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Opinion

Emerging Food Safety and Security Challenges in Asian Countries

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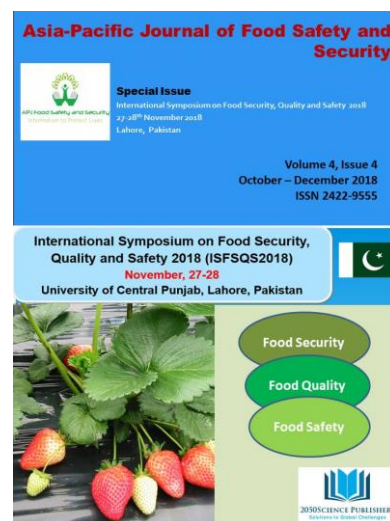
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Highlights

- Asia's large population has created unprecedented food security and food safety challenges.
- Climate change has greatly reduced crop yields and fisheries and livestock production.
- To feed the growing Asian population, smart technologies will be needed to combat climate change and maximise clean-green, safe, sustainable food production.

About Authors

Ravi Gooneratne (PhD) is Professor of Toxicology at Lincoln University, New Zealand, and has authored >200 scientific publications in journals and conference reports. He has been a teacher/researcher for 30 years in food safety & security, food toxicology, pesticide toxicology, and fungal & microbial toxins in food in 15 countries, including Australia, Canada, the USA, and China. He has supervised >70 PhD or MSc students, is an 'Excellent Chair Professor' in China at Guangdong Ocean University and 'Visiting Professor' at Jinan and Jiangnan Universities.

Abstract

Asia is home to almost two-thirds of the world's population and as a consequence faces unprecedented food security and food safety challenges. In addition, major weather and climatic changes have been occurring, and in the last 18 months, there have been floods (Thailand, Sri Lanka), heat waves (India, Pakistan, Bangladesh) and often times droughts. The oceans are warming and becoming more acidic, ice caps are melting, and sea levels are rising, which will impact on low-lying countries, such as the Maldives. Persistent and increased human activities in developing countries have resulted in declining groundwater reserves due to over-extraction, and emissions from the ever-increasing number of motor vehicles as well as the burning of coal and the cutting down of forests. These activities have all accelerated the production of greenhouse gases, mostly carbon dioxide, methane and nitrous oxide. These gases around the earth trap the sun's heat in a process that some call 'global warming', but it is better classified as 'climate change'. The impacts of climate change on temperature and rainfall will influence agricultural crop yields, food safety and security, especially for developing countries, which unlike the western developed world may not have the financial resources to mitigate many of these effects. All these factors raise challenges for Asian agricultural and food scientists in the 21st century to breed more resilient, drought-resistant nutritious crops and food-producing animals and to improve food storage and fine-tune supply chains to reduce food losses. In the future, major food production foci will need to be on soil biology, crop science, nutrient cycling, soil, water, energy, carbon conservation, and the development of more advanced pesticides and more-hardy crops to boost yields to maximise clean, green, safe food production.

Key words: Climate change; global warming; antimicrobial resistance, food security; food safety

Introduction

Food safety and food security are interrelated concepts with profound impacts on the quality of human life, and there are many external factors that affect both. Food safety is the concept of proper handling, preparation, and storage of food in ways to prevent food-borne illnesses (Linton and McSwane, 2013) and is the inverse of food risk and the probability of not having health problems after consuming a specific food (Lawley et al. 2012). Food safety can be compromised at any stage of food production: pre-farm gate, transport, processing, distribution, marketing and at the household level (Tirado et al. 2010). The allied concept of food security originated in the mid-1970s, and the Food and Agriculture Organization (FAO) defines it as the availability of and access to safe, stable and nutritious food for all people at all times to maintain a healthy and active life (FAO, 2004). Food security is affected by multiple factors, including microbial food contamination, government policies, global and national market fluctuations, population growth, but more importantly, by changes in climate. So, the hottest topic in food and nutrition is the potential role of climate change, which creates challenges to

food safety, food security and nutrition (Fanzo et al. 2018). The global average temperature has increased by 0.74°C in the past 100 years (Misra, 2014) but, because of climate change, mathematical models predict further increases of 1.1–6.4°C by the end of the 21st century. If that happens, extreme weather events like droughts, heat waves, fires and floods will impact negatively on crop and livestock production and the fishing industry. These will in turn limit food production and food availability, increase food prices and ultimately affect the affordability of safe, healthy food for the masses (Fanzo et al. 2018), increasing the already estimated (in 2017) 821 million undernourished people (10.9% of the world population; in Asia 515 million or 11.4% of the population) even further (FAO, 2018a).

Current situation and future prospects

Based on current predictions – uncontrolled industrial growth coupled with a population increase (an extra one billion people by 2025 and another billion by 2050) to 9 billion people on this planet by 2050 – most of the impact on food safety and security will be on the Asian continent (United Nations, 2017). Taking into account birth and death rates, this equates to developing countries building the equivalent of a city of one million people every five days between now and 2050. With the number of undernourished people in the world on the rise since 2014, the FAO (2018a) estimates a need to double current food production to cater for such an increase in population. But climate change could cut crop yields by more than 25%, which means food production would need to be more than doubled. FAO estimates that we will need to increase production of all types of food, including a 73% increase in meat and a 58% increase in dairy products, because as the Asian countries emerge from poverty, the newly emerging ‘middle classes’ will demand improved diets, as evidenced by already marked changes in dietary habits towards more western type diets with more meat and milk products.

As early as 2009 (The Guardian, 18 March), Professor John Beddington, then chief scientist to the UK government, predicted a ‘perfect storm’ of food shortages, water scarcity and insufficient energy resources threatening to unleash public unrest, cross-border conflicts and mass migration as people flee from the worst-affected war-torn regions by 2030. We are now in 2018 and most of the predictions have already come true, happening 12 years earlier than predicted, and it will only get worse in the future.

Asia-Pacific is home to almost two-thirds of the world’s population, so this region has unprecedented food security and food safety challenges. Many of the countries in Asia are traditionally farming nations. In some Asian countries, a significant portion of the crops is lost to pests and diseases before harvest and therefore, to boost yields, there is a need to develop more advanced pesticides and/or more hardy crops. Substantial amounts of food are lost post-harvest as well, because of inadequate storage facilities. To meet these challenges – including the increased demand for food, especially animal proteins – within the constraints of environmental resources - will necessitate marked improvements in efficiency of resource usage. If not, current practices will lead not only to a major food crisis but also to an

unsustainable environment. However, the world has risen to challenges in the past and will do so in the future.

Most of the increase in food production will have to be technology based because of the limitations of land and water. However, there is a major concern about levels of investment by most countries, including Asia-Pacific countries, on agricultural science and technological research and the training of agricultural scientists. Hence, rethinking is needed of governmental policies to divert at least some of the immense amount of funding currently allocated for commerce-related courses to instead train the best agricultural graduates at the world's top-class universities so that they can be geared to think 'out of the square' to come up with new 'smart' technologies that best suit their respective countries.

Aggravating the world food security situation is the diversion of food and feed crops to bioenergy, mostly by developed countries, which has led to a profound increase in world food prices. High food prices affect the most vulnerable sector in our society, the poor. Persistent instability in conflict-ridden regions, adverse climatic events in other parts of the world, and economic slowdowns that have affected more peaceful regions have worsened food security and are signs of a gloomy deteriorating situation. It is well recognised that many poor families eat less nutritious food, which in the long term can affect the life-long physical and mental well-being of many millions of our future generation. Malnutrition can increase infant and child mortality and also hinder learning and overall productivity. It is estimated that globally, one-third of all child deaths are due to malnutrition.

Another concern is the ever-increasing interaction between animal and human diseases, especially the zoonotic diseases. It is estimated that over 70% of human pathogens in the past three decades (including swine flu and bird flu and the mutant influenza strains) were zoonotic, with the contribution to this toll from domestic animals being >20%. How much of this is brought about by climate change is not known, and we can only speculate. Another significant threat to the Asian region is antimicrobial resistance (AMR) (FAO, 2018b) because antibiotics are freely available in many Asian countries and can be purchased without a prescription from a health professional. An estimated 700,000 people die each year from AMR infections and an untold number of sick animals may not be responding to treatment, and most of these occur in the Asian continent (So et al., 2016). Thus, AMR is a significant global threat to public health, food safety and security, as well as to livelihoods, animal production, and economic and agricultural development in Asia.

Agricultural practices to support population increases in the past decades have led to land degradation (of 11.5 billion hectares of vegetated land on earth, around 24% has undergone human-induced soil degradation). When coupled with future extreme weather events, increased greenhouse gas emissions (carbon dioxide, methane, ozone, nitrous and sulphur oxides), worsening biological diversity, exploitation of forests, depletion of marine fish stocks and over-extraction of groundwater, current practices will have major impacts on future food

production and environmental and human health.

The land, biodiversity, oceans, forests, and other forms of natural capital are being depleted at alarming rates. Unless we change how we grow our food and manage our natural capital, food security, especially for the world's poorest, will be at risk. Already, high food prices are the new normal. Investment in agriculture and rural development to boost food production and nutrition is a priority for the World Bank. The Bank works through several partnerships to improve food security, from encouraging climate-smart farming techniques and restoring degraded farmland to breeding more resilient and nutritious crops and improving storage and supply chains to reduce food losses.

Solutions

In the Asian continent, we need to learn from our past mistakes. We cannot continue our current agricultural practices, which have led to severe land degradation. If we continue in the same vein, this – in combination with current and future extreme weather events, deterioration of biological diversity, greenhouse gas emissions (even taking into account any over-estimation by climate scientists), depletion of forests, declining groundwater reserves due to over-extraction, food wastage, and unprecedented AMR – will impact not only on future food security but also on environmental, animal and human health. All these raise multiple challenges for Asian agricultural and food scientists in the 21st century. We need to breed more resilient, drought-resistant nutritious crops and food-producing animals, develop climate-smart technologies to produce more advanced pesticides and more resilient, hardy nutritious crops (to boost yields), improve food storage, and fine-tune supply chains to reduce food losses.

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