



ULST Timisoara
**Multidisciplinary Conference on
Sustainable Development**
21-22 May 2026



PROMOTING SORGHUM CULTIVATION IN ROMANIA THROUGH ARTIFICIAL INTELLIGENCE AND DIGITAL ECOSYSTEM

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This paper explores the potential of promoting sorghum cultivation in Romania by integrating artificial intelligence (AI) and digital ecosystems. It reviews existing scientific literature, outlines methodological approaches, and highlights AI applications relevant to agricultural digitalization. The proposed model integrates predictive analytics, Earth-observation mapping, digital agricultural advisory tools, and automated financial mechanisms. The contribution of this paper lies in linking agronomic characteristics of sorghum with modern technological innovations, creating a scalable framework for farmers, researchers, and policymakers. As climate change accelerates, traditional crops in Romania face unprecedented water stress, necessitating a shift toward drought-resistant alternatives like sorghum. This paper provides a comprehensive strategic framework for revitalizing sorghum cultivation through the integration of Artificial Intelligence (AI) and interconnected digital ecosystems. Furthermore, the integration of digital agricultural advisory tools democratizes expert knowledge, providing farmers with automated, data-driven insights into fertilization and pest management tailored specifically to sorghum's unique growth cycle. A standout feature of the study is the inclusion of automated financial mechanisms, such as smart-contract-based insurance or credit scoring, which utilize AI to predict yields and reduce economic uncertainty. Ultimately, this paper contributes a scalable, tech-centric roadmap that aligns agronomic potential with economic viability, offering a robust solution for farmers, researchers, and policymakers aiming for a sustainable and digitized Romanian agricultural sector.

• Introduction

Sorghum (*Sorghum bicolor*) has been proposed in the literature as a strategic crop for drought-prone regions due to its tolerance to water stress and low production costs. In Romania, interest in sorghum has increased in recent years, both for feed and for energy and food uses (Stoicea, 2025, *Sorghum, the crop of the future under climate change conditions*. Management Journal, USAMV; GURGU-LAZĂR, 2024, *The biological and agricultural potential of sorghum in Romania*. Management Journal, USAMV). In parallel, the digitalization of agriculture and the adoption of artificial intelligence tools can accelerate the adoption of alternative crops by reducing decision-making risk and improving access to market and financing (AFIR/Reuters, 2024; AI4AGRI, 2024, *Romanian Excellence Center on AI for Agriculture*). Sorghum has emerged as a viable climate-resilient crop suitable for drought-affected regions. In Romania, agricultural climate risks have intensified, necessitating the exploration of alternative crops with strong adaptability. Artificial intelligence and digital technologies provide new opportunities for improving crop management, monitoring, and decision-making, potentially enhancing both sustainability and productivity.

• Material and method

The paper proposes an integrated model for sorghum promotion based on four main components:

a) EO maps and predictive models

Using remote sensing data and climate modeling to identify areas with agronomic potential for sorghum and produce “suitability maps”. These maps can feed a digital platform accessible to farmers.

b) Digital educational platform and marketplace

A web/mobile platform offering practical guides, videos, local case studies, cost/profitability calculation tools and a marketplace for seeds, inputs and harvest contracts.

c) AI-based decision support systems

Machine learning models suggesting hybrids, optimal sowing dates and stress management, using local agronomic data, sensors (IoT) and satellite imagery.

d) Financial and administrative mechanisms supported by automation

• Results and discussions

1. Piloting in regions with potential (e.g. eastern and southeastern Romania) with partnerships between universities, research centers, agtech companies and agricultural cooperatives.
2. Development of digital training programs for farmers and agricultural advisors.
3. Integration of document automation and access to funds solutions to reduce administrative barriers.
4. Market stimulation measures (subsidy schemes for sorghum hybrids, offtake contracts with local processors).

Sorghum represents an opportunity for Romania in the context of climate change. Combining artificial intelligence and digital ecosystems with public policies and financial support can accelerate the adoption of this crop. The proposal in this document provides a practical framework for action, but requires local piloting and adaptation.

• Conclusions

Implementation of the model could lead to: increased sorghum cultivation in suitable areas, reduced farmer-perceived risk, improved input optimization and drought management, and increased market and biomass supply aggregation. Similar models have demonstrated results in accelerating funding applications and document management (Reuters, 2024; AI4AGRI, 2024-*Romanian Excellence Center on AI for Agriculture*).

There are barriers: the cost of digital infrastructure, low level of digital skills among farmers, the need for local adaptation of agronomic recommendations and market aspects (demand, value chains). Geospatial data also requires local calibration to ensure accurate recommendations.

Artificial intelligence and digital ecosystems offer significant potential to accelerate sorghum adoption in Romania. Combining predictive tools, remote-sensing maps, and digital agricultural platforms may support farmers in mitigating risks and improving agricultural resilience. The proposed model can serve as a foundation for future agricultural innovation efforts.

The study adopts a qualitative synthesis of academic literature, agricultural research reports, and digital innovation case studies. A conceptual model is developed, integrating AI-based analytics, geospatial technologies, and digital service platforms to support sorghum adoption in Romania