rate ranged between -1.9 % (slightly smaller than the target rate) and 2.6 % (slightly higher than the target rate).

The field test

In the field test, the accuracy of eventual crop spacing was assessed as 'very good' in all instances with one exception. Field emergence of all six varieties was assessed as 'very good'. This ranged between 94.5 % and 98.0 %, which is identical with the ability to germinate for the crops. The percentages of target spacings were between 93.2 % and 97.5 %. The percentages of doubles ranged between 0.3 % and 2.2 %. The percentages of gaps ranged between 1.9 % and 5.1 %.

The performance of the 6-row Amazone Precea 4500-2CC Super precision drill with Precis fertiliser metering system was impressive in the test which was conducted by criteria laid down in the DLG test framework. Based on these test results, the precision drill is awarded the DLG APPROVED quality mark in the test module "Working quality including cross-wise fertiliser distribution" for work rates of up to 12 km/h.

Table 1:
Overview of results

QUALITY PROFILE TO DLG STANDARDS		Evaluation*
Quality of work as the sole criterion		
Lab test	Plant distribution along rows	✓
	Fertiliser distribution across rows	✓
Field test	Plant distribution along rows	✓
	Field emergence	✓

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

The Product

Manufacturer and applicant

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Am Amazonenwerk 9-13, 49205 Hasbergen-Gaste, Germany

The product:
6-row precision drill
Amazone Precea 4500-2CC Super
with Precis fertiliser metering system

Description and technical data

The machine that came to the test was the 6-row Precea 4500-2CC Super precision drill with Precis fertiliser metering system from Amazone. According to the manufacturer, the machine is suitable for drilling into ploughed, min-till and no-till soils. For use in no-till schemes, the manufacturer reco mmends opting for hydraulic coulter pressure control.

6-row Amazone Precea 4500-2CC Super precision drill

The six sowing units are mounted to The sowing unit on a Amazone PreTeC 4500-2CC Super precision was specified an H-section bar and are controlled by a parallelogram frame. Each sowing unit on the test machine had a 55-litre seed box and 17-litre micro granule box. 70-litre seed boxes are available as an option. A double-disc coulter runs ahead of the sowing unit, placing the granules at a deeper depth than the seeds. The fertiliser coulter is followed by the double-disc seed coulter that cuts the seed slot. A furrow former is arranged between the two discs that make up the double-disc seed coulter. This furrow former reconsolidates and levels the seed slot, ensuring the seeds are placed with precision for uniform emergence. The furrow former is followed by a small tube that delivers the seeds from the sowing unit. The seeds are caught by the catcher roller which presses them into the seed slot. Controlled with precision, the roller is in full contact with the bottom of the groove, ensuring an optimum soil seed contact. The catcher roller is followed by two closing wheels.

The sowing unit itself is depth-controlled by two depth wheels. Seed depth, firming roller pressure and the ground pressure of the sowing unit are controlled manually by adjusting the specific levers without tools.

Figure 2:
The sowing units in working position

Figure 3:
The sowing units in transport position

Figure 4:
A sowing unit viewed from the side

The seed singling system is operated by air. The seeds are pressed into the holes in the electric seed singling disc. They remain here for three quarters of a turn in the opposite sense to the direction of travel. The holes in the singling disc are covered by a roller. The effect of this is that the seeds drop from the disc passing an optical sensor before they enter the delivery tube and shoot down into the seed slot.

SmartControl

The seed singling unit comprises a stripper that is split into three fingers. The test machine allowed operators to adjust the exact position of these stripper fingers from the cab-based terminal. The optical sensor and the fact that the sensor data are assessed statistically make it is possible to optimise the position of the stripper in such a way that doubles and gaps are minimised, says the company.

The percentages indicating target spacings, doubles and gaps are displayed on the terminal screen. In addition, the coefficient of variation and the standard deviation from target is constantly being computed and displayed to the driver.

To set up the drill, the operator enters either the target spacing or the target number of plants per hectare.

In general, the work rate of the seed singling unit is automatically adapted to the forward speed of the tractor which is supplied either by a GPS receiver or a radar speed sensor and supplied to the unit via the ISOBUS.

Amazone offers a choice of three seed singling discs for drilling maize:

- a green disc with 42 holes of 5 mm diameter
- a purple disc with 42 holes of 5.5 mm diameter
- a beige disc with 42 holes of 4.5 mm diameter

The Amazone drill can be specified with an automatic GPS-based shut-off system for the sowing units. When the tractor drill combination is approaching a skewed headland, the six seed singling units and the fertiliser and micro granule metering system switch off automatically one after the other.

Figure 5:
The Amazone AmaTron4 operator terminal was used in the test

Precis fertiliser metering system

The Precis fertiliser metering system is available with either a 950-litre or a 1,250-litre fertiliser tank. The filling level inside this tank is determined by two standard-fit contents sensors on the right and left hand side of the tank. Apart from that, the fertiliser tank has two inspection windows both in the front and rear wall.

The application rate is metered per row by means of a separate metering unit. The six metering units on the test machine were driven by one central electric motor. This specification allows operators to close the slides manually. The slides control the supply of granules from the tank to the metering units (which is important when drilling in water catchment areas, for example). Each row can also be specified with a separate electric motor to shut off individual rows. This motor is powered from the tractor's ISOBUS socket.

The cyclical speed of the metering unit is matched to the forward speed of the tractor. On our test machine, the forward speed was determined by the tractor-mounted GPS receiver and supplied to the drill via the ISOBUS.

Figure 6:
The FerTeC double-disc coulter for fertiliser

The granules that are metered from the tank into the individual sowing units are injected into the air flow from the blower. The company says this eliminates blockages and ensures an optimum distribution across rows. The granules are delivered through flexible plastic hoses to the FerTeC double-disc coulters that run ahead of each sowing unit, placing them 5 cm off the seed row. The depth is adjusted manually and separately on each individual coulter. For this the drill is supplied with a 24inch ratchet which is stored on the machine and hence readily at hand.

For calibration testing, operators fold the guide plate into a different position and fix the two calibration trays in their calibrating positions. Then they enter the fertiliser application parameters (e.g. forward speed, application rate, hectares calibrated) into the terminal (AmaTron 4). After that, calibration testing is started and the granules drop into the calibration tray. After that, the operator removes the two trays, pulling them conveniently out to the side and pouring the granules into the foldable bucket and weighing the sample with scales. The bucket and sales are standard items. The result is entered to the terminal.

The drill is also available with the so-called TwinTerminal as an option. This is mounted on the left hand side of the machine and allows operators to enter calibration data from the ground rather than having to mount the tractor each time. In the future, the drill will have a Bluetooth so operators can also enter the data to a cell phone app.

The drill is equipped with lights that are suitable for travel on public roads. Work lights and internal tank lights are options.

Further options include the ability to use application maps for drilling seeds, granules and micro granules.

The Method

The DLG test on “Working quality including crosswise fertiliser distribution” is carried out at the lab (lab test) and in the field (field test).

The lab test

The lab test measures the accuracy of placement and distribution of seeds in direction of travel plus the distribution of fertiliser across the direction of travel at various forward speeds that are simulated on the stationary drill. The results are assessed using the DLG test framework for precision drills.

Accuracy of maize seed placement and distribution

To determine the accuracy of seed placement and distribution the testers install optical sensors to the seed outlet on the sowing unit. This sensor technology measures the spacing between the individual seeds. Each test series consists of four test runs with each run containing 250 seed spacings resulting in a total number of 1,000 spacings per test series.

These 1,000 spacing measurements are used to determine the accuracy of seed placement by computing the standard deviation (after correcting the doubles and missed areas). The result is assessed according to the current DLG test framework for precision drills. The standard deviation expresses the level of consistency of actual seed spacings. The smaller the standard deviation figure, the more uniform are the seeds spaced within the row.

Furthermore, the testers also use these 1,000 measurements to determine and assess the accuracy of distribution (percentages of target spacings, doubles and gaps).

Table 2:
Accuracy of seed distribution

Accuracy of seed distribution	
Percentage of doubles [%]	< 0.5 times the actual spacing
Percentage of target spacings [%]	> 0.5 to < 1.5 times the spacing of the actual spacing
Percentage of missed areas [%]	> 1.5 times the spacing of the actual spacing
– one miss [%]	> 1.5 to < 2.5 times the spacing of the actual spacing
– two misses [%]	> 2.5 to < 3.5 times the spacing of the actual spacing
– three misses [%]	> 3.5 to < 4.5 times the spacing of the actual spacing
– four misses [%]	> 4.5 times the spacing of the actual spacing

In the lab test, all settings of the precision drill are logged (e.g. under/overpressure, metering disc fitted, stripper position).

Fertiliser distribution across the direction of travel and accuracy of fertiliser metering

The distribution of fertiliser across rows is determined with the machine parked up and the sowing units raised out of work while simulating various ground speeds and application rates. The granules are collected in a box that is placed under each coulter. Then the granules collected are weighed and used to compute the coefficient of variation (CoV). The smaller the coefficient of variation the more uniform is the fertiliser application across the work width. The computed coefficient of variation is then referenced to the DLG test framework and evaluated.

The test aims at determining the distribution of fertiliser across rows and the difference between target and actual fertiliser rate.

In addition to this, the bulk density of the fertiliser, the temperature and the humidity in the test hall are measured.

The field test

Accuracy of eventual crop spacing, distribution and field emergence

The DLG test on 'working quality' requires that at least three different maize varieties of different types of kernels and various ground speeds are drilled in the test. It is good practice to carry out the test in two different fields. Before and during the test the field history (previous crop, previous tillage scheme), the conditions at the time of drilling and the ground speeds are documented. The individual plots are marked out indicating the individual seed varieties sown here and a detailed test plan is drawn up.

The varieties sown are specified by variety, kernel type, breeder and thousand grain weight.

Soil samples are taken on the day the sowing takes place to determine the moisture levels in the seed placement layer and give an account of the test conditions. The soil moisture is determined to DIN 18121 standards.

The ability to germinate is determined in a lab test.

The accuracy of fertiliser placement in the soil is determined by taking random samples during work.

Then, 2-4 weeks after seeding, the spacings between the young plants are measured using a mobile distance meter. To do this, 4 x 250 crop spacings are measured in each seed row and each test version (= 1,000 spacings). One test version is defined by drilling one maize variety at a specific forward speed.

The spacings measured are then used to compute the accuracy of eventual crop spacing and distribution and field emergence. As a next step, the accuracy of eventual crop spacing and field emergence are referenced to the DLG test framework and given an assessment. The number of target spacings, doubles and missed areas are not assessed in the field test, because missed areas might be attributed to birds or the quality of seed bed preparation.

The drill dimensions are also measured in the test.

Detailed account of the test results

The following discusses the results of the lab test and the field test including the assessments.

The lab test

Accuracy of maize seed placement and distribution

The DLG lab test determined the placement and distribution accuracy of the following three maize varieties:

- Chiller from KWS (small round kernels; 255 g thousand grain weight)
- Bravissimo from KWS (big round kernels; 358 g thousand grain weight)
- Damario from KWS (tooth-shaped kernels; 351 g thousand grain weight)

The test on placement and distribution accuracy was carried out by simulating the following forward speeds: 6 km/h, 9 km/h and 12 km/h. The target seed spacing was 14 cm. This was entered to the machine terminal (14 cm is equivalent with 75 cm row spacings and 95,240 plants per hectare).

Table 3 shows the lab measurements on accuracy of seed placement and accuracy of distribution. The standard deviation, which expresses the level of consistency in actual seed spacing, ranges between 11.21 mm and 18.46 mm. The accuracy of seed placement at speeds of 6 km/h and 9 km/h was mostly assessed as 'good'. At 12 km/h, the accuracy of placement was 'satisfactory' in all three varieties.

Figure 7 shows the computed standard deviations as determined for the various forward speeds. The diagram shows that the following tendency was found in all three varieties: the standard deviation increases when forward speed increases. This means that the seed spacings become less uniform. The standard deviation of Bravissimo variety (big round seeds) was not as large compared with Damario (tooth shaped seed), which translates into more uniform spacings.

Table 3 shows the percentages for target spacings, doubles and gaps. In all tests the percentage of doubles was between 0 % and 0.1 % (very low). In all tests the percentage of gaps was between 0 % and 0.3 % (very low). The percentages of gaps in Chiller (small round kernels) were lower than those of the other two varieties. The percentages of target spacings were between 99.6 % and 100 %. This applies to all lab test runs at all forward speeds and all varieties.

In addition, all three varieties were lab tested also at 15 km/h. In these tests, the drill was found to produce a standard deviation of 21.24 mm, 0 % of doubles and 0.2 % of gaps when drilling Chiller. Drilling Bravissimo, the standard deviation was 20.83 mm, the percentage of doubles was 0 % and that of gaps 0.2 %. For Damario, the standard deviation was 22.87 mm, the percentage of doubles 0.1 % and the percentage of gaps 0.4 %.

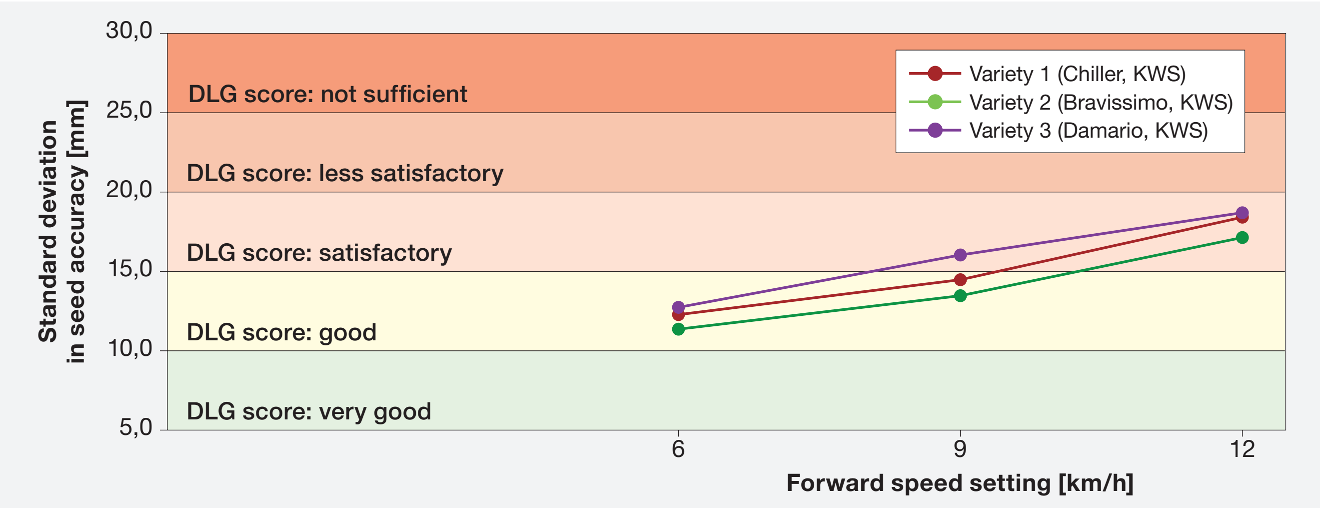

Figure 7:
The graph shows the standard deviation of all three maize varieties relative to forward speed as determined in the lab test

Table 3:
The results on placement accuracy and accuracy of distribution (lab test)

Maize variety and forward speed	Singling disc	SD* [mm]	SD assessment*	Doubles [%]	Assessment of doubles	Target spacings [%]	Gaps (one miss) [%]	Gaps (two misses) [%]	Gaps (three misses) [%]	Gaps (four misses) [%]	Assessment of gaps	Target spacing [mm]	Actual spacing [mm]
Chiller, 6 km/h	green	12.10	good	0.0	very low	100.0	0.0	0.0	0.0	0.0	very low	140	140.54
Chiller, 9 km/h	green	14.29	good	0.0	very low	99.9	0.1	0.0	0.0	0.0	very low	140	140.49
Chiller, 12 km/h	green	18.23	satisfactory	0.0	very low	100.0	0.0	0.0	0.0	0.0	very low	140	140.49
Bravissimo, 6 km/h	purple	11.21	good	0.0	very low	99.7	0.3	0.0	0.0	0.0	very low	140	140.59
Bravissimo, 9 km/h	purple	14.18	good	0.1	very low	99.7	0.2	0.0	0.0	0.0	very low	140	140.37
Bravissimo, 12 km/h	purple	16.97	satisfactory	0.0	very low	99.9	0.1	0.0	0.0	0.0	very low	140	140.28
Damario, 6 km/h	purple	12.55	good	0.1	very low	99.9	0.0	0.0	0.0	0.0	very low	140	140.54
Damario, 9 km/h	purple	15.86	satisfactory	0.0	very low	100.0	0.0	0.0	0.0	0.0	very low	140	140.49
Damario, 12 km/h	purple	18.46	satisfactory	0.1	very low	99.6	0.3	0.0	0.0	0.0	very low	140	140.43

Assessment of standard deviations in the lab test:
≤ 10 mm = very good / > 10 - 15 mm = good / > 15 - 20 mm = satisfactory / > 20 - 25 mm = less satisfactory / > 25 mm = not sufficient

Assessment of doubles und missed areas:
≤ 0.5 % = very low / > 0.5 - 2.5 % = low / > 2.5 - 5 % = tolerable / > 5 -7.5 % = high / > 7.5 % = very high

* = Standard deviation (SD)

The singling pressure was set to 45mbar in all tests.
The seed slider was set to position 3 in all Chiller tests.
The seed slider was set to position 4 in all Bravissimo and Damario tests.

Fertiliser distribution across the direction of travel

The following fertiliser rates and work rates were applied in the DLG tests:

- 60 kg DAP fertiliser/ha at 6, 9, 12 and 15 km/h (nominal area covered: 0.5 hectare)
- 120 kg DAP fertiliser/ha at 6, 9, 12 and 15 km/h (nominal area covered: 0.5 hectare)
- 200 kg DAP fertiliser/ha at 6, 9, 12 and 15 km/h (nominal area covered: 0.2 hectare)
- 250 kg DAP fertiliser/ha at 6, 9, 12 and 15 km/h (nominal area covered: 0.2 hectare)
- 300 kg DAP fertiliser/ha at 6, 9, 12 and 15 km/h (nominal area covered: 0.2 hectare)

The test on the distribution of fertiliser across the rows was carried out with DAP fertiliser (18 % nitrogen and 46 % phosphate). The fertiliser was supplied in the form of granules of a 937g/dm3 bulk density. The measurements were carried out in a hall at temperatures between 19.9 °C and 21.7 °C with relative humidity ranging between 43.7 % and 56.7 %.

Table 4 shows the coefficient of variation that was achieved for the distribution of fertiliser across rows and the difference between the target and actual rate achieved in the lab test.

The coefficient of variation on the quality of fertiliser distribution across the direction of travel as determined in 20 tests ranged between 0.2 % and 0.7 %. This leads to a distribution of fertiliser across rows that is 'very good' (++) in all aspects.

Table 4:
The test results on fertiliser distribution across rows and accuracy of fertiliser metering (lab test)

Target application rate setting [kg/ha]	Forward speed [km/h]	Area covered [ha]	Actual application rate [kg/ha]	Difference between target and actual rate [%]	CoV	Evaluation* of this CoV
60	6	0.5	61.54	2.6	0.7	++
60	9	0.5	60.95	1.6	0.5	++
60	12	0.5	60.59	1.0	0.6	++
60	15	0.5	60.22	0.4	0.5	++
120	6	0.5	121.23	1.0	0.4	++
120	9	0.5	119.79	-0.2	0.3	++
120	12	0.5	118.93	-0.9	0.3	++
120	15	0.5	118.38	-1.4	0.3	++
200	6	0.2	200.93	0.5	0.4	++
200	9	0.2	199.50	-0.3	0.2	++
200	12	0.2	198.41	-0.8	0.3	++
200	15	0.2	197.24	-1.4	0.3	++
250	6	0.2	250.42	0.2	0.4	++
250	9	0.2	248.28	-0.7	0.3	++
250	12	0.2	246.80	-1.3	0.3	++
250	15	0.2	245.17	-1.9	0.3	++
300	6	0.2	301.75	0.6	0.5	++
300	9	0.2	299.12	-0.3	0.4	++
300	12	0.2	296.63	-1.1	0.4	++
300	15	0.2	295.98	-1.3	0.4	++

* CoV evaluation scheme: ≤ 3 % = ++/≤ 6 % = +/≤ 10 % = ○/> 10 % = –

Fertiliser metering accuracy

The deviation between the set (target) and actual fertiliser rate was found to range between -1.9 % and 2.6 % (Table 4). Some of the rates were negative, because in some test runs the target rate was smaller than desired. The highest deviation was 2.6 % and was achieved at a target rate of 60 kg DAP at 6 km/h.

The field test

Accuracy of eventual crop spacing, distribution and field emergence

The soil in the test field is sandy humus (22 soil value points). After a crop of winter barley was harvested on 17 July 2020 (yielding 6.81t/ha, straw harvested), the field was cultivated by an Amazone Catros 7003-2TX disc harrow at a depth of 3 cm on 20 July 2020. On 24 July 2020, the test field received a 20 cm deep ploughing pass by an Amazone Cayron 200 VS with press. On 29 July 2020, the field was cultivated 6 cm deep by an Amazone KG 3001 rotary cultivator immediately before drilling the maize. The seedbed was described as sufficiently consolidated (Figure 8).

The following three maize varieties were drilled on 29 July 2020:

- Chiller (KWS), 255 g thousand grain weight, 95 % ability of germination as per LUFA lab analysis
- Bravissimo (KWS), 358 g thousand grain weight, 96 % ability of germination as per LUFA lab analysis
- Damario (KWS), 351 g thousand grain weight, 98 % ability of germination as per LUFA lab analysis

The varieties were sown at the following forward speeds: 6 km/h, 9 km/h and 12 km/h. Afterwards, the testers randomly sampled the seed rows to verify the accuracy of seed placement. Figure 9 shows an example of seed placement of Bravissimo at 12 km/h.

Figure 8:
The seedbed into which the crops were drilled

The fertiliser granules were placed in bands by a separate coulter. The testers verified the placement accuracy by taking random samples. They found that actual placement was identical with target placement (5 cm next to and 5 cm below the maize seeds).

There was no rainfall between 29 July 2020 (the date of drilling) and 11 August 2020, the date on which the crop spacings were evaluated. Although soil moisture levels were low on the day of seeding (12.9 %), it was found that thanks to capillary action the seeds had adequate access to moisture for germination. Amazone says, this is also attributed to the technical details of the sowing unit (for example, to the interaction of the furrow former and the catcher roller).

On 11 August 2020, the testers measured the spacings between the emerged crops. These results are shown in table 5.

Field emergence is always assessed as ‘very good’ in all test variants. This ranged between 94.5 % and 98.0 %, which is identical with the ability to germinate for the crops. The accuracy of eventual spacing of all varieties by forward speed and variety is assessed as ‘very good’ and ‘good’ with one exemption.

All standard deviations in eventual crop spacing in the field as related to the forward speed are shown in figure 11. This graph reflects the same trend for the field test as for the lab test: The crop spacings become less uniform as the work rate increases.

At 6 km/h and 9 km/h, the accuracy of eventual crop spacing is ‘very good’ without exception. At 12 km/h, the accuracy of eventual crop spacing by variety is ‘very good’ and ‘good’.

The percentages of target spacings were 93.2 % and 97.5 % in the test. (The percentages of doubles and gaps in the field are never assessed in a DLG field test.) The percentages of doubles in this test were between 0.3 % and 2.2 %. The percentages of gaps were 1.9 % and 5.1 % across all test runs (table 5). The Bravissimo and Damario maize varieties show that the percentages of gaps increased as forward speed increased.

Figure 9:
Uncovered Bravissimo seeds drilled at 12 km/h

The evaluation of the crop spacings on 11 August 2020 produced 45 gaps in the test field. These 45 gaps were uniformly distributed across all 9 varieties. In 40 out of these 45 gaps it was found that the individual seeds had been placed properly (89 %). The Amazone sowing unit had placed it accurately in the correct spot. The seeds uncovered in the gaps were found to have germinated but had ceased growing due to lack of water. Yet, no seeds were found in the other five gaps (out of 45) (11 %). Figure 10 shows the young plants on 11 August 2020 (Bravissimo drilled at 12 km/h).

All three maize varieties were also field tested at a work rate of 15 km/h. In these tests, the standard deviation was 27.26 mm, the percentage of doubles 0.7 %, that of gaps 4.8 % and the emergence rate was 95.4 % for Chiller. For Bravissimo, the standard deviation was 25.51 mm, the percentage of doubles was 1.0 %, the percentage of gaps 3.7 % and the emergence rate was 95.8 %. For Damario, the standard deviation was 28.55 mm, the percentage of doubles 2.6 % and the percentage of gaps 3.8 % and the field emergence rate was 95.9 %.

The dimensions of the test machine were also measured in the DLG test. All results are listed in table 6.

Figure 10:
Young Bravissimo plants drilled at 12 km/h, the Figure was taken on 11 August 2020

Table 5:
The test results on accuracy of eventual crop spacing, distribution and emergence (field test)

Maize variety and forward speed	Singling disc	SD* [mm]	SD assessment*	Doubles [%]	Target spacings [%]	Gaps (one miss) [%]	Gaps (two misses) [%]	Gaps (three misses) [%]	Gaps (four misses) [%]	Target spacing [mm]	Actual spacing [mm]	Field emergence [%]	Assessment of field emergence
Chiller, 6 km/h	green	20.20	very good	0.7	94.6	4.5	0.2	0.0	0.0	140	140.21	95.3	very good
Chiller, 9 km/h	green	21.58	very good	1.7	93.2	4.7	0.4	0.0	0.0	140	139.95	94.5	very good
Chiller, 12 km/h	green	24.75	very good	0.8	95.2	3.7	0.3	0.0	0.0	140	140.28	95.6	very good
Bravissimo, 6 km/h	purple	19.09	very good	0.6	97.5	1.9	0.0	0.0	0.0	140	140.05	98.0	very good
Bravissimo, 9 km/h	purple	19.84	very good	0.3	97.0	2.7	0.0	0.0	0.0	140	140.00	97.2	very good
Bravissimo, 12 km/h	purple	22.14	very good	0.5	96.4	3.1	0.0	0.0	0.0	140	140.45	97.0	very good
Damario, 6 km/h	purple	20.96	very good	1.1	96.7	2.1	0.1	0.0	0.0	140	140.28	97.6	very good
Damario, 9 km/h	purple	24.38	very good	2.2	95.0	2.8	0.0	0.0	0.0	140	139.54	96.6	very good
Damario, 12 km/h	purple	25.25	good	1.0	96.2	2.8	0.0	0.0	0.0	140	139.62	97.2	very good

Assessment of the standard deviations in the field:
≤ 25 mm = very good / > 25 - 30 mm = good / > 30 - 35 mm = satisfactory / > 35 - 40 mm = less satisfactory / > 40 mm = not sufficient

Assessment of field emergence in maize:
≥ 90 % = very good / 89 - 85 % = good / 84 - 80 % = satisfactory / 79 - 75 % = less satisfactory / < 75 % = not sufficient

* = Standard deviation (SD)

The singling pressure was set to 55mbar in all tests.
The seed slider was set to position 3 in all Chiller tests.
The seed slider was set to position 4 in all Bravissimo and Damario tests..

Table 6:
Dimensions of the tested maize drill

Dimensions	Measurement [m]
Drill length	2.34
Drill height (without bout marker)	2.11
Drill height (with bout marker)	2.48
Drill width in transport position	2.86

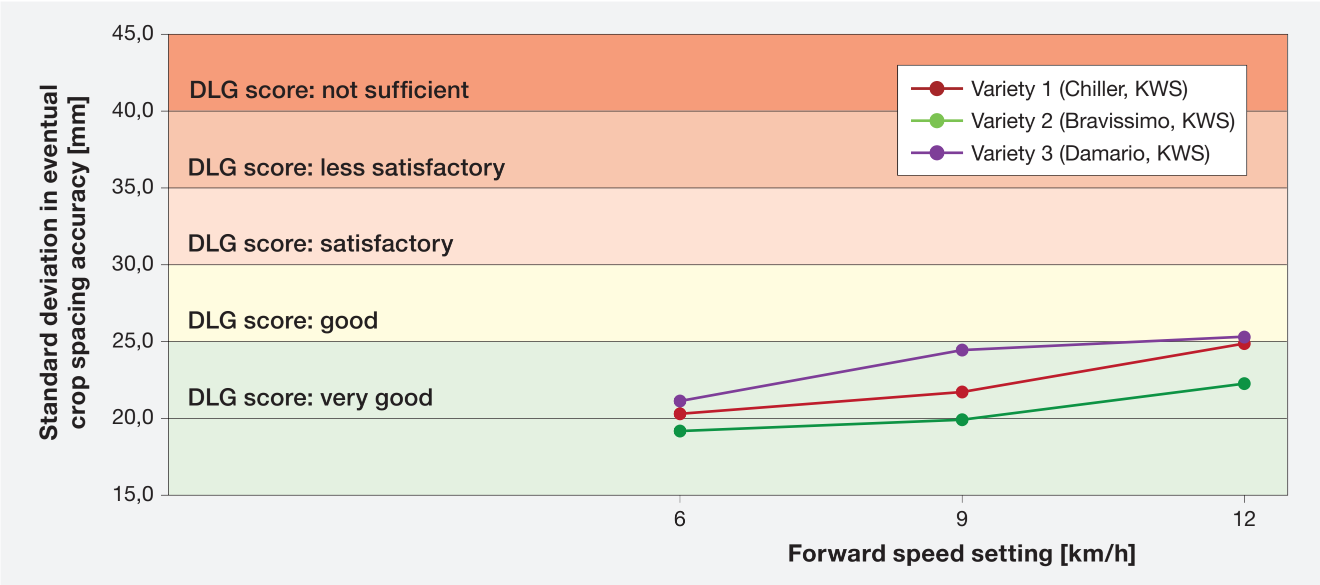

Figure 11:
The graph shows the field results of standard deviation in eventual crop spacing in all three varieties relative to the set forward speed

Summary

In the field test, the 6-row Amazone Precea 4500-2CC Super precision drill achieved a 'very good' and 'good' accuracy in eventual crop spacing by maize variety even when drilling at work rates of 12 km/h. Field emergence is always assessed as 'very good' in all test variants. These ranged between 94.5 % and 98.0 %, which equates the ability to germinate of this crop. The percentages of target spacings were between 93.2 % and 97.5 %. The percentages of double were between 0.3 % and 2.2 %. The percentages of gaps were between 1.9 % and 5.1 %.

In the lab tests, the percentages of doubles and gaps were found to be 'very small'. The distribution of fertiliser across rows in all test variants was rated as 'very good'.

Based on these test results, the 6-row Amazone Precea 4500-2CC Super with Precis fertiliser metering system is awarded the DLG APPROVED quality mark in the partial test "Working quality including crosswise fertiliser distribution" 2020 at work rates of up to 12 km/h.

Further information

Testing agency

DLG TestService GmbH, Gross-Umstadt location

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

DLG test framework

Precision drills (date of issue 04/2016)

Department

Agriculture

Head of Department

Dr. Ulrich Rubenschuh

Test engineer(s)

Dipl.-Ing. agr. Georg Horst Schuchmann *

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* Author

DLG – the open network and professional voice

Founded in 1885 by the German engineer Max Eyth, DLG (Deutsche Landwirtschafts-Gesellschaft – German Agricultural Society) is an expert organisation in the fields of agriculture, agribusiness and the food sector. Its mission is to promote progress through the transfer of knowledge, quality standards and technology. As such, DLG is an open network and acts as the professional voice of the agricultural, agribusiness and food sectors.

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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The DLG Test Center Technology and Farm Inputs and its test methods, test profiles and quality seals hold a leading position in testing and certifying equipment and inputs for the agricultural industry. Our test methods and test profiles are developed by an independent and impartial commission to simulate in-field applications of the products. All tests are carried out using state-of-the-art measuring and test methods applying also international standards.

Internal test code DLG: 2006-025

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