

Mapping crop area and fertilizer application rates globally for 173 crops

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Abstract: Geospatial data on crop distribution and crop-specific agricultural inputs, such as fertilizers, are essential data inputs for global-scale models used to evaluate and track progress towards sustainable agriculture. For the past two decades, many models have relied on datasets such as Monfreda et al. (2008) for global crop area maps and Mueller's et al. (2012) for fertilizer application maps, both of which have reference years around 2000. These datasets, while foundational, have become outdated, introducing uncertainties into global assessments as both the extent of cropland and fertilizer use patterns have changed significantly over the past two decades.

Recently, we introduced two new high-resolution geospatial datasets—CROPGRIDS (Tang et al., 2024) and NPKGRIDS (Nguyen et al., 2024)—which provide updated, crop-specific global maps of cropland distribution and fertilizer application rates, respectively. Both datasets were developed following a harmonized data fusion workflow to ensure consistency and were validated against independent statistics from National Statistical Offices (NSOs) across multiple countries. CROPGRIDS provides geo-referenced harvested and crop area data for 173 individual crops for the year circa 2020 at a geospatial resolution of 0.05° (about 5.6 km at the equator), with crop classifications aligned to FAO commodity definitions. NPKGRIDS provides corresponding crop-specific application rates of nitrogen (N), phosphorus (P, as phosphorus pentoxide, P₂O₅), and potassium (K, as potassium oxide, K₂O) for the same set of crops and year as in CROPGRIDS, mapped at the same geospatial resolution. Both datasets were publicly and freely distributed via *figshare*.

Importantly, the workflow of CROPGRIDS has been successfully embedded into the [Hand-in-Hand geospatial platform](#) of the Food and Agriculture Organization (FAO) of the United Nations (Bottini et al., 2025) and into the Google Earth Engine, allowing stakeholders to interactively explore the dataset. This integration also provides a solid foundation for future regular updates, supporting FAO's ongoing efforts to provide timely global data on food and agriculture. By representing grid cells with features such as crop type, harvested area, and NPK inputs, these datasets can be integrated into AI frameworks alongside climate, soil, and remote sensing data to model yields, nutrient losses, and input–output trade-offs. This enables more accurate recommendations and policy simulations to support sustainable agricultural management.

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