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Factors to consider when introducing allochthonous microorganisms into the soil

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Abstract

Beneficial soil microorganisms actively participate in the different processes of nutrient cycles (e.g. nitrogen, phosphorus, sulfur), fix atmospheric nitrogen, contribute to soil aggregates, plant health, and degradation of polluting compounds. Currently, there is a lot of momentum in research on microbiomes, such as the rhizosphere microbiome, which constitutes the volume of soil around the roots where microbial growth and diversity are stimulated. Studies focus mainly on the functions of microorganisms at the enzymatic and product level, on the definition of microbial consortia to activate metabolic pathways in the plant that promote its growth and defense against pathogens. This sometimes involves introducing foreign (allochthonous) microorganisms to enhance beneficial functions, and it is essential to take certain factors into account. The diversity of soil means that the behavior of a microorganism is not the same when introduced into different types of soil (e.g. Andisol versus Oxisol). Another factor is specificity, that is, the interaction between microorganisms, soil and host, which is essential for field applications, for example in legume-Rhizobium symbiosis, creating the need to identify the best symbiotic combinations. The nutritional status of the soil, such as high doses of phosphorus, affect plant infection by mycorrhizal fungi. The potential of native microorganisms is critical when foreign microorganisms considered efficient are introduced. Native microorganisms can have high populations and be very competitive, leaving no options for the allochthon. On the other hand, native microorganisms, being inefficient, can generate negative results that can be attributed to the allochthon. The cultivation system is another factor to consider. A low-input system promotes the colonization of the rhizosphere and roots, increasing the population of microorganisms and affecting the composition of the communities, giving greater diversity. If the soil is disturbed (type of tillage), the microbial potential decreases. This effect is related to the negative relationship between tillage intensity and phosphorus absorption. Herbicides that are not bactericidal or fungicidal affect diversity and populations, which impacts soil fertility. In soil with excess moisture, the introduced microorganism (generally aerobic) decreases its population. With the reduction (decrease in oxygen) in the soil, anaerobic processes will appear with methane production, which will also affect the crop. Under stress, the plant's defense

system collapses, which encourages the appearance of pathogens. Finally, it is also important to take into consideration factors such as the type of substrate used to inoculate the microorganism, the dose, the right time, the method and frequency of application. By considering all these factors, greater possibilities of colonization would undoubtedly be obtained, making the rhizosphere microbiome more functional, which will influence better crop nutrition and health.

Keywords: Microbial diversity, Microbiomes, Rhizosphere, Plant health.