



British Sugar: Microbial Biomass

Author: Mark Pawlett

Date: September 2022



Microbial Biomass

Method Information

Soil samples (9) were delivered to Cranfield University on 08/12/21, 24/02/22, 05/05/22 and 21/07/22. The samples were labelled as “Hort Loam”, “Sport and Turf”, and “Landscape”, each with three replicates (labelled as A, B and C).

The soils were analysed to estimate microbial biomass, which is the mass of intact microbial cells within each sample. This was done using the fumigation-extraction procedure described developed by Jenkinson and Powlson (1976), using the K_{EC} conversion factor of 0.45 to convert extracted microbial carbon to microbial biomass values (Vance et al, 1987). The laboratory Standard Operating Procedure (SOP) used at Cranfield University is based on the British Standard BS 7755: Section 4.4.2:1997 *Determination of soil microbial mass – fumigation-extraction* method (identical to ISO 14240-2:1997).

In brief, soils were fumigated with chloroform for twenty-four hours to lyse the cells and release carbon. The released organic carbon was then extracted from the soil using 0.5 mol/l potassium sulphate. Non-microbial organic carbon is also determined in an unfumigated sub-sample, the increase in extracted organic carbon used to determine microbial biomass. The amount of carbon extracted from the soil was quantified using an auto-analyser.

Data were analysed statistically using STATISTICA (Version 14) software by applying Repeated Measures (time) Analysis of Variance (RM-ANOVA) followed by Fisher Least Significance Difference (LSD) post-hoc analysis. Groups were considered significantly different if $p < 0.05$.

Results

ANOVA (Table 1) of Microbial Biomass data (Table 2) identified differences between the soils, with significant ($p < 0.05$) “Time X Soil ID” effects.

Sport and turf” values were consistently less than the “hort loam” and “landscape”, for all four sampling times. This difference was significant for 08/12/21 24/2/22 and 05/05/22, but at the final sampling time there was no significant difference between the “landscape” and “sport and turf” as there is an apparent reduction of microbial biomass in the “landscape” soil. In addition, there was no significant difference between analysis times for the “sport and turf” samples. The microbial biomass of agricultural soils would be expected to be between 200 to 400 $\mu\text{g-C/g}$; as all of the “sport and turf” values are < 50 they would be considered as having very low microbial biomass.

The difference between “hort loam” and “Landscape” was variable over time. For the 08/12/21 and 05/05/22 samples there was no significant difference between these samples; for the 24/02/22 and 17/07/22 samples the “hort loam” had the greatest microbial biomass.

Table 1: Repeated Measure ANOVA table showing significance (p value in red)

Effect	Repeated Measures Analysis of Variance				
	SS	Degr. Of f	MS	F	p
Intercept	369988.0	1	369988.0	216.9345	0.000006
Soil ID	114539.9	2	57270.0	33.5790	0.000552
Error	10233.2	6	1705.5		
TIME	9605.4	3	3201.8	3.4940	0.037138
TIME*Soil ID	25520.9	6	4253.5	4.6417	0.005110
Error	16494.7	18	916.4		

Table 2: Microbial Biomass Data

Sample ID	Soil Microbial Biomass ($\mu\text{g-C/g}$)			
	08/12/2021	24/02/2022	05/05/2022	21/07/2022
HORT LOAM A	67.8	198.2	185.8	145.4
HORT LOAM B	144.7	214.9	112.9	169.4
HORT LOAM C	95.0	272.8	191.3	135.5
SPORT AND TURF A	22.3	16.4	5.6	29.5
SPORT AND TURF B	20.5	18.0	30.1	21.5
SPORT AND TURF C	43.7	35.2	18.5	47.7
LANDSCAPE 20 A	153.5	134.3	141.0	54.7
LANDSCAPE 20 B	142.7	110.2	59.8	20.7
LANDSCAPE 20 C	134.7	141.2	187.7	126.8

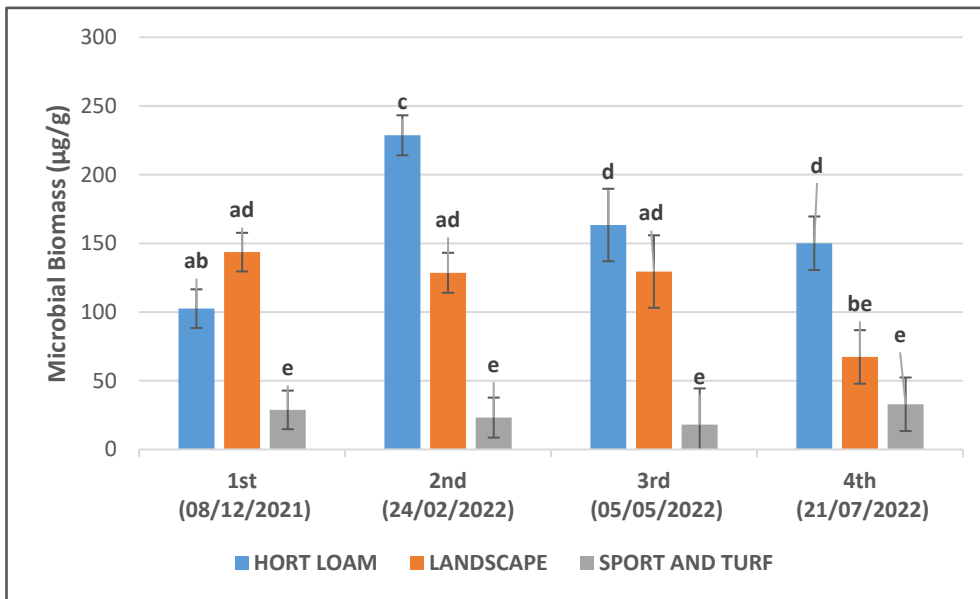


Figure 1: Microbial Biomass means (\pm Standard Error Bars). Letters above the bars denote significance ($p < 0.05$). Where groups have the same letter there is no significant difference.

Conclusion

- “Sport and turf” consistently had reduced microbial biomass compared to the other two soil types, with little change over time
- “hort loam” has the greatest microbial biomass overall
- “landscape” microbial biomass is slightly reduced compared to “hort loam”, particularly for the 4th sampling point.