# Assessing the impact of organic amendments on the structural and functional diversity of rhizospheric bacteria and soil health

Agriculture, a key contributor to the growing Indian economy, is facing significant challenges in meeting the needs of a rapidly expanding population. The prevalent use of synthetic fertilizers in conventional farming, while boosting productivity, has exacted an environmental toll due to indiscriminate agrochemical usage. Responding to this, a shift towards sustainable practices like organic farming has gained traction, emphasizing reduced agrochemical dependency, biodiversity enhancement, and climate resilience. Organic amendments have demonstrated benefits, fostering microbial activity, enhancing soil quality, and promoting plant development. Aligned with UN Sustainable Development Goals, organic farming embodies a more environmentally friendly agricultural system. The current study evaluated three cycles of the pigeon-wheat cropping system (PWCS) under conventional and organic farming systems in field experiments (over a period of four years). Employing a polyphasic approach, encompassing physicochemical assessments, traditional microbiological techniques, and advanced molecular tools, the research aimed to unravel the intricate dynamics of agricultural management on plant growth and soil health, particularly focusing on the rhizospheric bacterial community. Initial screening of manure samples across seven states aimed to understand antibiotic resistance patterns, raising concerns about its prevalence in organic amendments due to intensive farming practices. The study revealed a correlation between bacterial abundance, nutrient concentrations, and antibiotic resistance in manure, emphasizing a potential link between farming intensity, antibiotic usage, and resistance prevalence. The subsequent field experiments demonstrated that while conventional treatments outperformed in terms of plant growth and nutrient acquisition, organic farming significantly enhanced total bacterial abundance and improved rhizospheric bacterial community structure and function potential for both crops. However, a notable increase in antibiotic-resistant genes associated with manure amendments underscored the need for responsible management practices. The study concluded that the complex interplay between agricultural practices, plant and soil health, rhizospheric bacterial communities, and antibiotic resistance necessitates a comprehensive and sustainable approach to effective crop management.