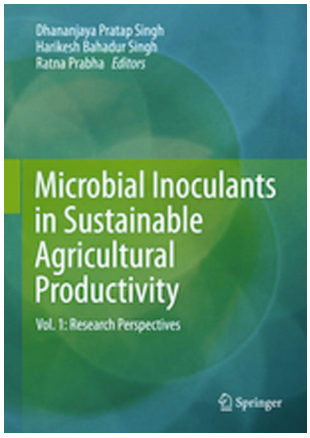

Microbial Inoculants in Sustainable Agricultural Productivity, Vol. 1: Research Perspectives. Dhananjaya Pratap Singh, Harikesh Bahadur Singh and Ratna Prabha (eds). Springer, New Delhi. 2016. xviii + 343 pp. Price: 139.99€/ £104.50/US$ 179.00. ISBN: 978-81-322-2645-1

Sustainable agriculture is one of the key target areas of research around the globe. With ever-increasing population, there is huge pressure on ever declining fertile soils to produce more and more food. The quality and quantity of productive soils have declined drastically in the last fifty years or so, attributed mainly to the indiscriminate use of chemicals such as pesticides and fertilizers. Apart from direct impacts on animals and humans, these chemicals have resulted in loss of soil organic content and microflora, both useful for the growth and development of plants. Research has shown that healthy soils have vigorous populations of useful plant growth promoting microbes (PGPM) in comparison to barren soils. Hence it is quite apparent that there is an urgent need to replenish the soils which have now become deficient in PGPM and also augment the normal agro-ecosystems with these useful microorganisms. PGPM can help the plants in various ways, and in the last few years researchers and industries have come up to utilize them for providing nutrients and protection to the crops. Advancement in understanding the key mechanisms involved in plant–microbe interactions has provided a new vision to enhance the quality and quantity of yields in a sustainable manner. Diverse soil beneficial microbes are now being used in the form of bioformulations for enhancing the growth of plants and protection from phytopathogens. With advancement of biotechnological techniques and bioengineering tools novel bioinoculants with better delivery systems and release options (of the introduced microbe) in a protected manner are now being developed. This has resulted in upswing in production of bioinoculants. Despite all the advantages, bioinoculants still are a miniscule part of the total inputs in agroecosystems. In this context, the book under review can be useful in providing comprehensive knowledge on the role of useful soil microbes and development of bioinoculants from them, to tackle the issues of soil fertility, control of pests and plant diseases, enhancement of yields and remediation of contaminated soils in a sustainable manner. The book systematically describes the utility and production of bioinoculants. The latest techniques involved in the production of bioinoculants and future course of research in development of reliable technology are also discussed in detail. The editors have tried to cover the information on this huge subject area with the help of well-known researchers who have contributed in this tome. The book has nineteen chapters and it is interesting to note that it covers basic research strategies to identify the PGPM and low input high through-put techniques for development of bioinoculants.

The chapters are well-edited and written in a way that non-experts can also understand. Chapter 1 starts by discussing techniques used for the characterization of agriculturally important bacterial strains. The authors emphasize on the use of conventional and molecular tools to identify potentially useful strains. It is important to first recognize the abilities of isolated strains and then classify their use as biofertilizers or biopesticides. The authors also discuss the mechanisms of action of different plant growth promoting rhizobacteria (PGPR). Chapter 2 stresses on the use of consortia-based bioinoculants for improving the crop yield, particularly for the abatement of abiotic stresses. Studies on signalling among plant–microbe–microbe can be useful for development of future bioinoculants. Endophytes, microbes which reside in the plant tissues, help them in a number of different ways. Chapter 3 provides insight into various plant growth promotion (PGP) and biocontrol traits of endophytes. A lot is yet to be discovered regarding the plant–endophyte relationship. The authors raise several queries such as signalling amongst the host and the symbiotic partner, nutrient balance, exact mode of action of endophytes in plants, production of useful metabolites and so on, which need to be studied to explore this wonderful association. The revelation of core mechanisms involved in plant–microbe interactions is a big issue for the development and success of microbial inoculants. Recently the use of 'omics' approaches has strengthened our knowledge regarding the plant–microbe interactions. The high-throughput omics-based techniques including genomics, transcriptomics, proteomics and metabolomics should be used to study the structural and functional aspects of genes taking part in plant–microbe interaction. These tools as emphasized in chapter 4 can go a long way in determining the genes and metabolite expression and induction during plant–microbe interactions, which can be exploited to control plant diseases and enhance the productivity even under stress conditions. It is now clear that before developing bioinoculant formulation, the taxonomic characterization of the microbes involved is essential, but conventional approaches cannot be relied upon for complete identification. Chapter 5 emphasizes on the use of polyphasic approaches for identification of microbes to be used as bioinoculants. Authors also highlight the lack of proper taxonomic classification in case of cyanobacteria and fungi and mention that because of this, there can be problems related to the quality of bioformulations. Chapter 6 also describes various approaches employed in identification and characterization of culturable microbes suitable for bioinoculant preparation. The chapter also emphasizes on the identification of non-culturable microbes present in rhizosphere and soil, as they form a much bigger pool in the agroecosystems and must be playing several important functions. Chapter 7 describes the diversity and roles of endophytes in plant growth stimulation, biological control and bioremediation. Exploitation of endophytes and development of consortial bioformulation from them with multiple activities can be the futuristic approach as mentioned in the chapter. Arbuscular mycorrhizal fungi (AMF) are well known for their mutualistic association with a wide variety of plants. Chapter 8 emphasizes on the utilization of AMF in enhancing crop productivity. It

is proved by several studies that application of consortia of AMF and PGPR is far more effective in protecting the plant and increasing the yields. Oilseed crops are of considerable agricultural importance and amongst them peanut is the fourth most significant crop of the world. However, every year a significant portion of this important oilseed crop is damaged by various phytopathogens. Chapter 9 describes the use of pseudomonads and *Trichoderma* as biopesticides in controlling the fungal pests of peanut in an ecofriendly manner. Chapter 10 provides an overview of submerged cultivation methodologies for mass scale production of pseudomonads, which can be used in multi-dimensional ways to enhance the crop quality and yields. The chapter outlines the fed batch cultivation techniques for obtaining higher population and metabolite concentrations. Chapter 11 provides an overview of the diverse microbes being used as biofertilizers and biopesticides. This chapter also reports the mechanisms and working of PGPM. Chapter 12 deals with the importance and efficacy of using PGPM as biopriming agents for abating biotic and abiotic stresses. Biopriming helps the plant at the initial stage and can be useful in controlling phytopathogens, including fungi and nematodes. The chapter stresses on the use of diverse PGPM as biopriming agents according to the requirement of plant and the conditions. *Azotobacter* is a well-known free living nitrogen fixer being used as a biofertilizer. Chapter 13 describes the diverse roles that *Azotobacter* can play, if used as bioinoculant. An interesting input is the ability of *Azotobacter* strains in degrading pesticides. Chapter 14 provides an update on beneficial effects and molecular diversity of endophytic bacteria of legumes and non-legumes. It is mentioned that endophytes can be far more effective in comparison to other rhizospheric bacteria. However, there is lot more to be explored in the endophytic world. Chapter 15 is focused on multidimensional utility of an important PGPR, *Pseudomonas fluorescence*. The chapter provides in detail the mechanism of action of *P. fluorescence* in plant growth promotion and biocontrol of phytopathogens. Plant pathogenic nematodes such as *Meloidogyne* spp. are one of the most economically destructive pests of a wide variety of crops and are pandemic. Chapter 16 discusses the use of bacterial and fungal antagonists in management of nematode infestation. It is highlighted that use of local or indigenous biocontrol strains will be more suitable to manage the nematode infections. Chapters 17, 18 and 19 provide an overview of the use of PGPM for sustainable agriculture. Shortcomings due to which the bioinoculants are lagging behind are also discussed. These chapters also mention the improvements that need to be made to develop confidence amongst the farmers for the use of bioinoculants. Authors also give an insight for future research in the field.

Largely, the book is an admirable work in the field of agricultural sustainability. The topics covered present a multidisciplinary approach in solving various agricultural problems related to yields, quality of produce, phytopathogens, bioremediation and stress management in an ecofriendly manner. The only blemish is that the chapters may have been better organized and repetition could have been avoided. Overall we would recommend this book as a valuable reference for researchers working in the field of plant–microbe interactions and development of bioinoculants. The book can also be useful for the industry people and education institutes related to agriculture, soil microbiology and biotechnology.

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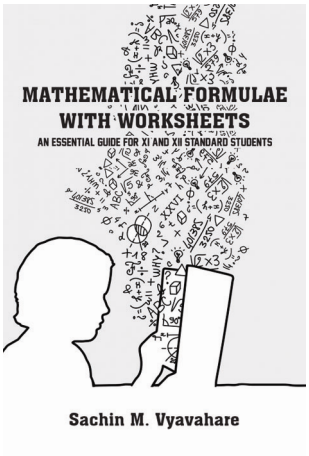

Mathematical Formulae with Worksheets: An Essential Guide for XI and XII Standard Students. Sachin M. Vyavahare. Notion Press, Chennai. 2016, xx + 184 pp. Price: Rs 225, ISBN: 9789386009876

The Times of India carried an article on 9 May 2015, bearing the caption 'Delhi students weak in maths: NCERT survey'. On 14 March 2016, it carried an article 'Very lengthy CBSE mathematics paper stumps students'. A number of students find mathematics to be a difficult subject. Nonetheless, it may not be an exaggeration to say that basic knowledge of mathematics is essential for survival in the present technology-driven world. In fact, mathematics invades, pervades and integrates subjects such as physics, chemistry, economics, accounting, finance, research, management and analytics. The Italian astronomer–physicist–mathematician–philosopher Galileo Galilei once said, 'Mathematics is the language in which God has written the universe'.

Formulae are the cornerstone of mathematics. The book under review dwells on scientific methods which will help the learner in comprehending, learning and recalling several formulae in mathematics. In the initial pages of the book, Sachin Vyavahare has explained that there are *three* basic formulae in trigonometry and *all* the other formulae in trigonometry (for instance, double-angle formulae, triple-angle formulae, half-angle formulae, factorization formulae, de-factorization formulae) can be derived from the *three* basic formulae only! The book explains that there are some formulae in mathematics which have to be applied from left-hand-side to right-hand-side, some have to be applied from