

Test Report



ACCORD EXACTA HL / VICON RS-XL fertiliser distributor
10-45 m working widths
Tested working width: 24 m

Manufacturer and entrant:

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Conclusion

The spreading performance of the ACCORD EXACTA HL / VICON RS-XL 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 2005.

On normal and late top spreading at 24 m working width with the tested fertilisers, the coefficient of variation (CV) for the evenness of transversal distribution was found between 5.1% and 9.8% from handbook settings or by optimisation. By use of the methods for in field tests provided by the manufacturer in special instructions, it will normally be possible to optimise the spreading pattern. By late top normal spreading with fertiliser D the requirements are not fulfilled.

On border spreading at 24 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 late top border spreading with fertiliser D the requirements are not fulfilled.

Calibration and adjustment of the spreader is easy to perform.

Flow rate control is easy to perform using the equipment delivered as additional accessories. The highest deviation between intended and obtained application was 20% found by spreading Fertiliser C (prilled fertiliser, > 0.9 kg/l). During the tests the calibration factor, which is used in the 'Exacta Remote' control, was changed.

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 clear 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, particle size distribution and bulk density. A test box for measuring the particle size distribution is supplied with the spreader and when used properly gives the necessary information about particle size distribution.

Instructions for use of the field test equipment are missing in the instruction handbook, but the needed instructions are supplied with the test kit for field test. Only instructions for 'in field' test by normal spreading are given. The 'in field' tests are carried out in between 2 tramlines which make it difficult to recognise different settings for the left and right side.

After the tests were completed the manufacturer has informed that the calibration factor in the Exacta remote control will be changed in order to ensure a better relation between the measured flow rate by calibration and the obtained application in the field. Also the spreading charts will be changed in order to ensure better late top spreading. Finally instructions for field testing (normal and border spreading) will be incorporated in the instruction handbook.

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 and performance of the tests should 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 two 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 from 395 to 525 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	3.66	0.994	5.2	ASS 26N + 13S
B	Granular < 0.9 kg/dm ³	3.46	0.73	4.1	Urea 46%
C	Prilled > 0.9 kg/dm ³	3.06	1.06	6.2	NPK 20-3-8 + 4S
D	Prilled < 0.9 kg/dm ³	1.58	0.74	5.8	Urea 46%
E	Compacted	3.05	1.08	5.8	Potassium 60%

The used fertilisers were supplied directly from the manufacturers.

Tested machine

The Accord Exacta HL / Vicon RS-XL is a fertiliser distributor of mounted type constructed for working widths from 10 to 45 m. The spreader has two discs operating from the centre towards the outside of the spreader.

The spreader has a 1700 litre 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 double acting electrical actuators. The actual setting of the shutters can be made in steps on scales from 0 till 90. With an electrical version, this can be programmed using a control box.

From the hopper, the fertiliser will be speeded up in the discharge ring and leave the discharge ring through a rectangular opening. In order to adjust the point where the fertiliser will meet the vanes of the discs, the discharge rings 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' F till Z for Accord HL and A till T for Vicon RS-XL.

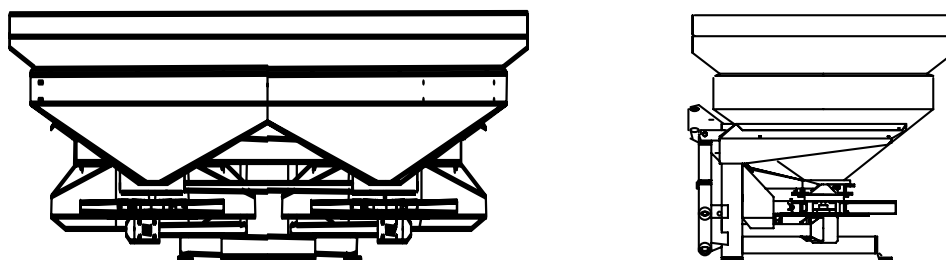
Agitators mounted at the bottom of the hopper ensure an even flow of fertiliser from the hopper. The agitators have a low speed (15% of disc speed), because of the special gearbox under the discs.

The calibration test, calibration of the flow rate factor, starting and stopping the spreading, closing one side for border, spreading is done using the electronic EXACTA REMOTE control-box.

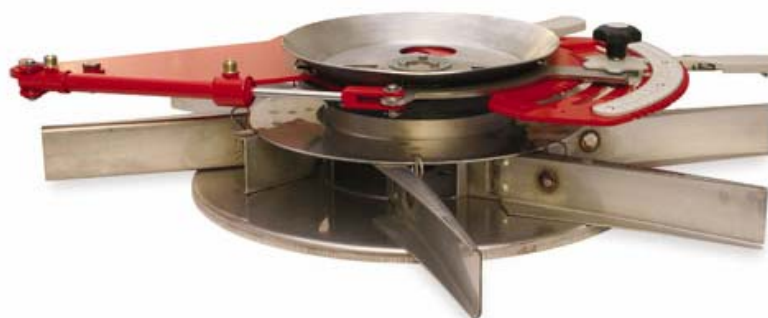
Two discs are placed just below the hopper and driven mechanically from the PTO-intake through gearboxes and power shafts. Each disc is equipped with eight vanes, of which 6 may be removed and two are fixed. The removable vanes are fitted to the discs at fixed positions by means of hair-type pins. The speed of the discs can be altered by changing the PTO connection at the central gearbox. One connection is for working width from 10 till 18 m and one connection for 21 till 45 m. With the speed of the PTO of the tractor, the correct speed of the discs can be set. The speed of the discs can be checked at the screen of the control box.

Equipment for flow rate control can be mounted around one of the discs. The fertiliser leaving the hopper is collected in a container placed on the ground. In case of flow rate tests or 'from' border spreading, the drive shaft connection between the central gearbox and the side gearboxes can be disconnected so only one disc is used.

By 'Till' border spreading (defined as spreading in a distance of ½ working width from the border line) the 'Exact line' (trim Flow for Vicon) is mounted on the right of the spreader. By 'From' border spreading (defined as spreading in a distance of 2 m from the border line), a border spreading plate is assembled in the centre of the spreader. In the instruction handbook, the correct setting of the machine can be found on the basis of information about type of fertiliser, bulk density and particle size distribution.



The ACCORD EXACTA HL / VICON RS-XL spreader



ACCORD EXACTA HL / VICON RS-XL dosing system and the spreading disc

Figure 1. Principle of the ACCORD EXACTA HL / VICON RS-XL spreader

Tests carried out

Tests were carried out at 24 m working width with 5 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 7 collecting bins (0.50 × 0.50 m in size) placed in the field in between two tramlines. The amount of fertilizers in the 7 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 is mentioned as ‘Optimisation’ in the report.

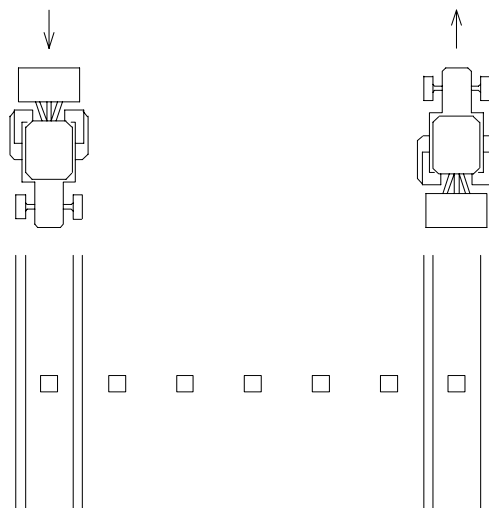


Figure 2. Proposed method for field testing of the spread pattern

By border spreading no advice for optimisation is given and from this reason no optimisation tests were done.

Results

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

Fertiliser A (ASS 26 N + 13 S, FERTIVA) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments						Results		
			Flowrate scale	Vane type	Timing scale	Pto speed rpm	Disc high cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2005072509	Handbook	77	23	Flat vanes	S	525	75	0	86	8,2	50,0 / 50,0
2005072508	Handbook	270	44	Flat vanes	S	525	75	0	283	10,3	48,2 / 51,8
2005072510	Optimisation	270	44	Flat vanes	T	525	75	0	286	11,1	48,0 / 52,0
2005072511	Handbook	460	58	Flat vanes	T	525	75	0	493	9,3	48,5 / 51,5
2005072512	Optimisation	460	58	Flat vanes	R	525	75	0	484	11,7	48,9 / 51,1
2005072513	Optimisation	460	58	Flat vanes	S	525	75	0	478	9,8	49,5 / 50,5

Fertiliser A (ASS 26 N + 13 S, FERTIVA) - Late top spreading

Test no	Test according to	Intended amount kg/ha	Adjustments						Results		
			Flowrate scale	Vane type	Timing scale	Pto speed rpm	Disc high cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2005072517	Handbook	77	44	Flat vanes	S	525	50	4	84	10,2	51,0 / 49,0
2005072518	Optimisation	77	44	Flat vanes	U	525	50	4	84	7,7	50,7 / 49,3
2005072519	Optimisation	77	44	Flat vanes	T	525	50	4	84	7,1	50,6 / 49,4

Fertiliser A (ASS 26 N + 13 S, FERTIVA) - Normal spreading - Border

Test no	Wanted distance to border m	Intended amount kg/ha	Adjustment							Results		
			Setting Scale	Vane type	Timing Scale	Pto speed rpm	Disc high cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border ‰	Max in 5 m area %
2005072515	12	270	44	Flat vanes	S	435	75	0	5A	20,1	2,3	104,5
2005072522	2	270	44	Flat vanes	S	395	75	0	standard plate pos.	22,2	0,3	104,9

Fertiliser A (ASS 26 N + 13 S, FERTIVA) - Late top Spreading - Border

2005072521	12	77	23	Flat vanes	T	435	50	4	5A	14,0	7,5	104,3
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FERTILISER B (UREA , GRANULAR, YARA) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments						Results		
			Flowrate scale	Vane type	Timing scale	Pto speed rpm	Disc high cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2005082401	Handbook	178	39	Flat vanes	N	525	75	0	181	13,7	50,9 / 49,1
2005082402	Optimisation	178	39	Flat vanes	P	525	75	0	184	6,7	50,4 / 49,6

FERTILISER B (UREA , GRANULAR, YARA) - Late top

Test no	Test according to	Intended amount kg/ha	Adjustments						Results		
			Flowrate scale	Vane type	Timing scale	Pto speed rpm	Disc high cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2005082406	Handbook	43	19	Flat vanes	N	525	55	4	51	14,8	50,9 / 49,1
2005082407	Optimisation	43	18	Flat vanes	P	525	55	4	47	7,7	51,5 / 48,5

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

Test no	Wanted distance to border m	Intended amount kg/ha	Adjustment							Results		
			Setting Scale	Vane type	Timing Scale	Pto speed rpm	Disc high cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border ‰	Max in 5 m area %
2005082403	12	178	39	Flat vanes	P	435	75	0	7	21,7	1,2	89,4
2005082404	2	178	39	Flat vanes	P	390	75	0	standard plate pos.	21,9	0,4	103,5

FERTILISER B (UREA , GRANULAR, YARA) - Late top spreading - Border

2005082409	12	43	18	Flat vanes	P	395	50	4	7,0	21,6	0,9	77,0
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FERTILISER C (NPK 20 - 3 - 8 + 4 S+1,2 MG, YARA PORSGRUNN) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments						Results		
			Flowrate scale	Vane type	Timing scale	Pto speed rpm	Disc high cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2005072602	Handbook	100	24	Flat vanes	P	525	75	0	120	8,0	50,2 / 49,8
2005072603	Optimisation	100	22	Flat vanes	N	525	75	0	103	5,1	48,6 / 51,4
2005072523	Handbook	350	45	Flat vanes	R	525	75	0	356	9,8	47,8 / 52,2
2005072524	Optimisation	350	45	Flat vanes	P	525	75	0	358	6,6	49,6 / 50,4
2005072525	Handbook	600	59	Flat vanes	S	525	75	0	590	8,5	49,0 / 51,0

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

Test no	Test according to	Intended amount kg/ha	Adjustments						Results		
			Flowrate scale	Vane type	Timing scale	Pto speed rpm	Disc high cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2005072607	Handbook	100	22	Flat vanes	P	525	50	4	97	6,3	49,3 / 50,7

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

Test no	Wanted distance to border m	Intended amount kg/ha	Adjustment							Results		
			Setting Scale	Vane type	Timing Scale	Pto speed rpm	Disc high cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border ‰	Max in 5 m area %
2005072604	12	350	46	Flat vanes	P	435	75	0	7A	21,4	2,8	108,8
2005072606	2	350	45	Flat vanes	P	395	75	0	standard plate pos.	17,5	2,7	91,4

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

2005072608	12	100	22	Flat vanes	P	435	50	4	7A	20,0	3,0	84,8
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FERTILISER D (UREA, PRILLED, YARA) - Normal spreading

Test no	Test according to	Intended amount kg/ha	Adjustments						Results		
			Flowrate scale	Vane type	Timing scale	Pto speed rpm	Disc high cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2005082413	Handbook	178	30	Flat vanes	H	570	75	8	172	7,8	51,0 / 49,0

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

Test no	Wanted distance to border m	Intended amount kg/ha	Adjustment							Results		
			Setting Scale	Vane type	Timing Scale	Pto speed rpm	Disc high cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border ‰	Max in 5 m area %
2005082414	12	178	30	Flat vanes	H	435	75	0	5H	23,1	1,5	99,8

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

Test no	Test according to	Intended amount kg/ha	Adjustments						Results		
			Flowrate scale	Vane type	Timing scale	Pto speed rpm	Disc hight cm	Tilt degree	Application rate kg/ha	CV %	Left / Right distribution %
2005072610	Handbook	283	44	Flat vanes	X	525	75	0	278	6,4	49,6 / 50,4

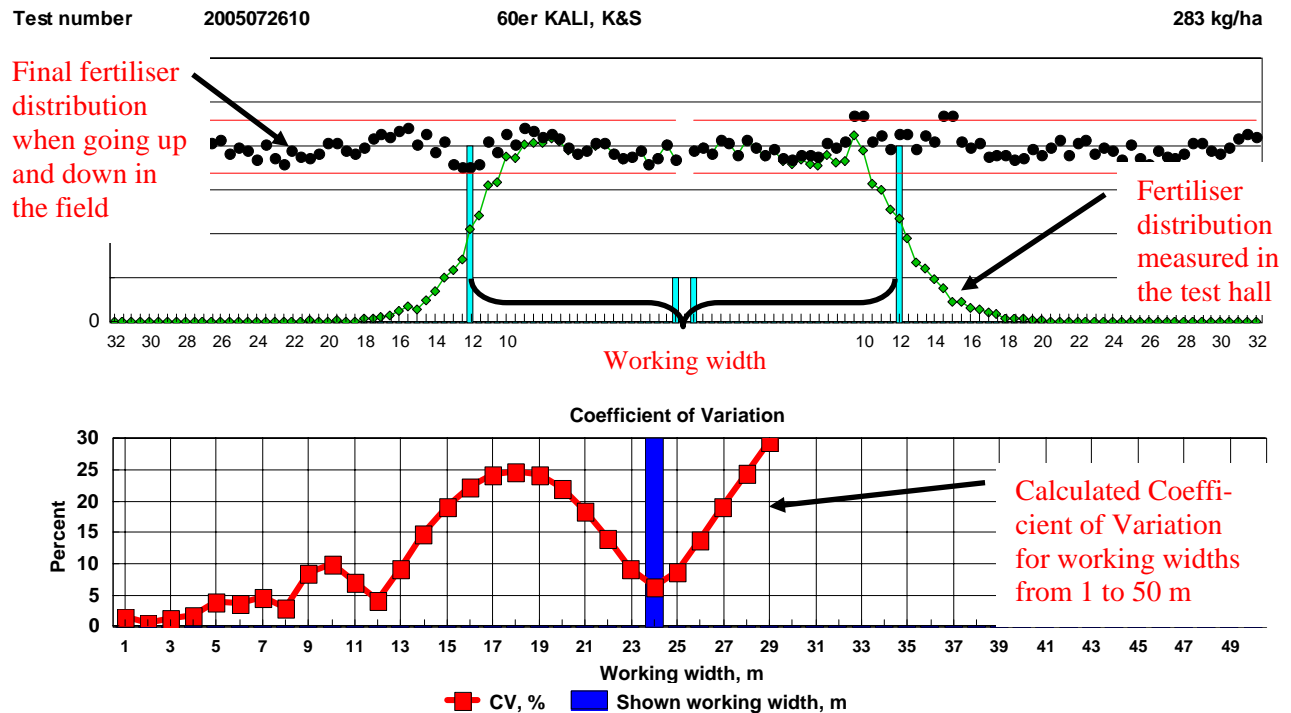
FERTILISER E (COMPACTED , KALI 60, K&S) - Normal spreading - border

Test no	Wanted distance to border m	Intended amount kg/ha	Adjustment							Results		
			Setting Scale	Vane type	Timing Scale	Pto speed rpm	Disc hight cm	Tilt degree	Setting of border plate scale	CT %	Amount outside border ‰	Max in 5 m area %
2005072611	12	283	44	Flat vanes	X	435	75	0	8	20,1	1,4	109,1
2005072615	2	283	44	Flat vanes	X	525	75	0	standard plate pos.	24,5	0,3	97,9

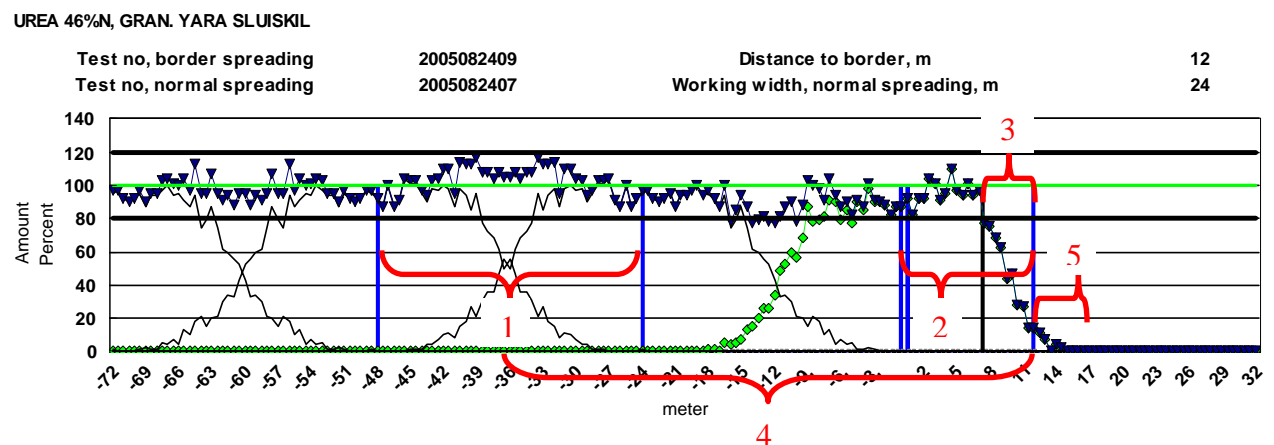
Graphic presentation of the results

In the following pages the best results from each tested setting are 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 m 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.

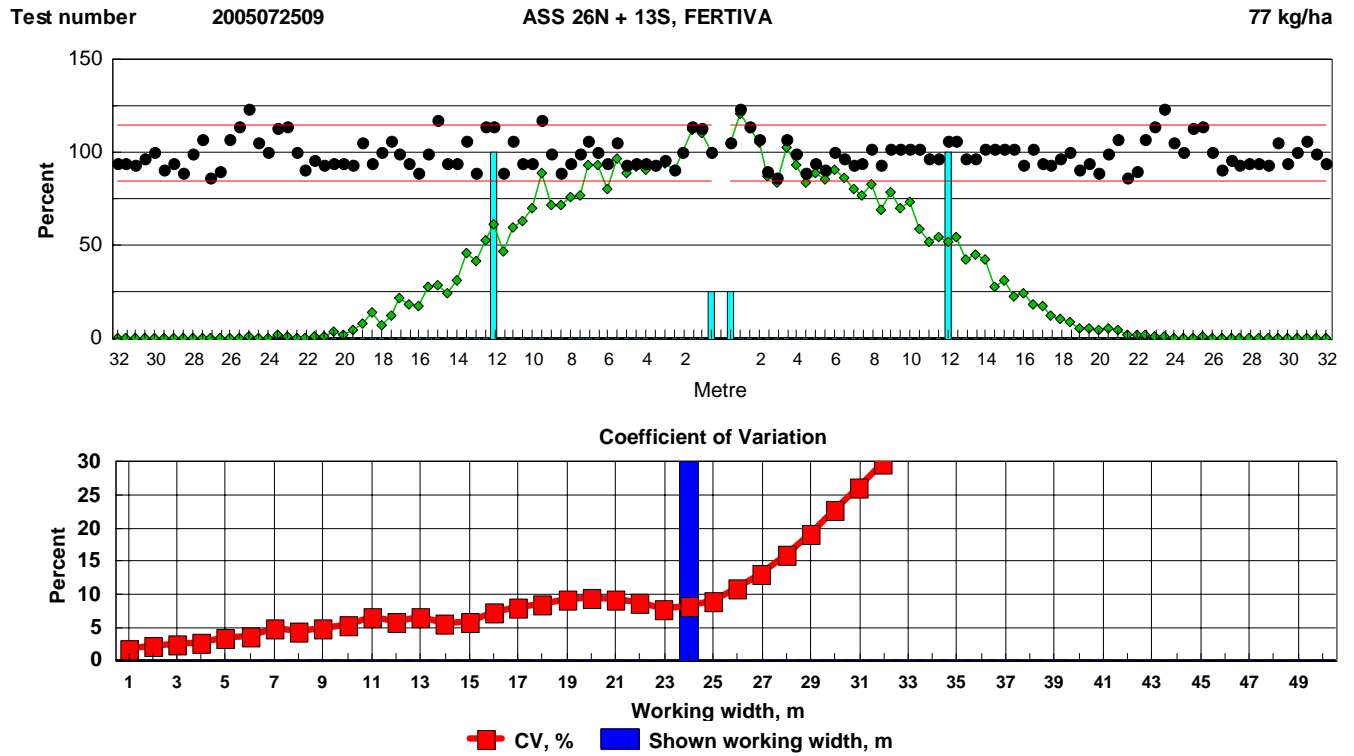


Figure 3. Normal spreading. ASS 26N + 13 S.
Intended application rate 77 kg/ha

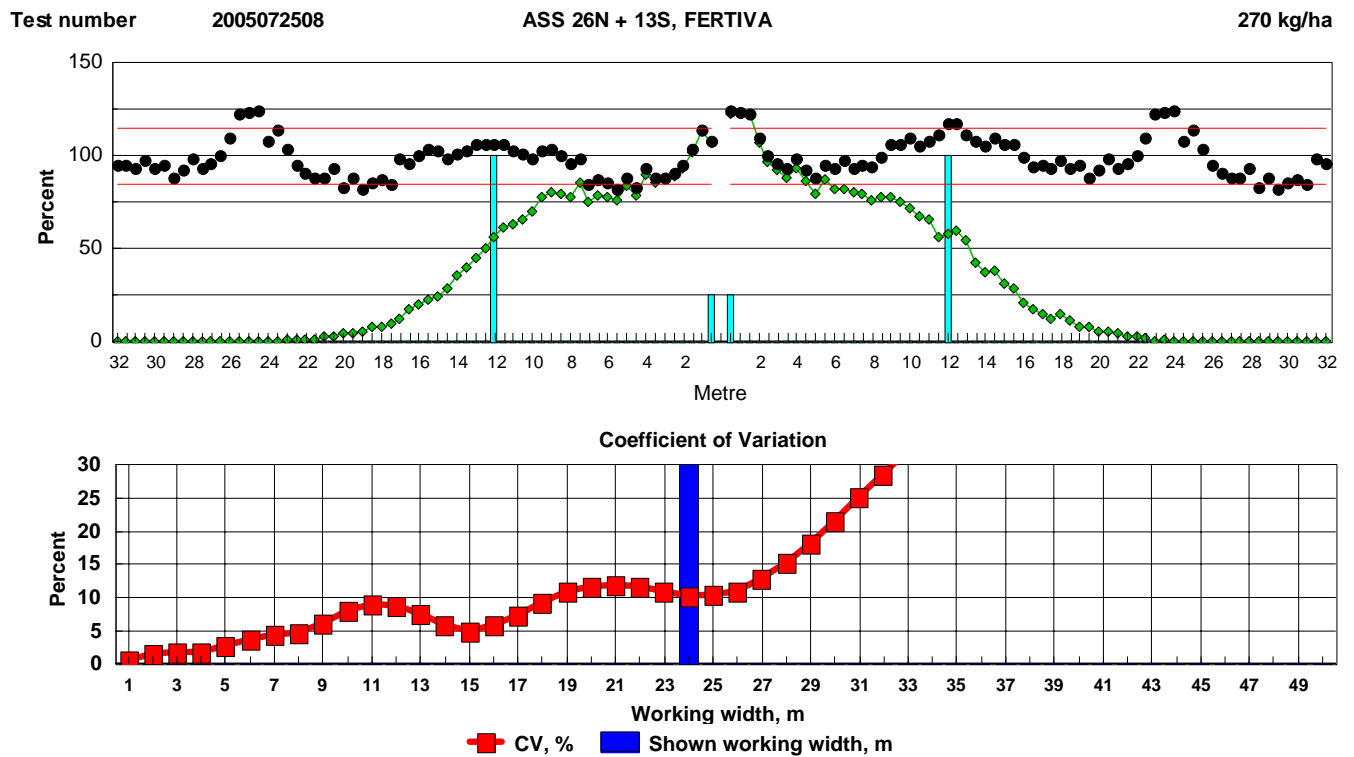
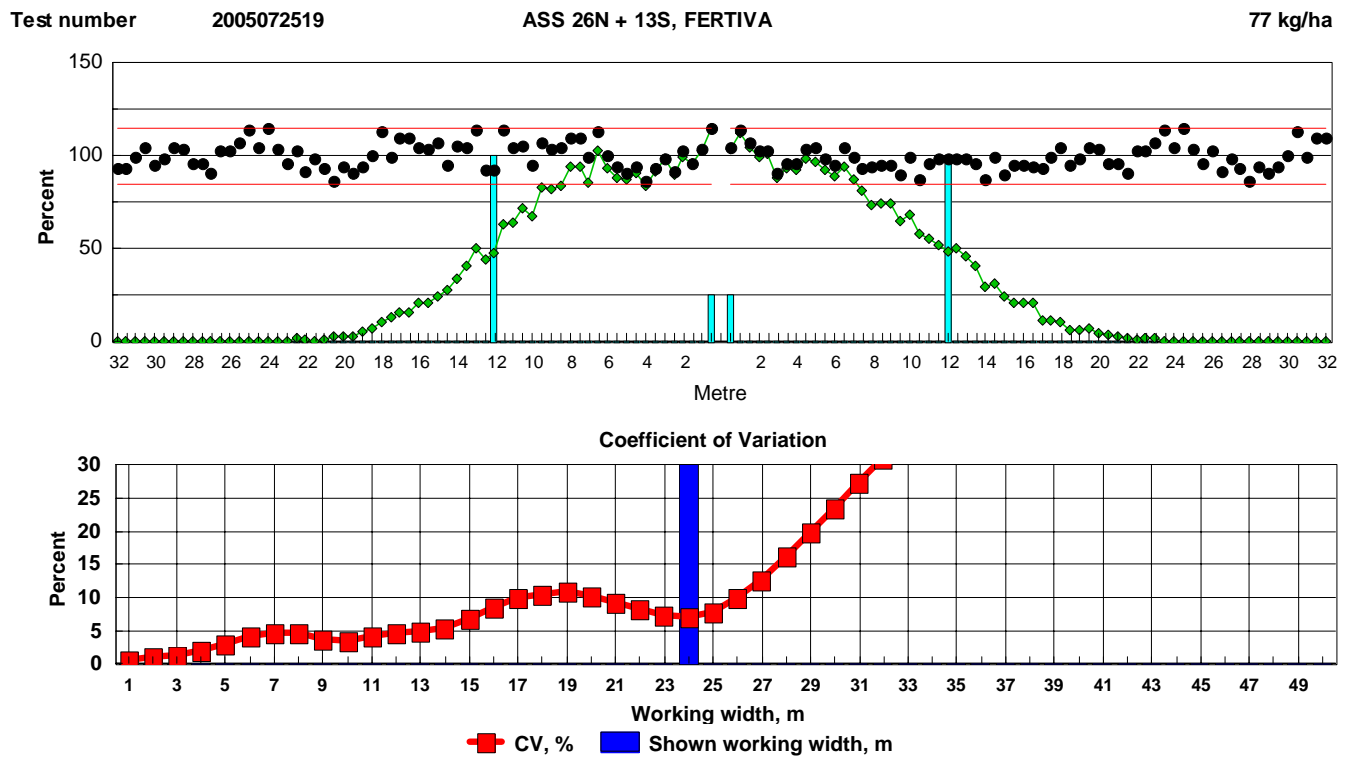
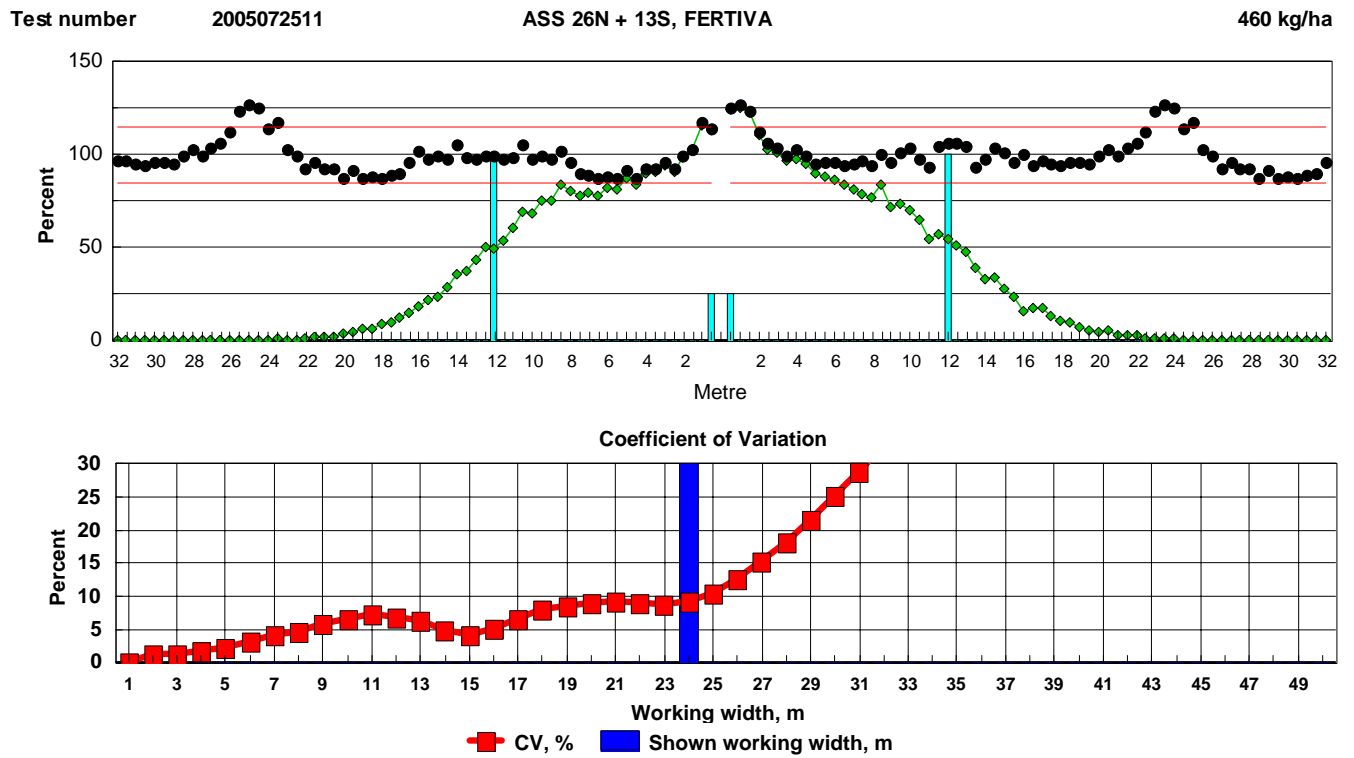


Figure 4. Normal spreading. ASS 26N + 13 S.
Intended application rate 270 kg/ha



ASS 26N + 13S, FERTIVA

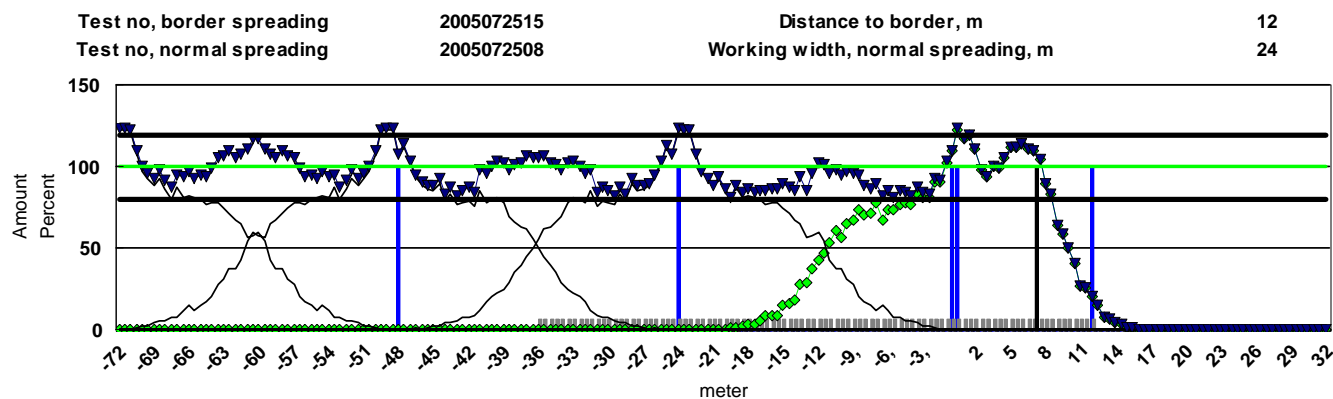


Figure 7. Normal, 'Till' border spreading. ASS 26N + 13 S.
Intended application rate 270 kg/ha

ASS 26N + 13S, FERTIVA

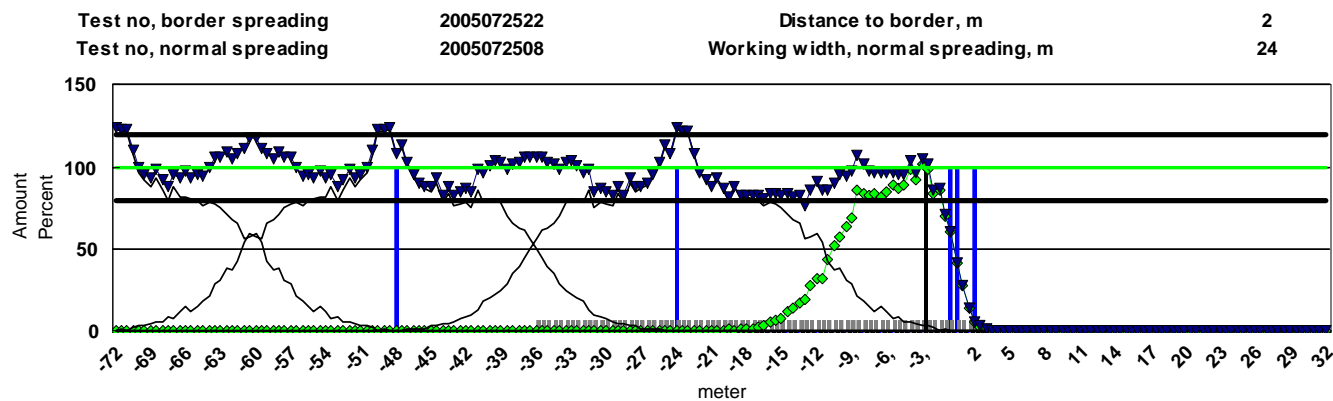


Figure 8. Normal, 'From' border spreading. ASS 26N + 13 S.
Intended application rate 270 kg/ha

ASS 26N + 13S, FERTIVA

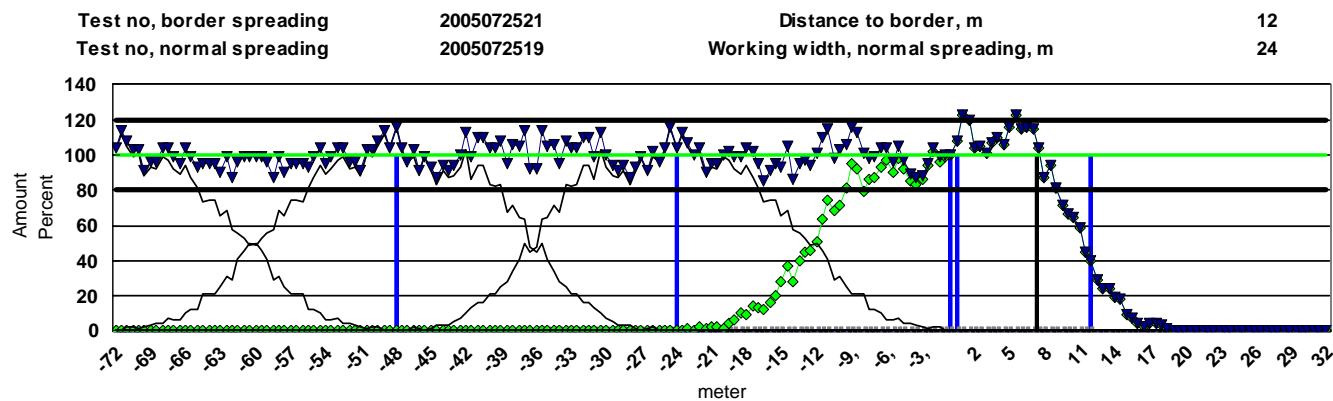


Figure 9. Late top, 'Till' border spreading. ASS 26N + 13 S.
Intended application rate 77 kg/ha

Test number 2005082402 UREA 46%N, GRAN. YARA SLUISKIL 178 kg/ha

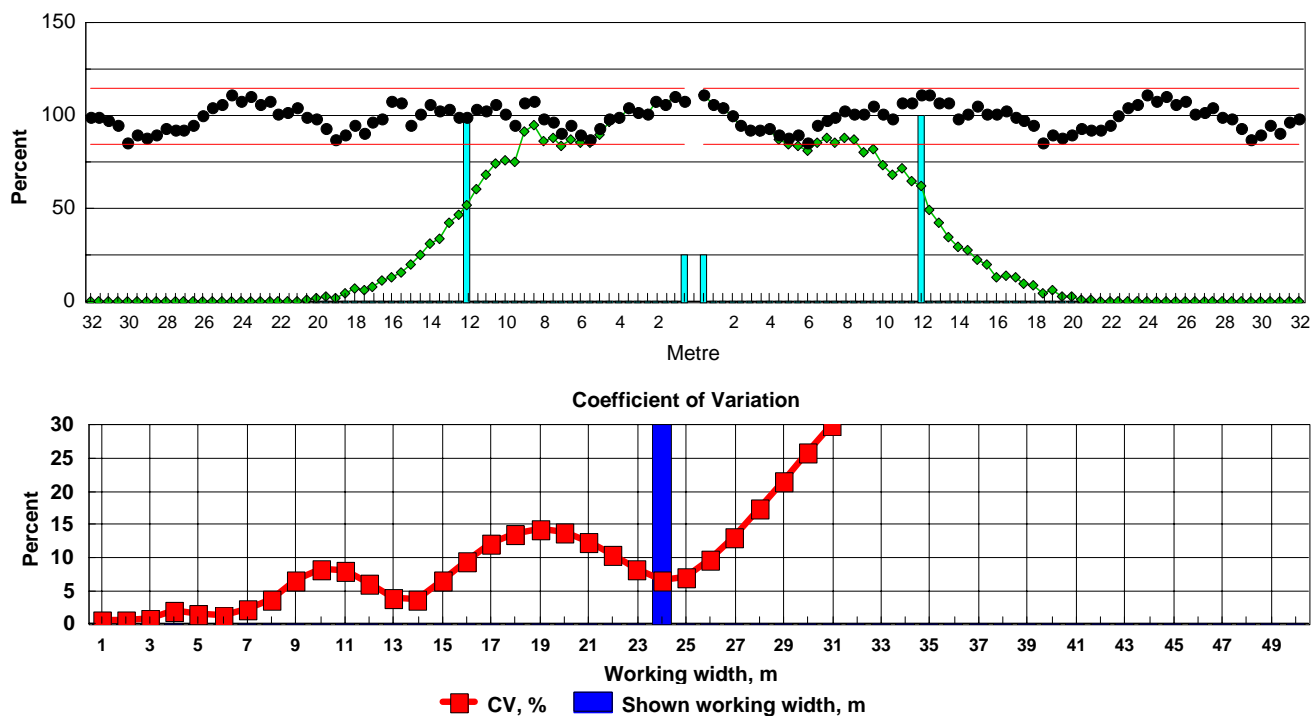


Figure 10. Normal spreading. Urea 46%, granular.
Intended application rate 178 kg/ha

Test number 2005082407 UREA 46%N, GRAN. YARA SLUISKIL 43 kg/ha

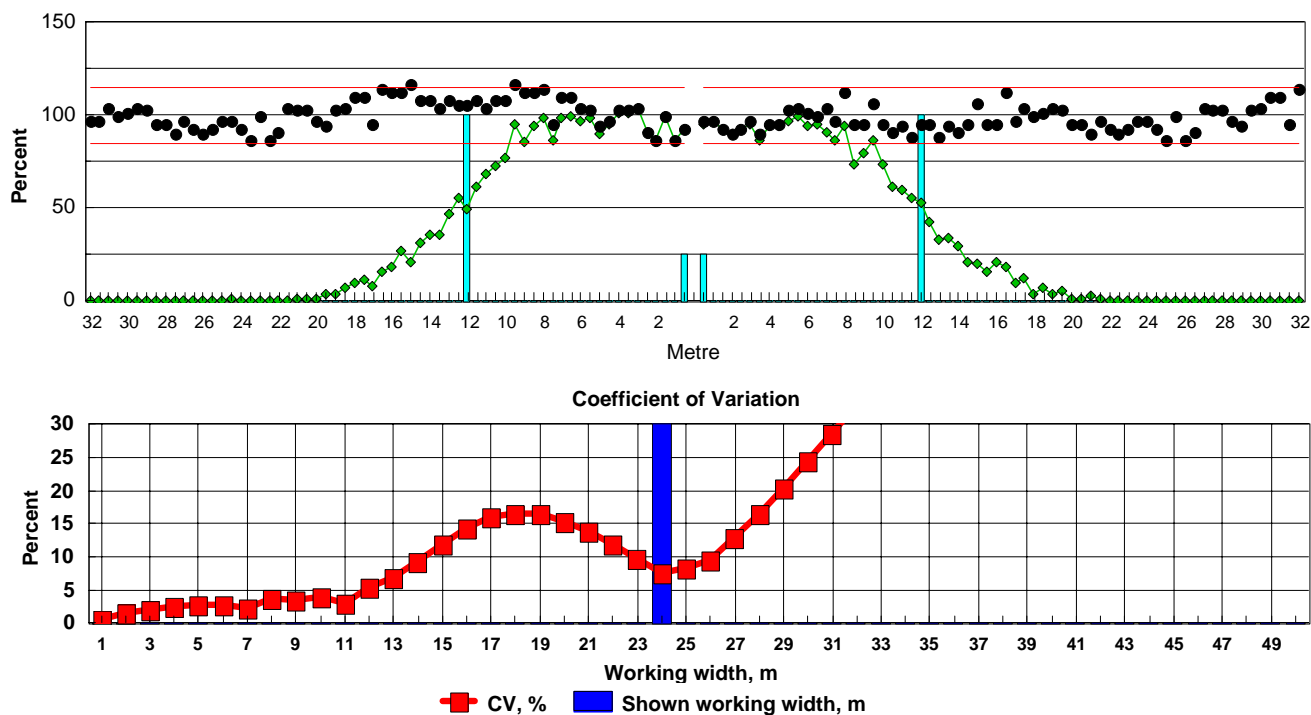
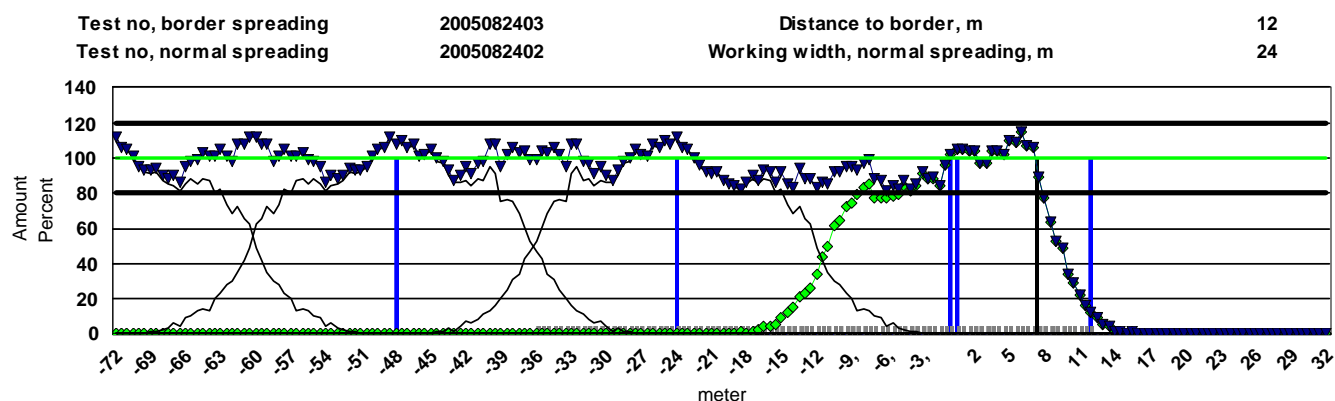


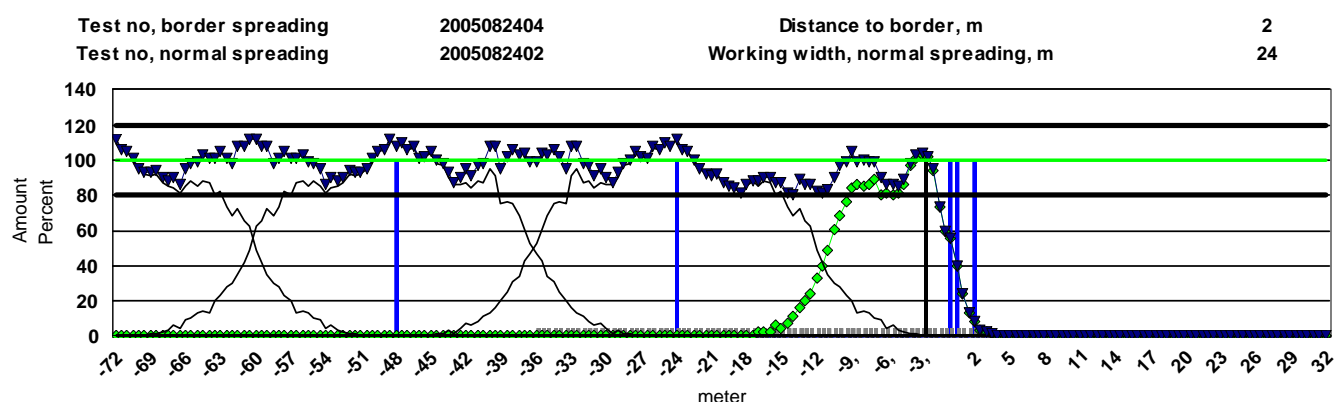
Figure 11. Late top spreading. Urea 46%, granular.
Intended application rate 43 kg/ha

UREA 46%N, GRAN. YARA SLUISKIL



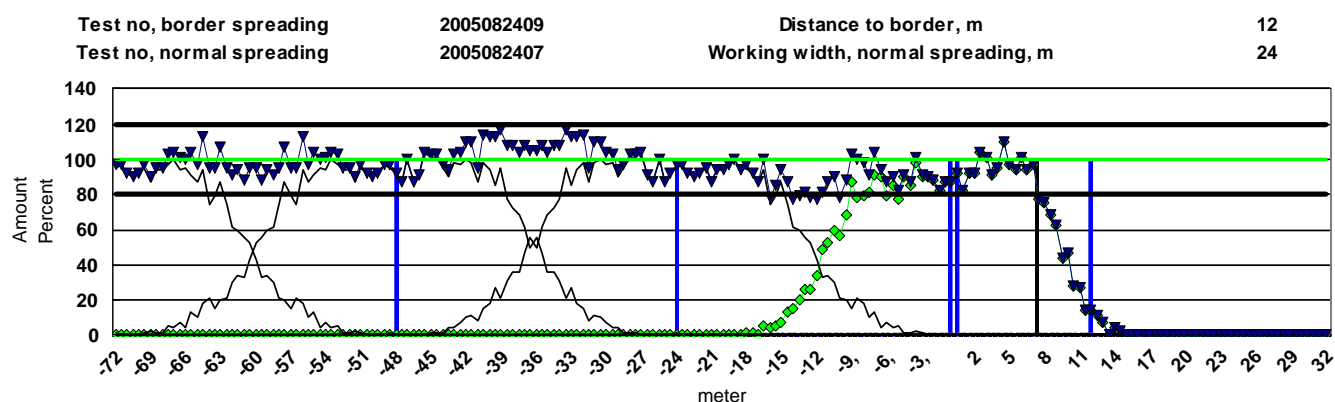
**Figure 12. Normal, 'Till' border spreading. Urea 46%, granular.
Intended application rate 270 kg/ha**

UREA 46%N, GRAN. YARA SLUISKIL



**Figure 13. Normal, 'From' border spreading. Urea 46%, granular.
Intended application rate 270 kg/ha**

UREA 46%N, GRAN. YARA SLUISKIL



**Figure 14. Late top spreading. 'Till' border spreading. Urea 46%, granular.
Intended application rate 43 kg/ha**

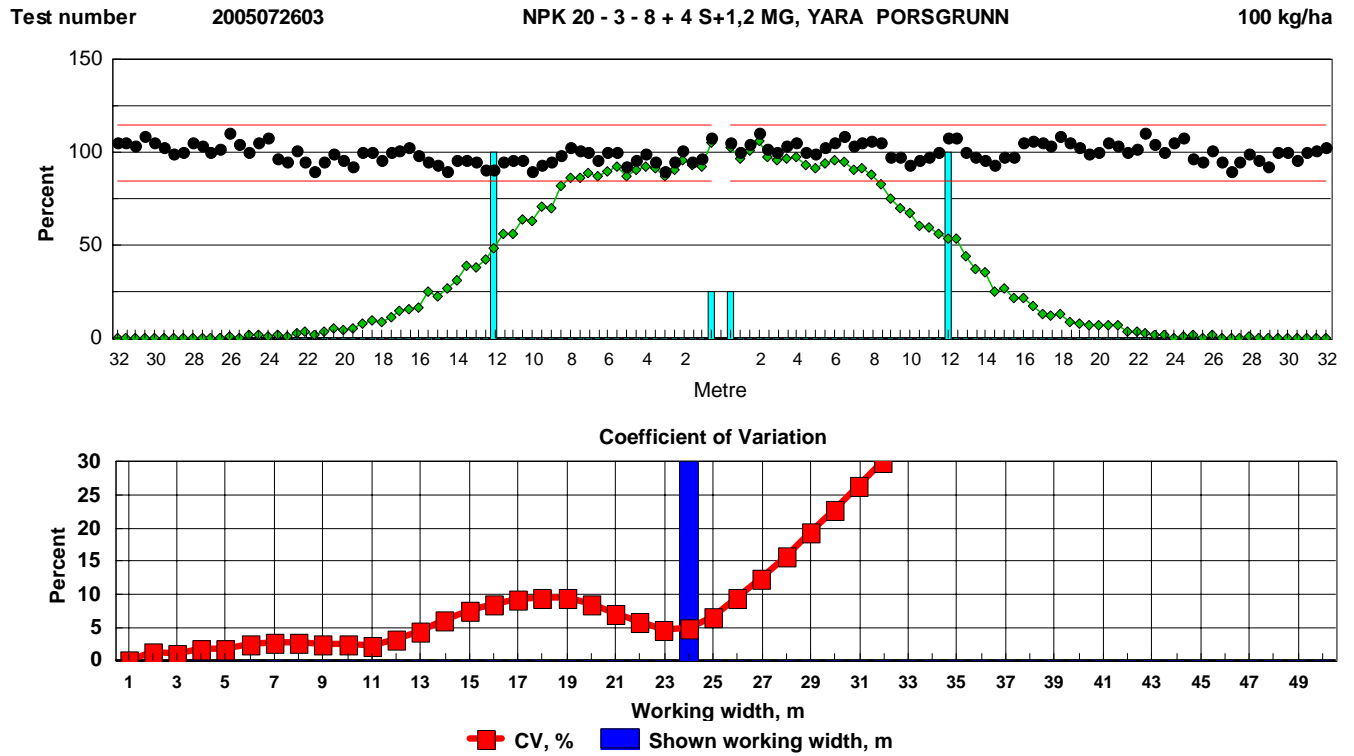


Figure 15. Normal spreading. NPK 20-3-8 + 4S. Intended application rate 100 kg/ha

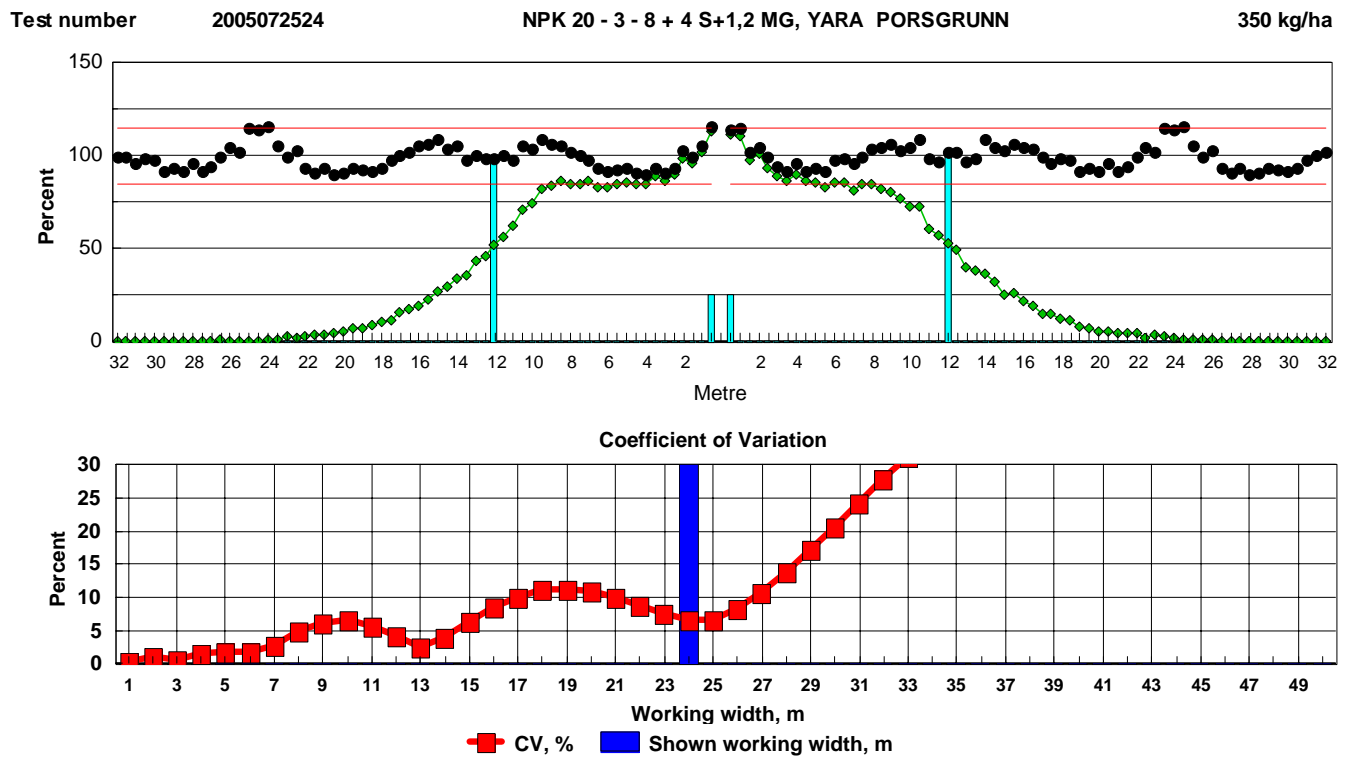


Figure 16. Normal spreading. NPK 20-3-8 + 4S. Intended application rate 350 kg/ha

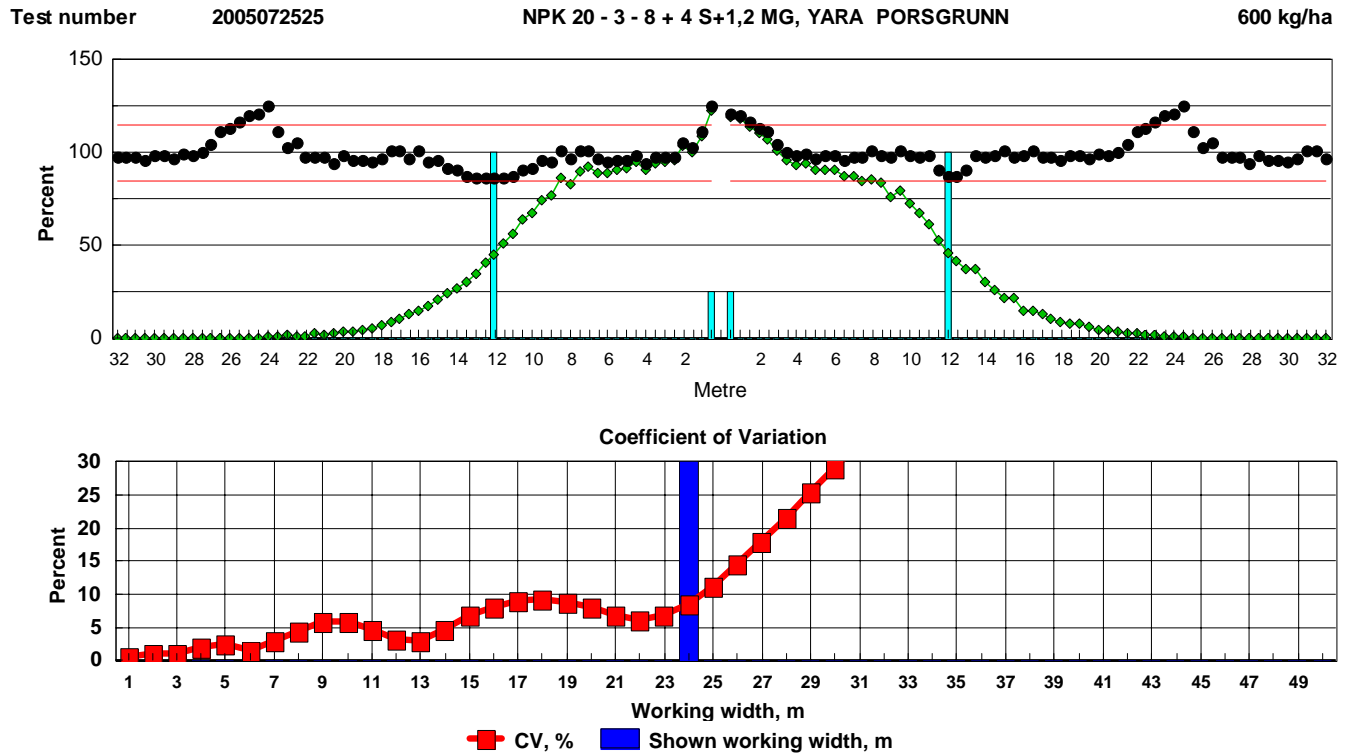


Figure 17. Normal spreading. NPK 20-3-8 + 4S.
Intended application rate 600 kg/ha

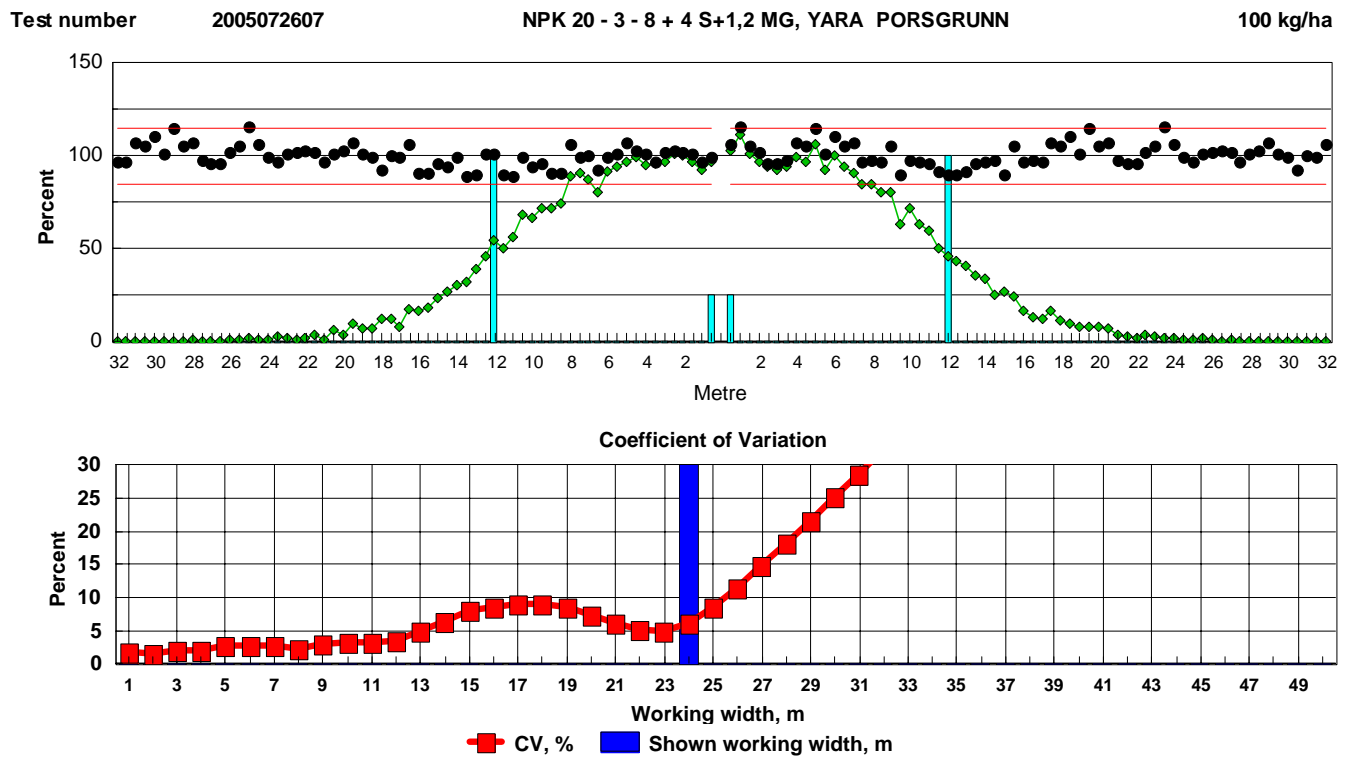
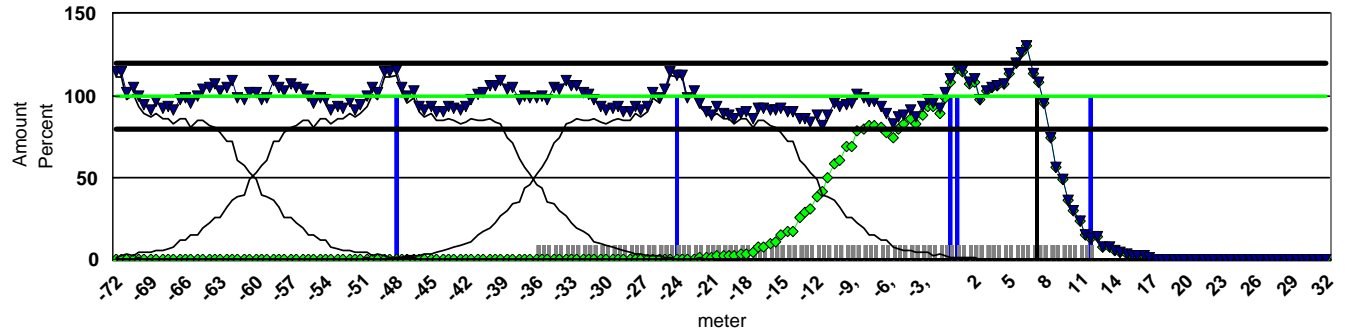


Figure 18. Late top spreading. NPK 20-3-8 + 4S.
Intended application rate 100 kg/ha

NPK 20 - 3 - 8 + 4 S+1,2 MG, YARA PORSGRUNN

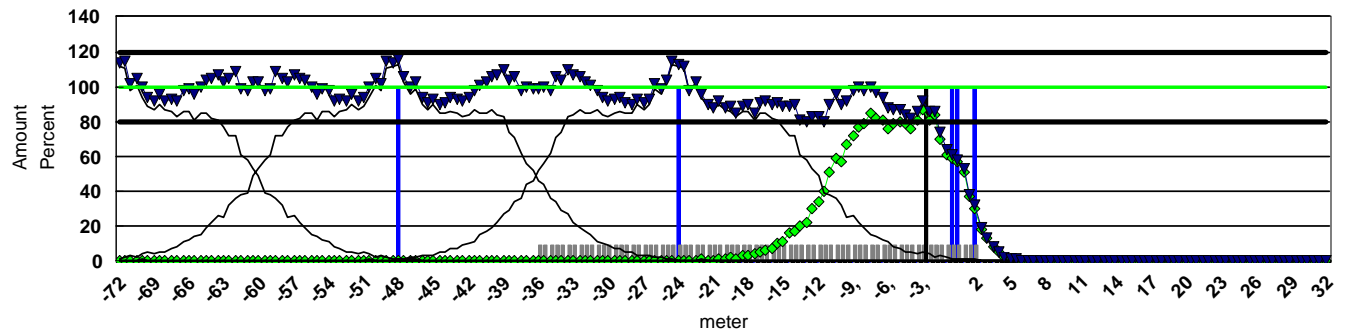
Test no, border spreading	2005072604	Distance to border, m	12
Test no, normal spreading	2005072524	Working width, normal spreading, m	24



**Figure 19. Normal, 'Till' border spreading. NPK 20-3-8 + 4S.
Intended application rate 350 kg/ha**

NPK 20 - 3 - 8 + 4 S+1,2 MG, YARA PORSGRUNN

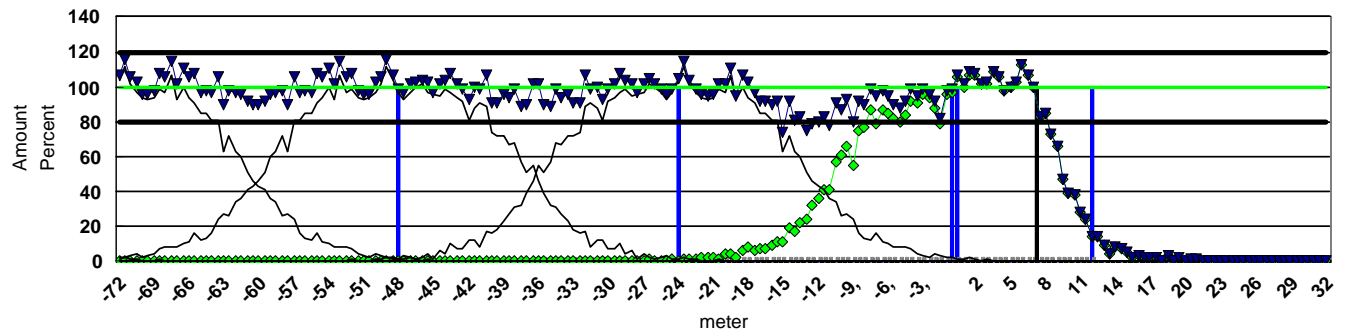
Test no, border spreading	2005072606	Distance to border, m	2
Test no, normal spreading	2005072524	Working width, normal spreading, m	24



**Figure 20. Normal, 'From' border spreading. NPK 20-3-8 + 4S.
Intended application rate 350 kg/ha**

NPK 20 - 3 - 8 + 4 S+1,2 MG, YARA PORSGRUNN

Test no, border spreading	2005072608	Distance to border, m	12
Test no, normal spreading	2005072607	Working width, normal spreading, m	24



**Figure 21. Late top. Normal, 'Till' border spreading. NPK 20-3-8 + 4S.
Intended application rate 100 kg/ha**

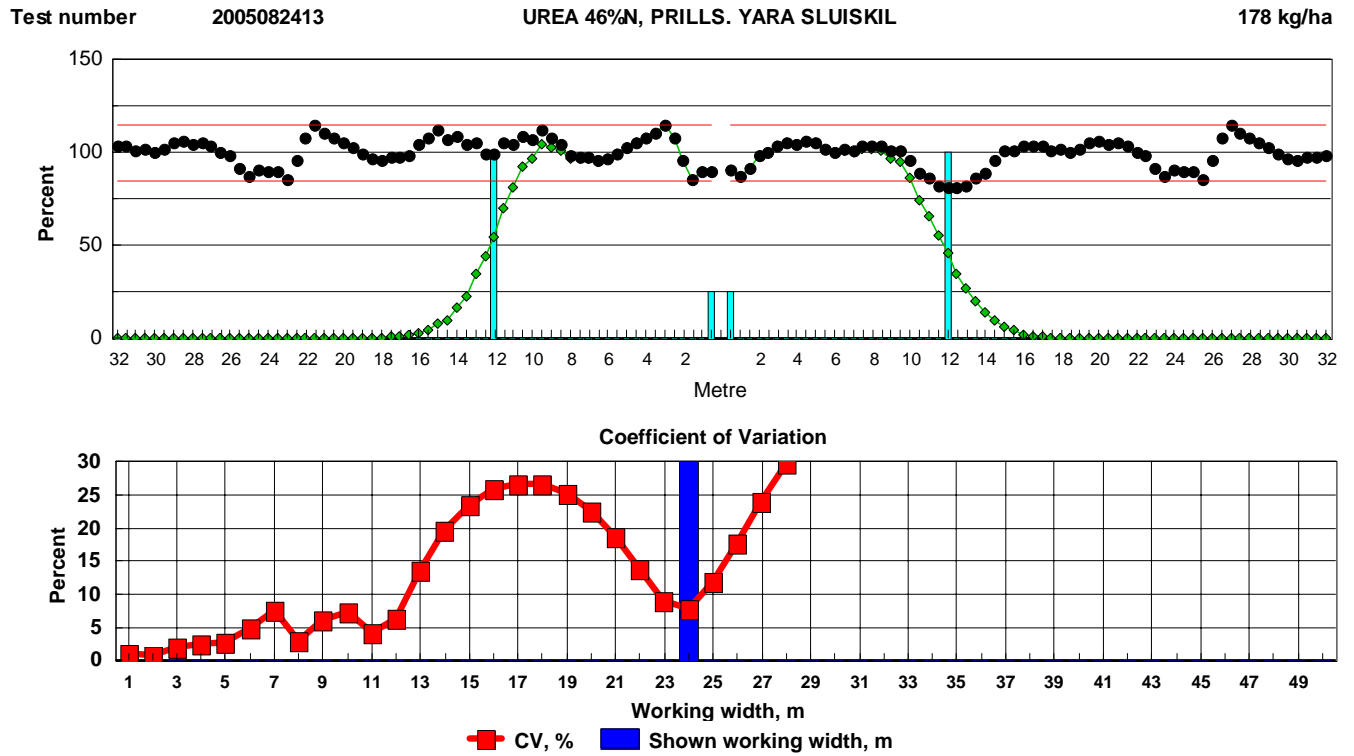


Figure 22. Normal spreading. Urea 46%, prilled.
Intended application rate 178 kg/ha

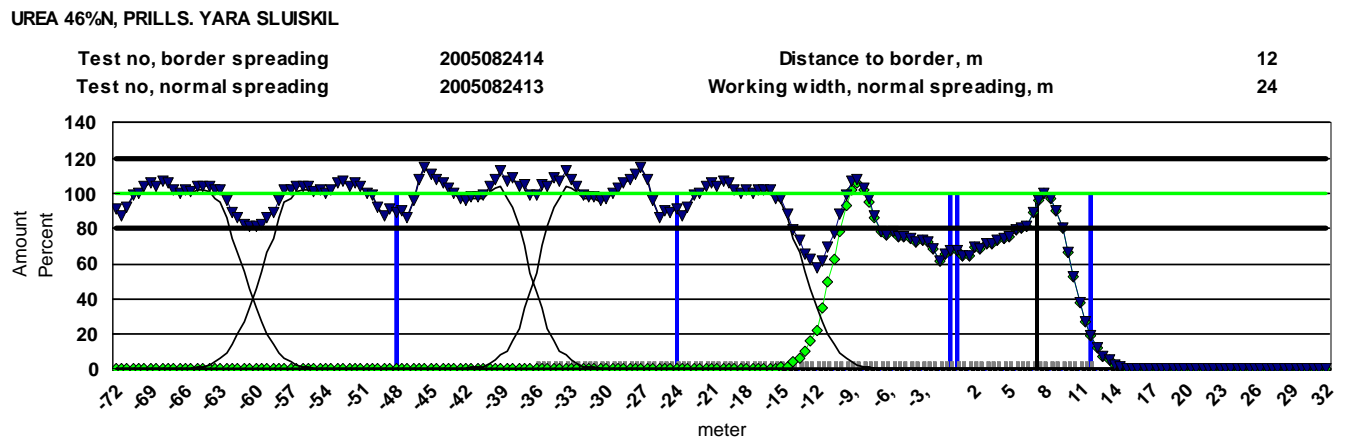
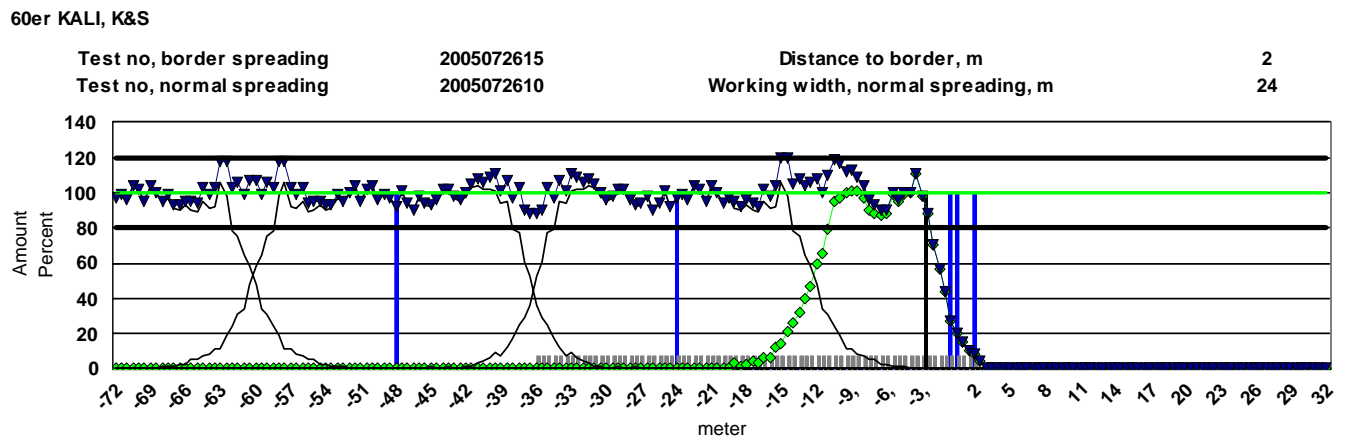
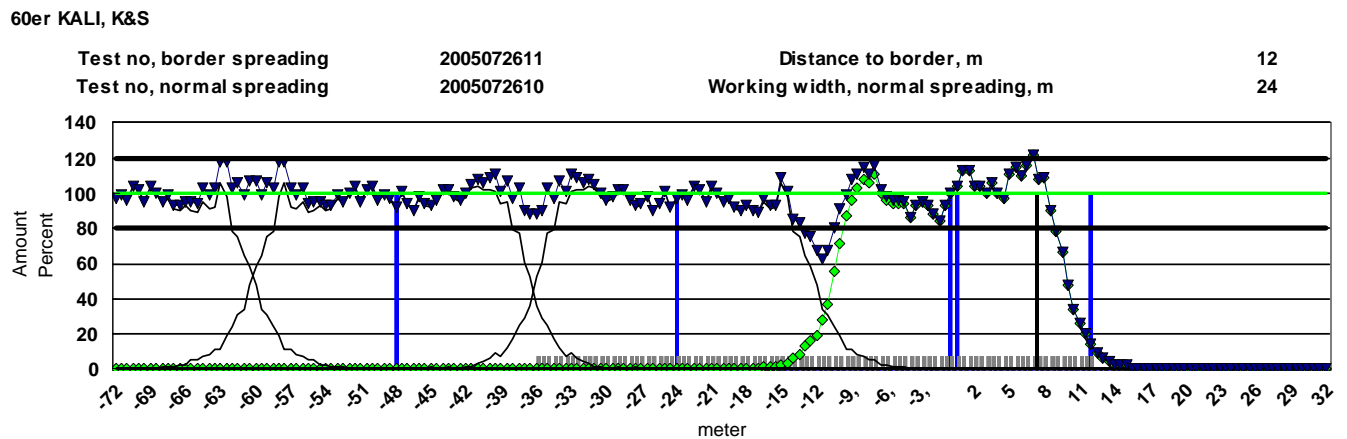
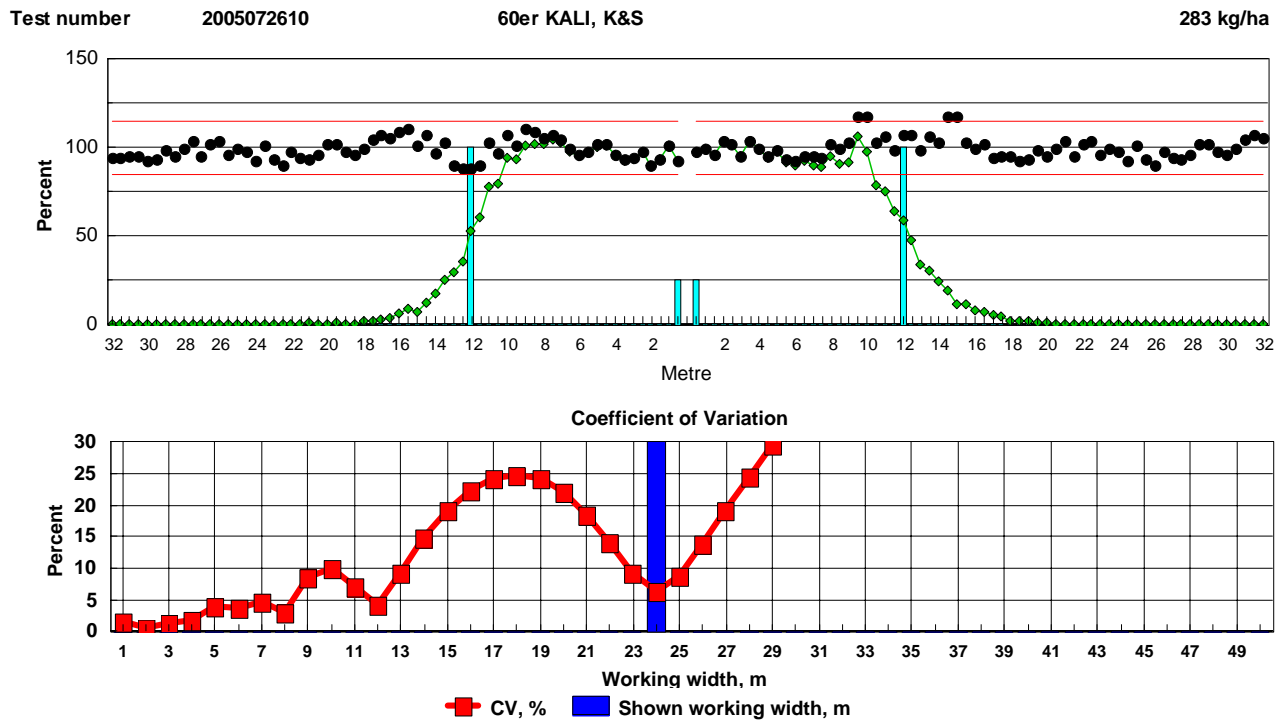


Figure 23. Normal, 'Till' border spreading. UREA, prilled.
Intended application rate 178 kg/ha



Identification of the tested machine

<i>Manufacturer:</i>	KVERNELAND Nieuw-Venep BV
<i>Model:</i>	ACCORD EXACTA HL / VICON RS-XL
<i>Production number:</i>	77326 01 1181
<i>Production year:</i>	2005
<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>	10 / 45
<i>Way of changing working widths:</i>	Changing speed of discs by changing gear ratio or PTO-speed and in special cases tilting the spreader forward 8 degrees. Also timing may be changed
<i>Way of doing border spreading:</i>	By 'Till' border spreading: Using the Exact line By 'From' border spreading : Using special deflector, disconnecting drive shaft to one disc and closing the discharge opening for the same disc
<i>Way of doing spreading at reduced working width:</i>	By changing disc speed and timing
<i>Way of performing flow rate test:</i>	By use of special flow rate test equipment
<i>Driving speed - min/max, km/h:</i>	6/14
<i>Flow rate - min/max, l/min:</i>	10 / 320 – depending on type of fertiliser
<i>Overall length, m:</i>	1.43
<i>Overall width, m:</i>	2.75
<i>Overall height, m:</i>	1.16
<i>3-point linkage:</i>	
▪ <i>Distance between lower linking points, m:</i>	0.815
▪ <i>Distance from ground to lower link point, m:</i>	0.03/0.21
▪ <i>Distance from ground to upper link point, m:</i>	0.64/0.74
▪ <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>	405
<i>Hopper capacity, l:</i>	1700
<i>Maximum stated load, kg:</i>	3200
<i>Scale inside hopper:</i>	Yes
<i>Sieve inside hopper:</i>	Yes
<i>Inspection window in hopper wall:</i>	Yes
<i>Possibilities of emptying spreader without spreading:</i>	Yes
<i>Way of turning discs:</i>	Mechanical
<i>Type of power intake:</i>	6-spline
<i>Speed of power intake:</i>	Variable – depending on type of working width, fertiliser and spreading
<i>Type and number of hydraulics:</i>	1 – single-acting cylinder for adjusting the limiter position
<i>Electrical connections:</i>	12 volt for electronic steering 12 volt for light
<i>Support for PTO-shaft:</i>	Yes
<i>Support for hydraulics:</i>	Yes
<i>Responsible test staff:</i>	Krister Persson Research Centre Bygholm, 2005 ISSN 1398-0416

DIAS

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