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# Climate and soil type effects on crop residue decomposition

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Crop residues are an important resource for maintaining soil productivity. The decay of crop residues is linked to many ecosystem functions, affecting atmospheric $CO_2$, nutrient release, microbial diversity, and soil organic matter quality. The rate of decay, in turn, is regulated by soil type, management, and environmental variables, some of which will be changing in the future. Our objective in this study was to evaluate effects of soil type, climate, residue placement on the decomposition and retention of residue-derived C. $^{13}$C-labelled barley straw was either placed at the surface or mixed to 10 cm in soils at four sites in Canada and one site in New Zealand representing different soil types and climates. Soils were collected periodically over 10 yr to determine $^{13}$C remaining. The loss of C from crop residues occurred quickly, most (70-75%) within the first 2 yrs but with only 5-10% remaining after 10 yrs. There were large losses of C from the mixed treatments within the first year, with 20-50% lost after 6 months over winter and 50-70 % lost after one year; after that decomposition slowed. Temperature was the single most important factor regulating the rate of residue decay. Thermal time, expressed as cumulative degree days, explained more of the variability in residue C recovered than time (in calendar years). Slower decay of surface-placed residues may be attributed to lower mean annual precipitation at those sites. Thermal time is a robust, consistent way of predicting crop residue decay rates (or C storage) for comparing C kinetics across sites with different soils and climates.