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Opinion

Improving Soil Quality Can be the Most Effective Way to Promote Plant Growth

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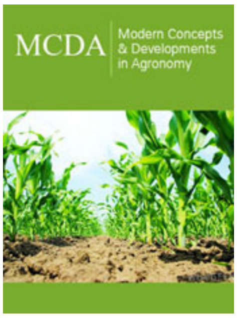

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Introduction

In the last decades, many efforts have been made to achieve a more sustainable agriculture, resulting from the economic and environmental needs of increasing food production with lower inputs of fertilizers and pesticides. In this context, there is a growing interest in exploring the beneficial activity of microbes, especially rhizosphere bacteria, collectively known as plant growth-promoting rhizobacteria (PGPR). Several studies have shown that many bacterial strains, belonging to different genera, isolated from soil and rhizosphere of plants, can effectively promote plant growth by means of direct and indirect mechanisms [1]. Despite the indisputable importance of PGPR for sustainable agriculture, the availability of inoculants for farmer scale is still scarce. The rising number of studies demonstrating the efficacy of new PGPR strains in many crop species does not result in a proportional rise of new inoculant products. In Brazil, a country with a long history of research and use of inoculants, there are only 12 PGPR strains authorized for the production of inoculants, which are recommended for only four species: rice, wheat, maize and eucalyptus [2]. This situation remains unchanged since 2011, although the efforts of numerous research groups. In the rest of the world, the situation is not much different. Some of main constraints to make available new inoculant products are linked to complex regulatory policies in each country [3]. Moreover, PGPR inoculants often show problems of stability during formulation and storage stages [3] and even registered PGPR inoculant products may have variable efficiency depending on soil, climate and plant genotype [4].

At the same time that inoculant registration and production still have some limitation, beneficial microbes are present in every soil and can be stimulated by proper management practices. The use of crop rotation, conservation tillage and fertilization management practices that improve soil quality can boost the microbial activity of the soil, resulting in benefits for plant development. Microbial processes, such as the control of plant pathogens via soil suppressiveness, the production of plant growth regulators, the solubilization of nutrients and the nitrogen fixation, are affected by edaphic conditions, which can be molded by soil management [5]. Usually, management practices that increase soil organic matter levels will also increase microbial biomass and activity and, consequently, soil suppressiveness. Other microbial processes, although they may also be favored by the increase in soil organic matter, have a more complex relationship with edaphic attributes. Nitrogen fixation rates, for instance, seems to be more influenced by the diazotrophic community structure than by soil characteristics [6]. So, to take full advantage of some soil plant-growth promoting activities, it is necessary to identify the microbial keystone taxa, which drive community composition and function, and elaborate strategies to modulate their abundance and diversity.

The concept of keystone taxa and the attempts to understand their complex metabolic and functional network in order to influence its composition are a recent topic in soil microbiology. They are the result of the so-called microbiome revolution [7] brought about by the fast advances in sequencing technology and bioinformatics analysis.

These techniques, which in a first moment were restricted to the academic environment, allowed the identification of keystone taxa and their influence on microbiome structure and functioning. Furthermore, allowed the establishment of the relationship between the microbiota, root-exuded specialized metabolites [8], soil properties and crop productivity, with predictive possibilities [9]. Gradually, as high-throughput sequencing technologies are getting more efficient and affordable, they trend to become routine analysis whose results will be directly available to farmers in a comprehensive way. Consequently, it will be increasingly possible to obtain refined microbiological indicators of soil quality that may prove to be equally useful as the current widely employed estimations of physical and chemical soil properties. By knowing the relationship between soil chemical and physical attributes, microbiome composition and function, and crop productivity, farmers will be able to make a decision in the direction of increasing the diversity and abundance of desirable microbial groups. With this information, farmers will be able to choose the most appropriate management, in order to build up a "plant grow-promoting soil" by shaping the soil microbial community to take advantage of its beneficial activities.

References

1. Saturnino HM, Pacheco DD, Kakida J, Nagashi T, Gonçalves NP (2005) Culture of Jatropha (*Jatropha curcas* L.). Agricultural Report 26(229): 44-78.
2. Nery AR, Rodrigues LN, Silva MBR, Fernandes PD, Chaves LHG, et al. (2009) Growth of Jatropha irrigated with saline water in a protected environment. Revista Brasileira de Engenharia Agrícola e Ambiental 13: 551-558.
3. Drumond MA, Santos CAF, Oliveira VR De, Martins JC, Anjos JB Dos, et al. (2009) Agronomic performance of different genotypes of physic nut in the semi-arid zone of Pernambuco state. Ciência Rural 40(1): 44-47.
4. Veras RP, Laime EMO, Fernandes PD, Soares FAL, Freire E De (2011) Plant height, stem diameter and production of jatropha irrigated under different salinity levels. Revista Brasileira de Engenharia Agrícola e Ambiental, Campina Grande, Brazil, 15(6): 582-587.
5. Carvalho CMde, Marinho AB, Viana TV De A, Valnir Júnior M, Gomes Filho RR, et al. (2015) Efficiency of water use in jatropha production in the northeastern semi-arid region. Revista Agrarian, Dourados, 8(29): 296-303.
6. Oliveira IRS, Oliveira FN, Medeiros MA, Torres SB, Teixeira FJV (2010) Initial growth of *Jatropha curcas* L. as a function of irrigation water salinity. Revista Caatinga, Mossoró, Brazil, 23(4): 40-45.
7. Padilha N, Silva CJ, Pereira SB, Silva JAN, Heid DM, et al. (2016) Initial growth of physic nut submitted to different water regimes in dystrophic haplustox. Ciência Florestal, Santa Maria, Clarifornia, 26(2): 513-521.
8. Teixeira LC (2005) Potential of biodiesel production with oil seed native species from Rondônia, Brazil. Informe Agropecuário, Belo Horizonte, Brazil 26(229): 18-27.
9. Antunes FZ (1986) Climate characterization of the state of minas gerais. Informe Agropecuário 12(138): 9-13.
10. Ferreira DF (2000) Statistical analysis using Sisvar for Windows version 5.3. In: 45th Annual Meeting of the Brazilian Region of the International Society of Biometrics. UFSCar, São Carlos, SP, Brazil, pp: 255-258.
11. Albuquerque WG, Beltrão M, Freire MAO, Azevedo CAV (2009) Evaluation of jatropha growth as a function of time, when subjected to water levels and nitrogen fertilization. Revista de Biologia e Ciência da Terra, Campina Grande, Brazil 9(2): 68-73.

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