DLG Test Report 7088

Fliegl Agrartechnik GmbH

Universal Spreader KDS 270 muck control

Muck distribution quality
Compost distribution quality
Poultry litter distribution quality
Digestate distribution quality

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Overview

FLIEGL
KDS 270 MUCK CONTROL
✓ Muck distribution quality
✓ Compost distribution quality
✓ Poultry litter distribution quality
✓ Digestate distribution quality
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The DLG APPROVED quality mark for ‘single, value-determining criteria’ is awarded to technical products that have passed a less comprehensive DLG usability test which is carried out and evaluated to independent and approved criteria. The purpose of this test is to highlight a product’s specific innovative and key features. The test is carried out to criteria that are laid down in the ‘DLG Full Test’ framework for technical products or may include further features and properties that confer a specific value to the product. DLG group of experts defines the minimum standards to be applied to the product and describes the test conditions and procedures as well as the criteria by which the test results are to be evaluated. These parameters reflect the acknowledged state of the art as well as scientific findings and agricultural insights and requirements. After a product has passed the test, a test report is produced and published and the quality mark is awarded to the product and will retain its validity for five years from the daate of award.

The Fliegl KDS 270 muck control universal spreader underwent DLG tests that assessed the quality of distribution in muck, compost, poultry litter and digestate. The machine’s spreading system comprises two wide-spreading discs and two horizontal beaters. The test examined the quality of distribution in muck (spread at rates of 10 t/ha and 30 t/ha), compost (5 t/ha and 25 t/ha), poultry litter (2.7 t/ha) and digestate (5 t/ha and 30 t/ha) by determining the quality of distribution across and along rows.

No other criteria were tested in this test.

Assessment – Brief Summary

In the DLG test, the Fliegl KDS 270 muck control achieved mostly very good (++) and good (+) results when applying all four products (muck, compost, poultry litter and digestate) across and along rows. Table 1 is a synopsis of all results.

Table 1:
The quality of distribution in muck, compost, poultry litter and digestate was determined by measuring the following parameters

	Product							
	Cattle manure		Compost		Poultry litter		Digestate	
Work width [m]	18	18	10	14	12	22	16	20
Target rate [t/ha]	10	30	5	25	2,7	2,7	5	30
Forward speed [km/h]	7,1	3,7	10,3	5,6	12,1	12,1	5,6	3,2
Distribution across rows								
– Coefficient of Variation (CoV) [%]*	14,5 (+)	14,7 (+)	13,9 (+)	14,4 (+)	8,9 (++)	19,3 (○)	7,9 (++)	14,7 (+)
Längsverteilung								
– Coefficient of Variation (CoV) [%]*	11,9 (+)	16,7 (○)	8,3 (++)	10,8 (+)	8,4 (++)	8,4 (++)	13,3 (+)	14,1 (+)
– Dilation within the tolerance zone [%]***	75,9 (++)	62,5 (+)	92,4 (++)	87,4 (++)	91,2 (++)	91,2 (++)	83,2 (++)	69,7 (+)

* In line with the DLG assessment scale that has been effective from May 2020 (distribution across rows): CoV > 15 % to ≤ 20 % = “○”; CoV > 10 % to ≤ 15 % = “+”; CoV ≤ 10 % = “++”

** In line with the DLG assessment scale that has been effective from May 2020 (distribution along rows): CoV > 15 % to ≤ 25 % = “○”; CoV > 10 % to ≤ 15 % = “+”; CoV ≤ 10 % = “++”

*** In line with the DLG assessment scale that has been effective from May 2020 (dilation within the tolerance zone): > 45 % = “○”; > 55 % = “+”; > 75 % = “++”

In May 2020, the DLG test commission on fertilisers and spreaders laid down revised and stricter standards for assessing the test results for this type of machinery. The revised standards reflect the technical progress that has been made in this field. These new standards supersede the previous standards applied by DLG in all its tests and in all DLG Test Reports prior to May 2020.

The Product

Manufacturer and Applicant

Fliegl Agrartechnik GmbH
Bürgermeister-Boch-Straße 1
84453 Mühldorf am Inn
Germany

The product:
Fliegl KDS 270 muck control universal spreader

Description and Technical Data

The Fliegl KDS 270 muck control is a universal spreader that has a chain-and-slat floor and two spreading discs. The main specifications of the tested spreader are listed below:

Model	KDS 270 muck control
Year of manufacture	2019
ID no.	WGJ112223LM400213
Gross weight	22,000 kg
Tongue load	4,000 kg
Axle load	9,000 kg on each axle
Kerb weight	10,560 kg
Capacity	approx. 21 m^3
Running gear	tandem axle with mechanical springs (Gigant Plus); drawbar with hydraulic suspension and K80 hitch
Brakes	dual circuit air brake with automatic load-sensing control (ALB)
Tyres	VF 710/50 R 26.5 on 10-stud rims
Body	1,400 mm · 2,150 mm · 7,000 mm (h · w · l)
Tractor spool requirement	3 load-sensing couplers (feed, return, control) for the slurry gate, the tailgate and the chain-and-slat floor (further functions available); 2 (double-acting) lines for the drawbar suspension system; 1 (single-acting) line for the steered axle
Electric sockets required	7-pin socket for the lights; 3-pin socket for the terminal control line
Spreading system	two 770 mm diameter horizontal beaters; two 1,100 mm diameter spreading discs, each with 6 adjustable vanes featuring replaceable wear-resistant steel plates; pto powered (max. 1,000 rpm); slurry gate between the loading space and the spreading system
Product feed	hydraulic chain-and-slat floor (two chains with 140 interlocking links; 50-tonne chain break strength) (infinitely variable speed control)

The Method

The test method is based on the DLG test framework 'Organic fertiliser spreaders' and the DIN EN 13080 standard 'Manure Spreaders – Environmental Protection Requirements and Test Methods'.

The distribution across rows is measured with the help of 50cm x 50cm x 10cm dishes placed on the test course next to each other across the direction of travel. Then the tractor spreader combination travels down the test course, spreading the product. In the next step, the material collected in the dishes is weighed and related to the total area spread to determine the spread pattern without taking into account the overlaps. The quality of distribution is expressed by the coefficient of variation (CoV). This reflects the accuracy of spreading the material across the rows, taking into account the rate of overlaps as the machine matches up with the previous pass. The CoV curve shows the point at which the accepted CoV threshold is undercut and also the range of the optimum work widths (smallest possible CoV).

The distribution along rows is assessed by measuring the mass flow. This is done by continuously measuring the axle and tongue loads on the stationary machine while this is being emptied. These measurements are used to compute the following parameters: typical spreading rate during unloading, dilation within the tolerance zone (percentage of unloading time during which the spreading rate is within the accepted tolerance range), the optimum overlap at match-up and the CoV at optimum overlapping levels.

The smaller the CoV the larger is the tolerance zone and the better the quality of distribution.

The Test Results in Detail

The test

The test was carried out in June 2020 at the company-owned test stand on the Fliegl Agrartechnik premises in Mühldorf, Germany. Prior to the test, the weighing systems were calibrated by an accredited partner lab (InfraServ Gendorf Technik GmbH, Burgkirchen) and the test stands were inspected for compliance with existing standards by DLG. Figures 2 shows the test facility for measuring the distribution across rows where dishes are placed on weighing cells. Figure 3 shows the weigh bridge which measures the changes in mass flow during the unloading process.

Table 2 lists the properties of the products applied.

The tractor used in the test was a John Deere 6190 R. The spreader was filled by a telescopic materials handler.

Figure 2:
The test stand for measuring the distribution across rows

Table 2:
Properties of the materials spread in the DLG test

Product	Bulk density [g/l]	Dry matter content [%]	Product source
Cattle manure	316	31	from deep litter systems
Compost	513	56	organic household waste, sieved woodchips, green clippings
Poultry litter	706	35	fresh laying hen litter
Digestate	406	23	separated from a biogas plant, mainly consisting of silage maize

Figure 3:
The Fliegl KDS 270 muck control on the test stand that measures the distribution along rows

Figure 4:
The operator terminal for the Fliegl KDS 270 muck control

Figure 5:
This scale on the headboard indicates the opening of the slurry gate upstream of the beaters

Figure 6:
The hole pattern where the drop-on point is set

Setting up the spreader

The spreading rate on the Fliegl KDS 270 muck control is controlled by the speed of the chain-and-slat floor, the opening of the slurry gate and the tractor speed. The feed rate of the floor is set steplessly between 0.5 m and 6 m per minute. The chain-and-slat floor is driven hydraulically. A slurry gate controls the gap between the loading space and the spreading system. The degree to which the gate is opened is also controlled steplessly from the operator terminal. The current opening is indicated on a scale from 0 to 16 on the front of the spreader (Figure 5).

All spreading elements on the Fliegl KDS 270 muck control are pto powered (max. 1,000 rpm). Two spreading discs spread the material across the direction of travel. Each disc has two adjustable vanes. Each of these has three holes that control three different spreading angles.

The spreading angle is set manually by undoing an M12 nut on each vane. The manual specifies the proper settings for various materials.

The point where the material drops on the discs is set with the help of a so-called spreading plate. This plate is adjusted with the help of two perforated plates on both sides of the spreader at the rear (Figure 6).

The manual also specifies the base settings for individual materials and various application rates. Due to great variations in the material properties, users are recommended to first trial a specific setting in an initial test run and then fine tune the settings as necessary.

Distribution across and along rows spreading cattle manure

To apply muck at a rate of 10 t/ha, the feed rate of the floor was set to 23 %. Tractor speed was 7.1 km/h. The testers had to do one initial run to optimise the settings in order to achieve the optimum coefficient of variation (CoV) of less than 20 % for the 18 m work width.

Graph 7 shows the spread pattern for cattle manure spread at a rate of 10 t/ha – without overlaps after two runs and with overlaps.

The graph in figure 8 shows the relationship between the coefficient of variation and the work width for cattle manure spread at a rate of 10 t/ha. The CoV curve shows that the CoV is 14.5 % when the work width is set to 18 m. This percentage scores a good (+). Only when the work width increases to 19 m does the CoV exceed the 20 % line.

To apply muck at a rate of 30 t/ha, the testers set the feed rate of the floor to 29 % while the tractor's forward speed was 3.7 km/h. In the first run during which the work width was set to 18m, the CoV on the quality of distribution was smaller than 20 %.

The graph in figure 9 shows the relationship between the coefficient of variation and the work width for cattle manure spread at a rate of 30 t/ha. The CoV curve shows that the maximum CoV is 14.7 % when the work width is 18 m or less. This percentage scores a good (+). Only when the work width increases to 19 m does the CoV exceed the 20 % line.

Assessing the quality of distribution of muck along rows, the computed coefficients of variation at both rates were 11.9 % at 10 t/ha (good (+) and 16.7 % at 30 t/ha (passed, ○). The dilation within the tolerance zone was 75.9 % (very good (++) when spreading muck at 10 t/ha and 62.5 % (good (+) when spreading muck at 30 t/ha.

Figure 10 shows the results for distributing muck along rows at a rate of 10 t/ha.

Settings
1st run (no optimising run was required);
Feed rate: 29 %; Spreading plate: Pos. 1;
Spreading vane position: Pos. 2

Figure 9:
Coefficient of variation relative to the work width in muck spread at a rate of 30 t/ha

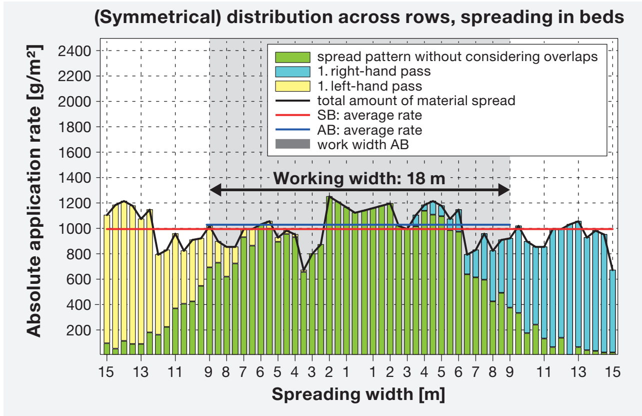
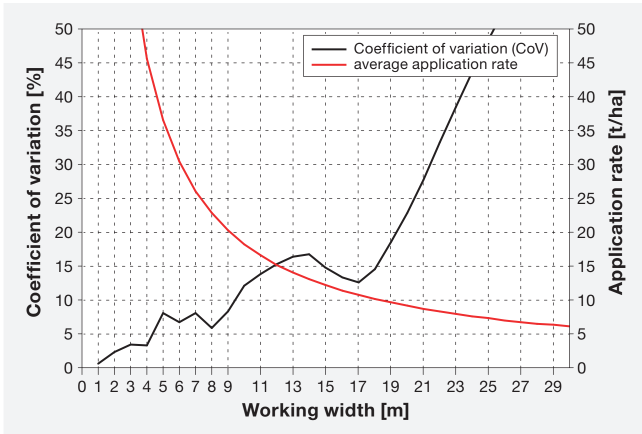
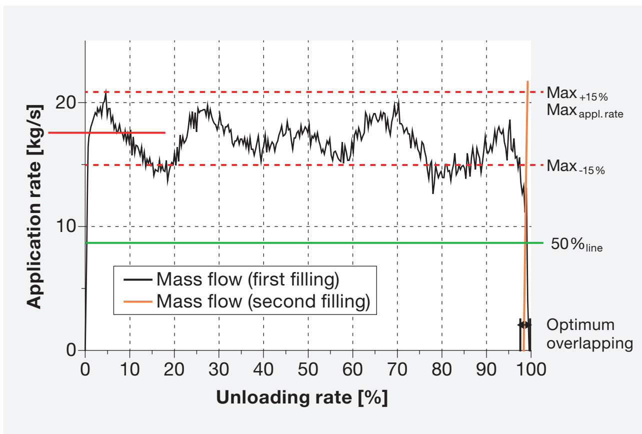


Figure 7:
Spread patterns with and without overlaps in muck applied at 10 t/ha



Settings
2nd run (one optimising run was required);
Feed rate: 23 %; Spreading plate: Pos. 1;
Spreading vane position: Pos. 2

Figure 8:
Coefficient of variation relative to the work width when applying muck at 10 t/ha



Consistent application rate: 17.73 kg/s
Dilation within the tolerance zone: 75.93 %
CoV at optimum overlaps: 11.91 %
Optimum overlaps along 50 % line: 1.24 %

Figure 10:
Application of cattle manure along rows (10 t/ha)

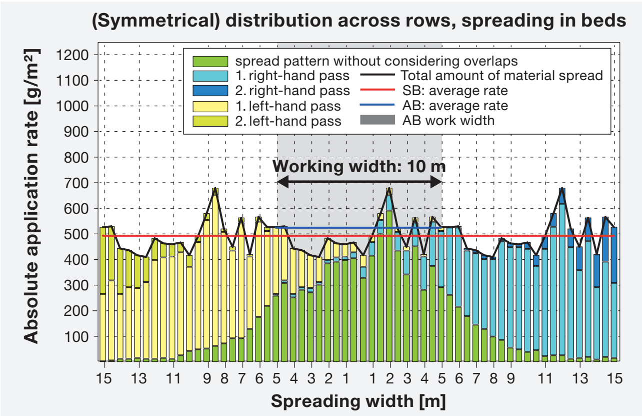
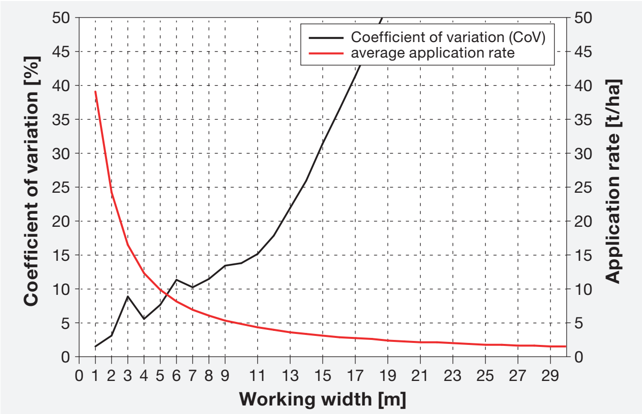
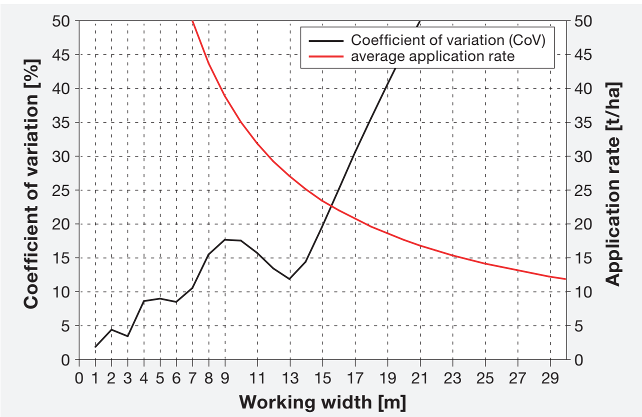


Figure 11:
Spread patterns without and with overlaps in compost spread at a rate of 5 t/ha



Settings
1st run (no optimising run was required);
Feed rate: 41 %; Spreading plate: Pos. 1;
Spreading vane position: Pos. 1

Figure 12:
Coefficient of variation relative to the work width when applying compost at 5 t/ha



Settings
2nd run (one optimising run was required);
Feed rate: 39 %; Spreading plate: Pos. 2;
Spreading vane position: Pos. 1

Figure 13:
Coefficient of variation relative to the work width when applying compost at 25 t/ha

Distribution across and along rows spreading compost

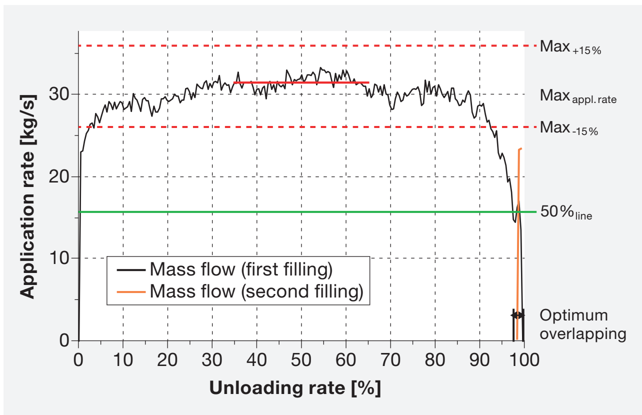
To apply compost at a rate of 5 t/ha, the feed rate of the floor was set to 41 % while forward speed was 10.3 km/h. In the first run at a work width of 10m, the CoV on the quality of distribution was less than 20 %. Graph 11 shows the spread pattern of compost at a rate of 5 t/ha – without overlaps after two runs and with overlaps.

The graph in figure 12 shows the relationship between the coefficient of variation and the work width in compost spread at a rate of 5 t/ha. The CoV curve shows that the maximum CoV is 13.9 % when the work width is 10 m or less. This result scores a good (+). The CoV increases beyond the 20 % mark only when work width exceeds 12m.

To apply compost at a rate of 25 t/ha, the feed rate was set to 39 % while forward speed was 5.6 km/h. The testers had to do one initial run to optimise the settings in order to achieve the optimum coefficient of variation (CoV) of less than 20 % for the 14 m work width.

The graph in figure 13 shows the relationship between the coefficient of variation and the work width for compost spread at a rate of 25 t/ha. The CoV curve shows that the CoV is 14.4 % when the work width is set to 14m. This percentage scores a good (+). Only when the work width reaches 15 m does the CoV exceed the 20 % line.

Assessing the quality of distribution of compost along rows, the computed coefficients of variation for



Consistent application rate: 31.18 kg/s
Dilation within the tolerance zone: 87.40 %
CoV at optimum overlaps: 10.84 %
Optimum overlapping along the 50 % line: 1.27 %

Figure 14:
Distribution along rows in compost (25 t/h)

both rates were 8.3 % at 5 t/ha (very good (++) and 10.8 % at 25 t/ha (good (+). The dilation within the tolerance zone for 5 t/ha compost was 92.4 % (very good (++) and for 25 t/ha compost 87.4 % (very good (++).

Figure 14 shows the results for distributing compost along rows at a rate of 25 t/ha.

Distribution across and along rows spreading poultry manure

To apply poultry litter at a rate of 2.7 t/ha, the feed rate of the floor was set to 29 % while forward speed was 12.1 km/h. The testers had to do one initial run to optimise the settings in order to achieve the optimum coefficient of variation (CoV) of less than 20 % for 12 m and 22 m work widths. Graph 15 shows the spread pattern without overlaps (distribution measured after three runs) and the spread pattern of poultry litter with overlaps at a rate of 2.7 t/ha.

The graph in figure 16 shows the relationship between the coefficient of variation and the work width for poultry litter spread at a rate of 2.7 t/ha. The CoV curve shows that the CoV is 8.9 % when the work width is 12 m. This percentage scores a very good (++). At a 22 m work width, the CoV is 19.3 % which scores a passed (○). However, the CoV exceeds the 20 % line at work widths of 9 m and between 15 m and 21 m.

Assessing the quality of distribution of poultry manure along rows, the computed coefficient of variation at a rate of 2.7 tha was 8.4 % (very good (++). The dilation within the tolerance zone was 91.2 % (very good (++).

Figure 17 shows the results for distributing poultry litter along rows at a rate of 2.7 t/ha.

Distribution across and along rows spreading digestate

To apply digestate at a rate of 5 t/ha, the feed rate of the floor was set the 35 % while the forward speed was 5.6 km/h. The testers had to do one initial run to optimise the settings in order to achieve the optimum coefficient of variation (CoV) of less than 20 % for the 16 m work width. Graph 18 shows the spread pattern without overlaps after two runs and the spread pattern with overlaps for digestate spread at a rate of 5 t/ha.

The graph in figure 19 shows the relationship between the coefficient of variation and the work width

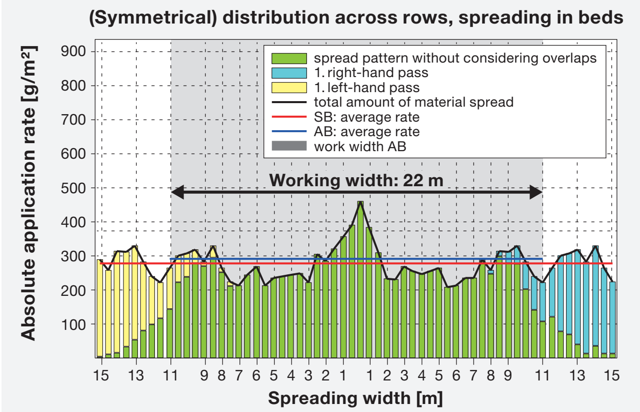
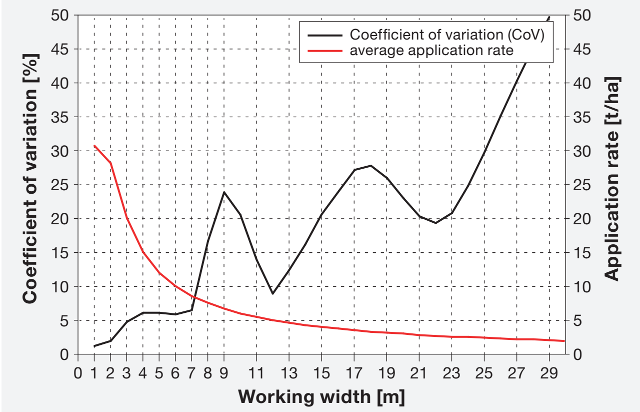
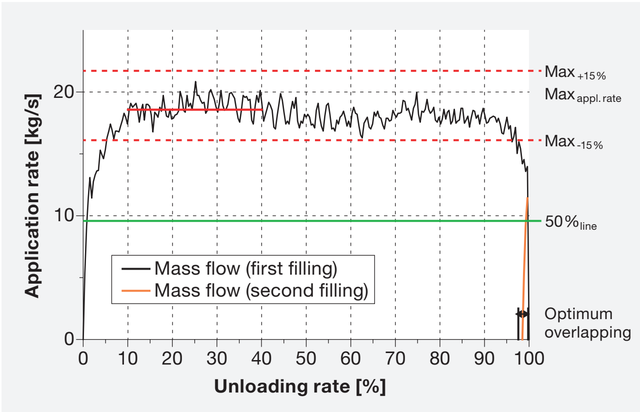


Figure 15:
Spread patterns with and without overlaps in muck spread at 2.7 t/ha



Settings
2nd run (one optimising run was required);
Feed rate: 29 %; Spreading plate: Pos. 3;
Spreading vane position: Pos. 1

Figure 16:
Coefficient of variation relative to the work width when applying poultry litter at 2.7 t/ha



Consistent application rate:	18.92 kg/s
Dilation within the tolerance zone:	91.24 %
CoV at optimum overlaps:	8.35 %
Optimum overlapping along the 50 % line:	1.53 %

Figure 17:
Distribution along rows in poultry litter (2.7 t/ha)

for digestate spread at a rate of 5 t/ha. The CoV curve shows that the CoV is 7.9 % when the work width is set to 16 m. This CoV percentage scores a very good (++). However, the CoV exceeds the 20 % line when work widths range between 10 m and 14 m and also at widths larger than 18 m.

To apply digestate at a rate of 30 t/ha, the feed rate of the floor was set to 50 % while the forward speed was 3.2 km/h. In the first run during which the work width was set to 20m, the CoV on quality of distribution was smaller than 20 %, which marks the best quality of distribution.

The graph in figure 20 shows the relationship between the coefficient of variation and the work width for digestate spread at a rate of 30 t/ha. The CoV curve shows that the CoV is 14.7 % when the work width is set to 20m. This percentage scores a good (+). However, the CoV exceeds the 20 % line when work widths range between 12 m and 18 m and also at work widths larger than 21 m.

Assessing the quality of distribution of digestate along rows, the computed coefficients of variation for both rates were 13.3 % at 5 t/ha (good (+) and 14.1 % at 30 t/ha (good (+). The dilation within the tolerance zone was 83.2 % (very good (++) when spreading digestate at a rate of 5 t/ha and 69.7 % (good (+) when spreading at a rate of 30 t/ha.

Figure 21 shows the results for distributing digestate along rows at a rate of 5 t/ha.

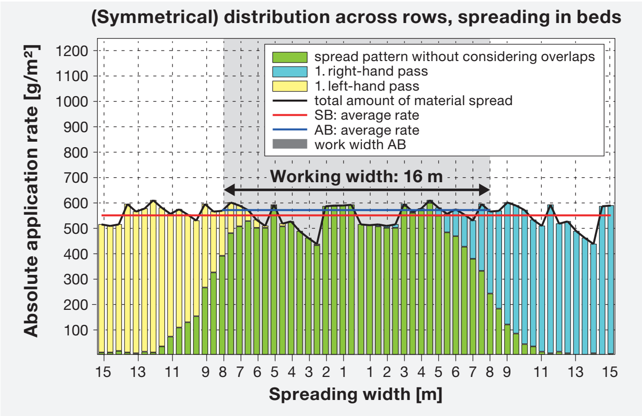
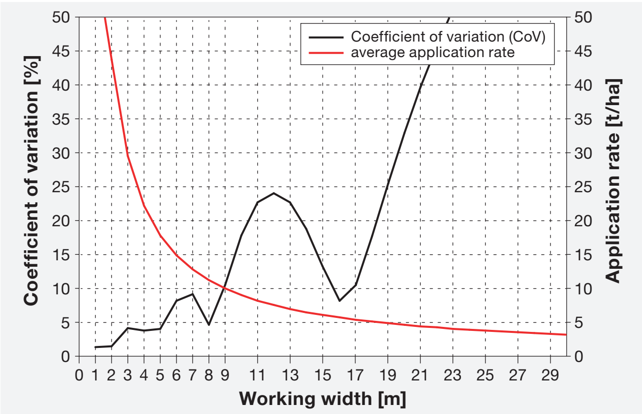
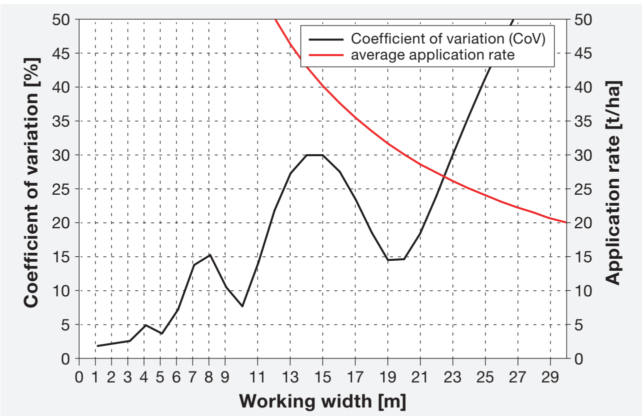


Figure 18:
Spread patterns with and without overlaps in digestate applied at 5 t/ha



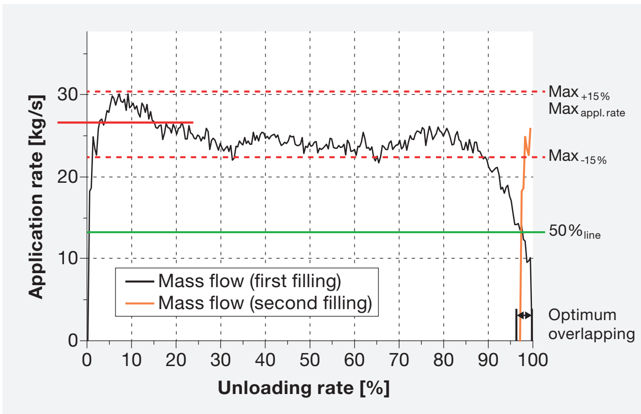
Settings
3rd test run (two optimising runs were necessary);
Feed rate: 35 %; Spreading plate: Pos. 2;
Spreading vane position: Pos. 1

Figure 19:
Coefficient of variation relative to the work width when applying digestate at a rate of 5 t/ha



Settings
1st run (no optimising run was required)
Feed rate: 50 %; Spreading plate: Pos. 1;
Spreading vane position: Pos. 1

Figure 20:
Coefficient of variation relative to the work width when applying digestate at a rate of 30 t/ha



Consistent application rate:	26.36 kg/s
Dilation within the tolerance zone:	83.20 %
CoV at optimum overlaps:	13.31 %
Optimum overlapping along the 50 % line:	2.75 %

Figure 21:
Distribution of digestate along rows (5 t/ha)

Summary

The DLG test measured the Fliegl KDS 270 muck control universal spreader in cattle manure (spread at rates of 10 t/ha and 30 t/ha), compost (5 t/ha and 25 t/ha), poultry litter (2.7 t/ha) and digestate (5 t/ha and 30 t/ha)

The coefficients of variation which indicate the quality of distribution across rows was found to be smaller than 20 % in all four products and scored a good (+) for the two application rates in muck and compost. The quality of distribution across rows in poultry litter scored a very good (++) at 12 m work width and a passed (○) at 22 m work width. In digestate, the distribution across rows was very good (++) at a rate of 5 t/ha and a 16 mwork width and good (+) at 30 t/ha and 20 m work width.

With one exemption, the results on distribution along rows were very good (++) and good (+) in all products. The exemption refers to the application of muck at 30 t/ha along rows where the coefficient of variation was 16.7 %, which scores a passed (○) according to the DLG scheme.

The manual specifies the base machine settings for the various materials and required application rates. Due to great variations in the material properties, users are recommended to first trial a specific setting in an initial test run and then fine tune the settings as necessary.

Based on the above test results, the Fliegl KDS 270 muck control universal spreader is awarded the DLG APPROVED quality mark 2020 after passing the test modules ‘Quality of distribution in muck, compost, poultry litter and digestate’.

Weitere Informationen

Test implementation

DLG TestService GmbH, Gross-Umstadt location
The tests are conducted on behalf of DLG e.V.

DLG test scope

Manure spreaders and secondary nutrient fertiliser spreaders (effective from May 2020)

Department

Agriculture

Head of Department

Dr. Ulrich Rubenschuh

Test engineer(s)

Graduate engineer. agr. Georg Horst Schuchmann*

* 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.

Leaders in the testing of agricultural equipment and input products

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: 2019-935-II

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