Utilizing Data for Sustainable Crop Selection

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Topic: Sustainable water management for agrifood systems transformation

Introduction

Water scarcity in agriculture is a significant issue, with overuse of resources leading to soil degradation and unsustainable practices. This proposal proposes a data-based approach to crop selection, enabling farmers to choose the right crop at the right time for successful growth, aiming to revolutionize agricultural decision-making and promote water conservation by developing and implementing a "Crop Suitability Platform".

Problem statement

The human population is projected to reach 9 billion by 2050, posing significant challenges to global food security. According to Liu et al. (2022), climate change is expected to severely impact water availability for agricultural production, with 39% of global croplands facing water scarcity between 2026 and 2050. Additionally, the adverse effects of climate change on water resources will disproportionately impact less developed countries, further limiting their agricultural productivity (Coulibaly *et al.*, 2020). Kogo *et al.* (2020) highlights that future climate variability will likely alter cropping patterns and yields across various regions. The Food and Agriculture Organization of the United Nations(FAO) (FAO, 2024) has emphasized that producing 60% more food by 2050 to feed the growing population will require significantly more water. Agriculture, which is the largest global user of freshwater, relies heavily on irrigation, consuming 70% of the total freshwater withdrawals. Ungureanu *et al.* (2019) reports that currently, 20% of agricultural land is irrigated, contributing to 40% of global food production. By 2050, the volume of water withdrawn for irrigation is projected to rise to 2.9 thousand km^3, with most of this increase occurring in low-income countries. Additionally, the net global irrigated area is expected to expand by at least 20 million hectares, predominantly in land-scarce developing regions.

In light of these challenges, there is an urgent need for sustainable water management strategies to transform agrifood systems.

Proposed policy idea

We propose the Crop Suitability Platform (CSP), a data-driven tool designed to assist farmers in selecting sustainable crops by evaluating water availability, yield potential and economic viability through historical and real-time data sets. CSP will offer comprehensive tools for crop water requirement analysis, market-driven suggestions, and geospatial analysis. The platform will generate real-time crop suitability maps based on climate and soil data, guiding farmers toward sustainable choices and maximizing water resource efficiency. Additionally, CSP will provide market-driven recommendations that align with regional and global market demands, fostering water conservation and increased farm income.

Implementation

The CSP will initially pilot in Kenya, Morocco and Algeria, with plans for scaling across Africa following successful implementation. Tailored to local agro-climatic conditions and agricultural contexts, CSP will integrate regional data sets and customizable features to ensure its relevance, accessibility, and effectiveness in managing water resources. Collaboration with national and regional agricultural ministries will be pivotal, integrating CSP with existing farmer support programs and offering financial incentives to promote adoption of water-saving cropping practices. Capacity development initiatives will focus on training extension agents and farmers, empowering them to utilize CSP effectively and make informed decisions based on its recommendations. To maximize outreach, CSP will be disseminated through agricultural extension services, farmer cooperatives, and local community organizations, leveraging workshops, demonstration plots, digital platforms, social media, and mobile applications. Targeting smallholder farmers, agricultural cooperatives, and regional agricultural planners as primary users, CSP will also cater to agribusinesses, NGOs, and policymakers to support broader agricultural development strategies.

The theory of change is based on the premise that access to accurate, timely, and actionable data will enable farmers to optimize their resource use, increase productivity, and adapt to changing climatic conditions, ultimately leading to more resilient and sustainable agrifood systems.

Anticipated challenges

1. ***Data privacy and security:*** Ensuring the protection of personal data and user information will be paramount. The platform will incorporate robust security measures, including encryption, authentication, user consent, and compliance with data protection laws and industry standards. Regular audits and surveys will be conducted to maintain high standards of data security.
2. ***Regional adaptation:*** Tailoring CSP to specific agro-climatic conditions and local agricultural contexts in Kenya, Morocco,and Algeria will require continuous customization and updates based on community feedback and environmental dynamics.
3. ***Adoption and training:*** Encouraging widespread adoption and effective utilization of CSP among farmers and stakeholders will be critical, necessitating comprehensive training programs.
4. ***Control over content:*** To prevent misuse, CSP will enforce strict governance and content control measures, ensuring only verified and relevant content is disseminated with a robust review system

Expected outcomes

1. Improved crop yields under water constraints through informed crop selection and water management practices.
2. Reduction in water use in agriculture by promoting water-efficient crops and optimizing irrigation practices.
3. Boost in farm profitability by advocating for high-value, water-efficient crops aligned with market demands.
4. Strengthened resilience of agrifood systems through sustainable water management techniques, stabilizing the global agrifood chain and ensuring sustainable farm revenue.
5. Enhanced water productivity by maximizing the output per unit of water used, thus ensuring more efficient and sustainable agricultural practices.

References

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