

FRENCH PLASTICULTURE & AGRI-ENVIRONMENT COMMITTEE (CPA)

GUIDE TO BEST PRACTICE FOR BIODEGRADABLE MULCH FILMS



EN 17033-certified and bearing the TÜV Austria 'OK biodegradable SOIL' certification label or the DIN Certco 'Biodegradable in Soil' label

This guide, drawn up by the CPA's Biodegradable Committee, is provided for information purposes only and is not a substitute for the contractual documents which the supplier is required to provide to the user

STORAGE



The storage of biodegradable mulch films **differs from** that used for recyclable polyethylene films. Thin biodegradable mulch film reels must be handled with greater care than reels of recyclable mulch film.

When not in use, rolls of biodegradable mulch film must always be **stored inside the farm store** in their original packaging, **away from water, light and direct sources of heat**. The rolls should be stored **flat and horizontally** to prevent the product from becoming compressed or deformed under the weight of the rolls. **Vertical storage is preferable**. Do not stack pallets of biodegradable film rolls on top of one another. If the film is torn, it is advisable to **remove any damaged sections** that could cause problems when unrolling the film in the field.

Unused or partially used rolls must be **stored in their original packaging**; otherwise, it is advisable to **store them upright** to prevent flattening, deformation or breakage. It is not advisable to reuse the rolls in the following season; however, various tests have shown that, provided the biodegradable mulch film is stored correctly, this may be considered.

Accidental tears caused by improper storage of materials or damage sustained during transport may have a negative impact on the film's lifespan in the field. Where possible, it is best to remove any damaged sections of the film before use.



SOIL PREPARATION



The methods used to work and prepare the soil (ploughing, tillage, etc.) are largely **the same as those used with recyclable plastics** for horticulture crops.

However, in order to achieve the best results – both in terms of weed control and the product's mechanical performance – it is essential to **prepare the soil properly** before laying the biodegradable mulch film.

The soil must be **finely tilled** and prepared so that stones and crop residues, particularly harder materials (such as maize or sorghum stalks, etc.), do not damage the film during installation.

Particular care must be taken when laying mulch film on soil containing a high proportion of rock fragments or stones. Where possible, **the surface should be prepared using a seedbed** that can incorporate crop residues and rock fragments into the soil. The beds should be **flat or slightly domed**, with the soil lightly compacted on the surface. Correct installation of the film ensures it lasts longer in the fields.

Organic amendments (manure, compost) should be applied **at least 4 weeks before the film is laid** (even if they are mature) and must be **thoroughly mixed** into the soil to prevent direct contact with the film, thereby preventing the organic soil improver from causing premature biodegradation due to its high microorganism content.

However, if fertilisation is carried out one or two months in advance, as is usually the case in standard agricultural practice, the film will not be affected in any way.



LAYING THE FILM



Laying the biodegradable mulch film and **preparing the soil** are **the most important operations** to ensure satisfactory results in the fields. The film can be laid mechanically using the same machinery as for recyclable plastic film, at a similar speed and with the same equipment. It is essential to ensure that the film-laying machine is **correctly calibrated** to guarantee the biodegradable film is laid correctly: the tension on the film must be kept to a minimum to prevent it from stretching excessively during application, which could weaken the film by reducing its thickness and making it less effective. However, the film must be sufficiently taut to prevent it from flapping on the ground.

It is therefore advisable to **adjust the brakes** and **clutch** on the mulching machine to avoid placing excessive strain on the film during this operation. It is also advisable to avoid using rollers that run over the film once it has been laid, in order to improve its adhesion to the ground. Due to its nature and the fact that it is very thin, the biodegradable mulch film adheres perfectly to the ground after a few days.

The leading **manufacturers of mulching machines** can now **provide information on the ideal settings** for laying biodegradable mulch film. Furthermore, some mulching machines available on the market have been optimised for the application of thin biodegradable film. Finally, **care** should be taken when **using micro-perforated rolls** in the field (or when creating perforations to allow irrigation water to penetrate the soil more easily).

If not carried out correctly, these perforations may allow too much light to pass through the film, thereby stimulating the growth of weeds, which could cause premature damage to the film. To avoid problems arising from the incorrect application of micro-perforations, it is **best to use pre-perforated films**. In particularly **windy areas**, it is advisable to **secure the mulch film firmly to the ground with small amounts of soil to anchor the film** (a shovelful is sufficient) every 2–3 metres in exposed areas. It is essential to **plant as soon** as possible; preferably lay the film and transplant the cuttings at the same time (using a mulch-laying and transplanting machine); otherwise, reduce the time between these operations to a minimum (no more than 3 to 4 days after laying). This will ensure that the biodegradable mulch film is used to its full potential.



PERFORATION



Perforation is usually **carried out during the laying of the film** and is therefore **fully mechanised**.

It is carried out using the same machinery and procedures as those used for recyclable plastics, taking into account the fact that biodegradable film is **generally more elastic**.

Ideally, the systems used should perforate the film once it has been laid on the ground. When manually perforated, do not use equipment that might produce holes with irregular edges (for example, cut-up tin cans), as these cuts can cause premature damage to the film.

One of the best ways to make perforations is to **use a knife** to make a **cross-, T- or Y-shaped incision**. This technique reduces the area of uncovered soil around the transplanted cutting.

Holes made using **cylindrical tools** (including heated cylinders) produce **‘clean’ edges**, suitable for biodegradable mulch film.

The film can, on request, be **micro- and/or macro-perforated by the supplier**.



WEED CONTROL



Test results and data from the widespread use of black mulch film in open fields have shown that biodegradable mulches are **just as effective at controlling weeds as recyclable mulches of the same colour**.

However, **particular attention** must be paid to **certain weed species**: field trials have shown that severe infestations of **horsetail** (*Equisetum* sp.) and **sedge** (*Cyperus* sp.) can damage the biodegradable mulch film, and this can also occur with thinner varieties of recyclable film.

CULTIVATION TECHNIQUES



The use of biodegradable mulch film requires no change to standard cultivation techniques. Irrigation is compatible with the same systems as those used with traditional plastic mulch: drip irrigation, sprinkler irrigation and surface irrigation (less commonly used for horticultural crops).

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Irrigation

In the case of **sprinkler irrigation**, the profile of the board must be such that irrigation water **does not accumulate** on the film. This is because the water can cause the film to deteriorate prematurely. After sprinkler irrigation, the film may sag slightly. This is normal, and it will regain its original tension once it has dried.

When using **drip irrigation**, the irrigation pipe must be buried to a **depth of at least 1 cm** to prevent constant contact with the film. This recommendation is particularly important when using a colourless film. Excessive irrigation can lead to premature degradation of the film, particularly gaps along the edge where it meets the soil, or beneath more sensitive fruits such as ‘Gallia’ melons; farmers are advised to refer to the irrigation guidelines issued by regional research stations.

The water vapour **permeability** of biodegradable mulch **is higher** than that of a recyclable film, and the use of biodegradable mulch requires irrigation to be precisely adjusted to the plant’s needs.

Fertilisers and agricultural inputs compatibility

No research organisation, university or end-user has reported any damage or adverse interactions between biodegradable mulch film and fertilisers and agricultural inputs, when applied at the same rates and under the same normal periods and conditions of use as for recyclable plastic films.

LIFESPAN OF THE FILM



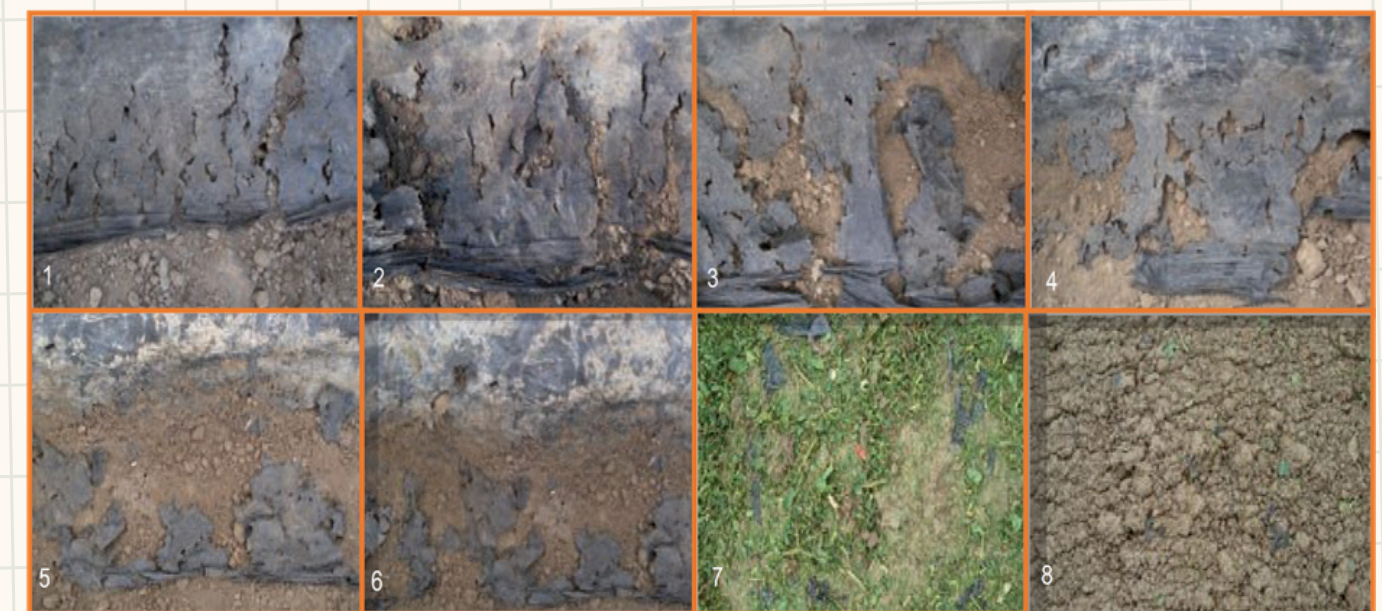
The lifespan of biodegradable mulch film in the fields **depends heavily on environmental factors** (rain, temperature patterns, solar radiation, etc.) and is therefore not solely dependent on the activity of microorganisms present in the soil.

The **15 µm-thick biodegradable** mulch film is used to grow a wide range of plant species with growing cycles of between 2 and 6 months: from lettuce or leafy crops transplanted in spring or summer to solanaceous crops grown in the open field. For crops **with longer cycles**, such as strawberries, which have an annual cycle (or remain in the ground for between 9 and 12 months and are transplanted in summer and autumn), the biodegradable mulch film has performed well under conditions typical of Mediterranean regions (Spain and Italy), with a thickness of **18 to 20 µm**.

The biodegradable film retains its **mulching capacity** for longer in **autumn crop** cycles than in spring or summer, due to the reduced impact of temperature and solar radiation, and the reduced activity of soil microorganism populations.

Finally, for crops where the soil needs to be covered for **more than a year**, a **40 µm-thick biodegradable** film may be a suitable solution. Some applications include soft fruits (raspberries), pineapples and new vine plantations.

Photos 1 to 6: the buried part of the biodegradable



The progression of the decomposition of black biodegradable mulch

Photos 7 and 8, after the film has been shredded and buried in the ground

FUTURE OF FILM AT THE END OF THE CULTURAL CYCLE



The biodegradable mulch film **must not be removed** or **collected** at the end of the growing cycle (a mandatory process for recyclable films); instead, it is incorporated directly into the soil. At the end of the growing cycle, the biodegradable film must therefore be worked into the soil along with the crop residues using a rotavator or disc harrow.

This process provides the biodegradable mulch film with the ideal conditions for complete biodegradation. At the end of its life cycle, thanks to the action of soil microorganisms, the biodegradable film breaks down into water, carbon dioxide and biomass. This is the final stage of biodegradation, leading to its bioassimilation, also known as mineralisation.

It is important to remember that it is the soil **microorganisms** that are **responsible for the bioassimilation** of the biodegradable film. Consequently, the rate of degradation will differ between the surface and the soil. A biodegradable mulch film left on the surface and not incorporated into the soil will therefore take longer to biodegrade. This is why the direct-drilling method is not currently recommended following the use of biodegradable mulch.

Soil conditions and environmental factors (sunlight, heat, humidity, etc.) are also factors that determine how well the material biodegrades, depending on the environment. **Living soil** – that is, soil rich in organic matter and therefore in microorganisms – will result in **faster biodegradation** than soil poor in microorganisms. For example, during winter, when soil temperatures are low, or in soils that remain waterlogged for long periods, biodegradation processes will naturally take longer.

At the end of its useful life, the film **loses some of its mechanical strength**; this allows it to be incorporated into the soil by tillage as soon as the crop has been harvested. Various methods can be used to incorporate the biodegradable mulch film into the soil, depending on the soil type and its condition at the time of tillage. **The soil must be tilled** (deep ploughing or shallow tillage) in such a way as to bury the film residues, which will continue to degrade.

In the event of a season with **extremely dry weather conditions**, the mulch will take longer to break down and fragments of biodegradable mulch may remain visible for longer. Fragments of degraded film may stick to the fruit at the end of the growing season where the fruit has been resting on the film (melons, squash, etc.); the farmer must therefore take appropriate measures to remove them (light manual or mechanical brushing).

SUMMARY

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STORAGE	Maximum 1 year
	Original packaging, in a temperate place, protected from moisture and heat
	Unused or partially used reels must always be stored in their original packaging
	Vertical storage of the reels is preferable
SOIL PREPARATION	Fine tillage
	Bury crop residues, clods of earth and stones
	Before laying the film, the soil must be at field capacity', i.e. irrigated until it reaches its maximum water retention, but under no circumstances should it be waterlogged
	The boards must be compacted and mounded
	Apply soil conditionerand fertiliser at least one month before laying the film
	Mix soil improvers and fertilisers thoroughly into the soil
LAYING	No fumigation
	Between 10 and 25°C in calm weather
	Adjust the speed and tension whilst unrolling
	The wheels or soil-working tools must rest on the bottom of the furrow and must not damage the film
	Secure the film to the ground every 2/3 metres, particularly in windy areas (except for lettuce)
LAYING	Do not drive over the film
	It is essential to plant as soon as possible, within 3 days at the latest

PERFORATION	Suitable diameter (to prevent weeds at the base of the plant)
	The film must be perforated using suitable, sharp tools
	Circular O-shaped cutters or T- or Y-shaped knives should be used in preference to prevent the film from tearing
	Avoid zigzag cuts
	Micro-perforation is not recommended (except for lettuce, for the above-ground part)
IRRIGATION	Hot macro-perforation is available on request
	Bury the drip irrigation lines – to avoid direct contact with the film
	In the case of sprinkler irrigation, the bed profile must be such that irrigation water does not accumulate on the film
	Due to higher water vapour permeability, irrigation must be adjusted
	Biodegradable mulch may break down before harvest – adjust irrigation
BURYING	Incorporation into the soil at the end of the growing season
	No direct sowing
ADVICE/ WARNINGS	Carry out trials on small areas, maximum 1 ha
	Contact your nearest research station
	Manual or mechanical brushing if flakes are present on fruit and vegetables

APPENDICES

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Glossary

Biodegradation: Degradation caused by biological activity, in particular by the action of enzymes, resulting in a significant change in the chemical structure of a material.

Biodegradable: An organic substance that can be broken down by living organisms. Complete biodegradation results in the total conversion of the organic substance into inorganic molecules, such as carbon dioxide (CO₂), water and methane (depending on the environment). It is important to note that the definition of the term ‘biodegradable’ must include the environment (soil or compost) in which biodegradation takes place and the time frame involved. In other words, it is necessary to define the conditions under which biodegradation is expected to occur and the time it will take. Without defining these elements, the term ‘biodegradable’ becomes vague and meaningless, as virtually all organic substances are biodegradable over an unlimited period of time.

Degradation: The molecular breakdown of materials caused by the action of microbes (biodegradation), water (hydrolysis) or light (photodegradation), or by any other process capable of causing such decomposition.

Abiotic degradation: The fragmentation of plastics due to physical and/or chemical environmental factors, such as oxidative embrittlement (thermal ageing) or photolytic embrittlement (ageing caused by light or UV rays), without the involvement of biological processes.

Bioassimilation: the final stage of biodegradation, also known as mineralisation. Organic matter is converted into CO₂, H₂O and humus during aerobic biodegradation, and into CH₄, CO₂, H₂O and humus during anaerobic biodegradation.

Standard EN 17033

“Plastics – Biodegradable mulch films for agriculture and horticulture – Requirements and test methods” defines the characteristics and requirements relating to the soil biodegradability of plastic films intended for agricultural use, **as well as toxicity tests on plants, invertebrates and micro-organisms. This standard also covers the optical properties and tensile strength of mulch films** intended for agricultural use.



Certification logos

TÜV Austria certifications – “OK biodegradable SOIL”:

A mark of conformity issued by the Austrian certification body TÜV for products and materials that are specifically biodegradable in typical soil. This label guarantees that the product/material is fully biodegradable in soil, without any additional treatment, within a timeframe determined by international criteria, and also guarantees that it will have no adverse effect on the soil.



DIN CERTCO certification – ‘Biodegradable in Soil’:

DIN CERTCO is the German certification body that issues a range of certificates, including those for biodegradable materials. DIN CERTCO has developed a certification programme for products that are biodegradable in soil.

