

Research reveals infertile spikelets contribute to yield in sorghum and related grasses

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Sorghum. Credit: Public Domain

Much of the food we eat comes from grasses such as rice, wheat, corn, sorghum, and sugarcane. These crops still resemble the wild species from which they were derived. In all grasses the structures that contain

the flowers and seeds are called spikelets. In the tribe Andropogoneae, a major group of grasses that cover 17 percent of the earth's surface, the spikelets come in pairs, one of which bears a seed and one of which doesn't (although in some species it produces pollen).

This structure can be seen clearly in [sorghum](#), and in the many wild grasses that make up North American prairies and African grasslands. It's tempting to think that spikelets that don't produce seeds are useless, but the fact that they have been kept around for 15 million years implies that they have an important function.

A team of scientists at the Donald Danforth Plant Science Center, in laboratories led by Elizabeth (Toby) Kellogg Ph.D., member and Robert E. King Distinguished Investigator, and Doug Allen, Ph.D., associate member and USDA research scientist, set out to answer the questions; could this apparently useless floral structure capture and move photosynthetic [carbon](#) to the seed? And, ultimately, if removed, would we notice a difference in yield?

The researchers used radioactive and stable isotopes of carbon, RNA-seq of metabolically important enzymes, and immunolocalization of Rubisco to show that the sterile spikelet collects carbon from the air and carries out photosynthesis while the awn does not. By tracking the flow of carbon, they discovered that the infertile spikelet transfers carbon to the seed-bearing one which appears to use it for energy, storing it in the seed. When they removed the infertile spikelet from a subset of the branches of sorghum plants, they found that seed weight (yield) was lower by ca. 9%.

"We used to think these floral structures might be vestigial, but they turned out to be quite the asset in terms of productivity," said first author, Taylor AuBuchon, senior technician in the Kellogg lab.

The findings, Sterile spikelets contribute to yield in sorghum and related grasses, were recently published in the journal *Plant Cell*. Additional comments can be found in the In Brief.

"This is a great example of how plant organs and [structure](#) can contribute to biomass and yield in ways not previously described," Allen said.

"This project was incredibly rewarding because of the strong collaboration, creativity and determination of everyone, sharing expertise, designing and conducting the experiments and analyzing the data together," Kellogg reflected.

In addition to the unique collaboration, Kellogg and Allen also attribute the success of the project to the expertise and cutting-edge technology provided by the Advanced BioImaging, Plant Growth and Proteomics and Mass Spectrometry facilities at the Danforth Center.

The next step would be to determine to what extent infertile spikelets affect yield in diverse varieties of field grown [plants](#). Existing sorghum diversity could indicate whether the size of the infertile spikelet affects the size of the [seed](#).

More information: Taylor AuBuchon-Elder et al, Sterile Spikelets Contribute to Yield in Sorghum and Related Grasses, *The Plant Cell* (2020). [DOI: 10.1105/tpc.20.00424](https://doi.org/10.1105/tpc.20.00424)

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