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Crop-Specific Beneficial Root-Associated Microbes from Different Geographical Regions, When Used Collectively, May Prove More Effective Than Those from A Single Location for Enhancing Crop Yield and Food Quality for A Healthy Gut: A Futuristic Approach

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Abstract

The quality of food being consumed may affect the population and functionality of gut microbes, as prebiotics. The effect of food quality grown under natural conditions or inorganic crop production conditions on the gut microbiome is not yet well studied. The food produced under inorganic inputs like fertilizers and pesticides has an adverse effect on gut microflora, and therefore, food produced under organic crop production inputs and crop-specific microbes will help in a healthy gut. Crop-specific inter-regional/continental root-associative collective beneficial microbial consortia may prove a boon for the yield enhancement and food quality, and to lessen the dependency on the inorganic fertilizer inputs, rather than the regional/local non-specific crop bio-fertilizers. Why these can be so important and beneficial is discussed in this opinion article.

Keywords: crop-specific; root-associated microbes; food quality; gut microbes

Introduction

The quality of food consumed may influence the population and function of gut microbes, similar to prebiotics (Ercolini and Fogliano, 2018). The impact of food produced under natural conditions compared to inorganic crop production on the gut microbiome has not been thoroughly studied (Ranadheera et.al, 2021). Food grown with inorganic inputs like fertilizers and pesticides can negatively affect gut microflora (Matsuzaki et.al, 2023), while food produced with organic crop inputs and crop-specific microbes may support a healthier gut. A new concept of human gut microbes assisted agricultural food production for better human health was suggested (Borkar, 2023). To produce the organic food, an array of plant-associated microbes, including the soil microbes, may be of immense use.

Soil microbes are an integral part of the root system in the rhizosphere (Gifford et.al, 2024) during different plant growth stages from seed germination to the crop harvest. These root-associated microbes (RAM) may be specific to the crop plants/ varieties and play an important role in all the physiological processes of crop plant growth (Wang et.al, 2024) due to their plant growth-promoting (PGP) activities. However, these crop-specific RAM may vary among geographical regions, soils, and environments across the regions in country or the continent. Such crop growth-promoting rhizobia known as PGPR/bio-fertilizers are used in agricultural production systems during the last 3 to 4 decades (Zhang et.al, 2024), but their use is limited and the technological spread on the large cultivation areas is a dream to realise.

A single crop, say for example rice, wheat, or maize, is cultivated across the globe in diversified soils and environmental conditions. The crop-specific PGPR of these crops in the diversified locations may be different or variable, but they have an affinity to that particular crop. All such crop-specific PGPR of a particular crop from diversified areas of the crop, when applied together, as a bio-inoculant of that crop, may exert the cumulative effect of such a combo bio-inoculant on the crop growth promotion activities and may also reduce the dependency on the inorganic input (Borkar, 2023) for crop cultivation. Those crop-specific combo bio-inoculants derived from different regions of a country, or intercontinental areas, have not yet been studied/tested anywhere. These are the crop beneficial microbes associated with a particular crop across the country, region, or continent (Borkar, 2015).

It is important to note that several crop plants, which originated in some other country, have been brought and domesticated in different countries of the world. Though these crops and seeds were brought from their native area of cultivation to the far-off places

across the globe, the native beneficial PGPR associated with these crops were never brought with these crops. The beneficial microbes are crop-specific, and the microbial strains associated with these crops in their native place of origin may be different than those which we are using now in the country of their domestication. Therefore, it is worth gathering all such beneficial microbial strains associated with the crop at their place of origin and the places of crop domestication. When all such beneficial microbial strains are prepared in a combo bio-inoculant for that crop, their results may be more than our expectations. Since these are the crop-associated beneficial microbial strains, they may not be harmful or hazardous in that crop cultivation system or to the ecology and environment. The crop-associated beneficial microbes are not yet reported to be pathogenic to crops, humans, or animals (Borkar, 2022a). Therefore, the risk of collecting such beneficial microbial inoculants of the particular crop from far-off places is negligible from the plant quarantine point of view (Borkar, 2022 b). If not at the inter-continent level, it should be collected at a state or national level to prepare a combo of crop-specific PGPR to derive their benefit to a greater extent. The crop produced by the use of such beneficial crop-specific root-associated microbes derived from different regions may be useful to enhance the crop yield as well as food quality, necessary for better gut health and gut microbes.

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