frontiers | Frontiers in Environmental Science

TYPE Editorial
PUBLISHED 04 October 2023
DOI 10.3389/fenvs.2023.1293440

OPEN ACCESS

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RECEIVED 13 September 2023
ACCEPTED 29 September 2023
PUBLISHED 04 October 2023

CITATION
Alizadeh K, Gathala MK, Mohammadi R and Amri A (2023), Editorial: Dryland agriculture: crop adaptations, increasing yield and soil fertility.
Front. Environ. Sci. 11:1293440.
doi: 10.3389/fenvs.2023.1293440

Editorial: Dryland agriculture: crop adaptations, increasing yield and soil fertility

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KEYWORDS

adaptability, crop production, rainfed areas, soil fertility 12 13, modelling

Editorial on the Research Topic
Editorial: Dryland agriculture: crop adaptations, increasing yield and soil fertility

1 Introduction

Dryland agriculture in low precipitation areas remain low productive than their potential harvest because of uncertain climate risk, dryland agricultural productivity may be increased by adopting the climate-resilient based agronomic management options. Research has shown that precise water management, coupled with improved soil and crop management and decision tools and efficient mechanization with accurate weather forecast can more than double agricultural productivity in rainfed areas with currently low yields. Abiotic stresses aggravated by climate change pose a serious threat to the sustainability of crop yields and account for substantial yield reductions. Plant breeding was highly successful during the second half of the 20th century, contributing substantially to keeping production ahead of population growth. Improved varieties and efficient crop husbandry practices in dryland agriculture resulted in significant increases in the productivity of cereals, grain legumes, and fodder crops. Breeding achievements in yield and yield stability under dryland agriculture are attributable predominately to genetic improvement of crop species. However, future research to increase the level of drought tolerance in crops needs to address the interaction between a number of traits and assemble those combinations of traits to maximize crop productivity in drought-prone environments. In drylands, timely decision is the most critical to mitigate the risk where efficient mechanization synchronized with accurate weather forecast is the essential component of crop production. Although changes in tillage systems and crop practices can improve production by conserving water, enhancement of the genetic tolerance of crops to drought stress is considered an essential strategy for addressing moisture deficits. Therefore, the main strategies should be focused on capturing the potential of both beneficial genetic adaptations and new technologies for higher productivity in drylands that are increasingly affected by climate change.

The present Research Topic compiles many aspects helpful to a better understanding required for improving sustainable agricultural production and climate-adapted cropping systems under dryland conditions.

1.1 Water and soil management by cover cropping

Severe soil erosion and depleting soil organic carbon coupled with water limitation in climate change conditions are common challenges in all drylands rainfed areas. Importance of soil quality (phisico-chemical properties) to dryland crop production (Sainju and Liptzin) was a published article in this Research Topic which concluded that the EC, CEC, IP, and K concentrations were related to most soil physical, chemical, biological, and biochemical properties, but pH and Al concentration were related to limited soil properties in dryland cropping systems of the northern Great Plains, United States. Cover cropping can improve the soil nutrient status, increase enzyme activities, and enhance the structure and functional diversity of soil microbial communities (Wang et al., 2020). Boussios et al. in a paper entitled, mixed crop-livestock production system in the drylands of Jordan, revealed that decisions are not strictly based on short-run financial outcomes but also on the effect of choices on resource levels, and hence future earning capacity. The interactions of the biological processes with agriculture productions and the stochastics of weather require modeling approaches that include the long-term perspectives, as well as the conditional responses of farming choices to the realization of stochastic events.

1.2 Modelling and network structure for increased production

Liu et al. showed the important role of composition and network structure of the soil microbial community in the orchard ecosystem. They reported that different cover cropping treatments in an apple orchard differently influenced the composition of soil bacterial and fungal communities (Liu et al.).

Ajilogba and Walker through modeling climate change impact on dryland wheat production showed a declining trend in yield for all future climate projections. They emphasized that using a crop model to simulate the response of crops to variations in weather conditions can be useful to generate advisories for farmers based on the potential effects of climate change on yield.

1.3 Perspectives

In conclusion, this Research Topic provided multidisciplinary investigations in cropping systems and modelling, focusing on soil and water management for enhancing dryland production. Nevertheless, incredible challenges to the sustainable production need more attention following future climate change scenarios.

Author contributions

KA: Writing–original draft. MG: Writing–review and editing. RM: Writing–review and editing. AA: Writing–review and editing.

Acknowledgments

We deeply thank all the authors and reviewers who have participated in this Research Topic.

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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