

# How well does APSIM NG simulate wheat yields with gridded data?

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**Abstract:** Crop models are increasingly applied with gridded soil and weather data, yet their validation often relies on small, sampled datasets, raising concerns about accuracy at broader scales. This study benchmarks the APSIM Next Generation (APSIM-NG) crop model for wheat yield prediction using data from 2005 to 2022 across multiple trials from Australia's Grain Research and Development Corporation's National Variety Trials. In total, 21,654 trials were simulated benchmarking APSIM NG wheat yields over 18 years across 217 sites and 45 cultivars. Our results show APSIM-NG captures spatial-temporal yield variation at national, state, and agroecological levels (nationally:  $R^2 = 0.5$ ,  $d = 0.83$ , bias = 6.9%, no significant monotonic trend, significant Genetic  $\times$  Environment interaction, Richetti et al., 2024). There is variability in the performance when looking from a temporal, spatial, or cultivar perspective. Key contributing factors include cultivar performance across various locations and seasons, improved understanding of the variability in gridded climate and soil parameters when simulating wheat yields. Several factors contributed to reduced performance in crop yield simulations using large-scale gridded input datasets. These include inaccurate cultivar classification, local variability in climate and soil parameters, and unaccounted impacts of pests and diseases. Cultivar ranking should be avoided without further site-specific calibration. For broader-scale simulations and scenario analyses, the use of broadly adapted cultivars is recommended, as they showed more consistent performance across environments and seasons.

## REFERENCES

Richetti, J., Lawes, R.A., Whan, A., Gaydon, D.S., Thorburn, P.J., 2024. How well does APSIM NextGen simulate wheat yields across Australia using gridded input data? Validating Continental-Scale Crop Model Simulations. *European Journal of Agronomy* 158, 127212. <https://doi.org/10.1016/j.eja.2024.127212>

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