

DLG Test Report 7232

Kuhn Maschinen-Vertrieb GmbH

Five-furrow reversible plough Kuhn Vari-Master L5 NSH

Functionality and quality of work; environmental protection and sustainable resource management; handling, ease of operation, service and maintenance; in-field performance



**KUHN PLOUGH
VARI-MASTER L5NSH**

- ✓ Functionality and quality of work
- ✓ Environmental protection and sustainable resource management
- ✓ Handling, ease of operation, service and maintenance
- ✓ In-field performance

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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.



KUHN PLOUGH VARI-MASTER L5NSH

- ✓ **Functionality and quality of work**
- ✓ **Environmental protection and sustainable resource management**
- ✓ **Handling, ease of operation, service and maintenance**
- ✓ **In-field performance**

DLG Test Report 7232

The following test was carried out with the five-furrow reversible plough Kuhn Vari-Master L 5 NSH and included the following DLG test modules:

- Functionality and quality of work
- Environmental protection and sustainable resource management
- Handling, ease of operation, service and maintenance
- In-field performance

These modules are comprised in the DLG test framework for the DLG tillage equipment tests.

The “functionality and quality of work” module requires the plough to cultivate various fields which differ in soil quality and trash volumes. The quality of this work is then assessed with the help of questionnaires that are completed by several farmers. The criteria include blockages incurred, quality of work along the edge of the field, the furrow profile and incorporation of residues in the soil.

The “environmental protection and sustainable resource management” module assesses the lubricants used, the number of grease points to be attended and the type of bearings fitted as well as draft requirement and fuel consumption which are measured with DLG metering equipment.

The “handling, ease of operation, service and maintenance” module assesses the setting options on the plough by applying appropriate DLG schemes. Furthermore, the testers carry out typical machine functions and routine service jobs and the time taken is being measured.

In the “in-field performance” module the plough is put through its paces on five different farms. After the field work, the plough and the quality of work is inspected and assessed by the farmers according to a standardised questionnaire.

Other criteria were not tested.

Assessment in brief

The five-furrow Kuhn Vari-Master L5 NSH reversible plough delivered impressive results in the criteria specified by the DLG test framework.

Based on these test results, the plough is awarded the DLG-APPROVED quality mark in the test modules “functionality and quality of work”, “environmental protection and sustainable resource management”, “handling, ease of operation, service and maintenance” and “in-field performance”.

*Table 1:
Overview of results*

DLG QUALITY PROFILE	Evaluation*
Functionality and quality of work	✓
Environmental protection and sustainable resource management	✓
Handling, ease of operation, service and maintenance	✓
In-field performance	✓

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

*Table 2:
Quality of work – summarised results (assessments made by farmers)*

Test parameter		Averaged result
Matching up with the previous furrow	Winter furrow after grain maize	good
	Seed furrow after grain maize	very good
	Winter furrow after a perennial flower mix	very good
	Seed furrow after a perennial flower mix	good
Level of finish	Winter furrow after grain maize	very good
	Seed furrow after grain maize	very good
	Winter furrow after a perennial flower mix	good
	Seed furrow after a perennial flower mix	good
Incorporation of residues	Winter furrow after grain maize	very good
	Seed furrow after grain maize	very good
	Winter furrow after a perennial flower mix	satisfactory
	Seed furrow after a perennial flower mix	very good
General quality of work and finish	Winter furrow after grain maize	good
	Seed furrow after grain maize	very good
	Winter furrow after a perennial flower mix	good
	Seed furrow after a perennial flower mix	good

*Table 3:
Summarised results on handling the plough*

Test criterion	Evaluation
Setting the work depth	very good
Setting the work width	very good
Setting the first furrow width	very good
Setting the tilt	very good
Setting the line of draft (set only once)	satisfactory
Storing the oil lines	good
Lighting system	good

Table 4:

Summarised in-field performance results (assessments made by farmers)

Test criterion	Averaged result
Accessibility of all 40 grease points	good
Marking of grease points	good
Greasing intervals	good
Replacing a share and/or a point	very good
Ride on public roads	good
Jockey wheel changeover to transport position	sufficient
Headland turnover	very good
Setting the work width	very good
Trip mechanism	very good
Clear user manual	good
Storage compartment for the manual	good
Level of finish	very good
Residue incorporation	very good
General quality of work	very good

The method

DLG test module “Functionality, quality of work”

In this module, the plough is field tested in line with the relevant DLG test framework. The measurements in this test take place in suitable test fields and are carried out at typical forward speeds and working depths. Before the test, the local conditions (preceding crop, soil type and soil moisture) and the weather are logged.

The plough is then set up in line with the local conditions. This is done after doing a number of trial passes during which the suitable settings the prevailing conditions are determined.

Match-ups, finish, trash incorporation and the general quality of work are then assessed by five farming experts who assess the quality using the following scheme: very good (1), good (2), satisfactory (3), sufficient (4), not sufficient (5).

As the plough is put through the test, the testers log any blockages occurred, the quality of work along the edges and the furrow profile. The incorporation of crop residues is assessed by applying the grid method by VOßHENRICH. This method clears out a 30cm deep trench across the full working width, making sure to cut a smooth

wall face. Then the area is sampled in 5cm-by-5cm grids, assessing and classifying the amount of residues incorporated in each square. The findings are illustrated in figure 8 which plots the biomass incorporation results with the help of different colours. A darker shade indicates a higher amount of straw in that particular grid.

DLG test module “environmental protection and sustainable resource management”

The “environmental protection and sustainable resource management” module assesses the lubricants used, the number of grease points to be attended and the type of bearings fitted as well as the draft requirement and fuel consumption which are measured with DLG equipment. The draft requirement is measured using the DLG-owned three-point linkage metering equipment. Forward speed and distance covered are measured with a Correvit L400 from KISTLER MESSTECHNIK. At the same time, the tractor’s fuel consumption is measured with the mobile DLG fuel consumption metering equipment. The machine’s nominal ha/h performance is computed using the actual forward speed measured and the work width.

DLG test module “Handling, ease of operation, service and maintenance”

This test module looks at the mechanical setting options for adjusting the working depth and width, the first furrow width, the tilt and the line of draft. Further details assessed to DLG schemes include the storage options for the hydraulic and electric lines.

Furthermore, farming experts carry out the service and maintenance jobs while the time taken is measured.

DLG test module “in-field performance”

The plough is operated on five different farms. At the end of each operation, the farmers complete a questionnaire that includes several questions on handling, ease of operation, service and maintenance and on the quality of work. Each question is answered to the following scheme: very good (1), good (2), satisfactory (3), sufficient (4), not sufficient (5).

The product

Manufacturer and applicant

Applicant:

KUHN Maschinen-Vertrieb GmbH, Schopsdorfer Industriestraße 14, 39291 Genthin, Germany

Manufacturer:

Kuhn, 2 Rue du Québec, 44110 Châteaubriant, France

Product:

Kuhn Vari-Master L5 NSH five-furrow reversible plough

Description and technical data

The five-furrow Kuhn Vari-Master L5 NSH reversible plough is mounted in the three-point linkage of a tractor (category 3/4 N). Its total mass is 2,780 kg. Its work width can be set infinitely variably from 1.50 m to 2.75 m. The underbeam clearance is 80 cm. The plough had a hydraulic trip system, the so-called solid LPO mould-boards and maize skimmers. The skimmer depth and angles are set with the patented Kuhn 3D-SKIM system (fig. 2) which helps bury the residues in a specific area inside the furrow.

There are four hydraulic lines, two of which supply the double-acting ram that turns the plough over, the other two lines supply the rams that adjust the depth and width, the first furrow width and plough angle. The rams are controlled from the KTS-10 control unit (fig. 3) which allows the operator to select the ram to be operated by the second spool. This means that all default settings are made from the tractor seat and with the help of scales that are clearly visible from the seat (fig. 4). The only setting that is made from the ground is the point of draft which is adjusted with the help of a tool supplied.

The Vari-Master is marketed with a choice of three jockey wheels: the first is the combination wheel which runs alongside the beam and serves as depth control in the field and transport wheel on the road; the second is the rear-mounted jockey wheel which is exclusively a transport wheel; the third is the side-mounted jockey wheel for in-field depth control only. The test plough had the side-mounted combination wheel. Figure 5 shows the plough in transport position. In this position, the wheel is rotated 90°, which is done with the help of a tool that is supplied with the machine. The top link is replaced by a chain which provides for sufficient travel between tractor and plough.

The lights are not removed for field work but are folded alongside the beam, a position in which they are protected from damage by two metal plates (fig. 6 and 7).

The operator's manual is stored in a capped plastic tube on the headstock.



Fig. 2:
The setting system on the 3D-SKIM skimmers



Fig. 3:
The spool selector on the KTS 10 control unit

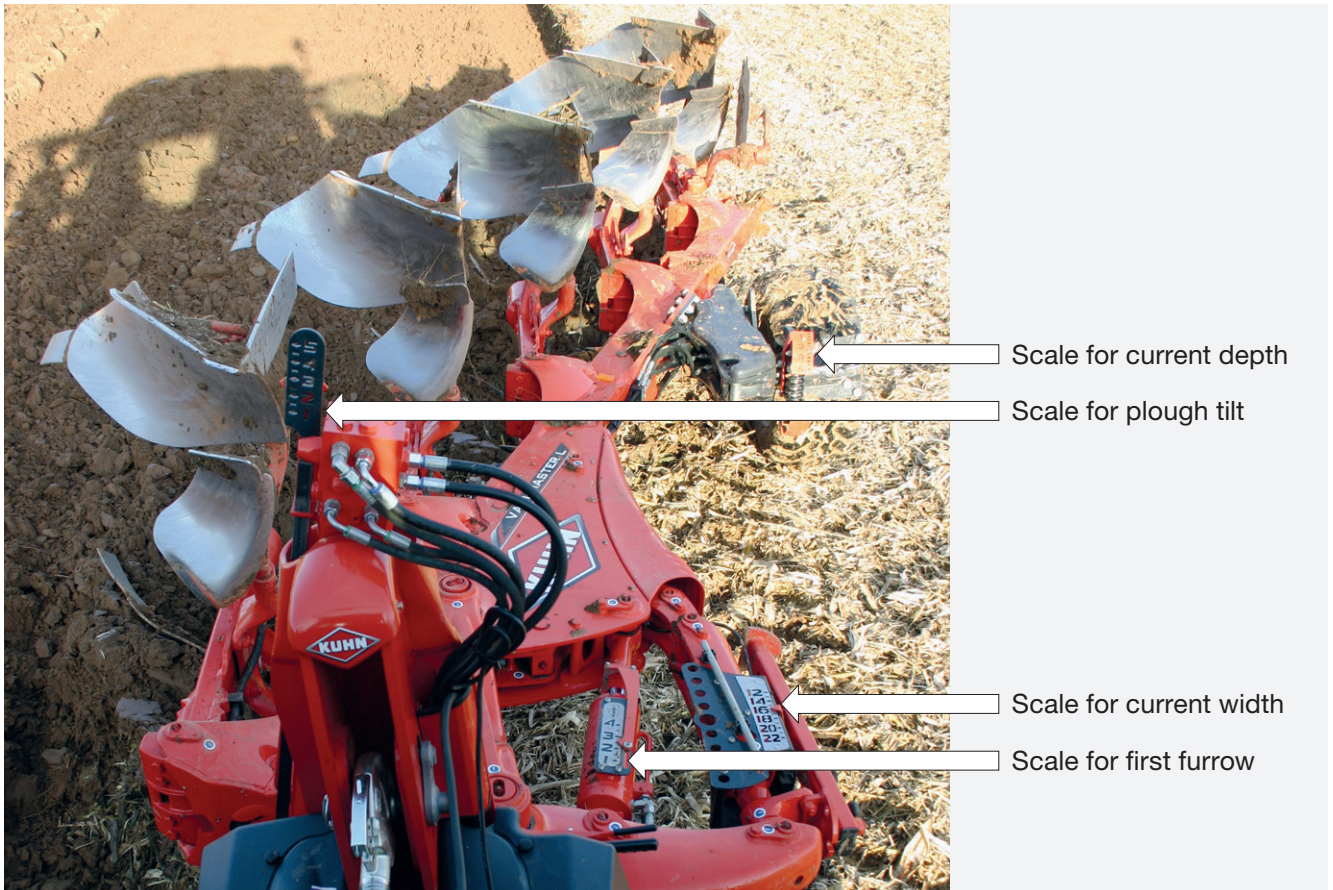


Fig. 4:
The Kuhn Pro-Set setting system



Fig. 5:
The plough in transport position



Fig. 6:
The lights in transport position



Fig. 7:
The lights in field position

Detailed account of the test results

Functionality and quality of work

The partial test on functionality and quality of work was carried in November 2021 in a plot of grain maize that had received a topping pass one week before the test and in a cover crop of perennial flowers that had received a topping pass three weeks before the test. The soil of the grain maize plot was loam (75 value points and 26.9 % soil moisture). The soil in the perennial flower mix plot was loamy clay (58 value points, 22.7 % soil moisture). The weather during the tests was sunny with light winds and temperatures between 9° and 14° C.

The plough was pulled by a Fendt Vario 722 (163 kW rated output and 168 kW maximum output at 2,100 rpm) that carried a 1,800 kg front weight in the front linkage .

The test involved creating one winter furrow (with maximum work width set to 2.75 m) and one seed furrow (work width set to 2.0 m) in each of the fields mentioned. In both fields, the depth was set to 27 cm and the forward speed was 6.2 km/h.

There were no disc coulters fitted. Not a single blockage was observed through the entire test.

Match-ups with the previous work, surface finish (roughness of the winter furrow, levelness of the seed furrow), incorporation of the biomass and the general quality of work were assessed by five experienced farmers who awarded mostly “very good” and “good” marks. The individual results are listed in table 5.

Table 5:
Assessing the quality of work by five farming experts

Test parameter		Individual assessments by person and the averaged result*						
		1	2	3	4	5	Ø	
Matching up with the previous furrow	Winter furrow after grain maize	2	1	1	2	2	1.6	good
	Seed furrow after grain maize	2	1	1	1	1	1.2	very good
	Winter furrow after a perennial flower mix	1	1	1	2	1	1.2	very good
	Seed furrow after a perennial flower mix	2	1	3	3	2	2.2	good
Level of finish	Winter furrow after grain maize	1	3	1	1	1	1.4	very good
	Seed furrow after grain maize	2	1	2	1	1	1.4	very good
	Winter furrow after a perennial flower mix	2	2	2	2	3	2.2	good
	Seed furrow after a perennial flower mix	1	1	3	2	3	2.0	good
Incorporation of residues	Winter furrow after grain maize	1	2	2	1	1	1.4	very good
	Seed furrow after grain maize	1	1	1	1	1	1.0	very good
	Winter furrow after a perennial flower mix	2	4	3	1	3	2.6	satisfactory
	Seed furrow after a perennial flower mix	1	1	1	2	2	1.4	very good
General quality of work	Winter furrow after grain maize	1	3	1	1	2	1.6	good
	Seed furrow after grain maize	2	1	1	1	1	1.2	very good
	Winter furrow after a perennial flower mix	1	2	2	2	3	2.0	good
	Seed furrow after a perennial flower mix	1	1	2	2	2	1.6	good

Grading system: very good (1), good (2), satisfactory (3), sufficient (4), not sufficient (5)

Environmental protection and sustainable resource management

The fully specified test plough had 40 grease nipples, all of which need to be attended at 20-hour intervals. The manual lists NLGI 2 multi-purpose grease to be used. Greasing all 40 nipples took an average of 3'50" and five rounds (see table 7).

The nominal acreage achieved at a workrate of 6.2 km/h and at a width of 2.75 m is 1.71 hectares per hour and 1.24 hectares per hour when the work width was set to 2 metres.

Figure 11 shows the results on draft requirement and fuel consumption. In general, the draft requirement is obtained by factoring in various parameters: the parts fitted, depth and width settings, forward speed plus soil type and soil moisture. Set up to the maximum work width of 2.75 m, the plough's draft requirement was 73.5 kW when ploughing the topped maize stubble and 85.7 kW when ploughing the topped perennial flower mix. Reducing the work width to 2 m for the seed furrow, the testers measured a draft requirement of 59 kW in the harvested grain maize plot and 68.5 kW in the topped perennial flower mix.

the harvested grain maize plot and 68.5 kW in the topped perennial flower mix.

The graph in the middle shows the fuel consumption per hour (excluding turn-around times). The consumption rate varies between 26.4 l/h (2 m work width, topped perennial flower mix) and 33.5 l/h (2.75 m work width).

Fuel consumption per hectare was calculated on the basis of the nominal ha/h performance mentioned. The parameter is plotted in the bottom graph of figure 11. Producing the winter furrow at a working width of 2.75 m, the test engineers measured a fuel consumption rate of 19.6 l/ha and 19.7 l/ha. By comparison, the measurement was 21.3 and 22.7 l/ha for the seed furrow at a work width of 2 m.

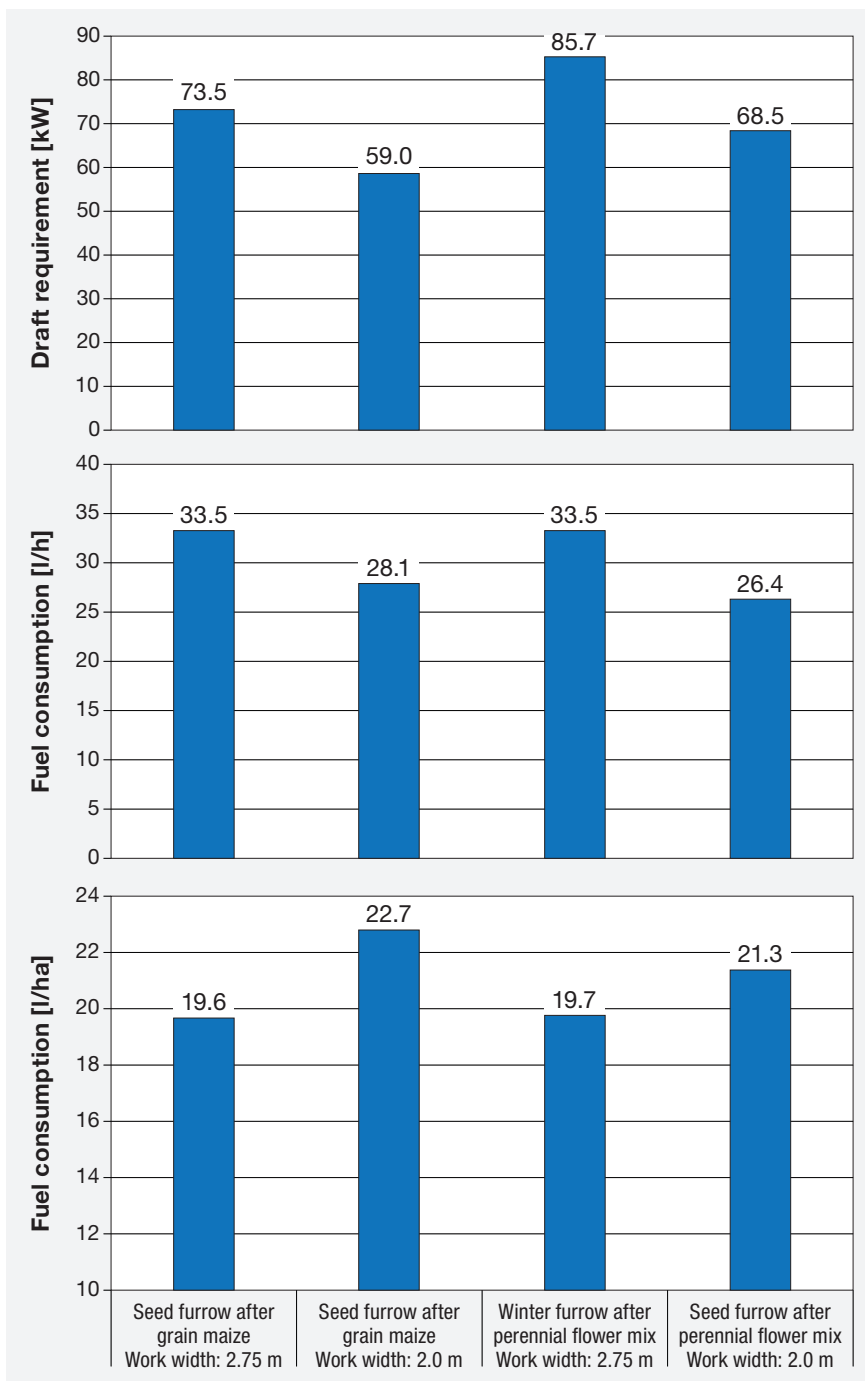


Fig. 11:
Draft requirement and fuel consumption at
6.2 km/h and 27 cm working depth

Handling, ease of operation, service and maintenance

Assessment of machine handling

Work depth, work width, first furrow width and tilt are controlled from the cab-mounted spools after selecting the relevant function from the KTS 10 control unit. Each cylinder on the plough has its own scale for convenient adjustment. All these setting options were assessed as “very good” (++).

The line of draft is set up with the help of a tool that is supplied with the machine. Here, too, a scale helps resuming a previous setting. This setting option was assessed as “satisfactory” (j).

All hydraulic couplers are colour coded and the same colour code is repeated on decals on the headstock for easy sorting of functions and hoses. The hoses can be stored in a holder that is provided on the plough. A drip container is not available here. The hose holder and the colour codes are assessed as “good” (+).

The plough has a lighting system that is permanently installed and not removed for field work. Instead, the two bars are folded forward which brings the lights in a safe position. There is no dust-/waterproof storage position for the electric connector. The lighting system is assessed as “good” (+).

Table 6 lists the results on machine handling and set-up.

Table 6:

Assessment of machine handling

Test criterion	DLG assessment*	Comments
Setting the work depth	very good	All settings can be executed from the cab and on the move. Appropriate scales are in place.
Setting the work width	very good	
Setting the first furrow width	very good	
Setting the tilt	very good	
Setting the line of draft (one-time setting)	satisfactory	The setting is made from the ground and with a tool.
Storing the oil lines	good	The oil hoses are colour coded and stored tidily in a holder.
Lighting system	good	The lights can fold out of the way during field work. There is no dust-/waterproof storage for the electric connector.

* The evaluation was based on the DLG assessment schemes for tillage equipment

Service and maintenance times

The time spent on servicing/maintaining the plough was also measured in this DLG test. For this, all tools and parts required were provided next to the plough. The various operations are straightforward and require no specialist tools. Table 7 lists the results.

Table 7:

Time required for service and maintenance and tractor attachment / removal

Operation	Time taken [min:s] per test person and averaged time					
	1	2	3	4	5	Ø
Replacing a share point	2:11	2:28	1:48	2:39	2:10	2:15
Replacing a share and the point	5:08	6:03	4:49	6:17	4:48	5:25
Servicing all 40 grease points	3:57	3:53	3:38	4:02	3:38	3:50
Changing from work into transport position (includes folding the lights and the jockey wheel into transport position)	4:36	3:45	4:43	2:47	2:38	3:42
Changing from transport into work position (includes folding the lights and the jockey wheel into work position)	4:13	2:44	4:00	2:58	2:45	3:20
Removing the plough from the tractor	3:22	3:34	2:22	2:00	1:48	2:37
Attaching the plough to the tractor	3:37	2:30	2:16	2:02	2:02	2:29

In-field performance

Five farmers in the Odenwaldkreis region near Frankfurt, Germany operated the plough in the period from 1 September to 15 November 2021, ploughing a total of 135 hectares of harvested grain, beans, silage maize and grain maize fields at work rates between 5 km/h to 11 km/h.

All five farmers find tractor attachment is good and very good. Adjusting the length of the stand is also good. The pipework is good. One farmer criticises that the oil lines are too long and at risk of tangling on the K80 hitch and tearing off. All farmers find that all components are manufactured to quality. Two find that the space between tractor and plough is very small. The advantage of this is that less weight is shifted off the front axle yet drawback is that there is not much room for coupling the plough.

More detailed results are listed in table 8.

Table 8:
Results from the “in-field performance” test module

Test criterion	Individual assessments by person and the averaged result *							
	1	2	3	4	5	Ø		
Aspects of handling, ease of operation, service and maintenance								
Accessibility of all 40 grease points	1	2	2	1	2	1.6	good	
Marking of grease points	3	2	1	1	2	1.8	good	
Greasing intervals (20 hours)	2	1	2	3	2	2.0	good	
Replacing a share and/or a point	2	1	1	1	1	1.2	very good	
Ride on public roads	2	3	3	1	2	2.2	good	
Jockey wheel changeover to transport position	3	4	2	4	5	3.6	sufficient	
Headland turnover	1	1	1	1	1	1.0	very good	
Setting the work width	1	1	1	2	1	1.2	very good	
Trip mechanism	1	1	1	1	1	1.0	very good	
Clear user manual	2	2	1	2	2	1.8	good	
Storage facility for the operator’s manual	2	2	2	4	1	2.2	good	
Would you buy the plough?	yes	yes	yes	yes	yes			
Questions on the quality of work								
Issues during field work	never	never	rarely	never	never			
Level of finish	1	2	2	1	1	1.4	very good	
Residue incorporation	1	1	2	1	2	1.4	very good	
General quality of work	1	2	1	1	1	1.2	very good	

* Grading system: very good (1), good (2), satisfactory (3), sufficient (4), not sufficient (5).

The farmers say that the plough is very easy to use. Setting up the plough to the field conditions always worked well. Soil penetration was good and the default depth was maintained accurately. The fact that the plough requires only two spools is given a great plus. Switching the hydraulic functions on the KTS box is also considered good. The plough can work very close to an obstacle or along and adjacent crop line, which is attributed to the jockey wheel being mounted centrally to the beam. The work width setting mechanism is integrated neatly in the beam. The setting options of the skimmers are considered favourable. Their depth is set conveniently by refitting a pin. Another advantage is the fact that the skimmers can turn towards and away from the ploughed land, which is useful to control the throw of the furrow slice. The damper on the depth wheel prevents the wheel flipping over during the turnover, which makes the process very gentle. In silage maize fields where game had been feeding on the crop, the plough ploughed the stalks in very well. No residues were found on the surface after the ploughing pass.

The farmers consider the number of 40 grease nipples (in full specification) as negative.

Changing the jockey wheel over into transport position is worth improving, because folding the jockey wheel and fitting a chain to replace the top link is cumbersome.

One farmer finds a storage facility for the KTS box useful.

Some decals were damaged by the pressure washer.

Two holding pins worked loose when ploughing in long maize stubble. Kuhn has addressed this and uses stronger pins now.

The paint coat on the beam was scratched by the vibrating lights when in work position; the Bowden cable that indicates the work width was damaged by scuffing on the stand. Kuhn has also addressed these issues and implemented modifications.

Summary

The Kuhn Vari-Master L5 NSH five-furrow reversible plough was submitted to a DLG test during a period from early September to late November 2021.

The quality of work produced in these tests was mostly assessed as “very good” and “good” by five farming experts. The biomass was incorporated at depths of 10 cm and deeper. Very rarely did the testers notice that biomass was left on the surface. The fuel consumption measurements produced rates between 19.6 l/ha and 22.7 l/ha. The tests on handling and ease of operation produced mostly “very good” and “good” results. All service jobs are carried out easily and without the need of specialist tools.

The field test involved five farmers ploughing 135 hectares of land. All five farmers assessed the quality of work as “very good”.

Handling was mostly rated as “very good” and “good” although all users agreed that changing the wheel over into transport position needed improving.

Based on these test results, the five-furrow reversible plough Kuhn Vari-Master L5 NSH is awarded the DLG-APPROVED quality mark in the test modules “functionality and quality of work, environmental protection” and “sustainable resource management”, “handling, ease of operation, service and maintenance” and “in-field performance”.

Further information

Testing agency

DLG TestService GmbH,
Gross-Umstadt location, Germany

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

DLG test framework

Tillage equipment (date of issue 04/2019)

Department

Agriculture

Division head

Dr. Ulrich Rubenschuh

Test engineer(s)

Dipl.-Ing. agr. Georg Horst Schuchmann*

Photos and graphics:

DLG and KUHN

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DLG – the open network and professional voice

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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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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: 2010-0032

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