DIFFERENCES IN CARBON SEQUESTRATION BETWEEN GRASS SPECIES.

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Introduction

The aim of this study was to look at the carbon sequestration characteristics of well established amenity turf and to see whether there existed differences between species. Extensive work has been carried out looking at the sequestration characteristics of permanent pastureland. In the past nothing has been done to investigate the characteristics of amenity grass this study shows the differences that exist between species; further ongoing work is now looking at whether there are differences between varieties. It is clear that the capacities of carbon sequestration are directly or indirectly linked to the development of root mass.

Methodology

1m² replicated trial plots are the common method by which varieties are assed over a three year period at the DLF Trifolium Plant Breeding Centre in Les Alleuds France. Les Alleuds is near the city of Angers, South West of Paris near Nantes. The area enjoys a mild moist climate, low snow cover in winter but quite high wind chill and a hot dry summer. Precipitation is on average about 700mm /annum.

The first set of trials sown in the autumn of 2005 and analysed 30 months later in the spring of 2008. The trials are maintained with 150 units of nitrogen fertiliser per annum, in 4 separate applications. No fungicide or herbicide applications were made. Irrigation was only done in the event of extreme drought conditions, which would otherwise kill the plants. The grass was cut at 5cm on a weekly basis and the clippings removed. The background carbon levels from soils samples were taken on a control plot previously planted with cereals. Accordingly the change in carbon levels in the soil could be attributed of the different turf grass species and varieties on each of the plots.

The species tested were Slender Creeping Red Fescue, Smooth Stalked Meadow Grass, Ray Grass, Agrostis stolonifera, and a mix containing micro-clover.

A more in depth study was also carried out with analysis being done in the winter of 2009, to see if there were any variety differences that could then be subsequently bred for.

In both sets of trials, core samples were taken from the plots using a standard golf course hole depth cutter to 20 cm and the samples were sent away for analysis to an independent Laboratory. The carbon content was analysed in the leaves, roots and the soil.

Table 1. TONS OF CO_2 / HA. STOCKED IN TURF GRASS AFTER 30 MONTHS		
	leaves	**roots**
Mixture	3,70	9,92
Smooth Meadow Grass	4,42	20,60
Hard Fescue	3,46	14,17
Rye grass	4,56	11,61
Agrostis stolonifera	5,48	15,96
Red Fescue	6,17	47,26
Average	**4,63**	**19,92**

Table 2. TONS OF CO_2 / HA. SEQUESTRATED PER YEAR INTO THE SOIL	
	soil
Mixture	9,65
Smooth Meadow Grass	5,66
Hard Fescue	14,08
Rye grass	19,36
Agrostis stolonifera	20,57
Red Fescue	4,70
Average	**12,34**

Results

It is standard practice to convert the carbon content into CO_{2eq} eq meaning the equivalent in reference to green house gas (GHG) emissions as defined by the IPCC Intergovernmental Panel on Climate Change. In this study no other GHG are involved so 1 unit weight of carbon becomes 3.67 unit weights of CO_2 because of the respective molecular weights of carbon and oxygen. ((12 + (16 x 2)) / 12)

The leaf CO_2 content is related to cutting height and sward density, it will therefore be variable.

The root stock represents the total carbon content of the roots accumulated after 30 months of trials. (table 1.)

The annual sequestration rate for CO_2 is calculated from the overall carbon content of the soil less the control plot and calculated on an average yearly basis, (table 2.)

What is immediately obvious is the significant difference between the capacities of amenity grass species to stock and sequester carbon, 175% in the leaves, 400% in the roots and 430% for annual sequestration.

The initial results showed the interesting characteristic of the Red Fescue species to hold more carbon in its roots; however the transfer of carbon to the soil was the lowest. The reason is not fully understood; is something blocking the decomposition of organic matter in Red Fescue or do the roots just live longer? Further research is required.

Conclusions

The significant difference of carbon stocks and sequestration in amenity grass species highlights the importance of roots and their interaction with the soil. It also indicates that further research & development on variety basis could establish if there are carbon sequestration differences within species, and whether it is an environmental factor that can be selected for.

For seed breeders roots will in the future, have an increasing role in the development of new varieties.