

# How Biologicals Boost Farm System Productivity



"I think you need to start with: What do I want to achieve?" For Brooks Coetzee, Global Biology Leader, Corteva Agriscience, the addition of new biological products to the farmer toolbox creates an opportunity to think about farming differently. "The biggest single change that farmers have started to move toward is to think about farming not from the perspective of a product or an input, but from the perspective of the system."

Juan José Navarro agrees. He's the Technical Director at Grupo El Palmito and an independent agricultural advisor in Murcia, Spain. He's been using biologicals for several years in citrus and other fruit crops, and now they're simply part of his systems approach. "I integrate biologicals into a program," he explains.

Coetzee and Navarro are part of a burgeoning trend. Biologicals are the fastest growing segment of the agriculture market. Many farmers are in the early stages of uncovering the potential in biologicals to help meet goals that go far beyond controlling pests to producing more in ways that are profitable, sustainable and meet food chain demands.

## Defining biologicals

Biologicals consist of materials that already exist in nature. Some are living organisms, such as beneficial bacteria. Others, such as enzymes, are derived from natural materials. Many biologicals support processes that plants do naturally. They can help boost performance, build resilience in the face of abiotic (non-living) stress such as unfavorable weather and, in some cases, protect a plant's potential against pests. Because they are made from naturally occurring materials, biologicals generally do not linger in the environment and typically result in low to no residues.

Navarro uses biologicals to mitigate multiple stressors, many of which he has seen exacerbated by increased extreme weather conditions. "Pests that had been established now produce many more generations in a year due to climatic conditions," he notes. Extreme heat and cold can also take a toll. "All of this influences production. It is causing losses, problems with quality. We only work with fresh fruit. Fresh fruit needs to appeal to the senses. That quality is being conditioned by the climate."

Navarro continues, "We cannot prevent the plant from suffering stress due to heat situations, cold or water quality," he says. "What we are looking for is a faster recovery from that situation." Navarro utilizes biologicals to help plants develop stronger root systems, improve nutrient uptake, cope with high-salinity soils and ward off pests.

## Protecting productivity and opportunity

Fruit and vegetable farmers have been on the leading edge of

incorporating biologicals into their farming systems because they can help them meet market demands that may limit use of certain conventional crop inputs. Coetzee describes a common scenario. "A conventional crop input might have an application limit that's described on the label registered where the crop is grown. If you use the product according to the label, you will be well within those limits. But there might be an export market out there that has much lower levels than those on the approved label. In that case, you can manage with conventional chemistry and then, toward the end of the season, manage with a biological."

Used in this way, biologicals can open up tremendous opportunities for farmers. "Growers are able to meet food chain requirements," says Francisco Javier García Domínguez, Biologicals Global Product Manager, Integrated Solutions, Corteva Agriscience. "This provides differentiation for the farmer's business, opening new export markets and creating trust with customers."

"For me, the residue issue is important as a fresh food producer for a demanding market," says Navarro. He notes that it's particularly helpful to have low- or no-residue options for the markets he supplies in Japan, Canada and across Europe.

## Enhancing a system of solutions

Biologicals can be used on their own, but research and on-farm experience demonstrate that they are especially effective when used to complement conventional crop protection products. "The impact of using biologicals in combination with traditional crop protection solutions is tangible and concrete," says Domínguez. "The combination of both kinds of solutions can provide superior performance and a spectrum of control."

Domínguez explains that combining biological and conventional solutions can provide more efficient control. "For instance, farmers may be able to reduce the number of conventional substances sprayed during the season." The combination can also be extremely effective in cases of high pest pressure or when pests are showing resistance

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to commonly used conventional crop protection products. "Biological products are great at preventing and controlling certain levels of pests and diseases," Domínguez says, "But agriculture is not always like this. So, in those cases, it is essential to know how to combine traditional tools with a strong knockdown effect together with biologicals to help overcome issues such as resistance."

"I use both conventional and biological products," Navarro says. "We do conservation. That is the first thing." Navarro incorporates multiple management practices, such as taking actions to preserve beneficial organisms, phytosanitary strategies and using conventional and biological solutions as needed. Today, Navarro sees conventional and biologicals as equally useful in his program, but he acknowledges it takes time and experience to develop comfort with using biologicals.

## Taking a new approach

Unlike conventional crop protection products, where results might be immediately recognizable, the contributions of biologicals to plant health are often more subtle: stronger root systems, more leaves to drive photosynthesis or more vigorous and colorful fruiting. When combined with conventional products, biologicals help farmers grow healthier, more productive plants that can better withstand diseases, damaging insects and abiotic pressures. Over time, farmers might not need to use conventional treatments as often.

Incorporating biologicals effectively into a farming system is also not as straightforward as what farmers may be used to with conventional products. As farmers understand, working with living things can be a nuanced process. Domínguez explains that, for example, "Performance of microbials can be affected by weather or physiological status of the plant. It requires a high level of precision to get the most from biologicals."

"With an insecticide, you have an immediate response. When you have a product based on a microorganism, you have a response time which is normally longer than that of a chemical," Navarro explains. "You have to put that together. You have to get used to knowing when to apply."

## Prioritizing the practical

Today, the science of biologicals is much more developed than when these products made from naturally occurring materials really expanded in the market about 30 years ago. "Being honest, when biologicals started, the industry did not have a full understanding of the best utilization practices and sometimes they overpromised," says Domínguez. "Today, thanks to the latest scientific progress in areas like decision

science, bioinformatics, genomics and molecular biology, we have a deeper knowledge of the mode of action, how to get the best performance from biologicals and predicting performance."

For biologicals to be successful in helping farmers, they have to be evaluated with scientific due diligence. Coetzee explains that Corteva takes a "hard-core scientific approach. We're looking at what do we want to influence, how do we want to influence it and is this biological the best option to get to that intended outcome?" Potential biological solutions are only truly viable if they work within the practicalities of an on-farm system. "A production system is a living, breathing system that needs to be optimized," Coetzee says. "You're looking for different opportunities to make it even more competitive, sustainable and profitable."

For Navarro, including biologicals has delivered measurable results. For example, it allows for planting in soils that might otherwise not be productive enough. "We cultivate these soils with biologicals and we have good yields. In lemons, we are going to have 50, 60 tons per hectare. In mandarin, we have reached 80. In grapefruit, we have gone over 120."

## Optimizing implementation of biologicals

Getting the most out of biologicals in combination with conventional crop protection requires a change in thinking and practices to a systems approach where farmers look at every action and input in context of the entirety of the farm's health and productivity. It also takes the right support in implementing biologicals on the farm. "There's an adaptation period where growers and technicians need to be trained accordingly, to design a holistic approach of control programs that meet grower needs and lead the way," Domínguez says.

"We see sustainability through the way we manage our crops," Navarro says. "In other words, what economic and agronomic actions will it take to reach that production goal with the least possible impact? The activity has to be sustainable. When I say sustainable, I mean that it also has to make money. Otherwise, there is no sustainability. For us, biologicals are an investment, not an expense."

By combining biologicals and conventional crop protection products, farmers have more of those levers to use, allowing them to raise productivity and differentiate themselves in the marketplace.