
Finish clean, start clean

For a hygienic start
in the new crop

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Let's
improve
together.

Finish clean, start clean

Our product specialists in Crop Care, Crop Rotation, and Horti-Hygiënz can help you in preparation of, and during, the start of the new crop. Whether it's once a year, as in tomato or pepper cultivation, once every 10 to 13 weeks in chrysanthemum cultivation, or once every 7 years in rose cultivation: it all revolves around planning, preparation, and the right applications.

For most growers, crop rotation is a hectic period: the old crop is removed, often in a short span of time, and the new crop has to start up again as soon as possible. Hygiene is a crucial here: by using various hygiene measures to prevent any diseases and pests from staying in the greenhouse, you ensure the new crop will not be contaminated again. So finish clean, start clean! In this brochure we list all the important points to consider when it comes to crop rotation.

If you have any questions after reading this brochure, please contact our product specialists

Important
points at a
glance



Crop rotation step-by-step plan

Have you already prepared your plan for the upcoming [crop rotation](#)? To make this process as smooth as possible, it's beneficial to work with a clear plan. That is why we've drawn up a step-by-step plan for crop rotation. By going through all the items on this checklist, you can ensure not to forget anything!

Step 1: Order HD hooks/twine/films

High-wire hooks have an average delivery time of 10 weeks. It's wise to order the hooks as early as possible, so you'll have peace of mind the high-wire hooks will be delivered on time.

Decide [which high-wire hooks](#) and [twine](#) you want to use, then determine [how many boxes/pallets](#) you need. It's also important to order [films](#) on time.



Step 2: End signaling

In the final phase of the cultivation, the biological equilibrium of natural enemies within the crop is also ending. It is important to spray the old crop 'clean' just before crop rotation. This is to prevent insects from surviving elsewhere, or leaving their larvae on the greenhouse floor.

In most cases, the crop is sprayed clean with (broad-spectrum) chemical crop protection products. Make sure you are properly protected with [personal protective equipment](#).

Step 3: Emptying the greenhouse

When [emptying the greenhouse](#) there is one essential rule of hygiene: prevent diseases and pathogens that could be present from being spread throughout the entire facility. For example, vegetable sap can cause disease and pests to be carried from their location and spread, and it's important this doesn't lead to reinfection elsewhere in the in the greenhouse.

Be alert for local disease pressure and be sure this part of the crop is removed carefully. Try to spill as little plant residue and sap as possible.

Crop rotation step-by-step plan

Step 4: Cleaning the glass

Once the crop and coarse residues have been removed, cleaning can begin. The cleaning of greenhouse stands and greenhouse equipment takes place over several cleaning rounds. To remove the last traces of chalk or coating on the outside of the glass, consider the product [Removit](#). For general cleaning, use a water brush and apply a glass cleaner if necessary.

The inside glass cleaning begins with clean water and the application of products such as Greenhouse GlassClean. Contact our [product specialists](#) for a suitable cleaning method, especially for diffused glass.



Step 5: Cleaning water system

During cultivation, biofilm can build up along the inside of the irrigation system, which, in addition to clogging up and reducing oxygen, also accommodates bacteria, fungi, and viruses. Mineral deposits may also form in the irrigation system due to precipitation/fertilizer reactions.

To prevent the spread of pathogens or blockages in the new crop, the irrigation system should be cleaned [after the cultivation](#) (preferably during the cultivation as well). [The plugs of the dripper](#) should be treated separately. In case of virus problems, it's recommended to remove the old plugs and install new ones. For cleaning organic pollution, the stabilized peroxide [Huwa-San](#) is added to the system. Besides the irrigation system itself, silos and basins also need to be cleaned and disinfected.

This may also contain undesirable pathogens, which could have a negative impact on the new crop. The outside of the irrigation tubes should be disinfected (with or without foam) with the broad-spectrum disinfectant [Menno Clean](#).

Crop rotation step-by-step plan

Step 6: Cleaning and disinfection of the greenhouse

For proper disinfection a clean surface is needed; a disinfectant can better act on pathogens. If there were problems with a virus in particular spots in the greenhouse, you should disinfect these places first before cleaning. This will reduce virus concentrations and to prevent them from spreading to other areas during cleaning. For cleaning surfaces with organic dirt and sap, we recommend using [Menno Clean](#) (possibly as a foam). After everything (concrete path, materials, etc.) has been thoroughly cleaned and dried, disinfection can start: eliminating any bacteria, fungi (spores), viruses, and viroids present.

This is the perfect time to invest in a clean start, and to deal with the legacy of diseases and pests from the old crop! For disinfection against a wide range of specific plant pathogens, [Menno Clean](#) is the always a great choice. The agent is extremely stable and not damaging to materials. This prevents growing gutters from rusting, which makes cleaning and disinfecting easier in the future. Thanks to the long stability and application time, the tests for GBM approval also showed that resting spores of fungi were effectively killed.



In addition to the greenhouse, it's also important to properly clean other areas such as the cafeteria, bathroom, and changing area. To distinguish these areas from each other and to prevent recontamination in your greenhouse, you can use [colored cleaning materials](#). Also, make sure you're not moving from non-disinfected sites to disinfected sites without taking measures. Lastly, consult [the disinfection protocol](#) for your crop.

Step 7: Start clean

At the start of a new crop, it is important to reorganize the greenhouse hygienically. This starts with the installation of film and [laying out the cultivation substrate](#). The use of full-field film is always recommended in crops susceptible to viruses. Make sure the materials that go into the clean area are clean to begin with.

This ensures no diseases and pests are brought in (also think of disinfection in advance for tools like shears and film cutters).

To make sure that everyone and everything enters the facility clean, consider [automatically filling disinfection mats](#) which everything simply rolls or walks on.

Crop rotation step-by-step plan

Step 8: Installation of personal hygiene

[The personal hygiene of employees](#) deserves extra attention. Most diseases and pests are spread through mechanical transmission, i.e. via hands and feet. Depending on the crop and disease pressure on the company, personal hygiene can be customized based on need. Simple personal hygiene includes [voluntary hand washing](#), sole cleaning via disinfection mats at the entrance, [guest overalls and overboots for visitors](#), and hand disinfection by means of dispensers. Ensure [the applicable rules](#) are clear to everyone.

Mandatory hygiene stations, for guests and employees, are a great solution before anyone can enter the facility. They'll first have to use to a forced hand and foot disinfection with mechanical cleaning of the soles of the shoes. Royal Brinkman can help you develop ideas for any new construction/renovations and to create the right walking route at your entrance.



Also take a close look at [the hygiene plan](#) and [the hygiene protocol for visitors](#): are these up to date at the company?

Step 9: Start signaling

Once the new crop is planted, the preventive deployment of biological control agents, and the timely detection of new [diseases and pests](#), begins.

Signaling starts with hanging sticky traps or sticky rolls.

Regular scouting also starts again: timely signaling and immediate action is the basis for the ideal crop protection.

Applying glass cleaner

Well-cleaned glass allows more light into the greenhouse. This light is very important for the growth of a crop. Regular cleaning the glass of the greenhouse to remove contamination such as rust, soot, lime, dust and other types of deposits from the glass is essential. A glass cleaner is used here, but how you apply a glass cleaner is important, too.

Composition

In horticulture, a fluoride-based glass cleaner is typically used. Fluoride-based glass cleaners come in two distinct forms: hydrogen fluoride-based cleaners, and ammonium bifluoride-based cleaners.

Hydrogen fluoride

Hydrogen fluoride-based glass cleaners have a very strong effect, but when using these cleaners, a vapor effect occurs. The substances released in this process are toxic to humans and cause damage to crops. It is imperative to ventilate well after using a glass cleaner with this composition. But neighboring crops – especially tuberous and bulbous plants such as freesia and lilies – can also be affected by this vapor effect. Take this into account.

Ammonium bifluoride

Glass cleaners based on ammonium bifluoride have a milder effect, but when using these cleaners, no vapor effect occurs. This makes these cleaners safer to use for both people and crops.



**More light
and more
production**

Applying glass cleaner

Applying a glass cleaner can be done manually with a (foam) spray gun, or mechanically with a greenhouse roof cleaner. After letting the glass cleaner soak in, there's an application time of 10 to 15 minutes*. Never allow a product to soak in longer than the recommended application time or it will dry out. Remove the product in time using a powerful jet and plenty of water.

*Unlike other glass cleaners, Greenhouse Glassclean has an application time of 25 to 30 minutes.

Note: tempered glass, diffused glass, or glass with a special coating cannot be cleaned with fluorine glass cleaners. The fluoride in the glass cleaners can cause damage to this material.

Personal protective equipment

When working with glass cleaners, always use personal protective equipment to avoid eye and skin contact. Consult the safety data sheet of the product used for more information on the required personal protective equipment.

Disinfection

Glass cleaners are intended purely for cleaning; they do not disinfect the glass. To remove remaining bacteria, viruses, fungi and viroids, use a disinfectant such as Menno Clean.



TIP

**Clean
the glass
regularly**



Good,
healthy water
quality

Cleaning the drip system after cultivation

The drip system allows the crop to get the required amount of water. However, if the system gets contaminated, germs and algae can spread through water, causing a biofilm to form. This would be disastrous for the water quality supporting the crop. It's important the drip system is cleaned and rinsed regularly. You can do this during cultivation as well as after cultivation. Different methods can be applied.

Cleaning the drip system during crop rotation

The most efficient and safest way of cleaning the drip system is to first clean the pipes with [Huwa-San](#) (against mineral pollution) and then flush them following a long application time. Next, fill up the entire water system with the correct dosage of [nitric acid](#) (against organic pollution), let it soak in as long as possible, then flush the system to remove the loosened dirt.

Preparation

- When using cleaning products, always be mindful of your own safety and use the proper personal protective equipment as indicated.
- Check in advance with the supplier/manufacturer of the irrigation system what the resistance of the water system is to the products used.
- Isolate the pH and EC probes so they do not come into contact with the cleaning products.
- Fill the system with the dosage, then measure in a number of places that the desired concentration is achieved.
- Remove end caps and flush drip lines thoroughly to remove coarse dirt. Be careful not to increase the pressure, so loosened dirt does not clog the capillaries.
- Repeat the process if necessary.



Fill up drip lines

- Fill the drip system with a solution of 38% nitric acid at a dosage of 3 litres of 38% nitric acid per 100 liters of water. A pH measurement ($\text{pH} < 2$) can be used to check whether the nitric acid has reached the end of the system.
- After 6 hours of soaking, drip the cleaning solution for 1 minute and then refill the system with a “fresh” solution of nitric acid (3 liters of 38% nitric acid per 100 liters of water). Place the drippers next to the slab to prevent affecting the substrate.
- After 24 hours you'll need to flush the system with clean water and then flush the drippers with clean water. Note: products should not come into contact with each other in high concentrations.
- Fill the whole system, depending on the degree of soiling, with a 0.2%, 0.5% or 0.7% solution of Huwa-San. Allow the cleaning products to reach the sand filter as well to clean it. Using peroxide strips, check whether the Huwa-San has reached the end of the system.
- After 6-12 hours of soaking, the liquid can be returned to the drain tank, or you can drip for 1 minute and then refill the drip system with a fresh solution of Huwa-San. Place drippers at high concentrations next to the slab to preserve substrate fibers.
- After 12-24 hours, you should flush the system thoroughly with clean (disinfected!) water.

Handling of wastewater during the crop rotation

A lot of wastewater can be produced during crop rotation, including leachate water, drain water, and cleaning water. These wastewater flows may contain fertilizers, plant protection products, or disinfectants. In most cases these should not be discharged into surface water. How do you handle wastewater in a hygienic way?

Limit

You can limit the amount of wastewater by stopping watering in time. The crop will absorb the remaining water from the substrate, which also helps the substrate to dry out as much as possible.

Collect

Wastewater containing fertilizers and/or plant protection products may not be discharged into surface water. This water should therefore be collected and disposed of. The following wastewater flows may not be discharged into surface water:

- **Leachate water:** when a crop is temporarily stored outside, it starts to decompose. This creates leachate water, which contains fertilizers and/or crop protection agents. Ensure you use leak-proof containers.
- **Leakage water from old substrate slabs:** Even if you have stopped watering in time, leakage water from old substrate mats still occurs. This must be drained via the sewer.
- **Cleaning water:** when cleaning with cleaning agents and/or disinfectants, the water is usually not allowed to be discharged into the surface water.
- **If you only use water,** then this is allowed.
- **Silo water:** when you clean the silo, you have to discharge the water into the sewer.
- **Leakage water of new substrate slabs:** when you cut the new substrate slabs after watering, you need to collect the water and recirculate or drain it. Since this generates a large amount of wastewater, it is best to cut the film a little bit at first before ultimately cutting it completely. This way, the water won't be released all at once, making it easier for you to collect it. You can also choose not to drain all the substrate slabs on the same day, but to spread this out.





Drawing up a hygiene plan



Starting clean helps prevent unwanted diseases and pests from entering the facility on people, machines, and tools. Company hygiene focuses on keeping these plant diseases and pathogens at bay. In order to use a hygienic but practical working method, it is advisable to draw up a hygiene plan with us. Do you already have a hygiene plan? Then check it and optimize where possible.

Hygiene plan contents

A hygiene plan includes a description of the hygiene measures a company takes. But also how often and/or at what times these measures must be taken or things must be checked.

Risk areas

Every crop has to deal with specific diseases and every company has a unique situation. There is no general hygiene plan, so every plan requires customization. However, every company does deal with the same risk areas:

- People and activities: employees or visitors can bring bacteria, fungi, or viruses in, and spread them via hands, shoes and clothing. Good access hygiene can prevent this.
 - Optimal water quality: attention to water quality is very important; bacteria, fungi, and viruses can spread rapidly in the water system.
 - Disease-free materials: materials such as trolleys, tools, forklifts, and crates cause the unwanted introduction of pathogens. Ensure proper cleaning and disinfection and make clear agreements about this with suppliers.
 - Responsible and sustainable: Growers want a safe environment for their employees, they want to meet the requirements of the customer, and they want to be able to use the materials and greenhouse equipment for as long as possible. Royal Brinkman only uses cleaning and disinfection agents that have been approved and have proven their effectiveness.
- Perfect crop rotation: An empty greenhouse is the best time to rid the facility of any bacteria, fungi, and viruses.



Let's improve together.



Do you have any questions after reading this brochure?

Please feel free to contact us and we'll connect you with a specialist

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