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Mucilage: More than just a carbon source for microbial life in the rhizosphere

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Although increasing evidence supports the prominent role of mucilage in soil-plant water relations, it remains unclear how long mucilage persists in soil of varying water content. The aim of this study was to measure: 1) the effects of soil moisture (optimum and drought stress) on mucilage decomposition, 2) the effect of mucilage on soil organic matter (SOM) decomposition, and 3) the effect of mucilage on enzymes activities. Two doses of maize root mucilage (i.e. C4 plant-derived) were added to a C3 soil at optimum moisture (80% WHC) and drought (30% WHC) conditions.

Under optimum conditions, CO_2 efflux increased with mucilage addition. In contrast, there was no effect of mucilage addition on CO_2 efflux under drought. After 15 days, most of the mucilage was decomposed under optimum water supply (98% and 88% for low and high dose, respectively). Drought significantly suppressed mucilage mineralization (77% and 30%). Incorporation of mucilage C into microbial biomass was not affected by drought, suggesting its unhindered bioavailability. High-dose mucilage amendment increased microbial biomass for both optimum and drought conditions compared to the treatment without mucilage. Despite this increase in microbial biomass, negative priming effect on native soil organic matter was induced by the addition of mucilage. Under drought, mucilage addition always increased enzyme activities and frequently also affinity relative to the non-amended soil, and thus compensated for the loss in enzyme activity or affinity induced by drought.

This study suggests that, besides its function as a C source for microorganisms, mucilage provides biofilm-like properties that maintain microbial and exoenzymatic activities, even under drought. The low decomposition rate of mucilage in drying soils, proves that mucilage can remain functional for long time, favoring the capture of water and nutrients, especially when water is scarce.