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Title: Drought stress delays endosperm development and misregulates genes associated with cytoskeleton organization and grain quality proteins in developing wheat seeds

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Highlights

- Drought stress delays endosperm development in wheat.
- Even a short duration drought stress reduces final grain size.
- Genes associated with cytoskeleton organization are differentially regulated in developing seeds by drought.

Abstract

Drought stress is a major yield-limiting factor for wheat. Wheat yields are particularly sensitive to drought stress during reproductive development. Early seed development stage is an important determinant of seed size, one of the yield components. We specifically examined the impact of drought stress imposed during postzygotic early seed development in wheat. We imposed a short-term drought stress on plants with day-old seeds and observed that even a short-duration drought stress significantly reduced the size of developing seeds as well as mature seeds. Drought stress delayed the developmental transition from syncytial to cellularized stage of endosperm. Coincident with reduced seed size and delayed endosperm development, a subset of genes associated with cytoskeleton organization was misregulated in developing seeds under drought-stressed. Several genes linked to hormone pathways were also differentially regulated in response to drought stress in early seeds. Notably, drought stress strongly repressed the expression of wheat storage protein genes such as gliadins, glutenins and avenins as early as 3 days after pollination. Our results provide new insights on how some of the early seed developmental events are impacted by water stress, and the underlying molecular pathways that can possibly impact both grain size and quality in wheat.

Keywords: Wheat, drought, seed development, cytoskeleton, endosperm, grain proteins

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