# BResilient

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## I. ORGANIC MULCHES IN VITICULTURE

Organic mulches have emerged as a promising and sustainable solution for enhancing cultivation practices worldwide. Unlike traditional synthetic materials, organic mulches are derived from natural sources such as plant residues, compost, straw, or even post-cultivation substrates like mushroom remnants. Their increasing popularity comes from the numerous benefits they bring to various agricultural systems, including the cultivation of crops like vineyards.

One of the main advantages of organic mulches is their ability to improve soil health and structure. As these mulches break down, they enrich the soil with essential nutrients, promoting better water retention and aeration. This leads to enhanced root development and overall plant growth, ultimately resulting in higher crop yields.

Beyond their soil-enriching properties, organic mulches also act as a protective barrier against environmental stressors. They shield the soil from extreme temperatures, reducing the risk of frost damage during colder months and helping retain moisture during hot spells. Additionally, these mulches suppress weed growth, minimizing the competition for nutrients and sunlight, which would otherwise hinder the growth of cultivated crops.

Another notable advantage of using organic mulches lies in their eco-friendliness. By opting for natural materials, farmers can contribute to sustainable agricultural practices and reduce their environmental impact. As these mulches decompose, they release organic matter back into the soil, strengthening its fertility and supporting the long-term health of the ecosystem.

Furthermore, the cost-effectiveness of organic mulches makes them an attractive choice for many farmers. Compared to synthetic alternatives, which often need to be replaced frequently, organic mulches gradually break down over time, ensuring a more extended period of benefits without significant expenses.

In the context of vine cultivation, organic mulches can prove particularly valuable. They offer a protective layer around the vine roots, insulating them from temperature fluctuations and facilitating optimal nutrient absorption. Moreover, the use of post-cultivation substrate from mushrooms as mulch represents a circular approach, transforming waste into a valuable resource and minimizing the overall environmental impact of the agricultural process.

As sustainable agriculture gains traction globally, the adoption of organic mulches is becoming a central principle in cultivating practices. By harnessing the power of nature, farmers can not only improve crop yields and soil health but also contribute to a greener and more resilient future for agriculture. Embracing organic mulches is not just a smart choice; it is a step towards cultivating in harmony with nature.

The Instituto de Ciencias de la Vid y del Vino (Institute of Grapevine and Wine Sciences) (ICVV) is currently engaged in two pilot programs that aim to test and demonstrate the impact of organic mulches in viticulture, utilizing mushroom and cereal residues. Let's explore their significant progress and findings in these initiatives.

## II. Mushroom Mulches

In the world of viticulture, the pursuit of sustainable practices has taken centre stage, and one remarkable solution gaining popularity is the use of organic mushroom mulch. Derived from post-cultivation mushroom substrate, this natural elixir has proven to be a game-changer for vineyard management, offering an abundance of benefits that contribute to both the health of the vines and the environment.

Organic mushroom mulch presents a double advantage for vineyards. Firstly, it provides a nutrient-rich medium that replenishes the soil with essential elements. As the mushroom substrate breaks down, it releases valuable nutrients, organic matter, and beneficial microorganisms into the soil. This organic cocktail nourishes the vine's root system, promoting robust growth, and fostering healthier, more resilient plants.

The second advantage lies in the mulch's ability to create a protective shield around the vines. In regions prone to extreme weather, such as frost or scorching heat, organic mushroom mulch acts as a natural insulator. It shields the vines from temperature fluctuations, safeguarding them from potential damage and ensuring a stable microclimate that fosters optimal growth conditions.

Moreover, the incorporation of organic mushroom mulch significantly reduces weed growth around the vines. This natural weed suppression reduces competition for resources, giving the vines a competitive advantage in accessing nutrients and water.

Beyond its direct impact on the vines, organic mushroom mulch represents an eco-friendly approach to viticulture. By repurposing post-cultivation mushroom substrate, vineyards contribute to the circular economy, reducing waste and turning it into a valuable resource. This sustainable practice aligns perfectly with the growing global awareness of environmental stewardship and reinforces the vineyard's commitment to green and responsible agricultural practices.

The ease of application and low maintenance requirements of organic mushroom mulch make it an attractive choice for viticulturists. The mulch can be easily spread around the base of the vines, and its gradual decomposition over time ensures a long-lasting effect. This efficiency saves both time and resources, making it a cost-effective and environmentally conscious choice for vineyard management.

In conclusion, the utilization of organic mushroom mulch in viticulture has proven to be a transformative and sustainable practice. Its nurturing properties improve soil health, promote vine growth, and protect the vines from environmental stressors. As vineyards continue to embrace the principles of sustainability, the adoption of organic mushroom mulch represents a vital step towards cultivating in harmony with nature and ensuring a bountiful harvest for generations to come.

### II.1 Main Objectives

The employment of mushroom mulch as a soil covering material has emerged as a sustainable and environmentally friendly approach, fostering a cascade of beneficial effects. The main objectives of incorporating mushroom mulch in viticultural practices encompass multifaceted aspects aimed at optimizing soil health, enhancing vineyard productivity, and bolstering the overall sustainability of the viticulture industry.

- Enhancing Organic Matter Content: The incorporation of mushroom mulch aims to address the prevailing issue of low organic matter content in vineyard soils, which is often observed to be less than 1%. By introducing mushroom mulch as a soil covering material, the decomposition process releases valuable organic compounds and nutrients into the soil. This infusion of organic matter not only enriches the soil's nutritional profile but also improves its physical structure, promoting better water retention and drainage. The enhanced organic matter content serves as a reservoir of nutrients, encouraging healthy vine growth and fruit development.

- Stimulating Microbial Activity: Mushroom mulch contributes significantly to the proliferation of beneficial soil microorganisms, including mycorrhizal fungi and diverse bacterial populations. These microorganisms engage in a symbiotic relationship with grapevine roots, forming a complex underground network. This network enhances nutrient uptake, facilitating the efficient transfer of essential elements to the vines. The microbial community also aids in suppressing harmful pathogens, promoting disease resistance in the vineyard, and reducing the need for chemical interventions.

- Promoting Regenerative Agriculture: The adoption of mushroom mulch aligns with the principles of regenerative agriculture, encouraging viticulturists to embrace sustainable practices that prioritize ecosystem health. Regenerative agriculture seeks to restore and revitalize the natural environment through agricultural activities. By utilizing mushroom mulch, viticulturists actively contribute to the enhancement of soil health, biodiversity, and overall ecosystem resilience. This holistic approach to farming fosters a balance between agricultural productivity and ecological preservation, ensuring the long-term sustainability of viticultural endeavours.

- Mitigating Soil Desertification: Soil desertification, an alarming threat to vineyards, arises from prolonged unsustainable land management practices. Mushroom mulch offers a valuable solution to combat this degradation by protecting the soil against erosion. The dense, organic structure of mushroom mulch acts as a protective barrier, preventing soil particles from being carried away by wind or water. This erosion control measure safeguards the topsoil, preserving its fertility and preventing the loss of precious nutrients. As a result, the utilization of mushroom mulch contributes to the prevention of soil desertification, preserving arable land for productive viticultural activities.

In summary, the integration of mushroom mulch in viticulture holds tremendous potential to address critical challenges faced by the industry. By increasing organic matter content, fostering microbial activity, promoting regenerative agriculture, and mitigating soil desertification, mushroom mulch emerges as an eco-friendly and sustainable approach that supports both vineyard productivity and environmental well-being. Embracing these innovative practices not only ensures the long-term prosperity of vineyards but also contributes to the broader global effort of sustainable agricultural stewardship.

### II. 2 Results

The application of mushroom mulch in viticulture has yielded significant results and benefits, as outlined below:

- Waste Reduction: By incorporating composting residues into vineyards, we successfully reduce the waste generated in composting plants.

- Improved Biodiversity: Several studies have confirmed a notable increase in soil biodiversity, contributing to a healthier and more sustainable ecosystem.

- Temperature Stability: In comparison to bare soils, the use of mushroom mulch has led to a reduction in soil temperature oscillation from 7.3ºC to 5.2ºC. This stability positively influences vine growth and development.

- Amplified Water Retention: The mushroom mulch has demonstrated water retention capabilities of up to 25%, ensuring better water availability for the vines, even during dry periods.

- Cost Savings: Implementing mushroom mulch has resulted in cost savings by eliminating the need for herbicides along the vine rows. This reduction in chemical usage not only saves on expenses but also supports soil conservation efforts.

These findings highlight the positive impact of mushroom mulch in viticulture, promoting more sustainable practices and favourable environmental outcomes.

## III. Cereal Mulches

In recent years, organic cereal mulch has emerged as a promising technique in viticulture, revolutionizing the way vineyards are managed and promoting more sustainable farming practices. This innovative method involves the use of cereal residues, such as straw or other plant material, as a protective layer on the vineyard floor.

The main objectives of implementing organic cereal mulch in viticulture are multiple, each contributing to the overall enhancement of vineyard ecosystems and agricultural sustainability:

- Soil Enrichment: One of the main aims of using organic cereal mulch is to enrich the soil with essential organic matter. In conventional farming, the soil often suffers from degradation due to repeated herbicide use and erosion. By incorporating cereal residues into the vineyard, the soil's organic content can be significantly increased, leading to improved soil structure and nutrient availability.

- Microbial Activity Boost: Organic cereal mulch provides an ideal habitat for beneficial soil microorganisms. These microorganisms play a vital role in strengthening soil fertility, nutrient cycling, and overall plant health. Encouraging microbial activity through mulching positively influences vineyard productivity and resilience.

- Water Conservation: Water scarcity is a growing concern in many viticultural regions. Organic cereal mulch acts as a natural moisture regulator, reducing evaporation and maintaining soil moisture levels. This water conservation effect benefits vine growth and grape quality while also contributing to more efficient water usage.

- Weed Suppression: Organic cereal mulch acts as a natural weed suppressor, minimizing the growth of undesirable plants that can compete with grapevines for resources. By reducing the need for synthetic herbicides, this mulching technique fosters a healthier environment for both vine growth and biodiversity.

- Erosion Control: Vineyards situated on slopes are particularly vulnerable to soil erosion. The application of organic cereal mulch helps stabilize the soil, preventing erosion and the loss of fertile topsoil. This safeguarding measure aids in preserving the long-term sustainability of the vineyard ecosystem.

- Biodiversity Promotion: Embracing organic cereal mulch in viticulture fosters a more diverse and balanced ecosystem. By encouraging beneficial insects and microorganisms, this method promotes natural pest control and reduces the reliance on chemical pesticides, safeguarding the ecological equilibrium.

Overall, the integration of organic cereal mulch in viticulture represents a transformative approach to sustainable farming. As more vineyards embrace this eco-friendly practice, the wine industry takes a significant step towards ensuring the longevity and health of vineyards while preserving the environment for future generations of wine enthusiasts.

### III.1 Main Objectives

Cereal mulch, a powerful organic material, serves several crucial objectives in viticulture. Its application in vineyards offers numerous benefits that directly contribute to the overall health and productivity of the grapevines and the soil they grow in.

- Weed Suppression: One of the primary goals of using cereal mulch in viticulture is to prevent or reduce the growth of unwanted weeds. By forming a protective layer on the soil surface, the mulch acts as a natural barrier, limiting weed germination and growth. This, in turn, reduces the need for herbicide application, promoting more sustainable and eco-friendly vineyard management.

- Enhancing Soil Microbial Activity: Cereal mulch fosters a thriving environment for soil microorganisms. As the mulch breaks down over time, it provides a steady supply of organic matter that fuels microbial activity in the soil. This increased microbial activity enhances nutrient cycling and nutrient availability for the grapevines, promoting healthier plant growth.

- Temperature and Water Regulation: The application of cereal mulch helps stabilize the temperature of the soil, providing insulation during extreme weather conditions. This regulation of soil temperature minimizes stress on the grapevines, ensuring optimal growing conditions. Additionally, the mulch acts as a water-saving measure, reducing evaporation and improving water retention in the soil, thus making the most efficient use of available water resources.

- Combatting Soil Desertification: Cereal mulch plays a significant role in preventing soil desertification. By protecting the soil from erosion and providing a nurturing environment for plant growth, the mulch contributes to maintaining soil structure and preventing degradation, ensuring the long-term health and productivity of the vineyard.

- Increasing Soil Organic Matter: The soil in vineyards often lacks sufficient organic matter, leading to reduced fertility. Cereal mulch helps address this issue by introducing a valuable source of organic material to the soil. As the mulch decomposes, it enriches the soil with essential nutrients and increases its organic matter content, ultimately supporting the development of healthier and more resilient grapevines.

In summary, incorporating cereal mulch in viticulture brings a range of benefits, including weed control, enhanced soil microbial activity, temperature, and water regulation, combatting soil desertification, and boosting soil organic matter content. These objectives collectively contribute to sustainable vineyard management practices, leading to healthier vines, improved grape quality, and a more environmentally friendly approach to wine production.

### III. 2 Results

Throughout the project, the utilization of cereal mulch as organic covering in vineyards has yielded highly positive results. This innovative cultivation technique has successfully eliminated the need for herbicides, thus promoting the preservation of beneficial species present in the soil and on the grapevines themselves. Additionally, the implementation of cereal mulch has effectively mitigated the impact of rising soil temperatures during the warmer months and contributed to enhanced water retention in the soil.

The absence of herbicides has proven to be a significant advantage, allowing beneficial organisms to thrive in the vineyard environment. Beneficial soil microorganisms and diverse plant species have been observed to flourish under the protective shield of cereal mulch. This fosters a balanced ecosystem, where the interplay between soil organisms and grapevines contributes to sustainable and naturally resilient viticulture.

Moreover, the application of cereal mulch has demonstrated its effectiveness in maintaining a stable soil temperature. During periods of high temperature, when exposed soil is prone to overheating, the cereal mulch acts as a temperature buffer. This moderation of soil temperature helps to prevent stress to the grapevines, leading to better fruit development and overall vine health.

Additionally, the use of cereal mulch has shown to improve water retention in the soil. The mulch layer acts as a barrier, reducing water evaporation and optimizing moisture levels within the soil profile. This benefit becomes particularly valuable during dry spells or drought conditions, as the increased water retention ensures a more reliable and consistent water supply for the grapevines.

In brief, the evaluation of cereal mulch as an organic covering in vineyards has provided compelling evidence of its numerous advantages. By eliminating the need for herbicides, supporting beneficial species, moderating soil temperature, and improving water retention, cereal mulch emerges as a promising and sustainable practice in viticulture. As the industry seeks more eco-friendly and resource-efficient approaches, the adoption of cereal mulch represents a significant step towards a more resilient and environmentally conscious future for grape cultivation.

## IV. More Information

For more in-depth insights into the advancements made in this area, you can refer to the research titled "*Effect of alternative viticulture on native entomopathogenic nematodes and other organisms linked to their soil food web in DOCa Rioja vineyards*," conducted by Rubén Blanco Perez. You can find the complete study and detailed findings at the following link:
https://www.sciencedirect.com/science/article/pii/S0167880920302139?via%3Dihub

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