Early Life Benefits of Hybrid Sports Turf

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'Hybrid turf', commonly used at elite level football in Europe, aims to combine the characteristics of both natural and artificial turf regarding playing performance/durability. The claims made for reinforced pitch systems include: they allow considerably more playing hours than a 100% natural pitch; pitches play faster, are more consistent and provide better playability throughout the year with minimal surface damage; and recover faster after play. Over recent years [1] natural turf pitch rootzone specifications require greater % sand and less % of finer silt/clay to avoid issues of moisture sensitivity and loss of strength (and drainage) during wetter periods. Sand is a relatively strong frictional soil, but lacks cohesion and requires good coverage of grass plant roots to increase stability. The purpose of this study was to explore the early-life play performance of a hybrid turf pitch.

Field monitoring was undertaken on the *early life development of traction performance* of a 'stitched' turf system on Loughborough University campus. The stitched system used a very similar construction profile to a high quality natural turf, with the addition of artificial (polyethyene) fibre *reinforcement* on a grid spacing of 20×20 mm and 180 mm deep (Fig. 1a). The *unreinforced* zone of natural turf around the perimeter formed a useful area for direct comparison. The pitch and perimeter were fertilised and watered regularly, after seeding with perennial ryegrass on 1st August 2019. Hardness (2.25 kg Clegg Hammer) and Rotational Traction (standard 6 stud) were monitored regularly over a period of 6 months, at 10 test locations, and insitu water content measured using a theta probe.

Competitive play occurred after only 6 weeks with positive feedback on pitch quality and damage resistance. The hybrid turf peak rotational traction (torque) values (Fig. 1b) increased steadily for the first 3 months of plant growth as the roots developed, similarly for the natural turf. The hybrid typically gave larger relative torque values throughout testing. Once fully established, after ~4 months, the hybrid turf maintained a consistent level of peak torque and was less susceptible to changes in traction, relative to the natural turf, through the very wet weather in Jan/Feb 2020. The detailed development of traction resistance indicated that the hybrid peak torque occurred at a larger angle of rotation, of between 5 and 20 degrees, and gave a higher traction stiffness relative to the natural turf (Fig. 1d). A bare area of natural turf peaked at 15 Nm, i.e. sand rootzone alone, and a similar bare area of hybrid turf gave 25-30 Nm (not shown), demonstrating an improved baseline of stability. The hybrid turf maintained a consistent range of hardness of

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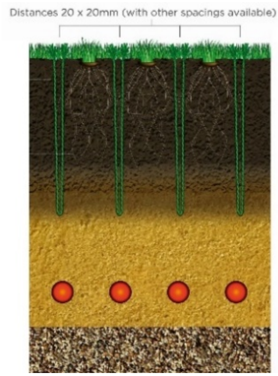
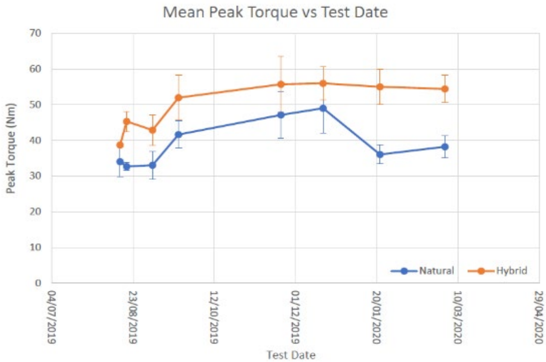
80-90 g, on average around 10 g higher than the natural turf, with no clear trend for plant root growth (Fig. 1c). The field water content measurements were consistently lower for the hybrid (15-20%) compared to the natural turf (20-30%) suggesting better drainage performance of the stitched area.

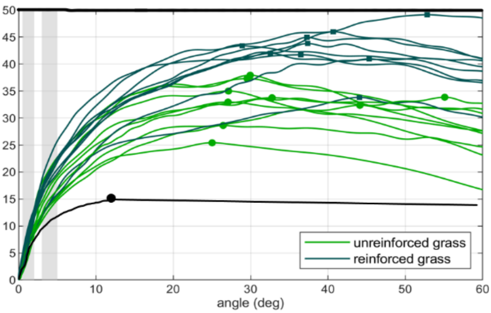


a)



b)

c)



d)

Fig. 1: (a) Idealised x-section of a stitched pitch [2], (b) Peak Torque +/- 1 S.D. (c) Extracted core from the hybrid turf showing the cohesionless sand bound together by healthy root growth, (d) Traction torque mobilisation (pitch nearly ready for play on 04/09/19).

As the grass roots became established they provided a form of fibre reinforcement to the soil, increasing its shear strength and hence traction resistance. Whilst further work is required to establish the resistance to divoting under more extreme loading conditions, Fig. 1d suggests the importance of the fibre-soil-root interaction to resist failure up to larger strains, and hence it could be argued local failures (divots) may occur less frequently. The next step is a model to predict resistance to divoting and design optimisation of the fibre spacing and depth for maximum cost-benefit.

1. DIXON S, FLEMING PR, et al. (2015) The Science and Engineering of Sport Surfaces. T&F, London.
2. ANDREWS, C., 2016. Hybrid football pitches: why the grass is always greener. IET, available online https://eandt.theiet.org/content/articles/2016/10/hybrid-football-pitches-why-the-grass-is-always-greener/ (Accessed 15 Oct 2021).

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