Effects of clipping and irrigation on carbon storage in grasses: implications for CO2 emission mitigation in rangelands

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Abstract

Understanding how individual grasses respond to herbivory and rainfall has been hampered by the difficulty of quantifying above- and belowground carbon (C) storage in grasses. Particularly by restoring degraded rangelands through reseeding, their C storage potential can be greatly enhanced. The responses of reseeded grasses to the effects of herbivory and precipitation were assessed to evaluate the potential of individual grasses for C storage as a technique for climate change mitigation. Clipping experiments were conducted on mature grass tufts of two native grass species, Chloris gayana and Cenchrus ciliaris, in the semi-arid Borana rangelands, Ethiopia. Further, above- and belowground C storage of young grasses of the same species in pot and field plot trials was experimentally quantified under simulated grazing and variable rainfall. The results showed that aboveground C was significantly 4 times lower in the clipped compared to unclipped mature grasses. In contrast, 3 times higher C was found in young reseeded grasses that were clipped compared to unclipped ones. Clipping and irrigation in combination significantly influenced belowground C in young grasses, with reduced irrigation overriding clipping effects. The paper concludes that moderate grazing should be encouraged to enhance CO2 uptake, consequently contributing to climate change mitigation in rangelands.

KEYWORDS: Borana, herbaceous layer restoration, herbivory, livestock management, rainfall variability