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“Towards multi-functional agro-ecosystems
promoting climate resilient futures”

Enabling data-driven agricultural transformation: GARDIAN and FAIRagro

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Abstract

Agriculture faces increasing pressure from climate change, resource constraints, and competing land-use demands. Developing climate-resilient agroecosystems requires interdisciplinary and data-driven approaches. Modern technologies generate large volumes of agricultural and environmental data, but reuse and integration remain limited. This is largely because agricultural data are often siloed, poorly documented, and rarely shared. Limited interoperability and Global South–North barriers further restrict knowledge exchange. Experiences from large-scale data initiatives show that technical solutions alone are insufficient; cultural, organisational, and governance barriers continue to limit data sharing and reuse. This contribution presents CGIAR’s GARDIAN and FAIRagro’s Search Hub as complementary initiatives enabling improved data sharing and reuse.

GARDIAN supports global agricultural data discovery, reuse, and interoperability through a digital platform enabling access to datasets, publications, and standardised data. GARDIAN provides access to over 470,000 publications, 26,000 datasets, and nearly 570,000 analysis-ready data points. These resources span over 20 entities, with about 180 institutions, including CGIAR research centers and their global partner networks, covering disciplines such as agronomy, crop breeding, livestock, socioeconomics, climate adaptation, and agroforestry.

FAIRagro supports community-driven research data management in the agrosystem sciences within the German National Research Data Infrastructure (NFDI), with the FAIRagro Search Hub as part of its service and support portfolio. Serving as a technical backbone, it integrates distributed research data infrastructures and enables access to datasets and repositories. The FAIRagro Dataset Finder provides access to over 2,000 datasets from five agricultural research institutes and is expanding to connect additional infrastructures, strengthening data discovery and reuse.

Both initiatives and their services for researchers will be presented, with selected success stories and concrete use cases to illustrate how FAIR data management and sharing strengthen collaboration across disciplinary, institutional, and regional boundaries and act as catalysts for urgently needed evidence-based transformation processes, particularly in the AI era. The contribution highlights key lessons learned, emphasising the importance of investing in cultural change alongside technical solutions. These include training, capacity building, community engagement, and use-case-driven development.

Together, CGIAR GARDIAN and FAIRagro Search Hub demonstrate how coordinated efforts can unlock the potential of agricultural data and support data-driven innovation for climate-resilient multifunctional agroecosystems.

Keywords: CGIAR, fAIR principles, FAIRagro, GARDIAN, NFDI, research data infrastructure (RDI), research data management (RDM)