

its relative ranking in global perspective. Extensive data have been provided with respect to growth of research publications during the last decade in peer-reviewed journals in different disciplines, their citation impact, number of active researchers, national and international patents, industrial designs, etc. Data reveal large increase in absolute numbers as well as relative contributions (in global perspective) in research publications from India, with only a few states in the country contributing more than 75% of research paper output. While India's share of global publications in 2010–11 was 3% compared to 1.9% during 2000–05, the share of highly cited papers increased from 0.3% in 2000 to 0.6% in 2011. Although an analysis based on Indian Science Abstracts shows agriculture to be the dominant research output field during 2005–2009, a similar analysis of the SCI-E database during the same period reveals the Indian contribution in agriculture to be much lower in global perspective. Similar trends are seen in mathematics, suggesting that many of the published research papers do not meet the internationally accepted quality.

While the number of researchers in the country is increasing, data on the number of active researchers, i.e. those with sustained scientific publication record, suggest high drop-out rates. Likewise the age profile of scientists working in India when compared with PIO also appears less favourable. The large number of PIO with excellent S&T credentials contrasts with limited performance of majority of those continuing in the country.

An analysis of the newspaper coverage of S&T developments, which has a strong potential in developing informed public awareness and involvement in national issues, reveals that possible negative consequences of technologies or environmental health issues, ethical–legal issues, or issues relating to patentability, regulations or standards, etc. are hardly discussed.

An increasing trend in the national as well as the US patents has been accompanied by a substantial increase in the base of inventors and assignees. However, most of the Indian patents appear to be in areas where the underlying science is already known. It is suggested that better organic linkages between R&D, university and industry would promote long-term research collaboration and

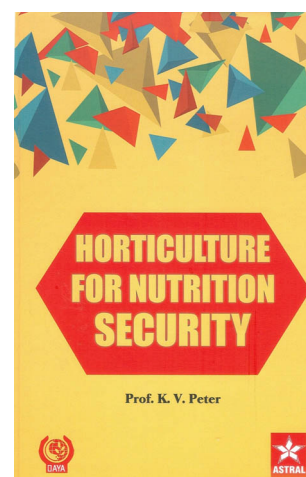
permit the industry to appreciate the necessity and complexities of fundamental research and the time-lag between a discovery and its application and delivery. This would also let the scientists appreciate the realities of commercial production with a greater sense of timeliness, accountability and deliverables. Without such partnerships and mutual realizations, mere streamlining of IPR in universities may not really boost industry–academia interactions.

A serious limitation of the present data analyses is the lack of integration between the large numbers of chapters dealing with similar or inter-related issues. For example, the research publications as indexed in SCOPUS and in ISI-WOK are discussed completely independently, without any crosstalk. The output and utility of the various datasets and their analyses would certainly have been significantly more informative and useful to readers/policy-makers if the editors and authors had attempted integration. The other limitation is the varying time periods for which the different sets of data have been examined in different chapters. This limits not only integration, but also precludes meaningful comparisons. The Index provided at the end is limited and therefore, is of limited value to a reader seeking data pertaining to a specific issue. The relatively few typos and grammatical errors could also have been avoided with a little more care.

The book is a rich source of data and their analyses and would obviously be of wide use, especially for policy-makers and analysts in various fields. Others who may be interested in seeking information on limited scale would also find this compilation useful.

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**Horticulture for Nutrition Security.** K. V. Peter (ed.). Daya Publishing House, A Division of Astral International Pvt. Ltd, 4760-61/23, Ansari Road, Darya Ganj, New Delhi 110 002. 2015. lxiii + 478 pp. Price: Rs 2995.

The book under review is an edited book with 4 preambles and 21 papers each referred to as a chapter. A few of the preambles and articles are not relevant to nutrition security through the consumption of vegetables and fruits. In the introduction, the editor refers to the three 'As' (*availability* of food, *access* to food and *absorption* of the ingested food) which ensure the food security at the individual household level. In his foreword, V. L. Chopra observes that vegetables and fruits which are rich sources of micronutrients (iron, iodine, zinc, vitamin A, vitamin B complex, vitamin D, etc.) are not consumed in the minimum recommended quantities on *per capita* basis in India. Therefore, the primary issues for discussion in the book should have been the pathways to enhance both the 'availability' and the 'access'. Unfortunately, none of the preambles and the chapters elaborates the means to achieve the goal. Chopra also refers to Swaminathan's concept of 'providing a horticultural remedy for every nutritional malady'; unfortunately, the book has little to do with it. As it stands, the book is a collection of assorted articles chosen by the authors in their own domain of expertise. The preamble I (Food and Agriculture Organization of the United Nations) 'The state of food and agriculture 2014 in brief: Innovation in family farming' and the preamble II (Micro-nutrient security for India: Priorities for research and action – Report by

INSA, New Delhi) provide useful information. Few of the chapters have some bearing on these two preambles. In chapter 2 on 'Economics of family farming', Peter *et al.* provide statistics on the under-nourished people in China and India during 1990–1992 and 2009–10. More appropriate would be to provide statistics of the 'malnourished' than the 'under-nourished' people. The purpose of reference to 'Green Revolution' in the context of family farming to fight 'hidden hunger' (i.e. micro-nutrient deficiency) is questionable. The chapter 3 on 'Nutritional garden' in the context of nutritional security (Indira and Peter) provides relevant data on the nutritional composition of various vegetables per 100 g edible portion. The chapter 19 on 'Indigenous leaf vegetables' (Sadhankumar *et al.*) brings out how leaf vegetables rich in micronutrients and vitamins could fight 'hidden hunger' at a reasonably affordable cost. The chapter 20 on 'Potatoes on nutritional security' (Singh *et al.*) aptly describes the potato as a 'cocktail of minerals and antioxidants'. It is a low energy diet rich in carbohydrates, proteins with essential amino acids, vitamin C and vitamin B complex. The caution against acrylamide in potato chips and French fries is relevant.

The chapter 6 on 'Vegetables and our health' (Singh *et al.*) provides valuable guidance to alleviate micronutrient deficiencies. Starting with a list of common vegetables containing folic acid, it elaborates the contents of one or more essential micronutrients in wide ranging vegetables. That several commonly-consumed vegetables may also contain anti-nutritional compounds/toxicants is eye-opener. The lesson is that a balanced diet is the key to good health. The chapter 8 on 'Food supplements to complement urban food security' (Peter and Bonny) suggests a practical approach to combat the nutritional maladies by promoting urban and peri-urban farming as well as nutrition garden/kitchen garden/backyard garden and similar programmes. The idea of disseminating the nutrition education to housewives through 'Kudumbasree' women self-help group (SHG) is laudable.

The preamble III is the Policy Paper No. 30: 'Organic farming approaches and possibilities in the context of Indian agriculture' issued by the National Academy of Agricultural Sciences (NAAS), New Delhi, serves little useful purpose. Sig-

nificantly, this policy paper omits essential aspects of organic farming such as its four cardinal principles enunciated by the International Federation of Organic Agriculture Movement (IFOAM). These principles are: (i) enhancing the health of soil, plant, animal and human species, (ii) working with living ecological systems and cycles, (iii) fairness in terms of social and gender equity, and (iv) precautionary principles to safeguard health and environment. Any failure to adhere to any of these principles would result in the denial of the 'organic certification'. Resource-poor small and marginal farms, often 'organic' by default, might lose the benefit of organic trade, if the abovesaid principles are not adhered to. The chapter 4 on 'Good agricultural practices and organic farming' (Peter *et al.*) also ignores the principles of organic farming. The chapter 5 on 'Organic spices' (Suma and Pradeepkumar), however, refers to the principles of organic farming and provides useful advisory for the spice farmers to switch over to organic farming for attractive economic profits in the export market.

The Policy Paper No. 7 – 'Diversification of agriculture for nutrition' issued by NAAS has a specific purpose in the development of sustainable agriculture and rural development. However, its relevance to theme of the book is not clearly brought out.

The chapters 11, 12 and 15 dealing with abiotic stresses in horticultural crops are both complementary and supplementary. The chapter 11 on 'Rootstocks for abiotic stress management in fruits' (Mitra and Irenaeus) describes the various kinds of abiotic stresses and how the different kinds of rootstocks specific to the species could confer tolerance. On a fundamental side, the authors present an interesting discussion on the mechanisms of plant response to abiotic stress. The chapter 12 on 'Abiotic stress tolerance in horticultural crops' (Bahadur and Singh) provides data on the critical tolerance limits of various vegetable and fruit crops to the abiotic stresses caused by high temperature, low temperature (freezing), water stress (drought), flooding (water logging), light of varying intensity and quality, salinity stress, etc. This paper is indeed a treatise on abiotic stress and its science-based management. Major biochemical and physiological parameters of abiotic stresses are appropriately discussed. The chapter 15 on

'Resistance to abiotic stress in vegetable and spices' (Peter *et al.*) provides data on the soil and climatic requirements of some of the vegetables and spices and also a list of a few drought-tolerant varieties of vegetable crops. This chapter elaborates the different stress-causing agents and the role of grafting in promoting tolerance to abiotic stress. However, the reference to 'QTL' and 130 drought-responsive genes in *Arabidopsis thaliana* seems out of place especially when it is not properly integrated with the sustainable management of drought in vegetable and fruit crops. Under grafting (page 337), in para 3, the last sentence reads, 'Transgenics can also be used as rootstocks (TRANSGRAFTS) for imparting resistance to abiotic stress where GMOs are not permitted'. If it is the view of the authors, it needs to have been substantiated. Or else, appropriate references should have been given.

The chapters 13 and 14 on 'Shelf-life of fruits and vegetables – interventions to prolong' (Pal and Maity) and on 'Physiology of spoilage of temperate fruits' (Bakshi *et al.*) respectively are related to the post-harvest deterioration during storage. The paper by Pal and Maity is interesting, as it brings out the relationship between respiration rates of various vegetables and fruits and their storability considering the influence of storage atmosphere. It is informative to note that the 'anabolic' and 'catabolic' reactions are a consequence of a 'biological clock' controlled by genes. The reference to the



Noni (*Morinda citrifolia* L.) – bearing tree.

'Pusa zero energy cool chamber' is quite appropriate, and the awareness of this should reach the small and marginal farmers. The paper on 'Physiology of spoilage of temperate fruits' (Bakshi *et al.*) comprehensively discusses the chemical changes responsible for spoilage of the temperate fruits as well as the biotic spoilage. Reference to toxigenic fungi commonly found in dried apricots, dates and prunes provides a note of caution to the consumers. Mycotoxins such as ochratoxin (OTA), aflatoxin B and others produced by several fungal species belonging to *Aspergillus* sections *Circumdati*, *Flavi* and *Nigri*, not only cause spoilage of dried temperate fruits but also possibly induce carcinogenesis in a few of the consumers. These are of academic and applied interest.

The chapters (No. 16 on 'Azadirachtin: its structure and insect activity' (Usha Rani), chapter 18 on 'Environment – sensitive-male-sterility in some food crops' (Saxena and Bharathi) and chapter 17 on 'Nanoparticles for crop production' (Tarafdar)) are of questionable relevance to the role of horticulture in nutrition security. The azadirachtin extracted from neem seeds is effective against rice moth and several sucking pests. The chapter 18 discusses different kinds of male-sterile systems in plants, but a striking omission is the exploitation of 'hybrid vigour' in vegetatively propagated horticultural crops. The chapter 17 on 'Nanoparticles for crop production' (Tarafdar) is quite out of place. The handling of nanoparticle technology in India without concurrent focus on its toxicological dimensions is fraught with serious consequences. The foliar application of nanophosphorus possibly enhances the yield of crops, but the consequences of increasing concentration of nanoparticles in the atmosphere, land and aquifers are poorly understood. The last chapter No. 21 on 'Urban and peri-urban agriculture (UPA) for food and nutrition security' (Peter and Bonny) is a collection of random thoughts haphazardly put together. It starts with Millennium Development Goals (MDGs) and jumps into biotechnology and nutraceuticals. The authors refer to the genetically engineered 'Flavr Savr' tomato, possibly unaware that it was indeed the first and most miserably failed GM crop! It was put in the market in 1996–97 in a few states across the US, only to be surreptitiously removed within a year. Toxicological tests had revealed

adverse biological effects. It had been cleared on the basis of unscientific 'substantial equivalence'. The wisdom of 'precautionary principle' was ignored. The reference to golden rice 'Swarna' is premature.

In a nutshell, the book has a few well-written meaningful chapters. However, some of the irrelevant preambles and chapters diminish its focus on the theme. Had the chapters of the book been based on the concept of providing 'horticultural remedies to the nutritional maladies', its impact on both horticulture and nutrition security would be far greatly immense.

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**Seismic Activity: Indian Scenario.** Buddha Ramalingeswara Rao, Buddha Publisher, Hyderabad. 2015. 656 pp. Price: Rs 2700. ISBN: 978-93-5196-697-5.

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At the outset I congratulate the author for a stupendous effort in collating information starting from Vedic times to present day. It requires a monumental effort to collect such information, pertaining to the most complicated natural hazard – earthquake. The effort assumes greater significance as Rao has gathered the historical data from various archival sources in order to have comprehensive data coverage. As applicability of any area-specific building code needs information pertaining to maximum credible earthquake, especially in different seismic regions, his focus on providing needed information deserves due recognition. As Himalayas continue to be active and significant deformation is noticed in Narmada–Son lineament, Kutch and even in SGT, the area-specific and event-specific information provided in this book is useful to effectively plan collection of additional data and to periodically upgrade hazard evaluation.

The book is divided into 9 chapters. In addition there are 6 appendices.

In the first chapter on 'Historical developments in seismology' a significant

effort has been made to cover various aspects starting from early Ideas on earthquakes and ending with paleoseismological Studies in India. This chapter has 16 subsections. It is good that the 38-page long chapter has details of general interest, including a write up on 'What is an earthquake'. Although the chapter contains significantly useful information, its structuring could have been better organized. Rao may keep this in view in structuring second edition, which I am sure will come out in due course, on demand from learned scientific and technical community.

In the second chapter on 'History of Indian Earthquakes', more than hundred pages in length, the author has succeeded in explicitly bringing out various facets of the history of Indian earthquakes. It is subdivided into 7 subsections. I am impressed by the contents in the subsection 'History of Indian earthquake catalogues'. Rao has provided references of more than 120 case studies. This information will be of immense help to researchers. Other subsection that caught my attention is 'Narration of historical earthquakes in Himalayas'. As Himalayas cover a span of about 5000 km and as almost entire belt has experienced seismic activity since time immemorial, the narration helps in having a panoramic view of earthquake activity along and across Himalayas. After witnessing colossal destruction due to recent Nepal Earthquake of 7.8 Mw (25 April 2015) and going through the information provided by Rao on earthquakes in Nepal dating back from 1255 AD, it is evident that this region could have been better fortified through structures that could withstand impact of high magnitude earthquakes. The information provided in this chapter helps in planning research activities in different segments of Himalayas, apart from planning pre-event preparedness and post-event rehabilitation measures, following Disaster Continuum approach.

In the third chapter on 'Seismicity of Indo-Gangetic Plains and North-East India', the author has covered details of seismic activity covering the Aravallis, Delhi Region, Bundelkhand craton and North-East India. This chapter is more than 90 pages in length. Chronological coverage of seismic activity in different parts of the studied region provides useful information about seismotectonics of the region. As any high magnitude