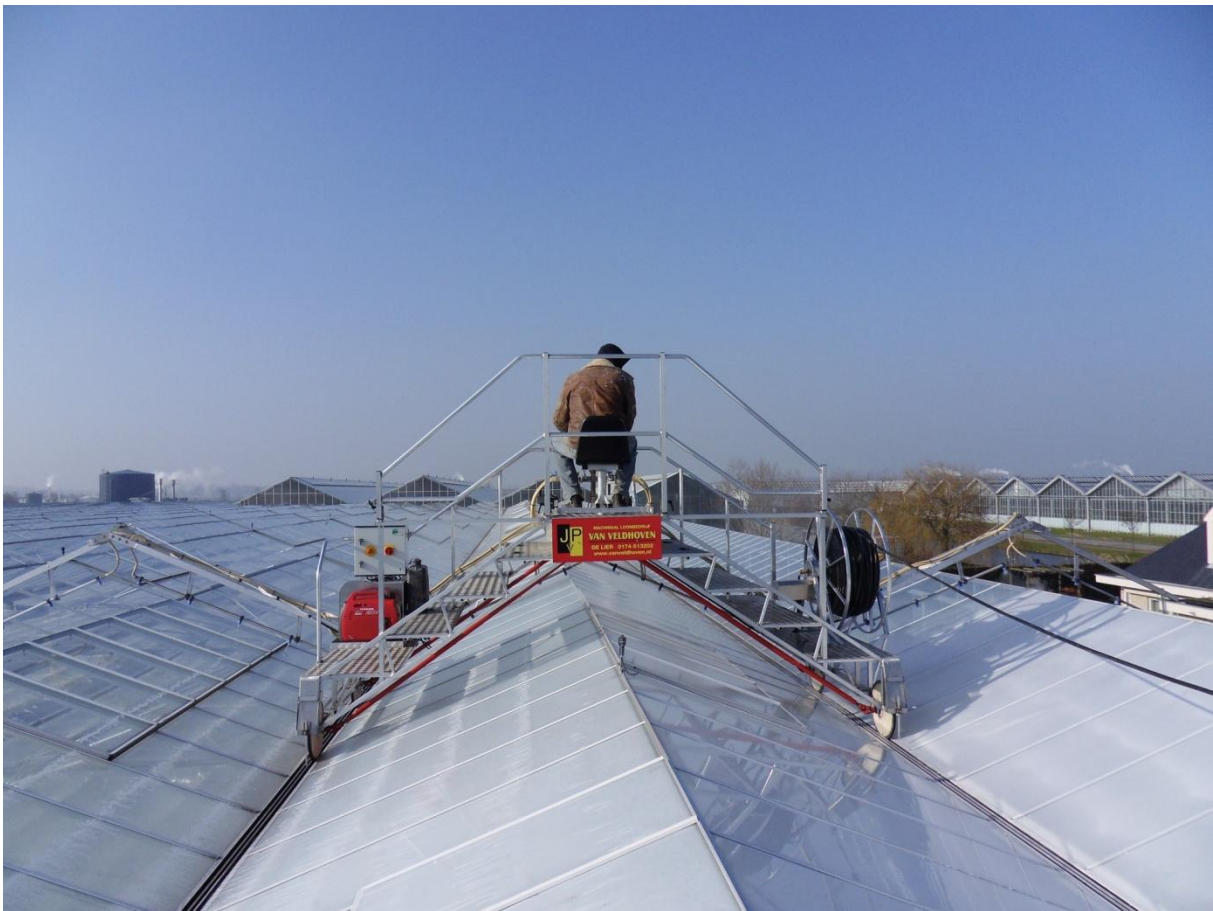


## Mechanical chalking greenhouse roofs

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## **Preface**

The demand for chalk machines has experienced an extreme increase over the past few years. The reason for this is that the ReduSystems® shading and transmission compounds by Mardenkro are best sprayed mechanically. That figures, because a chalk machine sprays an even layer on the greenhouse roof because the driving speed remains the same at all times. Moreover, a chalk machine can treat large surfaces in a short time. By using the right combination of machine, nozzles and weather circumstances, the efficiency of equipment that is often very valuable is as high as possible. You also work safely with a chalk machine. Modern greenhouses are getting higher and the greenhouse gutters more narrow. Walking on the roof of the greenhouse is therefore not an option any longer. Even more, unprotected walking on the roof is even prohibited.

This letter is intended to help you choose the right chalking method and extra tools. We also give you some practical calculation examples and practical tips so you can use this letter as reference work.

Van der Waay Machinebouw BV has been closely involved with mechanic chalking from its very existence. Except for its experience with building chalk machines, Van der Waay Machinebouw BV also has many years' experience with these machines.

Van der Waay Machinebouw BV waives all liability for direct or indirect damage of whatever nature, originating from or in any way related to the contents of this letter.

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# Necessities

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The following necessities are to be present to mechanically chalk a greenhouse roof:

1. A safe service rail attached to the greenhouse + protection on every greenhouse gutter
2. Chalk machine with a (possible) platform
3. A suitable high-pressure pump with mixing barrel

The following chapter specifically discusses aforementioned necessities.

## 1 Service rail

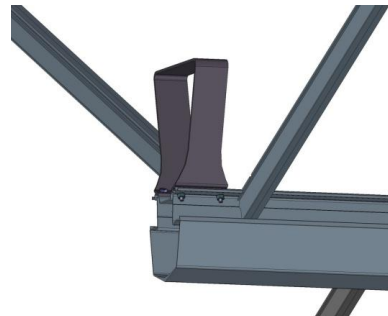
A rail attached to the front of the greenhouse is preferred to perform the work in a safe and quick way. A rail enables the usage of a platform that safely and easily transports the chalk machine.

On the other hand, it is also possible to lift a chalk machine directly on the roof by means of a hoisting crane.

IT IS ALSO IMPORTANT THAT EVERY GREENHOUSE GUTTER IS EQUIPPED WITH AN IMMOVABLE END OF GUTTER STOP. THIS PREVENTS THE CHALK MACHINE WITH OPERATOR DRIVING OFF THE GREENHOUSE.



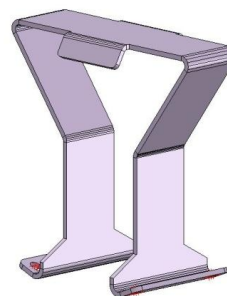
**Img. 1 Service rail**



**Img. 2 End of gutter stop fastened to greenhouse gutter**



**Img. 3 Top Sprayer with platform on greenhouse**



**Img. 4 End of gutter stop**

## 2 Chalk machines

Van der Waay Machinebouw offers several machines that can be used for chalking, but also as a brush machine.

*All machines mentioned hereafter comply with the latest European Machinery Directives.*

### 2.1 Top Cleaner Basic

The Top Cleaner Basic is a low-cost roof cleaner, driving through 2 greenhouse gutters. This variant is not equipped with an expensive operating panel, so the investment is a lot lower than in comparison with the automatic variant. This machine is extremely suitable for smaller companies and / or for countries where the labour costs are low. This machine can be converted into a chalk machine in two shakes. Large roof surfaces can be treated in a very short time because high speed is combined with 3 spray masts.

#### Specifications Top Cleaner Basic:

Size	:	Available for peak sizes 3.20 – 4.00 – 4.27 – 4.50 and 4.80 metres
Drive	:	230V 50Hz by means of a 2Kw compact generator
Driving speed	:	Steplessly adjustable up to 35 metres per minute
Spray masts	:	Covers 3 peaks in 1 movement



Img. 5 Top Cleaner Basic without spray masts



Img. 6 Very simple operation



Img. 7 Equipped for safe driving



Img. 8 Large protected brush rollers





**Img. 9 Top Cleaner Basic with spray masts and brushes**



**Img. 10 Top Cleaner Basic with only spray masts**

## 2.2 Top Cleaner

The Top Cleaner roof cleaner is the expanded version of the Basic variant. The big difference is that this variant can be fully automatized and expanded with several options. This machine has also been designed in a way that an operator can ride along safely while spraying ReduSystems®.

Large roof surfaces can be treated in a very short time because high speed is combined with 3 spray masts.

### Specifications Top Cleaner:

Size	:	Available for peak sizes 3.20 – 4.00 – 4.27 – 4.50 and 4.80 metres
Drive	:	Hydraulic
Voltage	:	400/480V 50/60Hz
Driving speed washing	:	15 metres per minute
Driving speed chalking	:	Steplessly adjustable up to 35 metres per minute
Spray masts	:	Covers 3 peaks in 1 movement



**Img. 11 Top Cleaner roof cleaner**



**Img. 12 Top Cleaner automation**



**Img. 13 Top Cleaner with spray masts**



**Img. 14 Top Cleaner with spray masts**

### 2.3 Safety-Car

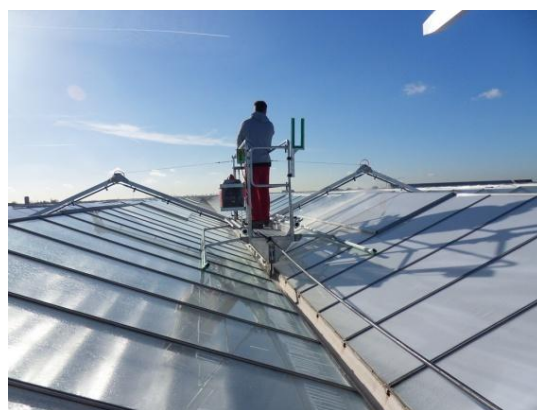
The Safety-Car is a lightweight gutter cart that rides through one greenhouse gutter by means of two electrically driven wheels. It therefore fits ever peak size. The hose is dragged through the greenhouse gutter and is pulled back by a second person when the Safety-Car drives back again. The Safety-Car can be equipped with a number of options, such as spray masts, brush set and gutter brush. Because of the relatively low investment, the Safety-Car is mainly designed for small-scale companies with short gutter lengths. We recommend the Top Cleaner (Basic) when you prefer a reel.

#### Specifications Safety-Car:

Size	:	Suitable for all peak sizes
Drive	:	230V 50Hz by means of a 2Kw compact generator
Driving speed	:	Steplessly adjustable up to 25 metres per minute
Spray masts	:	Covers 2 peaks in 1 movement



**Img. 15 Safety-Car with spray masts**



**Img. 16 Chalking a Venlo greenhouse**





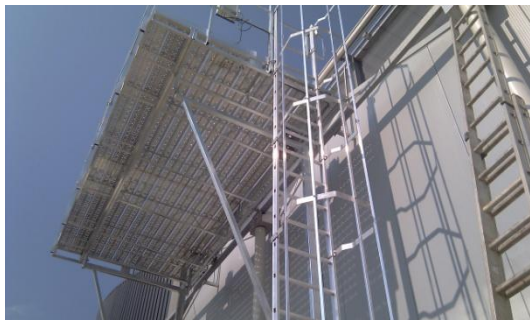
**Img. 17 Chalking a wide peak of 12.80m**



**Img. 18 Optional brush set**

### **3 Platforms**

We offer a movement platform to move aforementioned machines safely and quickly alongside the front of the greenhouse. The basic variant is rolled along the service rail by hand. An electric drive and several automatic variants are available too.



**Img. 19 Basic platform**



**Img. 20 Basic platform**



**Img. 21 Platform with Top Cleaner**



**Img. 22 Platform with Safety-Car**



#### 4 Moving the chalk machine with a scissor lift

For companies where a chalk machine has to be rehanged several times between different greenhouses, and in situations where a service rail is too big an investment, a second-hand scissor lift could be a good solution. The platform of the scissor lift is adjusted in a way that a chalk machine fits. Van der Waay can deliver an adjusted platform that is fastened on top of the scissor lift, and Van der Waay can even deliver the scissor lift itself.



Img. 23 Roof cleaner on scissor lift



Img. 24 Simple movement without rails / platform



Img. 25 Roof cleaner on scissor lift



Img. 26 Roof cleaner on scissor lift

#### 5 Mobile arrangement chalk pump + mixing barrel

A high-pressure pump with mixing barrel is needed to apply shading compounds. A membrane pump is normally used for this. Plunger pumps are not suitable for this task. A mixing barrel has a capacity of 1,000 to 2,000 litres and is to be equipped with a stirring device so the shading compound does not settle.

The needed pump capacity is about 70 litres / minute so enough return fluids remain to keep “stirring” the spray fluids. These pumps are driven by a tractor (PTO axle), an electric motor or petrol engine.

The most practical way is to place aforementioned on a wheeled undercarriage as one unit. In this way, the entire unit can be brought to the front of the greenhouse as one.



**Img. 27 Membrane pump**



**Img. 28 Example spray cart with 600 litres tank**



**Img. 29 Example spray cart with 2.000 litres tank**



**Img. 30 Example spray cart with 1.500 litres tank**

## 6 Flowmeter

To prevent spraying too much or too little shading compound, Van der Waay Machinebouw BV also delivers an optional flowmeter that can be fastened to a chalk machine. Several values are entered in and displayed on a display:

### ENTERING DATA:

1. Spray width in metres
2. Surface in m<sup>2</sup>
3. Desired spray fluid in litres per hectare

### DISPLAYED DATA:

1. Real-time flow in litres per minute
2. Real-time driving speed in metres per minute
3. Total used fluid
4. Total ridden metres
5. RESET feature

## 7 Spray technique

### 7.1 What determines what compound is used

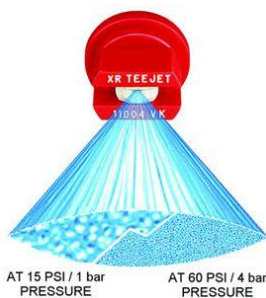
The amount of spray fluid (shading compound + water) that is used depends on three factors:

- 1 The size of the nozzle(s)
- 2 The work pressure on the nozzle(s). Please note: this is not the pump pressure, but the pressure measured at the spray masts / nozzle(s)!
- 3 The machine's driving speed

### 7.2 What nozzles

The aforementioned chalk machines are equipped with Teejet flat spray nozzles made of ceramic material.

These nozzles are assembled on the spray masts at a mutual distance of each other. The nozzles are simple to exchange for larger or bigger nozzles. Every nozzle size has its own unique colour code.



**Img. 31 Teejet nozzle  
XR11004VK**



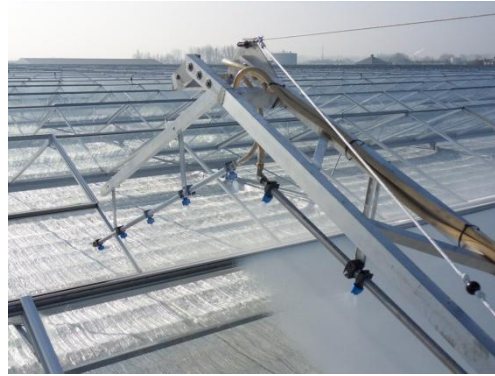
**Img. 32 Nozzle cap**



**Img. 33 Nozzle retainer**



**Img. 34 Spray image**



**Img. 35 Even cover**

### 7.3 Spray chart

Subjoined chart shows the release per minute per spray nozzle.

Please note: the release is measured with water.

Colour cap	Pressure in bars			
	2	3	4	5
	Release in litres per min / per spray cap			
11002	0.65	0.79	0.90	1.01
11003	0.97	1.18	1.37	1.52
11004	1.29	1.58	1.82	2.05
11005	1.10	1.60	2.00	2.30

### 7.4 Spraying the right amount of fluid

This section explains how you spray the right amount of fluid (shading compound + water) on the roof.

- I. First set the work pressure to 3 bars, measured at the spray mast.
- II. Then measure the exact release of 1 spray nozzle for 1 minute. Use the delivered 3L measuring jug for this.



**Img. 36 3 Litres measuring jug**



Subjoined formula has to be used to determine the right driving speed of the chalk machine:

*Measured release of nozzle X the number of nozzles = Total release per minute*

$$\frac{\text{Total release per minute}}{\text{Number of litres fluid per m}^2 \text{ you want to spray}} = \text{Capacity of machine in m}^2 \text{ per minute}$$

$$\frac{\text{Capacity of machine in m}^2 \text{ per minute}}{\text{Number of m1 spray mast width}} = \text{Needed driving speed of machine in metres per minute}$$

## 7.5 Calculation example 1

### Data:

Peak size	:	4.00 metres
Number of litres of fluid you want to spray (shading compound + water)	:	1.200 litres per hectare = 0.12 litres per m <sup>2</sup>
Chalk machine	:	Top Cleaner (Basic) 3 spray masts with a total of 30 nozzles
Real measured release per spray cap at a work pressure of 3 bars	:	1.5 litres per minute

You drive the chalk machine to the end of the greenhouse gutter with 1.5 spray mast opened and with the other half opened when you drive back. This makes 15 nozzles left towards the end and 15 nozzles on the right when you drive back. When all nozzles are opened, the flow of the hose will be too big, so pressure loss will occur and the desired work pressure is not attainable any more!

We have to determine the cap release first. We then determine the matching driving speed.

When we will in the formula (please see bottom of page 12), it would look like this:

$$1.5 \times 15 = 22.5 \text{ ltr} / \text{min}$$

$$\frac{22.5 \text{ ltr} / \text{min}}{0.12 \text{ ltr} / \text{m}^2} = 187.5 \text{ m}^2 / \text{min.}$$

$$\frac{187.5 \text{ m}^2 / \text{min.}}{6 \text{ m1 width spray mast}} = 31.25 \text{ m} / \text{min. drivingspeed}$$

## 7.6 Calculation example 2

### Data:

Peak size	:	3.20 metres
Number of litres of fluid you want to spray (shading compound + water)	:	1,400 litres per hectare 0.14 litres per m <sup>2</sup>
Chalk machine	:	Safety-Car 2 spray masts with a total of 16 nozzles
Real measured release per spray cap at a work pressure of 3 bars	:	1.3 litres per minute

When using the Safety-Car, it is best to first drive all the way to the end of the gutter, after which you drive back with both spray masts opened.

We first have to determine the cap release. We then determine the matching driving speed.

When we will in the formula (please see bottom of page 12), it would look like this:

$$1.3 \times 16 = 20.8 \text{ ltr} / \text{min}$$

$$\frac{20.8 \text{ ltr} / \text{min}}{0.14 \text{ ltr} / \text{m}^2} = 149 \text{ m}^2 / \text{min}.$$

$$\frac{149 \text{ m}^2 / \text{min}}{6.4 \text{ m} \text{ width spray mast}} = 23.3 \text{ m} / \text{min. driving speed}$$

## 7.7 Determining the driving speed

All aforementioned chalk machines are equipped with a steplessly adjustable speed control so you can always set the right driving speed.

It is then easy to determine the driving time that is necessary to pass 3 trellis girders (2 sections).

Let us say that a section size is 4.5 metres.

The desired driving speed = 23.3 metres per minute = 0.39 metres per second

2 x 4.5 metres = 9.00 metres : 0.39 metres per second = 23 seconds of driving time

So you would have to pass 3 trellis girders in 23 seconds.

## 8 Removing shading compounds

Removing the coating can take place with the same machine. ReduClean® is the cleaning compound for all ReduSystems products. You always use 250 litres ReduClean® per hectare, mixed with water. You can spray ReduClean® by means of the spray masts or when brushing, at which a dosage pump on the machine mixes the ReduClean® with water and sprays it on the adjacent peak.



Img. 37 Dosage pump for cleaning compound




Img. 38 Top Cleaner with "spurting mast"

## 9 Practical tips

Please find subjoined a number of practical tips to achieve the best possible spray result.

1. Work clean. Make sure that nozzles, hoses, mixing barrel and pump are clean before use. Old residue of shading compound makes the nozzle clog faster.
2. Comply with the dosage and safety advice of the manufacturer. Read the information on the package.
3. Please take your time to adjust the machine / pump before you start spraying.
4. Remove all possible brushes from the machine before you start spraying.
5. Spray as much with the biggest nozzles as possible and adjust the driving speed. Larger nozzles will clog less fast.
6. Make sure that the roof is brushed before spraying the mixture. Clean glass will adhere better than filthy glass.
7. The best spray results are achieved when one sprays at the moments of the day that the atmospheric humidity (RV) is the lowest.
8. A syrupy mixture cannot be sprayed. It is therefore best to apply high concentrations (> 1:3) in 2 layers. Only apply the second layer when the first layer has fully dried.
9. Consider applying the shading compound in 2 phases. This can be favourable from a cultivation point of view.
10. Take care of spare nozzles so you can quickly change the nozzle in case of clogging.
11. Replace the nozzles every year because of wear.

## 10 Price list

<b>Service rail</b>		
Prices on demand		
<b>Top Cleaner Basic</b>		
Top Cleaner Basic excl. generator	€ 15.800,00	from
Honda 2Kw generator	€ 1.740,00	
Set of spray masts	€ 2.842,00	from
250 metres hose ½"	€ 1.437,50	
Brush set	€ 4.100,00	from
Gutter brush	€ 1.135,00	
Dosatron dosage pump	€ 1.350,00	
<b>Top Cleaner (suitable for automation)</b>		
Top Cleaner roof cleaner including: <ul style="list-style-type: none"> <li>• Gutter brush</li> <li>• Set of window protection switches</li> <li>• Set of disk brushes for underneath the window</li> <li>• 250 Metres hose and cable on reels</li> </ul>	€ 27.000,00	from
Set of spray masts including frame adjustments	€ 6.600,00	
Dosatron dosage pump	€ 1.350,00	
<b>Safety-Car</b>		
Safety-Car excl. generator	€ 6.740,00	
Honda 2Kw generator	€ 1.740,00	
Set of spray masts	€ 1.895,00	from
Brush set	€ 7.186,00	from
<b>Platforms</b>		
Platform excluding options	€ 9.300,00	from
Supplement electric drive	€ 2.530,00	from
Supplement electrical folding undercarriage	€ 2.350,00	
4-way hoisting sling	€ 451,00	
Supplement automatic peak-to-peak movement (only applicable to Top Cleaner)	€ 20.310,00	from
<b>Scissor lifts</b>		
Prices on demand		
<b>Water pumps</b>		
Plunger pump 30L/Min – 70 Bars 400/480V placed on platform	€ 2.270,00	
<b>Chalk pumps</b>		
Membrane pump 35 L/Min - 40 Bars 400/480V 4Kw	€ 1.805,00	
		



<p>Membrane pump 110 L/Min - 50 Bars incl. PTO axle</p> 	<p>€ 1.760,00</p>	
<p>Membrane pump 70 L/Min - 40 Bars 400V 5.5Kw</p> 	<p>€ 3,415.00</p>	
<p>Membrane pump 70 L/Min - 40 Bars petrol engine</p> 	<p>€ 3,680.00</p>	
<b>Empas wheeled spray cart (excl. Pump)</b>		
<p>2 x 600 ltr</p> 	<p>€ 4.495,00</p>	
<p>Pulled models spray carts</p> 		
<p>1 x 600 ltr</p>	<p>€ 2.350,00</p>	
<p>1 x 1.000 ltr</p>	<p>€ 2.950,00</p>	
<p>1 x 1.500 ltr</p>	<p>€ 3.795,00</p>	

1 x 2.000 ltr	€ 5.355,00	
Galvanized frame instead of powder coating	€ 350,00	
Hose reel for ½" high pressure hose	€ 450,00	
More price for stainless steel hose reel	€ 225,00	
½" high pressure hose	€ 5,75	
<b>Other</b>		
Dosatron pump, acid-resistant model 	€ 1.350,00	
Flowmeter	€ 3.250,00	
End of gutter stop 	€ 11,70	

## **11 Contact:**

### **Mardenkro BV**

Geerstraat 8  
5111 PS Baarle-Nassau  
The Netherlands

T +31 13 507 7069

F +31 13 507 7343

E [info@mardenkro.com](mailto:info@mardenkro.com)

I [www.mardenkro.com](http://www.mardenkro.com)

### **Van der Waay Machinebouw BV**

Belgiëlaan 7  
2391 PH Hazerswoude-Dorp  
The Netherlands

T +31 172 210 311

F + 31 172 218156

E [info@vdwaay.nl](mailto:info@vdwaay.nl)

I [www.vdwaay.nl](http://www.vdwaay.nl)