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Editorial: Increasing resilience and adaptability to climate change of vulnerable groups in agriculture

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Editorial on the Research Topic
Increasing resilience and adaptability to climate change of vulnerable groups in agriculture

Introduction

Climate change continues to be a global concern because it threatens livelihoods, particularly those of society's marginalized or vulnerable populations. Despite contributing the least to climate change, developing countries are the most susceptible to its effects. This vulnerability stems from the fact that rain-fed agriculture is the primary source of livelihood for the majority of the population and poor households spend more than 60% of their income on food (Osei et al., 2024). Besides, investment in agriculture remains low with only 4% of the total agricultural lands under irrigation, particularly in sub-Saharan Africa. Other developing regions such as Asia and Latin America have 37 and 14% of their total cultivated lands under irrigation, respectively (International Center for Biosaline Agriculture, 2021).

As a result, these, primarily smallholder farmers, lack the institutional, technological, infrastructural, and economic capacity to adapt to climate change. Furthermore, the bulk of the resource-poor youth work in agriculture, making them more exposed to the effects of climate change. Recent climate change scenarios have predicted significant declines in staple food yields due to drought, high temperatures, rainfall variability, and a projected overall decline in agricultural revenue. These estimated negative consequences would directly impact food security, leaving millions of households malnourished.

According to the Food and Agriculture Organization (FAO) of the United Nations, between 720 and 828 million people worldwide are already experiencing chronic hunger. In addition, around 161 million children under the age of five suffer from stunting. In light of the uncertain climate, achieving food and nutrition security will require a radical transformation of the world's food and agricultural systems. Systems of this kind need to combat climate change, maintain the sustainability of ecosystems, increase crop yield, and help farmers become more resilient and adaptable to environmental shocks. To guarantee

food equity, climate-resilient, and sustainable food system interventions that focus on the most vulnerable segments of society are required. This Research Topic focused on articles that analyzed the development of sustainable climate-resilient pathways for smallholders and other vulnerable groups in agriculture.

In all, eleven of the twenty-four manuscripts received were published after undergoing rigorous editorial and peer review processes. The articles in this Research Topic fall under three topic themes: (i) determinants of smallholder farmers' adoption of climate-smart agricultural practices, (ii) promoting the development of climate-resilient crop varieties, and (iii) effectiveness of initiatives to build resilience against climate change.

Determinants of smallholder farmers' adoption of climate-smart agricultural practices

Climate-smart agricultural practices (CSAs) refer to a set of farming techniques intended to build the resilience of farmers and sustainably enhance productivity amidst climate uncertainties. These practices include rotational cropping with legumes, mulching, zero or minimal tillage, use of compost/organic fertilizer, and planting nitrogen-fixing trees on the farm to serve as windbreaks among others. Governments, non-governmental organizations (NGOs), and other development partners have made efforts to encourage farmers to adopt CSAs, especially in areas vulnerable to climate change. However, empirical evidence suggests that the rate of adoption remains low (Nkansah et al., 2021; Iqbal et al., 2022). Recent studies have, therefore, investigated the factors that influence farmers' adoption decisions about CSAs. According to Yiridomoh et al., extension contacts, credit access, availability of climate information, and household asset holding capacity were the most important factors in farmers' decisions to adopt SCAs in the Lawra District of Ghana's Upper West region. A related study by Asante et al. further revealed that off-farm income, household size, credit, education, extension services, and gender of the farmers were factors that determined the adoption of CSAs in Ghana. Jabbar et al. demonstrated that the formation of collective farmer action groups in rural areas of Punjab, Pakistan, encouraged the adoption of CSAs. Nonetheless, membership in the action groups was influenced by farmers' risk perception, peer pressure, education, and credit access.

Promoting the development of climate-resilient crop varieties

Many researchers have argued that the use of climate-resilient crop varieties (e.g., draught tolerant, early maturing, flood-tolerant, etc.) remains the most viable option for managing the impact of climate change, particularly in vulnerable regions across the globe. According to a review of pertinent studies conducted by Shah et al., Africa lags behind in the development of flood-tolerant rice varieties. The authors discovered that the majority of rice producers in Africa's flood-prone areas were unaware of the existence of such rice cultivars. It was further suggested that using plant growth-promoting rhizobacteria (PGPR) could be a reliable approach to increasing crop growth and yield in changing climates. In a related review across Africa, Mwakyusa et al. revealed that information about newly developed crop varieties (stress-tolerant, flood-resilient, etc.) is scarce, forcing farmers to rely on indigenous cultivars. They emphasized the importance of stepping up efforts to screen and identify flood-tolerant rice varieties in Africa. Annor and Badu-Apraku conducted a field experiment in Nigeria to discover stress-resistant quality protein maize (QPM) inbred lines for hybrid development and to examine the relationship between grain yield and other researched parameters. The experiment revealed that about 60% of the QPM inbreds assessed had various levels of tolerance to drought and low nitrogen.

Effectiveness of initiatives to build resilience against climate change

Taillandier et al. revealed that using agroforestry as a climate change adaptation and mitigation strategy has been successful in the Global South. Farmers who planted a combination of crops and trees/shrubs recorded lower insect/pest incidences, higher yields, and additional income from selling tree/shrub produce, boosting their resilience to climatic uncertainties (Taillandier et al.). A recent study by Mpala and Simatele evaluated the effectiveness of initiatives such as efficient use of water resources, use of early maturing crop varieties, and soil fertility management techniques in boosting crop yield and building the resilience of smallholder farmers in Zimbabwe against climate variability. The authors discovered that the identified climate-smart initiatives were successful and efficient in increasing the adopters' yield and income despite climate uncertainties. However, they admitted that the farmers require regular technical support to ensure the sustainability of the initial gains.

In India, Godara et al. reported that farmers who received regular information on climate-related issues (e.g., the onset of the rains, temperature, evapotranspiration, etc.) were more productive than those who did not. Using bio-economic models, Gbegbelegbe et al. simulated the impact of drought on yield and food security in southern Africa. The study found that food insecurity could worsen in the next years. Despite the drought, the authors reported that using stress-tolerant agricultural varieties, diversifying crops, and investing in water harvesting could boost productivity and food security. A related study by Amarnath et al. in Sri Lanka demonstrated that bundling climate-smart agricultural practices with weather index insurance could be effective in neutralizing the projected long-term severe yield declines and its income and food security implications.

Conclusion

Climate change remains a major threat to global food and nutrition security and attainment of the sustainable development goals. Based on the findings of the articles in this Research Topic, it can be concluded that members of farmer-based associations who receive regular extension services/education on climate change-related issues, and have access to credit or

off-farm income-generating activities are more likely to adopt improved technologies/CSAs to build their resilience against the effect of climate change on their yield and income irrespective of the location. Generally, the existing climate-smart agricultural practices have been effective in building the resilience of vulnerable farmers against climate change. However, there is a need for awareness creation or promotion of climate-resilient crop varieties among the farmers to encourage adoption. The adopter of the existing initiatives should be provided with regular technical support to achieve the intended purpose.

Author contributions

SE: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. FA: Resources, Validation, Writing – review & editing. JO: Resources, Writing – review & editing. ZL: Writing – review & editing. JL: Writing – review & editing.

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.

Publisher's note

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