



Towards zero plastic soil management  
agricultural practices

# LAYMAN'S REPORT



## Project details

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## Partners

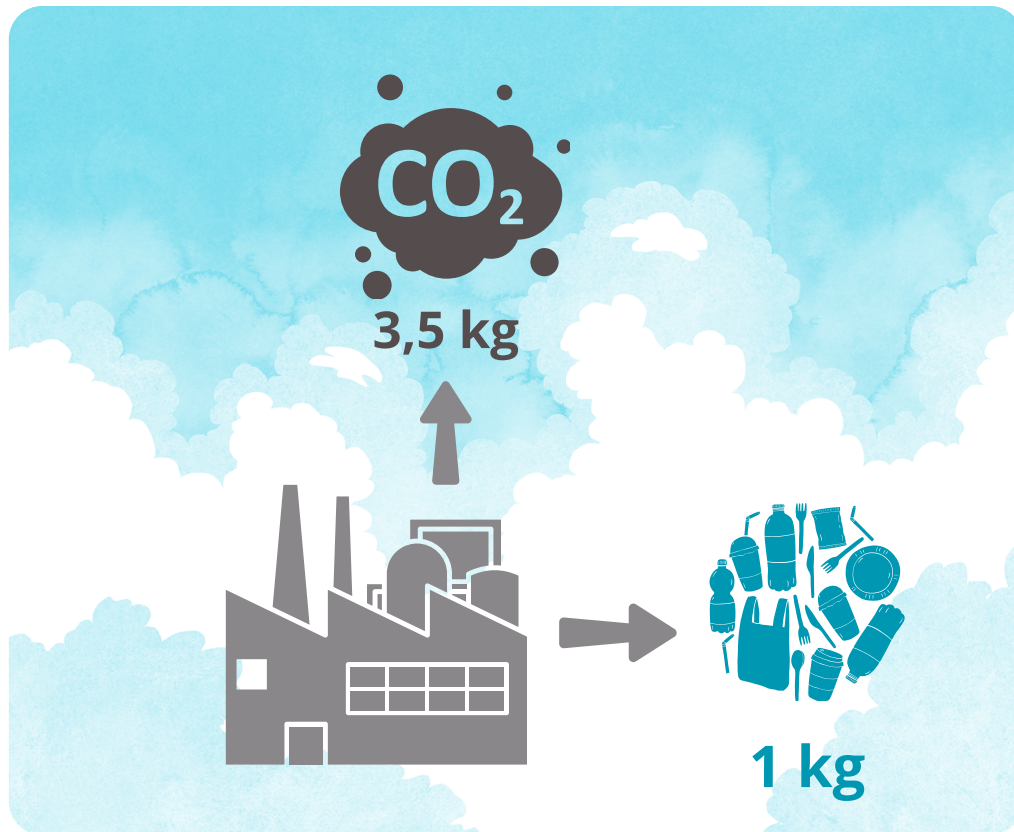


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## The problem of plastics in the soil and in the food system

The consumption of plastic worldwide is **6,500,000 tons per year**, with the consequent environmental impact that this implies in terms of GHG emissions for its manufacture and the waste that is then irreversibly left in the environment.



**Green House Gasses emissions:** 3,5 kg of CO<sub>2</sub> are generated throughout the production process of 1 kg of plastic.



**The products derived from the disintegration of plastics have toxic and altering effects on living beings**, including humans, and they can be found in the sea, but also in mainland, in our soils, our drinking water, our food and our bodies. Their presence has led to the decrease of soil fauna, such as mites, worms or insects, and compromised the fertility of the soil and the toxic chemicals released, such as phthalates and Bisphenol A (BPA) into the soil and water sources, getting into the food chain and causing harmful effects on the species that drink the water, have hormonal effects and can disrupt the hormone system of vertebrates and invertebrates. The smallest particles, nano plastics, may cause inflammation, traverse cellular barriers, and even the blood-brain barrier or the placenta. Within the cell, they can trigger changes in gene expression and biochemical reactions, among other things.

**Plastic mulch has direct contact with the soil and the crops we will eat**, and only 32% of plastic mulch used is collected at the end of use, with the rest being either landfilled, left in soils or burnt. This means that **68,000 tons** of the **100,000 tons** of plastic mulch used in the European Union per year, are added yearly to the European agroecosystems. This meaning a continuous addition to plastic particles and microplastics in soil as well as in water resources.







# Paper much for bettering our crops and the environment

Some of the alternatives that can be found in the market are **bio-based**, others just biodegradable and others have both properties. **Bio-based plastics** are polymers derived from biomass resources, while **bioplastics** can contain a certain amount of fossil-based materials.

**AgroPaper™ is 100% biodegradable**, made from long pine tree fibres and has the OK COMPOST HOME Certification (TÜV Austria), that guarantees its biodegradability through domestic composting process, which means, at environmental conditions, without the need of being exposed to the temperatures used in industrial composting.

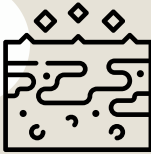
The use of **Life AgroPaper®**



-  Reduces GHG emissions and contributes to Carbon sequestration.
-  Contributes to increase soil biodiversity and protects wild biodiversity.
-  Reduces plastic production and pollution by avoiding it.
-  Contributes to soil protection and fertility.

And also contributes to the **11 goals set in the Voluntary Guidelines for Sustainable Soil Management set by FAO** [ac1]:

1



Reducir al mínimo la erosión del suelo

2



Prevenir, reducir al mínimo y mitigar la salinización y la alcalinización

3



Prevenir y **reducir** al mínimo la **contaminación** y la acidificación del suelo

4



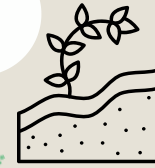
Prevenir y **reducir** al mínimo la **compactación** y el sellado del suelo

5



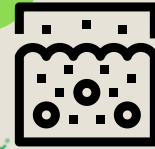
Incrementar el contenido de **materia orgánica**

6



Preservar y mejorar la biodiversidad del suelo

7



Fomentar el equilibrio y los **ciclos de los nutrientes** del suelo

8



Mejorar la gestión del **agua** del suelo

## How to use it

The project has helped delivering different kinds of paper mulch that cover different crop needs, managements and environmental conditions. Protected crops have different needs than if they were grown outside, but also the weather and environmental conditions affecting the mulch are different.

The **main parameters** to be considered when choosing a certain type of mulching will be whether the crop was **grown outside or in a greenhouse**, **how the paper mulch will be installed** (manually or mechanically), the **life cycle of the crop** (less than 2 months, between 2 and 6 months, more than 6 months), the **exact crop** for which it will be used, the **weather conditions** (such as wind exposure, humidity, rainfall and temperature), the type of **irrigation system** (sprinkler, drop or none) and, of course, the **range of adventitious plants** to be controlled.

The performance of the **AgroPaper™ mulch** will be influenced by the following parameters:

- **Grammage:** weight of paper per unit area ( $\text{g}/\text{m}^2$ )
- **Cobb60:** amount of water absorbed ( $\text{g}/\text{m}^2$ )
- **Gurley's Porosity:** air permeability (s/100ml)
- **Burst index:** tells about the property of the material to bear the stress when an external pressure is applied to it ( $\text{kPa}\cdot\text{m}^2/\text{g}$ )
- **Tear index:** force required to continue the tearing on an initial cut in a single sheet of paper: machine direction or cross direction ( $\text{mN}\cdot\text{m}^2/\text{g}$ )
- **Tensile strength:** maximum stress to break a strip of paper sheet ( $\text{kN}/\text{m}$ )
- **Wet strength:** percentage of conserved resistance of the paper after its immersion in water for 1 hour. (%)



**A full range of AgroPaper™ of different grammages between 50 and 90 g/m<sup>2</sup> were tested, to identify which one had better performance controlling adventitious plants, humidity and temperature.** The resistance of the paper mulch is highly relevant, especially for certain crops, so, the refining of the paper was kept low, to let fibres remain long, resulting in a porous and resistant paper mulch.

**The direction in which fibres are structured will have consequences on its response to tension.** The exposure to moisture and temperature changes in the area of the paper that remains on top of the soil, will need increased strength in the cross direction (CD) while when installed by machine, tensile strength in the installing direction (MD) will also be important to avoid tearing.

Another target was to **find a paper with the minimum possible water absorption, to avoid tearing.** After noting that applying natural inks for temperature regulation, helped decrease water absorption, **AgroPaper™** versions were either covered with ink (when needed) or varnished, with natural raw materials based products, also compostable and biodegradable.

**To increase the resistance of the borders of the paper sheets,** that remain buried since the very beginning of its installation, to be digested by soil microbiome, the solution was to apply **Polylactic Acid coating (PLA)**, that also fulfills the following criteria:

- It comes from **renewable sources** (it is not a bioplastic)
  - ➡ It is obtained from corn or cassava starch fermentation.
- TÜV AUSTRIA **OK Biobased** certification.
- DIN CERTO certification as **compostable under industrial conditions.**
- **Biodegradable** in CO<sub>2</sub>, water and biomass by microbial digestion.
- Suitable for **food contact** (EU and FDA regulations).
- Good **mechanical resistances.**

**AgroPaper™** can be manipulated by farmers manually or mechanically.

The **SXWS paper version** have been selected as the best options for outside crops grown under adverse weather conditions and the **SX/70 + PLA version** of **AgroPaper™** is also an optimum alternative for these managements and crops, since the PLA layer provides an important protection to the paper, avoiding water absorption and improving resistances.

There is a type of AgroPaper™ for each management, climatic condition and crop group, as well as the installation system.

It can be purchased in its natural **brown colour** or **tinted black** with natural biodegradable dyes on one or both sides.

In addition, it is **able to control adventitious plants such as sedge**.





**AgroPaper™ fulfils all the requirements set for inputs to be used in organic farming**

according to Regulation (EU) 2018/848 from the European Parliament and Council, of May the 30th 2018 on organic production and labelling.



**Paper mulch is ideal** and doesn't imply more management difficulties than plastic mulch when used in **greenhouses or areas with little exposure to wind.**



**For outdoor use, AgroPaper™ mulch shouldn't be installed on rainy or windy days,** the less stony the soil is, the better the installation and maintenance. It should also be ensured that no more than one week elapses between the installation of the mulch and the planting.

It is especially advantageous in **warm climates** and **during the summer period.**



**If the AgroPaper™ mulch is going to be installed mechanically,** some changes in the installation tools, normally used for plastic mulch, should be made. The main difference is that paper mulch requires **less tension** and is **more sensitive to the pressure** that may be exerted on the sides during installation. If paper mulch is being used for the first time, the speed should be moderated until the optimum velocity for its installation is found.



**Before perforating the AgroPaper™ for planting, an initial watering** should be carried out to settle the paper on the soil. And once it has dried, it can be perforated. During the crop's development, the paper should not be stepped on, as the strength of AgroPaper® decreases when wet.

**During the crop's development, the paper should not be stepped on,** as the strength of AgroPaper™ decreases when wet.

**After harvest, the paper mulch can be incorporated into the soil** by tilling or using a rotovator. Once mixed into the soil, if kept buried, AgroPaper™ will decompose within 8 to 10 weeks. If it is not completely buried, it will take longer to decompose, but will still act as a carbon reserve in the soil.



## What do farmers think of it?



The main motivation of farmers for using **AgroPaper™** mulch, is its role in **controlling adventitious plants**, being the main reason for **82%** of them. The exception to this are mainly greenhouse producers of southern mediterranean areas, for whom the priority is soil moisture conservation or in colder areas where soil temperature control becomes relevant.



And, **64%** of the users assign little or no importance to the role run by mulching on soil protection, but **the absence of the use of plastic** is, as well as the **carbon footprint** and Green House Gasses emissions of the production, is by a large majority, a priority and an important reason for using **AgroPaper™**.



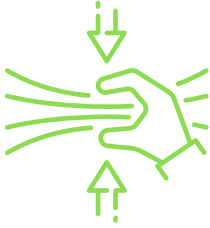
On the other hand, when asked for the contribution to fulfilling Common Agricultural Policy (CAP) and horizontal regulation's requirements, it is a clear that farmers are really concerned about it. The fact that **AgroPaper™** does not have to be removed after harvest and it is directly composted in the field when incorporated into the soil, **helps meeting the CAP requirements, lowers the costs and increases the presence of organic matter** and the activity of the soil's microbioma.



Once the paper has been incorporated in the soil, biodegradation has been valued very positively, and **73%** of the farmers had seen some or **good improvements on productivity**.



**The main concerns are the price of the product** (which can be compensated in the short-medium term by lower costs of removal and some positive results on productivity), **the risk of tearing**, the weight of the coil and that the higher number of coils of paper needed, comparing to other mulches, **uses more space to be stored**.



The weight and volume of coils is something inherent to the product, but **the price and the risk of tearing** is being **diminished by improvements in the product** (increasing its elasticity and protecting the edges with PLA coating), and also with the **detailed guidelines** on installation and **adaptation of tools** available in the [www.lifeagropaper.eu](http://www.lifeagropaper.eu) website.



Aprende a cultivar  
con acolchado de papel



**Ventajas de acolchar con AgroPaper®**

AgroPaper® es un acolchado 100% sostenible, biodegradable y compostable.

Al utilizarlo, mejoras el contenido en materia orgánica y la fertilidad de tu suelo, así como su actividad biológica, por lo que se reduce el riesgo de enfermedades asociadas al suelo y las causadas por hongos en tus cultivos.

Proteges el suelo contra la erosión, conservando y mejorando su estructura, evitando su degradación y compactación, y asegurando que las raíces de los cultivos puedan crecer adecuadamente. También aseguras una infiltración y almacenamiento eficiente del agua.

AgroPaper® ayuda a conservar la biodiversidad del suelo y la gama completa de sus funciones biológicas, optimizando el uso de insumos. Contribuyendo a asegurar disponibilidad y flujos de nutrientes apropiados para mantener o mejorar la fertilidad del suelo.

Todo esto puede suceder sin aportar plásticos ni otros contaminantes asociados, ni al suelo, ni al ambiente.



Papel producido por Smurfit Kappa, de acuerdo con el Reglamento (UE) 2019/1021, el Reglamento (UE) 2019/1020 de la Comisión Europea, la Resolución AP(2020) 1 del Consejo Europeo y la Recomendación alemana 89/3391. Resolución 13 para promover el contacto con el cliente.





## Legal framework

**AgroPaper™** complies with all the requirements set for biodegradable mulches so it's considered an agrarian input under the scope of *Regulation (EU) 2019/1009 of the European Parliament and of the Council, of 5 June 2019 laying down rules on the making available on the market of EU fertilising products* in Category CMC 9 of component materials of fertilizers and soil conditioners, such as polymers other than nutrient polymers.

**Using it, helps farmers to meet the goals set in the main Climate and Environment Agreements, Pacts, etc.:**



THE GLOBAL GOALS

SDGs of the Agenda 2030



European Green Deal



Climate Agreements



EU Action Plan for Nature, People and Economy



Thematic Strategy for Soil Protection COM/2006/0231 + Global Soil Partnership



European Soil Biodiversity Atlas + Global Soil Biodiversity Strategy



Initiative 4 per 1000 + Soil Health and Food Mission



EU Directive 2019/904 environmental impact of plastic, EU Soil Strategy, reverse plastic pollution in soils



Waste Framework Directive (2008/98/EC)



Landfill Directive (1999/31/EC); prevention of waste

And **complies with the environmental objectives** set in the **Common Agricultural Policy for the ecological transition of the agri-food systems**:

04



**Action against  
Climate Change**

05



**Environment  
protection**

06



**Landscape and  
biodiversity  
conservation**

09



**Protection of food  
quality and of  
health**



## Thinking about the future

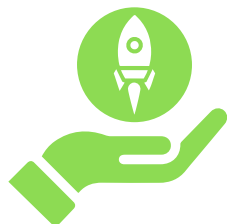
**AgroPaper™** is an input meant to help farmers improving the profitability of their crops in a **sustainable plastic-free way**. It has proved to be a viable mulch, an alternative solution for controlling adventitious plants and protecting the soil without the use of any plastic or fossil-based products. It has been **well valorised by farmers** and has been improved to be easier to install and manage and to increase in durability.

For all of this, **the main objectives for the future** are:



- To **continue improving the paper mulch** according to the feedback received from farmers.
- To **continue working on better tools** for its installation and management.
- To **ensure it is included** in the agricultural **inputs, organic farming** and environmental related regulations and **policies**.
- To **promote its use** and to disseminate its properties and the LIFE AGROPAPER project's results.

Through **the following actions**:



- **Product Development and marketing actions:** **Smurfit Kappa** will continue to improve **AgroPaper™** mulch based on the farmers feedback and assessment of sectoral organisations such as **SEAE**.

- **The dissemination of the LIFE AGROPAPER project results** and the communication on the properties and benefits of using **AgroPaper™** mulch, will continue and updated information will be available in:



<https://www.lifeagropaper.eu/> webpage



[Life AgroPaper - YouTube](#)



<https://www.facebook.com/LIFEAgroPaper>



<https://www.instagram.com/lifeagropaper/>



<https://twitter.com/LifeAgropaper>



<https://www.linkedin.com/company/life-agropaper/>

As well as in the **project partner's websites and media.**

- **Advocacy with regional, national and European administrations, institutions and influencing organisations, will be needed**, for the promoting and supporting the use of **AgroPaper™** through the regulation framework and policies, especially those focused on farming sustainability and profitability and alternatives to plastic.



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[www.lifeagropaper.eu](http://www.lifeagropaper.eu)