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Can species-specific differences in foliar chemistry influence leaf litter decomposition in grassland species?

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The influence of litter quality on its rate of decomposition is a crucial aspect of C cycle. In this study we concentrated on grassland ecosystems where leaf litter is one of the major sources of C input. To quantify the contribution of initial leaf chemistry within different plant species, the decomposition of chemically different leaf litter of three grassland species (Lolium perenne, Festuca arundinacea and Dactylis glomerata) was monitored, using the litter bag technique. Litter of different maturity stages i.e. green (fresh leaves) and brown litter (brown leaves were still attached to the plant), were incubated on bare soil surface. Samples were taken at different time intervals (0, 2, 4, 8, 20 and 44 weeks) and were analyzed for mass loss, organic C and N contents and stable isotopic signatures (C and N). Changes in litter chemistry were addressed by determining lignin-derived phenols after CuO oxidation and non-cellulosic polysaccharides after acid hydrolysis followed by gas chromatography. Green litter was chemically different from brown litter due to higher initial N and lower lignin contents. While in grassland species, both L. perenne and D. glomerata were similar in their initial chemical composition compared with F. arundinacea. Green litter showed higher rate of degradation. In green litter, Percent lignin remaining of initial (% OI) followed the similar decomposition pattern as of C remaining indicating lignin as controlling factor in decomposition. Constant Acid-to-Aldehyde ratios of lignin-derived phenols (vanillyl and syringyl) did not suggest any transformation in lignin structures. In green litter, increase in non-cellulosic polysaccharides ratios (C6/C5 and deoxy/C5) proposed microbial-derived sugars, while there was no significant increase in these ratios in brown litter. In conclusion, due to the differences in initial chemical composition (initial N and lignin contents), green litter decomposition was higher than brown litter in all grassland species. Regardless of similarities in initial composition of grassland species, green and brown litter of Lolium perenne decomposed more rapidly compared with other two species. So, Species related differences in initial litter chemistry did not control its degradation.