DLG Test Report 6257F

Great Plains International

X-Press 6.6 m short disc harrow

Power requirement and quality of work

DLG FOKUS TEST
11/14 Power requirement and quality of work

Test Center
Technology and Farm Inputs

www.DLG-Test.de

Overview

The FokusTest is a smaller-scale DLG usability test intended to allow product differentiation and special highlighting of innovations in machinery and technical products used primarily in agriculture, forestry, horticulture, fruit cultivation and viticulture, as well as in landscape and municipal management.

This test focuses on testing a product's individual qualitative criteria, e.g. fatigue strength, performance, or quality of work.

The scope of testing can include criteria from the testing framework of a DLG SignumTest, the DLG's extensive usability test for technical products, and concludes with the publishing of a test report and the awarding of a test mark.

The DLG FokusTest "Power requirement and quality of work" was carried out with the GREAT PLAINS X-PRESS 6.6 m mounted short disc harrow (working width: 6.6 m/260 in.). The measurements were taken on harvested, largely flat areas of wheat at the DLG International Crop Production Center in Bernburg-Strenzfeld (Saxony-Anhalt).

The DLG FokusTest "Power requirement and quality of work" examined the following testing parameters based on the DLG testing framework for soil cultivation equipment:

- tractive power requirement;
- actual travel speed and theoretical area treated per hour;
- actual working depth and cultivation horizon of the tools;
- profile of the soil surface before and after the working step;
- crumbling of the soil (aggregate size distribution);
- compactness after the working step;
- straw covering and straw incorporation;
- operation.

In addition, the tractor's fuel consumption was measured.

In order to document the field conditions during soil cultivation, the stubble heights, straw yield and ground moisture were determined and described.

Other criteria were not examined in this test.

Assessment – Brief Summary

The GREAT PLAINS X-Press 6.6 m short disc harrow allows stubble cultivation (shallow soil cultivation), as well as the subsequent deeper soil cultivation steps. The tests were carried out at two travel speeds (9 km/h and 13 km/h (5.6 and 8.1 mph respectively)), and working depths of 8 cm and 13 cm (3.1 and 5.1 in. respectively) were specified and adhered to. The measurement runs were performed without disturbances; no blockages occurred and no lateral pull was identified.

During the shallow soil cultivation step, the tractive power requirement is 112 kW (152 PS) (at a working speed of 9.5 km/h (5.9 mph)) and 170 kW (231 PS) (at 12.6 km/h (7.8 mph)). In the subsequent deeper soil cultivation step, the tractive power requirement is 108 kW (147 PS) (at 9.4 km/h (5.8 mph)) and 179 kW (243 PS) (at 12.9 km/h). As expected, there were corresponding gradations in the measured fuel consumption values. These are approx. 6.5 l/ha (0.7 GPA) and 8 l/ha (0.9 GPA) at travel speeds of 9 km/h (5.6 mph) and 13 km/h (8.1 mph) respectively.

The evenness of the surfaces and the compactness after cultivation were comparable in all trial variants.

With a straw covering of 8.8 t/ha (3.9 TPA), the shallow soil cultivation step incorporates 77 % of the straw into the soil at both travel speeds. For the deeper soil cultivation (second cultivation step), the straw covering was 3.5 t/ha (1.6 TPA). Here, the proportion of incorporated straw increases as the travel speed increases from 57 % at 9 km/h (5.6 mph) to 68 % at 13 km/h (8.1 mph). For the deeper soil cultivation step, the distribution of the incorporated straw over the various soil horizons is almost identical at both travel speeds. 65 % of the incorporated straw is mixed into the upper soil horizon (0 to 5 cm (0 to 2 in.)), approx. 29 % into the second soil horizon (5 to 10 cm (2 to 4 in.)) and approx. 6 % into the soil horizon between 10 cm (4 in.) and 15 cm (6 in.).

The discs' cutting angle can be configured quickly and easily (+). No tools are needed to adjust the working depth by a few centimetres; this is done using an easily accessible hydraulic cylinder and by inserting or removing spacers (+). To adjust the fundamental working depth, the operator must climb onto the equipment's frame (–).

The disc harrow has a permanently installed lighting unit (+) and a facility (bracket) for the orderly storage of hydraulic lines (+).

Manufacturer and Applicant

Manufacturer:
Great Plains UK Ltd
Woodbridge Road, Sleaford
Lincolnshire, NG34 7EW, England

Product:
X-Press 6.6 m short disc harrow

Applicant:
Great Plains International
1525 East North Street
Salina, Kansas 67401-5060 USA
beratung@greatplainsmfg.com
www.greatplainsmfg.de
Tel.: +49 (0) 151 7022 9901

Description and Technical Data

The GREAT PLAINS X-Press 6.6 m short disc harrow is suitable for stubble cultivation, deeper soil cultivation and seedbed preparation. The towed type is available with working widths of 4.6 metres (181 in.) to 10 metres (394 in.) (4.6 m (181 in.), 5.5 m (217 in.), 6.6 m (260 in.), 8.0 m (315 in.), 10.0 m (394 in.)) The short disc harrow used in the DLG test had a working width of 6.6 metres (260 in.). The mounted equipment is attached to the tractor via the linkage arms (category III).

The GREAT PLAINS X-Press with a working width of 6.6 metres (260 in.) has a total of 52 discs in two rows (26 discs in each row). In each row of discs, 13 discs point to the right and 13 discs point to the left. The spacing between the discs is 250 mm (9.8 in.) and the line spacing is 125 mm (4.9 in.). The cone-shaped concave discs of the tested machine (Figure 2) have a diameter of 500 mm (19.7 in) and are each mounted on one ball bearing; each ball bearing has a grease nipple. If long-life grease is used for maintenance, the manufacturer states that the grease need only be reapplied after 200 hours of operation. Each disc is connected to the frame via a spring-mounted supporting arm (Figure 2). According to the manufacturer, this makes it possible to adjust the machine to the ground contour by raising individual discs while maintaining the contact pressure. The spring-mounted supporting arms also act as an overload protection in the event of contact with an obstacle; if this happens, the discs can lift out of the way individually without affecting the working depth of the other discs.

The operator can adapt the cutting angle of the two rows of discs to the respective field conditions. Four cranks are used to manually adjust the angle steplessly from 0 to 25 degrees. Each crank is fitted with a five-step scale (Figure 3).

Figure 2:
Cone-shaped concave discs with indentations at the edge, incl. disc supporting arm

Figure 3:
Cutting angle adjustment for the first and second row of discs

Figures 4 and 5:
Depth adjustment by inserting spacers on the central hydraulic cylinder and via spindles on the rear roller

Table 1:
Technical data for the "GREAT PLAINS X-Press 6.6 m" short disc harrow

Technical data*	
Working width	6.60 m (260 in.)
Frame height	680 mm (26.8 in.)
Number of discs	52
Line spacing	125 mm (4.9 in.)
Number of bars	2
Distance from bar to bar	1.55 m (61.0 in.)
Transport width	3.0 m (118 in.)
Weight with "Double Disc Light" rear roller	6500 kg*

* Manufacturer's data

In order to adjust the working depth by a few centimetres, the operator must insert or remove spacers on the piston rod of the hydraulic cylinder (Figure 4). Fundamental adjustment of the working depth (e.g. in order to change the working depth from deep to shallow) can also be carried out via the rear roller, whose penetration depth into the soil is adjusted using four spindles (Figure 5).

The short disc harrow (working width: 6.6 metres (260 in.)) used in the DLG FokusTest was equipped with the two-part "Double Disc" steel packer roller with a total of six rear roller options. This roller has a diameter of 700 mm (27.6 in.). Soil scrapers are mounted between the 28 steel discs. The spacing between the discs is 228 mm. The two-part roller is mounted on eight ball bearings, each of which has a grease nipple. Figure 6 shows the rear roller used in the DLG test. On the headland, the short disc harrow is lifted off via the rear roller and not via the chassis.

When the short disc harrow is converted from working position to transport position, the right and left sections of the frame are folded into a vertical position by hydraulics. A clamping system can be used to connect the two folded-up side sections to one another to prevent them from unfolding unintentionally (Figure 7).

The GREAT PLAINS X-Press is fitted as standard with a lighting installation and eight red/white-striped marker boards (two signs pointing backwards, two facing forwards, two facing left and two facing right). The short disc harrow used in the DLG test was equipped with an air brake, which is available as an optional feature.

After removal from the machine, the four hoses of the two hydraulic circuits (folding, as well as lifting and lowering the chassis) can be hung easily on the brackets provided (Figure 8).

Figure 6:
Rear roller: "Double Disc" steel packer roller with soil scrapers

Figure 7:
Clamping device for preventing the two side parts from unfolding unintentionally

Figure 8:
Facility for hanging hydraulic hoses when shutting down the short disc harrow

Figure 9:
DLG 3D dynamometers
for measuring the tractive force requirement

The DLG FokusTest “Power requirement and quality of work” tests soil cultivation equipment based on the corresponding DLG testing framework in field tests and under practical conditions. For this purpose, measurements are taken on suitable trial areas at standard travel speeds and working depths.

In order to document the trial conditions, the testers determine the terrain characteristics, the stubble heights, the straw left behind on the area, and the soil moisture content, as well as documenting the prevailing weather during the test.

In the DLG FokusTest, the basic configuration of the soil cultivation equipment is adapted to the respective field conditions. Therefore, neutral runs are performed on the test area before the actual measurement runs begin in order to determine the suitable configuration for the machines.

Directly before or during the measurement runs, samples are taken in order to determine the soil moisture content, and the stubble heights are measured for the purpose of documenting the trial conditions. A description is made of the soil type and the arrangement of the areas.

The tractive power requirement is measured using the DLG Test Center’s modular measuring system. The travel speeds and route distances are recorded using a Correvit L400 from the company KISTLER MESSTECHNIK. In addition to this, the fuel consumption can be documented using the DLG’s mobile fuel-measurement technology.

The actual travel speed and working width are used to calculate the theoretical area treated per hour. This does not take account of possible overlaps or turning times.

A laser sensor is used to determine the surface profile before and after cultivation, as well as the penetration depths of the tools (discs) and the average working depth. The laser sensor scans the surfaces at right angles to the direction of travel without touching them, and the measured values are then used to compile a height profile. In order to describe the evenness of the area, the standard deviation (SD) for the height profile of the cultivated soil surface is calculated from the individual measured values. The lower the calculated standard deviation, the more even the cultivated soil surface. The cultivation horizon is exposed for the purposes of calibration (Figure 12). The measured values for the cultivation profile of the tools (discs) are then used to determine the maximum penetration depth and to calculate the average working depth.

In order to represent the crumbling effect of the cultivation equipment, the aggregate size distribution in the working layer is measured and described. For this purpose, soil samples are taken carefully and non-destructively from the cultivated soil layer and then air-dried to constant weight. The soil samples dried in this way are then fractionated by sieve analysis, and the proportions in the various soil fractions are used to calculate the weighted average diameter (WAD). The smaller the WAD, the greater the proportion of smaller soil aggregates.

The recompacting effect is determined based on the compactness of the soil, which is determined using core cylinder samples. The core cylinder samples are taken to a depth of 6 cm (2.4 in.) for the

Figure 10:
Kistler Correvit L400

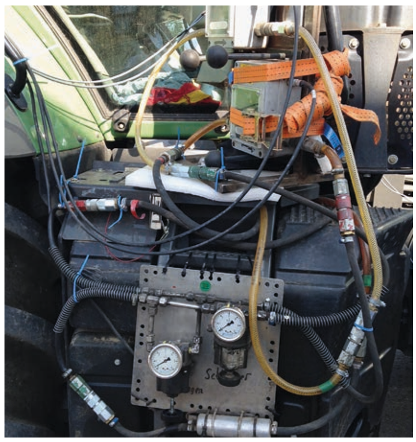

Figure 11:
Mobile DLG fuel-measurement technology

shallow stubble cultivation step and to a depth of 12 cm (4.7 in.) for the deeper soil cultivation step.

The straw covering is determined before and after soil cultivation. For this purpose, all of the straw is collected up over areas of 0.5 m² at several representative locations on the trial field before being air-dried and weighed. The quantity of straw incorporated into the soil due to cultivation is calculated from the difference between the two results.

The distribution of the incorporated straw in the individual soil horizons is determined using the grid screen method according to Voßhenrich (2003). The soil profile is exposed to a depth of 20 cm across the entire working width. In doing so, care is taken to ensure a cleanly cut profile wall. A grid screen is then used to assess and classify the incorporated proportion of straw for each assessment square (5 cm x 5 cm (1.97 x 1.97 in.)). The results are represented graphically (Figure 13). Different colours are assigned to the various classes for the straw proportions. The higher the proportion of straw in a grid, the darker the colour in the representation. To give a better overview, the diagram is divided into three

Figure 12:
Example image of a cultivation horizon

sub-diagrams (left section of width, central section of width, right section of width). The totals of the assessment values for each soil horizon are recorded in the diagram (bottom right) as parameters for the distribution of the incorporated straw. This is used to calculate the proportions of incorporated straw.

Figure 13 shows an example result from the DLG test with the GREAT PLAINS X-Press 6.6 m short disc harrow (deeper soil cultivation step, 13 cm (5.1 in.), travel speed 9.4 km/h (5.8 mph)).

The operation is evaluated primarily based on the following working steps:

- configuration of working depth;
- adjustment of disc cutting angle;
- adjustment of levelling unit (where present);
- installation and/or storage of the hydraulic lines;
- mounting and/or removal of the lighting unit.

The results are evaluated based on a DLG evaluation scheme. Other working steps going beyond these can also be described.

Working depth

Section 1 of width (left)

0–5 cm	25	10	25	10	25	10	10	10	10	10	25	25	50	25	75	10	50	25	50	10	25	50	10	10	10	25	50	75	75	25	10	10	10	10	10	10	10	10	10
5–10 cm	0	0	10	10	10	10	10	10	10	10	25	10	10	10	10	25	10	10	10	25	25	10	0	0	10	10	10	10	10	10	25	10	0	0	0	10	10	10	0
10–15 cm	0	0	0	0	0	0	0	0	10	10	10	0	0	0	0	0	10	0	0	0	10	0	0	0	0	0	10	10	10	0	0	0	0	0	0	0	0	0	0
15–20 cm																																							
20–25 cm																																							

Section 2 of width (centre)

0–5 cm	10	10	10	10	75	25	10	10	25	10	50	25	10	10	10	25	10	10	75	50	25	10	10	10	10	10	50	25	25	0	25	25	25	50	50	0	10	10	25
5–10 cm	0	25	25	10	10	10	10	10	0	10	10	10	10	10	10	10	10	50	10	10	25	50	25	10	10	10	10	10	10	0	10	10	0	25	25	10	0	0	10
10–15 cm	0	10	0	0	0	0	10	0	0	0	0	10	10	0	0	0	25	10	0	0	0	0	10	0	10	0	10	0	10	0	0	0	0	10	0	0	0	0	0
15–20 cm																																							
20–25 cm																																							

Section 3 of width (right)

																																							Total	Relative proportion
0–5 cm	10	25	25	50	50	10	25	10	25	25	10	10	10	10	10	25	50	25	10	10	10	25	25	10	10	25	10	75	50	25	10	0	10	10	10	10	100	50	2690	62 %
5–10 cm	10	10	0	0	10	10	10	10	25	10	10	10	10	10	10	10	10	10	10	10	25	10	10	10	10	10	10	10	10	25	10	10	10	10	10	10	10	10	1290	30 %
10–15 cm	0	0	0	0	0	0	0	10	0	10	10	10	10	10	10	10	0	0	10	10	0	0	0	0	0	10	10	0	0	10	0	0	0	0	0	10	0	0	345	8 %
15–20 cm																																							Σ 4325	100 %
20–25 cm																																								

Proportion of straw [%]	0	10	25	50	75	100

Figure 13:
Representation of straw incorporation into the soil according to the grid screen method (Voßhenrich, 2003

Test

The measurement runs were performed in August 2014 on a harvested wheat field at the DLG International Crop Production Center (IPZ) in Bernburg-Strenzfeld (Saxony-Anhalt). The trial field is largely homogeneous and has soil of the type “loess clay” with a soil rating of 87 points according to the Reichsbodenschätzung (German soil survey). During the test, the weather was sunny with light winds and temperatures of around 20 °C (68 °F). The soil was wet during the measurement period. The determined soil moisture content during the test was between 20.0 % and 23.3 %. The straw was chopped by the combine harvester during harvesting and left on the field. The straw distribution and the chopping quality of the combine harvester were assessed visually and evaluated as good.

A first, shallow soil cultivation step and a second, deeper soil cultivation step were carried out in the DLG test. The first soil cultivation step took place on an area of wheat stubble as the first working step after combine harvesting. For the second, deeper soil cultivation step, the trial area had already been shallow cultivated once before the test (working depth: 6 to 8 cm (2.4 to 3.1 in.)) with the GREAT PLAINS X-Press 6.6 m short disc harrow. A period of 12 days then passed before the second soil cultivation step; 35.8 mm of precipitation fell during this time.

On the area of stubble, an average stubble length of 18 cm (7.1 in.) was measured (minimum: 11 cm (4.3 in.), maximum: 26 cm (10.2 in.), standard deviation: 2.9 cm (1.1 in.)). The straw covering (chopped straw and stubble before the soil cultivation step) was 8.8 t/ha (3.9 TPA) on average (minimum: 6.4 t/ha (2.9 TPA), maximum: 11.8 t/ha (5.3 TPA), standard deviation: 1.6 t/ha (0.7 TPA)). For the second, deeper soil cultivation step, the straw covering on the trial area was 3.5 t/ha (1.6 TPA) on average (minimum: 2.0 t/ha (0.9 TPA), maximum: 6.0 t/ha (2.7 TPA), standard deviation: 1.3 t/ha (0.6 TPA)). Table 2 shows the basic field conditions and the various trial variants.

A Fendt Vario 936 tractor was available for the test (rated power at 2200 rpm: 330 PS, maximum power at 1900 rpm: 360 PS).

Table 2:
Trial variants

	First soil cultivation step = stubble cultivation		Second soil cultivation step	
Soil type, soil rating points	loess clay, 87 points			
Soil moisture content	20 % to 23.3 %			
Previous working steps	combine harvesting with straw chopper		combine harvesting with straw chopper, first soil cultivation step	
Straw covering before cultivation	8.8 t/ha (3.9 TPA)		3.5 t/ha (1.6 TPA)	
Target working depth	8 cm (3.1 in.)		13 cm (5.1 in.)	
Travel speed	9 km/h (5.6 mph)	13 km/h (8.1 mph)	9 km/h (5.6 mph)	13 km/h (8.1 mph)

Table 3:
Travel speed, working depth, tractive power requirement, fuel consumption and area treated per hour

	First soil cultivation step = stubble cultivation		Second soil cultivation = deeper soil cultivation	
Actual travel speed	9.5 km/h (5.9 mph)	12.6 km/h (7.8 mph)	9.4 km/h (5.8 mph)	12.9 km/h (8 mph)
Maximum penetration depth	8.9 cm (3.5 in.)	8.1 cm (3.2 in.)	12.8 cm (5 in.)	12.9 cm (5.1 in.)
Average working depth	4.2 cm (1.7 in.)	3.7 cm (1.5 in.)	7.3 cm (2.9 in.)	7.1 cm (2.8 in.)
Tractive power requirement	112 kW (152 PS)	170 kW (231 PS)	108 kW (147 PS)	179 kW (243 PS)
Fuel consumption	6.6 l/ha (0.71 GPA)	8.0 l/ha (0.86 GPA)	6.3 l/ha (0.67 GPA)	7.6 l/ha (0.81 GPA)
Theoretical area treated per hour	6.3 ha/h (15.56 ac/h)	8.3 ha/h (20.50 ac/h)	6.2 ha/h (15.31 ac/h)	8.5 ha/h (21 ac/h)

Travel speed, working depth, tractive power requirement, fuel consumption and area treated per hour

Table 3 summarises the results for the actually achieved travel speed and working depth, for the resulting tractive power requirement and fuel consumption, and for the calculated, theoretical area treated per hour.

The target travel speeds and working depths are achieved in the DLG test. The tractive power requirement is influenced more strongly by the travel speed than by the working depth. It increases as the travel speed increases from 112 kW (152 PS) to 170 kW (231 PS) in the shallow soil cultivation step and from 108 kW (147 PS) to 179 kW (243 PS) in the deeper soil cultivation step. As expected, there were corresponding gradations in the measured fuel consumption values. These are approx. 6.5 l/ha (0.7 GPA) and 8 l/ha (0.9 GPA) at travel speeds of 9.5 km/h (5.9 mph) and 13 km/h (8.1 mph) respectively.

For the short disc harrow with a working width of 6.6 metres, the calculated values for the theoretical areas treated per hour were around 6.3 ha/h (15.6 ac/h) at a travel speed of approx. 9.5 km/h (5.9 mph) and around 8.5 ha/h (21 ac/h) at a travel speed of approx. 13 km/h (8.1 mph).

Surface structure, compactness and crumbling

The standard deviation (SD) is used to describe the roughness of the surface, and the weighted average diameter (WAD) of the produced soil aggregates is used to describe the crumbling. The evenness of the surfaces and the compactness after cultivation were comparable in all trial variants. Slightly less crumbling is observed in the deeper soil cultivation step at a high travel speed. Table 4 presents a summary of the test results.

Figure 14 shows an example of the graphical representation from the survey of the soil surfaces at the time of the shallow stubble cultivation step at a travel speed of 12.6 km/h (7.8 mph). The coloured lines represent the profiles of the soil surfaces before cultivation (red) and after cultivation (green), as well as the exposed cultivation horizon of the discs (blue). The blue arrow in Figure 14 shows the maximum penetration depth (= working depth), which is 6.9 cm (2.7 in.) in the chosen example. A value of 3.7 cm (1.5 in.) is calculated for the average working depth (see orange arrow). The standard deviation (SD), used as a measure of the roughness of the soil surface after cultivation with the short disc harrow, is 2.9 cm (1.1 in.) in the chosen example.

After the shallow stubble cultivation step, strips of stubble with a width of 10 cm (3.9 in.) appear behind the machine in the middle of some of the tracks; these strips are cultivated less intensively by the machine's discs. Great Plains has taken this as a reason to fit the machine with an

Table 4:
Surface structure, compactness and crumbling

	First soil cultivation step = stubble cultivation		Second soil cultivation step	
Actual travel speed	9.5 km/h (5.9 mph)	12.6 km/h (7.8 mph)	9.4 km/h (5.8 mph)	12.9 km/h (8 mph)
Roughness [average SD* from three repetitions]	2.5 [2.9/2.5/2.1] 0.98 in (1.14/0.98/0.83)	2.8 [2.9/3.3/2.1] 1.10 in. (1.14/1.30/0.83)	2.5 [2.5/2.7/2.3] 0.98 in. (0.98/1.06/0.91)	2.3 [1.9/2.3/2.7] 1.06 in. (0.75/0.91/1.06)
Compactness	1.29 g/cm³	1.27 g/cm³	1.21 g/cm³	1.20 g/cm³
Crumbling [WAD**]	17.54 mm (0.6906 in.)	16.19 mm (0.6374 in.)	18.41 mm (0.7248 in.)	22.13 mm (0.8713 in.)
Aggregate size proportions [%]				
< 2,5 mm	21.72 %	20.28 %	20.10 %	17.69 %
2,5 to 5 mm	15.96 %	16.59 %	15.43 %	13.75 %
5 to 10 mm	16.00 %	16.84 %	15.84 %	13.70 %
10 to 20 mm	16.23 %	18.12 %	17.09 %	15.95 %
20 to 40 mm	16.75 %	18.55 %	16.99 %	17.87 %
40 to 80 mm	13.34 %	9.62 %	14.55 %	21.04 %
> 80 mm	0.00 %	0.00 %	0.00 %	0.00 %

* Standard deviation
** Weighted average diameter of soil aggregates

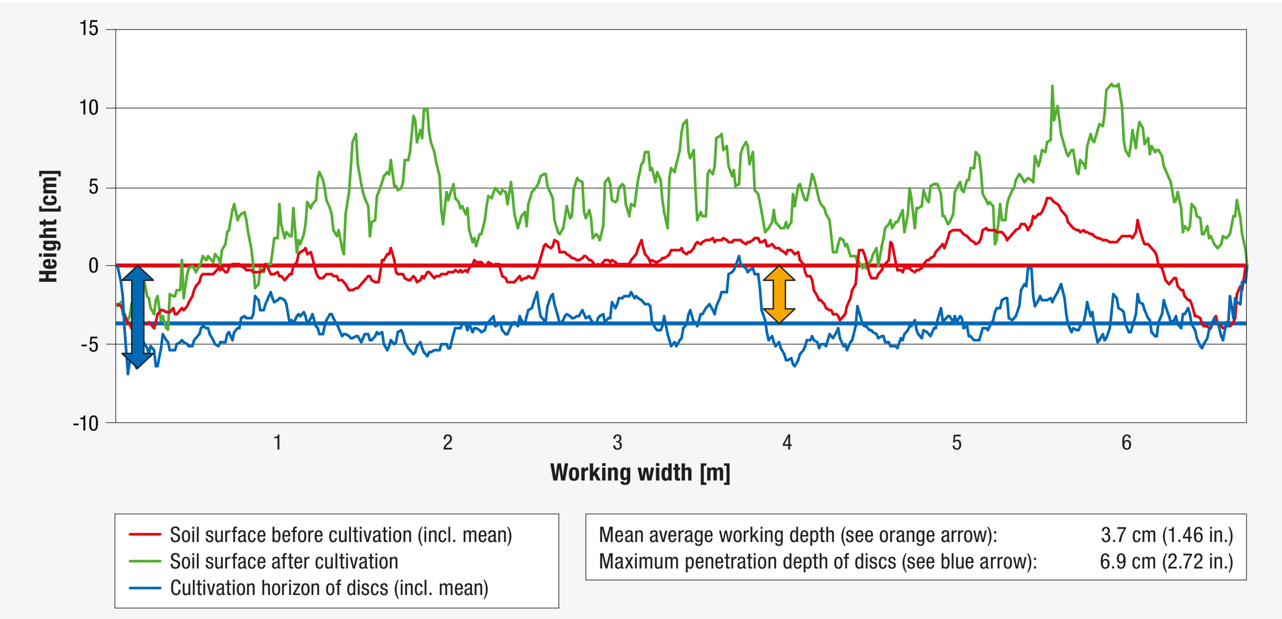

Figure 14:
Measurements of soil surface and cultivation horizon in the event of a repetition of the shallow stubble cultivation step

Table 5:
Incorporated quantity of straw per soil horizon in the second working step (straw covering prior to cultivation: 3.5 t/ha)

Incorporation results with a straw covering of 3.5 t/ha (1.56 TPA) prior to cultivation		
Travel speed	9.4 km/h (5.8 mph)	12.9 km/h (8 mph)
Incorporated straw	57 % (2.0 t/ha (0.89 TPA))	68 % (2.4 t/ha (1.07 TPA))
Distribution in soil horizons		
0 to 5 cm (0 to 2 in.)	65 % (1.3 t/ha (0.58 TPA))	65 % (1.5 t/ha (0.67 TPA))
5 to 10 cm (2 to 4 in.)	29 % (0.6 t/ha (0.26 TPA))	28 % (0.7 t/ha (0.31 TPA))
10 to 15 cm (4 to 6 in.)	6 % (0.1 t/ha (0.05 TPA))	7 % (0.2 t/ha (0.09 TPA))

additional disc in the front row of discs in future. According to the manufacturer, this measure will mean the whole soil area is cultivated.

Straw covering and straw incorporation

Before the first soil cultivation step, the straw covering on the trial area was 8.8 t/ha (3.9 TPA) (chopped straw and stubble). The first working step (stubble cultivation) incorporated approximately 77 % of the straw covering (6.8 t of straw per hectare (3 TPA)) into the soil both at a travel speed of 9.5 km/h (5.9 mph) and at a travel speed of 12.6 km/h (7.8 mph). As an example, Figure 15 shows a cultivated sub-area following the first working step (at a travel speed of 12.6 km/h (7.8 mph)).

Prior to the second, deeper soil cultivation step, the trial area had already been tilled once with the GREAT PLAINS X-Press 6.6 m short disc harrow. The straw covering remaining on the trial area for the subsequent working step was 3.5 t/ha (1.6 TPA). With the second, deeper soil cultivation step, approximately 57 % of the straw (2.0 t/ha (0.9 TPA)) was incorporated into the soil at a working speed of 9.4 km/h (5.8 mph). At an increased travel speed of 12.9 km/h (8 mph), the proportion of incorporated straw increased to 68 % (2.4 t/ha (1.1 TPA)). The travel speed had only a slight influence on the proportional distribution of incorporated straw across the various soil horizons. 65 % of the straw is incorporated into the first soil horizon (0 to 5 cm (0 to 2 in.)) and approx. 30 % is incorporated into the second soil horizon (5 to 10 cm (2 to 4 in.)) (see Table 5). As an example, Figure 16 shows a sub-area after the second soil cultivation step (at a travel speed of 12.9 km/h (8 mph)).

Assessment of operation

The disc cutting angle can be configured easily using four crank handles. These crank handles are easily accessible to the operator, as they are attached the outside of the equipment's frame (+).

To adjust the basic setting of the working depth (e.g. from deep to shallow), the hydraulic cylinder on the drawbar must be retracted or extended. Furthermore, to adjust the rear roller, there are four spindles that must be turned to a longer or shorter length. To do this, the operator has to climb onto the equipment's frame (–).

The working depth can be adjusted by a few centimetres without using tools. This is achieved by retracting or extending the hydraulic cylinder on the drawbar; this cylinder can be controlled from the tractor cabin by hydraulics. The operator must then get out of the tractor to fold spacers in or out of place on the easily accessible piston rod of the hydraulic cylinder. It is not necessary at this point to adjust the rear roller using the four spindles, so it is possible to perform all of the work outside of the frame (+).

Figure 15:
Cultivation pattern left behind by the X-Press 6.6 m short disc harrow in the first working step (working speed: 12.6 km/h (7.8 mph))

On the equipment being tested, all of the hydraulic couplings were marked with coloured cable ties. A cable tie of the same colour is attached to the associated hydraulic cylinder. This makes it easy for the operator to identify the hydraulic cylinder to which the corresponding hydraulic couplings belong. After removal from the machine, the hydraulic hoses can be hung on the brackets provided (Figure 8). The storage facility for the hydraulic hoses is evaluated as "good" (+) according to the DLG evaluation framework.

The disc harrow has a permanently installed lighting system, which need not be removed for soil cultivation (+).

Table 6 shows an overview of the results of the evaluation of operation.

Figure 16:
Cultivation pattern left behind by the X-Press 6.6 m short disc harrow in the second working step (working speed: 12.9 km/h (8 mph))

Table 6:
Evaluation of operation for the GREAT PLAINS X-Press 6.6 m

Test criterion	Test result	Evaluation*	Comments
Configuration of working depth	unsatisfactory	–	To fundamentally adjust the working depth, the operator has to climb onto the equipment's frame.
Adjustment/fine adjustment of working depth	good	+	All controls are easily accessible. The configuration work can be carried out without tools. To adjust the depth by a few centimetres, it is not necessary for the operator to climb onto the frame.
Configuration of cutting angle	good	+	The cutting angle adjustment is attached outside of the frame in an easily accessible manner. Adjustment does not require tools. The cutting angle can be configured to values of 5 to 25 degrees.
Storage of hydraulic lines	good	+	The equipment has coloured marking of the hydraulic hoses and a facility for their orderly storage.
Mounting/removal of lighting system	good	+	The lighting system is permanently installed and need not be removed prior to soil cultivation.

* Evaluation based on the DLG evaluation schemes for soil cultivation equipment

Summary

In the DLG FokusTest "Power requirement and quality of work", the GREAT PLAINS X-Press 6.6 m short disc harrow was tested at various working depths and travel speeds on harvested areas of wheat.

The short disc harrow allows both the stubble ploughing step (shallow soil cultivation) and the subsequent deeper soil cultivation steps. The measurement runs were performed without disturbances; no blockages occurred. No lateral pull was identified.

During the shallow soil cultivation step, the tractive power requirement is 112 kW (152 PS) (at a working speed of 9.5 km/h (5.9 mph)) and 170 kW (231 PS) (at 12.6 km/h (7.8 mph)). In the subsequent deeper soil cultivation step, the tractive power requirement is 108 kW (147 PS) (at 9.4 km/h (5.8 mph)) and 179 kW (243 PS) (at 12.9 km/h (8 mph)). As expected, there were corresponding gradations in the measured fuel consumption values. These are approx. 6.5 l/ha (0.7 GPA) and 8 l/ha (0.9 GPA) at travel speeds of 9 km/h (5.6 mph) and 13 km/h (8.1 mph) respectively.

The operation is essentially easy. However, fundamental adjustment of the working depth requires the operator to climb onto the equipment frame briefly.

Further information

Within the field of the DLG's technical work, the DLG Committee for Technology in Crop Production deals with the topic of soil cultivation.

Instruction leaflets and documents relating to this technical work carried out on a voluntary basis are available for free in PDF format at: **www.dlg.org/technik_pflanzenproduktion.html**

Test execution

DLG e.V.,
Test Center
Technology and Farm Inputs,
Max-Eyth-Weg 1,
D-64823 Groß-Umstadt

DLG Testing Framework

FokusTest
"Power requirement
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Field

Technology in outdoor operations

Project manager

Dr Ulrich Rubenschuh

Test engineer(s)

Dipl. Ing. agr.
Georg Horst Schuchmann*

* Reporting engineer

The DLG

In addition to conducting its well-known tests of agricultural technology, farm inputs and foodstuffs, the DLG acts as a neutral, open forum for knowledge exchange and opinion-forming in the agricultural and food industry.

Around 180 full-time staff and more than 3,000 expert volunteers develop solutions to current problems. More than 80 committees, working groups and commissions form the basis for expertise and continuity in technical work. Work at the DLG includes the preparation of technical information for the agricultural sector in the form of instruction leaflets and working documents, as well as contributions to specialist magazines and books.

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DLG e.V.
Test Center Technology and Farm Inputs
Max-Eyth-Weg 1 · 64823 Groß-Umstadt
Telephone +49 69 24788-600 · Fax +49 69 24788-690
tech@DLG.org · www.DLG.org

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