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Commentary

The Impact of Seasonal Climatic Changes on Anatomical and Physiological Characteristics of Phloem

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DESCRIPTION

The timing of phonological changes in woody angiosperms and variations in carbon allocation that occur in response to seasonal climatic changes can have significant effects on species ranges, interactions, and ecosystem processes. A physical constraint on the capacity of woody angiosperms to transport carbon and signals may be imposed by physiological and anatomical changes inside the phloem during important transitions from fall to winter and from winter to spring. The literature on seasonal phloem anatomy, physiology, and tree (floral or foliar) phenology is scarce, and as a result, we know little about how carbon transport may vary seasonally, especially in temperate climates. Grazing, wildfire, and climate have historically changed grassland ecosystems because these factors are essential ecological drivers. Through physiological mechanisms, these grassland drivers affect the shape and productivity of grasses, leading to distinct water and carbon-use strategies among species and populations. The underlying structure of plants, which has been demonstrated in the past to reflect patterns of carbon absorption and water utilization in leaf tissues, limits the physiological responses at the leaf level. However, it is still unknown how much grassland drivers affect anatomy and physiology. In order to fill this information gap, we collected samples from three sites along a latitudinal gradient in the central Great Plains' mesic grassland region between the growth seasons of 2018 and 2019 (wetter). At the plot level, we assessed yearly biomass and forage quality and gathered physiological data.

Anatomical characteristics of each site's ungreased and cattle-grazed areas at the leaf level. *Andropogon gerardi*, carbon uptake and overall productivity were lowered by the effects of ambient drought conditions, which outweighed any local grazing interventions. Anatomical characteristics at the leaf level differed across years, between locales, and especially those related to water usage. In particular, xylem area increased in the presence of more water in 2019 whereas xylem resistance to cavitation was seen to rise during the drier growth season (2018). Our findings emphasize the value of long-term research in natural systems and how trait plasticity may be a useful tool for predicting how grasslands will respond to climate change since the environment had a greater influence on leaf physiology and architecture than grazing did. The anatomy, diurnal gas exchange, and chlorophyll fluorescence of mature leaves from seedlings, saplings, an adult tree, and suckers growing from stumps of *Macaranga gigantean*.

The idea that ontogenetic changes in leaf architecture and physiology cause patterns of resource usage to alter during different life stages. The air gap within the lamina was biggest in seedling leaves and lowest in mature tree leaves among leaves of various developmental stages, with seedling leaves being the smallest and thinnest and adult tree leaves being the largest and thickest. In comparison to adult tree leaves, seedling and sapling leaves have greater Photosynthetic Nitrogen-Use Efficiency (PNUE). A tree's mature leaves had a mean PNUE that was 1.6 times higher in seedling leaves. Because seedling leaves have the lowest Nitrogen (N) content per unit leaf area among the developmental stages, their net Photosynthetic rate (Pn) per unit leaf area is also the lowest. Sapling leaves had the largest in situ water vapour stomatal conductance (g(s)) at a certain leaf-to-air vapour pressure deficit, indicating that they have a high hydraulic efficiency per unit leaf area. The intrinsic water-use efficiency (Pn/g(s)) and photochemical capacity of photosystem II were lowest in seedling leaves among developmental stages. Indicating that the progressive change from the seedling stage to the sapling stage is accompanied by an accumulation of N in plant bodies and the development of hydraulic systems, sapling leaves had the highest N concentration, Pn per unit dry mass, and g(s).

CONCLUSION

Phloem phenology with an emphasis on how the morphology of sieve elements and the flow of phloem sap may impact the availability of carbon throughout the year. A direct model of phloem sap flow and analyses how variations in sap concentration, pressure gradient, and sieve plate pores can affect flow over the winter in order to determine whether flow is feasible predicts that phloem transport may occur year-round in some species, even during the winter, but it is challenging to confirm this prediction given the limitations of present techniques for monitoring all the variables related to phloem sap flow. Highlight open concerns concerning phloem function in the winter and stress the necessity for fresh approaches to fill in knowledge gaps about phloem function.

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