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Grass species selection to control for concentrated flow erosion in grassed waterways.

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Grassed waterways reduce water runoff, prevent scouring and encourage sediment deposition from erosion prone land. The aim of this study was to assess the efficacy of conventional and novel grass species (as monocultures and mixtures) to control erosion, at an early establishment stage (6 weeks), within grassed waterways. The experimental treatments included bare soil (B), a conventional mix of Lolium perenne and Festuca rubra (C), Festulolium cv prior (F1), Festulolium cv prior and Festulolium bx511 (F1+F2), and all grass species combined (F1+F2+C). F1 is adapted to flooded conditions, whilst F2 is adapted to drought conditions. With climate change in the UK likely to result in drier summers and wetter winters these Festulolium species will be adapted to future climatic conditions. However, little is known about their efficacy within grassed waterways. The grasses were established in 1.2 x 1 x 0.5m macrocosms in a sandy clay loam soil during June-Aug, 2019. A sub sample of each experimental treatment was taken (0.3 x 0.1 x 0.1m) from the macrocosms within a stainless steel box. Tests were replicated in quadruplicate.
The following above ground trait (Stem area density) and the following below ground traits (Total root length of fine roots <0.25mm, root diameter and root surface area) were determined for each experimental replicate. Prior to testing, the grass was cut to circa 3.0 cm height to represent a mowed grass sward before being placed into a fully instrumented hydraulic flume. The hydraulic flume simulated a concentrated flow event and treatment performance was assessed in terms of turbidity, sediment concentration, soil loss and flow velocity.
The effects of roots+shoots and of roots only on performance indicators were determined to quantify the relative contribution of above ground vs below ground traits in controlling erosion. One set of replicates was tested only with roots whilst another set of replicates was tested with roots+shoots and then with roots only. This was done to isolate the effect of below ground and above ground traits.
All replicates were subjected to a concentrated flow event with increasing incremental flow velocities from 0.2-0.6l s-1 for bare soil, 0.2-0.8l s-1 for roots+shoots treatments and 0.2-1.4l s-1 for roots only treatments. Each flow rate velocity was run for 60 seconds. For each flow rate, duplicate water samples were taken downslope of the treatment and water depth was measured, upstream of the treatment, in the centre of the treatment and downstream of the treatment. The water samples were used to determine sediment concentrations. The water depth measurements were used to determine runoff velocity. Furthermore, a turbidity meter continuously measured turbidity during the concentrated flow event. Soil detachment and transport rates were significantly reduced for all experimental treatments as compared to the bare soil ($p<0.05$). Final treatment

efficacy will be assessed based on a ranking of the key performance indicators. The knowledge gained from this research can be used and applied to other grassed soil erosion mitigation features such as in field and riparian buffer strips, swales as well as grassed waterways.