- Innovation guide for ornamental growers and landscapers -

# Weed control cover materials for sustainable container-grown plant production

Which cover material do you choose to prevent weed growth in container-grown plants?

PCS

This innovation guide is a publication of the Proefcentrum voor Sierteelt PCS Ornamental Plant Research and was developed during practical research at the PCS.

colophon

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# Do you already use cover materials as an alternative to herbicides for weed control?

Cover materials are efficient for weed control in the ornamentals and green sector. Extensive research from the PCS Ornamental Plant Research confirms this. Because there are fewer and fewer herbicides on the market and the application conditions are becoming stricter, a sustainable alternative is required. Cover materials offer a good solution: they are affordable and good for people and the environment, which is in line with the IPM principle 'Keep chemistry as the last option'.

Have you already used cover materials in your company? Before purchasing, have you sufficiently compared the properties of the different types of cover materials and have you made a cost price calculation? Using this innovation guide, based on independent research from the PCS, you have the necessary information about cover materials to hand. This way it will become a lot easier in the future to choose the right cover material and to focus on sustainable innovation in your company.

**Bruno Gobin**
PCS Director

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contents

Lots of weed control cover materials are available on the market. But do you know which ones are best suited for use in container-grown plant production? PCS gives advice.

# 1 Use cover materials as an alternative weed control

Herbicides are often used to prevent weeds competing with floricultural crops for water and nutrients. Not only IPM legislation, but also increasing concern for the environment, force us to look for alternatives. To keep the nursery free of weeds, cover materials are a fully-fledged, sustainable solution. Cover materials prevent weed growth and reduce the labour costs of weeding. Furthermore, they ensure better water retention and offer an aesthetically added value.

# 1.1. Preventing weed growth and consequences for business operations

A weed-free company is necessary in order to be able to offer high-quality plants. To prevent weed growth, we need to know how weeds develop.

## HOW WEEDS GROW

A plant is made up of roots, stems, leaves, flowers and fruits. It is advisable to look closely at these components for the recognition of weeds. Weeds may be annuals, biennials or perennials.

- Annual weeds germinate, develop, form seeds and die in one calendar year.
- Biennial weeds form leaves in the first year. Flowers and seeds do not develop until the second year and these weeds then die.
- Perennial weeds die down to the ground every year, but emerge again every spring.


Depending on the method of multiplication we differentiate various types of weeds: seed weeds, root weeds, mosses and ferns.

### 1. SEED WEEDS

Seed weeds multiply sexually through seed. If the seed only germinates under the influence of light, then one talks of **light** germinators. If no light stimulus is needed to germinate, people speak of **dark germinators**. The seed from seed weeds may easily spread via wind, water and animals, so that it ends up in the pots. If the seed falls directly onto the substrate, it can quickly germinate there and grow into unwanted weeds if there is sufficient moisture available. But if you provide the pots with a layer of cover material when potting, the seed will end up on the cover material. Because the cover material provides less favorable growing conditions, the seed will germinate less easily. This way weed growth is prevented.

### 2. ROOT WEEDS

If multiplication occurs mainly via rhizomes, one speaks of root weeds. Root weeds can also multiply via seed, but with these weeds propagation through roots, tubers or parts of them is more important. These weeds usually form a deep or widely branched root system. The roots of these plants (taproot, rhizomes, tubers and underground stems) serve as spare organs. They remain in the substrate and form new shoots throughout the year. An example of this is creeping or field thistle. Root weeds spread less quickly over the pots and mainly cause problems if they are already present in the pot at the start of the cultivation. So here the message is to ensure the plant material and substrate

**Info**

Bittercress, also known as touch-me-not because of the fruits that fly off, produces 5,000 seeds per plant. You must prevent this seed formation by acting on time.

## WEED TYPES AND THEIR GROWTH


**Recommendation**
If only the above-ground part of root weeds is removed, the weeds will continue to grow. Even a layer of cover material will not stop the weed, because it just grows through it. Problems with these stubborn weeds can only be prevented by starting with weed-free material (substrate and plants).

are free of weeds. If this doesn't happen, the weeds will grow through the cover material during the growing season. If weeding is then required during the growing season, the layer of cover material will be damaged when the root weeds are pulled out. The result is that the substrate is no longer covered, so that seed weeds again have the opportunity to germinate.

### 3. MOSSES AND FERNS

In addition to the above-mentioned weeds, we also differentiate mosses and ferns. These plants produce spores. Only the mosses will be discussed further here. They have stems and leaves, but no real roots. Their stems form root-like appendages, rhizoids. The mosses can still be divided into two groups: mosses and liverworts.

With the **mosses** the leaves are in spirals or in two rows. Mosses form spores in capsules, where, after maturing, they are either thrown forcefully through a small opening or released through four slits or, as with most mosses, through an opening or mouth that emerges after the cover has fallen off. On the ground, they immediately develop into new plants. Mosses can be monoecious or dioecious, depending on the species. The male reproductive cells move through an extremely thin layer of water on the plant to the female organs, which are known to release a chemical attractant. Humid conditions are essential for sexual reproduction. Once the female organs are fertilised, a spore capsule develops in which spores form.

"Save valuable time by using cover materials."

**Liverworts** are flat and lobed in structure or have small leaves in three rows. The life cycle is similar to that of the mosses. Male and female organs are often clearly visible on the lobed types. The capsule differs from that of mosses in that it bursts into four flaps, releasing the spores.

**Info**
When the combination of *Pinus maritima* bark and coir is used as cover material, more moss growth occurs than when only *Pinus maritima* is used.

## HOW TO PREVENT WEEDS

When plants reach the container field, seeds can germinate on the substrate and grow into unwanted seed weeds. Depending on the weed pressure and the weather conditions, these then need to be removed manually several times during a growing season. Lots of valuable time is lost this way.

To counter this, there is the possibility of using a limited number of approved herbicides that prevent seed weed germination. These residual herbicides have a good effect in the first half of the growing season. However, they are broken down by microbial degradation and under the influence of light, so that weed seeds will germinate later on during the growing season. The number of weeding sessions therefore decreases, but cannot be avoided completely.

Because the cover material dries out quickly on the top after irrigating or a rain shower, the seed will not germinate. This way weed growth is prevented.

## METHODS FOR EFFICIENTLY AND ENVIRONMENTALLY CONSCIOUSLY DEALING WITH WEEDS IN POTS

| METHOD | | PROS AND CONS |
|---|---|---|
| Control by manual weeding |  | - labour intensive |
| Control using herbicides *= avoiding weed germination and growth* |  | + less labour intensive than manual weeding<br>- only really works in the first part of the growing season<br>- weeding remains necessary further into the growing season<br>- herbicides are harmful to the environment |
| Control using cover materials *= avoiding weed germination* |  | + weed seed rarely germinates on cover materials<br>+ almost no control needed<br>+ hardly any weeding<br>- do not use plant material containing weed seeds, rhizomes or spores, this reduces the weed control effect of cover materials |

By using cover materials, the opportunity for weed seeds to germinate is much smaller. Most cover materials have the property that the covering layer applied dries quickly, so weed seeds will only sporadically grow. The valuable time gained with this can therefore be used more efficiently elsewhere.

# 1.2. Cover materials and their use within IPM

By applying cover materials you prevent weed growth, which amounts to the first IPM principle 'Prevent rather than cure'. The use of cover materials also fits perfectly within the fourth IPM principle 'Keep chemistry as the last option'.

**Legislation**
The use of cover materials is part of the IPM legislation under basic principle 1 'Prevent instead of cure' and basic principle 4 'Keep chemistry as the last option'.

## INTEGRATED CROP PROTECTION (IPM)

Integrated crop protection (Integrated Pest Management or IPM) has been mandatory since 1 January 2014 in agriculture and edibles and ornamentals horticulture. IPM is the well-considered combination of all crop protection techniques, with minimal risk to people and the environment, wherein crop damage and crop protection costs remain within economically acceptable levels. To put IPM regulations into practice, eight general basic principles are defined that allow the grower to control diseases, pests and weeds in an ecologically and economically responsible and efficient manner. These eight basic principles together form an IPM step-by-step plan that is shown schematically alongside. To check whether a grower is complying with the application of IPM legislation, a checklist has been drawn up quickly to assess whether sufficient efforts are being made. This checklist provides a series of measures per basic principle, from which a number may be selected.

## PREVENTION IS BETTER THAN CURE

It is always easier to prevent problems than to try and resolve them afterwards. Neat cultivation not only helps to prevent many problems, but it also gives a more professional appearance. IPM starts with keeping out pests. The protected storage of substrate and soil improvers is one of the measures that occurs within this first basic principle. This way weed seeds are prevented from contaminating the substrate.


The eight basic principles of integrated crop protection.

Publication 'Integrated Crop Protection (IPM) in ornamental plant production' from the PCS (2014)

## KEEP CHEMISTRY AS THE LAST OPTION

IPM starts with good nursery hygiene and preventive measures in order to minimise the general level of pests (1st IPM principle). The crop is then regularly checked for pests and/or damage (2nd IPM principle) and - if necessary - the correct time is determined for treatment (3rd IPM principle). The next step in this integrated approach is to choose the optimum crop protection technique, with preference being given to non-chemical control. This is the 4th IPM principle: 'Keep chemistry as the last option'. This principle includes measures that are a supplement or alternative to chemical weed control. The use of cover materials is therefore an excellent example of this. For a more detailed explanation of the basic IPM principles and related measures for ornamental plant production, we refer to the IPM publications of the PCS and the Department of Agriculture and Fisheries of the Flemish government.

"Thanks to cover materials, a lot of weed problems are avoided."

# 1.3. Cover materials and their use

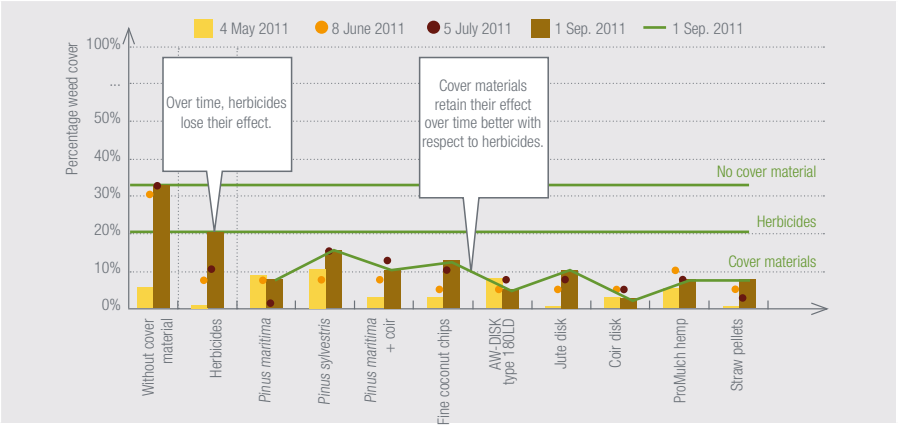
## COVER MATERIALS

By cover materials we mean all materials that can be used to cover the substrate and in this way prevent weed growth. The focus is mainly on sustainable materials that have a limited influence on growth and the ultimate plant quality. Within this publication we focus primarily on cover materials that can be used in container-grown plant production. These cover materials also often find application in field-grown plant production or in landscaping. In addition to the use of cover materials to prevent weed growth, other techniques are also used in these sectors, such as biodegradable films, mechanical and thermal weed control, green cover plants, ground cover plants, etc. These topics are not included in this publication.

## COVER MATERIALS' OPERATION

A mechanical barrier is formed when the substrate is covered. The cover material prevents weed seeds from ending up on the substrate. The surface of the cover material will dry out faster compared to the surface of the uncovered substrate. The germination conditions are therefore less favourable, so that the pots remain weed-free for longer. Sometimes it's not possible to start with uncontaminated plant material and weed seeds are already present on the substrate, originating from the background weed population in the previous growing year. By applying a cover material to the substrate after repotting, the weed seeds are shielded from the light. This light barrier will ensure that the development of light germinators is prevented.

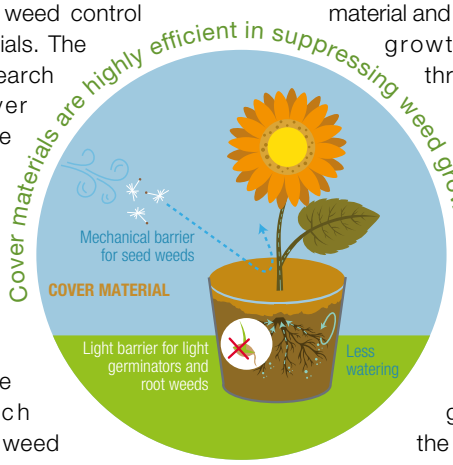
PERCENTAGE WEED COVER FOR 3 LITRE POTS OF *LIGUSTRUM OVALIFOLIUM*




Cover materials proved their weed control effect in several trials at the PCS.

## EFFICIENCY EXAMINED VIA WEED CONTROL TRIALS

For several years, research was carried out at the PCS into the weed control effect of cover materials. The many years of research shows that cover materials are effective for weed control. The efficiency was assessed by carrying out a weed inspection at different times, scoring the coverage of the weeds on the pot. After each assessment of the weed population, the weeds present were removed so that fresh weed emergence was assessed in the subsequent assessment. The weed population was plotted in relative values with respect to the control and with respect to the starting population.




## RESEARCH RESULTS

Each time the weed control effect of the cover materials was observed. Without cover material and herbicides, more weed growth was observed throughout the season. Year after year it was observed that when treatment with residual herbicides (chemical control) was carried out shortly after potting, weed growth was strongly suppressed in the first half of the growing season. Later in the season, the herbicide effect reduced, so that more weeds were observed. When using cover materials, a lower weed pressure was observed in each case compared to the non-covered pots, but also in comparison with the use of the residual herbicides.

### Highlights: use cover materials as alternative weed control

1. By using cover materials, IPM basic principle 1 ‘Prevent instead of cure’ and IPM basic principle 4 ‘Keep chemistry as the last option’ are met.
2. Thanks to cover materials, weed seeds hardly have a chance to germinate. The surface of the substrate, which forms an ideal microclimate for seed germination, is shielded from wind-blown weed seeds.
3. It is important to start with weed-free plant material and substrate. After all, cover materials are unable to cope with existing root weeds because they can grow through them.

2

# Know the properties of cover materials

By knowing the different properties of cover materials and, moreover, knowing what actions and technical adjustments are needed to use them, the many benefits of these quickly become clear. With these criteria in mind, it is a lot easier to choose the right cover material, which also ensures a high-quality end product.

# 2.1. Characteristics of cover materials

Foremost cover materials ensure that the substrate is kept weed-free. Depending on the specific characteristics of the raw materials and the processing that the cover materials undergo during the production process, a different result will be achieved. By knowing the characteristics, you will be able to make the right decision when choosing the cover material for your crops.

In addition to the specific characteristics of the cover materials, the climate and cultivation conditions and the growing method of the cultivated plant also have a major influence on the effect. Humid and warm growing conditions will accelerate the degradation of certain materials. Crops which cover only a small area of the substrate clearly experience a stronger 'weed pressure'. If rapid coverage of the substrate is expected, cover materials can be applied with a lower or faster decreasing efficiency.

### PACKAGING

Depending on the supplier, cover materials are packaged or delivered in bulk. The method with which the cover material is processed within the company will determine the choice of delivery method. Cover materials packed in bags are easier to use when small quantities are needed. Cover materials supplied in bulk may be used more easily for machine processing and will in many cases be more economical.

### DESIRED COVERING LAYER THICKNESS

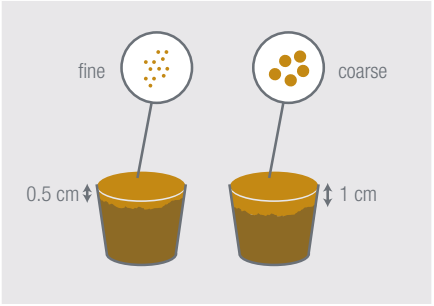
The volume ratio of cover material to substrate is determined by the thickness of the covering layer. The cover material replaces a certain volume of substrate in the pot. The volume depends on the type of cover material and the pot size in which the plants are potted. In P9 pots, 0.5 cm of certain cover materials may suffice, while for larger pot sizes this might amount to 2 to 3 cm. Cover materials with a finer composition can often be used in a thinner layer than coarser materials. The coarser materials must be applied thicker to prevent light from coming through the cover layer.

### FRACTION SIZE

The loose cover materials are often available in different fraction sizes. They can go from very fine to rather coarse materials. Certain cover materials are passed over a sieve with different mesh sizes, so that the end products vary in particle size. This offers interesting perspectives for using cover materials in container-grown plant production, where pot sizes may vary greatly.

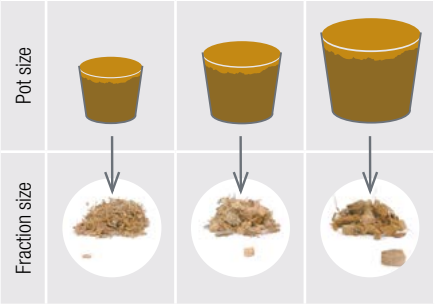
The layer thickness of cover materials varies depending on the pot size and the composition of the cover material.

COVER LAYER THICKNESS IS DETERMINED BY FRACTION SIZE




The finer the fraction of the cover material, the thinner the covering layer may be to obtain a sufficient weed control effect.

LARGER FRACTION SIZE FOR LARGER POT SIZE




The smaller the pot size, the smaller the fraction to be used.

When plants are potted into the smaller pot sizes, it will be easier to apply a finer cover material. Because the particles are smaller, the layer thickness does not have to be too deep to shield the underlying substrate from the light. In this way the ratio of cover material to substrate can be kept rather limited. Larger cover materials can be used with larger pot sizes. Due to a larger volume of substrate, the influence of the cover material on the growth of the plant will be smaller.

With the fixed cover materials it is important that the discs have the same surface area as the pots on which they will be placed. After all, if the discs are too small, weeds will grow between the pot edge and the cover disc. It is also important that the cover disc fits as closely as possible around the stem of the plant to prevent weed growth.

## COMPOSITION

Cover materials are often different types of tree barks, fibres or residual products from the processing industry. They each have their own characteristics. These are discussed in detail in Chapter 3.

## COLOUR AND AESTHETIC VALUE

The colour of cover materials provides an aesthetic added value and is determined by the constituent components. Colour

The end product, a high-quality plant, is made more attractive by a pot provided with cover material.

pigments may be added to some cover materials in order to make the cover material more attractive, such as with Container Mulch. Cover materials cover the substrate nicely, whereby weeds don't get a chance to grow. The end product, a high-quality plant, is made more attractive by a pot provided with cover material. As a result, the plant, and certainly also the pot, always looks neat and tidy. This is a product characteristic that customers greatly appreciate and will have a positive impact on sales to private individuals. This sales argument can therefore be used in the marketing strategy for your product.

## ABILITY TO STICK

Cover materials can contain a natural glue substance, for example starch glue or resin glue, whereby the particles stick to each other. An artificial adhesive or extra fibres may be added to other cover materials to achieve the same effect. The shape of the individual particles can also ensure that they stick nicely to each other, so that a tight-knit layer is obtained. As a result, when the pots fall over, the cover material stays in place nicely, so that little loss occurs and no extra cleaning up has to be done. An additional benefit is that little cover material falls off the pot even during transport.

"With glued cover materials, nothing is lost if the pots fall over or during transport."


The higher the sticking capacity, the less loss of cover materials during transport.

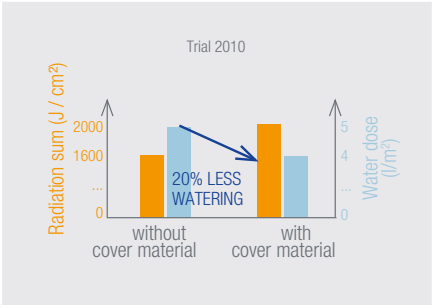
## WATER RETENTION CAPACITY AND EVAPORATION

The water holding capacity also called moisture-retention capacity, is a measure of the amount of water that is retained by the cover material when it is saturated. The higher the water-holding capacity, the less sensitive the cover material will be to drying out during drier periods.

Trials by the PCS have shown that plants that were potted in a covered substrate are less likely to dry out than the same plant species potted in a substrate without cover material. By using a cover material on the surface of the substrate, the moisture loss owing to evaporation is reduced. When applying cover materials, it is therefore important that irrigation is controlled.

At the PCS irrigation is controlled based on the radiation sum. When a preset radiation sum is reached, the irrigation system switches on automatically and the radiation sum is reset to zero. The following irrigation event is carried out as soon as the radiation sum set is reached again. In a trial with a pot size of 1.5 litres, it was determined that the radiation sum can be adjusted

## COVER MATERIALS INCREASE WATER RETENTION CAPACITY




Trials by the PCS have shown that plants that were potted in a covered substrate are less likely to dry out than the same plant species potted in a substrate without cover material.

400 J/cm² higher when using cover materials. In concrete terms, this means approximately 20% less watering when using cover materials. The percentages of course vary depending on the nature and thickness of the cover layer.

The radiation sum is the amount of radiation (or light) received in a certain period. It is calculated by multiplying the light intensity by the duration. Light intensity is understood to mean the amount of radiation (or light) at a given moment.

**Radiation sum (J / cm²)**
= light intensity (W / m²) x duration (s) x 0.0001

### EXAMPLE CALCULATION

*How is the radiation sum calculated by the climate computer? Suppose a constant light intensity of 100 W / m² (or 100 J / s.m²) is registered for 1 hour (= 3,600 s), then the computer calculates a radiation sum of 36 J / cm². The radiation sum is expressed per cm² (= 0.0001 m²).*

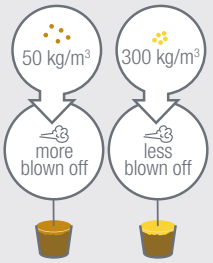
Radiation sum = 100 W / m² x 3,600 s x 0.0001
= 36 J/cm²

### SPECIFIC WEIGHT

The weight determines the transport options to and from the nursery. Take this into account when choosing your means of transport. Also whether or not the cover material is blown off when used on the pot is influenced by this, among other things.

The specific weight is important for loose cover materials. This is defined as the weight in kilograms of one cubic metre (m³) of cover material. For example, cocoa shells (58.3 kg / m³), which have a lower specific weight, will blow away faster than Container Mulch (<400 kg / m³).

## SPECIFIC WEIGHT




The lower the specific weight, the easier the transport, but the greater the chance of blowing off loose cover materials.

DRY MATTER


The higher the percentage of dry matter in the cover material, the less water there is in the original material.

On the other hand, the weight per unit area is important for fixed cover materials. Because the fixed cover materials may differ in diameter depending on the pot size, it is difficult to compare them with each other. This becomes easier by expressing the weight of fixed cover materials per square metre ($m^2$).

## DRY MATTER

The dry matter percentage indicates what proportion of the cover material remains after evaporation of moisture from the cover material. The higher the percentage of dry matter in the cover material, the less water there is in the original material.

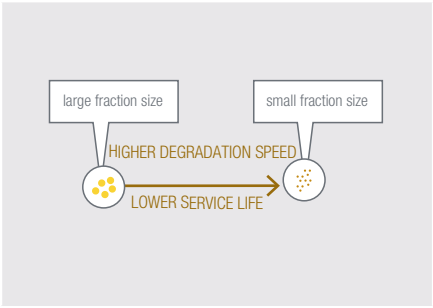
## DEGRADATION SPEED

The service life of a cover material is determined by the speed at which it breaks down or degrades. To test the biodegradability of cover materials, the so-called 'respiration test' was set up on a laboratory scale. Using this test it is possible to measure the microbial activity in organic material via the respiratory intensity. The speed at which organic carbon is broken down under conditioned circumstances is investigated. This makes it possible to form an opinion on the stability of the cover material.

The stability of the different cover materials relative to each other can be compared relatively through this respiration test. The composition of the material will determine the degree to which it is broken down: the higher the lignin content, the more stable the material is. Lignin, also known as wood dust, is a substance that is difficult to degrade. Lignin is only broken down by microorganisms if there are sufficient other, more readily degradable carbon sources. The microorganisms get the energy needed for the

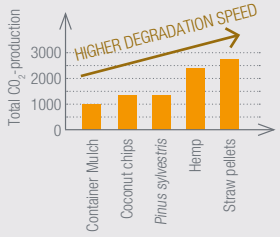
"The service life of a cover material is determined by the speed at which it breaks down or degrades."

COVER MATERIALS DEGRADATION SPEED




The fraction size will influence the rate of degradation of the material. The larger the individual particles, the slower the degradation will be.

## COVER MATERIALS DEGRADATION SPEED

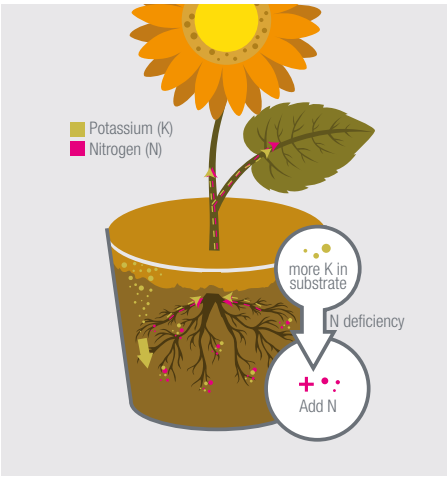



Based on the respiration test performed at the PCS (2014), the stability of the different cover materials can be compared to each other. Organic carbon has a higher degradation rate with small fraction sizes and lower lignin content.

difficult breakdown of lignin from those easily degradable carbon sources. Trials show that Container Mulch, *Pinus sylvestris* and coconut chips break down less quickly than hemp and straw pellets.

On the other hand, a finer fraction is more rapidly subject to degradation, as a result of which the weed control efficiency decreases faster over time: the layer thickness shrinks and the mulch itself becomes 'substrate' for weeds. During the decomposition, nitrogen will be fixed depending on the cover material. Depending on the crop, an additional nitrogen dose may or may not have to be added to keep the growth optimal.

# 2.2. Influence of cover materials on the plant




With certain cover materials, an additional fertiliser application is necessary to maintain an optimum ratio between the nutrients in the substrate.


Trials at the PCS have shown that nitrogen can be withdrawn due to the degradation of the cover material, which makes additional fertiliser application necessary.

The use of cover materials has an influence on the substrate and consequently on the plant. This should be taken into account when making the correct choice of cover material.

### CHEMICAL EFFECT

The origin, nature and processing of the cover material determine its chemical composition. Certain elements can leach out into the substrate, thereby disrupting the desired nutritional balance. For example, if a lot of potassium leaches from the cover material into the substrate, the ratio between nitrogen and potassium will no longer be optimal. As a result of the higher potassium content, the nitrogen will be more difficult to absorb by the plant, causing a nitrogen deficiency in the plant. If this occurs, an extra nitrogen dose is necessary to bring the nitrogen-potassium ratio back to an optimal balance.

### ACIDITY OR pH ($H_2O$)

The pH or the (degree of) acidity is a measure of the hydrogen ion concentration in an aqueous solution. It determines the absorption of the nutrients by the plant. The pH of the cover material can have a significant influence on the pH of the substrate and thus on the uptake of the nutrients. This influence becomes greater as the cover material / substrate ratio becomes larger. For small pot sizes, it is preferable therefore to choose a cover material whose pH approximates as much as possible to that of the substrate.

**Tip**
Keep an eye on plant quality and, if in doubt, have a substrate analysis carried out to know the nutritional status and which nutrients you need to add.

## ELECTRICAL CONDUCTIVITY

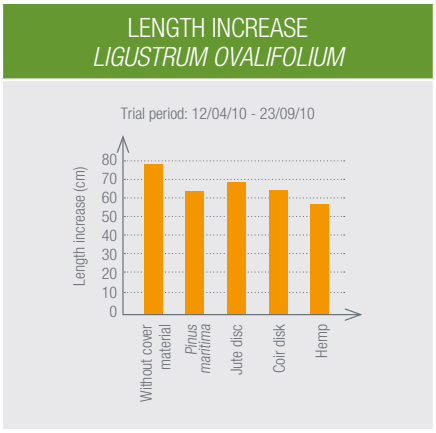
The electrical conductivity or EC is a representation of the number of ions in an aqueous solution (1: 5 substrate / water ratio, according to Gabriëls method). A high EC (e.g.> 500 µS / cm) may indicate that certain ions can easily migrate from the cover material to the substrate. In this way a nutritional imbalance can arise, which means that nutrient levels to be adjusted.

## ORGANIC MATTER

Organic matter is a complex mixture of carbonaceous compounds and consists of ± 50% organic carbon. All cover materials included in this publication have an organic matter percentage of around 90%.

## C/N RATIO

The C/N ratio (carbon/nitrogen) determines the speed at which a cover material is broken down. Cover materials with a relatively low C/N ratio degrade more easily. At a high C/N ratio (> 100), nitrogen is withdrawn from the substrate to degrade the cover material. Once it's degraded, the nitrogen is released again. To prevent too low a nitrogen content as a result of the nitrogen extraction, an extra nitrogen dose may be provided so that the plants can grow under optimal conditions.




Trials at PCS show that with the use of cover materials, depending on the crop, an additional nitrogen dose may or may not have to be added to keep the growth of the plant optimal.

Development of mushroom fruiting bodies is possible on some cover materials in wet weather conditions.

## OTHER INFLUENCES

Depending on the nature of the cover material, unwanted organisms may develop. For example, the growth of mushrooms is observed on certain cover materials. Mushrooms are the fruiting bodies of a fungus. The majority of the fungus, the fungal threads, is located in the substrate. In this way the plant suffers competition for water and nutrients. As a result, the plant will grow less well and become more susceptible to diseases.

# 2.3. Manual or automated application of cover materials to pots

Cover discs are usually applied manually.

Loose cover materials can be applied manually as well as mechanically.

The application of cover materials to the pots is an additional process, but can, depending on the type, be done manually or mechanically.

## MANUAL COVERING

All loose cover materials may be applied manually. The fixed cover materials, the discs, can be placed on the pot very easily in one movement. These discs can only be used on plant species with one stem in the centre of the pot, with no side shoots emerging at the base of the plant during the growing season. The disc is placed around the stem and will fit nicely against the stem and the pot edge.

"Up to 6,000 pots per hour can be mechanically treated with cover materials."

## MECHANIZED COVERING

Depending on the size and structure of the individual particles, loose cover materials can be applied on to the pot by machine. The application is usually done immediately after potting via an application machine.

With some loose cover materials, the particles easily stick together, owing to, for example, their fibrous structure. This sticking together can cause the application machine to clog. That's why it is better to apply these materials manually to the pot.

**Safety**
Wear safety shoes, gloves, goggles and protective clothing when working with the application machine.

| ADJUSTMENT POSSIBILITIES OF THE APPLICATION MACHINE | |
|---|---|
| ADJUSTMENT POSSIBILITY | RESULTS |
| conveyor belt speed for pots | the faster, the thinner the layer of cover materials |
| adjustable slide plate | applies cover materials accurately on the pot |
| adjustable scrapers | ensure a good distribution and remove excess material |

The machine applies a cover layer of choice on the top of the pot under the plant. By controlling the speed of the feed-through system, the thickness of the cover layer can be controlled. Round and also square pots rotate around their axis when they are treated, so that the cover material is evenly distributed over the surface of the pot. Afterwards, the pot is wiped off and the excess cover material is collected and reused.

## Highlights: know the properties of cover materials

1. By knowing the properties of the cover materials, one can choose the most suitable cover material for the intended application.
2. Cover materials ensure a lower evaporation and therefore a reduced moisture loss, which means that less irrigation is required.
3. It's fairly easy to apply the cover materials: loose cover materials are applied mechanically or manually, while discs can easily be applied manually.

3

# Know the different types of cover materials

The range of cover materials is large, there are many types with different characteristics on the market. This is an introduction to the different types and their properties in container-grown plant production. Knowing the properties and weighing them against each other makes it easier to decide which cover material you'll use.

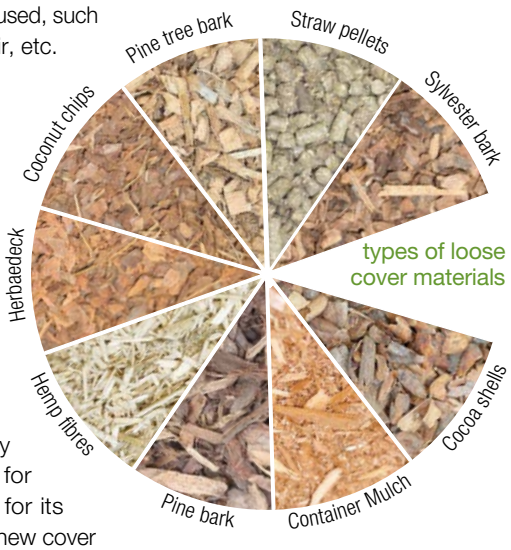
# 3.1. Loose cover materials

The loose cover materials are products that can be applied on the substrate. Think of mulches such as bark, wood fibres and all kinds of residual products from the industry. The major advantage of these cover materials is that they can be used independently of the pot size.

## ORIGIN

Different types of bark are available depending on the origin. Examples are Norway spruce, *Picea, Pinus sylvestris*, *Pinus maritima*, ... In addition to bark, fibres may also be used, such as hemp fibres, coir, etc.

Other loose cover materials are often residual products from industries for which a market is being sought, such as cocoa shells. Since the processing industry is always looking for potential markets for its residual products, new cover materials may still be added in the future. The composition of these products varies greatly depending on the origin.




## POINTS FOR ATTENTION ON USE

These cover materials are available in various fractions. The choice of fraction size is determined by the application. As a general rule, the smaller the pot size, the smaller the fraction to be used. The fraction size will also influence the degradation rate and thus the stability of the material. The larger the individual particles, the slower the degradation will be.

## TYPES OF LOOSE COVER MATERIALS

The following pages give you an overview of the various loose cover materials with their properties. More information about the properties discussed can be found in Chapter 2.

## COCOA SHELLS

This cover material consists of pure cocoa shells. They are obtained in the production of chocolate. The cocoa beans are roasted, so that the shells open and the beans come out.

The weight of the shells themselves is just enough so as not to blow away at low wind speeds. If the shells are moistened, their own weight increases, so that the cover material does not blow away even at higher wind speeds. This is because when they are moistened, the shells curl up slightly and hook into each other, so that the wind has less influence on them.

Cocoa shells have a low C/N ratio, which makes degradation relatively quick. This is due to the low content of dry and organic matter and the high nitrogen content. During decomposition, little or no nitrogen is withdrawn from the substrate, which means that no additional nitrogen dosing is required.

Cocoa shells have the property of keeping snails away. They can be obtained from Greenyard Horticulture.

### PROPERTIES

| | |
|---|---|
| Packaging | 60 litre bags |
| Desired cover layer thickness | 10-20 mm |
| Fraction size | 5-10 mm |
| Composition | cocoa shells |
| Colour | brown |
| Sticking capability | yes |
| Water retaining capability | 500-600 g/100 g dry matter |
| Specific weight | 58.3 kg/m³ |
| Dry matter | 80% |
| pH ($H_2O$) | 5.6 |
| Electrical conductivity | 900 µS/cm |
| Organic matter | 90% |
| C/N ratio | 15.7 |
| How to apply? | manually or mechanically |

### TRIAL EXPERIENCES

The electrical conductivity (EC) is very high. This certainly needs to be taken into account when applying the cover material to small pot sizes.



## CONTAINER MULCH

Container Mulch is an organic cover material consisting of 100% untreated softwood (2-10 mm) from sustainably managed forests (PEFC-certified). It undergoes thermal treatment during the production process. Natural mineral colour pigments are added to achieve an attractive colour. The production process is certified in accordance with the DIN EN ISO 14001 standard.

It has the property of letting through water, while hardly retaining it. The cover material therefore dries quickly after irrigating, which prevents the formation of moss. Container Mulch has the special feature that the cover material forms a cohesive layer after irrigating. This has the benefit of preventing cover material being lost when the pots fall over or are transported.

Container Mulch can be applied using the usual application equipment.

This cover material is distributed by Klasmann-Deilmann Belgium NV.

### PROPERTIES

| | |
|---|---|
| Packaging | 70 litre bags, big bags, big bales, bulk |
| Desired cover layer thickness | 1-2 cm |
| Fraction size | 2-10 mm |
| Composition | soft wood |
| Colour | red brown |
| Sticking capability | yes |
| Water retaining capability | 300 to 700 g/100 g dry matter* |
| Specific weight | < 400 kg/m³ |
| Dry matter | 45%* |
| pH ($H_2O$) | 5.1-5.9 |
| Electrical conductivity | < 100 µS/cm |
| Organic matter | > 95%* |
| C/N ratio | 305.4* |
| How to apply? | manually or mechanically |

* Value determined by PCS

### TRIAL EXPERIENCES

The product was included in the lab test at the PCS wherein the degradation of various cover materials was monitored. This test shows that Container Mulch breaks down relatively slowly.

## PINE BARK

Pine bark is tree bark (including fibre) from the different species of *Pinus* and *Picea* (pine and spruce) from the Belgian Ardennes. Hence pine bark doesn't have to be transported over large distances, which lowers the ecological footprint.

The bark has a very natural look.

The desired layer thickness is 2 cm.

Pine bark is distributed by various suppliers.

### TRIAL EXPERIENCES

There are currently no own trial experiences with this cover material in container-grown plant production.

### PROPERTIES

| | |
|---|---|
| Packaging | big bags, bulk |
| Desired cover layer thickness | 2 cm |
| Fraction size | 10-20 mm, 10-40 mm |
| Composition | bark from *Pinus* and *Picea* |
| Colour | brown |
| Sticking capability | no |
| Water retaining capability | 400 to 800 g/100 g dry matter |
| Specific weight | +/- 280 kg/m³ |
| Dry matter | 55%* |
| pH ($H_2O$) | 5-6 |
| Electrical conductivity | < 200 µS/cm* |
| Organic matter | > 90% |
| C/N ratio | 134.2 |
| How to apply? | manually or mechanically |

* Value determined by PCS





## HEMP FIBRES

Hemp comes from the annual hemp plant (*Cannabis sativa*) This plant grows very fast, so that virtually no weed pressure occurs during cultivation. The plants are grown without the application of herbicides or other pesticides. The hemp fibres are grown in the Champagne region. With the hemp plant, the outer part of the stem consists of fibres and the inner part is woody. Only the inner part is used as cover material. It consists of 50% cellulose, 15-20% lignin and 9% hemicellulose (polyose).

An important added value for the grower is that hemp has a nice white colour, which gives the whole of the plant with the treated pot an extra aesthetic value.

This product does not acidify the substrate.

By coming into contact with water, the hemp fibres will stick to each other via natural adhesion so that no cover material is lost when the pots fall over or are transported.

### PROPERTIES

| | |
|---|---|
| Packaging | 200 l bales or 2.3 m³ big bags |
| Desired cover layer thickness | 1.5-2 cm |
| Fraction size | 2 mm x 20 mm fibres |
| Composition | hemp fibres |
| Colour | white/cream coloured |
| Sticking capability | yes |
| Water retaining capability | 370 g/100 g dry matter |
| Specific weight | +/- 110 kg/m³ |
| Dry matter | 80-90% |
| pH ($H_2O$) | 6.1-7.3 |
| Electrical conductivity | 220-430 µS/cm |
| Organic matter | 95-97% |
| C/N ratio | 87-156.6 |
| How to apply? | manually or mechanically |

Hemp fibres can be obtained from La Chanvrière de l'Aube (ProMulch), Greenyard Horticulture (Hemp litter) and Telermaat (Cantop).

## TRIAL EXPERIENCES

Trials at the PCS show that a slight withdrawal of nitrogen from the substrate can occur. On the one hand this is a result of decomposition. On the other hand a fairly high EC was measured in the water by using a rudimentary measurement, in which a portion of hemp was placed in water for 24 hours, This high value indicates that the material itself can also have an influence on the nutritional composition of the substrate. This can be adjusted via a small addition of fertiliser.

It was also found experimentally that the particles adhere very well to each other over time, as a result of which the cover material does not fall off the pot when falling over or transporting.



## HERBAEDECK

Herbaedeck is made from tree bark from *Pinus pinaster* and *Pinus sylvestris* from Spain, Portugal and Sweden and is 100% natural. The tree bark is sieved and therefore contains a very low proportion of fine particles.

Accurate application is very important for an optimal effect. The desired layer thickness is 1.5 to 2 cm. Irrigation then ensures proper settlement of the material.

Herbaedeck mainly has an effect on the prevention of liverwort and other weeds, this is due to the rapid drying out of the top layer. In addition to the effects mentioned, Herbaedeck gives a better moisture distribution in the pot.

The product is easy to apply mechanically and is visually attractive. Owing to the different fractions, it is suitable for both large and small pots.

### PROPERTIES

| | |
|---|---|
| Packaging | big bales, bulk |
| Desired cover layer thickness | 1.5-2 cm |
| Fraction size | 5-15 mm |
| Composition | bark from *Pinus pinaster* and *Pinus sylvestris* |
| Colour | red-brown |
| Sticking capability | none, unless fibres are added |
| Water retaining capability | 200 to 600 g/100 g dry matter* |
| Specific weight | 275 kg/m³ |
| Dry matter | 25-45% |
| pH ($H_2O$) | 5-6 |
| Electrical conductivity | < 100 µS/cm* |
| Organic matter | > 95% |
| C/N ratio | - |
| How to apply? | manually or mechanically |

* Value determined by PCS

Fibres can be added to Herbaedeck to form a tighter layer. This has the advantage of reducing loss from the pot. Here too, a layer thickness of 2 cm applies.

Herbaedeck is distributed by Horticoop.

## TRIAL EXPERIENCES

Dutch research shows that Herbaedeck reduces weed growth well. Occasionally some weeds germinate. Moss growth was not observed. The cover material lies rather loosely on the pot, which makes it possible to lose it when the pots fall over or during transport.

## COCONUT CHIPS

Coconut chips come from Sri Lanka, which makes the product less interesting in terms of ecological footprint. They come from the coconut husk that surrounds the coconut. The entire coconut husk, both the fibres and the peat, is cut into small pieces. These consist of 35-45% cellulose and 40-45% lignin. The cover material is 100% organic and can be obtained in various fractions. The product is produced according to the RHP quality mark.

The cover material has no acidifying effect.

As a result of the fibres, a tight covering layer is formed, so that no material is lost when pots are tipped over or transported. The product must be applied as uniformly as possible after potting. The layer thickness to be applied is 1 to 2 cm.

### PROPERTIES

| | |
|---|---|
| Packaging | 180 l bales, 1.5 m³ big bags, bulk |
| Desired cover layer thickness | 1-2 cm |
| Fraction size | 2-6 mm, 6-12 mm, 12-14 mm |
| Composition | coconut husk |
| Colour | light brown |
| Sticking capability | yes |
| Water retaining capability | 500-800 g/100 g dry matter |
| Specific weight | +/- 150 kg/m³ |
| Dry matter | 25% |
| pH ($H_2O$) | 5.5-7 |
| Electrical conductivity | < 400 µS/cm |
| Organic matter | > 90% |
| C/N ratio | > 100 |
| How to apply? | manually or mechanically |

Coconut chips are distributed by Copertiz bvba.

### TRIAL EXPERIENCES

It has been found that the coconut chips dry out less quickly on the surface. As a result, sometimes slightly more moss growth can be observed compared with other cover materials.

## PINE TREE BARK

French decorative pine bark is tree bark from *Pinus maritima* (maritime pine). This comes from the Landes region in France, hence the name 'Pin de Landes'. More and more bark is also coming from Portugal and Spain. Pine bark has a red-brown colour and a highly decorative appearance. This bark has little fibre and nice equal pieces.

The C/N ratio is high owing to the low nitrogen content and the high content of dry and organic matter. The high C / N ratio indicates slow decomposition.

A layer of 1 to 2 cm is needed to prevent weed growth on pots.

Pine tree bark is distributed by various suppliers.

### PROPERTIES

| | |
|---|---|
| Packaging | 70 litre bags, (only 15/25 fraction), big bags, bulk |
| Desired cover layer thickness | 1-2 cm |
| Fraction size | 04/08-08/15-15/25-25/35-35/45-35/80 (depending on supplier) |
| Composition | bark from *Pinus maritima* |
| Colour | red-brown |
| Sticking capability | no |
| Water retaining capability | 400-800 g/100 g dry matter |
| Specific weight | +/- 300 kg/m³ |
| Dry matter | 45%* |
| pH ($H_2O$) | 5.5-7* |
| Electrical conductivity | < 400 µS/cm |
| Organic matter | > 90% |
| C/N ratio | 183.5 |
| How to apply? | manually or mechanically |

* Value determined by PCS

### TRIAL EXPERIENCES

This cover material was used as a reference for several years during trials at the PCS.

Trials with *Ligustrum ovalifolium* showed a growth reduction of 20 to 25% when the substrate was covered with *Pinus maritima.*

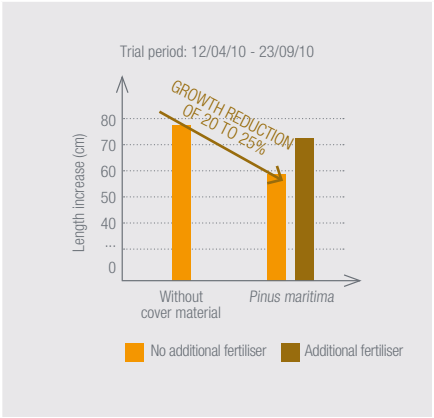
Owing to the high C/N ratio, the cover material extracts nitrogen from the substrate, so that growth is reduced. Thanks to targeted additional

fertiliser, 1.5 g per litre of substrate using a fertiliser with 20% nitrogen, this reduction can be offset.

With a higher moisture content at the top of the substrate, there was a clear increase of various weeds, especially willow seedlings and liverworts and mosses.

The combination of *Pinus maritima* with coconut fibres reduces the problem of mulch loss when pots fall over, which is often a nuisance when shipping plants. If the combination of *Pinus maritima* and coir is used as cover material, more moss growth is observed.

LENGTH INCREASE
*LIGUSTRUM OVALIFOLIUM*




Trials at PCS show that nitrogen is fixed during the decomposition of the cover material. To keep the growth optimal, an extra nitrogen dose is required.

## STRAW PELLETS

A straw pellet is a pellet made from wheat straw or straw from other crops, depending on the supplier. The straw is heated during the production process. This way, pathogens and weed seeds are destroyed.

The pellet swells under the influence of moisture, after which a thick continuous layer is formed. The volume of the cover material increases by a factor of three to four. That's why it is sufficient to apply the pellets so that they just touch each other. Owing to the considerable swelling, the stem of the plant is well enclosed.

After swelling, the layer formed will first dry on the surface as a result of the sun. This forms a crust. This crust ensures that the layer formed remains in place and doesn't blow away.

The crust formed is a rough surface on which snails do not like to move.

Different types of straw pellets are offered, each with their own specific characteristics:

- Sometimes 1% iron sulphate is added against moss growth.
- Certain straw pellets consist exclusively of wheat straw, others consist of a mixture of barley and rapeseed straw.

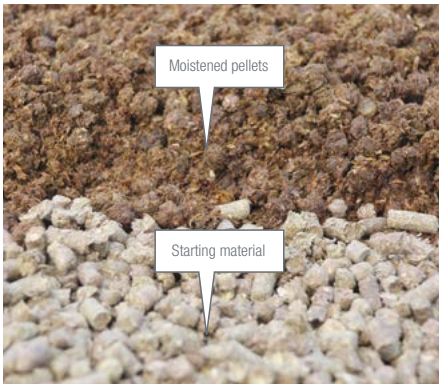
### PROPERTIES

| | |
|---|---|
| Packaging | 20 kg bags, big bags, bulk |
| Desired cover layer thickness | do not over apply the pellets |
| Fraction size | granule diameter of 6 to 10 mm x 20 mm |
| Composition | > 95% wheat straw or straw from other crops (depending on supplier) |
| Colour | straw-coloured, gradually turns brown |
| Sticking capability | yes |
| Water retaining capability | 300 to 400 g/100 g dry matter |
| Specific weight | 450-525 kg/m³ |
| Dry matter | 90-95% |
| pH ($H_2O$) | 5.9-6.5 |
| Electrical conductivity | < 500 or < 800 µS/cm (depending on supplier)* |
| Organic matter | 80-90% |
| C/N ratio | 80-85 |
| How to apply? | manually or mechanically |

* Value determined by PCS

- There are pellets of 6 mm, 8 mm and 10 mm thickness. The 6 mm pellets have smaller particles and absorb moisture faster and much more than 8 mm pellets.
- If the straw pellets are crushed, straw pulp is obtained, a product with smaller fractions. This product has the same properties as straw pellets and can be used in smaller pot sizes.
- Products from different suppliers may have a different specific weight or density. This means that a different number of pots can be treated with the same weight. With a lower density one can treat more pots with the same weight, with a higher density fewer pots can be treated. Products can be purchased both by weight and per unit of volume.

**Tip**
Place two bags of the same weight next to each other and see the difference in height. The largest bag contains pellets with the lowest density, with which more pots can be treated.



When straw pellets are moistened, the volume increases by a factor of four.

Straw pellets are available from Strovan and Sentio bvba.

## TRIAL EXPERIENCES

Trials at the PCS with Strovan's straw pellets have shown that when straw pellets are used in humid and warm periods, mushrooms can grow on the cover material. The mushrooms disappear in drier conditions. No negative impact on plant growth was observed due to the mushrooms.

During drier periods some shrinkage was found, as a result of which weed growth at the edge of the pot was more likely.

With *Fagus sylvatica*, when the substrate is covered with straw pellets, growth inhibition is observed after a single growing season. The measurements show that the decomposition causes nitrogen fixation, so that less nitrogen remains available for the plants. An extra nitrogen dose will eliminate this growth inhibition. This can also occur with the other cover materials.

One thought is that the electrical conductivity, depending on the supplier, is quite high. This should certainly be taken into account when applying cover material on smaller pot sizes.

## SYLVESTER BARK

Sylvester bark is tree bark from *Pinus sylvestris* (Corsican pine) from the Belgian Ardennes, Luxembourg or northern France. The sylvester bark does not have to be transported over large distances, which makes it interesting in terms of the ecological footprint.

Sylvester bark has a light brown colour and has a nice natural appearance. The bark is soft and has no sharp edges.

A layer of 1 to 2 cm is needed to keep weeds in check.

Sylvester bark is distributed by various suppliers.

### TRIAL EXPERIENCES

Trials at the PCS show that liverwort and willow seedlings grow on this cover material, especially under wet and warm weather conditions.

### PROPERTIES

| | |
|---|---|
| Packaging | big bags, bulk |
| Desired cover layer thickness | 1-2 cm |
| Fraction size | 4-8 mm, 10-20 mm, 10-40 mm |
| Composition | *Pinus sylvestris* bark |
| Colour | light brown to brown |
| Sticking capability | no |
| Water retaining capability | 400 to 800 g/100 g dry matter |
| Specific weight | +/- 250 kg/m³ |
| Dry matter | 60%* |
| pH ($H_2O$) | 5-6 |
| Electrical conductivity | < 100 µS/cm* |
| Organic matter | > 90% |
| C/N ratio | 92.9 |
| How to apply? | manually or mechanically |

* Value determined by PCS

# 3.2. Fixed cover materials

## TYPES

Fixed cover materials can be plastics, bioplastics or fibre mats. These are cover materials that can be applied in one piece.

There are two types of fibre mats available: 'woven' and 'non-woven' fibre mats, depending on the arrangement of natural or synthetic fibres. Weed inhibition is better when the arrangement is random, such as with non-woven cover materials.

## POINTS FOR ATTENTION ON USE

With the fixed cover materials used in container-grown plant production, it is important that the plant is in the centre of the pot. Fixed cover materials can therefore only be used for plants with a fixed central stem. The mats or discs are in fact provided with a cut up to the centre so that they can easily be placed around the stem.

The mats cannot be used on crops that shoot from below the substrate surface because these would push the mats up.

Experience also shows that when we apply the disc to a non-weed-free surface, some weeds can grow through the mat (including cardamine, grasses, etc.). This depends on the thickness and the density of the mat. Particular attention should be paid to this when repotting perennial crops contaminated with seed or spores.

The use of the discs requires an exact fit of the disc relative to the pot diameter. If too many gaps occur in the covered surface, light will fall on the substrate and weed growth can significantly increase.

## TYPES OF FIXED COVER MATERIALS

The following pages give an overview of the different fixed cover materials with their properties. More information about the properties discussed can be found in Chapter 2.

Examples of fixed cover materials

## ACRYLIC CD-DISC

This cover disc is made from recycled textile waste (350 g / m²) such as cotton, acrylic, polyester and wool. This waste is cleaned and unravelled. The unravelled textile is then sewn on a polyethylene backing (35 g / m²). The desired shape is then cut to size. The pot size thus determines the shape and size of the cover disc.

The cover disc is 100% biodegradable and is mainly used for covering pots of annual plants.

The Acrylic CD-DISC is distributed by La Zéloise.

### PROPERTIES

| | |
|---|---|
| Packaging | depending on the quantity desired |
| Cover disc thickness | tailored to suit |
| Composition | recycled textile waste (350 g/m²), such as cotton, acrylic, polyester and wool |
| Colour | grey with colour accents |
| Weight/m² | +/- 400 g/m² * |
| Dry matter | 94.5%* |
| pH ($H_2O$) | 6.69* |
| Electrical conductivity | < 100 µS/cm* |
| Organic matter | > 95%* |
| C/N ratio | 4.6* |
| How to apply? | manually |

* Value determined by PCS

### TRIAL EXPERIENCES

There are currently no own trial experiences with this cover material.



## AW-DISC

The AW-DISC is a cover disc consisting of sustainable natural fibres and natural latex. All components are completely biodegradable.

Two different types are available. The HD (High Density) has a weight of 1,100 g/m² and offers the highest quality. It consists of coconut fibre, sisal and jute and is mainly used in biennial crops. The LD (Low Density) has a weight of 800 g/m². It consists of coconut fibre and sisal and is used in annual crops.

The AW-DISC is available in various sizes. The appropriate AW-DISC is selected according to pot size, this may be either round or square.

The AW-DISC is distributed by Engrow.

### PROPERTIES

| | |
|---|---|
| Packaging | depending on the quantity desired |
| Cover disc thickness | 5 to 8 mm |
| Composition | coir, latex, sisal, jute (only with HD disc) |
| Colour | light brown |
| Weight/m² | 800-1,100 g/m² |
| Dry matter | 90%* |
| pH ($H_2O$) | 5.5-7 |
| Electrical conductivity | < 300 µS/cm* |
| Organic matter | > 90% |
| C/N ratio | 134.2 |
| How to apply? | manually |

* Value determined by PCS

### TRIAL EXPERIENCES

Experience at the PCS shows that the AW-DISC has a good weed control effect when the discs fit perfectly for the pot size used. When light falls on the substrate through cracks, weeds will still grow in those places, but this applies to all types of cover discs.

## HEMPFLAX TREE DISCS

HempFlax tree discs are made from 100% pure natural hemp fibre. The processing of the raw fibre is done entirely mechanically and no chemical agents are used. The strong fibres are carded and needled and the result is a high-quality felt that is punched into round shapes.

Hemp fibre has a naturally high absorption and heat insulating capacity. The use with potted young trees, shrubs and plants prevents the growth of weeds and gives a heat-insulating effect. Heat has a moisture-regulating effect on the fibre which benefits the plants.

HempFlax tree discs are water permeable. Owing to their natural colour, the tree discs don't stand out.

These tree discs are supplied as standard with a diameter of 45 cm. The above mentioned properties only apply to this diameter. The tree discs can also be produced in a different thickness and diameter on request.

### PROPERTIES

| | |
|---|---|
| Packaging | depending on the quantity desired |
| Cover disc thickness | thickness / weight per m²<br>3 mm / 550 g/m²<br>5 mm / 800 g/m²<br>8 mm / 1,100 g/m² |
| Composition | 100% natural pure hemp fibre |
| Colour | beige, sand coloured |
| Weight/m² | cover disc thickness |
| Dry matter | 90%* |
| pH ($H_2O$) | 7.12* |
| Electrical conductivity | < 300 µS/cm* |
| Organic matter | > 95%* |
| C/N ratio | 93.7* |
| How to apply? | manually |

* Value determined by PCS

These tree discs are only distributed by HempFlax.

### TRIAL EXPERIENCES

There are currently no own trial experiences with this cover material.

## JUTE CD-DISC

This cover disc comes from recycled and unravelled jute fibres. Jute (*Corchurus capsularis*) consists of approximately 13% lignin and 70% cellulose. Threads are spun from the fibres of the stems, which have been rooted in water and these are then processed into fabrics. The jute fibres are cleaned and frayed. A mat is then made using a needle felting machine. No chemical binders are added. The desired shape is then cut to size. The pot size thus determines the shape and size of the cover disc.

A jute mat of 1,000 g/m² has a service life of 1.5 to 3 years.

In consultation with the supplier, the jute disc can also be treated on one side with a hydrophobic layer that repels water.

### PROPERTIES

| | |
|---|---|
| Packaging | depending on the quantity desired |
| Cover disc thickness | tailored to suit |
| Composition | 700 g/m² jute fibres |
| Colour | beige |
| Weight/m² | 1,000 g/m² |
| Dry matter | 90%* |
| pH ($H_2O$) | 6.14* |
| Electrical conductivity | < 150 µS/cm* |
| Organic matter | > 95%* |
| C/N ratio | 165* |
| How to apply? | manually |

* Value determined by PCS

The Jute CD-DISC is distributed by La Zéloise.

### TRIAL EXPERIENCES

Trials from the PCS show that the jute disc has relatively little or no influence on plant growth. It was also found that the treatment of the jute disc with a hydrophobic layer on the underside causes a slower decomposition of the disc.

## COIR CD-DISC

This cover disc consists of coir that is pressed into a mat in combination with natural latex. The coir discs are cut into round shape from this latexed mat. The size of the disc can be adjusted depending on the pot size. The discs are 7mm thick.

The cover disc consists of natural material and is 100% biodegradable.

The Coir CD-DISC is distributed by La Zéloise.

### TRIAL EXPERIENCES

There are currently no own trial experiences with this cover material.

### PROPERTIES

| | |
|---|---|
| Packaging | depending on the quantity desired |
| Cover disc thickness | 7 mm |
| Composition | coir and natural latex |
| Colour | light brown |
| Weight/$m^2$ | depending on diameter |
| Dry matter | 89%* |
| pH ($H_2O$) | 6.79* |
| Electrical conductivity | < 150 µS/cm* |
| Organic matter | > 95%* |
| C/N ratio | 204* |
| How to apply? | manually |

* Value determined by PCS

## WECULT

### PROPERTIES

| | |
|---|---|
| Packaging | 800 to 2,400 per box depending on diameter |
| Cover disc thickness | 3 mm |
| Composition | plastic yarn |
| Colour | black |
| Weight/$m^2$ | 300 g/$m^3$ |
| Dry matter | > 95%* |
| pH ($H_2O$) | 6.7* |
| Electrical conductivity | < 100 µS/cm* |
| Organic matter | > 95%* |
| C/N ratio | 340.6* |
| How to apply? | manually |

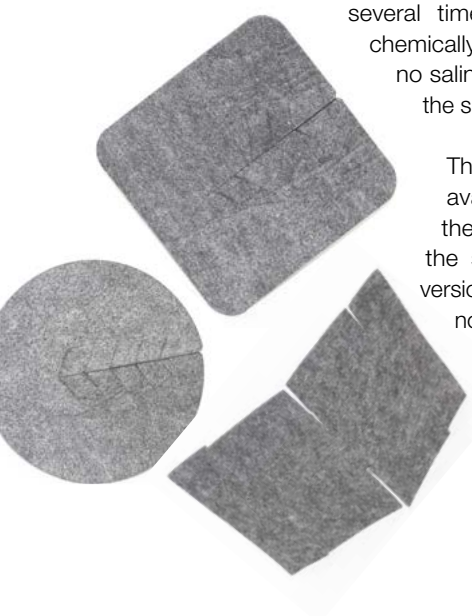
* Value determined by PCS

Wecult is a cover disc, made from a felt-like plastic yarn.

The cover disc lays easily around the plant. Even with plants that are not fully centred, the cover disc can be used thanks to the incisions made in the form of a herringbone.

Wecult is UV-resistant; it can be disinfected and because of this, may be reused several times. The cover disc is chemically neutral, so that there is no salinisation or pH change of the substrate.

The Wecult products are available in two versions: the standard version and the strong, heavy, medium version. The medium discs do not fly away in strong wind. The standard discs are cheaper but will blow away more easily.



Both of these products can be produced in different forms: from round to square pots, and also for different types of trays.

There are also multi-compartment discs for propagation trays, so that the trays remain weed-free from the start.

Van Krimpen distributes the Wecult cover disc.

### TRIAL EXPERIENCES

Research in the Netherlands has shown that few weeds are observed with the Wecult. Under wet conditions, some ‘star moss’ (a bryopsida) may develop.

## Highlights: know the different types of cover materials

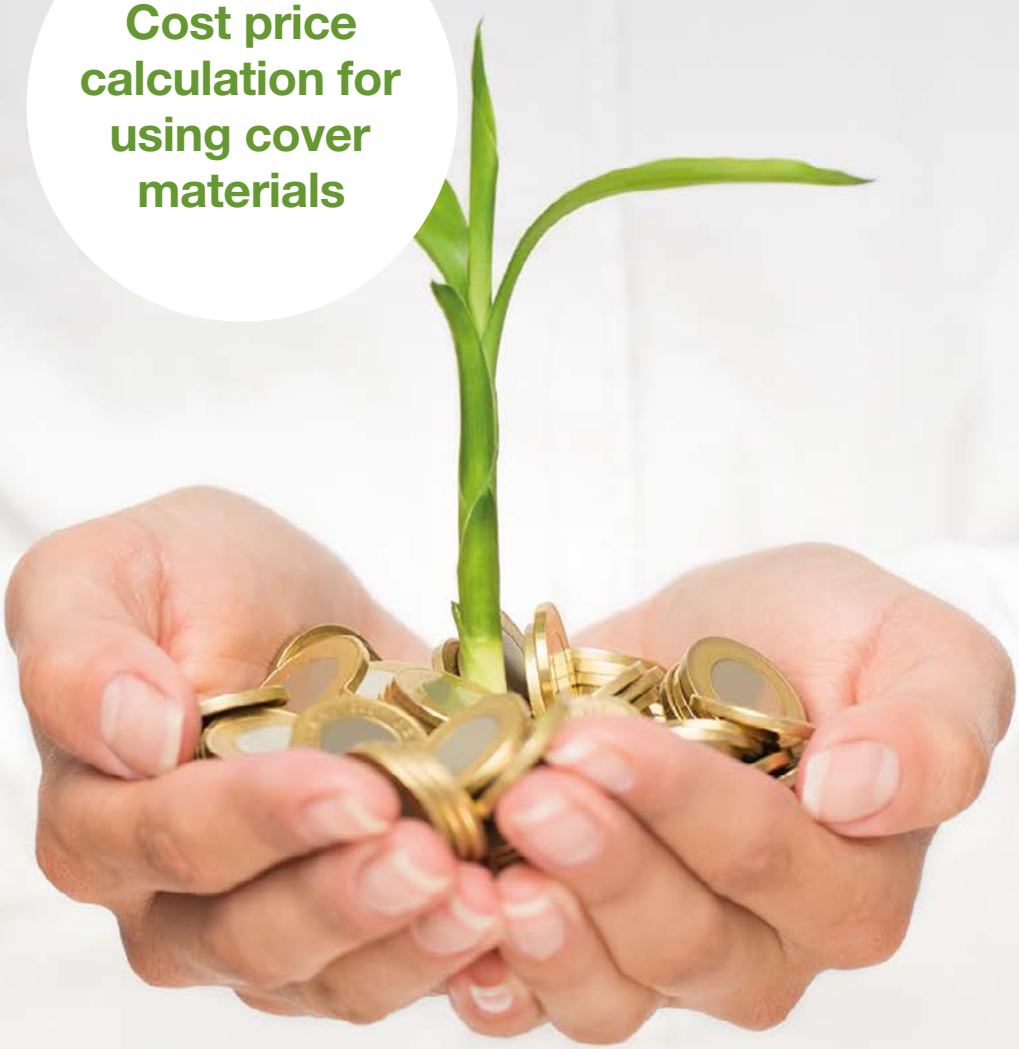
1. The choice of cover material depends on the growth habit of the plant. For crops that shoot from below the substrate surface during the growing season, loose cover materials are best used. For crops whose stem is at the centre of the pot, it's possible to opt for both a fixed or a loose cover material.

2. A suitable cover material is chosen depending on the pot size: the smaller the pot, the smaller the fraction for loose cover materials or the diameter for fixed cover materials.

3. The cover materials have already individually proven their weed control effect. Based on their specific properties, a choice can be made for a specific material.

4

# Cost price calculation for using cover materials



When deciding whether to apply cover materials, the cost price will also be a determining factor. In this, various aspects must be taken into account: the cost price for the material, the application and any additional fertiliser. A comparison of the cost price of the various cover materials helps with the choice of the desired cover material.

# 4.1. Cost price calculation for using loose cover materials

In order to check the actual cost price when using cover materials, a number of issues have to be taken into account. Using the calculation below you can find out what loose cover materials cost for your nursery.

A number of assumptions and accounting operations were applied in the calculations, which merely serve as examples. It is not the intention in this chapter to compare the prices of the cover materials discussed because they change over time.

## MATERIAL COST OF LOOSE COVER MATERIALS

In order to determine what the cost price will be, the volume of the cover material to be used must first be calculated per pot:

**Volume ($cm^3$)**
$= \pi \times [\text{pot radius (cm)}]^2$
x cover material layer thickness (cm)

$\pi$ = number pi or 3.14
radius pot = pot diameter: 2
cover material layer thickness: see table per cover material from Chapter 3

You then have to calculate how many pots can be treated per cubic metre of covering material:

**Number of pots/$m^3$ cover material**

$$= \frac{1}{\text{volume } (cm^3) \times 0.000001}$$

1 $cm^3$ = 0.000001 $m^3$ = 0.001 l, 1 l = 1,000 $cm^3$

Afterwards you can calculate the cost price of the cover material per pot; for this, ask your supplier for the cost price of the cover material per cubic metre. When a cover material is used, part of the substrate is replaced, so the cost of this part of substrate must be deducted.

**Additional cover material cost per pot (€)**

= cost price cover material per pot (€)
- cost price volume decrease of substrate (€)

$$= \frac{\text{cost of cover material per } m^3 \text{ (€)}}{\text{number of pots/} m^3 \text{ cover material}} - \frac{\text{substrate cost price per } m^3 \text{ (€)}}{\text{number of pots/} m^3 \text{ cover material}}$$

The percentage additional cost for the material is then calculated as follows:

**Additional cover material cost per pot (%)**

$$= \left[\frac{\text{cost price of pot with cover material (€)}}{\text{pot cost price without cover material (€)}} - 1\right] \times 100$$

### EXAMPLE CALCULATION

*Suppose that a cover material is applied to a 3 litre pot with a diameter of 19 cm costs € 60/ $m^3$. What is the material cost of the cover material per pot for this type of pot?*

**1. Calculate the volume of the cover material per pot**
To calculate the volume of the cover material per pot, you first need to know the radius of the pot and the necessary layer thickness of the cover material on the pot.

pot radius (r)
= pot diameter : 2
19 cm: 2 = 9.5 cm

In Chapter 3, look for the desired layer thickness of the chosen cover material.

Required layer thickness of cover material = 1.5 cm

Using the above data you can calculate the volume of the cover material per pot:

Volume of cover material/pot (V)
= 3.14 x [9.5 cm]² x 1.5 cm
= 425.08 cm³ = 0.00042508 m³ = 0.42508 l

In this example, the volume of cover material that will be used per pot is therefore equal to 425.08 cm³.

**2. Calculate how many pots can be treated per cubic metre of cover material**

Number of pots/m³ cover material
= 1 : (425.08 cm³ x 0.000001)
= 2,353 pots

It will then be possible to treat 2,353 pots per cubic metre of cover material.

**3. Calculate the additional cost of the cover material per pot**
On the basis of the figures above, the additional cost of the cover material to be used can be calculated per pot. In this calculation example, the material chosen has a cost of € 60/m³ and the substrate € 50/m³.

Additional cover material cost per 3 l pot with Ø 19 cm
= [€ 60/m³ : 2,353 pots] - [€ 50/m³ : 2,353 pots]
= € 0,00425/pot

This gives the following percentages per pot:

% additional cover material cost per 3 l pot with Ø 19 cm
= [[€ 50 x (3 l - 0.42508 l) +
€ 60 x 0.42508 l] : [€ 50 x 3 l] - 1] x 100
= 2.8% per pot

**Conclusion:** The additional cost of the covering material applied to a 3 litre pot with a diameter of 19 cm is € 0,00425/pot. The use of the cover material gives an additional material cost of 2.8% per pot.

## COST PRICE FOR APPLYING THE MATERIAL

A distinction must be made between manual or mechanical application of the cover materials.

### A. MANUAL APPLICATION

If the cover material is applied manually, one extra person must be brought in after the potting machine. The cost price per pot can be determined based on the wage cost and the number of pots that can be potted and covered.

$$\text{Labour cost of manual application/pot (€)} = \frac{\text{wage cost (€)}}{\text{number of pots per hour}}$$

### EXAMPLE CALCULATION

*Suppose that the potting capacity equals 1,000 pots per hour and that the wage cost is € 16.50 / hour, what is the labour cost for manual application to the pot?*

Labour cost of manual application per pot
= € 16.50/hr : 1,000 pots per hour
= € 0.01650/pot

**Conclusion:** The labour cost for manual application to the pot is € 0,01650 / pot.

## B. MECHANICAL APPLICATION

**Mechanical application cost/pot**
$$= \frac{\text{machine depreciation (€) + maintenance cost (€)}}{\text{number of pots}}$$

For machine processing, you can calculate the annual cost based on the purchase value and the period over which you will depreciate the machine. Also include the cost price of energy consumption and maintenance. Based on the number of pots that will be processed per year, a cost price per pot can be calculated.

### EXAMPLE CALCULATION

*Suppose the purchase value of the application machine is € 18,000, the depreciation period is set at 5 years, the maintenance of the machine takes 8 own working hours per year and that 250,000 pots are treated annually. What is the cost price for the mechanical application to the pot?*

**1. Machine depreciation**

Depreciation cost per year
= € 18,000 : 5
= € 3,600

**2. Machine maintenance**

This cost consists of cleaning and lubricating the application machine. There were no other operating costs (such as energy consumption) and replacement parts were offset in the case of damage or wear.

Machine maintenance cost per year
= 8 hrs x € 16,50/hr
= € 132

**3. Mechanical application cost per pot**

Mechanical application cost/pot
= [€ 3,600 + € 132] : 250,000 pots
= € 0,01493/pot

**Conclusion:** The cost price for the mechanical application of the cover material per pot is € 0.01493 / pot.

## COST PRICE OF ANY FFERTILISER

When using organic cover materials, it may also be necessary to include a cost for additional fertiliser application, because cover materials are converted into a stable product in which nitrogen is extracted from the environment. In order to know if additional fertiliser is necessary, it is best to have a substrate analysis carried out via a laboratory to understand the current nutritional status for the plant species and to know which nutrients you need to add.

Afterwards you can calculate the cost price of the top-up fertiliser per pot as follows:

**Cost of top-up fertiliser/pot (€)**
= fertiliser cost/pot (€) + labour/pot (€)

### EXAMPLE CALCULATION

*Suppose a slow-acting fertiliser is added during cultivation, that the cost price of the fertiliser is € 40 per 25 kg, that 2 g per pot would be applied and that 1,000 pots per hour could be treated. What then is the cost price for the top-up fertiliser per pot?*

**1. Fertiliser cost per pot**

Fertiliser cost per pot
= [€ 40 : 25,000 g] x 2 g
= € 0.00320/pot

**2.Labour cost of top-up fertiliser per pot**

Labour cost of top-up fertiliser per pot
= € 16.50/hr : 1,000 pots/hr
= € 0.01650/pot

**3. Cost of top-up fertiliser per pot**

Cost of top-up fertiliser per pot
= € 0.00320/pot + € 0.01650/pot
= € 0.01970/pot

**Conclusion:** The cost price for top-up fertiliser per pot is € 0.01970 per pot.

## TOTAL COST WHEN USING LOOSE COVER MATERIALS

Because we have already determined the previous parameters, we can now calculate the total cost of using cover materials per pot.

**Total cost of cover material/pot (€)**
= material cost/pot (€) + application cost/pot (€) + top-up fertiliser/pot (€)

### EXAMPLE CALCULATION

*From previous calculation examples you know what the material cost, the cost of application and the cost for additional fertiliser per pot is. What is the total cost for the use of the cover material per pot?*

**1. Total cost of cover material/pot with manual application**

Total cost of cover material/pot
= € 0.00425/pot + € 0.01650/pot + € 0.01970/pot
= € 0.04045/pot

**2. Total cost of cover material per pot with mechanical application**

Total cost of cover material/pot
= € 0.00425/pot + € 0.01493/pot + € 0.01970/pot
= € 0.03888/pot

**Conclusion:** The total cost price of the cover material in this example is € 0.04045 per pot for manual application and € 0.03888 per pot for machine application.

**Note:**

- Remember that traditional weed control also costs money.
- A five-year depreciation period was taken into account when calculating the mechanical application. This depreciation cost expires five years after purchase, making the cost of mechanically applying the cover material cheaper. On the other hand, the application machine can be used for longer than five years; taking this into account you can extend your depreciation period, whereby the additional cost of the covering material with mechanical application will still decrease.
- An extra fertiliser application does not need to be carried out with all cover materials and also not for each type of crop, whereby the additional cost is significantly reduced.
- If any weed growth still occurs when applying a cover material, the additional cost for the manual or chemical removal of this weed must be taken into account.

# 4.2. Cost price calculation for using fixed cover materials

If you opt for fixed cover materials, you can determine the actual cost price for your nursery using the steps below.

### MATERIAL COST OF FIXED COVER MATERIAL

Because the cover discs must fit perfectly with the pot size you work with, it is recommended that you contact the supplier of the cover disc of your choice. You can then purchase a tailored cover disc. The price will also change depending on the quantities that would be purchased.

### COST PRICE FOR APPLICATION

Cover discs are applied manually. The pot size will determine how many pots can be fitted with a cover disc per hour. The cost price for application per pot can then be calculated on the basis of the wage cost (see 4.1).

### COST PRICE OF ANY TOP-UP FERTILISER

Although the decomposition of fixed cover materials is less pronounced than with loose cover materials, additional fertiliser may sometimes be required. For the calculation of this, reference is made to 'Cost price of any top-up fertiliser' for loose cover materials in 4.1.

### TOTAL COST WHEN USING FIXED COVER MATERIALS

For the calculation of this we refer to the total cost when using loose cover materials in 4.1.

# 5

# Decide which cover material you select for your crops

To keep your crops free of weeds, the use of cover materials is preferred. In order to facilitate the selection of the cover material that best suits your company, we have drawn up a step-by-step plan for you. This guides you through the five steps for selecting the suitable cover materials for your company.

# 5.1. The choice of weeding, herbicides or cover materials

When considering whether to keep your crop free of weeds by using weeding, herbicides or cover materials, you have to take a number of issues into account.

## WEEDING

If weeds have grown in the pots during the growing season, they can be manually removed from the pots. Weed growth will be strongly determined by the climate and the presence of weed seeds. Under certain circumstances it may be necessary to repeat the weeding at various times. This method will therefore be labour-intensive and entails significant labour cost.


## HERBICIDES

With regard to herbicides, there are fewer and fewer to select from. Because of their impact on the surroundings and environment, the application conditions are becoming stricter or the product approval is sometimes withdrawn. On the other hand, few new products are being added because of the expensive and complicated approval procedure that they have to undergo before a grower can use them, certainly in the small ornamentals sector.

The use of herbicides often has to be done carefully in order to prevent damage to the crop. Certain products may only be used over deciduous crops during dormancy. Other products can be sprayed over evergreen crops or even over plants as long as the plants are irrigated after spraying. The purpose of this irrigation is either to rinse the herbicides from the plants in order to avoid damage to the crop, or to wash the herbicides into the substrate.

## COVER MATERIALS

The use of cover materials and the application of herbicides do not necessarily have to be mutually exclusive. Moreover, by applying both weed control measures judiciously, the principles of integrated cultivation (IPM) can be met.

The benefits have already been discussed in detail with regard to cover materials.

# 5.2. How do I choose the right cover material for my nursery: step-by-step plan

### STEP 1: CONVINCE YOURSELF OF THE BENEFITS OF COVER MATERIALS

List the pros and cons of your current weed control programme and the possible alternatives for your company on the basis of Chapter 1. On that basis you will see that it is worthwhile including cover materials in your sustainable crop production system.

### STEP 2: DETERMINE WHICH CHARACTERISTICS ARE IMPORTANT FOR YOUR CROPS

From Chapter 2, select the properties of the cover materials that are important for your company. In doing so, take account of:

- **Packaging:** do you opt for smaller packages or bulk?
- **Plant type:** fixed cover materials may only be used for plants with a central stem in the pot. Loose cover materials may be used for all other crop types.
- **Covering layer thickness:** the size of the pot determines the thickness of the covering layer. The smaller the pot size, the thinner the desired covering layer.
- **Fractions:** the thickness of the covering layer also determines the required fraction size of the cover material.
- **Colour:** do you also choose a cover material based on colour so that the aesthetic value increases?
- **Chemical properties:** cover materials can have an influence on the substrate and consequently on the plant. Therefore take account of the chemical aspects of acidity, electrical conductivity, organic matter and C / N ratio of the cover material.

### STEP 3: SELECT THE COVER MATERIALS AVAILABLE FOR YOUR CROPS

Using the above preferences you can select your preferred cover materials from the range of cover materials in Chapter 3.

### STEP 4: FIND OUT WHAT THE COST PRICE IS OF YOUR PREFERRED COVER MATERIALS

By performing the calculations from Chapter 4, you can determine what the cost will be for the use of cover materials in your company. Because the prices change over time, it's best to check with the supplier.

### STEP 5: CHOOSE THE RIGHT COVER MATERIALS FOR YOUR COMPANY

By following the step-by-step plan above, you will be able to choose the cover materials that best suit your company. Sometimes it will be more practical to use multiple types. Then it is advisable to apply them to a limited number of pots so that you gain practical experience and select the cover material with the best results. Good luck!

## Highlights: decide which cover material you choose for your crops

1. The choice of the method of weed control at your company must be carefully made. However, the methods do not necessarily have to be considered in isolation from each other.
2. If you choose cover materials, you can select the right cover material for your company using the five-step plan.
3. If there are several types of cover material that can be used for your crops, you can try them out on a limited number of pots and compare the advantages and disadvantages with each other. Only then start working with large quantities of cover materials.

# Research on cover materials

Research conducted by the PCS forms the basis of this innovation guide.

Cover materials and mechanical weed control in the tree nursery (2007-2008), carried out by PCS and funded by the Flemish government and the European Union.

Integrated crop protection in ornamental plant production (2013-2015), carried out by PCS and ILVO (Institute for Agricultural and Fisheries Research) and funded by the Flemish government and the European Union.

PCS practical research, carried out by the Tree Nursery Department of the PCS and funded by the Flemish government, the Province of East Flanders and the ornamentals sector.

# 10 tips for weed-free and sustainable container-grown plant production

1. As much as possible start with weed-free plant material and substrate.
2. Know the properties of cover materials so that you can use them efficiently for what they are intended for.
3. Choose the desired cover material to cover your pots so that weed growth is minimised.
4. Know what the effect on the growth of your plants can be when using cover materials. It is possible that an adjustment of the nutritional level during production is desirable. You can obtain more information about this on the basis of a substrate analysis.
5. Apply the desired thickness of the cover material for an optimal weed control effect.
6. If weed growth still occurs on top of the cover material, chemical weed control can still be considered.
7. For perennial crops, pots should be cleaned at the start of a growing season before applying new cover material to them.
8. Compare the different cover materials with each other and ask the supplier for the cost price in order to choose the right cover material for your company.
9. If different cover materials seem interesting, you can undertake a trial in which the different materials are applied over a limited number of pots. This way you gain experience and you can still select the best cover material for your company.
10. Whether or not you opt for the mechanical application method depends on the type of crop and the amount of pots that you will process each year.

***Still have questions?***

*Contact the PCS Ornamental Plant Research via info@pcsierteelt.be or +32 (0)9 353 94 94.*

ornamental plant research

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