Considering that there are hardly any evidences of direct observational reports in the texts of the medieval period, this is a significant discovery and should have been highlighted in the preface itself. It is suggested that the subsequent editions of the book highlight this on the back cover or in the preface.

Balachandra Rao further describes examples from the *vakya* system, which is mysterious for a first-time reader. The book has been published at a time when the tradition of *vakya* itself has been lost. Before they are completely forgotten, efforts like the ones in this book are needed to pass on our heritage to the next generation.

This book is a must for all youngsters, enthusiasts and also to those who downplay the observational skills of ancient Indian astronomers.

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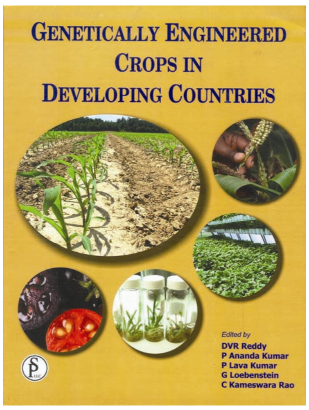

Genetically Engineered Crops in Developing Countries. D. V. R. Reddy *et al.* (eds). Studium Press LLC, P.O. Box 722200, Houston, TX 77072, USA. 2015. xviii + 405 pp. Price not mentioned.

The global area under transgenic or genetically engineered (GE) crops has grown rapidly since their introduction nearly two decades ago, and now occupies more than 181.5 m ha across 28 countries, of which 20 are developing nations (C. James, 2014, ISAAA Brief 49). The worldwide acreage under GE crops has increased more than hundred-fold from a modest 1.7 m ha in 1996 to 181.5 m ha in 2014, covering nearly 10% of the Earth's arable land and making genetic engineering the fastest adopted crop technology in recent times. World over, about 18 million farmers are cultivating several GE crops, including soybean, maize, cotton, canola, sugar beet, papaya, squash, tomato, sweet pepper and alfalfa. The traits are mainly herbicide tolerance and insect resistance. Among the developing countries, Brazil has the largest area (42.2 m ha), followed by Argentina (24.3 m ha) and India (11.6 m ha). The only GE crop that has been deregulated in India is the insect-resistant *Bt* cotton (*Bt* represents the bacterium *Bacillus thuringiensis*, one or more genes from which are inserted into the cotton plant to impart resistance to insect pest attack). In the 13 years since its commercialization in 2002, there has been a phenomenal 230-fold increase in area. Both production and yield have increased and India – once a cotton-importing country – is now an exporter. There is also a long pipeline of products, both in India and other developing countries.

Notwithstanding the above, transgenic crops have not received universal welcome. There is a trail of chequered – and acrimonious – history across the globe. Opposition is mainly centred on the following issues: (a) safety to humans and animals as food and feed; (b) safety of non-target organisms (biodiversity), soil and water; (c) the perception that the technology push is mainly industry-driven and consequently the fear of industry taking an exploitative hold over world agriculture and (d) ideological discomfort with scientists 'playing god'. All these have added up into a no-holds-barred 'war' against them. The sad result is that GE science has been maligned and misinterpreted, often deliberately. Consequently, public opinion is wholly against GE crops in several countries across the European Union and Africa, and opposition is spreading in other countries such as the Philippines and India. Although *Bt* cotton got through in India, *Bt* brinjal (eggplant) was successfully blocked, with an indefinite moratorium placed on it. It does not help that scientists are not eager public communicators and thus activists have successfully hijacked the agenda. This book aims to 'provide reviews on the scientific position on various issues related to the development and deployment of GE crops, in the hope this will promote informed decisions by all stakeholders'.

The book is organized under 13 contributed chapters. The first two chapters lay a good foundation on what is to follow. Chapter 1 on the socio-economic impact of GE technologies, responds to some commonly held 'stylized charges' about GE crops: that the choice of crops goes beyond the four – soybean, maize, cotton and canola (in fact, there are over 25 approved crops of food and non-food usage); that the product range extends beyond herbicide/insect resistance towards disease and drought tolerance, and moving into the next level with modified product quality. However, the charge that a few multinational companies dominate the field with too many patents, mergers and acquisitions still holds good. Available evidence shows that the private sector is far ahead (with 300 GE technologies) of the public sector (35 technologies). The obvious answer is to aggressively fund public sector institutions to promote products of crucial importance to resource-poor farmers, forge creative public–private partnerships and directly purchase technologies where possible. Chapter 2 discusses specific issues concerning development, deployment and biosecurity regulation of GE crops, including, *inter alia*, biosafety evaluation, environmental safety, biosecurity regimen in India and global activism. Pointing out that GE crops and products have gained farmer and consumer acceptance over 18 years, the chapter argues that biosecurity regulatory regimes are scientifically sound, robust

Diseases and crops targeted for genetic engineering disease resistance. Banana xanthomonas wilt-affected banana.

and stringent, and are more or less similar in all countries. Vehement and persistent anti-GE activism has curtailed wider adoption of these crops globally. Long before agri-biotech products were developed, scientists (and not activists) were conscious of the potential risks of the recombinant technology. Biosecurity guidelines have evolved and incrementally improved over time. Indeed, transgenic foods are the most stringently tested food products in human history. Over the years, doubts have been repeatedly raised on the safety of GE crops, but none has been substantiated. The chapter argues that unreasonable demands (e.g. on the number and duration of safety tests) and misrepresented provisions of regulatory protocols (e.g. Convention on Biological Diversity, Cartagena Protocol, the Precautionary Principle) have added to the regulatory burden.

Two chapters on the status of crop biotechnology in China (chapter 3) and Ghana (chapter 13) present contrasting pictures. China was one of the earliest countries to conduct R&D in agri-biotechnology with a robust regulatory system for GE crops. Ghana, on the other hand, is yet to commercialize a GE crop (transgenic high-protein sweet potato is under confined field trials). The earliest commercial success in China was Monsanto's *Bt*-cotton technology in the 1990s, but now home-grown technologies dominate. Papaya, sweet pepper, tomato and poplar are the other crops that have been deregulated with traits including insect/virus resistance and longer shelf-life. Technology for deployment of 'golden' rice rich in β-carotene was ready, but strong opposition by activists put a halt to the efforts.

Insect resistance and *Bt*-cotton figure prominently in chapters 4 and 5. As pointed out in these chapters, *Bt*-cotton technology came at a time when farmers had no viable solution to the management of bollworms on cotton. The all-round gains of this technology are unparalleled in the history of crop protection and production. It has reduced insecticide usage and increased the socio-economic status of small, marginal and resource-poor farmers in several developing countries. Poor compliance on the recommended non-*Bt* refuge crop is a matter of grave concern as it will surely lead to pest resistance if nothing else is done. Chapter 5 strongly recommends developing alternate strategies of refuge delivery with assured farmer compliance. Five chapters 6, 7 and 9–11 are devoted to resistance to pathogens such as viruses, fungi and bacteria. Chapter 6 analyses the status of GE crops in Asia and Latin America and chapter 7 examines the situation in Africa. The other three chapters 9–11 are detailed technical reviews on research approaches such as pathogen-derived, non-pathogen-derived and host plant-derived resistance for enhancing viral resistance in crop plants.

Chapter 8 is an appraisal of the global status of herbicide-resistant GE crops. Transgenic canola, cotton, maize and soybean are already commercialized in some of the Asian, African and Latin American countries. A few Latin American countries have also deregulated cotton and maize with combined resistance to herbicides and insects. Chapter 12 outlines the strategies for nutritional enhancement in staple food crops and concludes that while biofortification of crops is technically feasible through genetic engineering without compromising on agronomic performance, the major challenge is public acceptance.

At the end of the day, have GE crops been socio-economically beneficial across the world? Interestingly, a recent meta-analysis published while this book was in press (Klümper, W. and Quaim, M., *PLoS One*, 2014, **9**(11), e111629; doi: 10.1371/journal.pone.0111629) summarizes the findings of 147 original studies published between 1995 and March 2014, to provide robust evidence that GE technology applied to soybean, maize and cotton has reduced chemical pesticide use by 37%, increased crop yields by 22% and enhanced farmer profits by 68%. The analysis also concluded that (a) yield gains and pesticide reductions are larger for insect-resistant crops than for herbicide-tolerant crops, and (b) yield and profit gains are higher in developing countries than in developed countries. It is important to note that this analysis was exclusively publicly funded (and not industry-sponsored).

The editors state in the Preface that the book is designed to address politicians, policymakers, the bureaucracy, judiciary, young scientists, students, teachers, general public and, especially, the media. That is too diverse a constituency and impossible to reach through a single volume such as this. The book has a pleasing get-up, but careful proofreading could have avoided several irksome glitches. Some examples: (a) the first author's first name (Basavaprabhu) is misspelt in the title page of chapter 12 (p. 341); (b) the text on p. 5, line 19 cites Ahluwalia, 1978, but under references on p. 30 it is Montek A. S., 1978; (c) 'Monsanto exits', 2001 is cited on p. 139, line 10, but is missing under references; (d) high, 2004 cited on p. 139, line 19 is actually High *et al*., 2004. The five half tones included in the book could have been of a better quality. The labels on the photographs and legend in figure 1 (p. 225) are confusing. These minor blemishes apart, the chapters have been written by experts in the field. The authors and editors must be complimented for painstakingly putting together the information in one place. The book certainly succeeds in putting forth the scientific viewpoint on several contentious issues relating to the development and deployment of transgenic crops, and deserves to be read by all those interested in this area. Whether it will fulfil the hope to 'promote informed decisions by all stakeholders' will be interesting to see.

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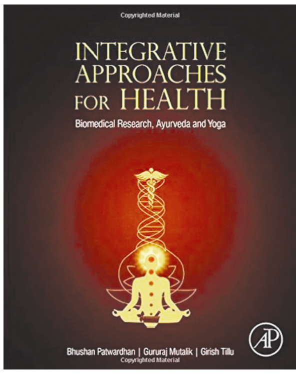

Integrative Approaches for Health: Biomedical Research, Ayurveda and Yoga. Bhushan Patwardhan, Gururaj Mutalik and Girish Tillu. Academic Press, Elsevier. 2015. 382 pp. Price: US$ 84.96.

The twelve chapters of the book titled *Integrative Approaches for Health: Biomedical Research, Ayurveda and Yoga* is an extremely timely publication. The