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Effects of black carbon on aggregate stability, runoff generation, splash erosion and slopewash of a clay loam under simulated rainfall

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Black (pyrogenic) carbon (BC) was produced from native hardwoods pyrolysed in a ring kiln at $\sim$400˚C and ground and sieved to $<$ 2 mm. The BC was then added to a clay loam (sieved to $<$3.35 mm) at rates of 0, 5, 25 and 50 g kg^{-1} to create triplicate samples totalling 3000 g for each treatment. 435 ml of water (30% of water holding capacity of the control treatment) was thoroughly stirred into each sample. Samples were incubated at 21˚C in sealed containers in a dark room without natural light. After 50, 100 and 150 days, a subsample of 100g was removed from the top of each container and dried for 24 h at 45˚C. Dried subsamples were sieved to obtain the 3.35 – 4 mm fraction, $\sim$10g of which was weighed then spread evenly on a 500 μm sieve and subjected to simulated rainfall for 2 minutes. The sieves were then oven-dried for 24 h at 45˚C then sieved and weighed again to determine the percentage of aggregates $>$ 3.35 mm remaining. After 200 days of incubation, the remainder of each sample was air-dried and sieved to $<$ 5 mm. Each sample was then placed in a square plot and subjected to 40 minutes of simulated rainfall. Runoff and subsurface drainage were measured at 2 minute intervals and runoff was collected at 5 minute intervals to enable subsequent determination of sediment concentrations, sediment yields and erosion rates of soil and BC. Splash cups were placed on each side of the plot to allow measurement of overall splash detachment for each simulation.

A BC content of 5g kg^{-1} did not affect the mean aggregate stability of the clay loam, but a content of 25 g kg^{-1} led to a decrease in mean aggregate stability of $>$40%, with a further significant reduction observed when the BC content was 50 g kg^{-1}. There were no statistically significant changes in aggregate stability between 50, 100 and 150 days of incubation for any of the application rates. Results showing the effects of BC on runoff generation, splash erosion and slopewash will also be presented.