

Biologicals Solutions and Regenerative Agriculture

€pivio[™]Energy

Innovation

powered by nature



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: EPIVIO[™] Energy

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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



END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

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 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 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 three main categories: biostimulants, biocontrol, and nutrient use efficiency

The role of Biologicals in Regenerative Agriculture **products**. Biostimulants 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**. Biocontrol help plants to face and overcome the pitfalls posed by **weeds or parasites**. **Nutrient use efficiency products** – considered biostimulants or biofertilizers in some markets – improve macro- and micronutrient availability and uptake to promote growth, increase resilience or enhance yield.

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.

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. Lastly, nutrient use efficiency products can effectively support fertilization, by helping plants optimize the nutrients at their disposal and prevent yield reductions that may be caused by nutrient loss.



Nutrient Use Efficiency

Market perspectives reflect farmers' increasing interest in Biologicals.



- Biostimulants
- Biocontrols
- Nutrient Use Efficiency

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. Seed treatment encompasses a spectrum of technologies and methodologies aimed at improving seed performance and health, enhancing processes such as seed germination, seedling emergence and plant biomass development, and having effect on yield and disease control. As the global agricultural landscape is confronted with the pressing challenges of population growth, climate change, and the need of limiting the use of natural resources, this practice has gained significant attention also due to its intrinsic sustainability advantages that encompass environmental, economic, and social dimensions.

The sustainability benefits of seed treatment



In fact, the time- and space-targeted nature of seed treatment applications results in optimal resource utilization. In fact, this practice employs small doses of products, minimizing waste and excess use, with an approach that strongly supports the transition to a more efficient and environmental-positive agriculture. Moreover, on the farmer side, the saying goes: "well sown is half grown". In fact, seed treatment supports the farmer in the moment of truth of crop establishment, which is also the stage in which the crop is most vulnerable. Seed treatment offers tangible benefits in minimizing input costs, improving crop establishment, enhancing yield potential, and reducing production risks, therefore safeguarding farmers' profitability against adverse climatic events and market fluctuations.

Through these multifaceted contributions, **seed treatment appears as an important ally to a regenerative agriculture strategy**, aimed at transforming food systems with a view to the multiple aspects of sustainability.

Contractive Contr

EPIVIO[™] Energy is a biostimulant solution dedicated to seeds, that aims at supporting their growth even in conditions of stress. Thanks to a combined effect on the seed and the rhizosphere, this innovative product cascades several effects during crop establishment and ensures optimal development of the seedling, resulting on healthier plants, great resilience to environmental stress, and maximization of yield results.



Good crop establishment for crop success

The phases of germination and emergence constitute foundational events in the lifecycle of crops, profoundly influencing

Seed germination and seedling emergence are the most important and vulnerable phases of the crop cycle. They represent the earliest stages of crop life, identifying respectively the transition from seed dormancy to active growth and the point in time when the seedling emerges from the soil, commencing photosynthetic processes crucial for sustained growth and development.

The **seed germination and seedling emergence potential** of a given crop depends primarily on seed and seedling subsequent growth trajectories and yield potentials. Giving crop support starting from the seed is key to obtain crop success.

characteristics, like seed mass or size, seed coat thickness, seed dormancy, seed microbiota, location of seed reserve, etc... However, in practice, **a number of factors limit or reduce such potential**, that include **abiotic factors** (e.g.: chemical, thermal, mechanical and water stress in the seedbed) as well as **biotic factors** (e.g.: soil-borne pests and pathogens, pest, weeds and predators). This makes the seed-to-seedling transition one of the most critical stages in the crop life cycle.



Stresses occurring during germination phase reduce the number of plants and make germination slower and stand not uniform.



Stresses occurring during vegetative phase reduce the speed of initial growth, decreasing the number of leaves and tillers (therefore increasing the critical period of competition with weeds) and make seedlings more susceptible to root and earlyseason fungal diseases.

In this context, seed treatment could offer a valuable help to prepare plants to counteract more successfully abiotic stress conditions and reach their full potential, avoiding **crop loss**. The treatment at the seed stage is a practice with high sustainability potential due to its efficiency in terms of resource usage: it requires only a single treatment, with small quantities of active ingredients per seed. Moreover, in this framework, biostimulants can play a key role among the possible seed treatment agents. By treating seeds with biostimulant solutions, farmers can kickstart plant growth and development from the earliest stages, even under adverse conditions. Also, the direct application to seeds allows delivery of beneficial substances directly to the germinating plant and the rhizosphere, maximizing the effectiveness of the treatment. As such, their use aligns well with sustainable agricultural practices and fits perfectly into the regenerative agriculture framework.

EPIVIO™ ENERGY: Crop Establishment backed by Nature Able to enhance the vigor and vegetative development of plants in the early stages of growth, EPIVIO[™] ENERGY can support crop establishment especially under moderate abiotic stress conditions such as drought and temperature drops.

Carefully formulated with algal extracts and other molecules of plant origin, EPIVIO™ Energy cascades several effects during crop establishment:

Improves the germination energy of seeds thanks to Ascophyllum nodosum extracts (an algae). The biologically active substances have a cascading effect on the release of hydrolytic enzymes that degrade starch reserves in the endosperm, releasing simple sugars that support the embryo's growth. The result is an enhancement of the germination process for faster seedling emergence and uniformity.

Stronger seedling growth. EPIVIO[™] Energy drives the activation of key biological processes and hormone signals that are directly involved in increasing the elongation of

young tissues, enhancing the growth of the seedling in the early stages of development. This is further supported by other biomolecules, such as sugars, whose availability is increased by the enhanced activity of the starchdegrading enzymes, and suberin, a biomolecule that contributes to the strength of cell walls. Furthermore, the presence of manganese in the product determines the increase of reserve substances inside the plant.

Guarantees higher resistance in adverse conditions. It enhances the biosynthesis process of proteins that help protect plants from environmental stresses such as drought, high salinity, and extreme temperatures. Moreover, it boosts the production of suberin, which thanks to its barrier-forming effect within plant cell walls helps protect plant tissues from water loss and other environmental stresses.

Working as alleviator of abiotic stress in crop plants in early stages, with a targeted and efficient mode of application that aims at optimizing the use of resources, EPIVIO™ ENERGY can be a valid ally of Regenerative Agriculture, helping achieve the following outcomes:



Increase in the productivity of existing farmlands as it help seeds and seedlings reach their genetic yield potential also when stressors jeopardize it



Reduction of the environmental impact of agricultural activities as seed treatment is a form of precision application, aimed at optimizing the use of the product and minimizing waste



Mitigation of the effects of climate change on

crops as it helps crops become more resilient to abiotic and climate-related stresses during their most critical stage of their life, safeguarding their health and productivity





*base treatment containing fungicide and insecticide, including thiamethoxam

The graph depicts 19 trials conducted across TH, IN, ID and PH on corn. In drought stress conditions, the use of EPIVIO™ ENERGY allowed for a mean 4.5% yield increase vs untreated, corresponding to an average value of + 350 kg/ha.

Mean yield difference in Corn compared to base treatment



Crop enhancement trials, n= 25 2017-2021, TH, IN, ID, PH.

*base treatment containing fungicide and insecticide, including thiamethoxam

The graph depicts 25 trials conducted across TH, IN, ID, PH and VN on corn. In normal conditions, the use of EPIVIO™ ENERGY allowed for a mean 5% yield increase vs untreated, corresponding to an average value of + 392 kg/ha.





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

that combine environmental and

economic sustainability while

respecting margins.

spreading Regenerative Agriculture

practices, in order to create strategies

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