Several gaps remain. First, many studies still rely on seasonal climate summaries that are too coarse to represent the biological reality of stage-specific stress. Second, genotype differences are often acknowledged but insufficiently parameterized in operational models. Third, interactions among heat, drought, soil constraints, and excess rainfall remain under-modeled in many sorghum systems. Fourth, strong local case studies exist, but transferability across regions is still limited. Finally, predictive accuracy is improving faster than interpretability in some data-driven studies, which risks producing models that are useful technically but harder to trust agronomically.

Future work should move toward integrated sorghum modeling systems that connect phenology, plant physiology, remote sensing, and climate analytics in the same framework. More attention is needed on stress timing around flowering and grain filling, on genotype-specific calibration of water-use and heat-response traits, and on decision tools that translate model output into locally actionable advice. For both researchers and practitioners, the most productive perspective may be to treat sorghum neither as a miracle crop nor as a victim crop, but as a biologically understandable crop whose yield can be better stabilized when climate signals are interpreted through the lens of development, physiology, and carefully chosen models.

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