

syngenta  
Biologicals

# Biologicals Solutions and Regenerative Agriculture

**MC LINE**

**Innovation**  
powered by nature

**syngenta**  
Biologicals

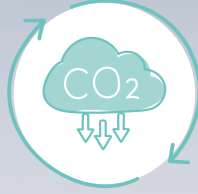


# Biologicals' four benefits to Regenerative Agriculture



## Healthier soils

Biologicals can help improve the biochemical activity of the soil, contributing to its capacity to function as a vital living ecosystem that sustains the life of plants, animals, and humans.



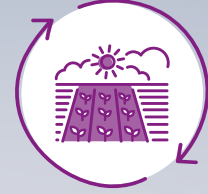
## Reduced greenhouse gas emissions

The integration of biological inputs in crop management can help contain emissions through a more efficient use of resources and an increase in productivity.



## Better water management

Biologicals for water use efficiency help farmers optimize the use of agricultural water, making the most of this precious resource.



## Increased farm productivity and profitability

Biologicals can help crops be more productive and face the abiotic and biotic stresses that jeopardize their yield and quality, therefore protecting farmers' incomes and limiting the expansion of agricultural land.





## Biologicals Solutions for Regenerative Agriculture: MC LINE

### Summary

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# Rethinking Agriculture

The availability of food for the whole world depends, directly or indirectly, on agricultural production.

The increase in crop productivity achieved over the last century has alleviated poverty and malnutrition around the world, and, at the same time, has made it possible to limit the conversion of habitable land for agricultural purposes to feed a growing population.

However, this success was only temporary. The combined effects of global warming,

scarcity of resources and population growth, which reached 8 billion in 2022, now make it necessary to rethink the way we produce food.

**Guaranteeing enough healthy food for the entire world population, and, at the same time, limiting the consumption of resources and safeguarding the health of plants, soil and ecosystems:** this is the challenge that modern agriculture is facing, a challenge that requires a rigorous approach and globally coordinated measures.



To drive change, the United Nations has dedicated a goal of the Sustainable Development Goals (UN-SDGs) to food production, number 2, which aims to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture".

However, as a confirmation of the central role that agriculture occupies in our society, and its transversal impacts, the goals connected to the production of food among the UN-SDGs

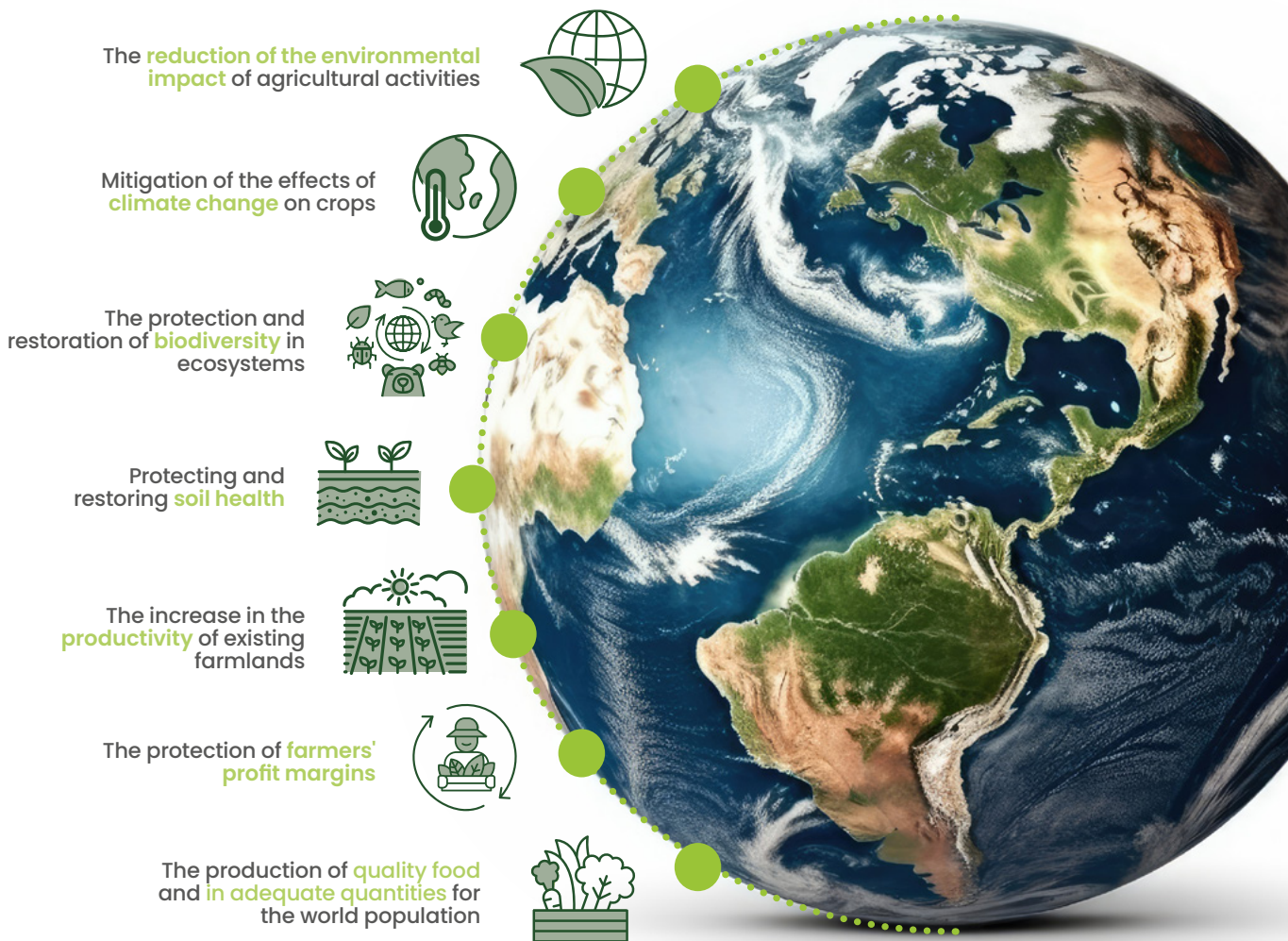
are the majority, and are distributed among objectives of an environmental, social and economic nature.

In this complex and interconnected panorama, all the players in the food chain will have to find effective and innovative solutions to face the challenge that awaits us.

Solutions leveraging both on the imperative of ecosystems conservation and on the answers provided by scientific innovation.

# What is Regenerative Agriculture?

We define regenerative agriculture as an **outcome-based** approach, that is to say, oriented towards obtaining specific agronomic and ecological results. Some of these objectives are:



At the same time, we identify **principles and practices** that are functional to achieving these goals. According to the principles of regenerative agriculture, **traditional practices** such as minimal or no-tillage, the use of cover crops, or crop rotation meet with **innovative solutions and technologies** in accordance with the specific needs of crops and land, to tailor an approach that is simultaneously beneficial to humans, the environment and the entire value chain.

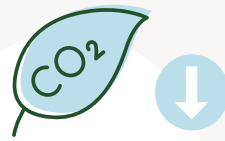
This strategy supports the UN-SDG Objective n.2 in its promotion of a "sustainable agriculture", with the idea that **only by safeguarding the well-being of the environment and of the crops themselves it is possible to obtain results that are sustainable in the long term from an economic, social and environmental point of view.**





## Regenerative Ag in Germany: example

**+60%**  
profits for farmers\*



annual GHG savings of  
**35 million**  
tons\*\*

**↑** socio-economic benefits  
**8.5 billion**  
euros a year



\* in the medium/long term

\*\* Equivalent to the emissions of 1/3 of German private car traffic

Report from BGC Nabu, 2023



Regenerative agriculture requires rethinking not only the way of cultivating the land, but also the systemic agronomic strategy and the use of external inputs for crop nutrition and protection. The latter are still considered, but managed in the principle of **precision application**: administered in a targeted way, minimizing waste, and leveraging on the most innovative technologies to optimize treatments on the basis of the single crop or area.

In this context, an important help is provided by **Biologicals**, innovative products that **valorize the action of molecules and organisms present in nature** with the aim of improving crop performance and soil quality. These solutions are designed on

## The role of Biologicals in Regenerative Agriculture

the basis of a **deep knowledge of the chemical and biological mechanisms underlying the physiology of plants** and their interactions with the environment, to ensure their **health and productivity** while respecting ecosystems.

Biologicals are made up of two main categories: **Biostimulants and Biocontrol**. The former improve the natural physiological processes of crops to increase their **quality, resilience to climatic stress and efficiency in the use of resources**, also benefiting the **microbial activity of the soil**; the latter help plants to face and overcome the pitfalls posed by **weeds or parasites**.

**Biologicals are not born as alternative solutions to traditional inputs, but to be used in synergy with them and to optimize their use.** In particular, Biostimulants improve the health and nutrition status of plants; by doing so, they allow crops to better react to adverse climatic events, or, depending on the type of product, to make the best use of the available resources, minimizing the waste of nutrients. In addition, Biofertilizers – often considered part of the Biostimulant category - can positively affect soil quality by improving the microbial processes that lead to the formation of nutrients.

Products in the Biocontrol category, on the other hand, exploit molecules and substances present in nature to implement highly targeted, specific and low-impact crop defense strategies. An example is the use of pheromones, chemical substances used by parasites for signals between individuals, used to alter reproductive behavior in areas of agricultural interest without harm to the surrounding environment.



Biostimulants

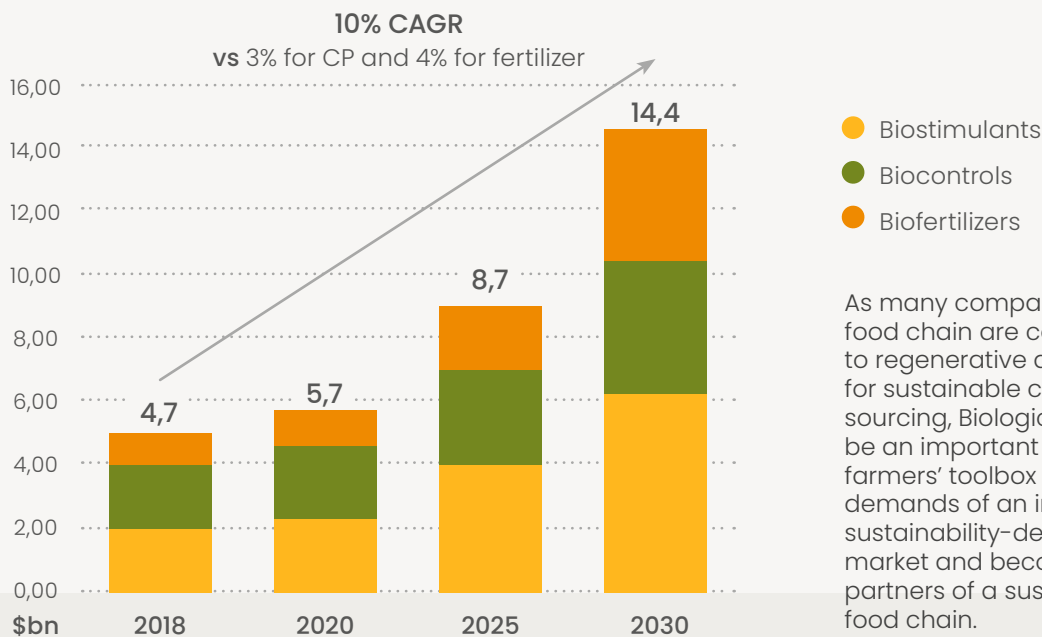


Biocontrol



Biofertilizers

## Market perspectives reflect farmers' increasing interest in Biologicals.



As many companies in the food chain are committing to regenerative agriculture for sustainable commodity sourcing, Biologicals can be an important tool in the farmers' toolbox to meet the demands of an increasingly sustainability-demanding market and become chosen partners of a sustainable food chain.



**MC LINE for  
Regenerative  
Agriculture**

The MC LINE is a range of technical solutions based on active vegetal ingredients derived from a sustainable source: *Ascophyllum nodosum*, a brown alga from the northern seas. Each

product of the line is formulated to support the plant in a different stage of plant growth, to ensure optimal crop quality and yield, for high-quality food production in respect of the environment.



## Seaweed as an instrument to help meet sustainability targets in agriculture

*Being able to meet future food demands requires us a transformational change and a shift in mindset. We need to look both at a reduced consumption of resources and at identifying novel ones that can be produced with low impact on*

*the environment. As for the latter strategy, seaweed are attracting increasing interest, for their potential role as a sustainable resource for food, feed, fuel - and last but not least, agriculture.*

**Seaweed have a long history of agricultural use in several areas of the world.** With early mentions dating back to essays from the Roman period, they have been extensively used as natural agricultural inputs especially in northern countries, due to the richness in mineral salts of the algal biomass. This practice attracted much interest from the scientific community, that started to investigate their interaction with plants and soils with particular attention to their biostimulant effect. **The main effects verified on crops using seaweed extracts are related to abiotic stress tolerance**, that is, the resilience to stress caused by environmental factors. Furthermore, among others, interesting effects were also verified in terms of **enhanced**

**growth and nutritional quality, improvement of shoot and root growth, early flowering, higher yield, and uniform fruit size and ripening.**

One of the seaweed species that is most used for agricultural purposes and for the creation of biostimulants is ***Ascophyllum Nodosum*, a large brown alga that can be found in northern oceans, highly valued for its richness in bioactive components.** In particular, when collected in the arctic environment, the extreme and stressful growth conditions make *A. Nodosum* synthesize a unique set of molecules that help cope with the natural challenges of the environment, making its extracts particularly useful as a nutritional input for crops.

**In addition to these benefits to plant health, seaweed also bring benefits to the surrounding environment and advantages in terms of sustainability:**



They do not occupy agricultural land, therefore not contributing to the increasing pressure on this limited, precious resource.

Their presence in the sea can have important effects on climate change mitigation, as their intense photosynthetic effect locally limits ocean acidification and deoxygenation.



They are a renewable raw material and can be collected periodically, provided that harvesting measures are respectful of plant growth and ecosystems conservation. Sustainable harvesting practices include, for example, leaving a portion of the thallus (the base of the seaweed) intact, and giving seaweed enough time to regrow (4-5 years) after each harvesting season.

In the light of this, seaweed have the potential to become an important ally in a sustainable food production strategy that aims both at an adequate and a high-quality production: one of the objectives of Regenerative Agriculture. Nevertheless, a further step must be made: scientific research and innovation is necessary to unravel the complexity of algal extracts, in order to rationalize their effects, maximize their efficacy, and create effective solutions that respond in a targeted way to the evolving needs of modern agriculture.

*The MC Line solutions ensure an increase in quality and yield of crops by supporting them along the different stages of their life cycle: MC EXTRA supports the balanced development of plant tissues and fruits; MC CREAM helps plants utilize light energy more efficiently and increase the growth of plant organs and fruit; MC SET stimulates and optimizes the physiological processes underlying flower and fruit production. This allows crops to grow and thrive, so that farmers can get the most out of them in a sustainable way.*

**MC Line: from the best of the sea, the best of the earth**

All products of the MC line, obtained by *Ascophyllum Nodosum* extracts, are carefully formulated to help plants express their full yield and quality potential with a personalized approach depending on their life cycle phase. In this, the abundance and diversity of active molecules that can be obtained by *Ascophyllum Nodosum* play an important role, but what is truly crucial is the internal, in-depth knowledge of this valuable raw material, for the valorization of such molecules under the form of diversified final products.

In fact, first of all, the time of harvesting is crucial to obtain extracts with the desired characteristics, as the concentration of the active ingredients in *A. Nodosum* changes throughout the year in response of season, growth conditions and age of the plant. Then, by using targeted extraction methods it is possible to select and isolate the desired active ingredients from the same matrix to

formulate products addressing different needs of the plant.

The topic of **sustainable yield increase is a key focus of regenerative agriculture**, in a context where the agricultural land expansion must be limited and the effects of climate change on farming are increasingly dramatic. In addition, regenerative agriculture also addresses the **profitability** aspect, in its aim of creating a farming model that is positive not only for the environment but also for farmers. **In this regard, the products of the MC line are powerful allies**, as they are designed to support crops in the functions that are essential to guarantee high yield and quality, looking at the same time on productivity and profitability.

**MC CREAM acts on improving the photosynthesis process in the plant, as well as greater cell proliferation and expansion, decisive factors to determine fruit growth and increased yield.** Furthermore, it helps improve plant health conditions by favoring the production of vitamins and amino acids, which, among other effects, contribute to the protection against the light radiation oxidative stress.

**MC EXTRA helps the plant maintain a correct vegetative-productive balance, to achieve a good yield and with satisfactory quality parameters.** Achieving equilibrium between vegetative and productive phase is key, as imbalances in that sense can cause negative effects impacting on yield and plant health. Therefore, the product acts on regulating **the plant's hormonal network**, balancing the main physiological processes, to make it able to support good production and increase the quality parameters of the crop.

**MC SET supports the plant in the phases of flowering and fruit set, stages that are crucial for achieving excellent yields in terms of quantity and quality.** During flowering and fruit set, crops need more energy to produce hormones in support of these delicate processes; furthermore, such process can be strongly impacted by adverse environmental factors. **By means of MC set, nutrients are redistributed towards flowers and fruits** so that the plant is supported in this crucial process both in adverse and normal environmental conditions.



*As such, solutions of the MC line can give a significant support to the Regenerative Agriculture outcomes, with particular attention to the productivity-related ones:*



**Protection of farmers' profit margins** as it contributes to making farming more productive, contributing to increase yield and quality of crops.



**Production of quality food and in adequate quantities for the world population** as it ensures plants to grow, thrive and perform at their best, in a way that is balanced and respectful of their physiology.

# On the field

## Key crops performances

Total average yield increase on all crops refers to all trials done with MC line.



MC CREAM	Average Yield Increase (%)	MC EXTRA	Average Yield Increase (%)	MC SET	Average Yield Increase (%)
Apple	5.1	Apple	6.9	Almond	8.4
Cherry	9.7	Fresh tomato	7.9	Fresh tomato	10.3
Citrus	9.7	Onion	2.0		
Coffee	11.2	Pear	12.0		
Corn	4.1	Potato	6.7		
Cucumber	4.7	Soybean	4.6		
Fresh Tomato	3.9	Strawberry	7.3		
Mandarin	13.3	Table grape	4.2		
Onion	4.0	Wine grape	1,1		
Peach	4.1				
Pepper	15.4				
Potato	4.2				
Soybean	3.8				
Table Grape	3.8				
Wine Grape	8.6				



## Cultivating Sustainability

Sustainable practices and use of products such as Biologicals are good enablers of regenerative agriculture, but this is still not enough! First and foremost, a culture of sustainability must be cultivated along the whole supply chain, leading to a deeper awareness of the issues that we are facing, their repercussions on a global scale, and what tools can be used to address them. In addition, Biologicals such as TALETE™, although actually simple to use, require training and technical assistance for an optimal result configured on the precise needs of the customer.

For this reason, we devote ourselves to providing farmers frequent technical trainings on the use of Biologicals solutions in the framework of Regenerative Agriculture. From region to region, a special focus is put on the management of the local key crops and the main pain points for farmers, in order to close the knowledge gap that often hinders the adoption of new sustainable practices and products. In addition, we guarantee a system of continuous, widely distributed on-field support, with

a technical support team composed of experienced specialists in the field of Biologicals, competent in the agronomic field and, at the same time, trusted advisors for customers from plantation to harvest. These figures, combining excellent technical, commercial and human skills, have a strategic role in creating a link between the technology and its use, contributing to the goal of spreading Regenerative Agriculture practices, in order to create strategies that combine environmental and economic sustainability while respecting margins.

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