frontiers | Frontiers in Sustainable Food Systems

TYPE Editorial
PUBLISHED 11 December 2023
DOI 10.3389/fsufs.2023.1284383

OPEN ACCESS

EDITED AND REVIEWED BY
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RECEIVED 28 August 2023
ACCEPTED 27 November 2023
PUBLISHED 11 December 2023

CITATION
Tsusaka TW, Kristiansen P, Ho TDN and Chandio AA (2023) Editorial: Adaptation strategies to climate change impacts on food systems in Asia: greater efforts toward achieving the Sustainable Development Goals. *Front. Sustain. Food Syst.* 7:1284383. doi: 10.3389/fsufs.2023.1284383

Editorial: Adaptation strategies to climate change impacts on food systems in Asia: greater efforts toward achieving the Sustainable Development Goals

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KEYWORDS

climatic stress, crop productivity, food security, resilience, adaptive capacity, temperature, waste utilization, rural transformation

Editorial on the Research Topic
Adaptation strategies to climate change impacts on food systems in Asia: greater efforts toward achieving the Sustainable Development Goals

Climate change and its impact have been a major theme in the global economic discourse, posting significant challenges to agricultural production and associated systems (Shahzad et al., 2021). The agricultural sector is particularly vulnerable to climate dynamics as it directly depends on natural resources and is exposed to seasonal meteorological events (van Oort and Zwart, 2018; Abbas and Mayo, 2021). The unfavorable impacts of global warming and unpredictable climatic events have had detrimental effects on the productivity, efficiency, and resilience of important agricultural systems (Otsuka and Fan, 2021).

These concerns are particularly pronounced in the Asian region, where agrarian pursuits constitute the cornerstone of their large and rapidly growing economies and the livelihoods of a substantial proportion of the populace. Changing weather induces pest and disease outbreaks, causing crop failures (Masud et al.). Heat stresses on crops and livestock reduce productivity, while floods and droughts cause yield losses (Farhad et al.; Wang et al.). In particular, climate change hotspots are frequently reported in India, Sri Lanka, Bangladesh, China, and Vietnam in association with paddy- and wheat-based production systems (Ho et al., 2022; Chandrasiri et al., 2023). In this light, farming communities and associated stakeholders have been exploring strategies to adapt to climate change, with the overarching goal of maintaining the yield of food crops (Gorst et al., 2018; Abegunde et al., 2019).

Although farmers have embraced an array of strategies in response to climatic stresses, the effective adoption of suitable practices has not consistently been realized due to contextual differences or limitations in adaptive capacity (Cradock-Henry et al., 2020). The agrarian transformation in the face of climatic challenges holds a direct bearing on the achievement of several Sustainable Development Goals (SDGs), particularly No Poverty (SDG1), Zero Hunger (SDG 2), and Climate Action (SDG 13) (UNDP, 2020). This adaptive

process resonates closely with certain objectives under Gender Equality (SDG 5), Decent Work and Economic Growth (SDG 8), Responsible Consumption and Production (SDG 12), and Life on Land (SDG 15). In practice, achieving these SDGs requires that strategies for adaptation be designed to curtail the loss of productivity, bolster food security, and promote environmental sustainability (Tschakert et al., 2023). To ensure agricultural sustainability, there is an imperative to minimize the dependence on external and synthetic inputs in the agricultural production processes for both staple commodities and high-value crops (Tsusaka and Otsuka, 2013; Lipper et al., 2018; Deguine et al., 2023).

In this Research Topic issue for *Frontiers in Sustainable Food Systems*, six pertinent papers address questions related to climate change adaptation in agriculture, highlight some key opportunities and challenges, emphasizing the multi-disciplinary nature of the issue in Asia. Masud et al. investigate the mediating role of adaptive capacity between adaptation practices and economic, social, natural, technological, informational, and institutional limitations. Survey data from 500 farmers in Malaysia reveal barriers hampering adaptation practices and reinforcing their interrelations. Their study informs the national adaptation plan for the agri-food industry to enhance competitiveness, production, food security, and sustainability. Manh et al. explore indigenous farmers' barriers to climate change adaptation and their influence on adaptation intentions. Data collected from 362 indigenous farmers reveal 24 key barriers affecting adaptation practices in Vietnam. Probit analysis links education, occupation, income, technical issues, costs, pesticide access, and technical support to adaptation intentions, emphasizing their role in policy formulation. Recognizing the tendency of adaptation initiatives, Abdel-Fattah and Hiary introduce a participatory multi-criteria decision analysis in agricultural value chains in Jordan, highlighting downstream needs for engaging stakeholders for tailored capacity building programs. Specifically, marketing, post-harvest treatment, formation of active producer unions and federations are identified as the top priorities of the focus groups including farmers, technicians, engineers, traders, and exporters of agricultural produce.

Regarding specific crops, Wang et al. experimentally examine the impacts of climate warming on the grain quality of early-stage paddy in subtropical China using a free-air temperature increase facility. Warming reduced growth duration, milled and head rice rates, and amylose contents, and increased chalkiness, amino acid contents, viscosity, and breakdown. The result underscores a challenge for high-quality grain production in warming environments. Farhad et al. conduct a comprehensive review of heat stress in wheat, emphasizing the crop failure occurring during the reproductive phase. They notice that wheat faces terminal heat stresses resulting in altered growth, reduced grain quality, and shorter filling duration, whilst the wheat plant adapts via morphological, physiological, and genetic changes. Lastly, Thach studied garlic, a high-value crop that can be grown under diverse climatic conditions. While husks are often considered as waste, he finds their potential use as a source of phytonutrients. Extraction temperature at 60–70°C for 60–90 min generates optimal conditions for extracting antioxidants, underlining the potential for utilizing garlic husks as antioxidants in supplements or food products. Such findings hint at the opportunities for crop diversification and value addition to improve the resilience of farmers.

These studies contribute to furthering the understanding of climate change adaptation and resource utilization in Asia. From mediating the adaptive capacity among farmers to addressing barriers in indigenous communities, the studies emphasize the complexity of adaptation in diverse contexts. A participatory approach is introduced to tailor capacity-building programs, acknowledging downstream needs often overlooked. Staple crops, such as wheat and paddy, illustrate the complex effects of global warming, for which genetic and physiological adaptations are identified as key strategies. Incorporating stress-tolerant crops such as sorghum and millets may be a potential risk-coping tactic. Furthermore, the potential of waste utilization is explored, as seen with garlic husks. Collectively, the studies contribute insights into agricultural policy formulation, genetic interventions, and sustainable resource management in the face of climatic challenges, reflecting the multidimensional nature of transformation in agricultural landscapes and communities.

From a broader perspective, the findings in this Research Topic of *Frontiers in Sustainable Food Systems* underscore the necessity of customized approaches, stakeholder involvement, genetic progress, and resource efficiency for agricultural adaptation to climatic stresses. These measures are essential in ensuring sustainability of cropping systems in Asia and beyond, in the face of evolving climatic challenges.

Author contributions

TT: Writing – review & editing, Writing – original draft. PK: Writing – review & editing. TH: Writing – review & editing. AC: Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Acknowledgments

The topic editors thank the authors of the papers submitted to this Research Topic. They are also grateful to the reviewers for their valuable contributions to improving the quality of the submitted papers.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

Publisher's note

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