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Opinion

The Use of Biofertilizers to Increase the Bioactive Compounds in Legumes and Non-Legumes

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Opinion

Increasing interest in preserving the environment and consumer health is leading to changes in production methods and dietary habits. Consumers are increasingly demanding safe functional foods with health-promoting properties focused primarily on protection against carcinogenesis and oxidative processes. The consumption of fresh fruits and vegetables containing bioactive compounds has increased significantly in recent years and numerous studies have been conducted on the potential benefits of such compounds for various aspects of human health [1]. The increase in quality demanded by consumers requires specific agricultural practices, such as fertilization with products containing microorganisms [2]. Inoculation with Plant Growth-Promoting Rhizobacteria (PGPR), which reduce the chemicals added to plants, can improve plant growth through various direct mechanisms such as nitrogen fixation, phosphate solubilization, and the production of various compounds such as phytohormones or indirect mechanisms such as the production of siderophores [3]. In addition, the quality of plants and fruits can be improved these microorganisms can mobilize nutrients for plants, influence the hormonal balance of plants or produce microbial inhibitors that prevent the growth of phytopathogens [1,3-5].

To achieve both goals of promoting plant growth in legumes and non-legumes and human health benefits, it is necessary to use non-pathogenic microorganisms in biofertilization programs [6]. Human nutrition is a serious problem nowadays due to various factors including economic, energy and political factors. In developing countries, legumes and cereals are the main, and sometimes the only one sources of proteins for human nutrition [7]. Legumes have the ability to fix atmospheric nitrogen by establishing symbioses with nitrogen-fixing bacteria, called rhizobia, which can convert atmospheric di-nitrogen into ammonia that is available for plants [4,7-9]. Inoculation of a legume with rhizobia leads to metabolic changes in the plant, of which the mot studied to date are the increase in nitrogen and protein content and has used in agriculture to improve the yield of various legumes, reducing the use of chemical allowing health and environmental protection [10]. In recent, the study of other legume components more related to the human health has gained interest. In addition to high-quality proteins, legumes contain several bioactive compounds such as polysaccharides, bioactive peptides, phenolics, including isoflavones, carotenoids, tocopherols and fatty acids, as well as other phytochemicals, which make legumes excellent functional foods and include them in nutraceutical products [11]. The studies on the effect of rhizobia inoculation on legume bioactive compounds have been conducted in edible legumes, with particular emphasis on the studies conducted in soybean, given the economic importance of this legume worldwide. Couto [9] reported that inoculation of Glycine max with Bradyrhizobium japonicum increased the content of phenolic compounds and organic acids. The same was observed for volatile compounds, although compounds such as linalyl acetate, menthyl acetate and α-farnesene were detected only in inoculated plants. The phenolic extracts showed stronger antioxidant capacity than the extracts from organic acid. In addition, extracts from plants inoculated with B. japonicum exhibited significantly higher antioxidant activity than control samples. In addition, inoculated seeds had higher total fatty acid content, which was due to an increase in monounsaturated (MUFA) and Polyunsaturated Fatty Acid (PUFA) content [8]. Similar results were observed after inoculation of chickpea (Cicer arietinum) with a Mesorhizobium strain which did not cause a significantly increase in antioxidant potential, but significantly increased the content of flavonoids in the seeds [12]. Considering the economic importance of soybean around the world, experiments on soybean have been highlighted.

Strains of different Rhizobium species have also been reported to act as root colonizers and plant growth- promoters in some vegetables, such as pepper (Capsicum annuum) [5,13], tomato (Solanum lycopersicum), lettuce (Lactuca sativa) and carrot (Daucus carota) [6,14]. Flores Félix [1] showed that Phyllobacterium, phylogenetically related to the Rhizobiaceae family, promotes the growth of strawberry, one of the most important berry fruits consumed in European. Also, this strain was able to improve the content on vitamin C on fruit, been this compound the main organic acid involved in antioxidant activity of this fruit. In another study with strawberries, Flores Félix [15] investigated the effects of inoculation of strawberry plants with strain PEPV16 of Rhizobium sp. from the phylogenetic group of R. legumin Sarum. The results showed that PEPV16 promoted strawberry growth by significantly increasing the number of stolon's, flowers, and fruits, had higher concentrations of Fe, Zn, Mn, and Mo, and also had higher concentrations of organic acids, such as citric and malic acids, and lower amounts of ascorbic acid than fruits, compared with uninoculated controls. Biofertilization with rhizobacteria can increase the yield and quality of legumes and non-legumes, helping to protect human health and the environment.

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