

Test Report



AGREX Mineral fertiliser distributors

12 - 24 m working widths

Tested model: XPL 800

Tested working width: 18 m

Manufacturer and entrant:

AGREX S.p.A. - Via Bella, 55/57 - 35010 Villafranca Padovana - ITALY

Tel.: +39 49 9075684 - Fax: +39 49 9075524



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ITALY

Tel.: +39 49 9075684

Fax: +39 49 9075524

Danish Institute of Agricultural Sciences PO Box 50
8830 Tjele Denmark
Tel: 45 8999 1028
www.agrsci.dk

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Conclusion

The spreading performance of the AGREX XPL 800 spreader has been tested according to the requirements and test methods given in the standard EN 13739 part 1 and 2 which is the European environment standard for mineral fertiliser distributors. The tests have been performed at Danish Institute of Agricultural Sciences, Department of Agricultural Engineering in 2006.

On normal and late top spreading at 18 m working width with the tested fertilisers, the coefficient of variation (CV) for the evenness of transversal distribution was found between 5.6% and 11.0% from handbook settings or by optimisation. By use of the methods for in field tests provided by the manufacturer it has been possible to optimise the spreading pattern if necessary.

On border spreading at 18 m working width with the tested fertilisers and by use of handbook settings, it will be possible to reduce the amount of fertiliser spread outside the border by use of a deflector unit mounted on left side of the machine.

Calibration and adjustment of the spreader is easy to perform.

Flow rate control can be performed by use of the equipment delivered by the manufacturer. When doing the flow rate test the disc in one side has to be removed and the test equipment has to be mounted. The highest deviation between intended and obtained application was 20% found by spreading Fertiliser C (prilled fertiliser, > 0.9 kg/l).

The hopper is equipped with sieves to prevent blockage of the feeding device. A filling grade scale inside the hopper will show the actual amount of fertiliser in the hopper. The hopper can be emptied through the feeding device when the vanes have been removed from the discs. The machine is easy to clean.

The instruction handbook gives information about the handling of the spreader and how to set the spreader for different fertilisers. The correct setting can be made on the basis of information about type of fertiliser. The number of fertiliser mentioned in the handbook is limited.

Instructions for use of the field test equipment are given in the instruction handbook. The instructions how to adjust the machine based on field test are sufficient.

During the test minor modifications were done on the machine by the manufacturer. Also the instruction handbook was revised during the test period.

General conditions

Test methods

The tests are based on the standard EN 13739 parts 1 and 2 for fertiliser distributors. The standard describes the requirements and methods for testing in relation to protection of the environment (normal as well as border spreading). Using the handbook provided by the manufacturer, the standard says that it should be possible to distribute fertilisers in a way which is harmless to the environment. The handbook information's must be simple and easy to read and the instructions for adjustment of the distributor must clearly indicate how spreading can be done in an acceptable way. It should be possible to obtain an acceptable result without depending on detailed information about e.g. brand and producer of the fertiliser. Furthermore, it should also be possible to recognise actual fertilisers by their physical properties rather than by the name of the fertiliser.

Test site

The tests were carried out indoors in a laboratory measuring 80 × 60 m. Temperature as well as humidity was controlled by equipment installed to ensure a constant maximum relative humidity (normally 50%) and a minimum temperature of 12°C.

Spreading patterns were measured by spreading the fertiliser over a 56 m wide field divided into 448 funnel-shaped 0.25 × 0.50 m and 0.80 m deep collecting bins, placed in two rows. The results of the spreading pattern tests are based on an average picture from three runs over the test field. During the tests the fertiliser distributor was mounted on a tractor operating at a speed of 8.3 km/h and PTO speed of 540 rpm.

Test materials

In accordance with the EN standard, five fertilisers were selected to represent the categories of fertilisers mentioned in the standard. The fertilisers had the following physical properties.

Table 1. Specifications of the chosen fertilisers

	Product	Particle size D50 mm	Bulk density kg/dm³	Flowability kg/min	Actual fertiliser
A	Granular > 0.9 kg/dm ³	3.78	1.04	5.9	CAN 27% + S + Mg
B	Granular < 0.9 kg/dm ³	3.12	0.75	4.5	Urea 46%, Yara
C	Prilled > 0.9 kg/dm ³	3.06	1.06	6.2	NPK 20-3-8 + S
D	Prilled < 0.9 kg/dm ³	1.74	0.73	5.8	Urea 46%, Poland
E	Compacted	3.05	1.08	5.8	Potassium 60%

Fertiliser D did not fulfil the requirements in the EN standard. This did not influence the test results. The used fertilisers were supplied from manufacturers or dealers.

Tested machine

The Agrex XPL 800 is a fertiliser distributor of mounted type constructed for working widths from 12 to 24 m. The spreader has two discs operating from the centre towards the outside of the spreader.

The spreader has a 800 litre basic hopper, of which the lower part is divided into two funnel-shaped sections and covered with sieves. The fertiliser will leave the hopper by way of gravitation through a discharge opening at the bottom of each funnel section. Mechanical agitators are mounted above the discharge openings. The openings are covered by a shutter mechanism which will be moved through a rod system by single acting hydraulic cylinders. The actual setting of the shutters can be made in steps on scales from 0 to 10 placed on the back of the machine.

In order to adjust the point where the fertiliser will meet the vanes of the discs, the position of the bottom openings may be turned by means of handles placed on each side of the hopper. The outlet position of the fertiliser on the disc can be set on 'timing scale' A to Z placed on the left and right side of the machine.

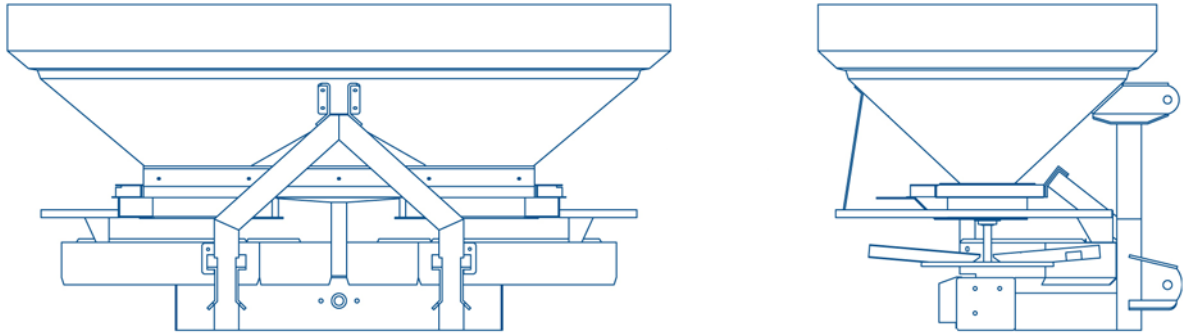
Agitators mounted at the bottom of the hopper ensure an even flow of fertiliser from the hopper.

Two discs are placed below the hopper and driven mechanically from the PTO-intake through gearboxes and power shafts. Each disc is equipped with 2 vanes having different length. The vane position depends of the working width and fertiliser type. The shortest vane has a rectangular opening which size may be adjusted depending of the fertiliser type.

Equipment for flow rate control can be mounted below one of the outlets after removing the vanes and the disc. The fertiliser leaving the hopper is collected in a container placed on the ground.

By border spreading (defined as spreading in a distance of $\frac{1}{2}$ working width from the border line) a 'deflector' unit DF800 is used. The setting of the deflector depends on the fertiliser and distance from the tramline and the border.

In the instruction handbook, the correct setting of the machine can be found on the basis of information about type of fertiliser.



The AGREX XPL 800 spreader



AGREX XPL 800 dosing system and the spreading disc

Figure 1. Principle of the AGREX XPL 800 spreader

Tests carried out

Tests were carried out at 18 m working width with five fertilisers mentioned above. The tests were carried out according to the handbook and covered normal spreading, late top spreading and border spreading.

The definitions for the chosen spreading types are as follows:

Normal: Normal spreading in the field by distributing the fertiliser as evenly as possible by going to and fro in the field.

Late top: Normal spreading at a height above the crop according to the instructions given by the manufacturer.

Border: Spreading along the field edge in a way that prevents fertiliser to be thrown out side the field edge.

(More detailed definitions and explanations for the different spreading type are found in the EN 13739 standard).

All combinations of fertiliser and application rates given in the EN 13739 standard were tested at first by following the instruction handbook and the spreading chart delivered with machine. This first test is defined as 'Handbook' in the report.

In separate instructions a method for field testing of the spreading pattern by normal spreading is given and during the tests, this method was used in order to decide if an optimisation should be carried out. The field test method advised by the manufacturer use 5 collecting bins (0.50 × 0.50 m in size) placed in the field according to instructions given in the handbook. The amount of fertilizers in the 5 collectors will indicate the actual distribution pattern and based on the pattern it may be decided to change the setting of the machine. In case that optimisation tests were done this are mentioned as 'Optimisation' in the report.

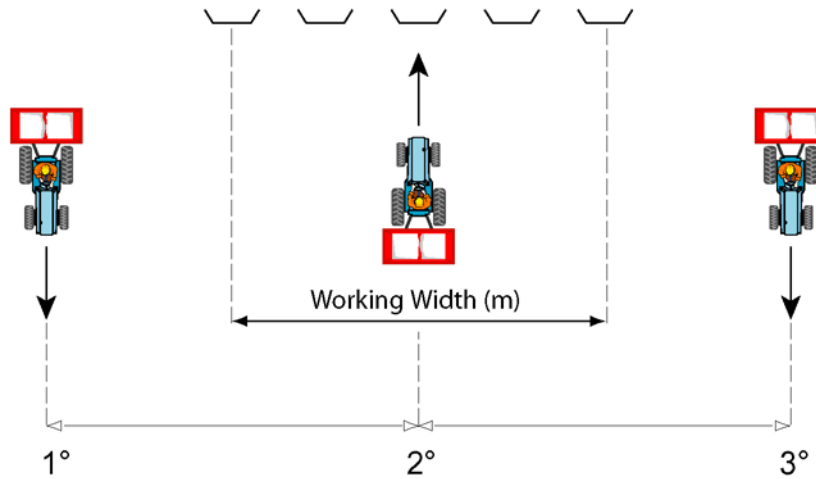


Figure 2. Proposed method for field testing of the spread pattern

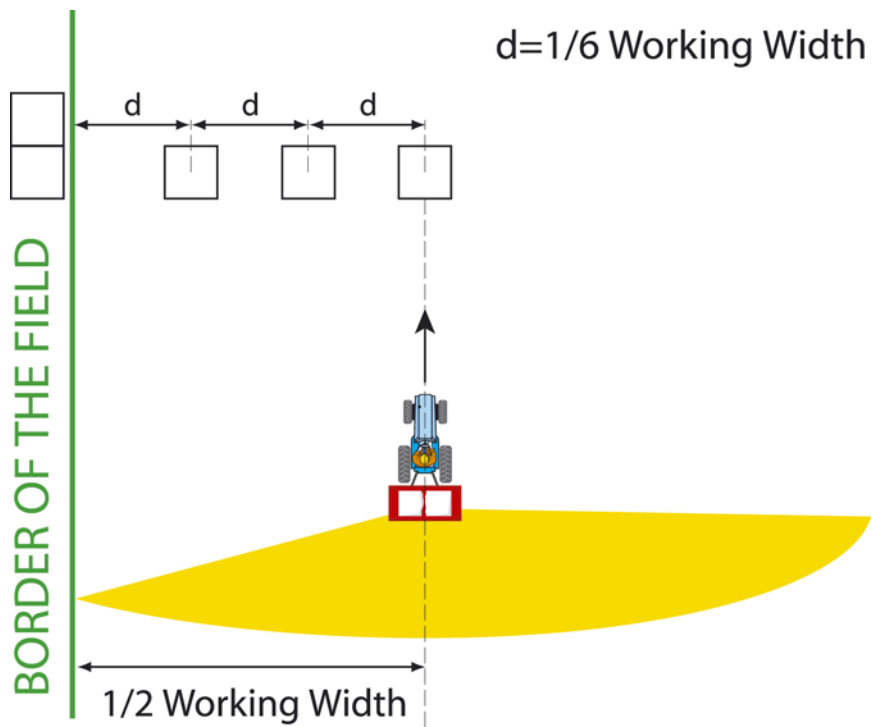


Figure 3. Proposed method for field testing of the border spreading

Results

The obtained results from the handbook settings and the optimised settings are given in the following tables and figures.

Fertiliser A (CAN 27% N - Lithuania) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments							Results		
			Flowrate scale	Disc type	Vane setting scale	Timing scale	Pto speed rpm	Disc height cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2006032405	Handbook setting	74	2,5	24 m	A1 / B3 / 5	C	540	80	0	96,3	10,2	50,1 / 49,9
2006032406	1. optimisation	74	2	24 m	A1 / B3 / 5	C	540	80	0	71,2	13,9	51,1 / 48,9
2006032407	2. optimisation	74	2	24 m	A1 / B2 / 5	C	540	80	0	73,4	8,3	50,4 / 49,6
2006032401	Handbook setting	259	4,5	24 m	A1 / B4 / 5	C	540	80	0	278,0	7,6	49,0 / 51,0
2006032403	Handbook setting	440	6	24 m	A1 / B5 / 5	C	540	80	0	451,5	14,1	49,7 / 50,3
2006032404	1. optimisation	440	6	24 m	A1 / B4 / 5	C	540	80	0	454,6	6,1	49,7 / 50,3

Fertiliser A (CAN 27% N - Lithuania) - Late top - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments							Results		
			Flowrate scale	Vane type	Vane setting scale	Timing scale	Pto speed rpm	Disc height cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2006032410	Handbook setting	74	4 / 4,5	24 m	A1 / B3 / 5	C	540	50	+ 4	64,8	29,6	49,4 / 50,6
2006032411	1. optimisation	74	2	24 m	A1 / B2 / 5	C	540	50	+ 4	81,6	15,0	50,5 / 49,5
2006032412	2. optimisation	74	2,25	24 m	A1 / B2 / 6	C	540	50	+ 4	77,2	10,6	48,9 / 51,1

Fertiliser A (CAN 27% N - Lithuania) - Normal spreading - Border

Test no	Test according to	Intended amount kg/ha	Adjustment								Results		
			Flow setting Scale	Vane type	Vane setting scale	Timing Scale	Pto speed rpm	Disc height cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border ‰	Max in 5 m area %
2006032409	Handbook setting	259	4 / 4,5	24 m	A1 / B4 / 5	C	540	80	0	Deflector 10, Deviator 7	23,2	1,7	92,3

Fertiliser A (CAN 27% N - Lithuania) - Late top spreading - Border

Test no	Test according to	Intended amount kg/ha	Adjustment								Results		
			Flow setting Scale	Vane type	Vane setting scale	Timing Scale	Pto speed rpm	Disc height cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border ‰	Max in 5 m area %
2006032414	Handbook setting	74	1,75 / 2,2	24 m	A1 / B2 / 6	C	540	50	+ 4	Deflector 10, Deviator 7	25,5	1,7	62,9
2006032415	1. optimisation	74	1,75 / 2,2	24 m	A1 / B2 / 6	C	540	50	+ 4	Deflector 9, Deviator 7	25,0	2,5	60,4

FERTILISER B (UREA , GRANULAR, YARA) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments							Results		
			Flowrate scale	Vane type	Vane setting scale	Timing scale	Pto speed rpm	Disc height cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
20060920001	Handbook setting	152	3,65	24 m	A4 / B2 / 7	F	540	80	0	147,6	11,6	48,3 / 51,7
20060920002	1. Optimisation	152	3,65	24 m	A4 / B2 / 8	F	540	80	0	147,0	5,6	48,7 / 51,3

FERTILISER B (UREA , GRANULAR, YARA) - Normal spreading - Border

Test no	Test according to	Intended amount kg/ha	Adjustment								Results		
			Flow setting Scale	Vane type	Vane setting scale	Timing Scale	Pto speed rpm	Disc height cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border %	Max in 5 m area %
20060920004	Handbook setting	152	3,2 / 3,65	24 m	A4 / B2 / 7	F	540	80	0	Deflector 7 Deviator 8	20,5	1,1	102,9
20060920005	1. Optimisation	152	3,2 / 3,65	24 m	A4 / B2 / 6	F	540	80	0	Deflector 6 Deviator 8	19,3	1,5	97,0

FERTILISER C (NPK 20 - 3 - 8 + 4 S+1,2 MG, YARA) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments							Results		
			Flowrate scale	Vane type	Vane setting scale	Timing scale	Pto speed rpm	Disc height cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2006032417	Handbook setting	100	2,5	24 m	A1 / B3 / 5	D	540	80	0	107,8	6,1	49,1 / 50,9
2006032418	Handbook setting	350	5	24 m	A1 / B5 / 5	D	540	80	0	366,9	7,5	48,5 / 51,5
2006032419	Handbook setting	600	6,7	24 m	A1 / B5 / 5	D	540	80	0	595,3	9,1	48,4 / 51,6

FERTILISER C (NPK 20 - 3 - 8 + 4 S+1,2 MG, YARA) - Late top - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments							Results		
			Flowrate scale	Vane type	Vane setting scale	Timing scale	Pto speed rpm	Disc height cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2006032416	Handbook setting	100	2,5	24 m	A1 / B1 / 5	D	540	50	+ 4	106,0	11,0	49,6 / 50,4

FERTILISER C (NPK 20 - 3 - 8 + 4 S+1,2 MG, YARA PORSGRUNN) - Normal spreading - border

Test no	Test according to	Intended amount kg/ha	Adjustment								Results		
			Flow setting Scale	Vane type	Vane setting scale	Timing Scale	Pto speed rpm	Disc height cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border %	Max in 5 m area %
2006032421	Handbook setting	350	4,25 / 5	24 m	A1 / B5 / 5	D	540	80	0	Deflector 7 Deviator 8	20,2	3,3	95,9
2006032422	1. Optimisation	350	4,25 / 5	24 m	A1 / B5 / 5	D	540	80	0	Deflector 8 Deviator 8	21,4	2,6	107,9
2006032423	2. Optimisation	350	4,5 / 5	24 m	A1 / B5 / 5	D	540	80	0	Deflector 8 Deviator 8	20,4	2,8	106,7

FERTILISER D (UREA, PRILLED, POLAND) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments							Results		
			Flowrate scale	Vane type	Vane setting scale	Timing scale	Pto speed rpm	Disc height cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
20060920007	Handbook setting	152	3,15	24 m	A3 / B1 / 5	D	540	80	0	155,6	8,7	48,0 / 52,0
20060920008	1. Optimisation	152	3,15	24 m	A4 / B2 / 6	D	540	80	0	154,6	8,0	48,3 / 51,7

FERTILISER D (UREA, Prilled, YARA) - Normal spreading - border

Test no	Test according to	Intended amount kg/ha	Adjustment								Results		
			Flow setting Scale	Vane type	Vane setting scale	Timing Scale	Pto speed rpm	Disc height cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border %	Max in 5 m area %
20060920004	Handbook setting	152	3,2 / 3,65	24 m	A4 / B2 / 7	F	540	80	0	Deflector 7 Deviator 8	20,5	1,1	102,9
20060920005	1. Optimisation	152	3,2 / 3,65	24 m	A4 / B2 / 6	F	540	80	0	Deflector 6 Deviator 8	19,3	1,5	97,0

FERTILISER E (COMPACTED , KALI 60, K&S) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments							Results		
			Flowrate scale	Vane type	Vane setting scale	Timing scale	Pto speed rpm	Disc height cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2006032426	Hanbook setting	283	4,5	24 m	A3 / B4 / 4	B	540	80	0	285,9	12,3	49,1 / 50,9
2006032427	1. optimisation	283	4,5	24 m	A3 / B5 / 4	B	540	80	0	282,2	8,5	48,9 / 51,1
2006032428	2. optimisation	283	4,5	24 m	A3 / B5 / 5	B	540	80	0	278,2	8,2	48,6 / 51,4

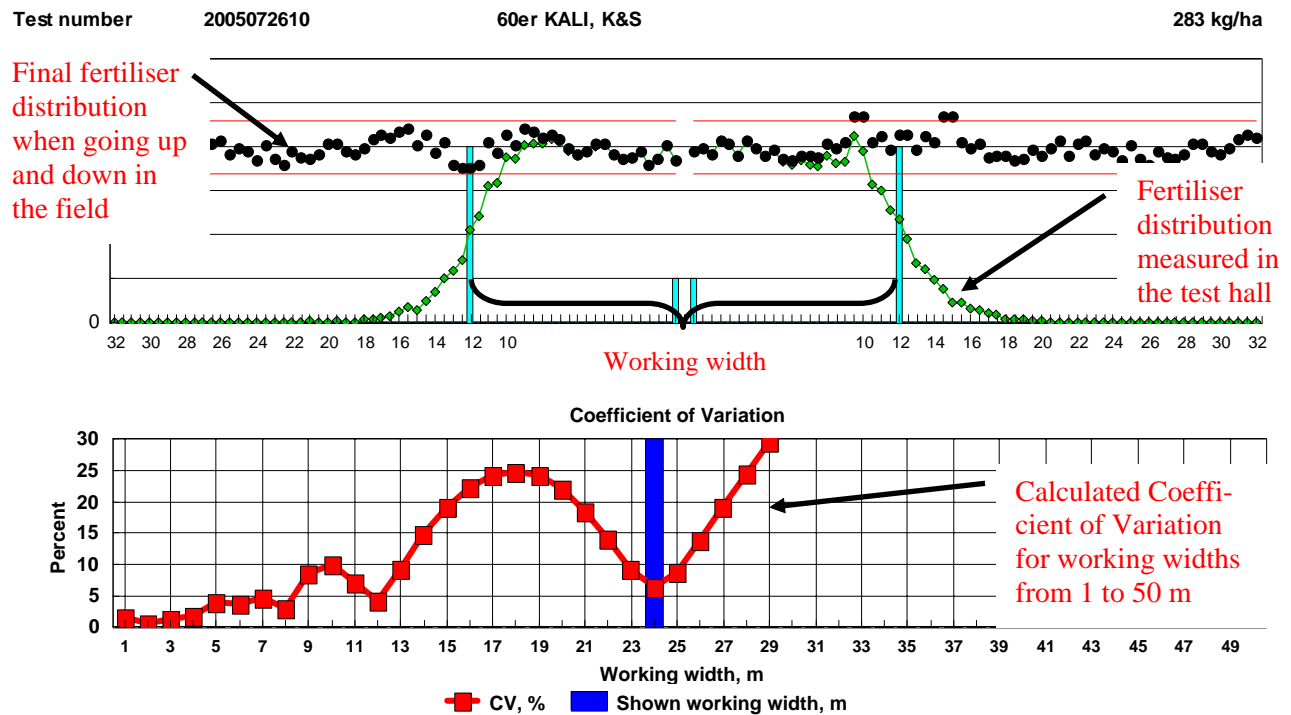
FERTILISER E (COMPACTED , KALI 60, K&S) - Normal spreading - border

Test no	Test according to	Intended amount kg/ha	Adjustment								Results		
			Flow setting Scale	Vane type	Vane setting scale	Timing Scale	Pto speed rpm	Disc height cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border %	Max in 5 m area %
2006032429	Handbook setting	233	4	24 m	A3 / B5 / 5	B	540	80	0	Deflector 1 Deviator 7	15,7	3,6	102,6
2006032430	1. Optimisation	233	4	24 m	A3 / B5 / 5	B	540	80	0	Deflector 2 Deviator 7	16,6	1,9	100,7

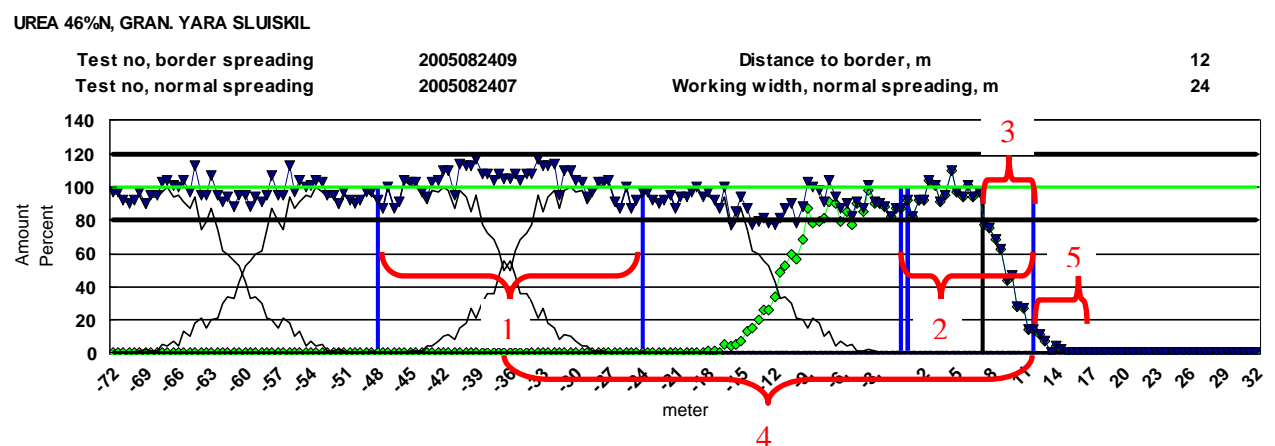
Graphic presentation of the results

In the following pages the best results from each tested setting is presented. How to read the results is explained in the following.

Normal and late top spreading



Border spreading



- 1 Working width
- 2 Distance from 1st tramline to the border
- 3 5 metre area in which the amount of fertiliser should not exceed the average amount in the field more than 20%
- 4 Area in which the evenness of the distribution is calculated. The value is called the 'CT' and must be below 25%
- 5 Amount of fertiliser outside the border. The amount of fertiliser outside border should not exceed 3‰ of the amount of fertiliser used inside the field.

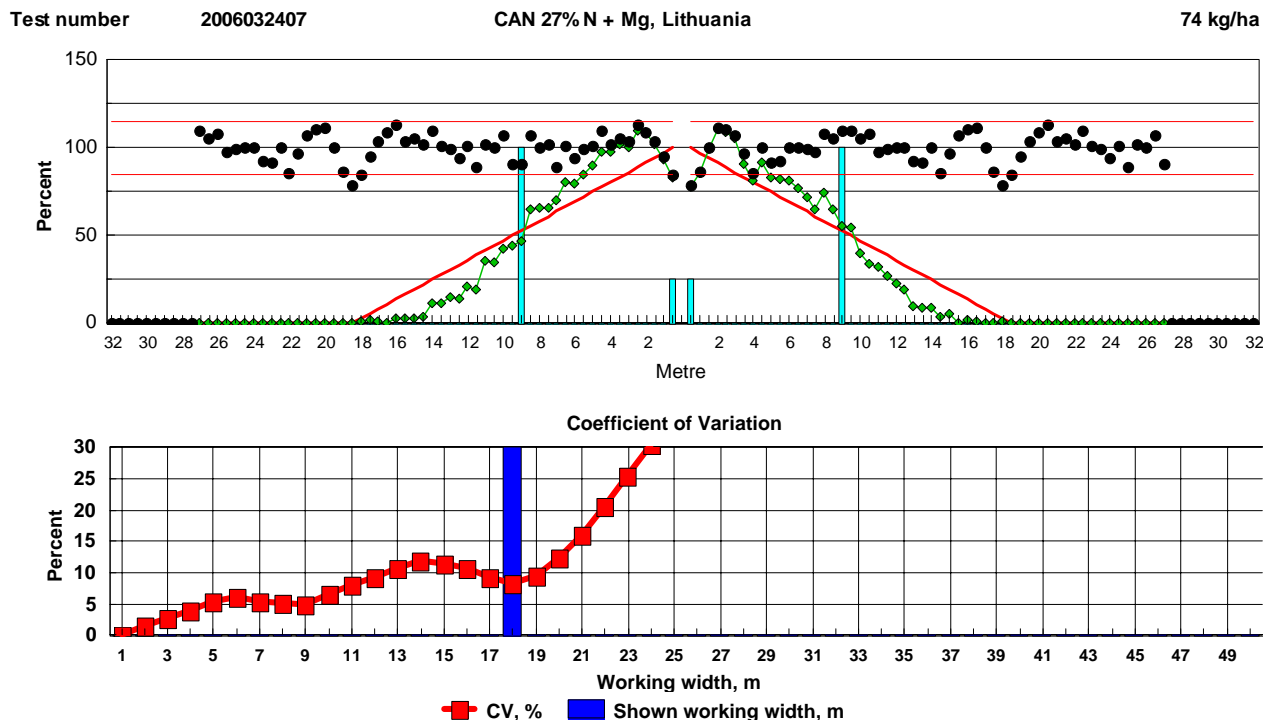


Figure 4. Fertiliser A. Normal spreading. Intended application rate 74 kg/ha

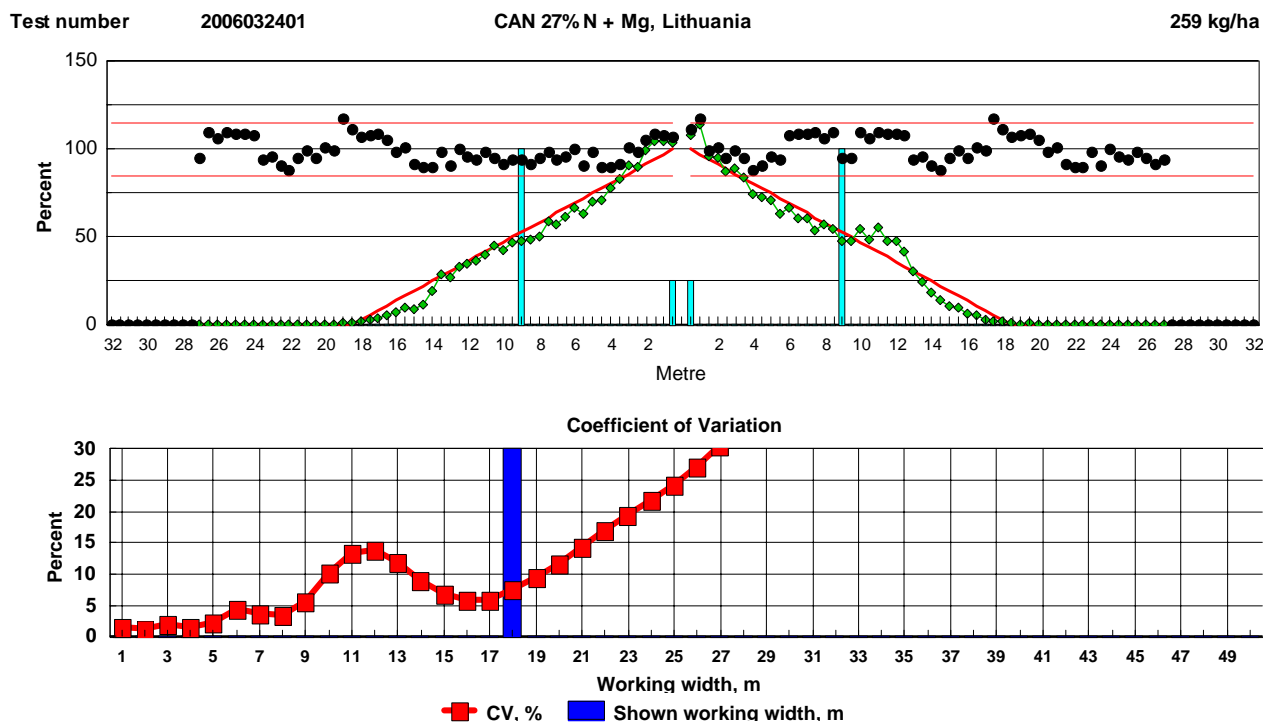


Figure 5. Fertiliser A. Normal spreading. Intended application rate 259 kg/ha

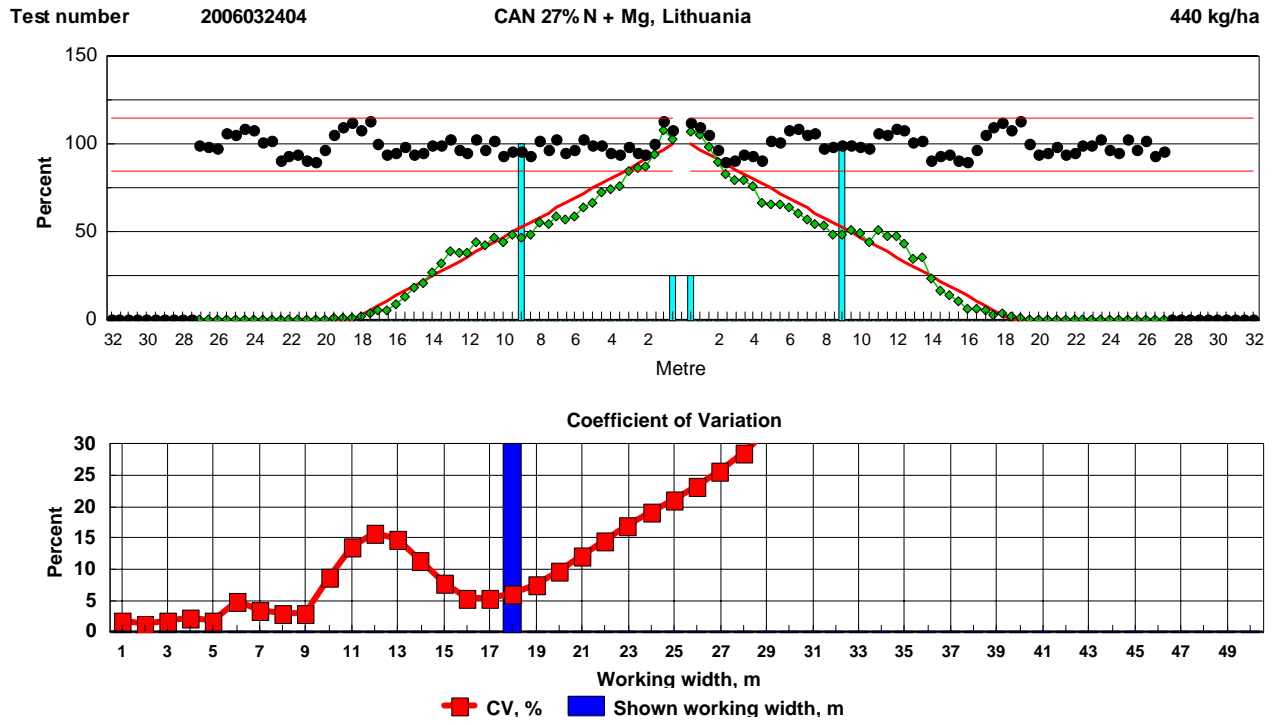


Figure 6. Fertiliser A. Normal spreading. Intended application rate 440 kg/ha

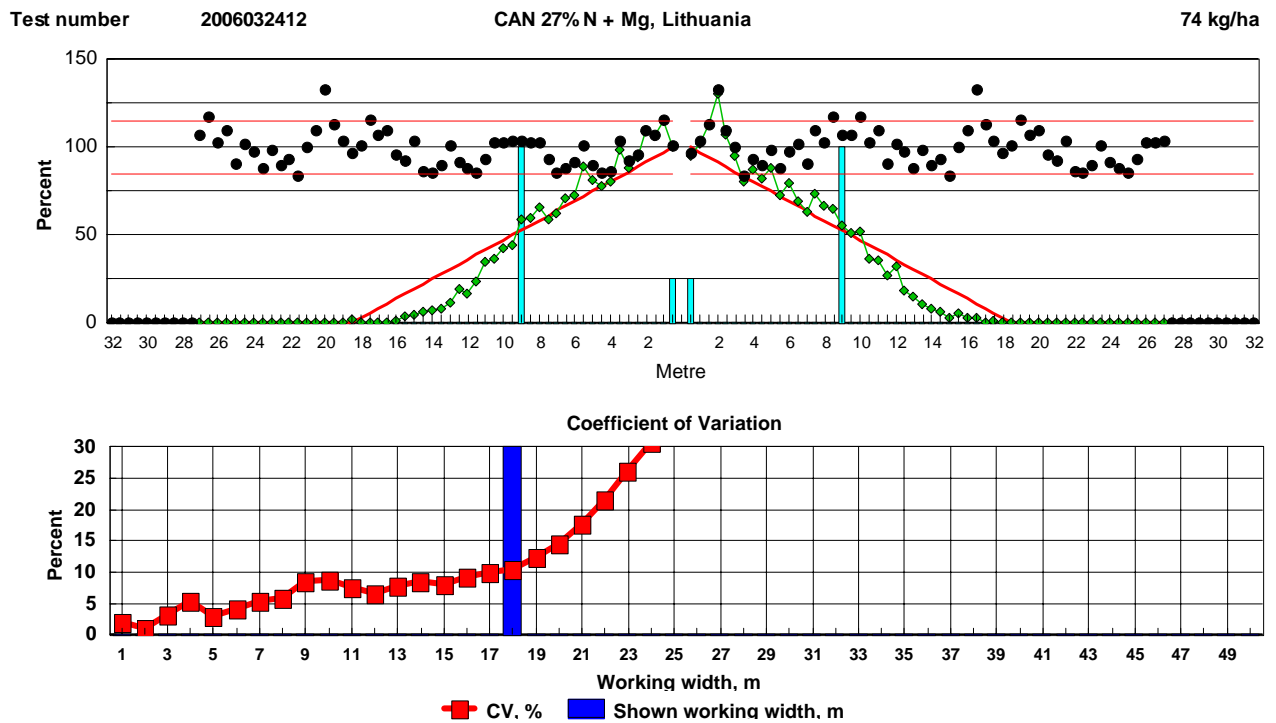


Figure 7. Fertiliser A. Late top. Normal spreading. Intended application rate 74 kg/ha

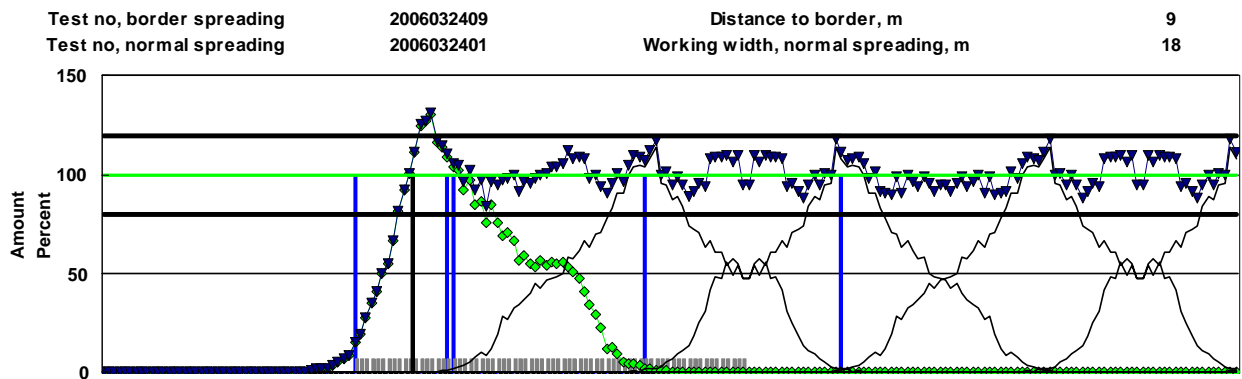


Figure 8. Fertiliser A. Normal, Border spreading. Intended application rate 270 kg/ha

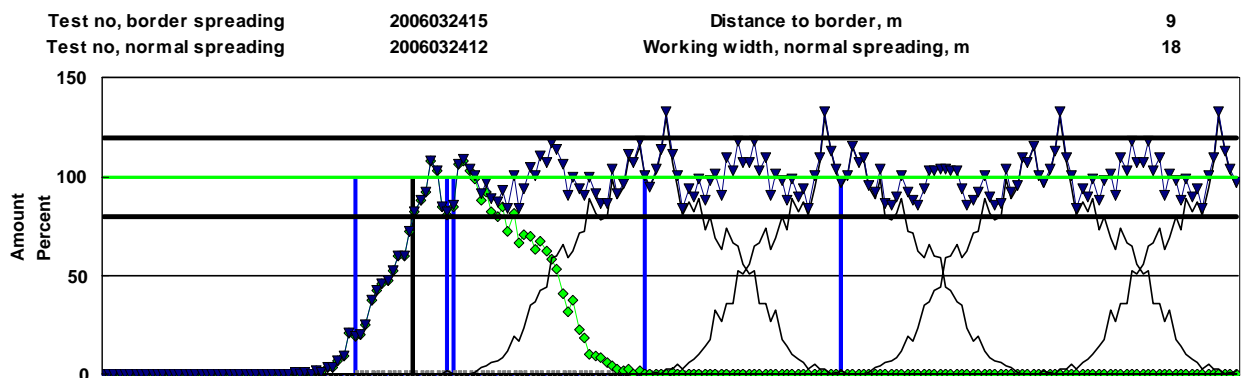


Figure 9. Fertiliser A. Late top, Border spreading. Intended application rate 74 kg/ha

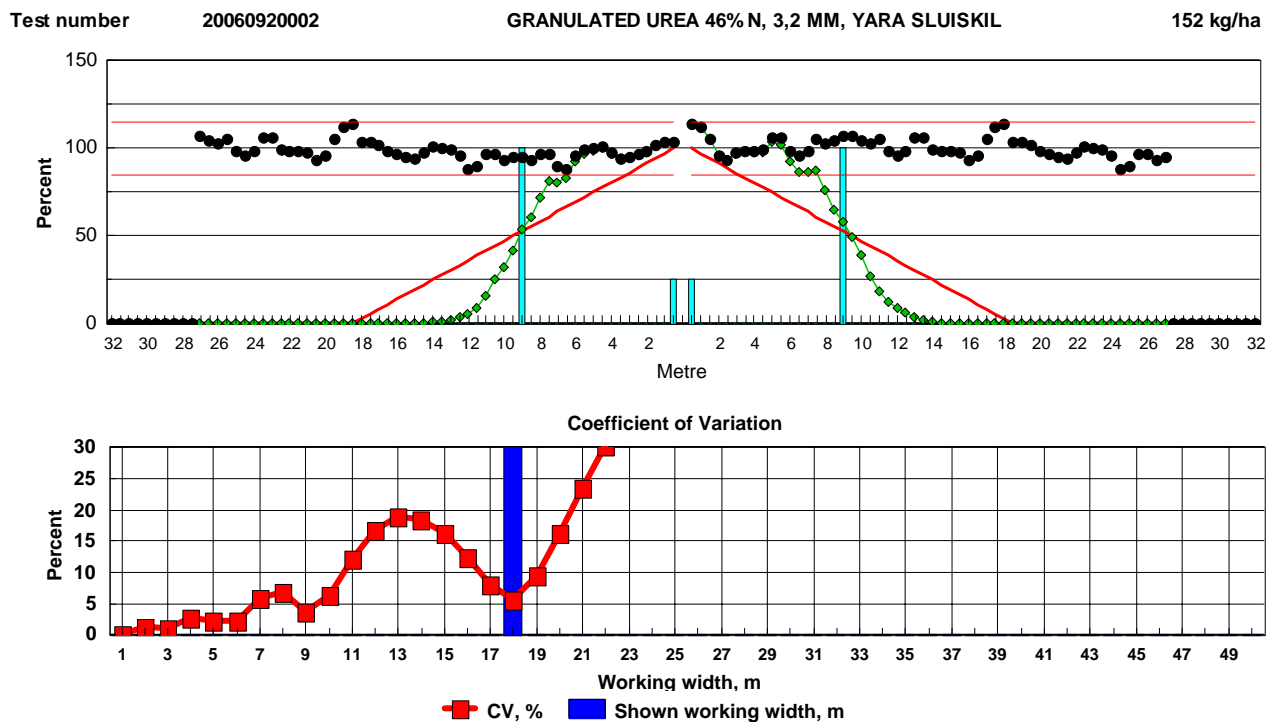


Figure 10. Fertiliser B. Normal spreading. Intended application rate 152 kg/ha

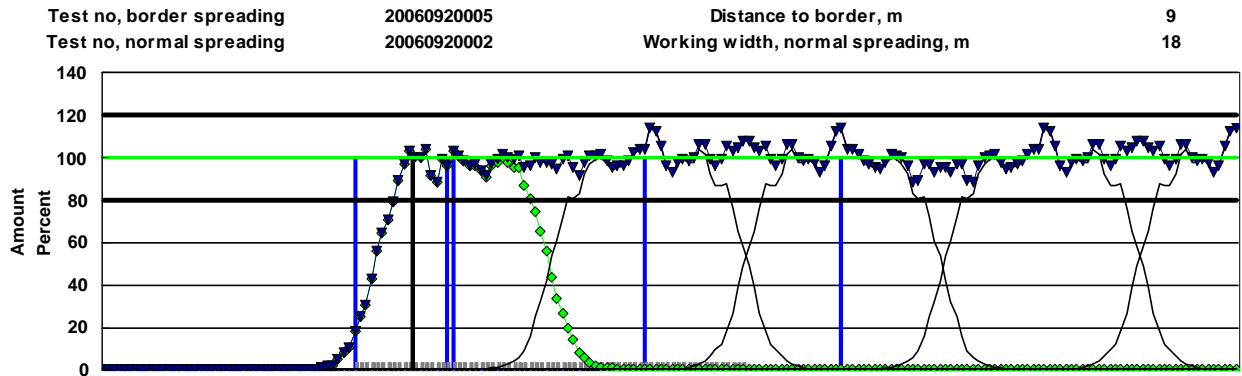


Figure 11. Fertiliser B. Normal, Border spreading. Intended application rate 152 kg/ha

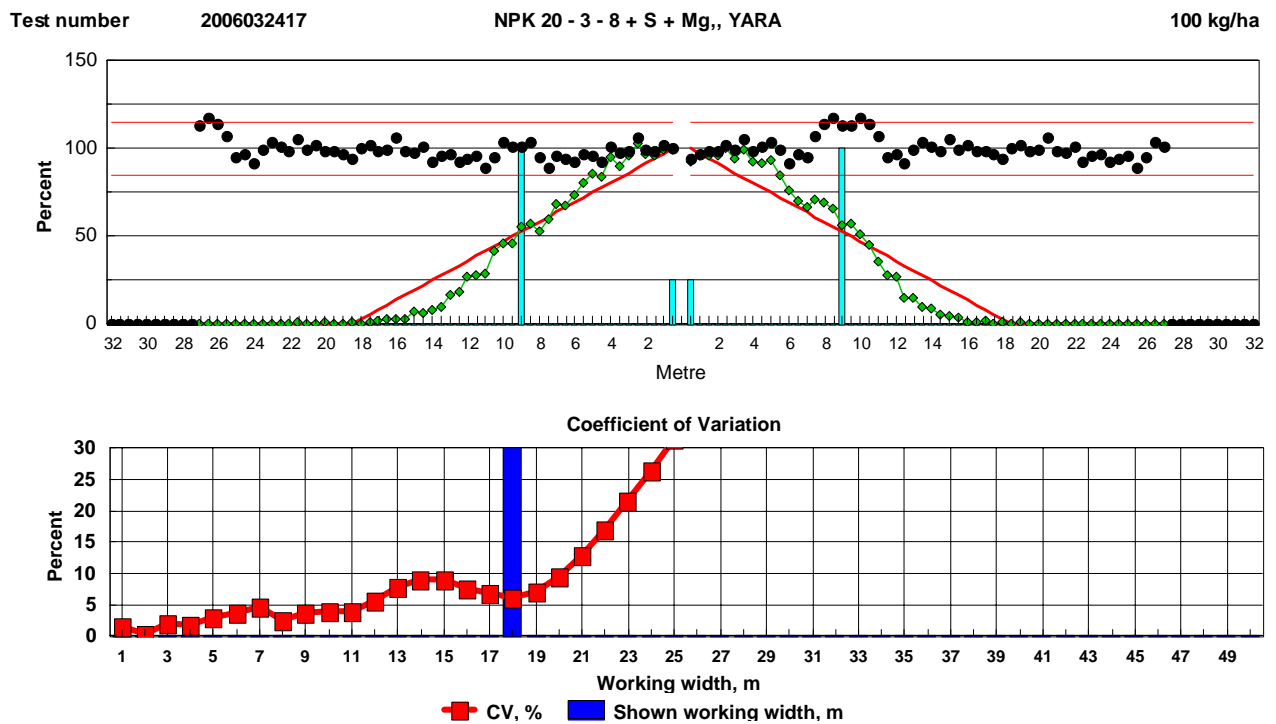


Figure 12. Fertiliser C. Normal spreading. Intended application rate 100 kg/ha

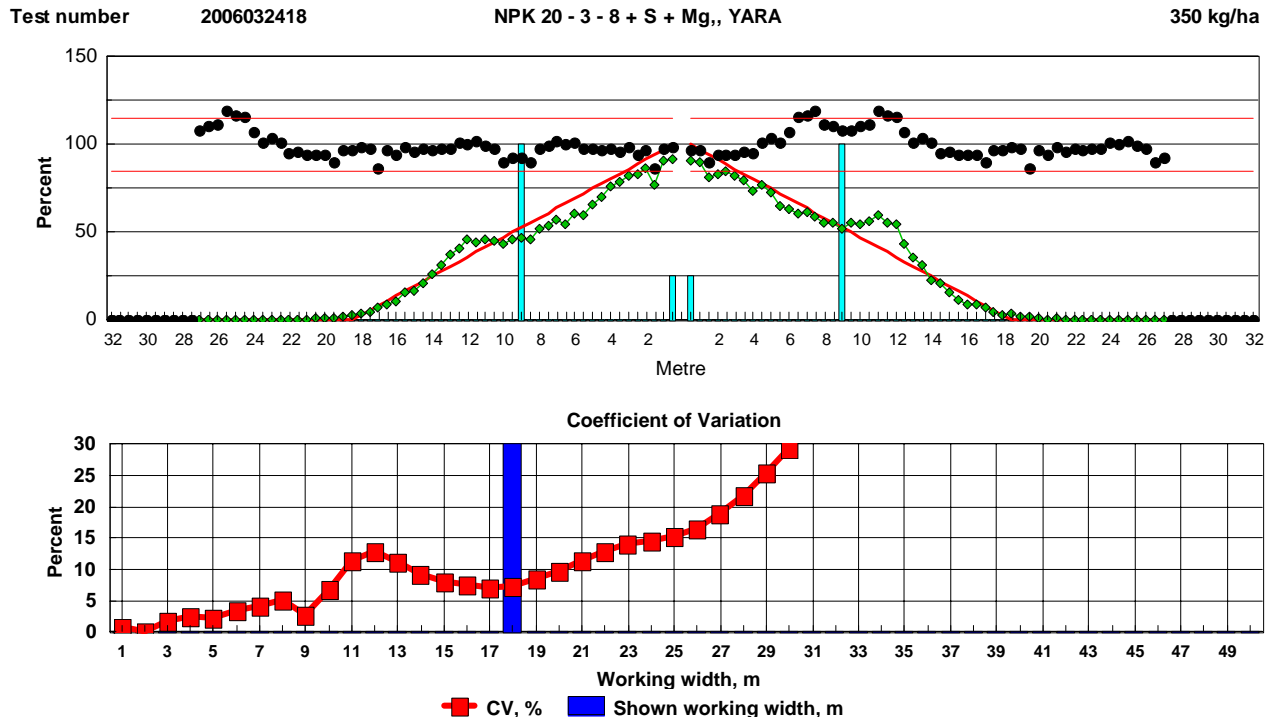


Figure 13. Fertiliser C. Normal spreading. Intended application rate 360 kg/ha

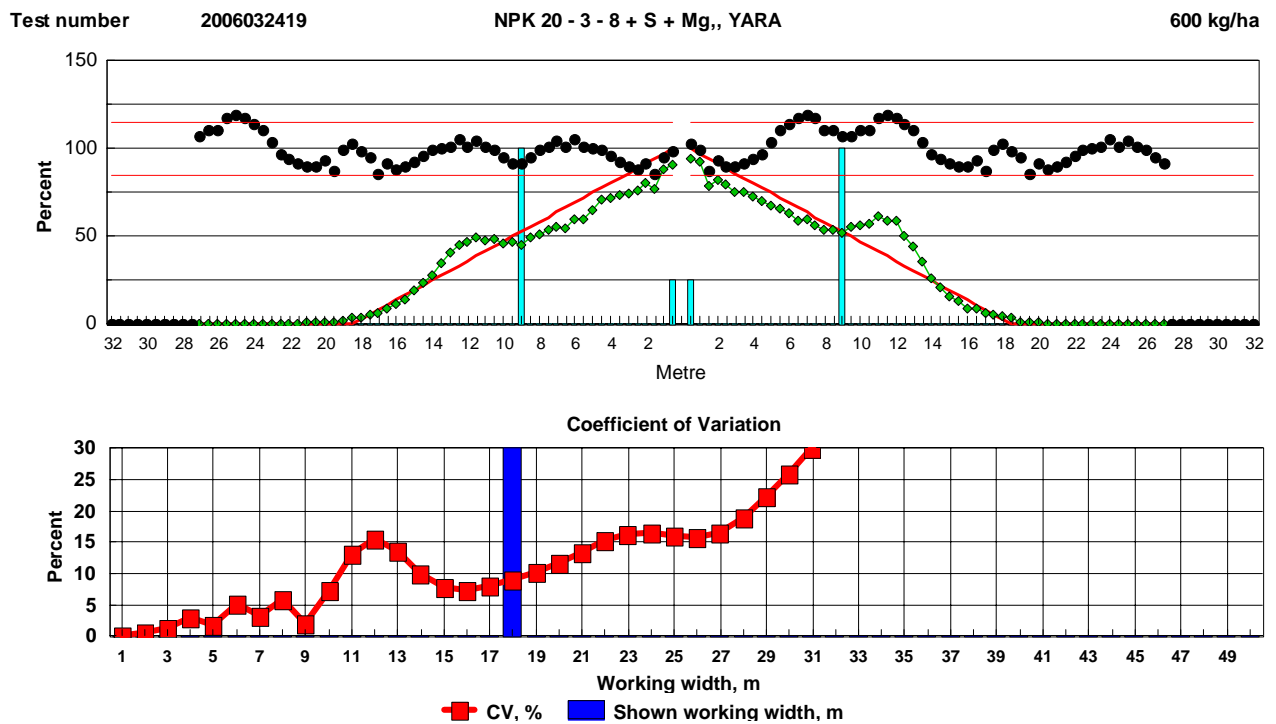


Figure 14. Fertiliser C. Normal spreading. Intended application rate 600 kg/ha

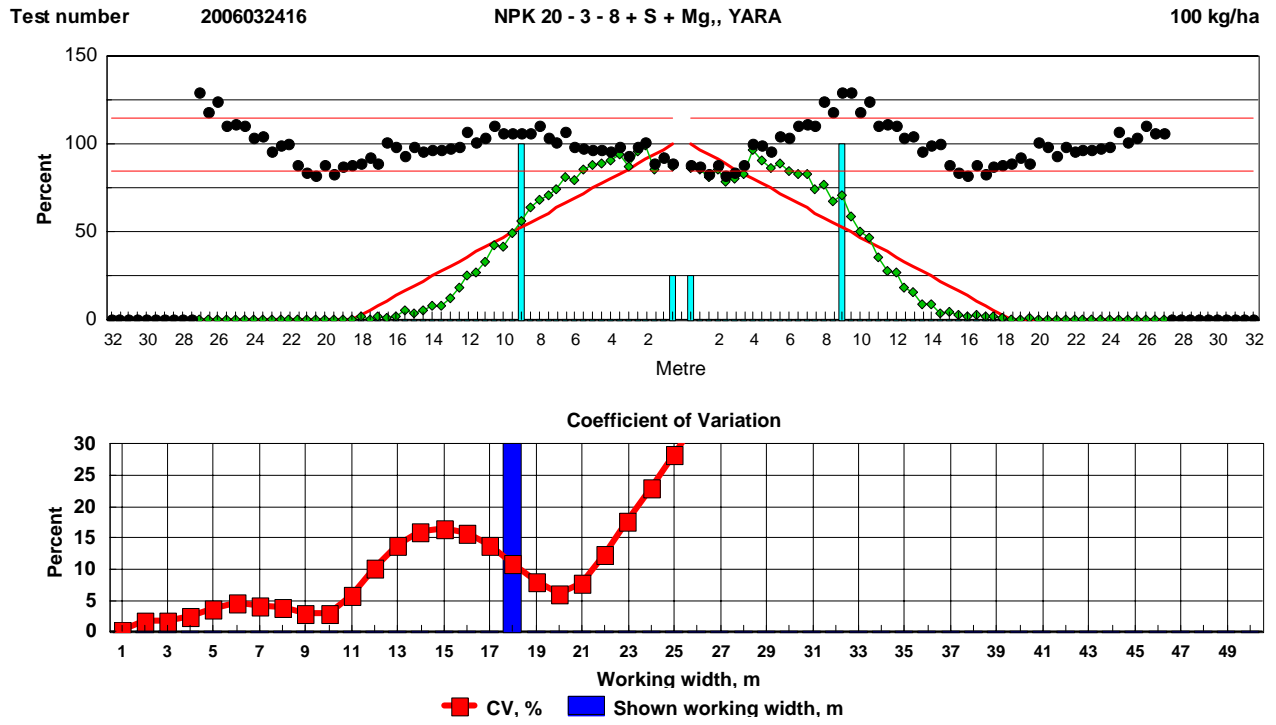


Figure 15. Fertiliser C. Late top spreading. Intended application rate 100 kg/ha

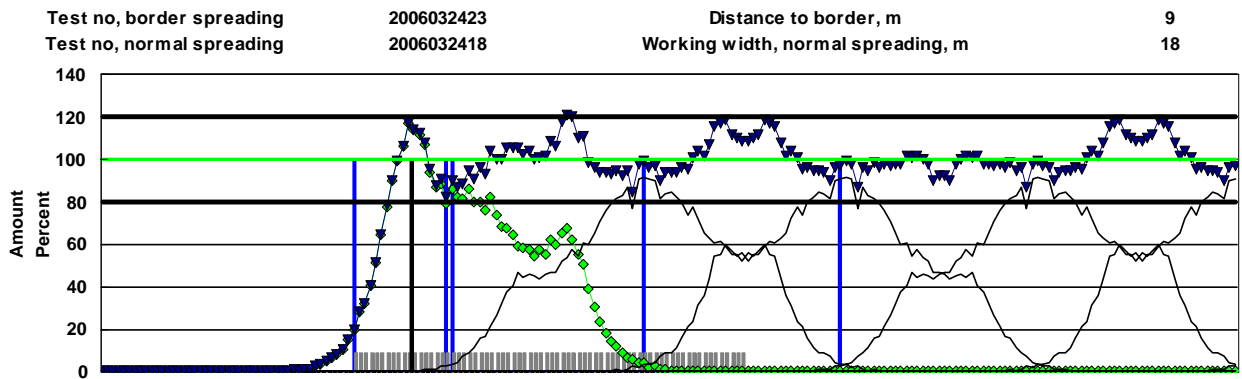


Figure 16. Fertiliser C. Normal, Border spreading. Intended application rate 350 kg/ha

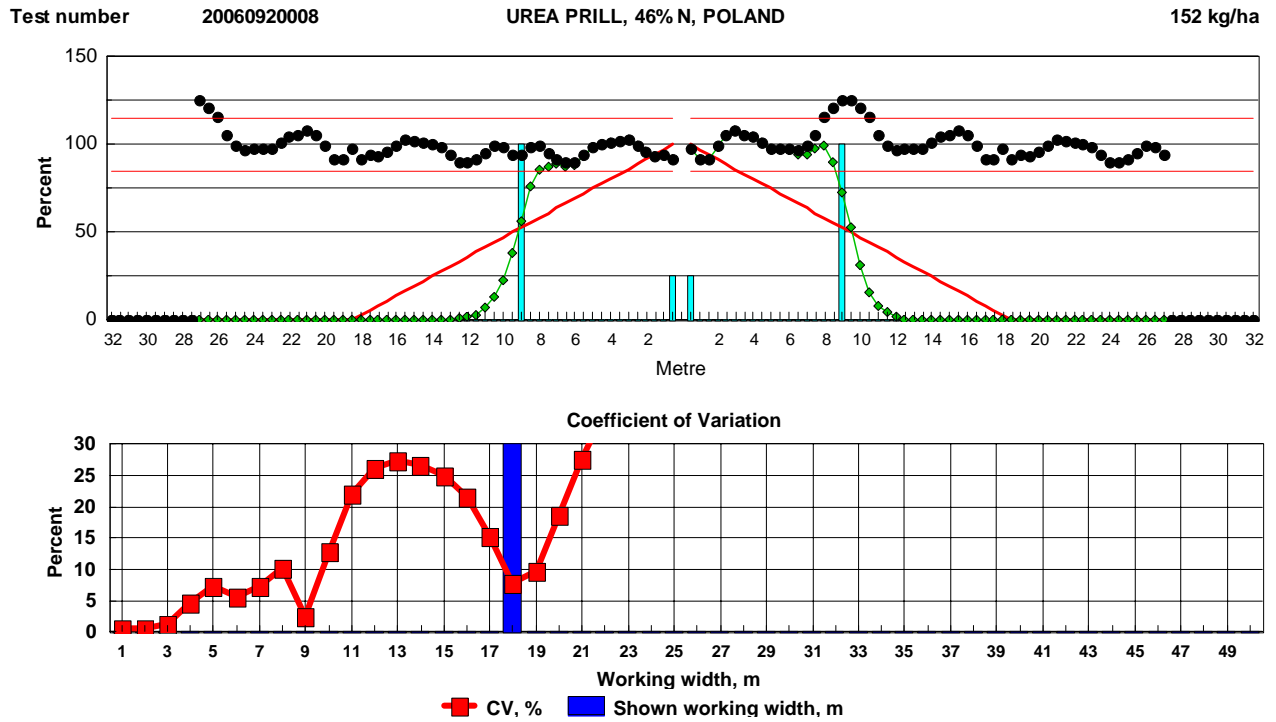


Figure 17. Fertiliser D. Normal spreading. Intended application rate 152 kg/ha

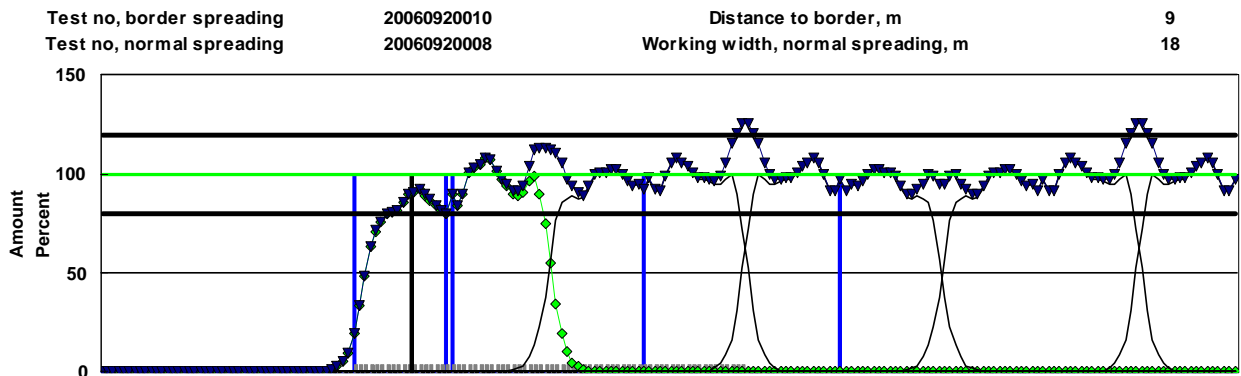


Figure 18. Fertiliser D. Normal, Border spreading. Intended application rate 152 kg/ha

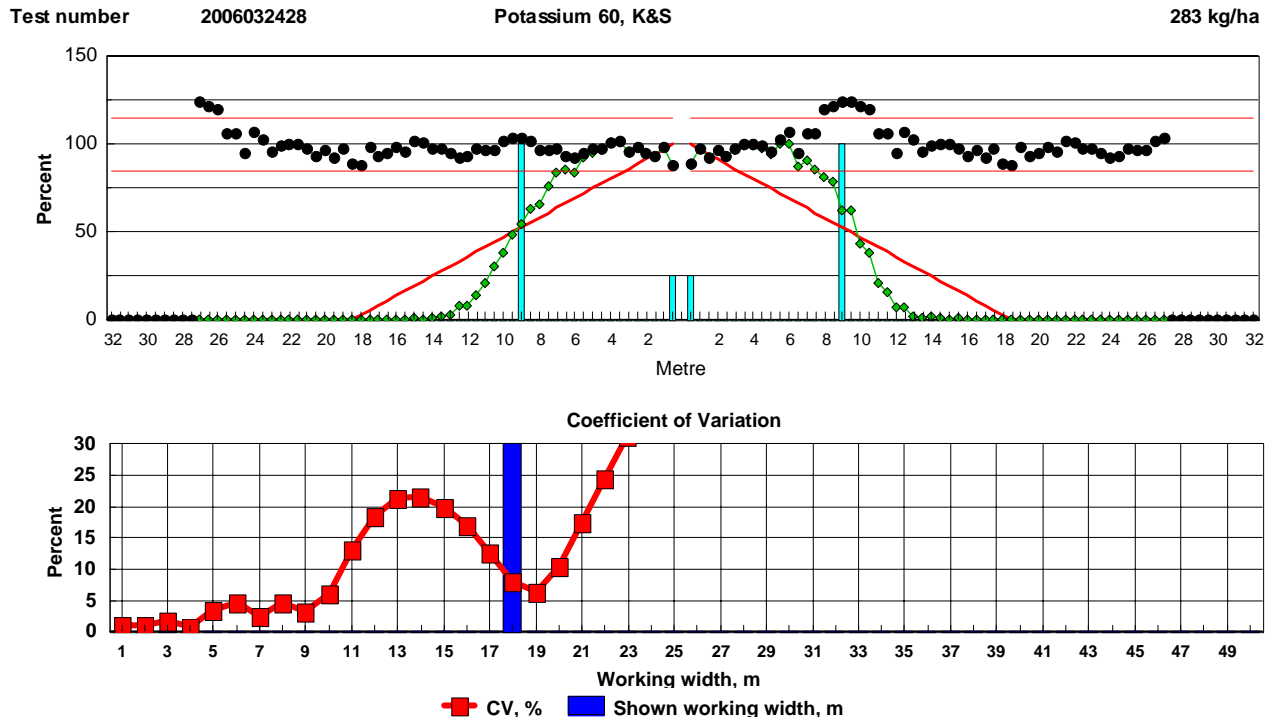


Figure 19. Fertiliser E. Normal spreading. Intended application rate 283 kg/ha

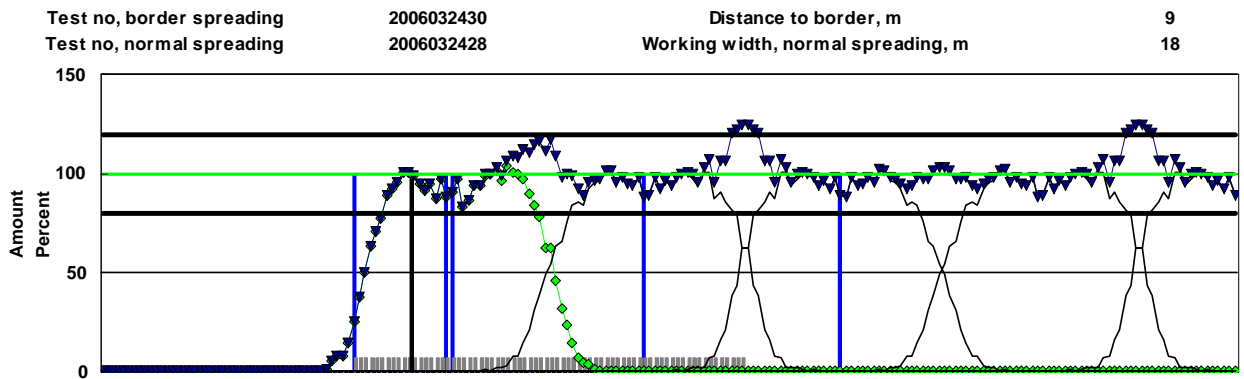


Figure 20. Fertiliser E. Normal, Border spreading. Intended application rate 350 kg/ha

Identification of the tested machine

<i>Manufacturer</i>	AGREX S.p.A
<i>Model</i>	AGREX XPL 800
<i>Production number</i>	30892
<i>Production year</i>	2006
<i>Type of spreader – mounted/trailed</i>	Mounted
<i>Feeding system</i>	By gravity through cylinder on disc
<i>Distribution system</i>	Double discs turning from centre towards outside the spreader
<i>Working widths min/max, m</i>	12 / 24
<i>Way of changing working widths</i>	Changing disc type, vane position and/or drop point
<i>Way of doing border spreading</i>	By 'Till' border spreading: Using the deflector unit
<i>Way of doing spreading at reduced working width</i>	By changing vane types
<i>Way of performing flow rate test</i>	By use of special flow rate test equipment
<i>Driving speed - min/max, km/h</i>	8 / 12
<i>Flow rate - min/max, l/min</i>	4.5 / 265 – depending on type of fertiliser
<i>Overall length, m</i>	1.20
<i>Overall width, m</i>	2.15
<i>Overall height, m</i>	1.05
<i>3-point linkage</i>	
▪ <i>Distance between lower linking points, m</i>	0.67
▪ <i>Distance from ground to lower link point, m</i>	0.15
▪ <i>Distance from ground to upper link point, m</i>	0.74
▪ <i>Diameter of lower link pins, mm</i>	28
▪ <i>Diameter of upper link pin, mm</i>	25.7
<i>Net weight mass, kg</i>	230
<i>Hopper capacity, l</i>	800 (by adding hopper extensions capacities of 1000/1200/1500 may be obtained)
<i>Maximum stated load, kg</i>	1500
<i>Scale inside hopper</i>	Yes
<i>Sieve inside hopper</i>	Yes
<i>Inspection window in hopper wall</i>	No
<i>Possibilities of emptying spreader without spreading</i>	Yes – after removing the vanes and when running the machine
<i>Way of turning discs</i>	Mechanical
<i>Type of power intake</i>	6-spline
<i>Speed of power intake</i>	Variable – depending on working width and fertiliser
<i>Gear ratio- pto speed / disc speed</i>	1 : 1.27
<i>Type and number of hydraulics</i>	2 – single-acting cylinder
<i>Support for PTO-shaft</i>	Yes
<i>Support for hydraulics</i>	Yes
<i>Responsible test staff</i>	Krister Persson and Hans Skovsgård Research Centre Bygholm, October 2006 ISSN 1398-0416

DIAS

Department of Agricultural Engineering

Schüttesvej 17, DK-8700 Horsens

Tel.: +45 89 99 19 00 . Fax: +45 89 99 31 00

e-mail: jbt.djf@agrsci.dk

