Programme Area: Bioenergy

Project: Characterisation of Feedstocks

Title: D12 Phase 2 Final Report - Appendices

Abstract:

Final report on investigations into the effect of harvest time and variety on willow SRC and the effect of harvest time and storage method on Miscanthus quality Deliverable Context and Key Content. This deliverable is one of three to be provided under the second phase of the Characterisation of Feedstocks Project. This report is the Final Report from this second Phase. It is complementary to the Final Report from the first phase (D6) and the synthesis report bringing together the findings from the whole project, deliverable D13. It is supported by the Excel dataset (D11). The purpose of this deliverable (D12) is to report on the impact of harvest time on the properties of UK produced Short Rotation Coppice (SRC) willow and Miscanthus; the impact of variety on UK produced SRC willow properties, and; the impact of four different types of commonly used storage types over time on UK produced Miscanthus properties. The second phase of work was set out against the following hypotheses about feedstock characteristics.

Context:

The Characterisation of Feedstocks project provides an understanding of UK produced 2nd generation energy biomass properties, how these vary and what causes this variability. In this project, several types of UK-grown biomass, produced under varying conditions, were sampled. The biomass sampled included Miscanthus, Short Rotation Forestry (SRF) and Short Rotation Coppice (SRC) Willow. The samples were tested to an agreed schedule in an accredited laboratory. The results were analysed against the planting, growing, harvesting and storage conditions (i.e. the provenance) to understand what impacts different production and storage methods have on the biomass properties. The main outcome of this project is a better understanding of the key characteristics of UK biomass feedstocks (focusing on second generation) relevant in downstream energy conversion applications, and how these characteristics vary by provenance.

ETI Project Code: BI2010

Project Title: Characterisation of Biomass Feedstocks

Deliverable title: Final report on investigations into the effect of harvest time and variety on willow SRC and the effect of harvest time and storage method on *Miscanthus* quality - Appendices

Reference: D12 (Appendices)

Participant lead: Forest Research

Other participant: Uniper Technologies Ltd

Submission date: 9th March 2017

Version number: v2.2

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Contents

1. Table of removed outliers

VARIATION	Sample	VARIABLE	MODEL	EXCEL_ROW	OBSERVED	FITTED	DIFFERENCE	RESIDUAL	Considered an outlier?	Reason
1	052/Misc/1/B	Mo	2	8	0.198	0.4096	-0.2117	-2.0288	No	Within range seen
1		Pb_2	1	8	5.4402	1.2032	4.237	2.4881	Yes	
1	053/Misc/1/B	%wt_Cl	2	9	0.26	0.3312	-0.0712	-2.0887	No	Within range seen
1		%wt_S	2	9	0.09	0.0646	0.0254	2.5519	No	Within reproducibility
1		Br	2	9	13.3508	25.3595	-12.0086	-2.0179	No	Within range seen
1		wt%_Cl	2	9	0.2692	0.3507	-0.0815	-2.2248	No	Within range seen
1	056/Misc/1/B	%wt_H	2	10	5.8172	5.8731	-0.0559	-2.2409	No	Within reproducibility
1		Br	2	10	46.8313	30.7424	16.0888	2.7036	No	Within range seen
1		Co	2	10	0.5734	0.2782	0.2952	4.3983	No	
1		Mo	2	10	0.8879	0.5496	0.3383	3.2423	No	
1		wt%_H	1	10	6.037	6.1024	-0.0655	-2.0761	No	Within reproducibility
1		wt%_S	2	10	0.0332	0.0575	-0.0243	-2.2901	Removed	Calculation issue - dry OK
1	060/Misc/1/B	Ba	2	12	12.0159	9.2335	2.7824	2.7407	No	High Ba site
1		Br	2	12	9.6896	22.3141	-12.6244	-2.1214	No	Within range seen
1		Na2O_1	2	12	0.3729	0.6458	-0.2728	-2.0171	No	Within range seen
1	049/Misc/2/Jan 16	Ni	2	13	0.3315	0.2461	0.0854	2.6632	No	Within reproducibility
1	052/Misc/2/Jan 16	%wt_S	2	14	0.0568	0.032	0.0248	2.487	No	Within range seen
1		wt%_S	2	14	0.0587	0.0326	0.026	2.452	No	Within range seen
1	053/Misc/2/Jan 16	As	1	15	0.0814	0.0382	0.0432	2.7355	No	Within range seen
1		BaO	1	15	0.04	0.0251	0.0149	3.0369	No	Within range seen
1		BaO_1	1	15	0.0776	0.0385	0.039	4.0853	No	Within range seen
1		Fe2O3_1	1	15	0.6595	0.3332	0.3263	2.2382	No	Within range seen
1		MgO_1	1	15	7.6235	4.8435	2.78	2.9324	No	Within range seen
1		Mn3O4_1	1	15	0.3666	0.1876	0.1791	2.6029	No	Within range seen
1		Pb_2	1	15	5.0615	1.2032	3.8583	2.2657	Yes	
1		Sb	1	15	0.1034	0.0556	0.0478	3.0469	No	Within range seen
1		TiO2	2	15	0.11	0.0715	0.0385	2.0493	No	Within range seen
1		TiO2_1	2	15	0.2134	0.1193	0.0941	3.2298	No	Within range seen
1	056/Misc/2/Jan 16	GCV_kJ_kg_2	2	16	19495	19694.67	-199.6652	-2.1639	No	Within reproducibility
1	060/Misc/2/Jan 16	Cu	1	18	4.612	2.8633	1.7487	2.6403	Yes	
1		Pb_2	1	18	6.0407	1.2032	4.8375	2.8407	Yes	
1	049/Misc/3/Mar 16	P2O5	1	19	9.38	7.0818	2.2982	2.1348	No	Within range seen
1	052/Misc/3/Mar 16	BaO	1	20	0.03	0.0194	0.0106	2.1506	No	Within range seen
1		BaO_1	1	20	0.0447	0.0255	0.0192	2.005	No	Within range seen
1		MgO_1	1	20	5.1712	3.1341	2.0371	2.1487	No	Within range seen
1		SiO2	1	20	27.24	38.11	-10.87	-2.0396	No	Within range seen
1		SO3	2	20	5.21	3.9947	1.2153	2.3005	No	Within range seen
1	053/Misc/3/Mar 16	Be	2	21	0.1636	0.1255	0.0382	2.0377	No	LOD
1		MgO	1	21	1.75	3.192	-1.442	-2.4528	No	Within range seen
1		MgO_1	1	21	2.1975	4.8435	-2.646	-2.7911	No	Within range seen
1	056/Misc/3/Mar 16	CaCO3	1	22	32.6996	15.9481	16.7515	3.3345	Yes	
1		CaO	1	22	18.02	7.595	10.425	4.1166	Yes	
1		Cd_2	1	22	0.7899	0.069	0.7209	5.0047	Yes	
1		SiO2_1	1	22	39.4223	54.5169	-15.0946	-2.8044	Yes	
1		Zn	2	22	40.3078	27.4248	12.883	2.294	No	Site effect
1	052/Misc/4/	Be	2	26	0.183	0.1441	0.0389	2.0761	No	LOD
1	053/Misc/4/	Ash_wt%	2	27	1.11	1.8148	-0.7048	-2.3101	Yes	Due to high M
1		GCV_kJ_kg	2	27	9311	13208.25	-3897.2488	-2.8205	Yes	Due to high M
1		H_wt%	2	27	2.9116	4.15	-1.2384	-2.8032	Yes	Due to high M
1		K2O	2	27	22.46	14.05	8.41	2.146	No	Within range seen
1		K2O_1	2	27	31.011	21.1008	9.9101	2.1801	No	Within range seen
1		Moisture_content_wt_%	2	27	51.6	30.3878	21.2122	2.9025	Yes	
1		NCV_kJ_kg	2	27	7415.2591	11557.61	-4142.3552	-2.8311	Yes	Due to high M
1		Volatile_matter_wt_%	2	27	38.2	54.3167	-16.1167	-2.7986	Yes	Due to high M
1	056/Misc/4/	P2O5	1	28	9.63	7.443	2.187	2.0315	No	OK normalised
1		Sulphur_wt%	2	28	0.02	0.0333	-0.0133	-2.0043	No	OK on dry/Daf basis
1		Volatile_matter_wt_%_1	2	28	84.98	83.4054	1.5746	2.2496	Yes	
1		wt%_H	1	28	6.026	6.1024	-0.0765	-2.425	No	Within range seen
1	059/Misc/4/	SO3	2	29	5.22	4.0944	1.1256	2.1308	No	Within range seen
1	060/Misc/4/	Chlorine_wt_%	1	30	0.26	0.1581	0.1019	2.9786	No	Site effect
1	049/Misc/5/	%wt_C	1	31	46.3903	47.7716	-1.3813	-3.1458	Yes	
1		Al2O3	1	31	1.7	0.2833	1.4167	4.9218	Yes	
1		Al2O3_1	1	31	1.8242	0.3514	1.4729	4.7199	Yes	
1		As	1	31	0.0871	0.0382	0.0489	3.0958	Yes	
1		Cr	1	31	0.5477	0.2455	0.3022	3.5641	Yes	
1		F	1	31	4.066	2.1176	1.9484	5.0227	Yes	
1		Fe2O3	1	31	0.81	0.2187	0.5913	4.4052	Yes	
1		Fe2O3_1	1	31	0.8692	0.2931	0.5761	3.9519	Yes	
1		Ni	2	31	0.2655	0.1996	0.0659	2.0566	No	Within range seen
1		P2O5_1	1	31	5.6551	8.4397	-2.7845	-2.0419	No	Within range seen
1		V	1	31	0.3817	0.186	0.1957	3.8522	No	LOD
1		wt%_C	2	31	47.9238	48.8284	-0.9046	-2.8827	Yes	
1	052/Misc/5/	Sulphur_wt%	2	32	0.02	0.0333	-0.0133	-2.0043	No	OK on dry/Daf basis
1	053/Misc/5/	%wt_C	1	33	47.1705	48.1895	-1.019	-2.3206	No	ok on DAF basis
1		%wt_Cl	2	33	0.23	0.1562	0.0738	2.1628	No	Site effect
1		Chlorine_wt_%	1	33	0.2	0.1192	0.0808	2.3607	No	Site effect
1		Cr	1	33	0.463	0.254	0.209	2.4652	Yes	
1		Cu	1	33	4.4294	2.7117	1.7177	2.5935	Yes	
1		P2O5_1	1	33	11.8827	8.8177	3.065	2.2476	No	within range seen
1		wt%_Cl	2	33	0.24	0.1582	0.0817	2.2318	No	Site effect
1	056/Misc/5/	MgO	1	34	4.04	2.4909	1.5491	2.635	No	within range seen
1		Mn3O4	1	34	0.385	0.2396	0.1454	2.4791	No	within range seen
1		Mn3O4_1	1	34	0.4149	0.2663	0.1485	2.159	No	within range seen
1		Mo	2	34	0.1006	0.3288	-0.2282	-2.1873	No	LOD effect
1		Sulphur_wt%	2	34	0.05	0.0333	0.0167	2.5054	No	OK on dry/Daf basis
1		Zn	2	34	0.1006	15.4082	-15.3076	-2.7258	Removed	Corrected
1	059/Misc/5/	%wt_N	2	35	0.2776	0.4047	-0.1271	-2.3522	No	Within range seen
1		Hg	2	35	0.02	0.0092	0.0108	4.1262	Yes	
1		Sb	1	35	0.0837	0.0401	0.0436	2.7804	No	Within range seen
1		Volatile_matter_wt_%_1	2	35	86.17	84.2639	1.9061	2.7232	Yes	
1		wt%N	2	35	0.2823	0.4138	-0.1315	-2.353	No	Within range seen
1	060/Misc/5/	K2O_1	2	36	35.3942	25.4673	9.9269	2.1838	No	within range seen

VARIATION	Sample	VARIABLE	MODEL	EXCEL_ROW	OBSERVED	FITTED	DIFFERENCE	RESIDUAL	Considered an outlier?	Reason
2	114B/SRC-W/Nov15	Ba	1	42	11.0434	6.8625	4.1808	2.1962	No	Within range seen
2		BaO	1	42	0.07	0.0435	0.0265	2.8033	No	Within range seen
2		BaO_1	1	42	0.071	0.0454	0.0256	2.3772	No	Within range seen
2		Cd_2	1	42	0.1302	2.0221	-1.892	-2.1326	Yes	
2		Mn3O4	1	42	0.66	0.3387	0.3213	2.7916	No	Within range seen
2		Mn3O4_1	1	42	0.6692	0.3485	0.3206	2.7978	No	Within range seen
2		Ni	1	42	0.2502	0.6355	-0.3854	-2.3551	No	Within range seen
2	048B/SRC-W/Jan16	Be	2	44	0.1091	0.0949	0.0141	2.0038	No	LOD
2		Mo	2	44	0.1091	0.0949	0.0141	2.0038	No	LOD
2		SO3	2	44	2.48	2.8299	-0.3499	-2.2691	No	Within range seen
2		V	2	44	0.1091	0.0949	0.0141	2.0038	No	LOD
2	103B/SRC-W/Jan16	Al2O3_1	1	45	0.6004	0.3538	0.2466	2.1226	No	Within range seen
2		K2O	2	45	8.12	12.775	-4.655	-2.0661	No	Within range seen
2	112B/SRC-W/Jan16	Ash_%	1	46	1.28	1.6569	-0.3769	-2.1968	No	Within range seen
2		Ash_wt%	1	46	0.58	0.7517	-0.1717	-2.1245	No	Within range seen
2		Br	1	46	2.0213	1.9368	0.0846	2.2534	No	LOD
2		F	1	46	2.0213	1.9368	0.0846	2.2534	No	LOD
2		Se	1	46	0.4043	0.3874	0.0169	2.2534	No	LOD
2	114B/SRC-W/Jan16	Co	1	48	0.2469	0.13	0.1169	2.1694	No	Within range seen
2		H_wt%	1	48	2.6016	2.8015	-0.1999	-2.0178	No	OK on dry/Daf basis
2		Pb_2	1	48	7.3399	1.0356	6.3043	3.5179	Yes	
2		TiO2	1	48	0.15	0.0381	0.1119	2.6348	No	Within range seen
2		TiO2_1	1	48	0.1573	0.0407	0.1165	2.5481	No	Within range seen
2		Volatile_matter_wt_%	1	48	35.3	37.7711	-2.4711	-2.0474	No	OK on dry/Daf basis
2		wt%_Cl	1	48	0.01	0.0186	-0.0086	-2.2055	No	Within reproducibility
2		wt%_H	1	48	6.1286	6.1929	-0.0643	-2.0085	No	Within reproducibility
2	017B/SRC-W/Jan16	P2O5	2	49	15.86	14.2781	1.5819	2.1632	No	Within range seen
2	048B/SRC-W/Mar16	Al2O3	1	50	0.7	0.4	0.3	2.775	No	Within range seen
2		Al2O3_1	1	50	0.714	0.4134	0.3006	2.5878	No	Within range seen
2		As	1	50	0.0663	0.038	0.0283	2.3829	No	Within range seen
2		Fe2O3	1	50	0.45	0.3051	0.1449	2.5994	No	Within range seen
2		Fe2O3_1	1	50	0.459	0.3165	0.1424	2.3576	No	Within range seen
2		Sb	1	50	0.1985	0.0425	0.156	3.4804	No	Within range seen
2		SiO2	1	50	4.49	2.2278	2.2622	2.1172	No	Within range seen
2		SiO2_1	1	50	4.5797	2.2973	2.2824	2.0267	No	Within range seen
2	112B/SRC-W/Mar16	Cu	1	52	5.0351	4.1838	0.8513	2.5521	No	Within range seen
2		Hg	2	52	0.0063	0.0048	0.0015	2.872	No	Within range seen
2		Na2O	1	52	0.46	0.2894	0.1706	2.7884	No	Within range seen
2		Na2O_1	1	52	0.5041	0.3232	0.1809	2.7493	No	Within range seen
2		Sulphur_wt%	1	52	0.02	0.0113	0.0087	2.5617	No	Within range seen
2		wt%_S	2	52	0.0458	0.0318	0.014	2.0221	No	Within reproducibility
2	114B/SRC-W/Mar16	%wt_C	2	54	48.4023	48.9416	-0.5393	-2.2165	No	Within range seen
2		%wt_N	1	54	0.3916	0.5172	-0.1256	-2.0854	No	Within range seen
2		GCV_kJ_kg_1	2	54	19460	19669.4	-209.4	-2.4815	No	Within range seen
2		GCV_kJ_kg_2	2	54	19771	20046.6	-275.6	-2.7453	No	Within range seen
2		H_wt%	1	54	3.0397	2.8015	0.2382	2.4044	No	OK on dry/Daf basis
2		MgO	1	54	3.77	4.496	-0.726	-2.0438	No	Within range seen
2		MgO_1	1	54	4.1629	4.7267	-0.5637	-2.0644	No	Within range seen
2		Moisture_content_wt_%	1	54	50.38	53.9301	-3.5501	-2.3158	No	Within normal range
2		Sulphur_wt%	1	54	0.02	0.0113	0.0087	2.5617	No	OK on dry/Daf basis
2		Volatile_matter_wt_%	1	54	40.53	37.7711	2.7589	2.2859	No	OK on DAF basis
2		wt%_C	1	54	49.1744	50.2078	-1.0334	-2.8478	No	Within range seen
2		wt%N	1	54	0.3979	0.5261	-0.1282	-2.083	No	Within range seen

VARIATION	Sample	VARIABLE	MODEL	EXCEL_ ROW	OBSERVED	FITTED	DIFFERENCE	RESIDUAL	Considered an outlier?	Reason
3	115/SRC-W V/Endura	%wt_H	1	57	6.1615	6.0806	0.081	2.0317	No	OK on DAF basis
3	115/SRC-W V/Tora/Fe	Br	2	58	1.8682	1.946	-0.0778	-2.042	No	LOD
3		Se	2	58	0.3736	0.3892	-0.0156	-2.042	No	LOD
3	115/SRC-W V/Terra N	%wt_S	2	59	0.0743	0.0467	0.0276	2.7457	Yes	
3		F	1	59	1.9844	3.1928	-1.2085	-2.481	No	LOD
3		Sulphur_wt%	2	59	0.03	0.0183	0.0117	2.5721	Yes	
3		wt%_S	2	59	0.0757	0.0475	0.0282	2.7477	Yes	
3	115/SRC-W V/Resolut	%wt_N	2	60	0.6942	0.6119	0.0823	2.397	No	Site effect
3		Na2O	2	60	1.9	1.6345	0.2655	2.4364	Yes	
3		Na2O_1	2	60	2.0305	1.7125	0.318	2.6836	Yes	
3		wt%N	2	60	0.7049	0.6203	0.0846	2.3578	No	Site effect
3	116/SRC-W V/Tora/Fe	As	1	64	0.0772	0.0309	0.0462	3.42	No	Within range seen
3		Ash_%	2	64	2.54	2.0394	0.5006	2.2989	No	Within range seen
3		Ash_wt%	2	64	1.14	0.9335	0.2065	2.0511	No	Within range seen
3		Cr	1	64	0.4526	0.1942	0.2585	2.6345	Yes	
3		Fe2O3	1	64	0.51	0.2411	0.2689	2.0595	No	OK on normalised basis
3		GCV_kJ_kg_2	2	64	20408	20195.67	212.3324	2.166	No	Within reproducibility limits
3		Hg	1	64	0.0082	0.0048	0.0034	4.0096	Yes	
3		Pb_2	1	64	9.3728	1.4114	7.9614	4.8462	Yes	
3		TiO2	1	64	0.12	0.032	0.088	2.6829	Yes	Within range seen
3		TiO2_1	1	64	0.1187	0.0321	0.0866	2.5598	Yes	Within range seen
3	116/SRC-W V/Terra N	GCV_kJ_kg	2	65	9156	8666.488	489.5117	2.2976	No	Due to M level
3		GCV_kJ_kg_2	2	65	20022	20229.87	-207.8676	-2.1205	No	Within reproducibility
3		H_wt%	2	65	2.8232	2.6574	0.1657	2.2686	No	Due to M level
3		Moisture_content_wt_%	2	65	53.35	56.1227	-2.7727	-2.4584	No	Within expected range
3		NCV_kJ_kg	2	65	7237.6817	6716.41	521.2723	2.3186	No	Due to M level
3		Volatile_matter_wt_%	2	65	38.5	35.716	2.784	2.6222	No	Due to M level
3	116/SRC-W V/Resolut	%wt_C	2	66	50.2274	49.8983	0.329	2.0209	No	OK on DAF basis
3		GCV_kJ_kg_1	2	66	19925	19781.62	143.3754	2.0093	No	OK on DAF basis
3		Mo	2	66	0.0346	0.0716	-0.037	-2.2354	No	LOD effect
3		Sb	1	66	2.9472	0.2126	2.7346	5.0793	Yes	
3	116/SRC-W V/Nimrod	Zn	1	68	237.4653	155.0021	82.4632	3.0837	Yes	
3	117/SRC-W V/Endura	Ash_%	2	69	3	2.4736	0.5264	2.4174	Yes	
3		Ash_wt%	2	69	1.56	1.27	0.29	2.8805	Yes	
3	117/SRC-W V/Tora/Fe	Al2O3	1	70	0.49	1.3027	-0.8127	-2.731	No	Within range seen
3		Al2O3_1	1	70	0.5131	1.3883	-0.8752	-2.7807	No	Within range seen
3		As	1	70	0.0199	0.0519	-0.0321	-2.3732	No	LOD effect
3		CaCO3	2	70	76.7124	69.7196	6.9929	2.7387	No	Within range seen
3		CaO	2	70	41.16	37.2389	3.9211	2.6878	No	Within range seen
3		Fe2O3	1	70	0.24	0.5456	-0.3056	-2.3413	No	Within range seen
3		Fe2O3_1	1	70	0.2513	0.5819	-0.3306	-2.4245	No	Within range seen
3		SiO2	1	70	2.63	7.6405	-5.0105	-2.7441	No	Within range seen
3		SiO2_1	1	70	2.7538	8.1466	-5.3928	-2.789	No	Within range seen
3	117/SRC-W V/Terra N	Cr	1	71	0.599	0.3104	0.2886	2.942	Yes	
3	117/SRC-W V/Resolut	Al2O3	1	72	2.18	1.3027	0.8773	2.9483	Yes	Probably Soil contamination
3		Al2O3_1	1	72	2.334	1.3883	0.9457	3.0047	Yes	Probably Soil contamination
3		Fe2O3	1	72	0.89	0.5456	0.3444	2.6378	Yes	Probably Soil contamination
3		Fe2O3_1	1	72	0.9529	0.5819	0.3709	2.7201	Yes	Probably Soil contamination
3		SiO2	1	72	12.81	7.6405	5.1695	2.8312	Yes	Probably Soil contamination
3		SiO2_1	1	72	13.7149	8.1466	5.5683	2.8797	Yes	Probably Soil contamination
3		V	1	72	0.2497	0.1665	0.0832	2.1035	No	Within range seen
3	117/SRC-W V/Sven/F	%wt_Cl	1	73	0.0447	0.0223	0.0224	3.7324	Yes	
3		Chlorine_wt_%	1	73	0.02	0.0104	0.0096	5.1025	Yes	
3		TiO2	1	73	0.15	0.0579	0.0921	2.8086	No	Within range seen
3		TiO2_1	1	73	0.1595	0.0618	0.0977	2.8887	No	Within range seen
3		wt%_Cl	1	73	0.0457	0.0228	0.023	3.7123	Yes	
3	117/SRC-W V/Nimrod	%wt_Cl	1	74	0.01	0.0223	-0.0123	-2.0413	No	LOD effect
3		Ba	1	74	108.6752	66.7856	41.8895	4.5035	Yes	
3		BaO	1	74	0.57	0.3555	0.2145	4.2904	Yes	
3		BaO_1	1	74	0.627	0.3789	0.2481	4.3495	Yes	
3		Cd_2	1	74	6.9747	3.1688	3.8059	3.8532	Yes	
3		MgO	2	74	3.41	2.4018	1.0082	2.5018	No	Within range seen
3		MgO_1	2	74	3.751	2.6843	1.0666	2.5417	No	Within range seen
3		Mn3O4_1	1	74	0.682	0.3341	0.3479	2.0137	No	Within range seen
3		Ni	1	74	1.2544	0.5567	0.6977	2.7254	Yes	
3		P2O5_1	2	74	9.5039	7.1916	2.3123	2.0495	No	Within range seen
3		wt%_Cl	1	74	0.01	0.0228	-0.0128	-2.0632	No	LOD effect
3	118/SRC-W V/Endura	%wt_C	2	75	49.8073	49.2994	0.508	3.1198	No	Within range seen
3		%wt_H	1	75	6.1672	6.0806	0.0866	2.1734	No	Within reproducibility
3		wt%_C	2	75	50.7203	50.3295	0.3908	2.0767	No	Within range seen
3		wt%_H	1	75	6.2802	6.2018	0.0784	2.1287	No	Within reproducibility
3	118/SRC-W V/Sven/F	Al2O3	1	79	1.66	0.9634	0.6966	2.341	Yes	Probably Soil contamination
3		Al2O3_1	1	79	1.712	0.9995	0.7126	2.264	Yes	Probably Soil contamination
3		F	1	79	3.943	2.2752	1.6678	3.4238	Yes	
3		Fe2O3	1	79	0.8	0.5262	0.2738	2.0971	Yes	Probably Soil contamination
3		Fe2O3_1	1	79	0.8251	0.5469	0.2782	2.0402	Yes	Probably Soil contamination
3		SiO2	1	79	9.64	5.6912	3.9488	2.1627	Yes	Probably Soil contamination
3		SiO2_1	1	79	9.9422	5.9012	4.0409	2.0898	Yes	Probably Soil contamination
3		V	1	79	0.2794	0.1694	0.11	2.7815	No	Within range seen
3	119/SRC-W V/Endura	GCV_kJ_kg	2	81	9363	9864.679	-501.6788	-2.3547	No	Due to M
3		H_wt%	2	81	2.8857	3.0624	-0.1767	-2.4185	No	Due to M
3		Moisture_content_wt_%	2	81	52.28	49.804	2.476	2.1953	No	Within expected range
3		NCV_kJ_kg	2	81	7456.9101	7980.669	-523.7587	-2.3297	No	due to M
3	119/SRC-W V/Tora/Fe	Co	1	82	0.4371	0.1399	0.2972	4.6621	Yes	
3		GCV_kJ_kg	2	82	9306	8763.879	542.1212	2.5445	No	due to M
3		H_wt%	2	82	2.8626	2.7029	0.1597	2.1855	No	due to M
3		Mn3O4	1	82	1.076	0.5843	0.4917	2.9391	Yes	
3		Mn3O4_1	1	82	1.0595	0.5762	0.4833	2.7974	Yes	
3		Moisture_content_wt_%	2	82	52.86	55.514	-2.654	-2.3532	No	Within expected range
3		NCV_kJ_kg	2	82	7391.2865	6819.172	572.1144	2.5448	No	Due to M
3	119/SRC-W V/Terra N	Ni	1	83	1.3026	0.6716	0.631	2.465	Yes	
3	119/SRC-W V/Resolut	K2O	2	84	20.87	17.7662	3.1038	3.4723	No	Within range seen
3		K2O_1	2	84	20.4023	17.7424	2.66	3.2623	No	Within range seen
3	119/SRC-W V/Nimrod	%wt_H	1	86	5.9993	6.0806	-0.0812	-2.038	No	Within reproducibility limits
3		Be	2	86	0.04	0.0699	-0.0299	-3.103	No	Impact of LOD values for most samples
3		Cu	1	86	1.7993	3.7244	-1.925	-3.0324	Yes	
3		MgO	2	86	3.56	4.554	-0.994	-2.4665	No	Within range seen
3		MgO_1	2	86	3.6383	4.6126	-0.9744	-2.3218	No	Within range seen
3		Mo	2	86	0.04	0.0803	-0.0403	-2.4339	No	Impact of LOD values for most samples
3		P2O5	2	86	7.82	10.7447	-2.9247	-2.5069	No	Within range seen
3		P2O5_1	2	86	7.9919	10.9069	-2.915	-2.5837	No	Within range seen

Removed rows								
VARIATION	Sample	VARIABLE	MODEL	EXCEL_ROW	OBSERVED	FITTED	DIFFERENCE	RESIDUAL
2		Chlorine_wt_%	NA	NA	NA	NA	NA	NA
3		S	NA	NA	NA	NA	NA	NA
3		Pb	NA	NA	NA	NA	NA	NA
1		wt%O_by_difference	2	31	45.3312	44.6848	0.6464	2.2094
2		wt%O_by_difference	1	54	44.1426	43.0859	1.0567	2.7607
3		wt%O_by_difference	2	81	43.3775	42.9245	0.453	2.061
1		sum_as_CaCo3	1	34	0	72.667	-72.667	-3.2038
1		sum_as_CaCo3	1	35	0	72.667	-72.667	-3.2038
2		sum_as_CaCo3	1	40	0	81.1774	-81.1774	-2.7391
2		sum_as_CaCo3	1	51	0	80.8513	-80.8513	-2.7281
3		sum_as_CaCo3	1	61	0	73.7534	-73.7534	-3.4621
3		sum_as_CaCo3	1	62	0	73.7534	-73.7534	-3.4621
1		SO4	2	14	3888.8749	2061.248	1827.6265	2.1922
1		SO4	2	25	1312.6997	3010.807	-1698.1077	-2.0369
2		SO4	2	38	2318.6423	2824.355	-505.7129	-2.1572
2		SO4	2	43	3676.5546	3037.21	639.3451	2.7272
3		SO4	1	59	3968.7046	2045.142	1923.5631	4.1128
1		Pb_1	2	8	5.4402	2.1331	3.3071	2.4865
1		Pb_1	2	18	6.0407	2.8543	3.1864	2.3957
2		Pb_1	1	50	2.0879	0.8111	1.2768	2.2228
3		Pb_1	1	64	9.3728	1.4114	7.9614	4.8462
1		Fixed_carbon_wt_%	2	27	9.09	12.78	-3.69	-2.5621
2		Fixed_carbon_wt_%	1	54	8.31	7.5981	0.7119	2.1017
3		Fixed_carbon_wt_%	2	82	7.73	7.2208	0.5092	2.0762
1		Cd	1	22	0.7827	0.2778	0.5048	2.3879
3		Cd	1	74	6.9747	3.0133	3.9614	3.3783
1		Cd_1	1	22	0.7899	0.0699	0.72	4.8244
2		Cd_1	1	44	3.4028	2.7078	0.695	2.536
1		as_CaCO3	1	22	32.0756	11.5584	20.5172	3.7207
1		as_CaCO3	1	34	0	11.5584	-11.5584	-2.0961
2		as_CaCO3	1	40	0	50.5048	-50.5048	-2.7549
2		as_CaCO3	1	51	0	48.6479	-48.6479	-2.6536
3		as_CaCO3	1	61	0	44.488	-44.488	-3.2388
3		as_CaCO3	1	62	0	44.488	-44.488	-3.2388

VARIATION	VARIABLE	MODEL	EXCEL_ROW	OBSERVED	FITTED	DIFFERENCE	RESIDUAL
4	Col_U._Moisture_content_wt_.	2	109	16.86	13.99	2.87	2.43
4	Col_V._Volatile_matter_wt_.	2	101	71.41	69.01	2.40	2.00
4	Col_V._Volatile_matter_wt_.	2	109	65.45	68.60	-3.15	-2.63
4	Col_W._Fixed_carbon_wt_.	1	94	13.85	15.06	-1.21	-2.85
4	Col_X._Ash_wt.	2	88	2.06	1.68	0.38	2.29
4	Col_Y._GCV_kJ.kg	2	109	15814.00	16306.13	-492.13	-2.25
4	Col_Z._Sulphur_wt.	2	89	0.04	0.03	0.02	2.91
4	Col_AC._NCV_kJ.kg	2	109	14337.00	14878.30	-541.30	-2.31
4	Col_AD._Ash_.	2	88	2.27	1.85	0.42	2.17
4	Col_AG._.wt__C	2	89	48.62	48.08	0.54	2.31
4	Col_AG._.wt__C	2	94	47.47	48.03	-0.56	-2.39
4	Col_AI._.wt_S	2	119	0.06	0.05	0.01	2.04
4	Col_AK._Volatile_matter_wt_.	2	94	84.41	83.35	1.06	2.13
4	Col_AK._Volatile_matter_wt_.	2	109	80.96	81.98	-1.02	-2.06
4	Col_AM._wt._C	2	89	49.54	49.03	0.51	2.13
4	Col_AM._wt._C	2	94	48.26	48.90	-0.64	-2.67
4	Col_AN._wt._H	2	110	6.05	5.94	0.11	2.08
4	Col_AN._wt._H	2	111	5.82	5.94	-0.12	-2.17
4	Col_AP._wt._S	2	89	0.04	0.03	0.01	2.53
4	Col_AR._wt.O_.by_difference.	2	94	45.10	44.49	0.61	2.36
4	Col_AU._Ba	1	92	8.22	5.88	2.34	2.44
4	Col_AW._Cr	2	118	0.97	0.75	0.22	2.08
4	Col_AY._Cu	1	94	3.15	2.01	1.14	2.89
4	Col_BC._V	2	119	0.78	0.69	0.09	2.59
4	Col_BD._Zn	1	94	23.24	15.64	7.60	2.07
4	Col_BO._F	2	100	6.28	15.51	-9.23	-3.77
4	Col_BO._F	2	102	21.37	15.56	5.81	2.37
4	Col_BP._Br	1	91	28.60	17.47	11.12	2.53
4	Col_BS._Cd	1	92	0.09	0.05	0.05	2.42
4	Col_BT._Pb	1	114	12.95	1.10	11.85	3.73
4	Col_BW._BaO	2	90	0.02	0.03	-0.01	-2.05
4	Col_BW._BaO	2	92	0.05	0.04	0.01	2.05
4	Col_BX._CaO	1	93	7.02	5.15	1.87	2.34
4	Col_BY._Fe2O3	1	94	0.52	0.25	0.27	2.84
4	Col_CA._MgO	2	89	4.29	3.63	0.66	2.06
4	Col_CD._P2O5	1	95	11.81	8.03	3.78	2.62
4	Col_CG._TiO2	1	92	0.08	0.03	0.05	2.11
4	Col_CG._TiO2	1	114	0.09	0.03	0.06	2.49
4	Col_CH._as_CaCO3	1	93	12.50	9.18	3.32	2.34
4	Col_CK._BaO	1	92	0.06	0.04	0.02	2.06
4	Col_CL._CaCO3	2	93	14.99	10.90	4.09	2.19
4	Col_CM._Fe2O3	1	94	0.57	0.30	0.27	2.52
4	Col_CO._MgO	1	89	4.80	3.88	0.92	2.08
4	Col_CR._P2O5	1	95	15.56	10.36	5.20	2.29
4	Col_CT._TiO2	1	114	0.13	0.03	0.10	2.74
4	Col_FU._Ca	2	93	772.55	607.00	165.55	2.19
4	Col_FV._Fe	1	94	59.70	33.50	26.19	2.50
4	Col_FW._K	2	88	4418.21	3543.27	874.94	2.04
4	Col_FX._Mg	1	89	473.62	389.17	84.45	2.07
4	Col_GA._P	2	95	997.71	698.75	298.96	2.14
4	Col_GB._Si	2	90	5086.11	3591.18	1494.93	2.01
4	Col_GC._Ti	1	114	13.77	3.14	10.63	3.17
4	Col_GE._Alkali_index	2	88	0.29	0.23	0.06	2.05
4	Col_AG:_%wt__C	NA	104-107	Month Outliers			
4	Col_AM:_wt%_C	NA	104-107	Month Outliers			
4	Col_AR:_wt%O_(by_difference)	NA	104-107	Month Outliers			
4	Col_BO:_F	NA	100-103	Month Outliers			

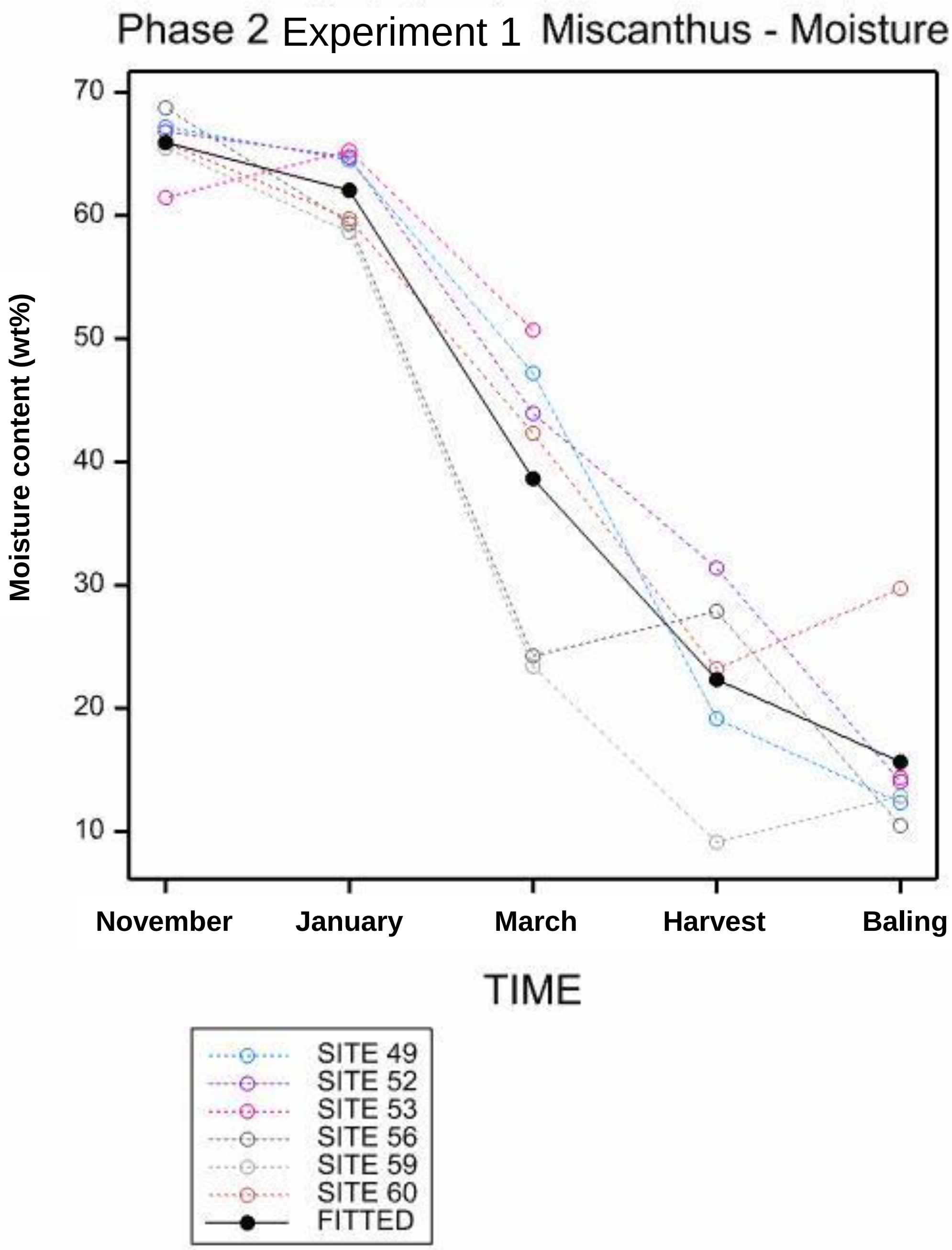
2. Graphs of all *Miscanthus* feedstock characteristics at the five sampling times

Table 1 List of variables and bases for analysis

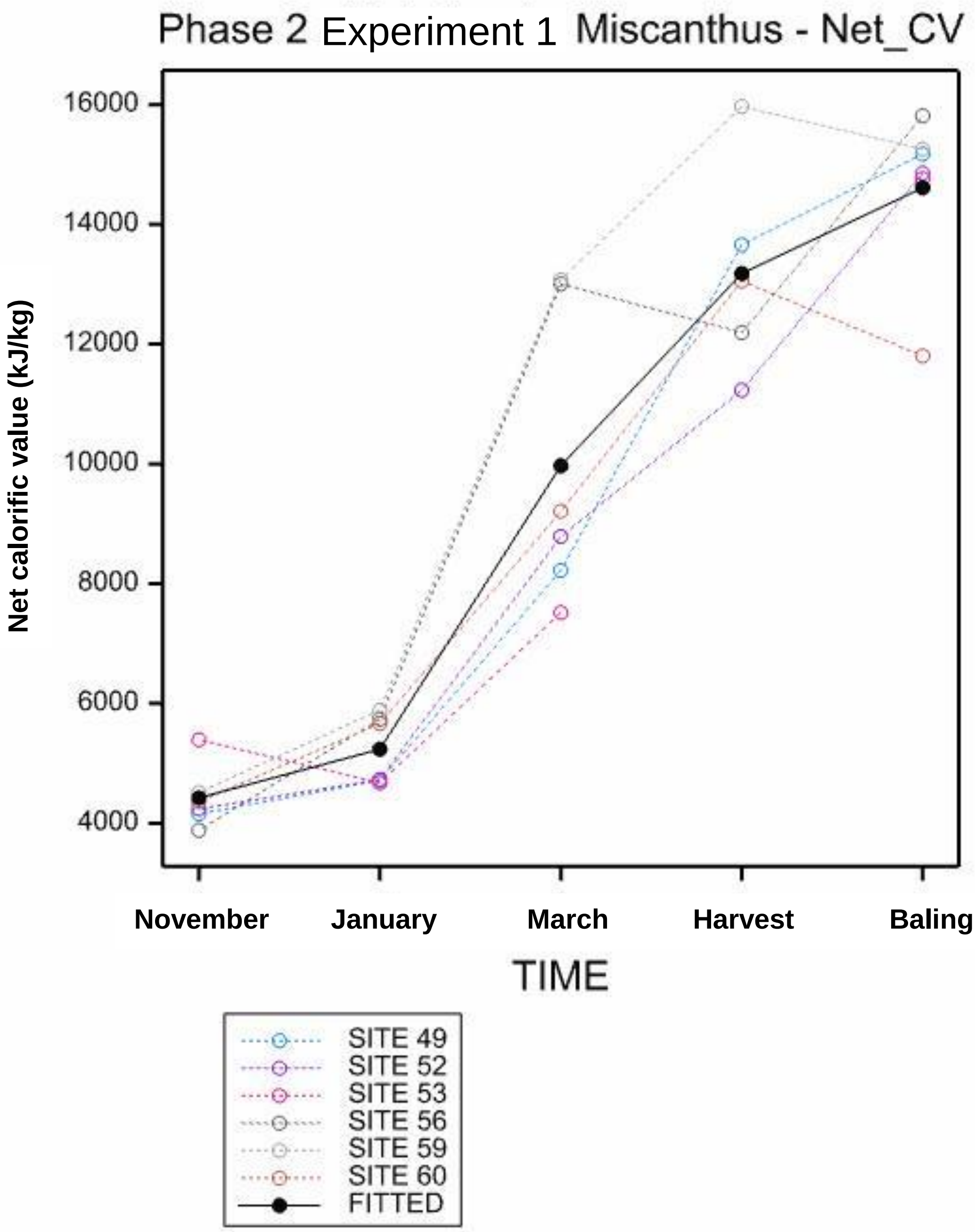
Variable	Basis of analysis
Moisture	As received
Net calorific value	As received
Ash content	Dry fuel
Volatile matter	Dry, ash free
Gross calorific value: GCV_1	Dry fuel
Gross calorific value: GCV_2	Dry, ash free
Carbon: C	Dry fuel
Carbon: C_1	Dry, ash free
Hydrogen: H_1	Dry fuel
Hydrogen: H_2	Dry, ash free
Nitrogen: N	Dry fuel
Nitrogen: N_1	Dry, ash free
Sulphur_1	Dry fuel
Sulphur_2	Dry, ash free
Chlorine_1	Dry fuel
Chlorine_2	Dry, ash free
Barium	Dry fuel
Beryllium	Dry fuel
Chromium	Dry fuel
Cobalt	Dry fuel
Copper	Dry fuel
Molybdenum	Dry fuel
Nickel	Dry fuel
Vanadium	Dry fuel
Zinc	Dry fuel
Antimony	Dry fuel
Arsenic	Dry fuel
Mercury	Dry fuel
Fluorine	Dry fuel
Bromine	Dry fuel
Selenium	Dry fuel
Cadmium	Dry fuel
Lead	Dry fuel
Aluminium	Dry fuel
Calcium	Dry fuel
Iron	Dry fuel
Potassium	Dry fuel
Magnesium	Dry fuel
Manganese	Dry fuel
Sodium	Dry fuel
Phosphorous	Dry fuel
Silicon	Dry fuel
Titanium	Dry fuel
Al_2O_3	Normalized ash
BaO	Normalized ash
$CaCO_3$	Normalized ash
Fe_2O_3	Normalized ash
K_2O	Normalized ash
MgO	Normalized ash
Mn_3O_4	Normalized ash
Na_2O	Normalized ash
P_2O_5	Normalized ash
SiO_2	Normalized ash
TiO_2	Normalized ash
Alkali index	

Please note the following key with respect to the chart titles below

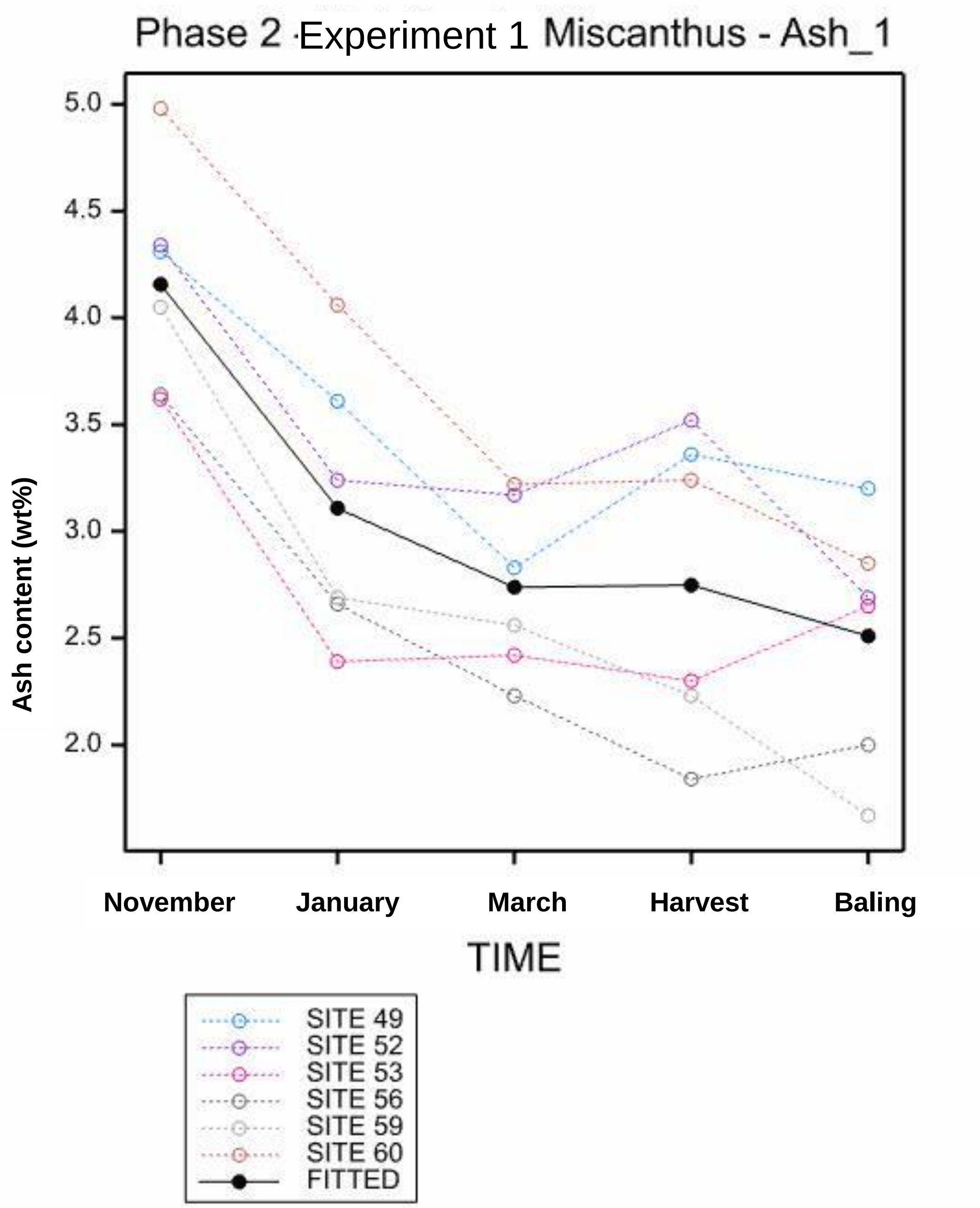
As used below:	**This refers to:**
Phase 2 Experiment 1	Study 5: Impact of harvest time on *Miscanthus* properties
Phase 2 Experiment 2	Study 6: Impact of harvest time on SRC willow properties
Phase 2 Experiment 3	Study 7: Impact of variety on SRC willow properties
Phase 2 Experiment 4	Study 8: Impact of storage on *Miscanthus* properties



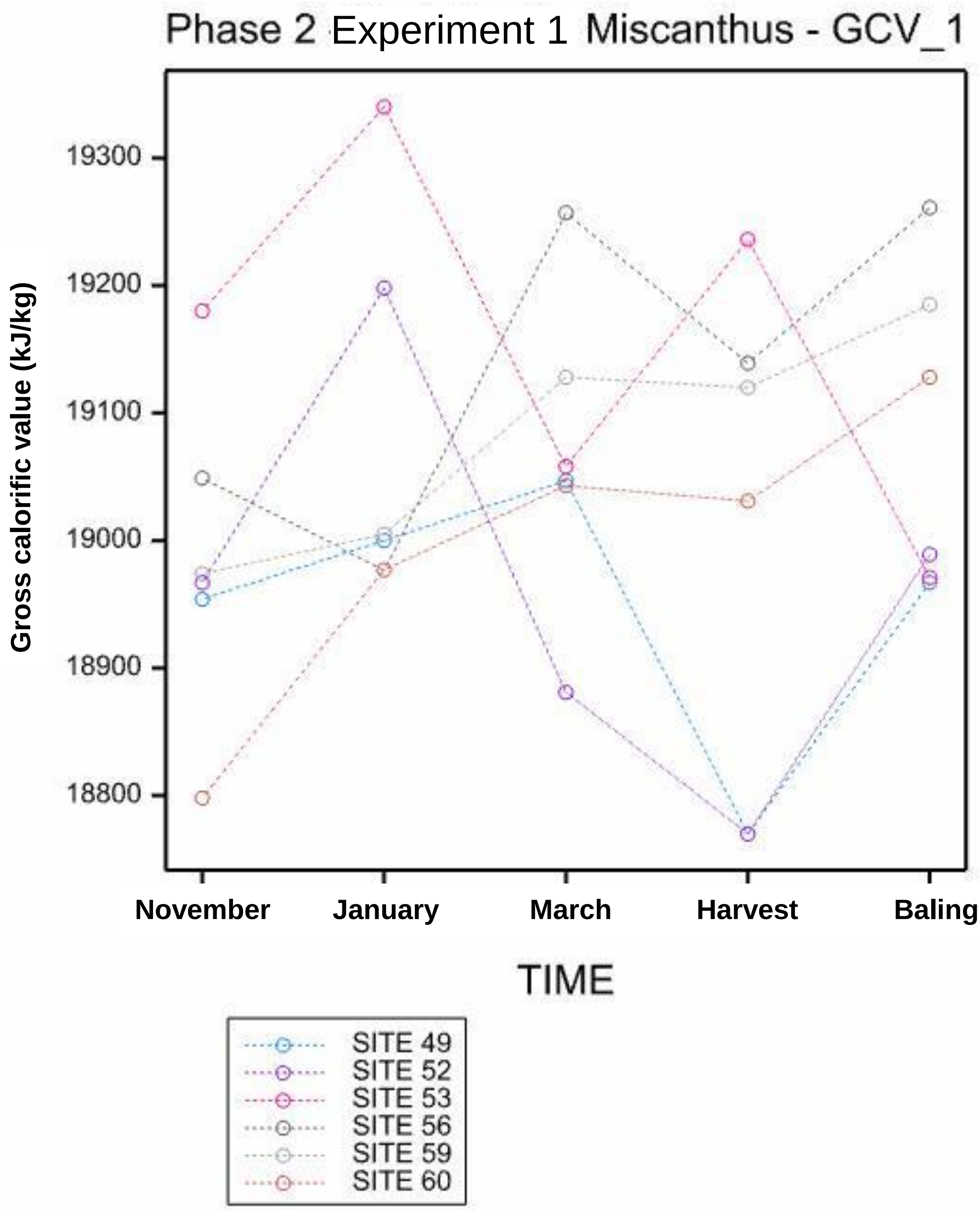
Phase 2 Experiment 1 Miscanthus - Moisture
Moisture content (wt%)
70
60
50
40
30
20
10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED



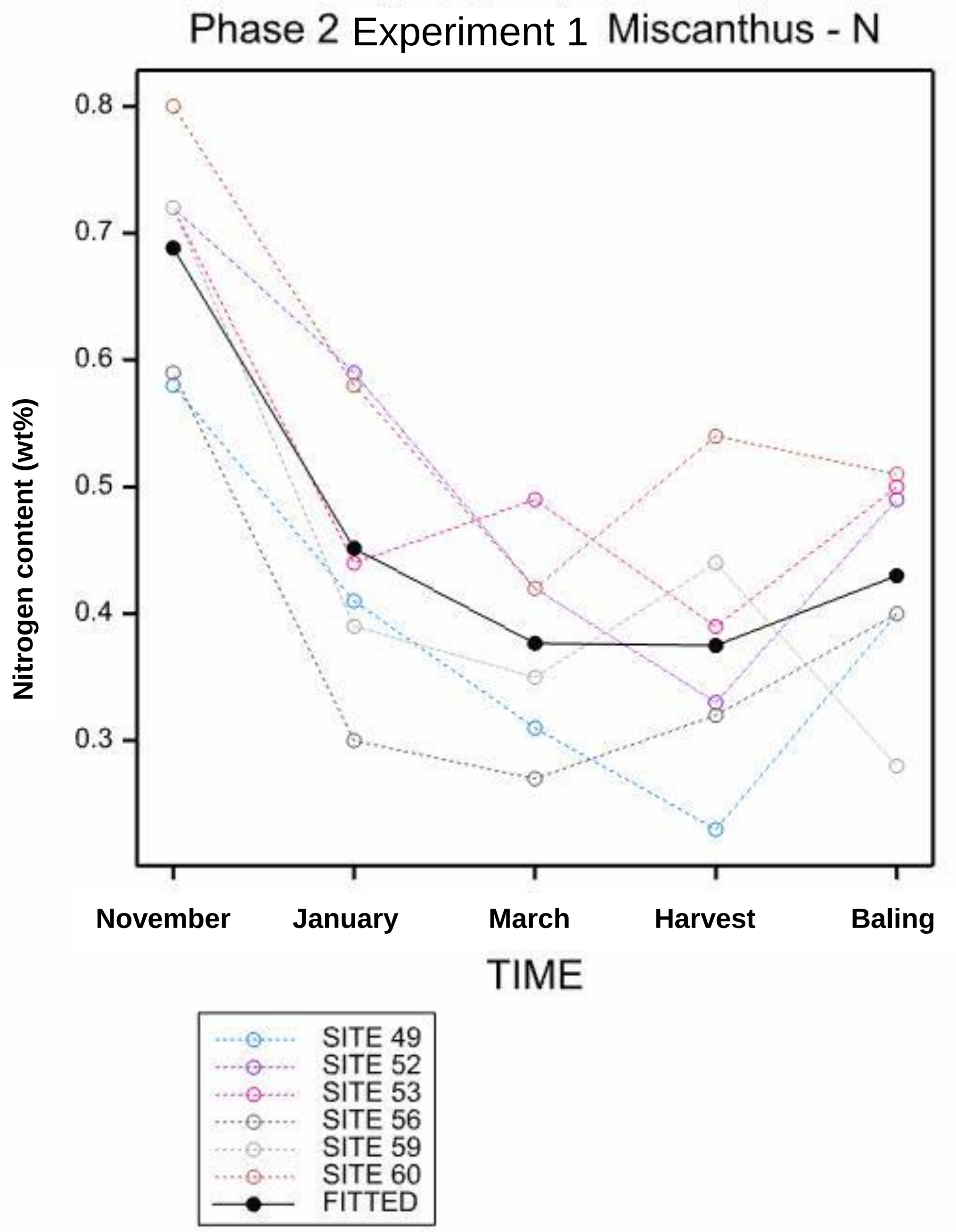
Phase 2 Experiment 1 Miscanthus - Net_CV
Net calorific value (kJ/kg)
16000
14000
12000
10000
8000
6000
4000
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

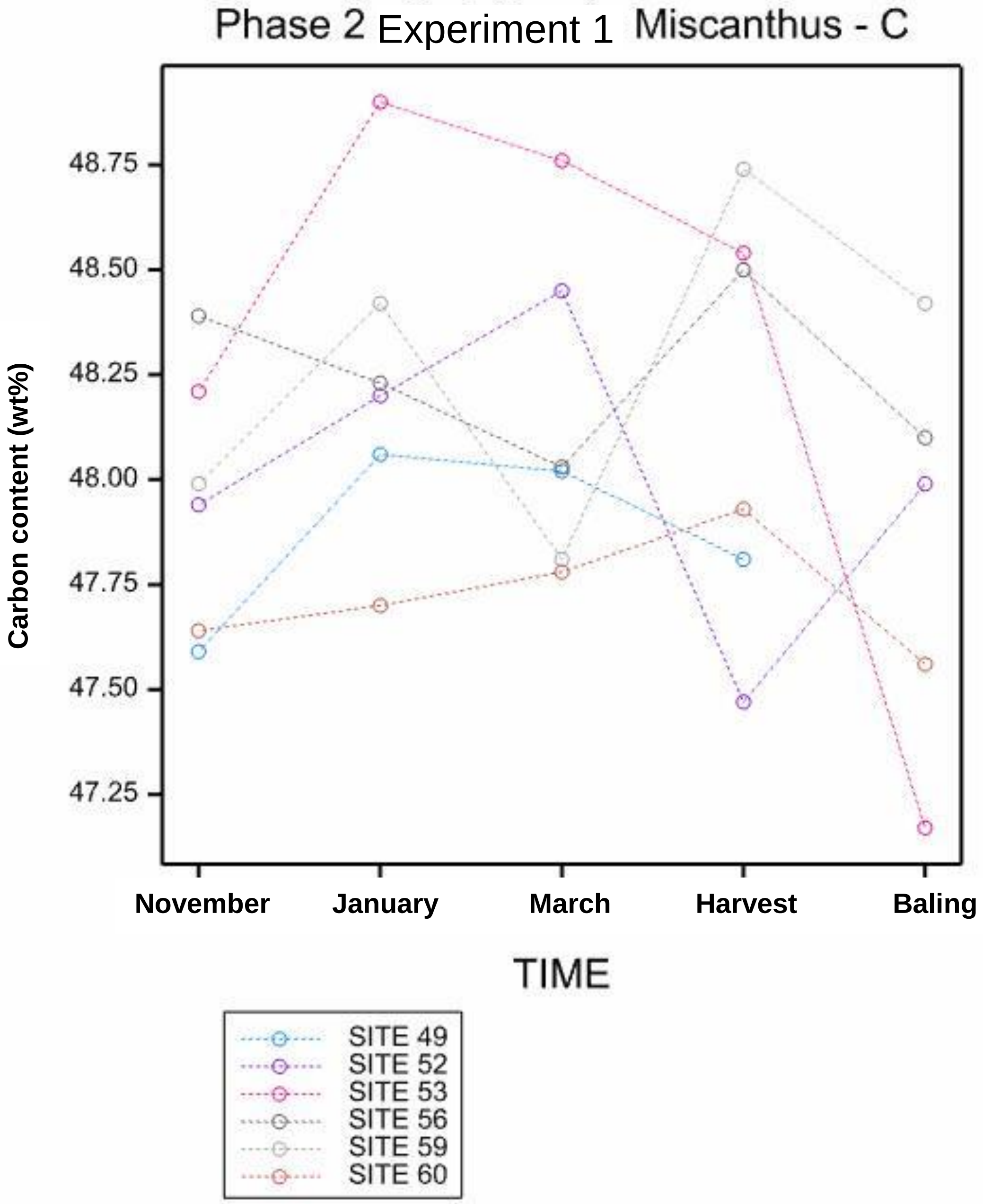


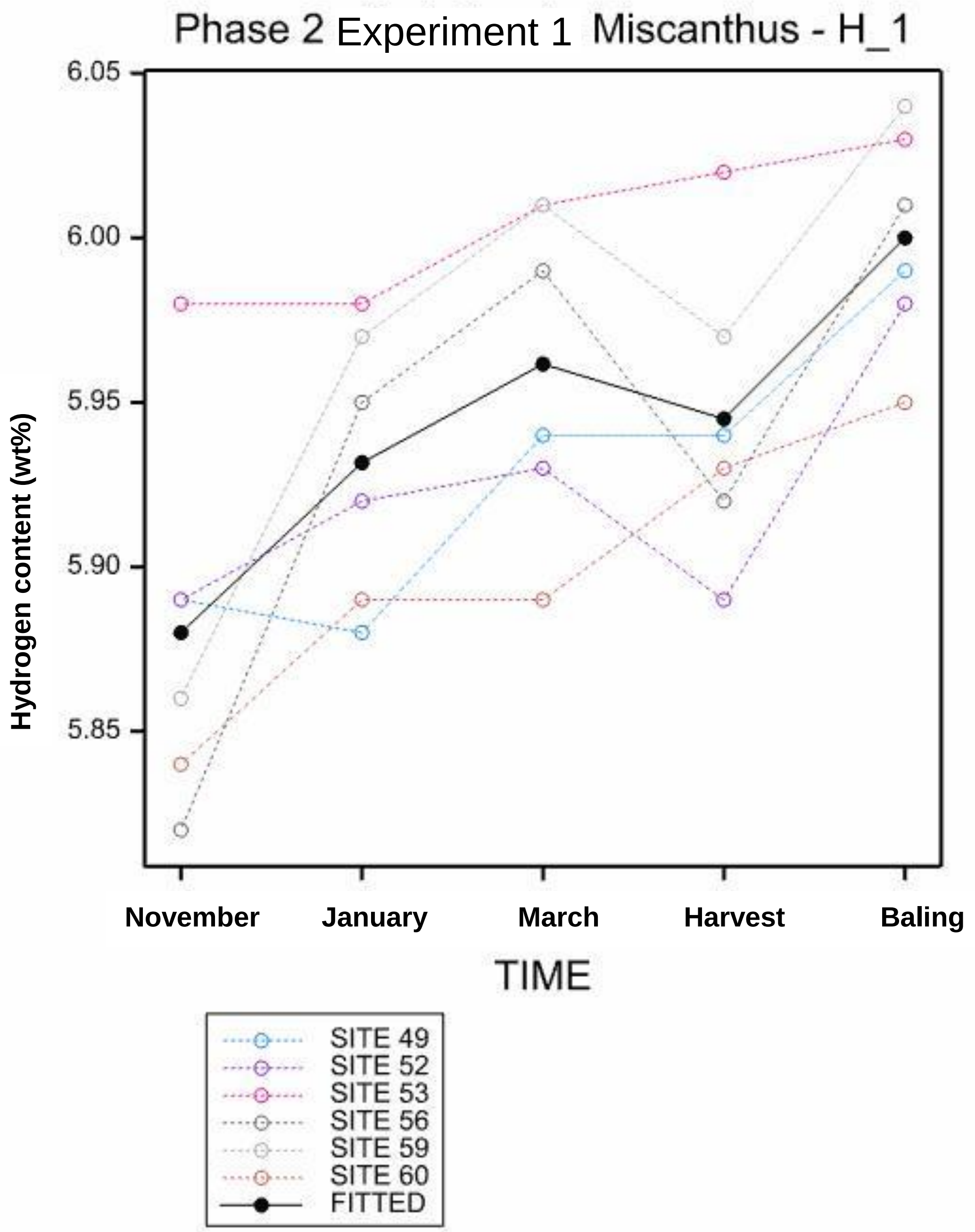
Phase 2 Experiment 1 Miscanthus - Ash_1
Ash content (wt%)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

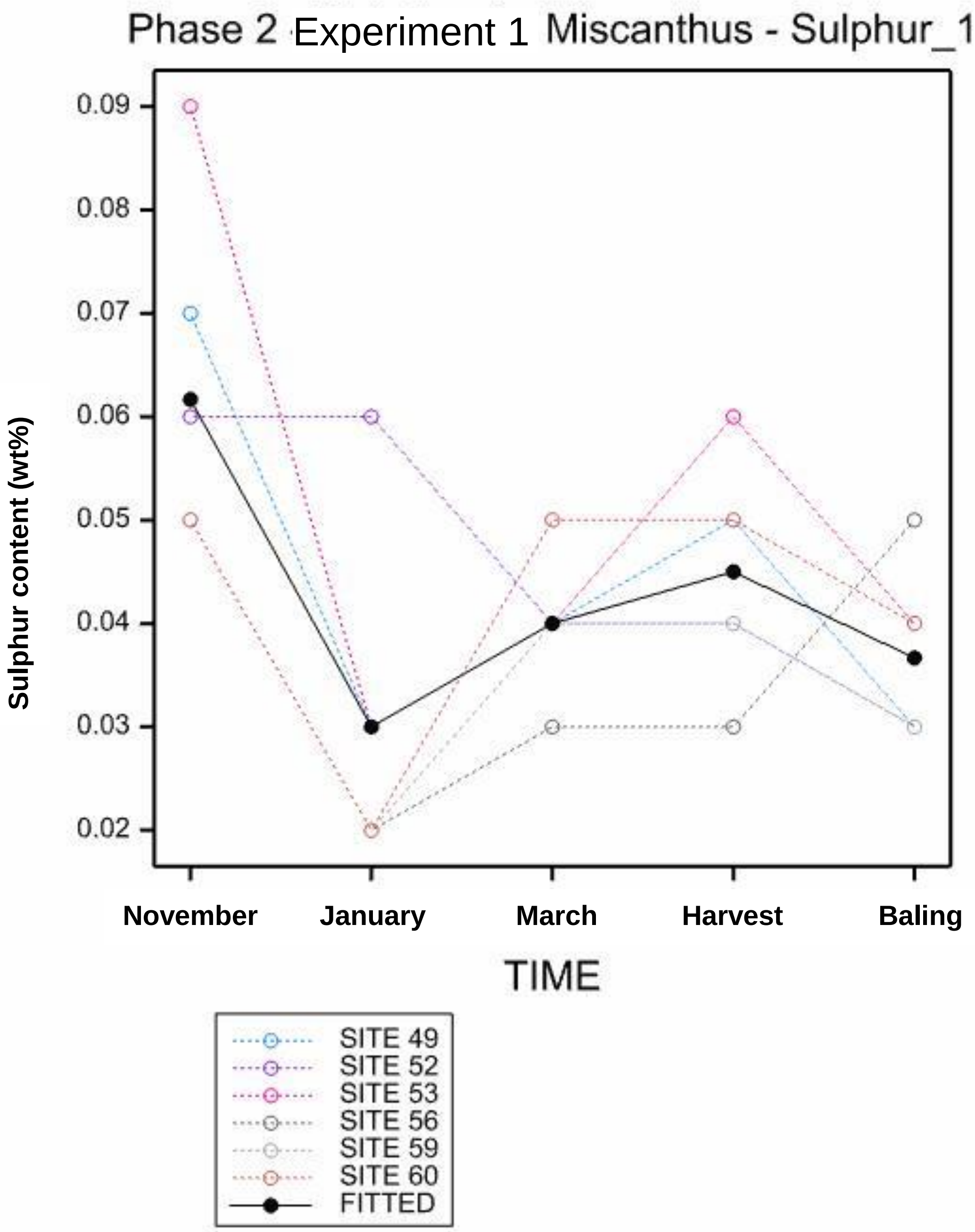


Phase 2 Experiment 1 Miscanthus - GCV_1
Gross calorific value (kJ/kg)
19300
19200
19100
19000
18900
18800
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

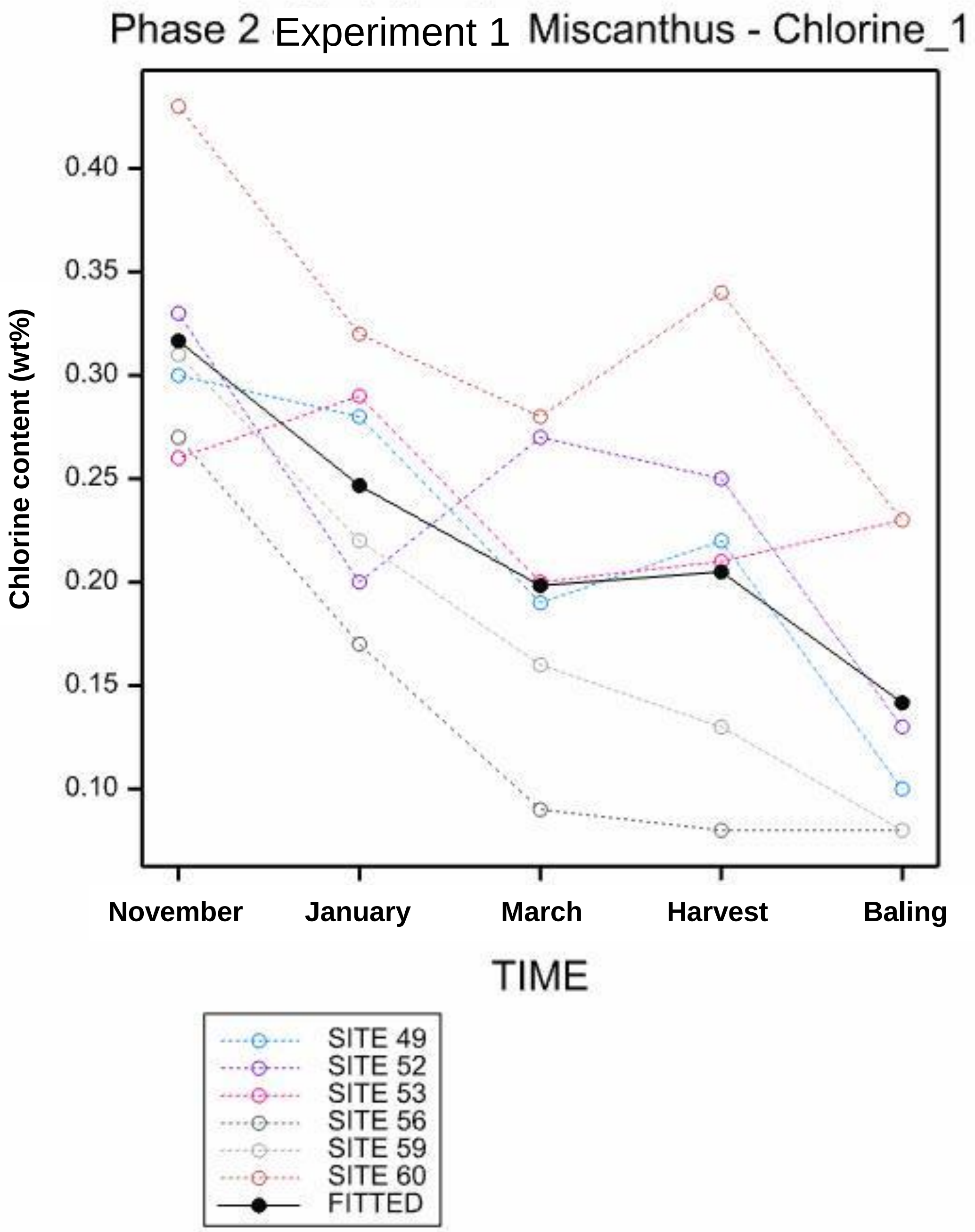

Phase 2 Experiment 1 Miscanthus - N
Nitrogen content (wt%)
0.8
0.7
0.6
0.5
0.4
0.3
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

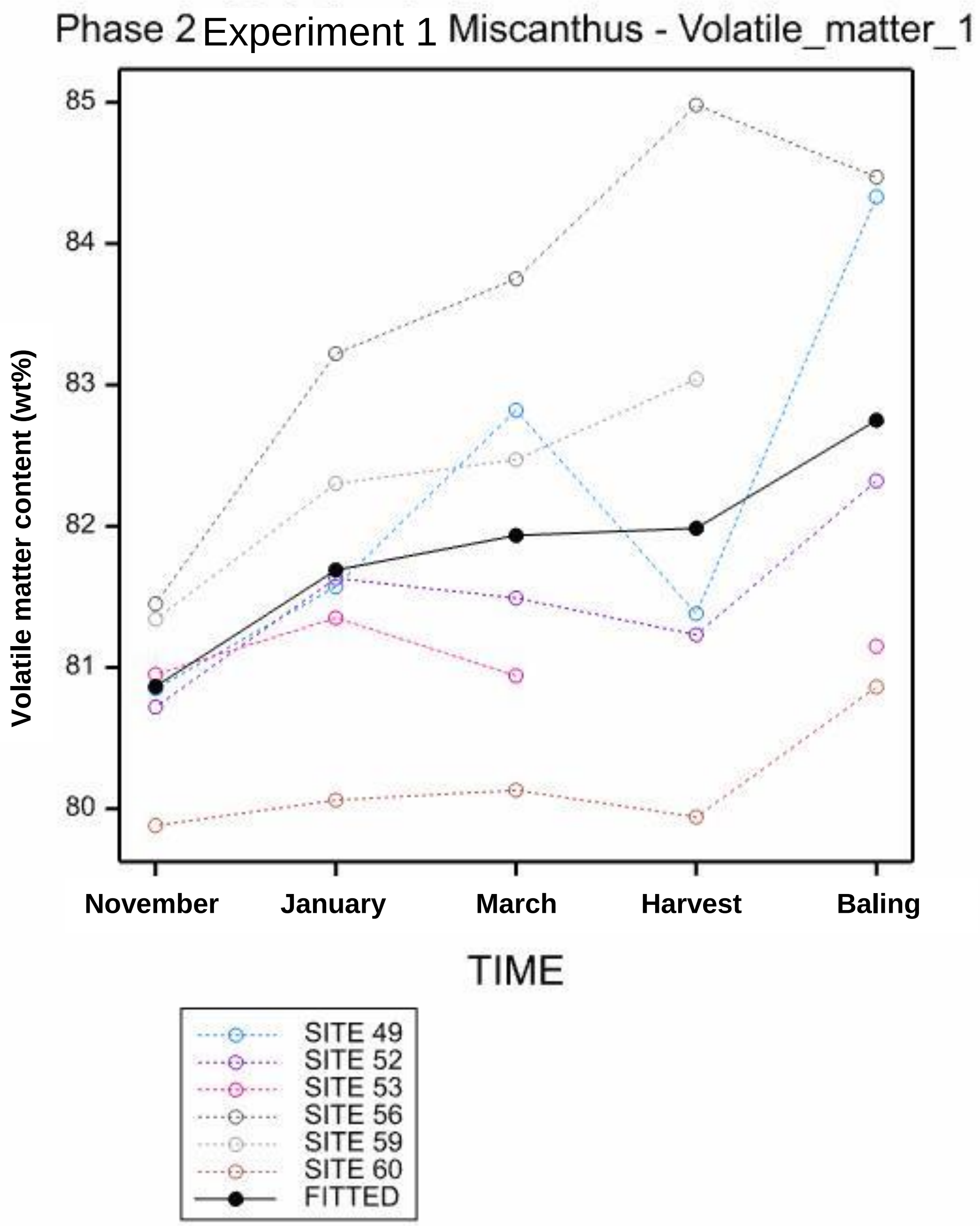

Phase 2 Experiment 1 Miscanthus - C
Carbon content (wt%)
48.75
48.50
48.25
48.00
47.75
47.50
47.25
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

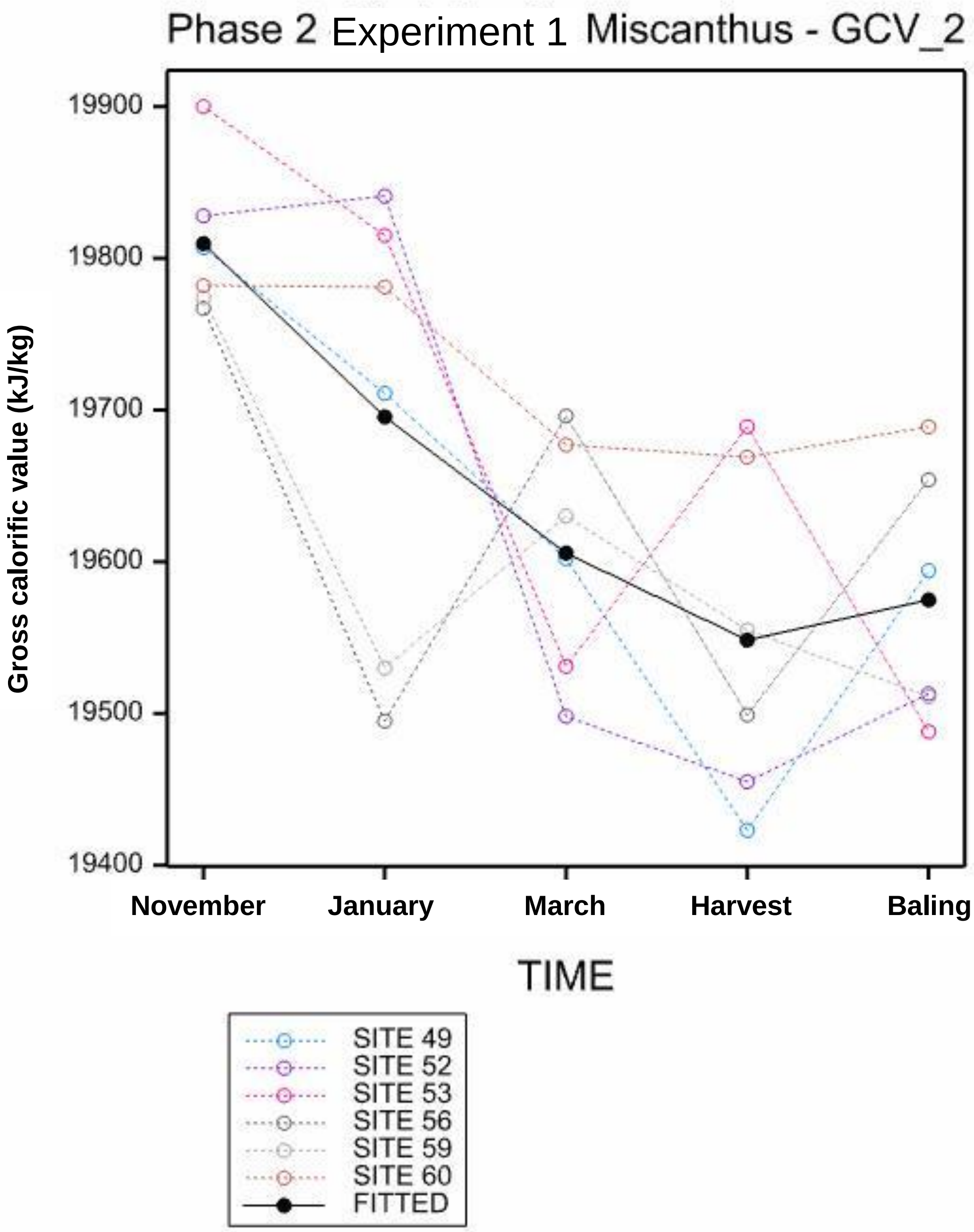

Phase 2 Experiment 1 Miscanthus - H_1
6.05
6.00
5.95
5.90
5.85
Hydrogen content (wt%)
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED



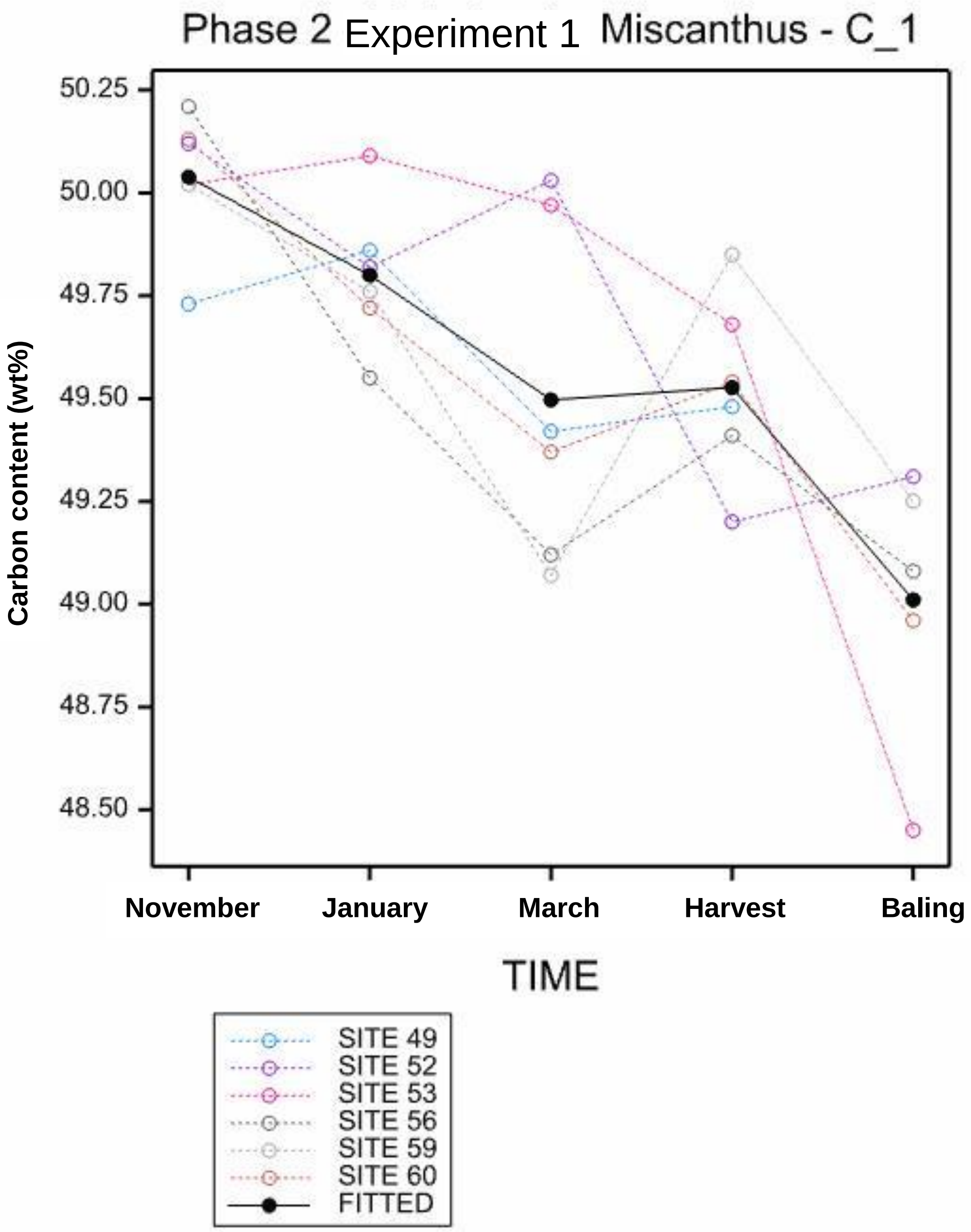
Phase 2 Experiment 1 Miscanthus - Sulphur_1
Sulphur content (wt%)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

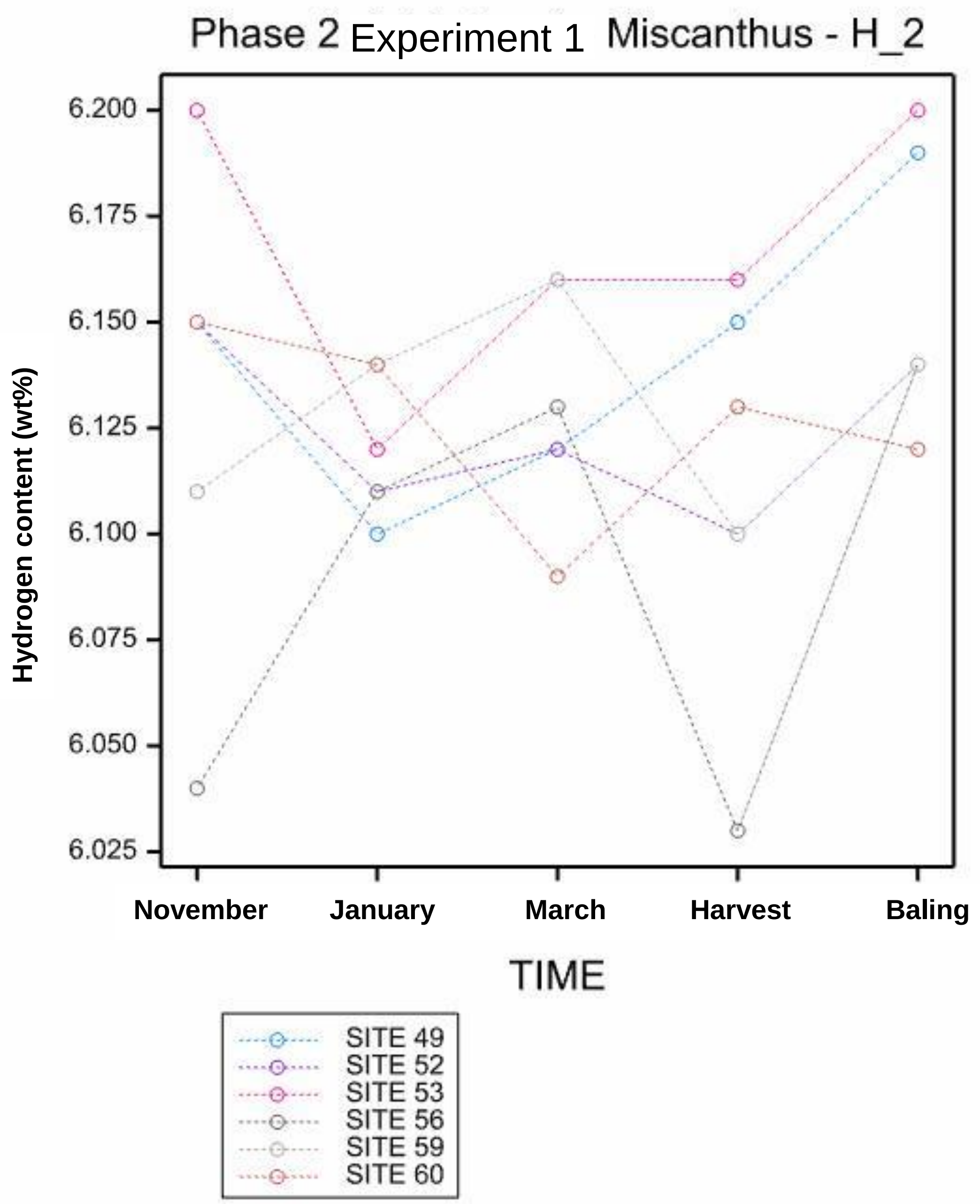

Phase 2 Experiment 1 Miscanthus - Chlorine_1
Chlorine content (wt%)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED


Phase 2 Experiment 1 Miscanthus - Volatile_matter_1
Volatile matter content (wt%)
85
84
83
82
81
80
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

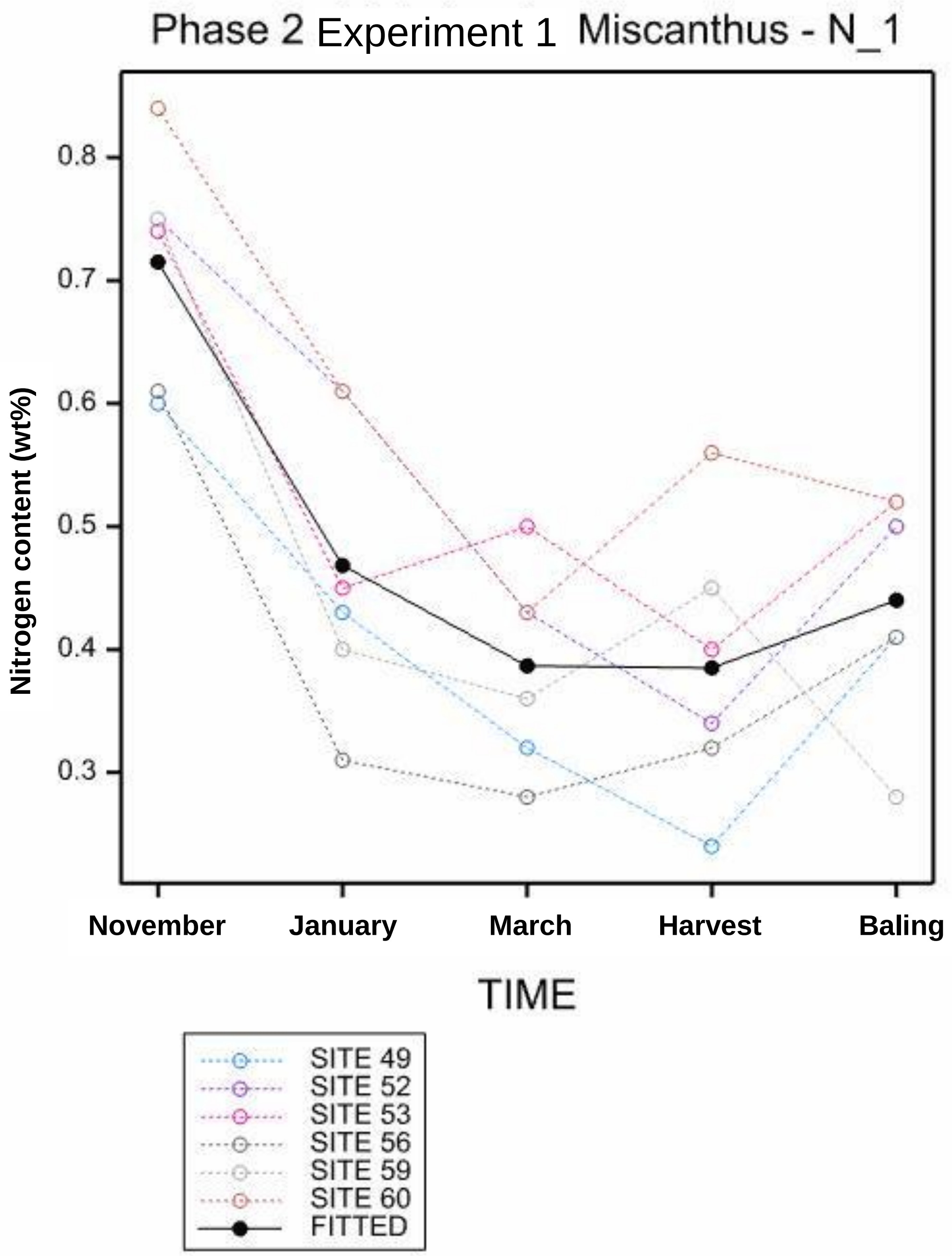


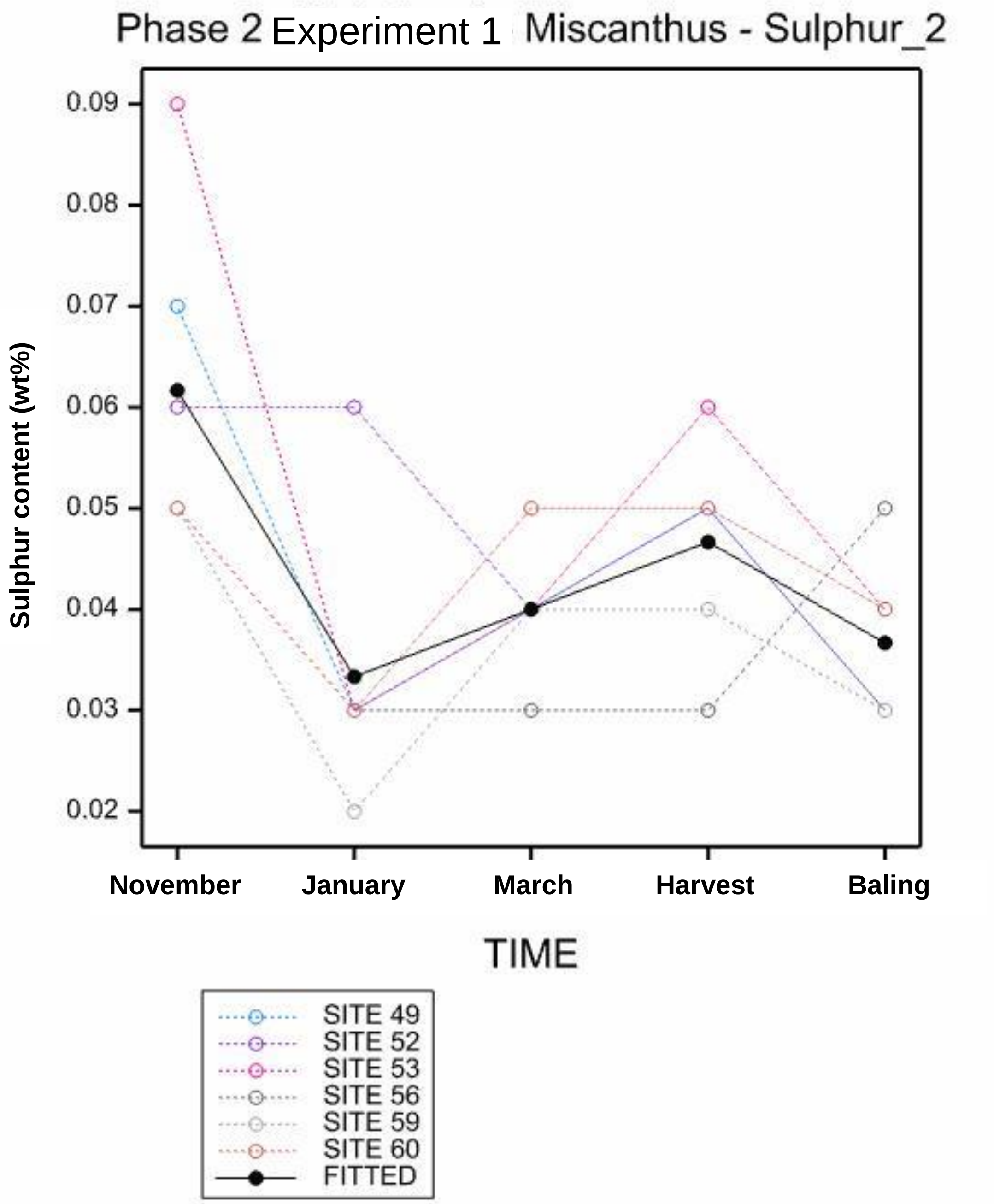
Phase 2 Experiment 1 Miscanthus - GCV_2
Gross calorific value (kJ/kg)
19900
19800
19700
19600
19500
19400
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

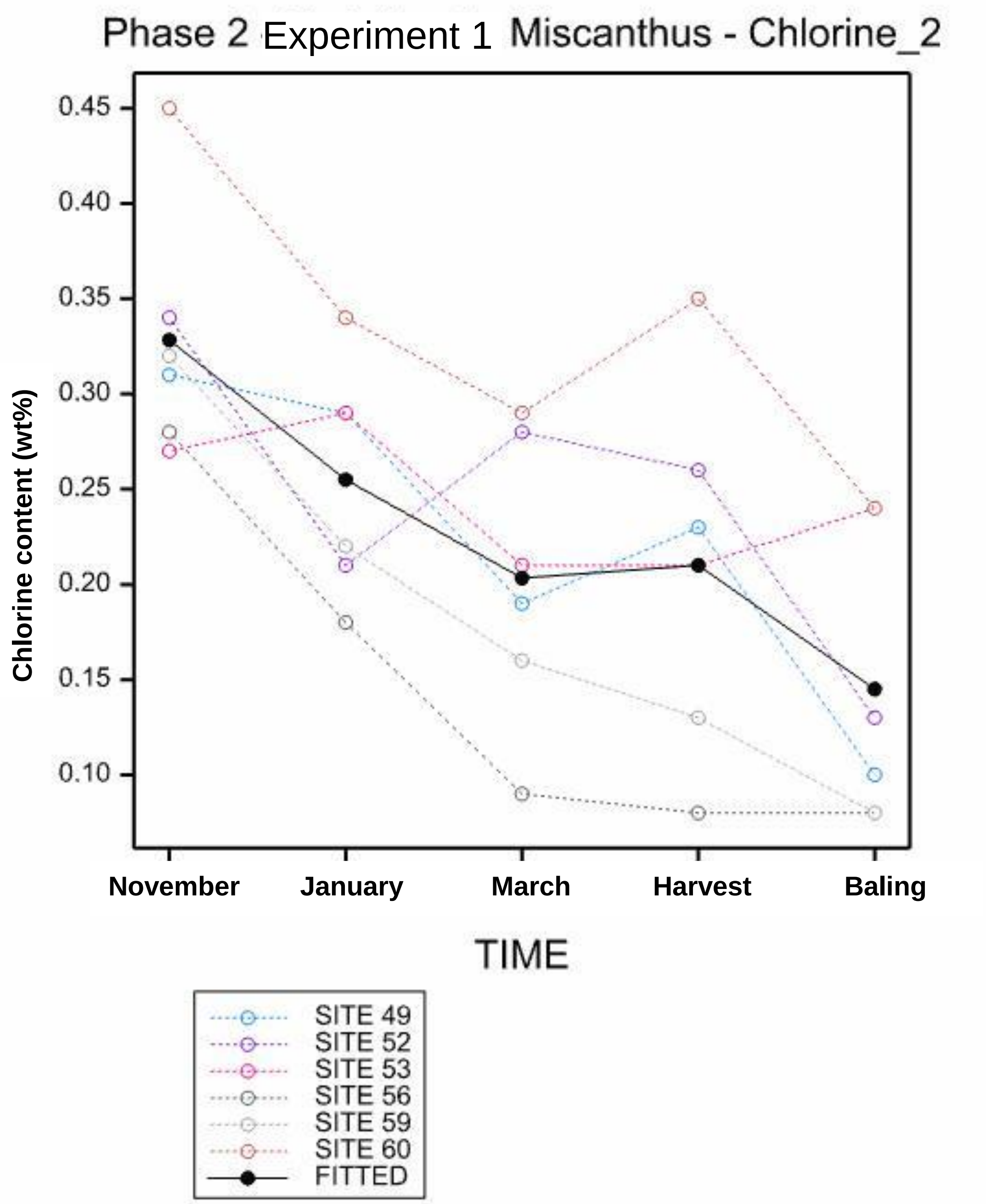

Phase 2 Experiment 1 Miscanthus - C_1
50.25
50.00
49.75
49.50
49.25
49.00
48.75
48.50
Carbon content (wt%)
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED



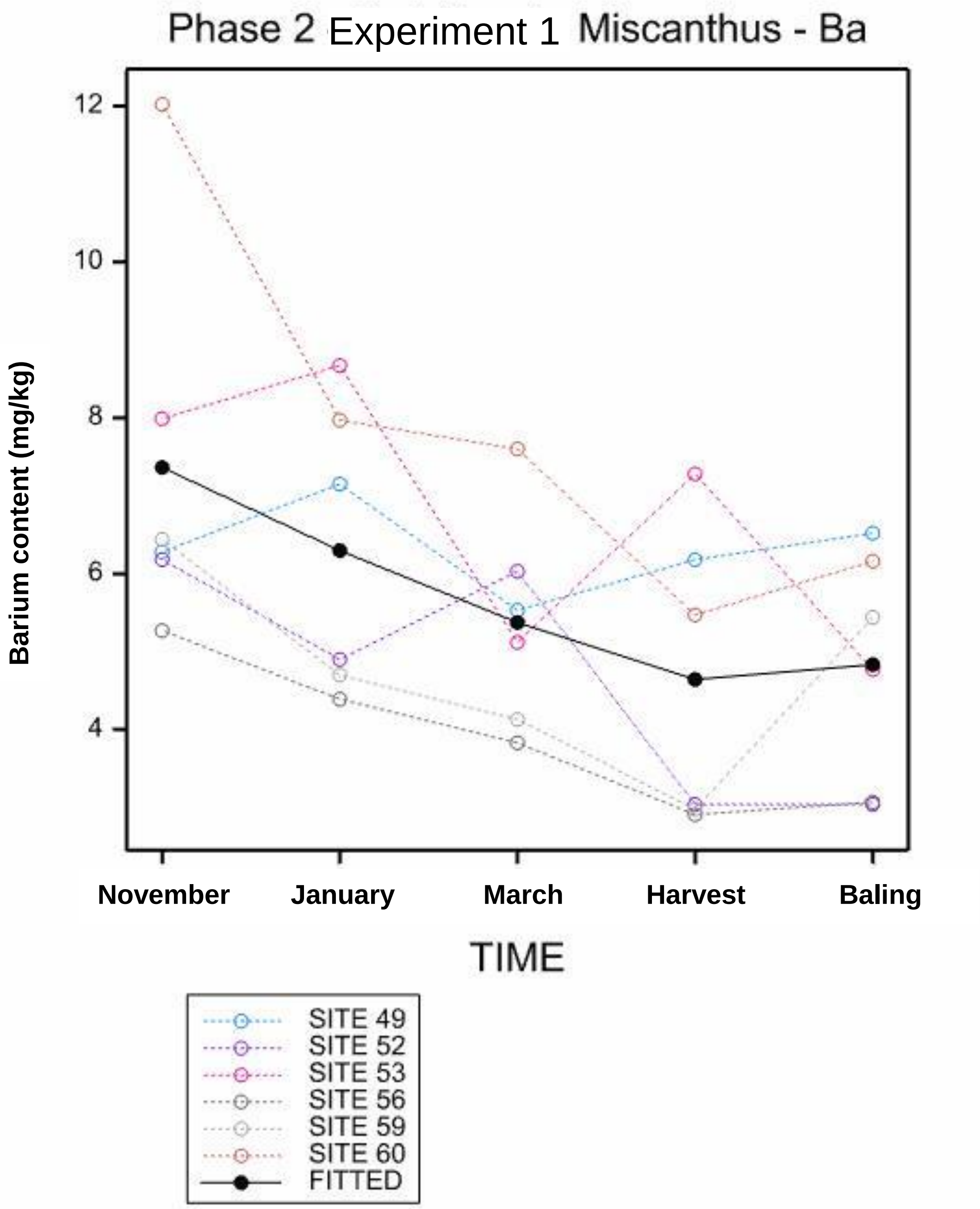
Phase 2 Experiment 1 Miscanthus - H_2
Hydrogen content (wt%)
6.200
6.175
6.150
6.125
6.100
6.075
6.050
6.025
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

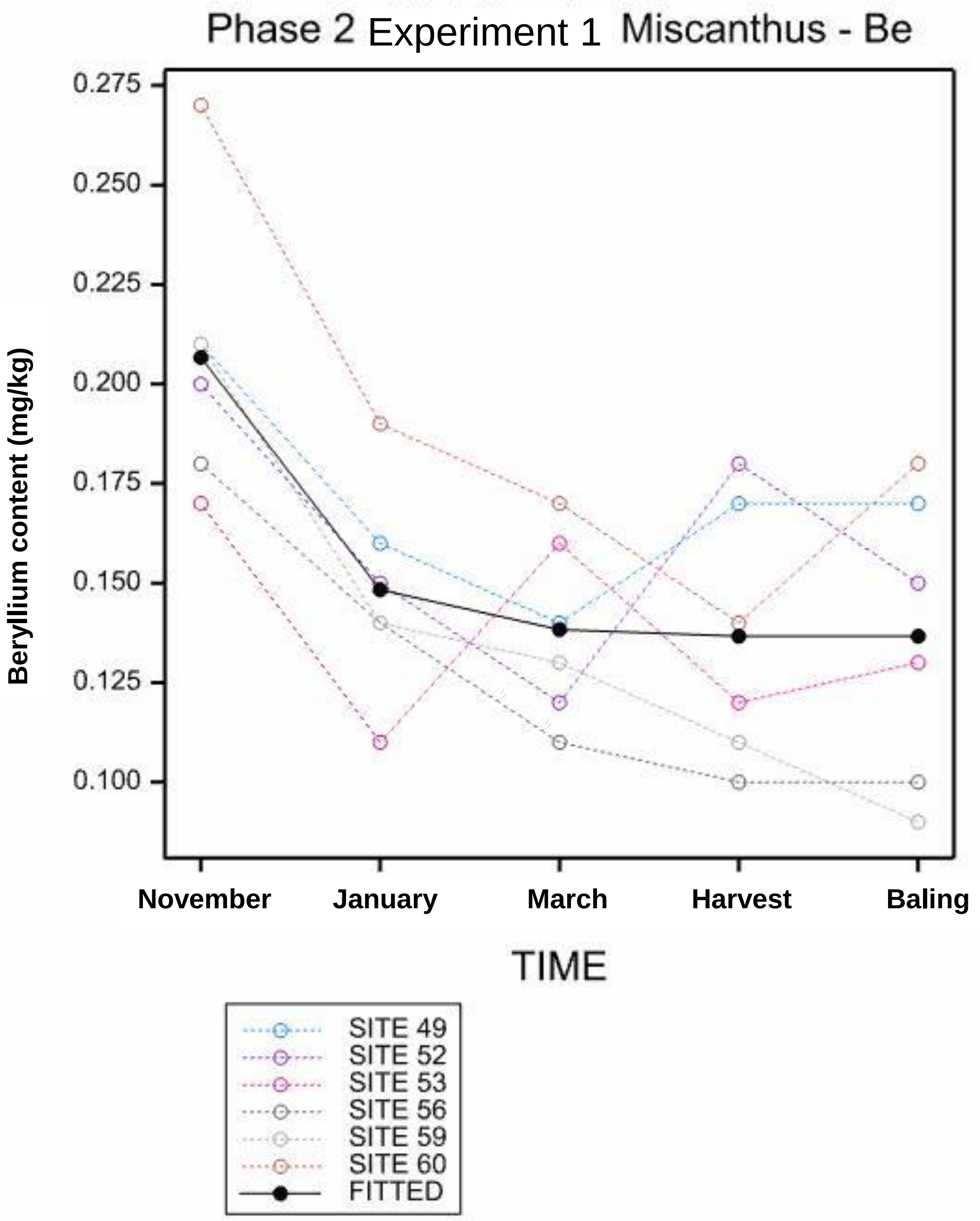

Phase 2 Experiment 1 Miscanthus - N_1
Nitrogen content (wt%)
0.8
0.7
0.6
0.5
0.4
0.3
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

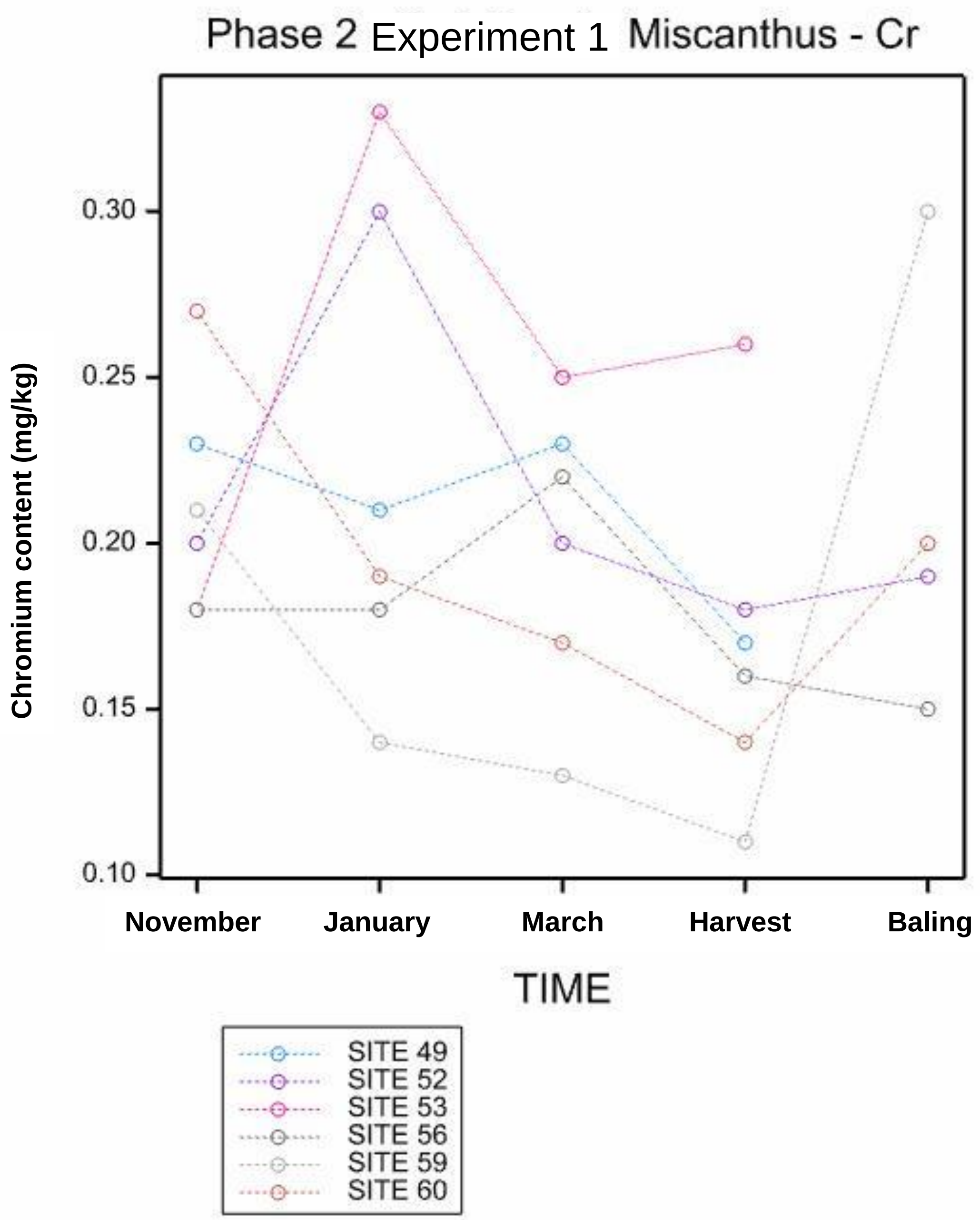

Phase 2 Experiment 1 Miscanthus - Sulphur_2
Sulphur content (wt%)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED



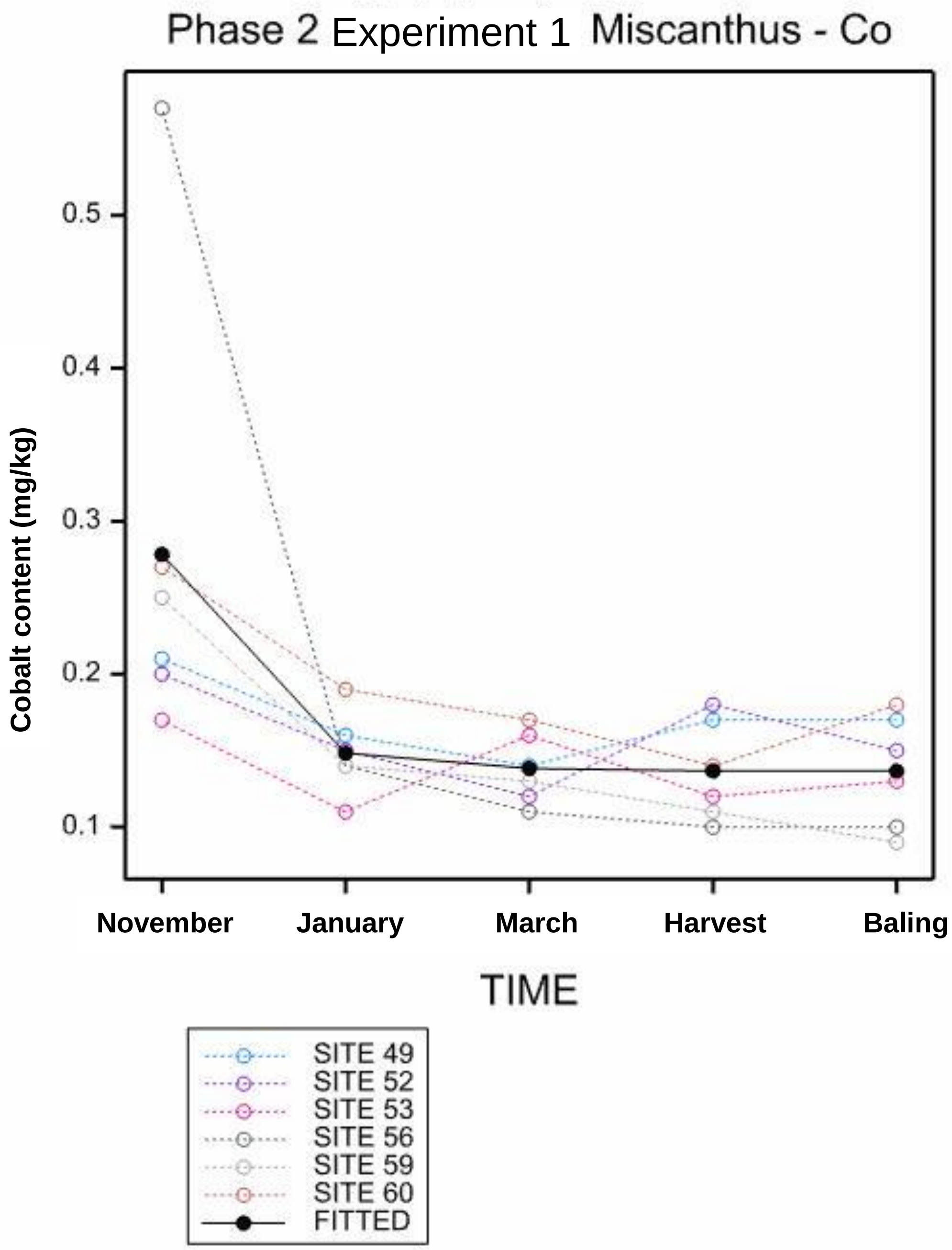
Phase 2 Experiment 1 Miscanthus - Chlorine_2
Chlorine content (wt%)
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED


Phase 2 Experiment 1 Miscanthus - Ba
Barium content (mg/kg)
12
10
8
6
4
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

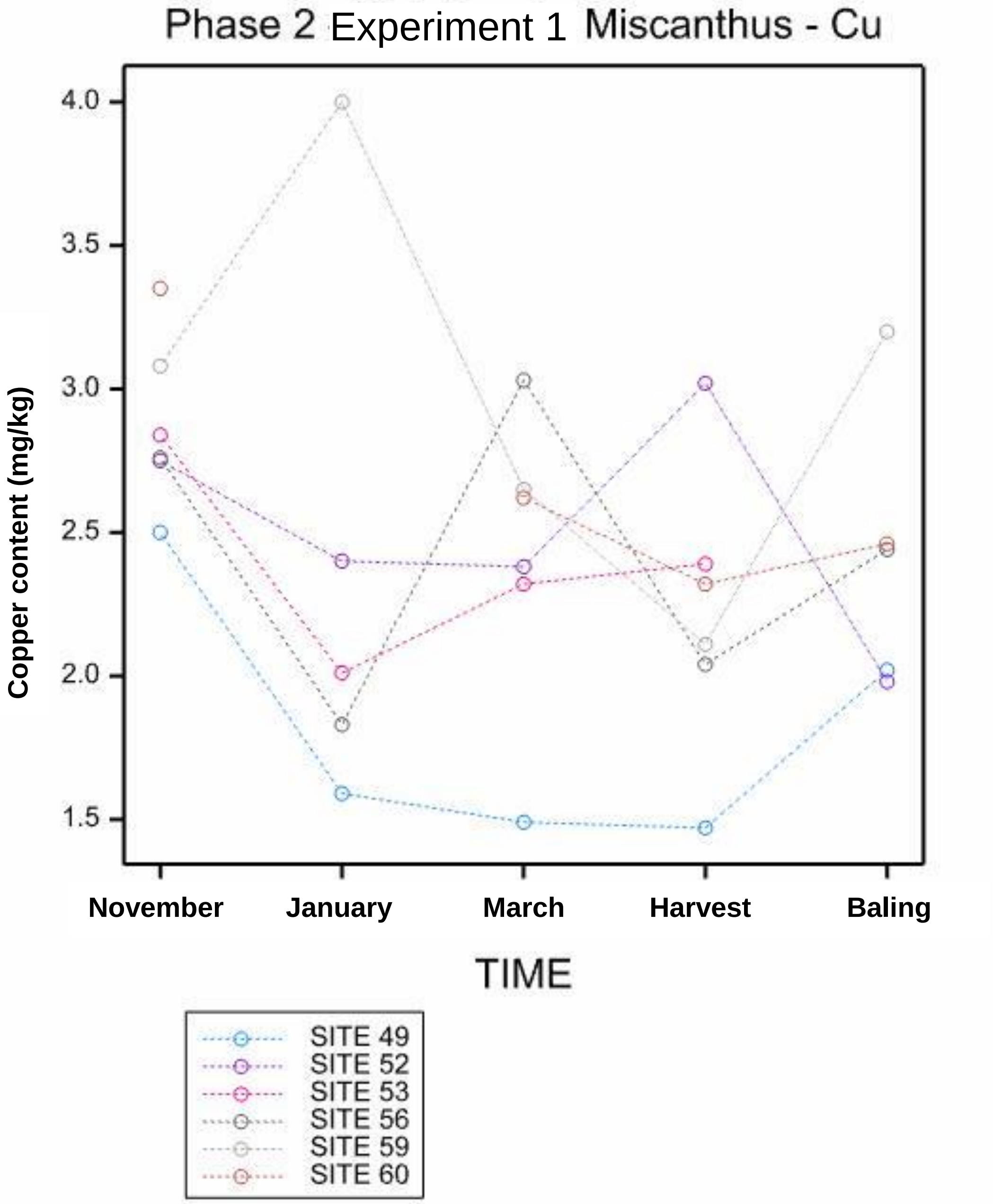

Phase 2 Experiment 1 Miscanthus - Be
Beryllium content (mg/kg)
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED



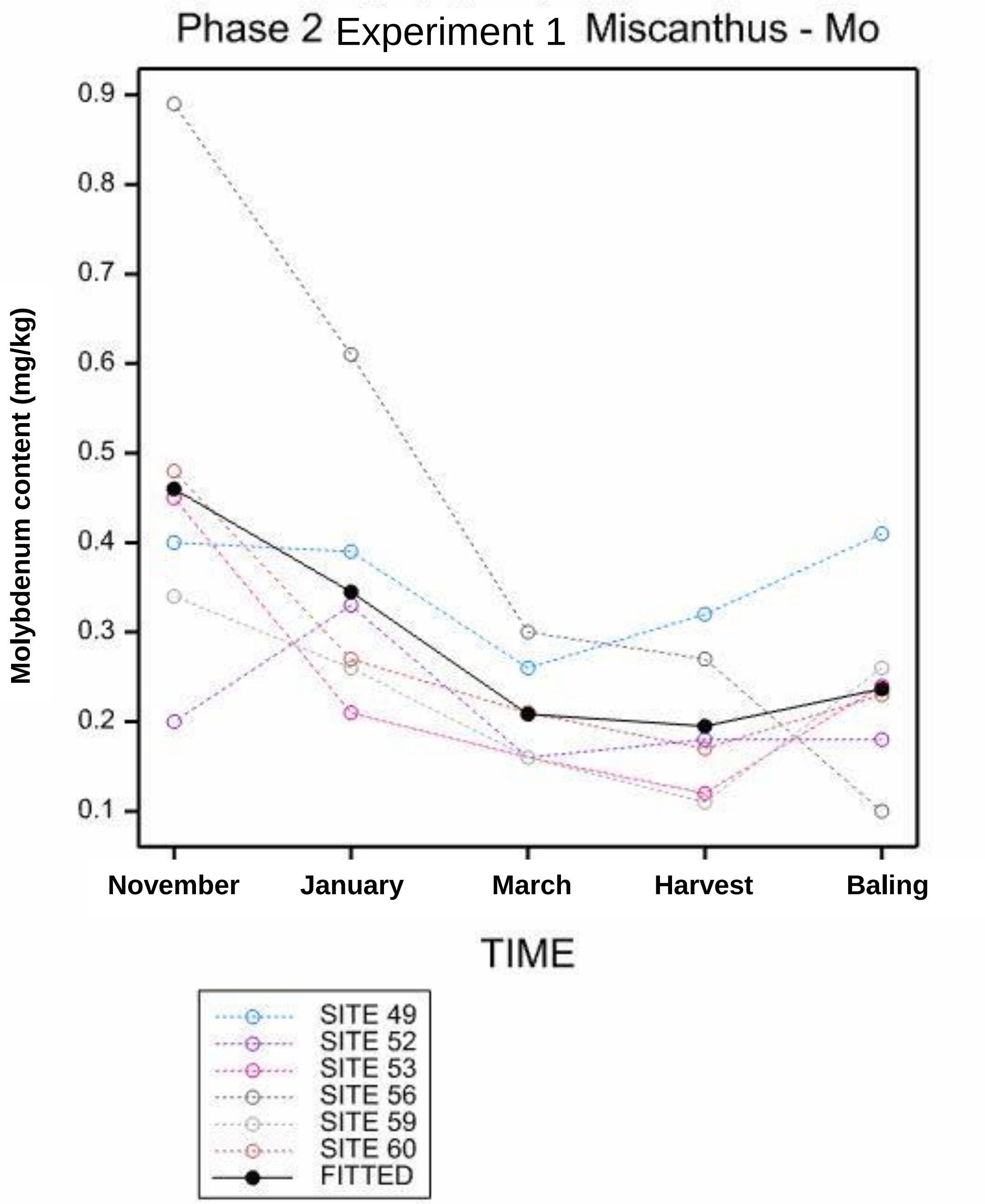
Phase 2 Experiment 1 Miscanthus - Cr
Chromium content (mg/kg)
0.30
0.25
0.20
0.15
0.10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

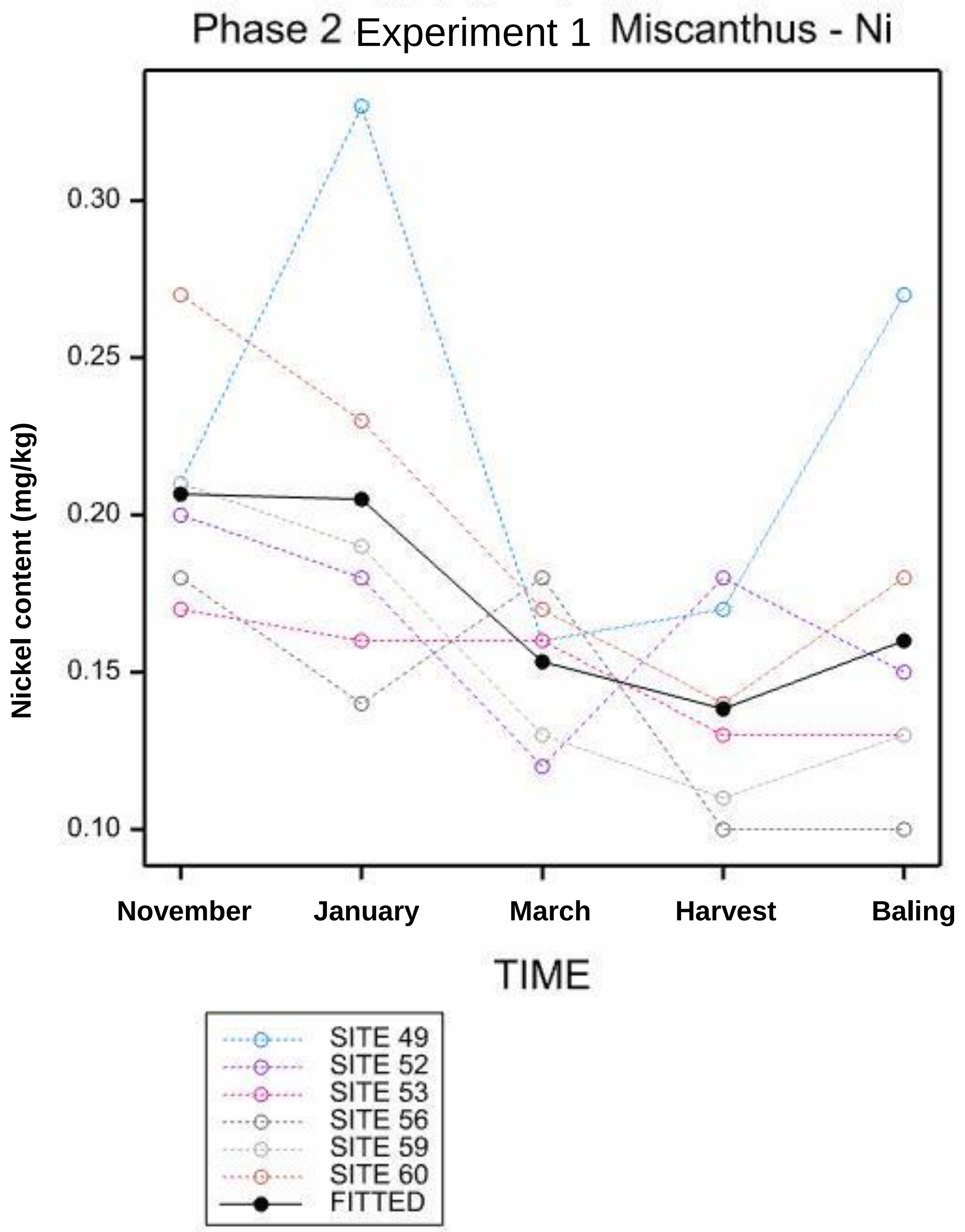


Phase 2 Experiment 1 Miscanthus - Co
Cobalt content (mg/kg)
0.5
0.4
0.3
0.2
0.1
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

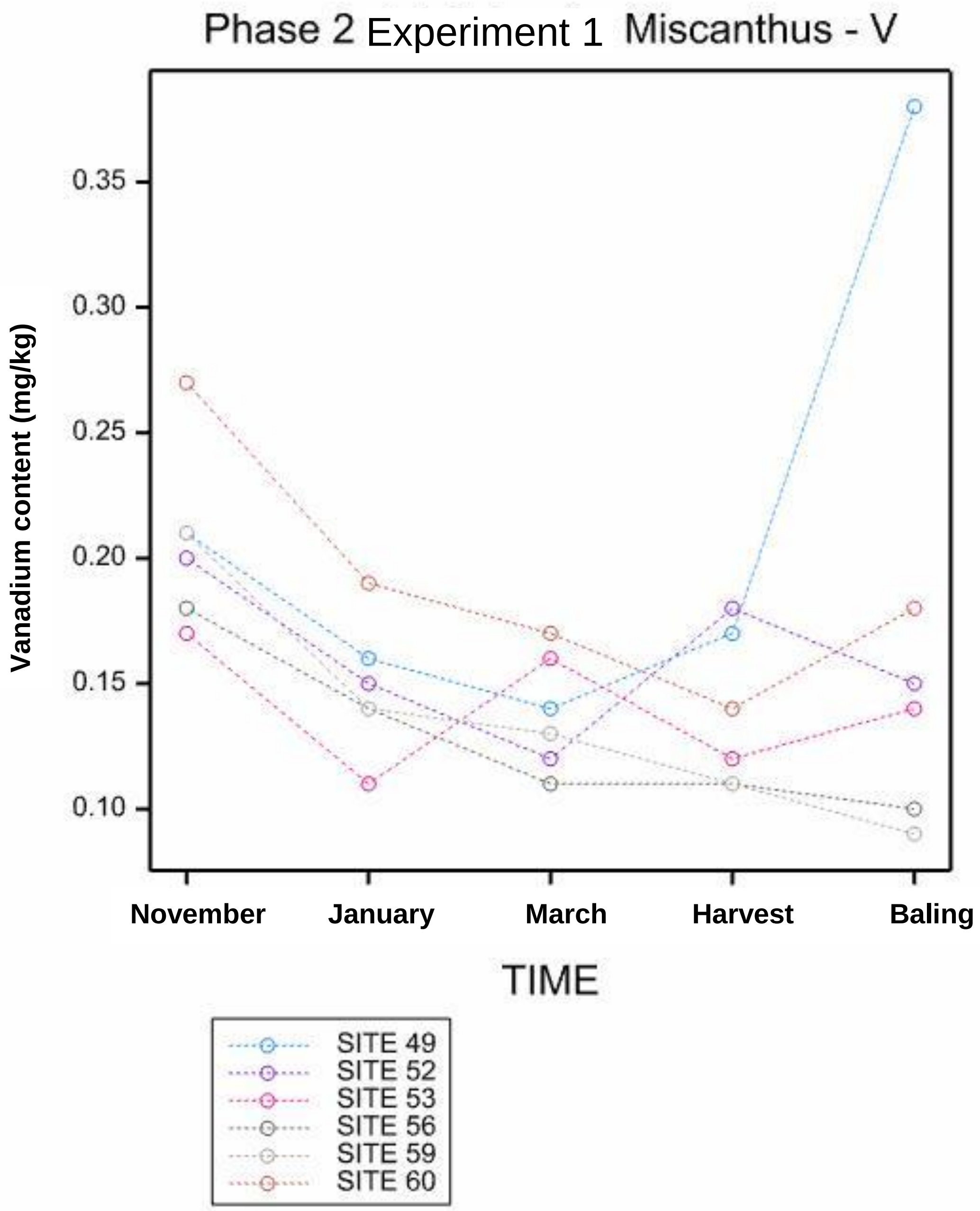


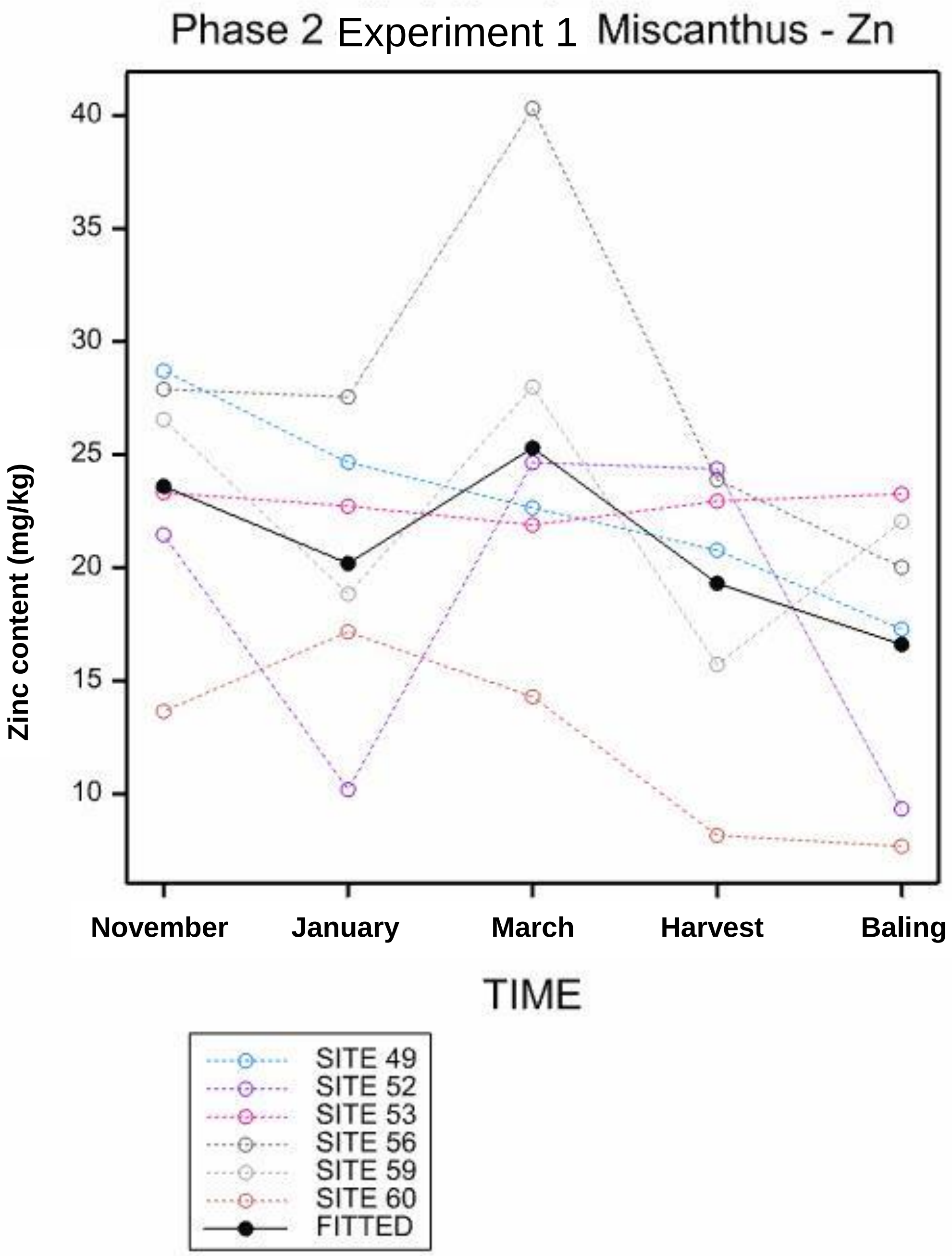
Phase 2 Experiment 1 Miscanthus - Cu
Copper content (mg/kg)
4.0
3.5
3.0
2.5
2.0
1.5
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60


Phase 2 Experiment 1 Miscanthus - Mo
Molybdenum content (mg/kg)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

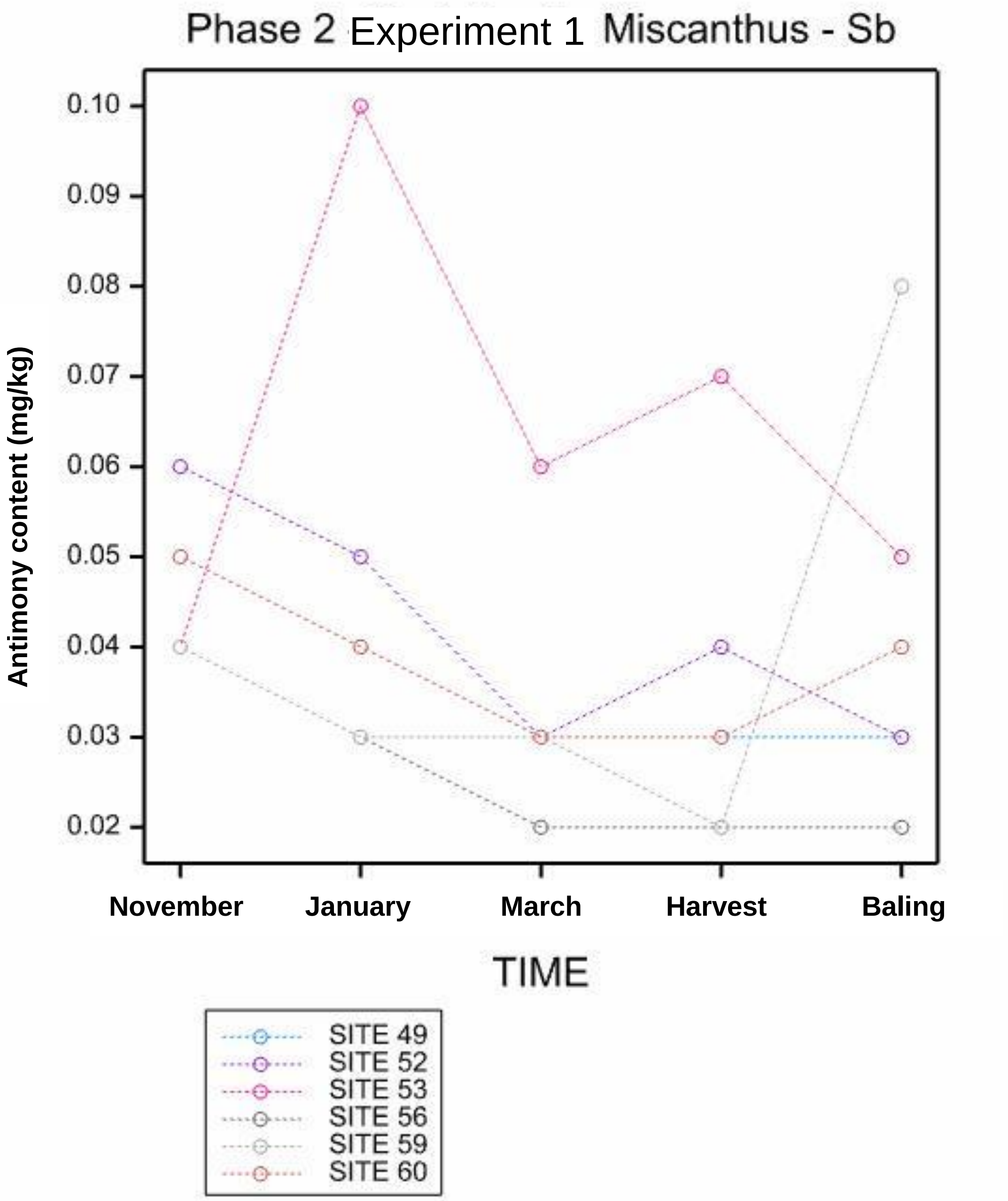


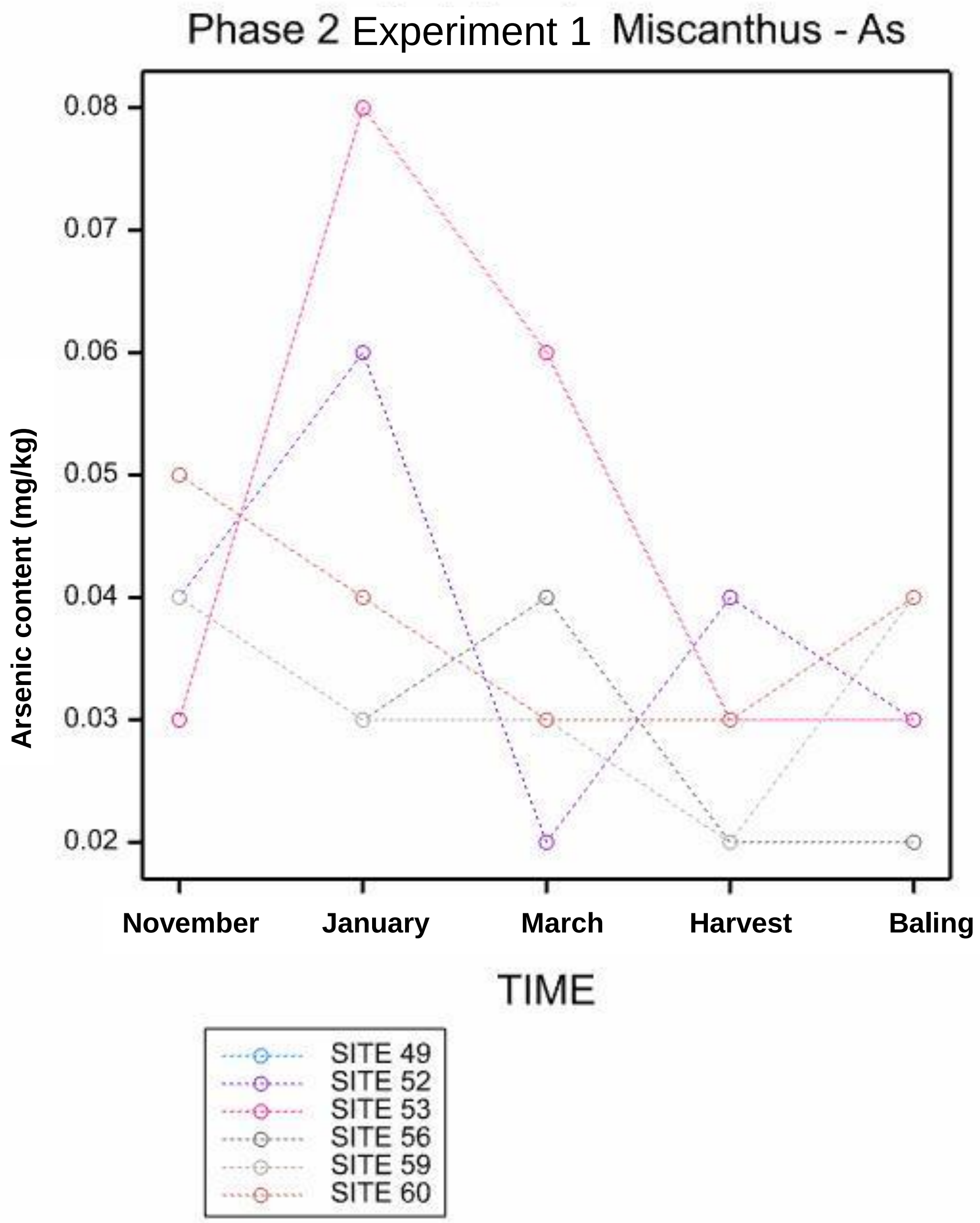
Phase 2 Experiment 1 Miscanthus - Ni
Nickel content (mg/kg)
0.30
0.25
0.20
0.15
0.10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

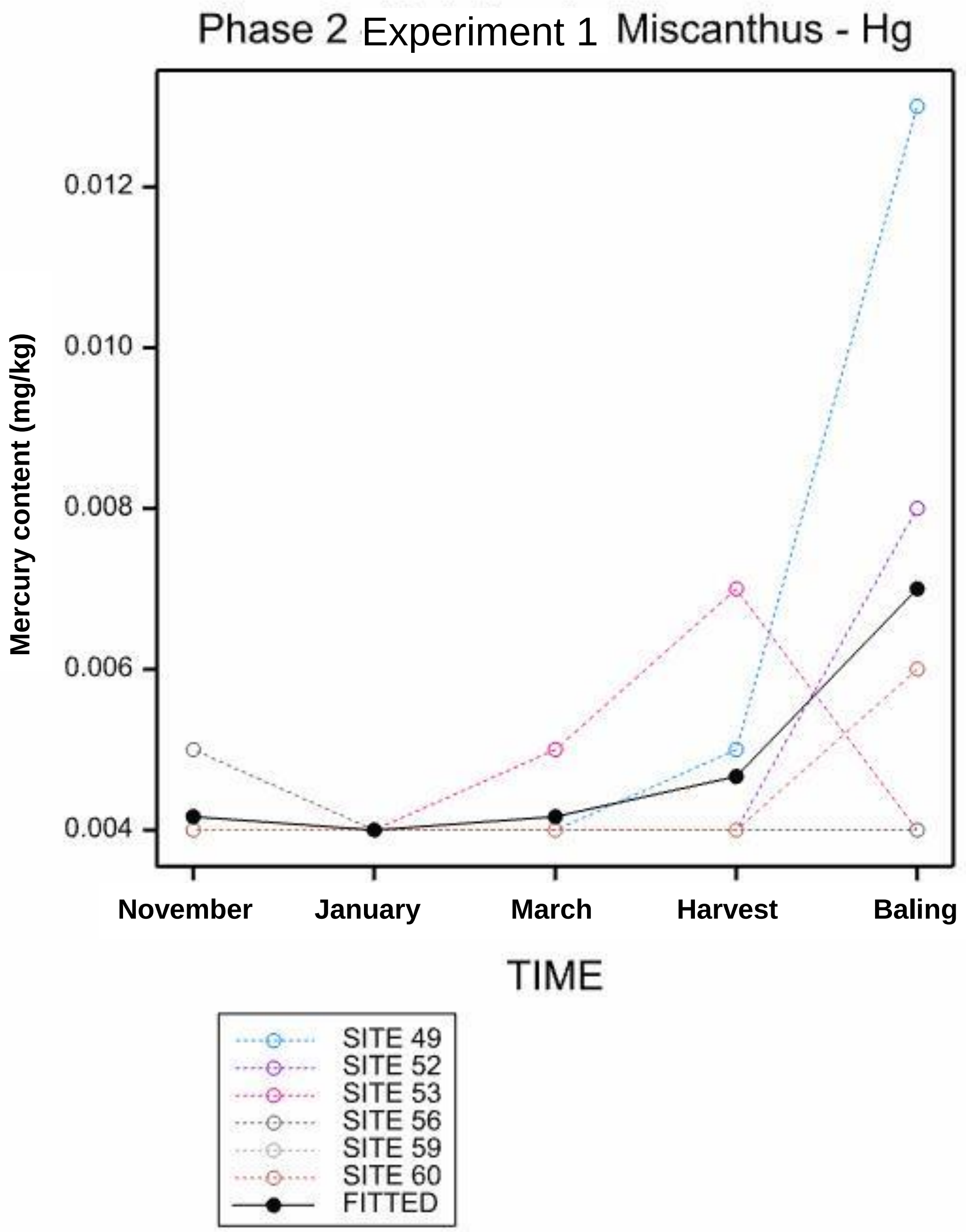

Phase 2 Experiment 1 Miscanthus - V
Vanadium content (mg/kg)
0.35
0.30
0.25
0.20
0.15
0.10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

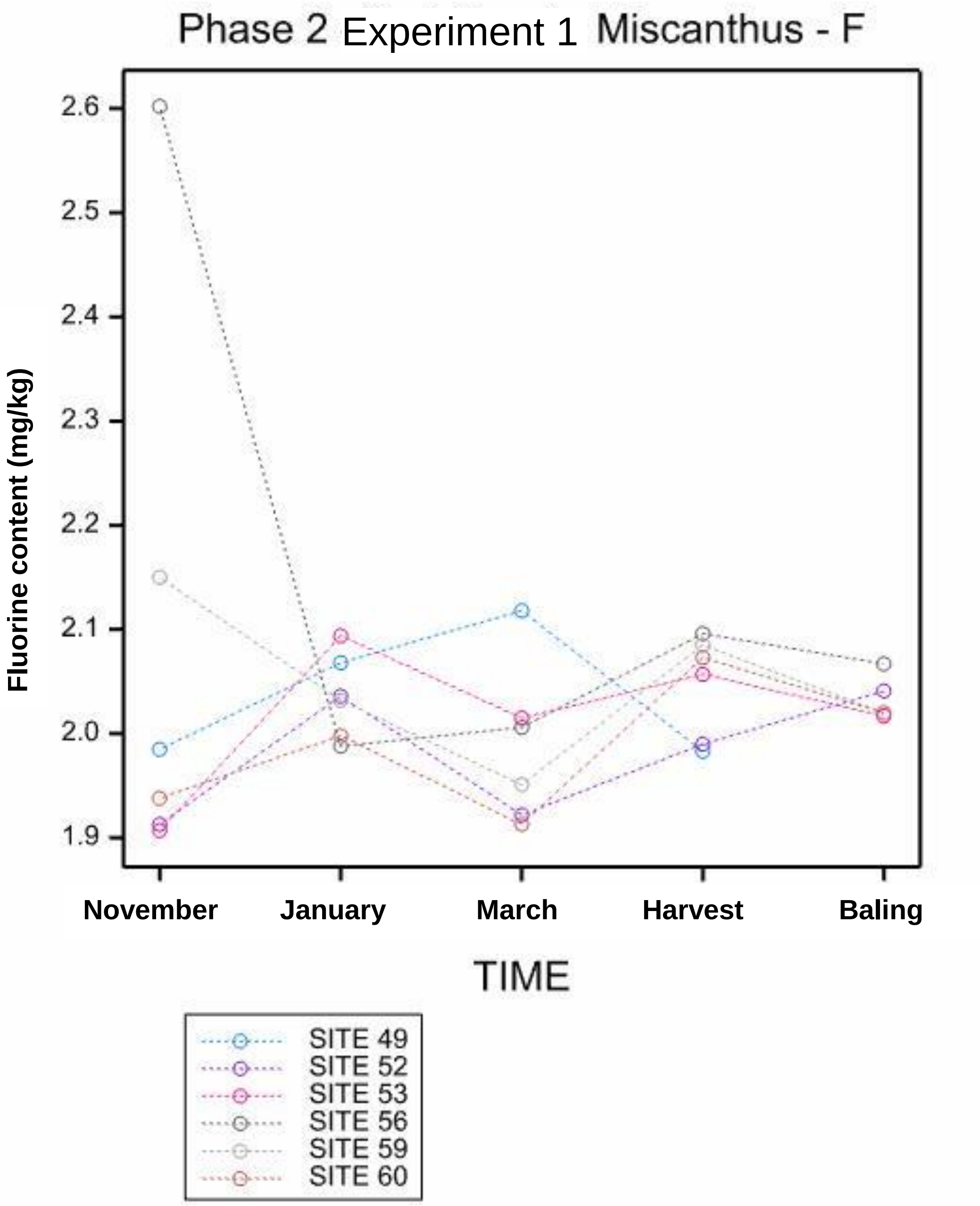


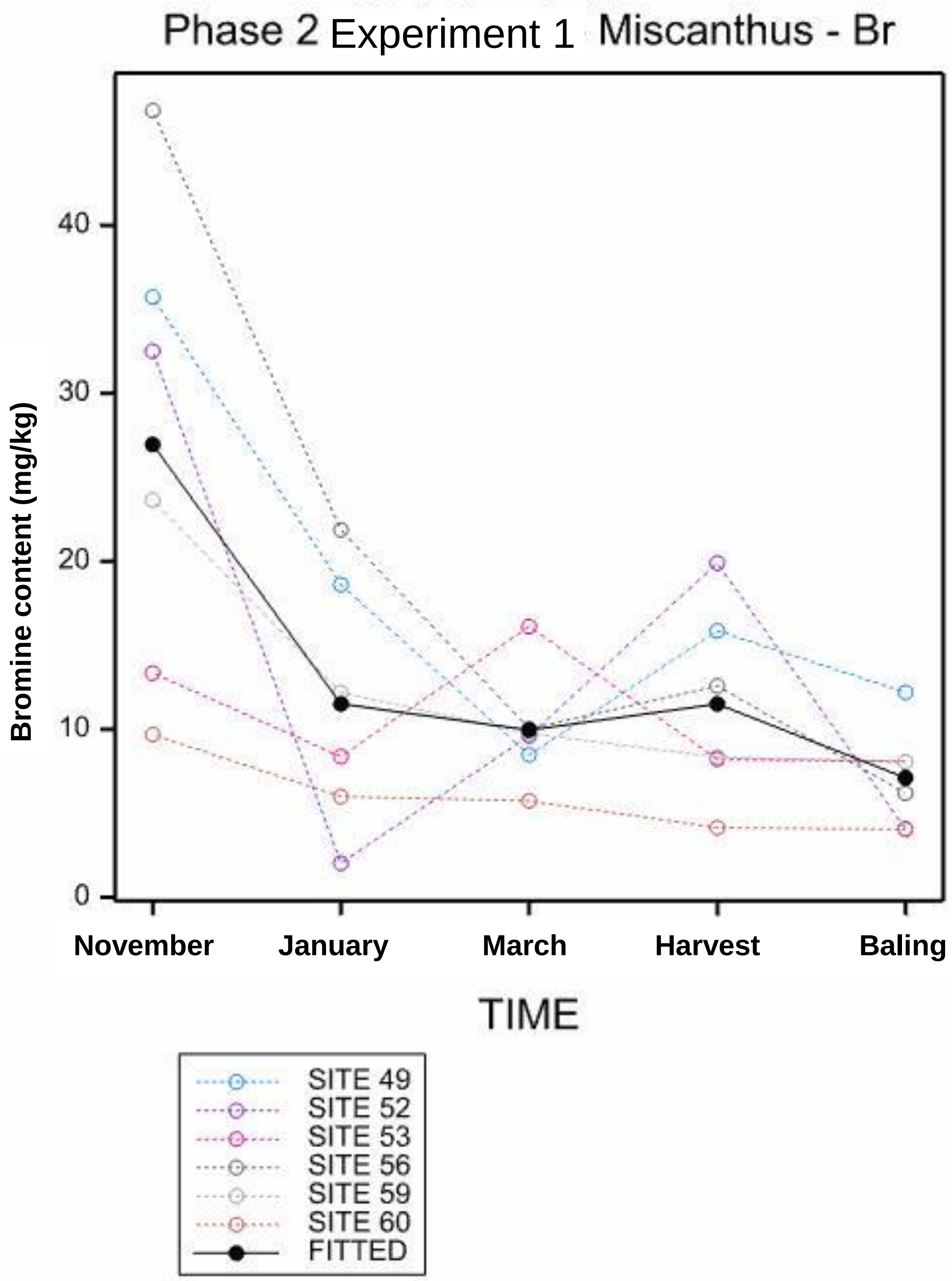
Phase 2 Experiment 1 Miscanthus - Zn
Zinc content (mg/kg)
40
35
30
25
20
15
10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

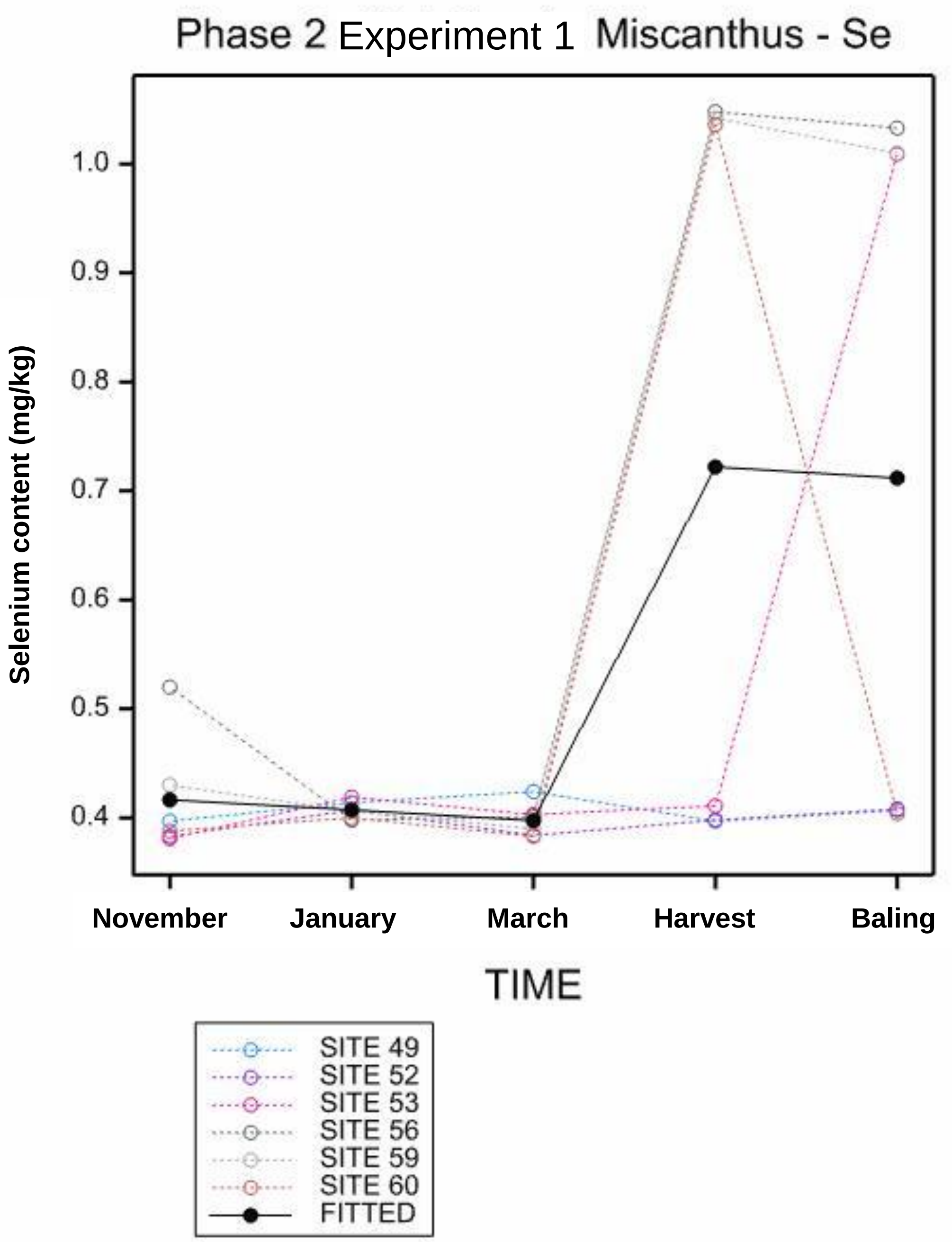

Phase 2 Experiment 1 Miscanthus - Sb
Antimony content (mg/kg)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

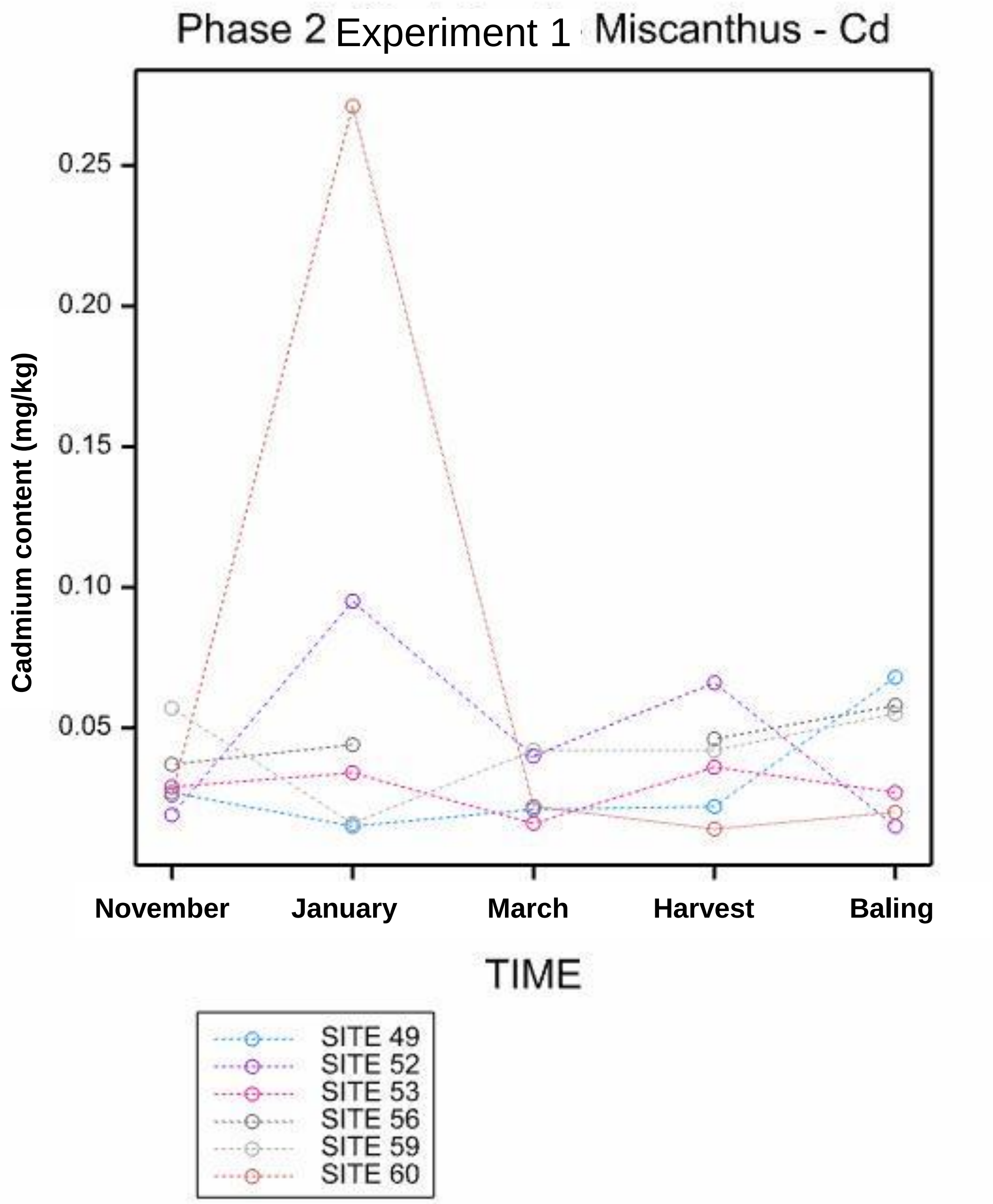

Phase 2 Experiment 1 Miscanthus - As
Arsenic content (mg/kg)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

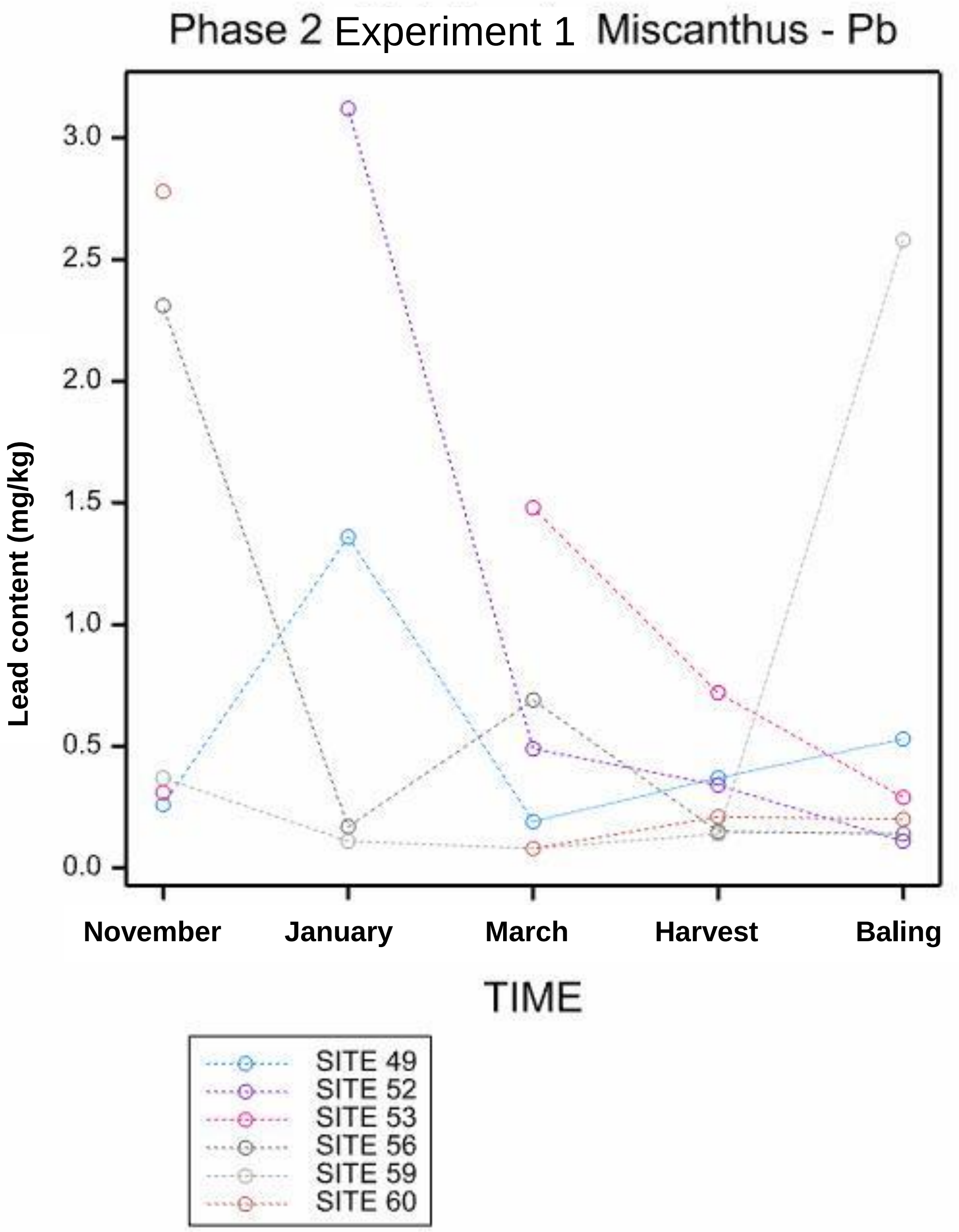

Phase 2 Experiment 1 Miscanthus - Hg
Mercury content (mg/kg)
0.012
0.010
0.008
0.006
0.004
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

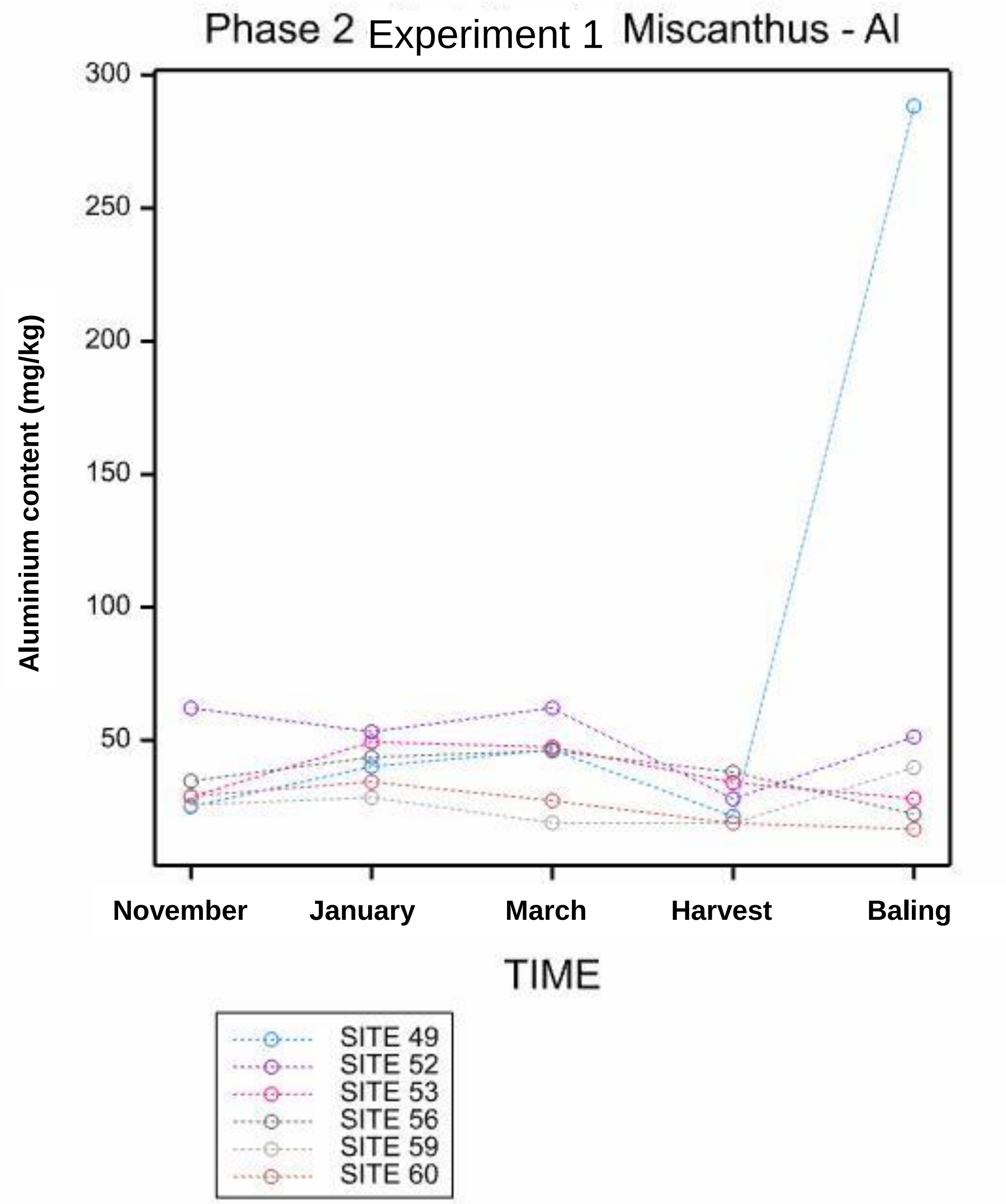

Phase 2 Experiment 1 Miscanthus - F
Fluorine content (mg/kg)
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

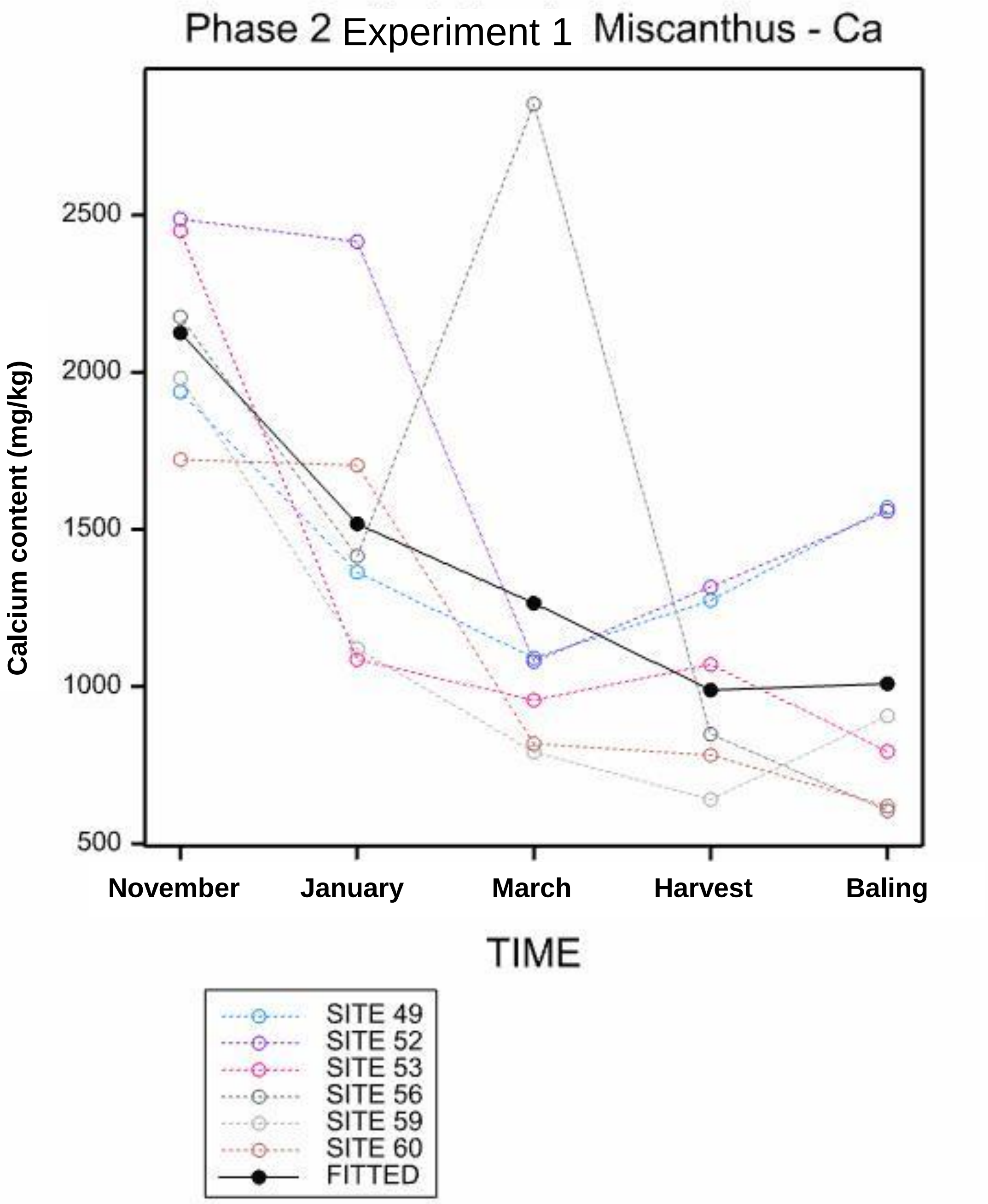

Phase 2 Experiment 1 Miscanthus - Br
Bromine content (mg/kg)
0
10
20
30
40
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

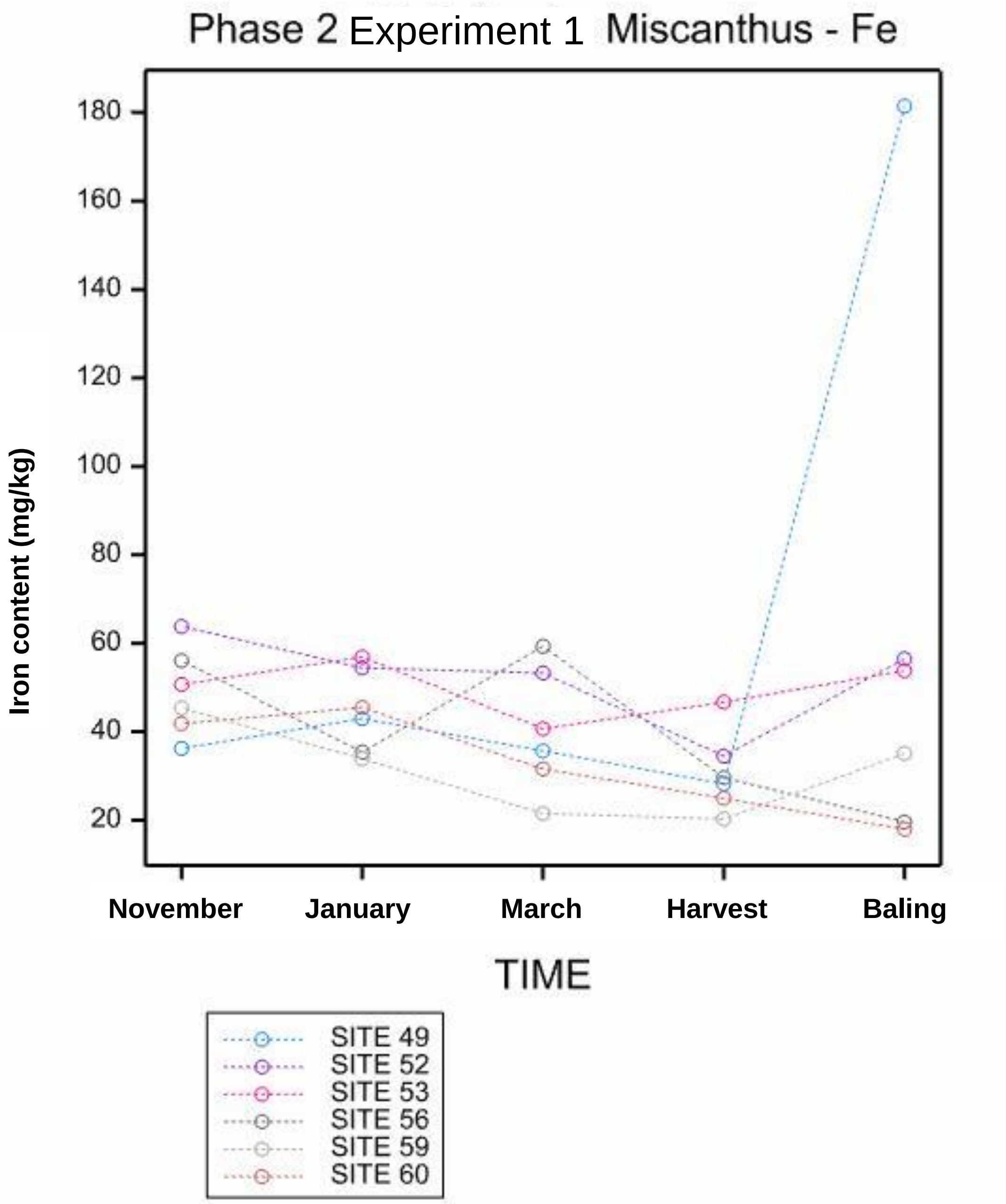

Phase 2 Experiment 1 Miscanthus - Se
Selenium content (mg/kg)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

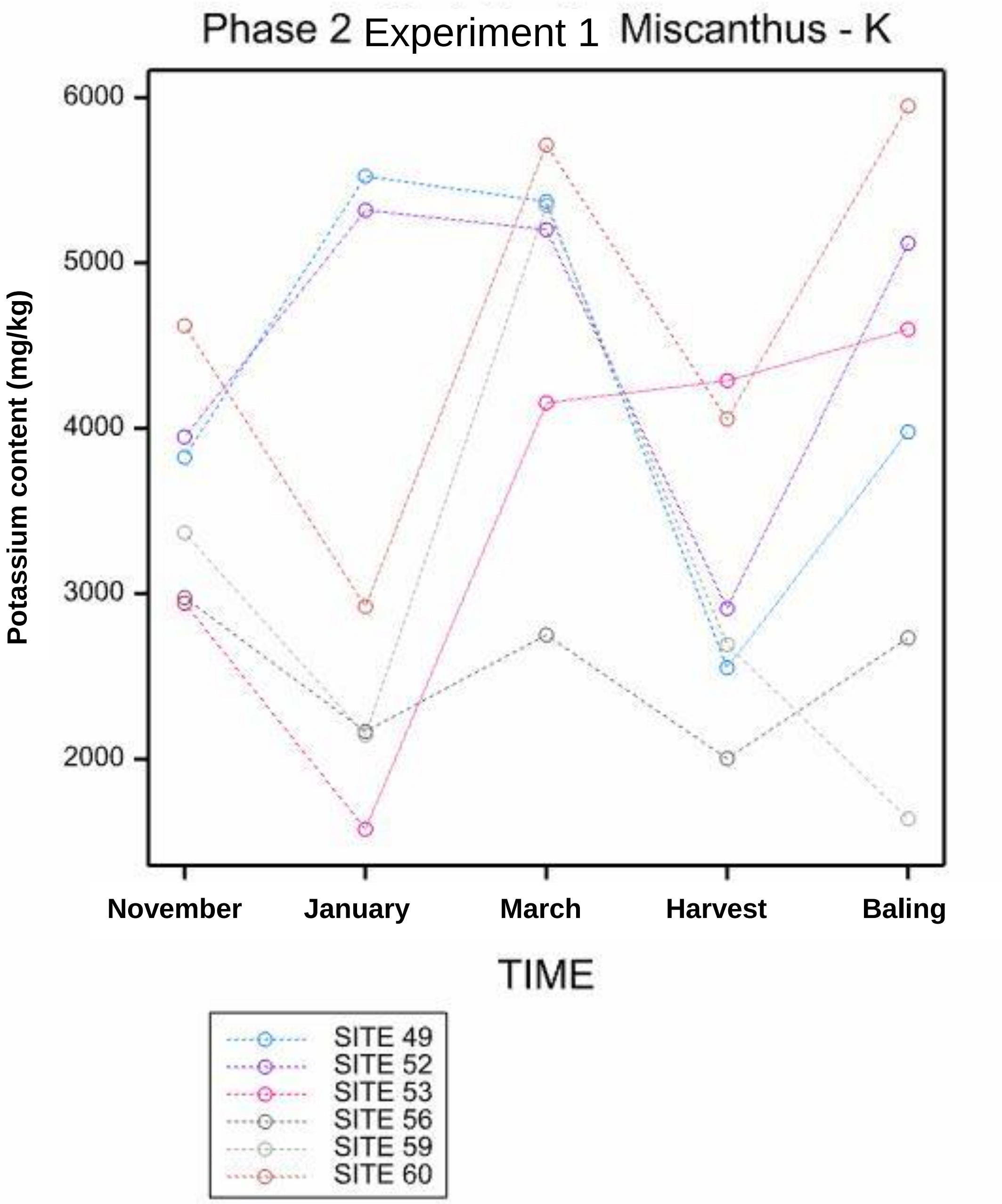

Phase 2 Experiment 1 Miscanthus - Cd
Cadmium content (mg/kg)
0.25
0.20
0.15
0.10
0.05
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

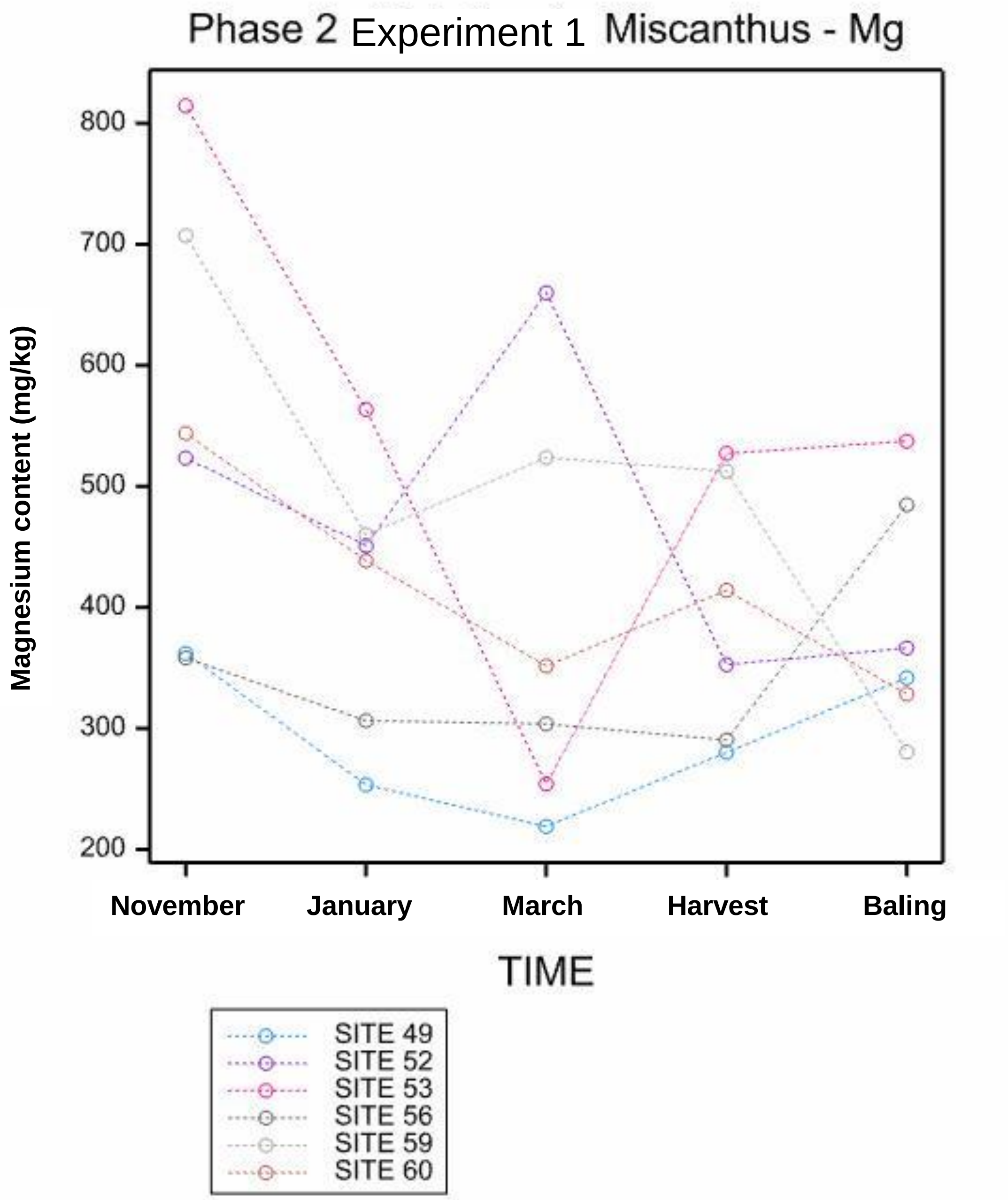

Phase 2 Experiment 1 Miscanthus - Pb
Lead content (mg/kg)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60


Phase 2 Experiment 1 Miscanthus - Al
Aluminium content (mg/kg)
300
250
200
150
100
50
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

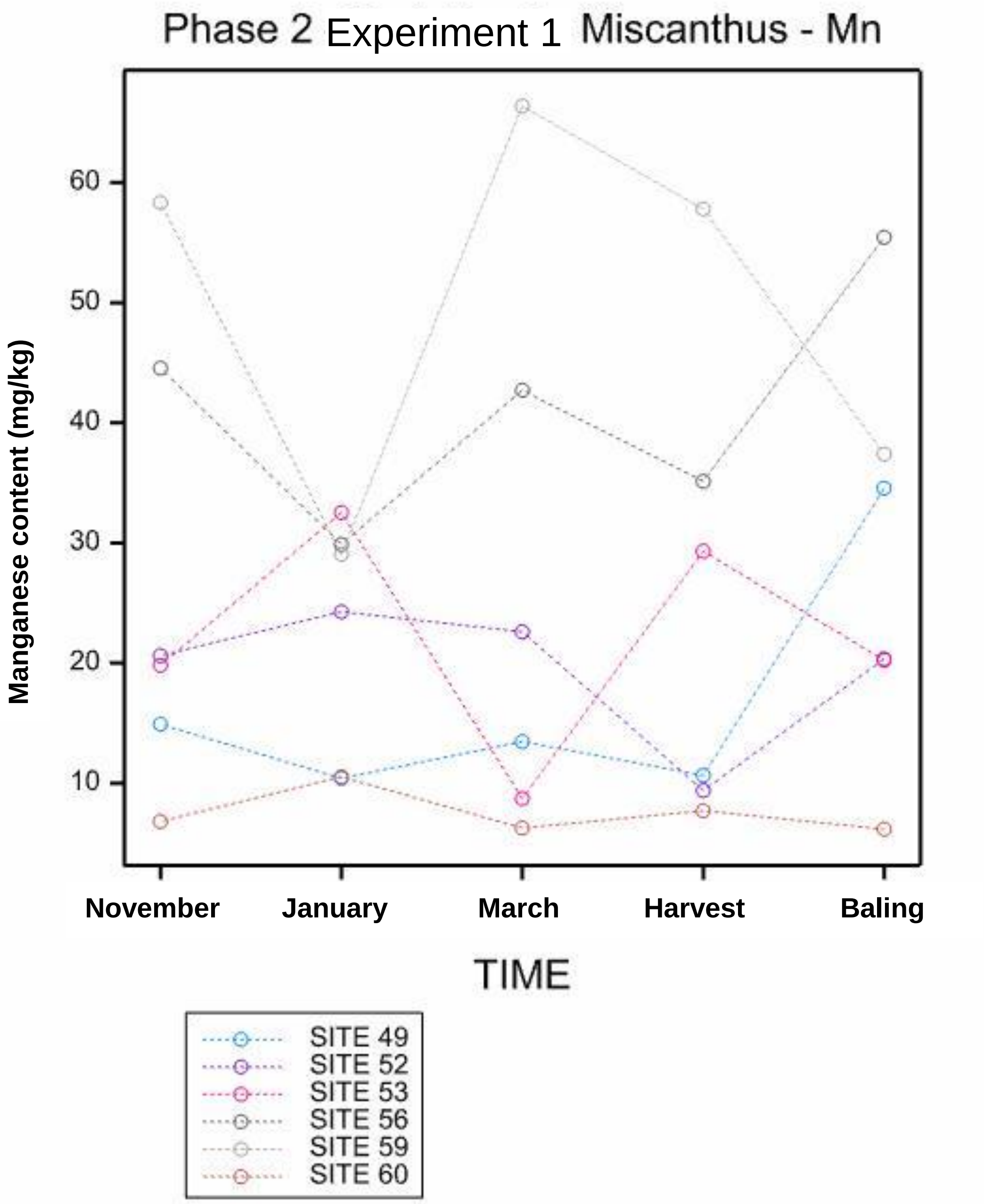

Phase 2 Experiment 1 Miscanthus - Ca
Calcium content (mg/kg)
2500
2000
1500
1000
500
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED


Phase 2 Experiment 1 Miscanthus - Fe
Iron content (mg/kg)
180
160
140
120
100
80
60
40
20
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

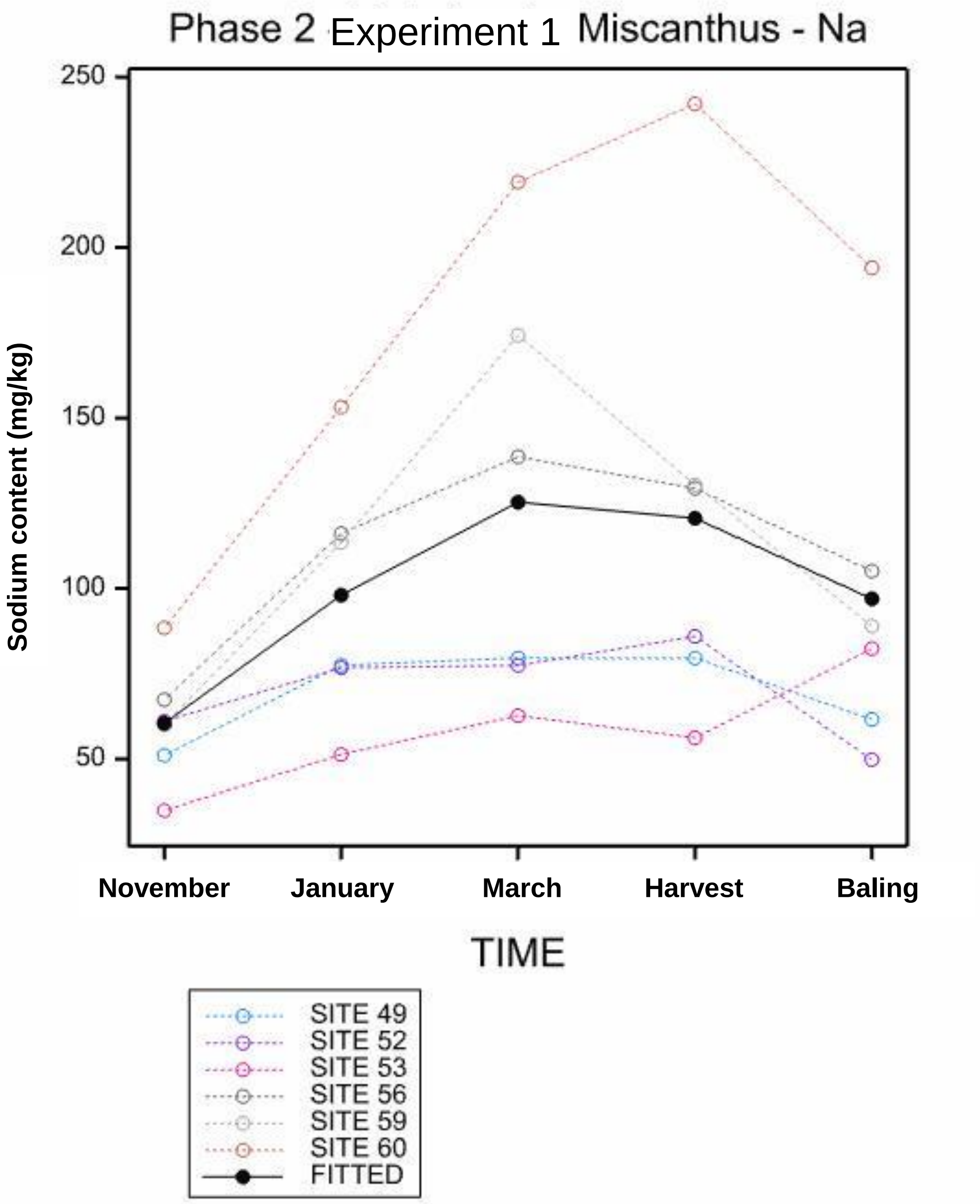

Phase 2 Experiment 1 Miscanthus - K
Potassium content (mg/kg)
6000
5000
4000
3000
2000
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

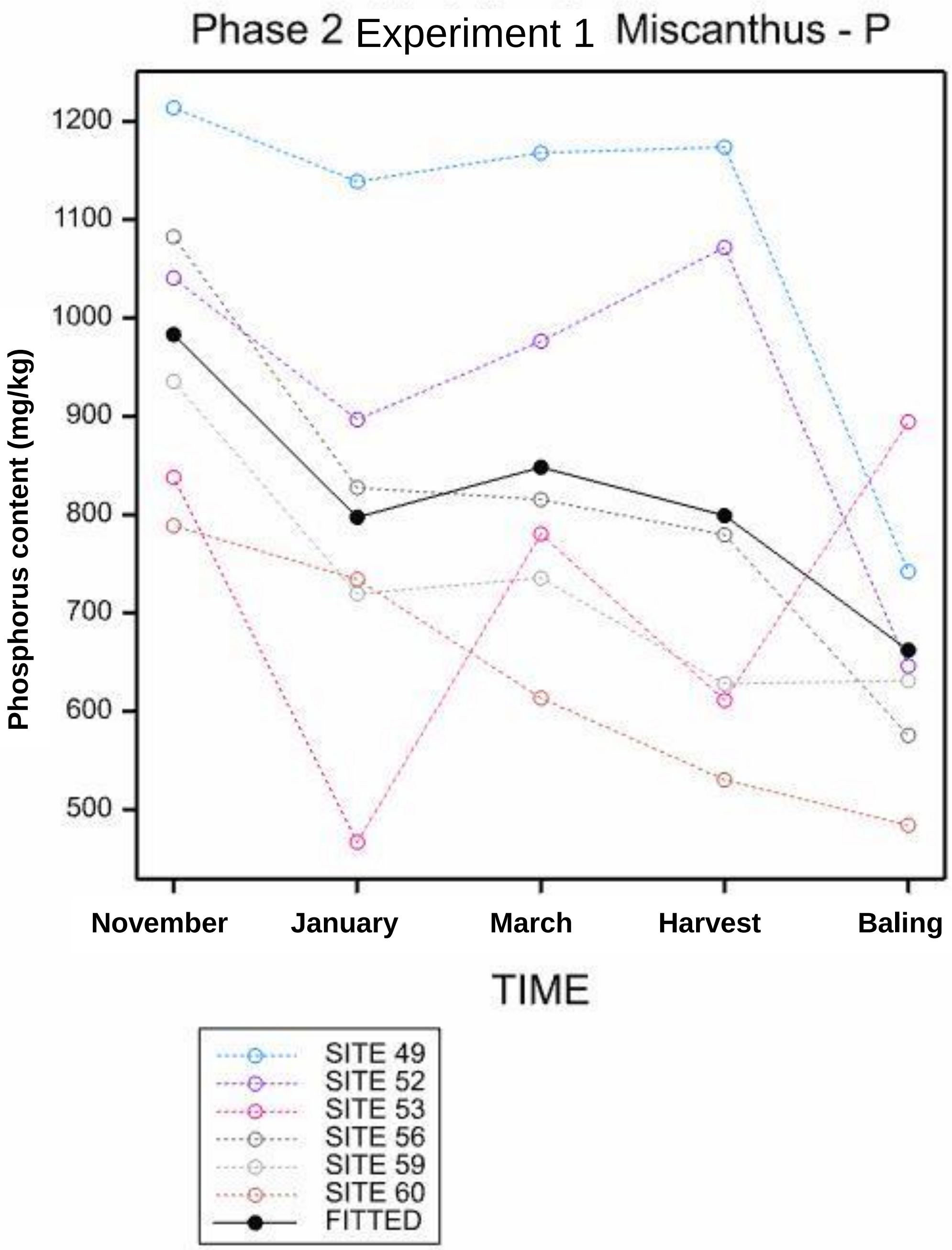


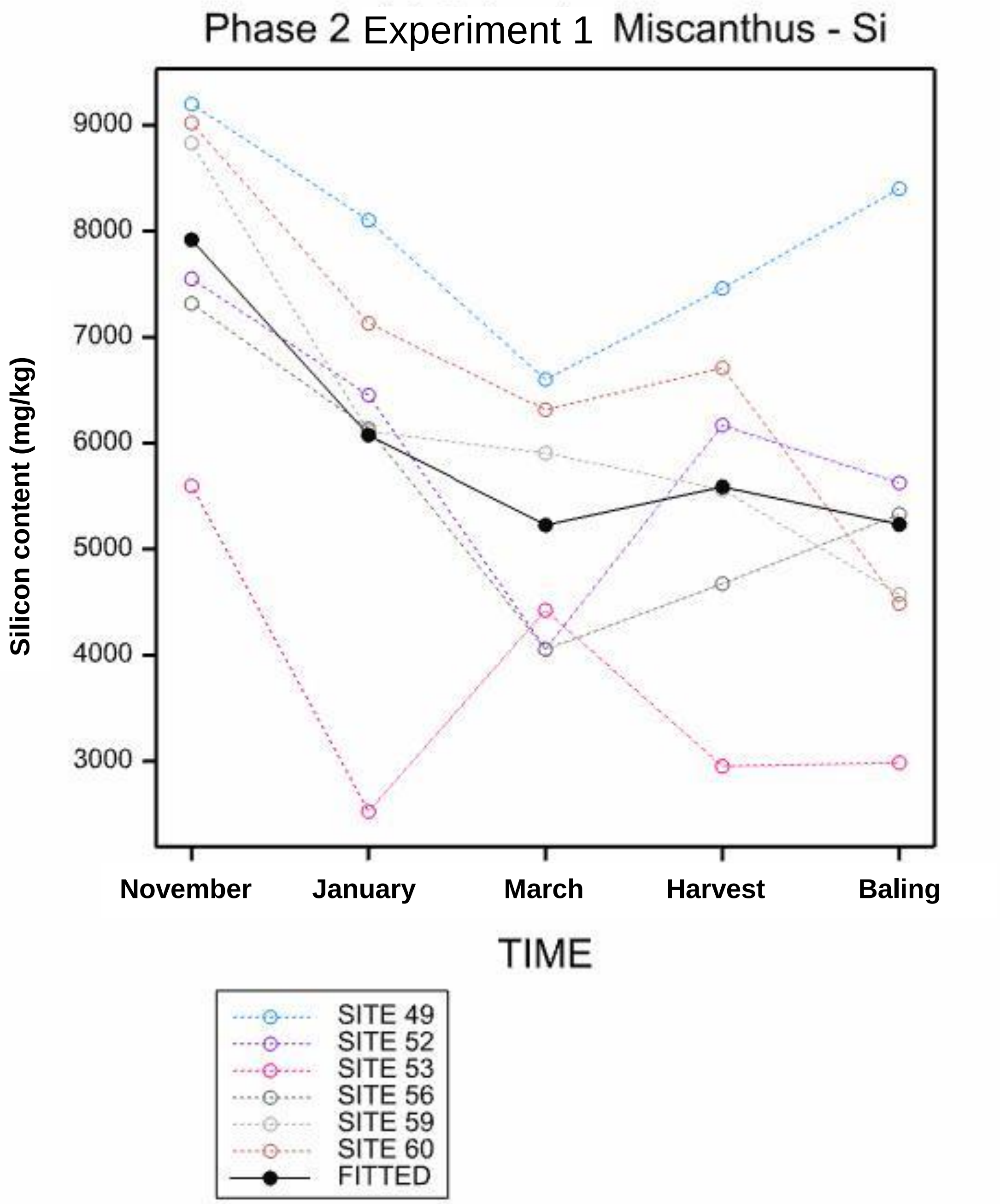
Phase 2 Experiment 1 Miscanthus - Mg
Magnesium content (mg/kg)
800
700
600
500
400
300
200
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

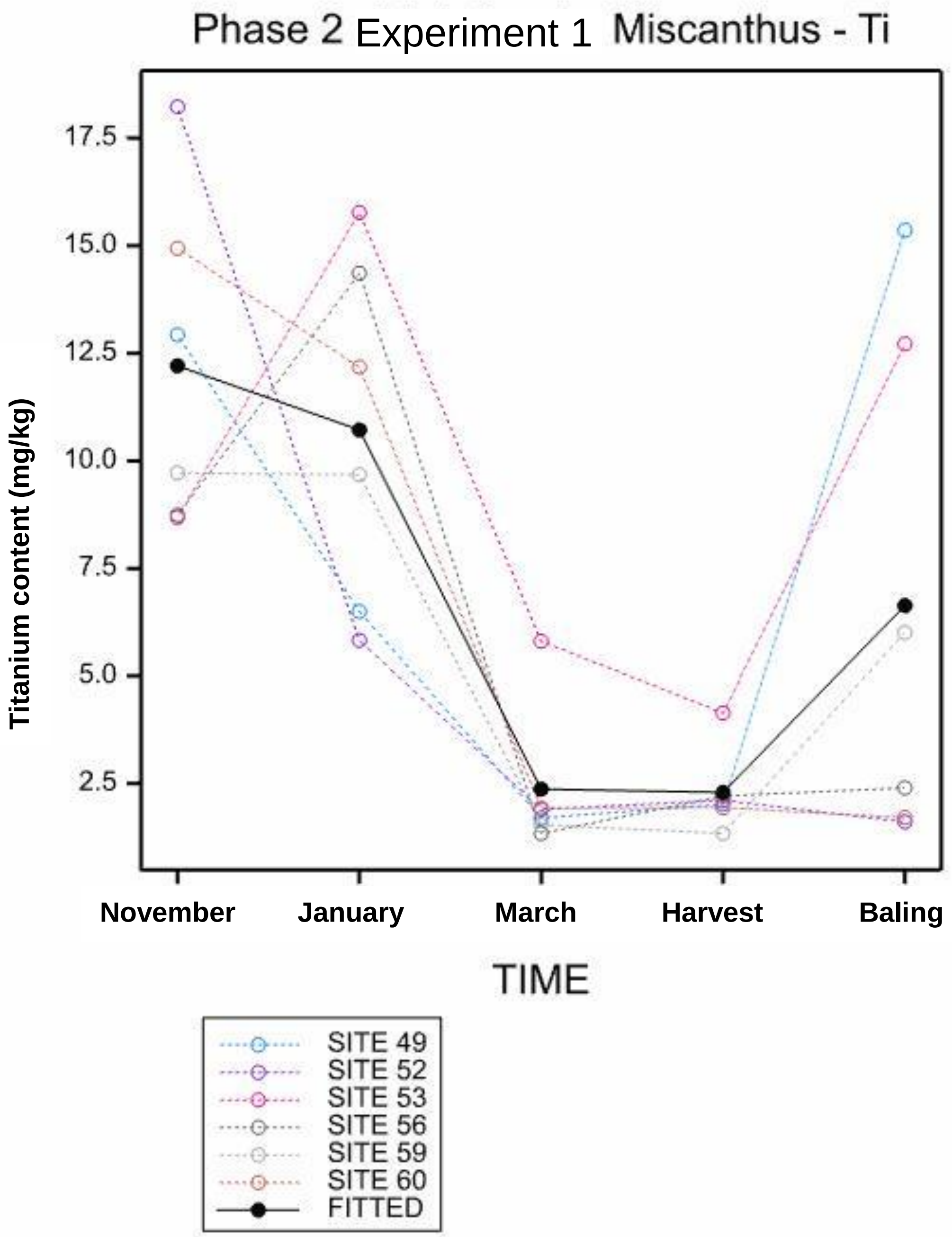


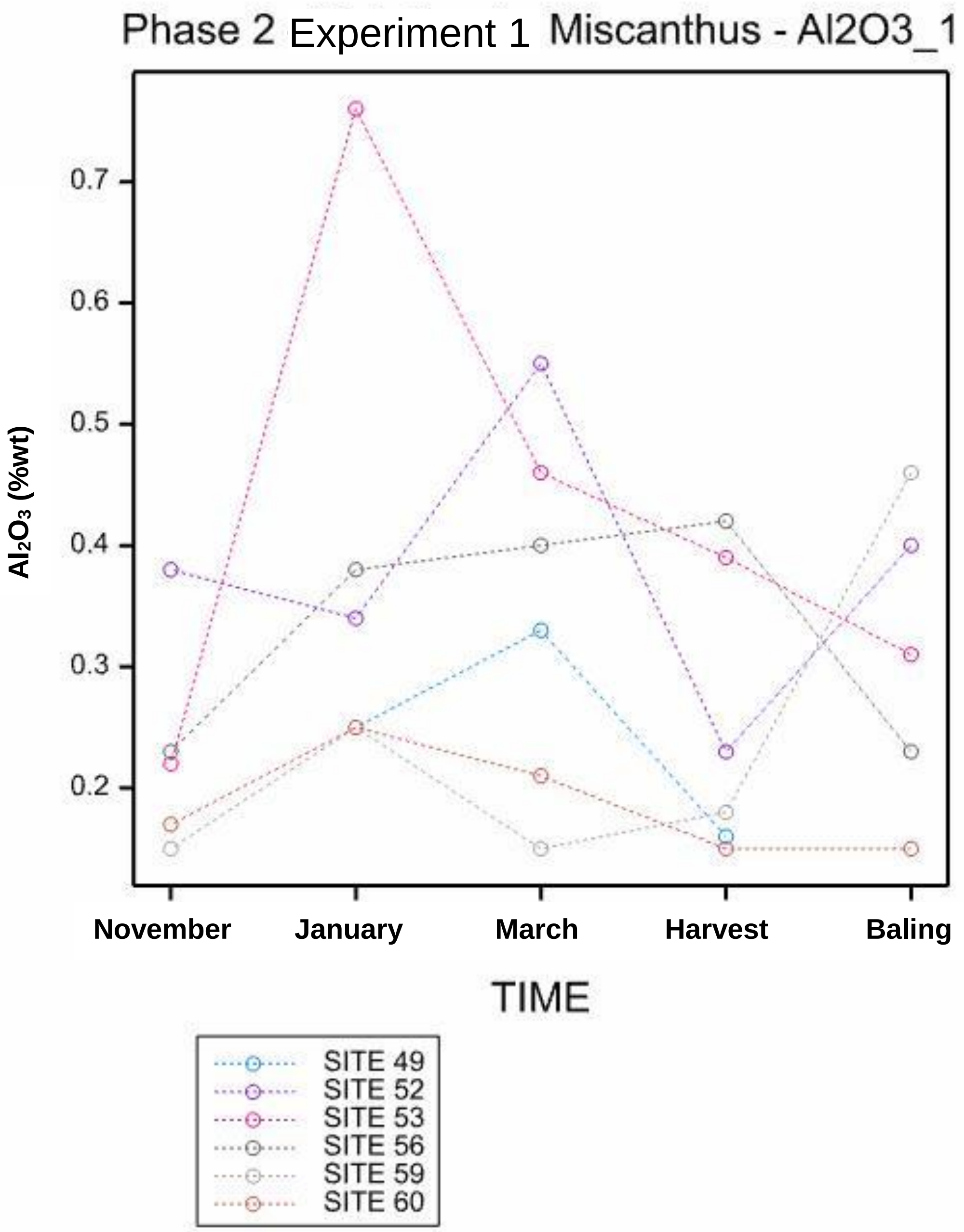
Phase 2 Experiment 1 Miscanthus - Mn
Manganese content (mg/kg)
60
50
40
30
20
10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

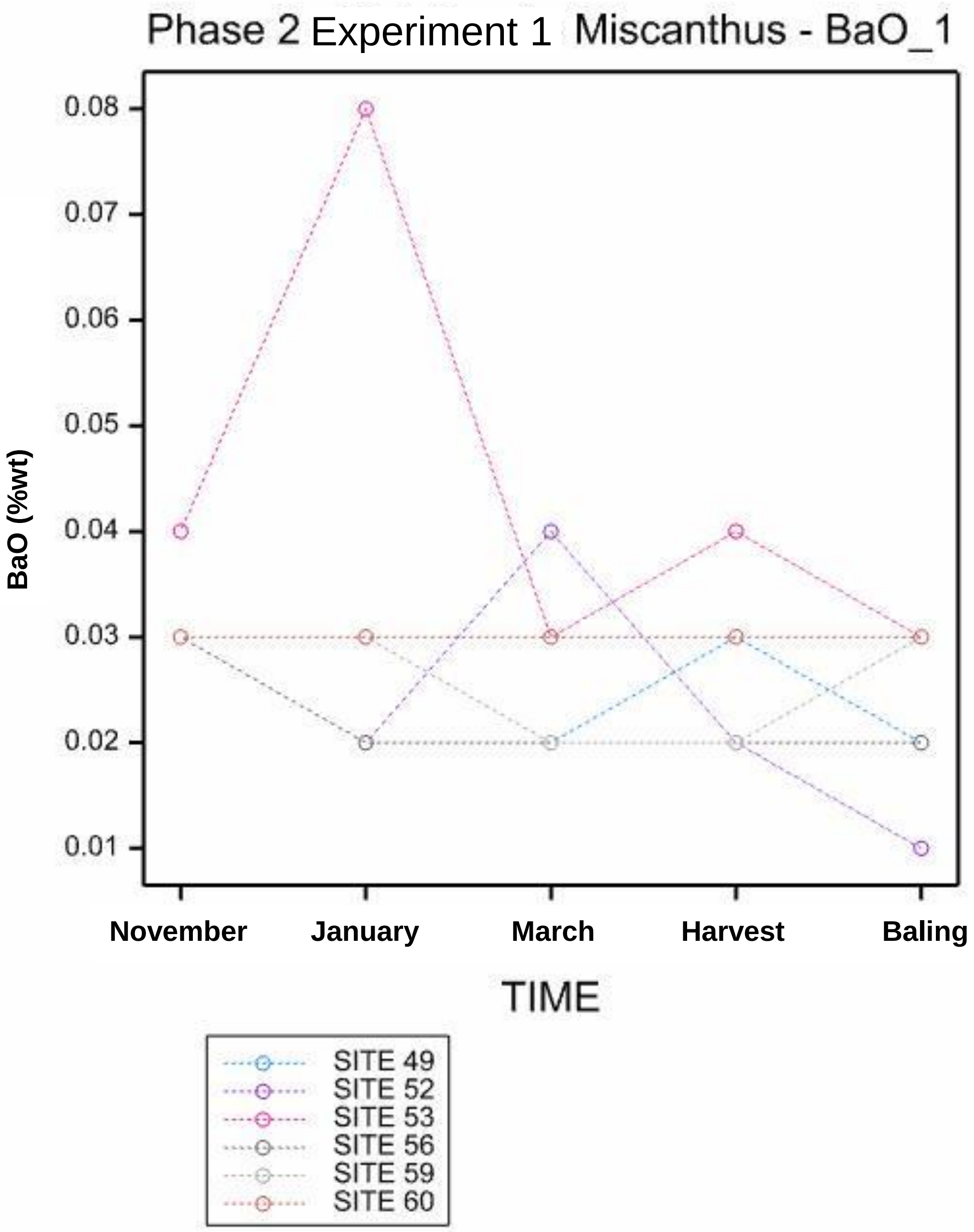

Phase 2 Experiment 1 Miscanthus - Na
Sodium content (mg/kg)
250
200
150
100
50
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED


Phase 2 Experiment 1 Miscanthus - P
Phosphorus content (mg/kg)
1200
1100
1000
900
800
700
600
500
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

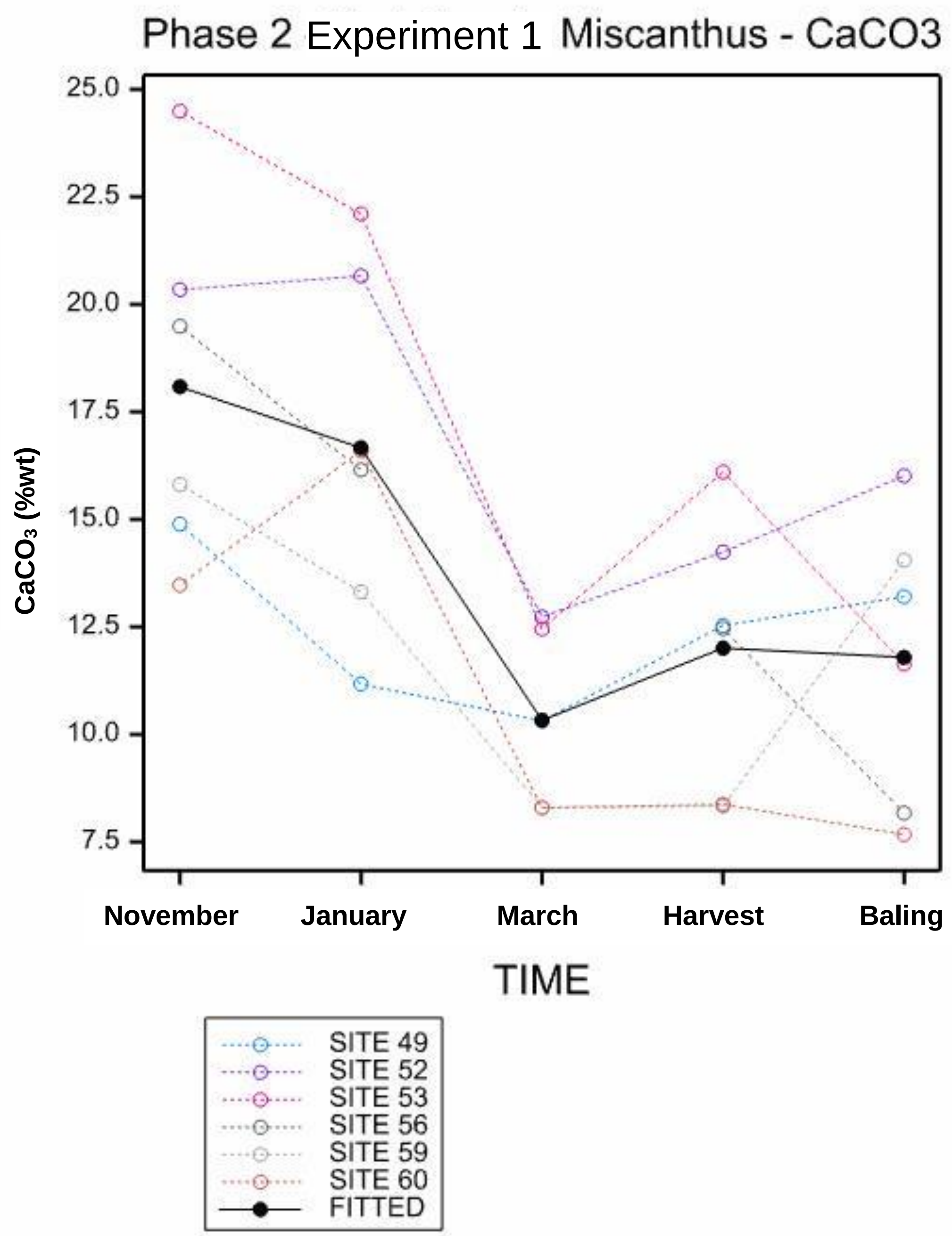

Phase 2 Experiment 1 Miscanthus - Si
Silicon content (mg/kg)
9000
8000
7000
6000
5000
4000
3000
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED


Phase 2 Experiment 1 Miscanthus - Ti
Titanium content (mg/kg)
17.5
15.0
12.5
10.0
7.5
5.0
2.5
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

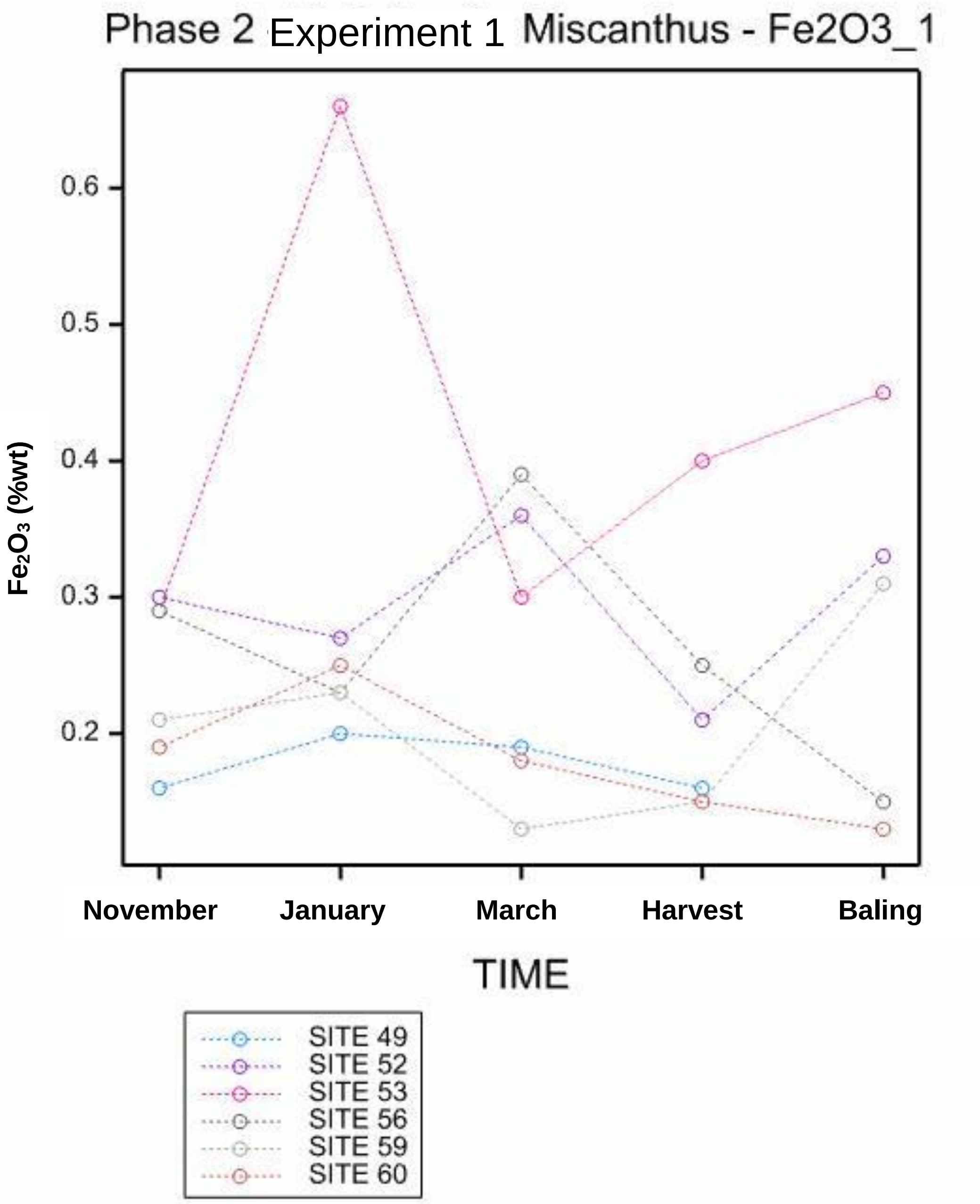

Phase 2 Experiment 1 Miscanthus - Al2O3_1
0.7
0.6
0.5
0.4
0.3
0.2
Al₂O₃ (%wt)
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60



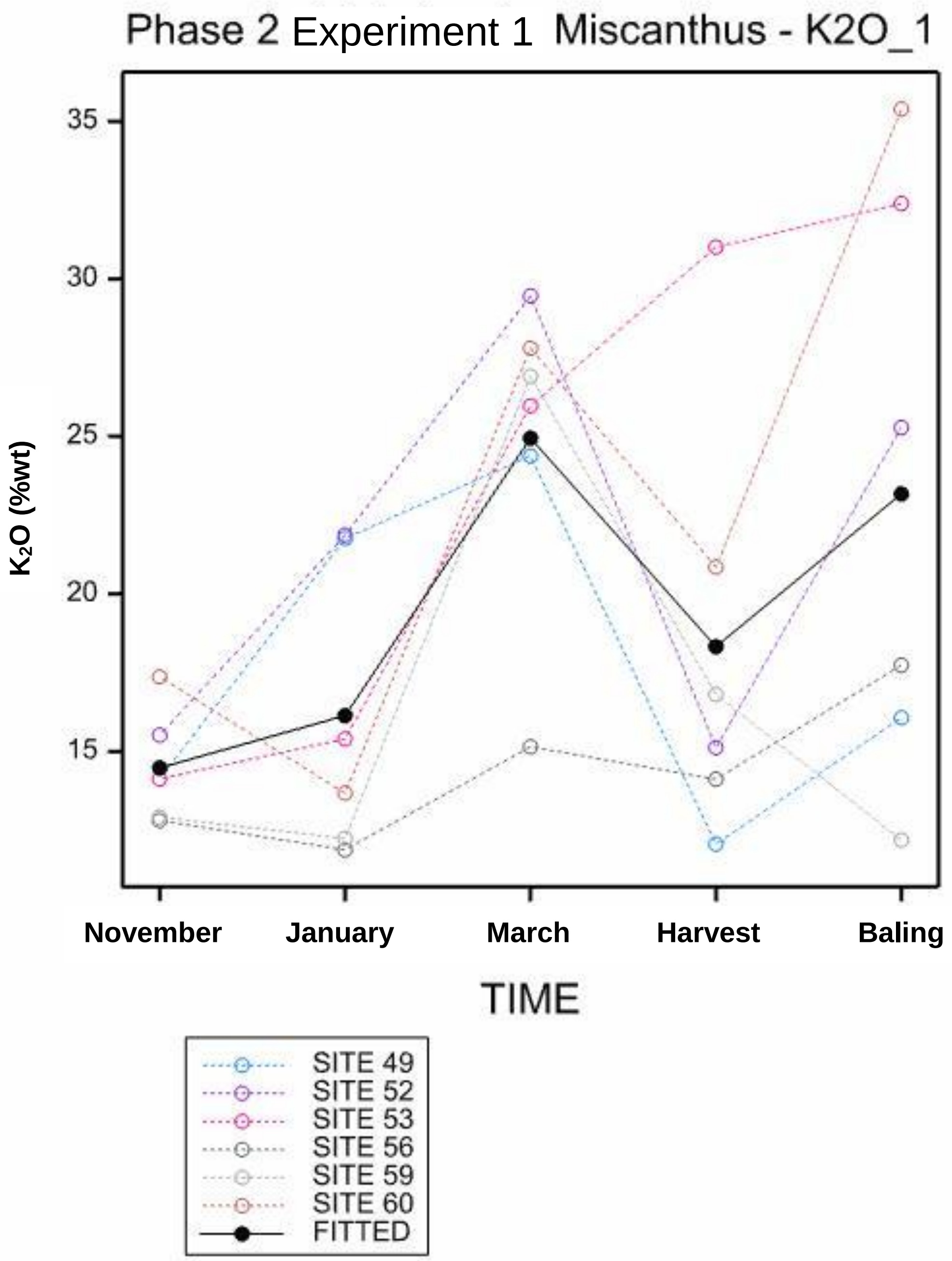
Phase 2 Experiment 1 Miscanthus - BaO_1
BaO (%wt)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

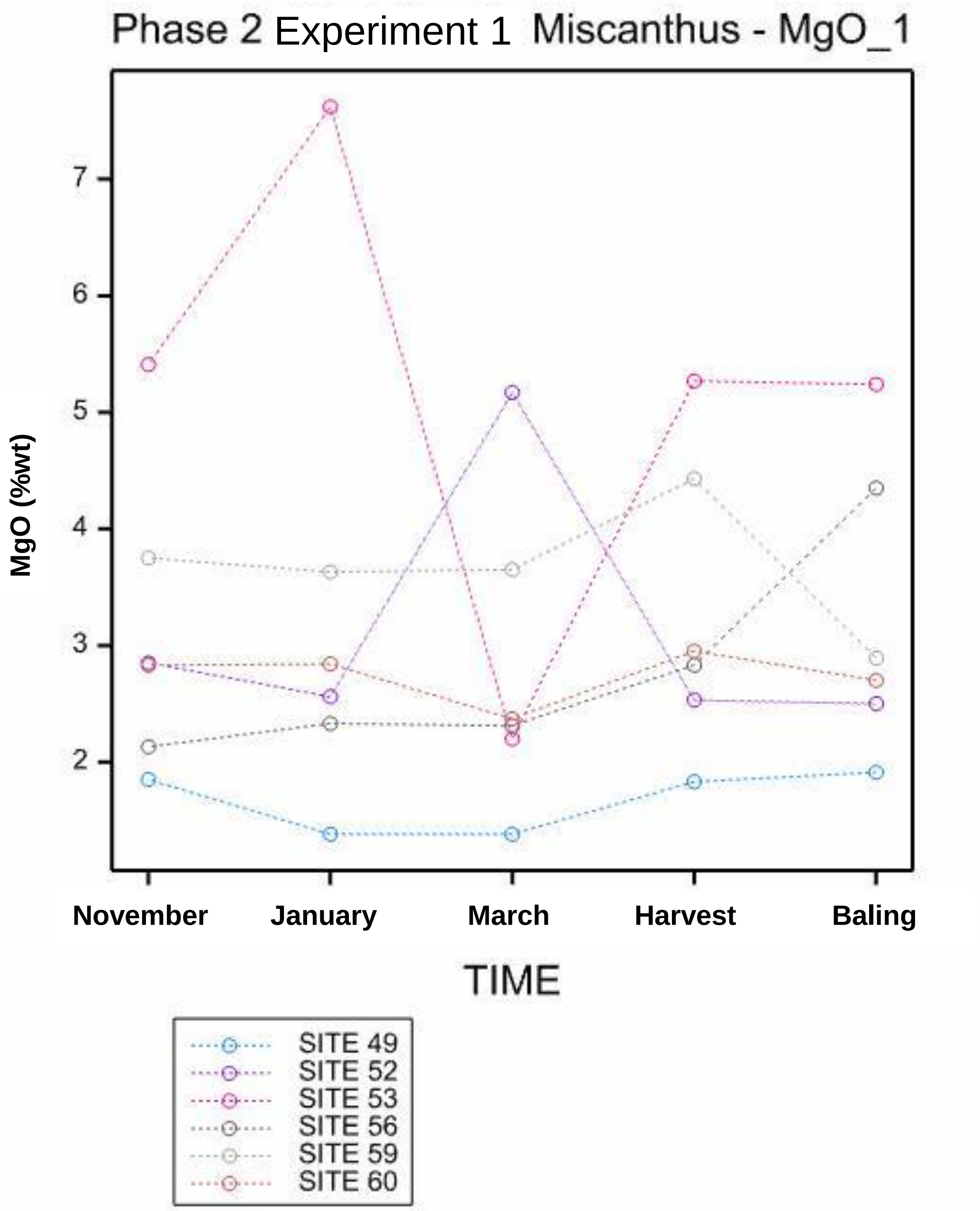


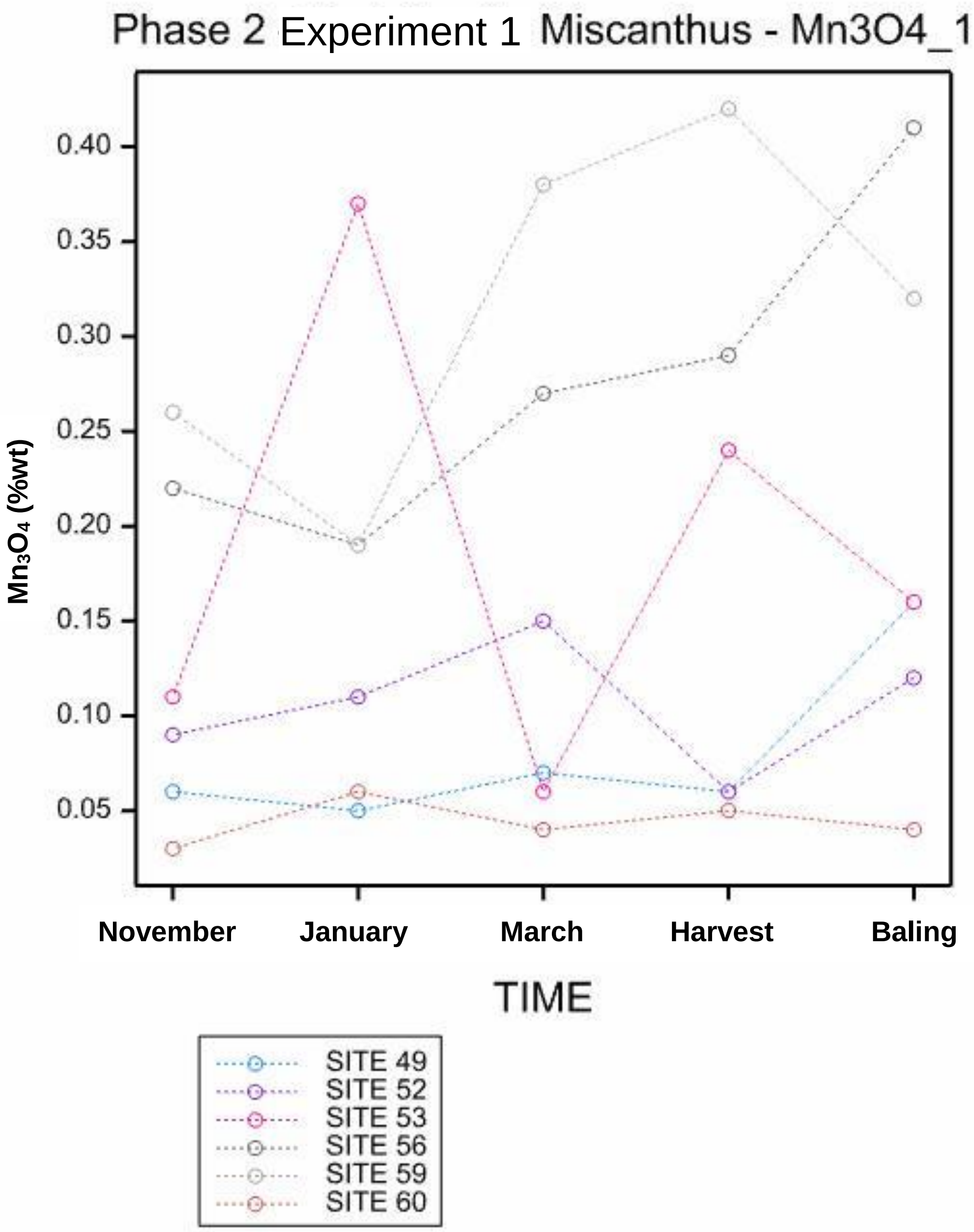
Phase 2 Experiment 1 Miscanthus - CaCO3
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
CaCO3 (%wt)
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

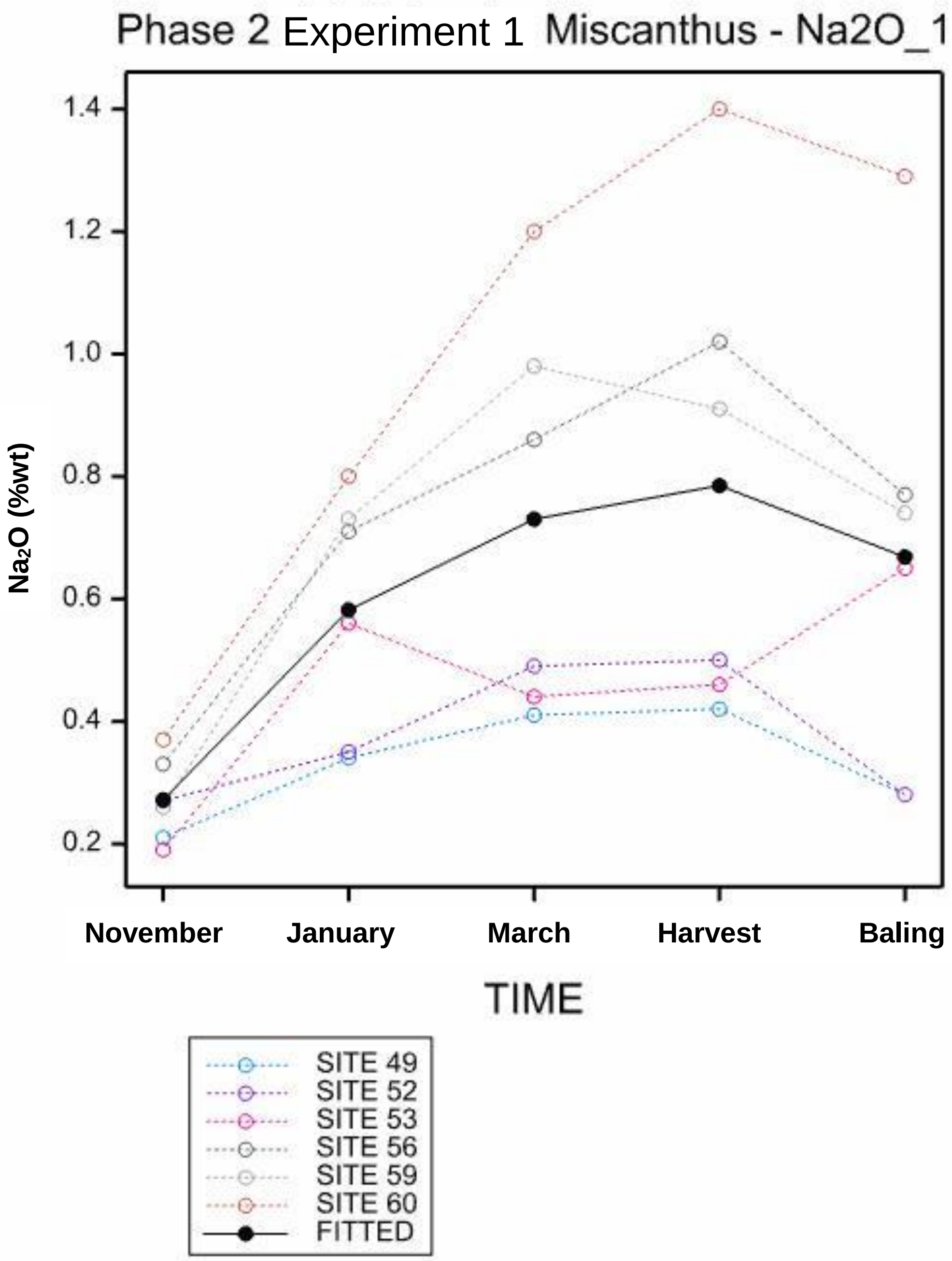


Phase 2 Experiment 1 Miscanthus - Fe2O3_1
0.6
0.5
0.4
0.3
0.2
Fe2O3 (%wt)
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

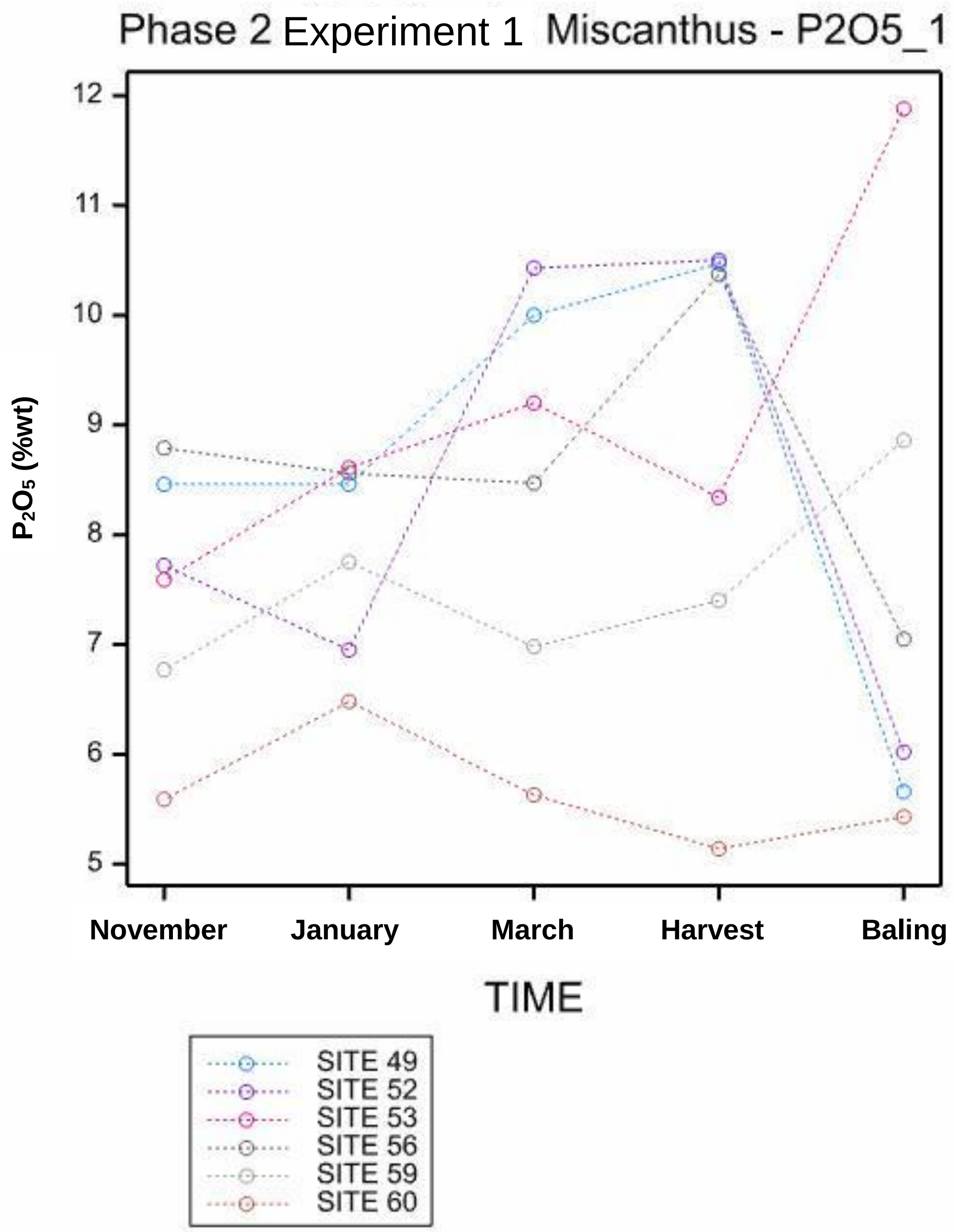

Phase 2 Experiment 1 Miscanthus - K2O_1
K₂O (%wt)
35
30
25
20
15
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

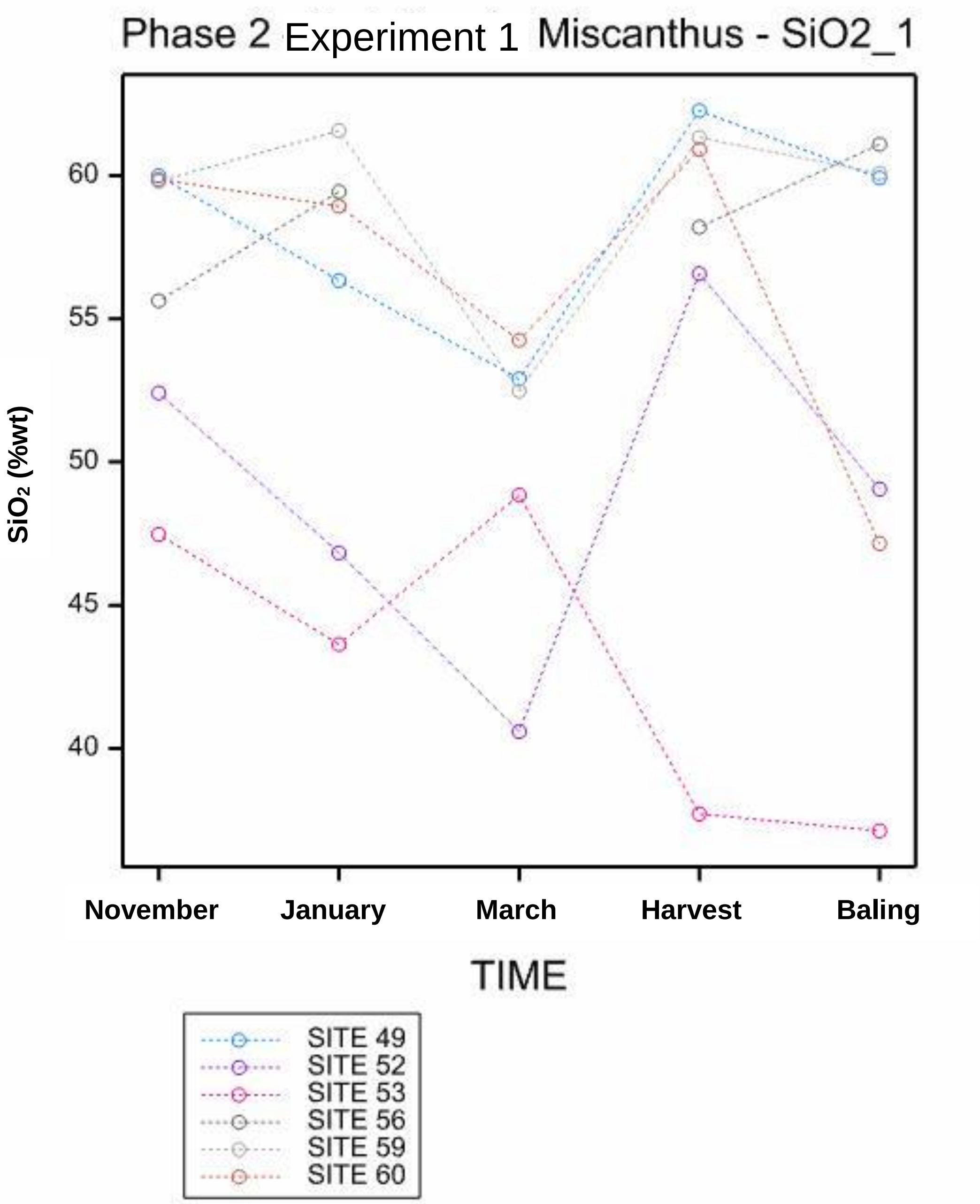

Phase 2 Experiment 1 Miscanthus - MgO_1
MgO (%wt)
7
6
5
4
3
2
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60


Phase 2 Experiment 1 Miscanthus - Mn3O4_1
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
Mn₃O₄ (%wt)
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

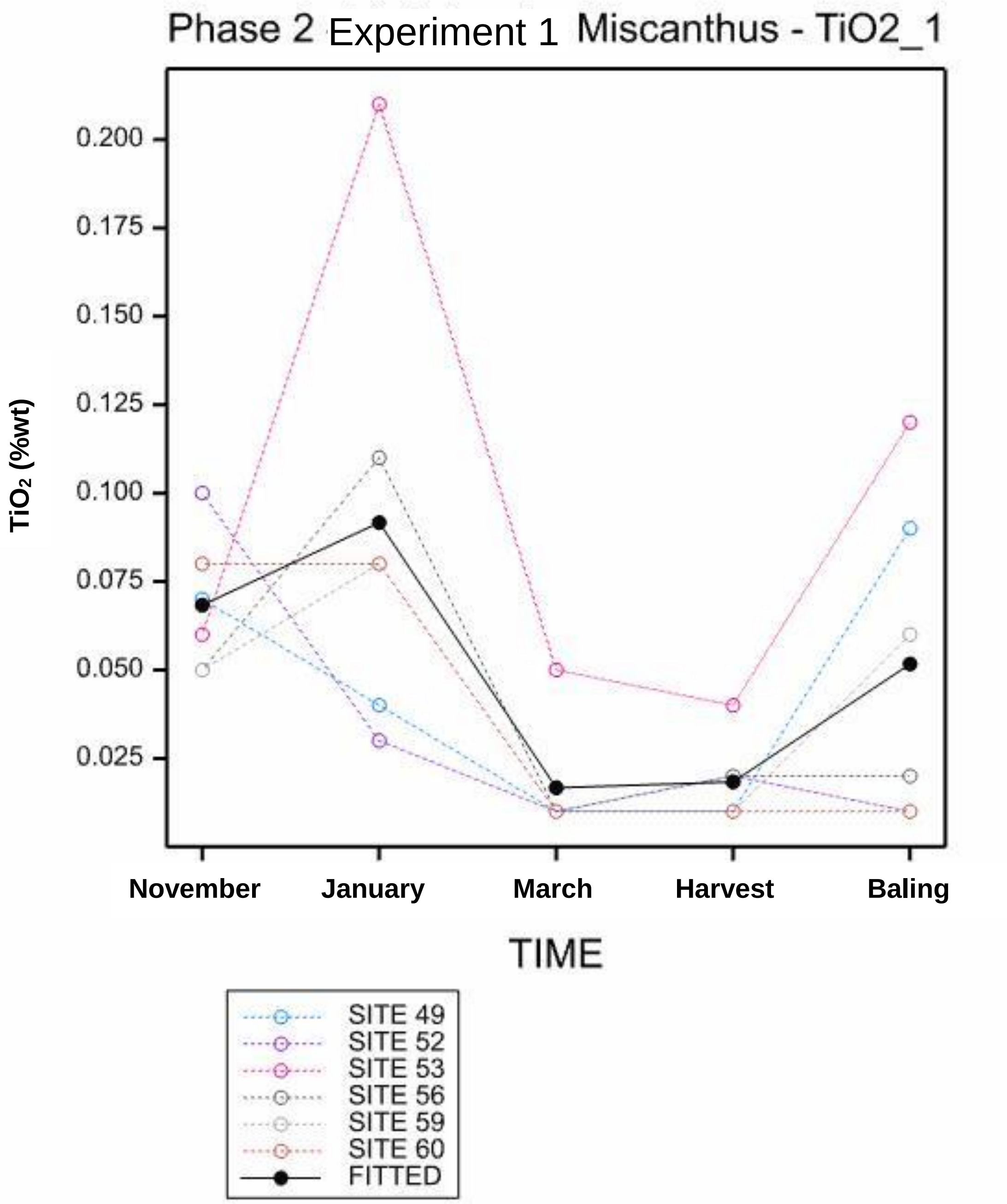


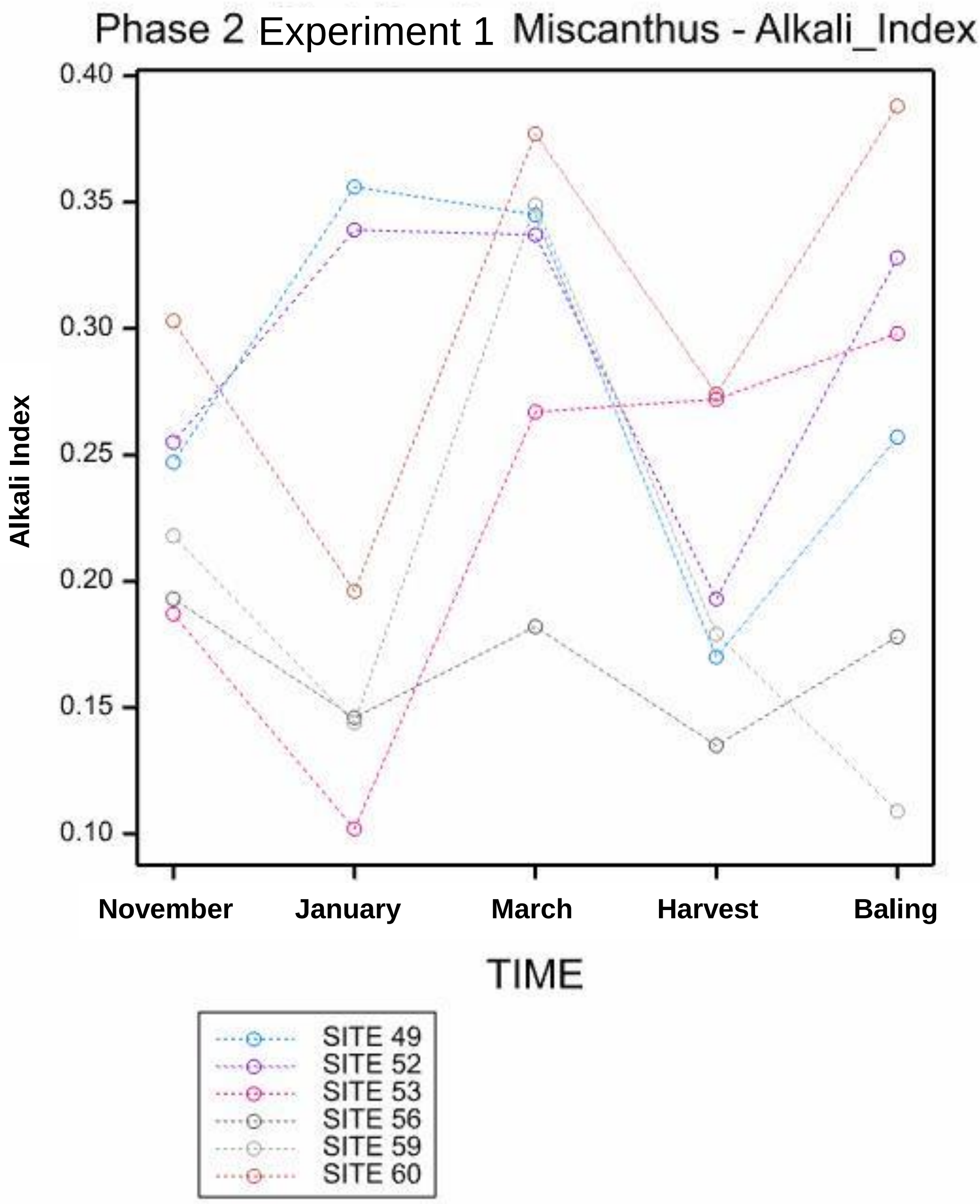
Phase 2 Experiment 1 Miscanthus - Na2O_1
Na2O (%wt)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED


Phase 2 Experiment 1 Miscanthus - P2O5_1
P_2O_5 (%wt)
12
11
10
9
8
7
6
5
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

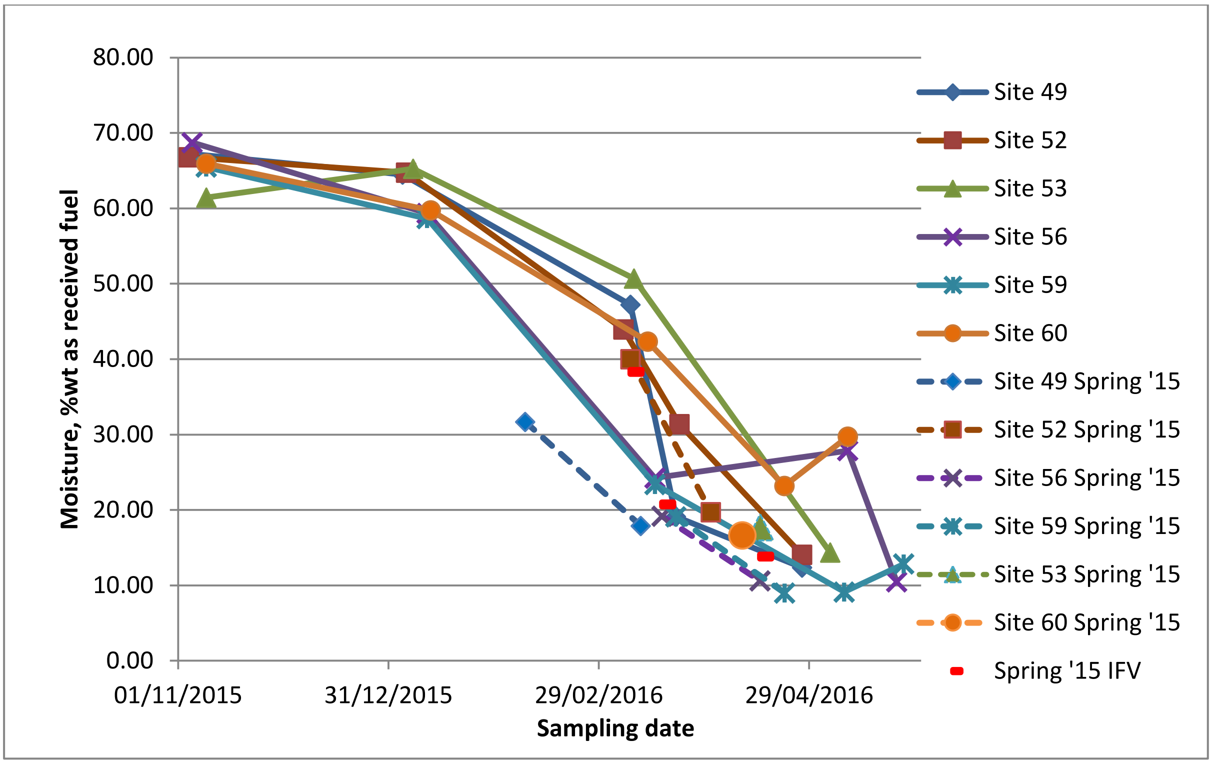


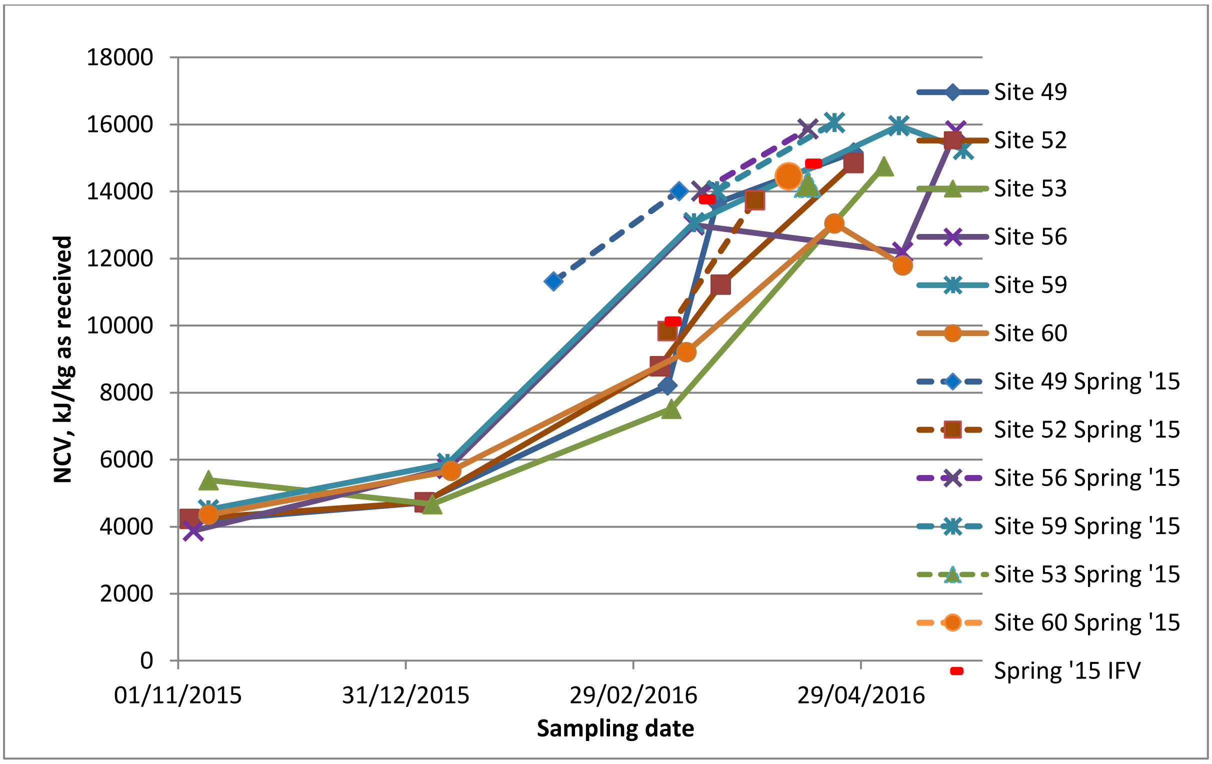
Phase 2 Experiment 1 Miscanthus - SiO2_1
60
55
50
45
40
SiO₂ (%wt)
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

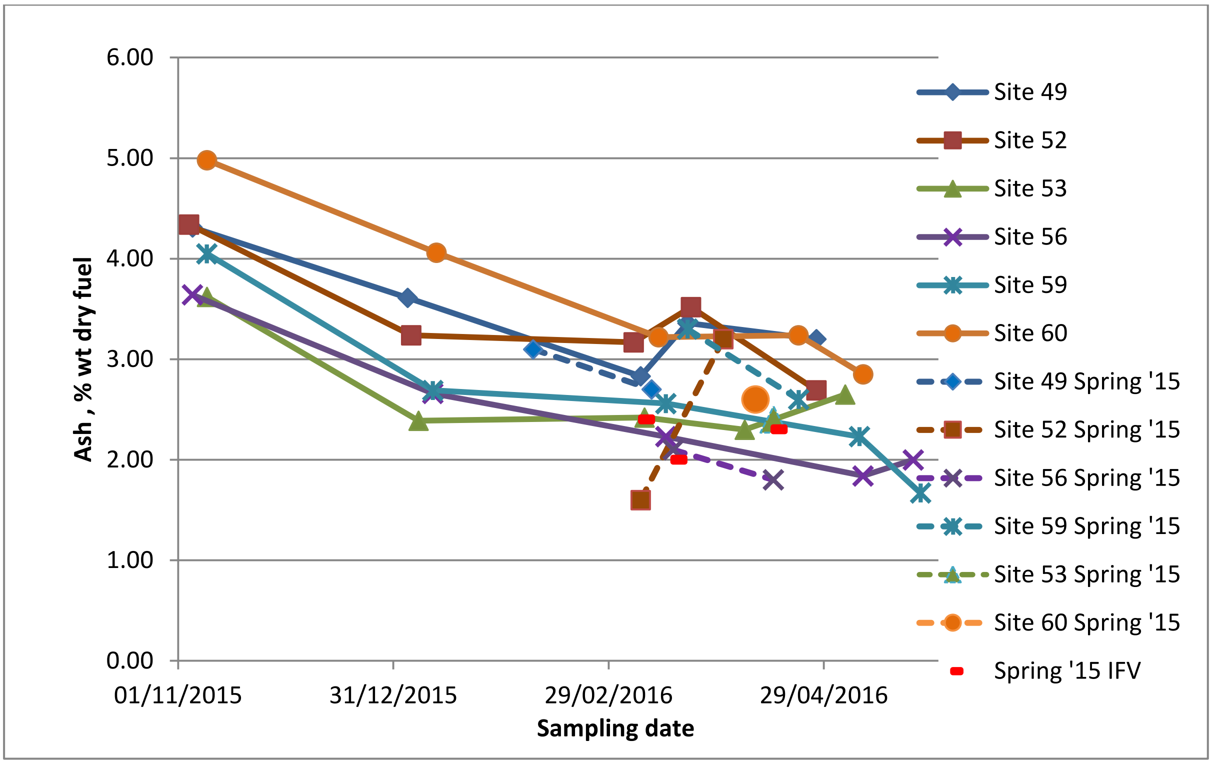

Phase 2 Experiment 1 Miscanthus - TiO2_1
TiO2 (%wt)
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60
FITTED

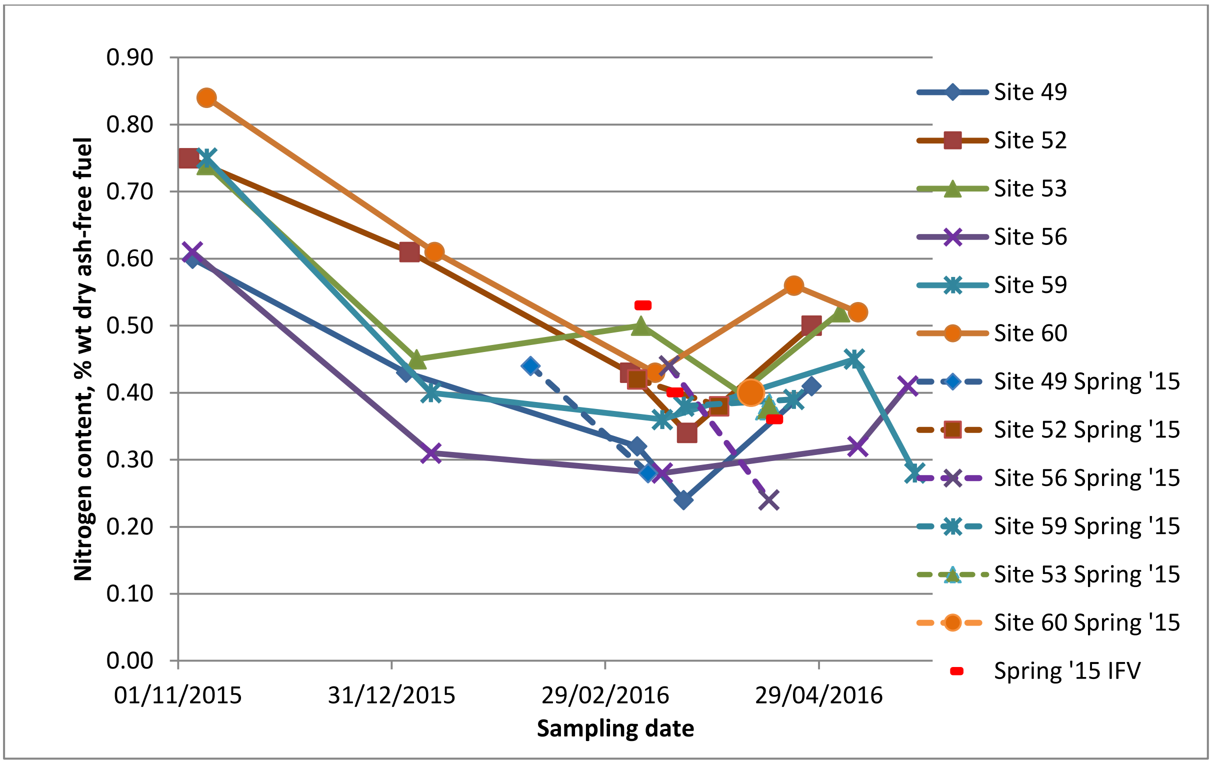

Phase 2 Experiment 1 Miscanthus - Alkali_Index
Alkali Index
0.40
0.35
0.30
0.25
0.20
0.15
0.10
November
January
March
Harvest
Baling
TIME
SITE 49
SITE 52
SITE 53
SITE 56
SITE 59
SITE 60

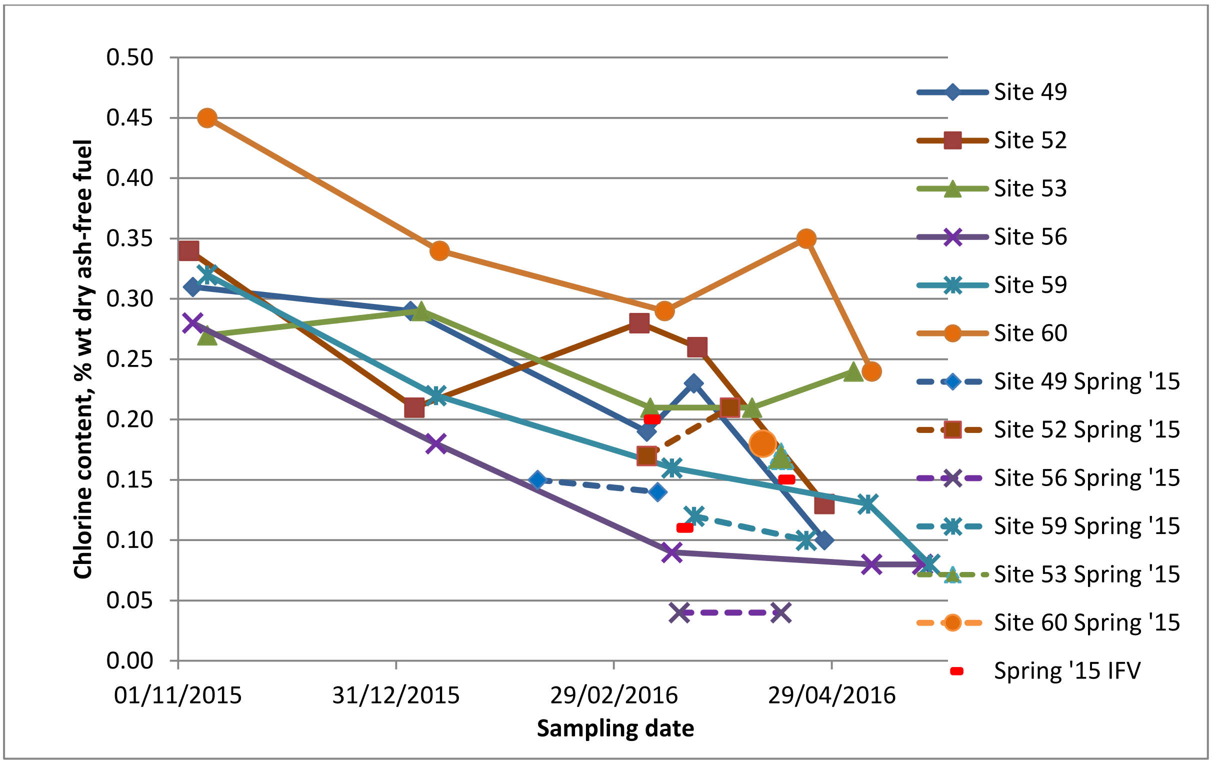
3. Graphs of comparable *Miscanthus* feedstock characteristics in Spring 2015 and 2016. Note that data points from 2015 are overlaid on the equivalent day of 2016.

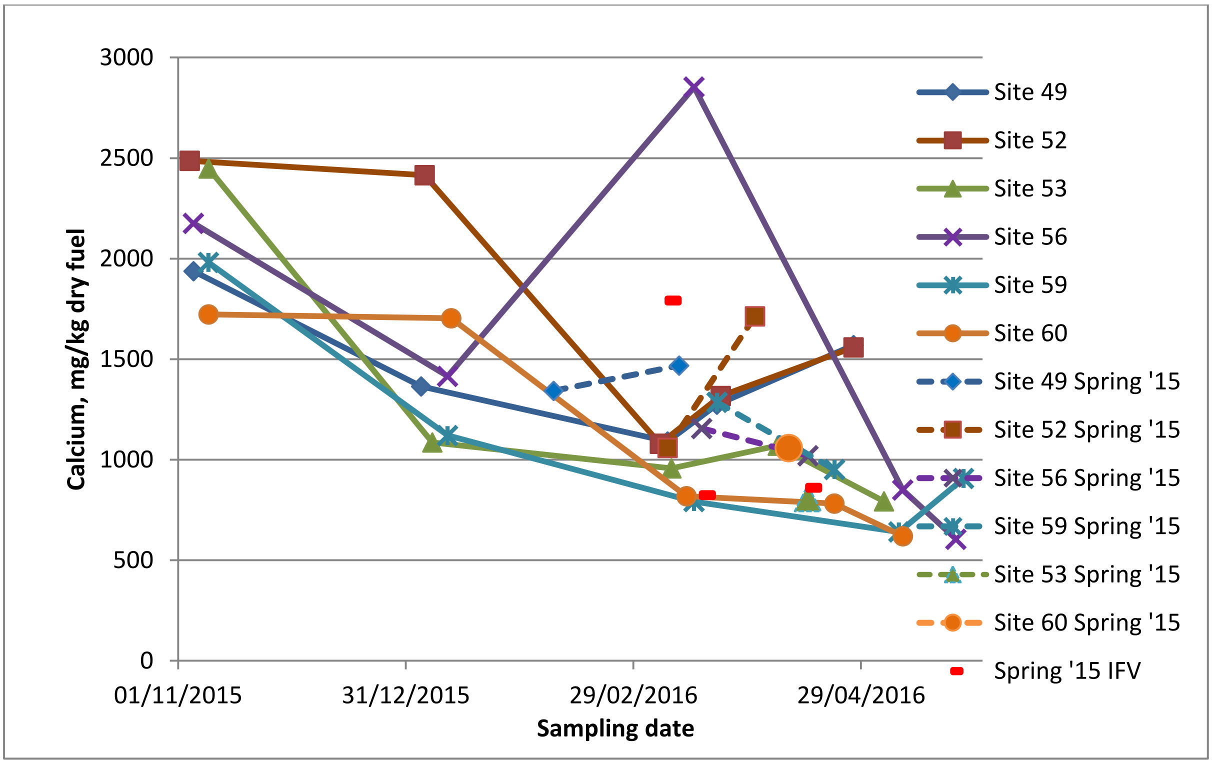


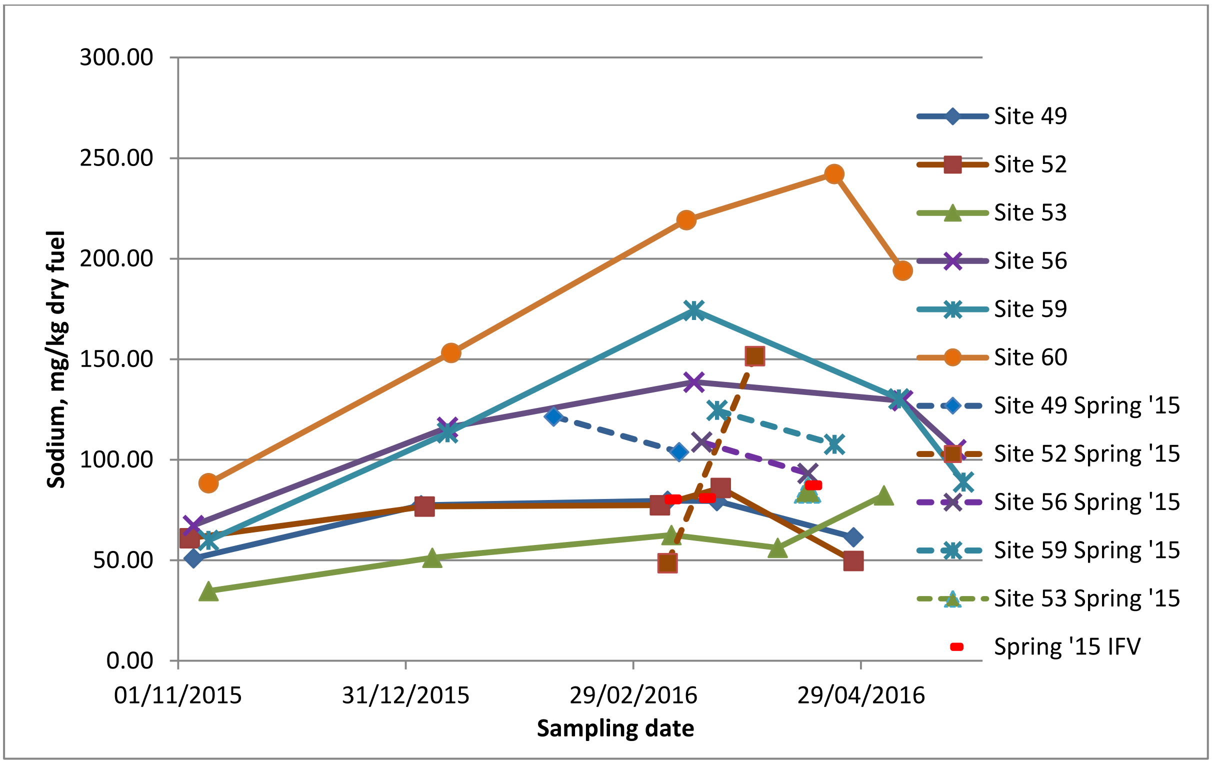



6.00
5.00
4.00
3.00
2.00
1.00
0.00
Ash , % wt dry fuel
01/11/2015
31/12/2015
29/02/2016
29/04/2016
Sampling date
Site 49
Site 52
Site 53
Site 56
Site 59
Site 60
Site 49 Spring '15
Site 52 Spring '15
Site 56 Spring '15
Site 59 Spring '15
Site 53 Spring '15
Site 60 Spring '15
Spring '15 IFV


0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Nitrogen content, % wt dry ash-free fuel
01/11/2015
31/12/2015
29/02/2016
29/04/2016
Sampling date
Site 49
Site 52
Site 53
Site 56
Site 59
Site 60
Site 49 Spring '15
Site 52 Spring '15
Site 56 Spring '15
Site 59 Spring '15
Site 53 Spring '15
Site 60 Spring '15
Spring '15 IFV


0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Chlorine content, % wt dry ash-free fuel
01/11/2015
31/12/2015
29/02/2016
29/04/2016
Sampling date
Site 49
Site 52
Site 53
Site 56
Site 59
Site 60
Site 49 Spring '15
Site 52 Spring '15
Site 56 Spring '15
Site 59 Spring '15
Site 53 Spring '15
Site 60 Spring '15
Spring '15 IFV

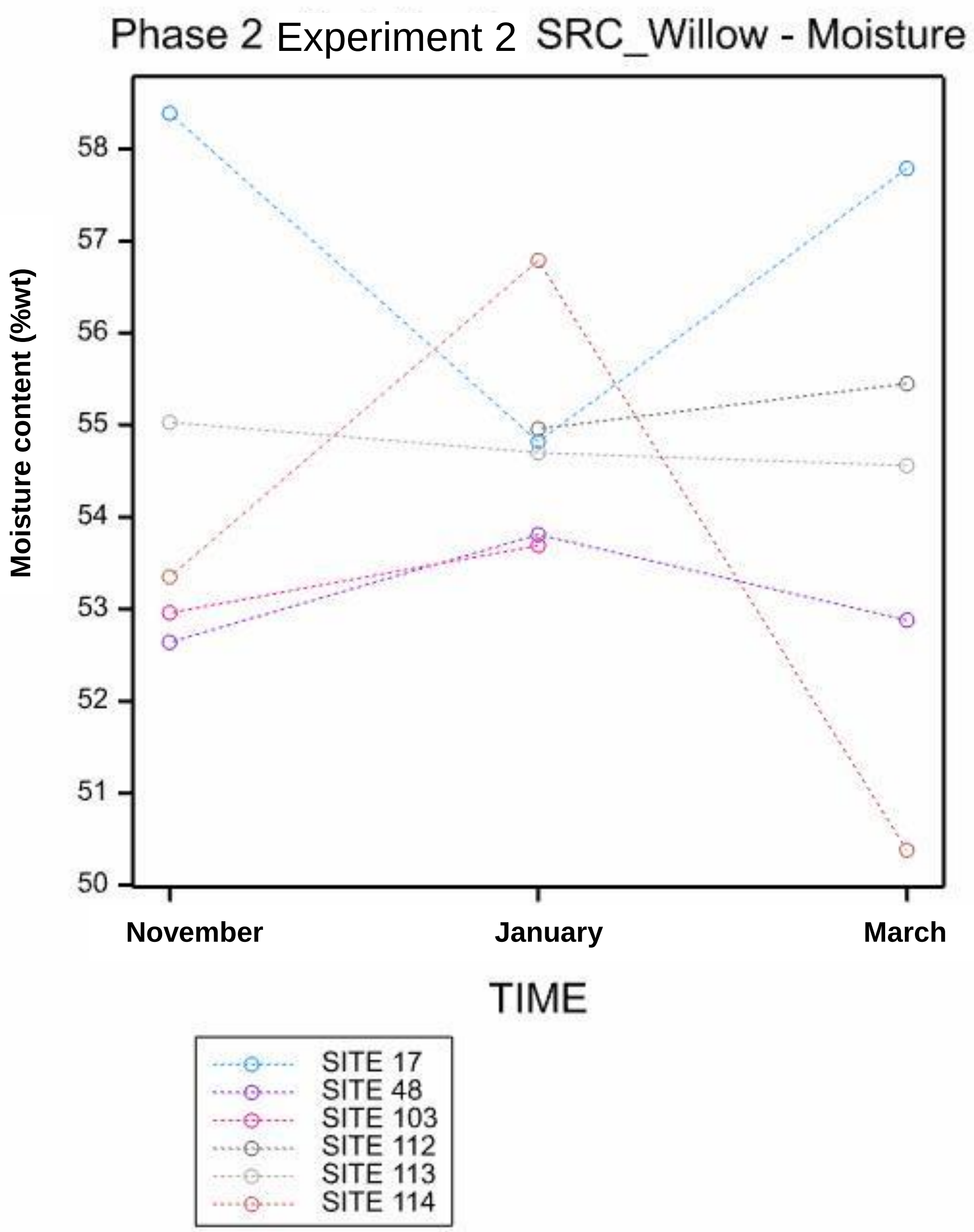

3000
2500
2000
1500
1000
500
0
Calcium, mg/kg dry fuel
01/11/2015
31/12/2015
29/02/2016
29/04/2016
Sampling date
Site 49
Site 52
Site 53
Site 56
Site 59
Site 60
Site 49 Spring '15
Site 52 Spring '15
Site 56 Spring '15
Site 59 Spring '15
Site 53 Spring '15
Site 60 Spring '15
Spring '15 IFV


300.00
250.00
200.00
150.00
100.00
50.00
0.00
Sodium, mg/kg dry fuel
01/11/2015
31/12/2015
29/02/2016
29/04/2016
Sampling date
Site 49
Site 52
Site 53
Site 56
Site 59
Site 60
Site 49 Spring '15
Site 52 Spring '15
Site 56 Spring '15
Site 59 Spring '15
Site 53 Spring '15
Spring '15 IFV

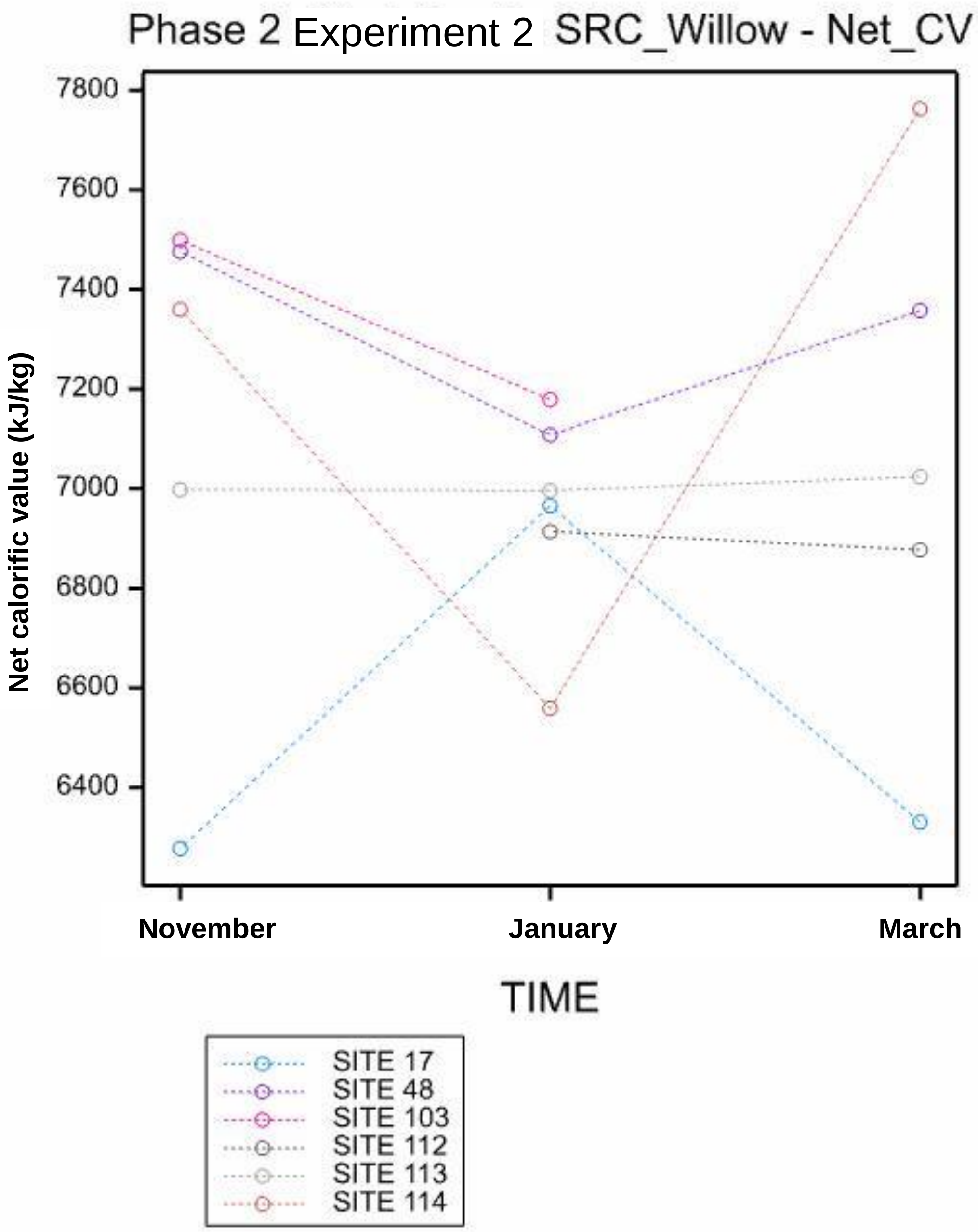
4. Graphs of all willow SRC feedstock characteristics at the three sampling times

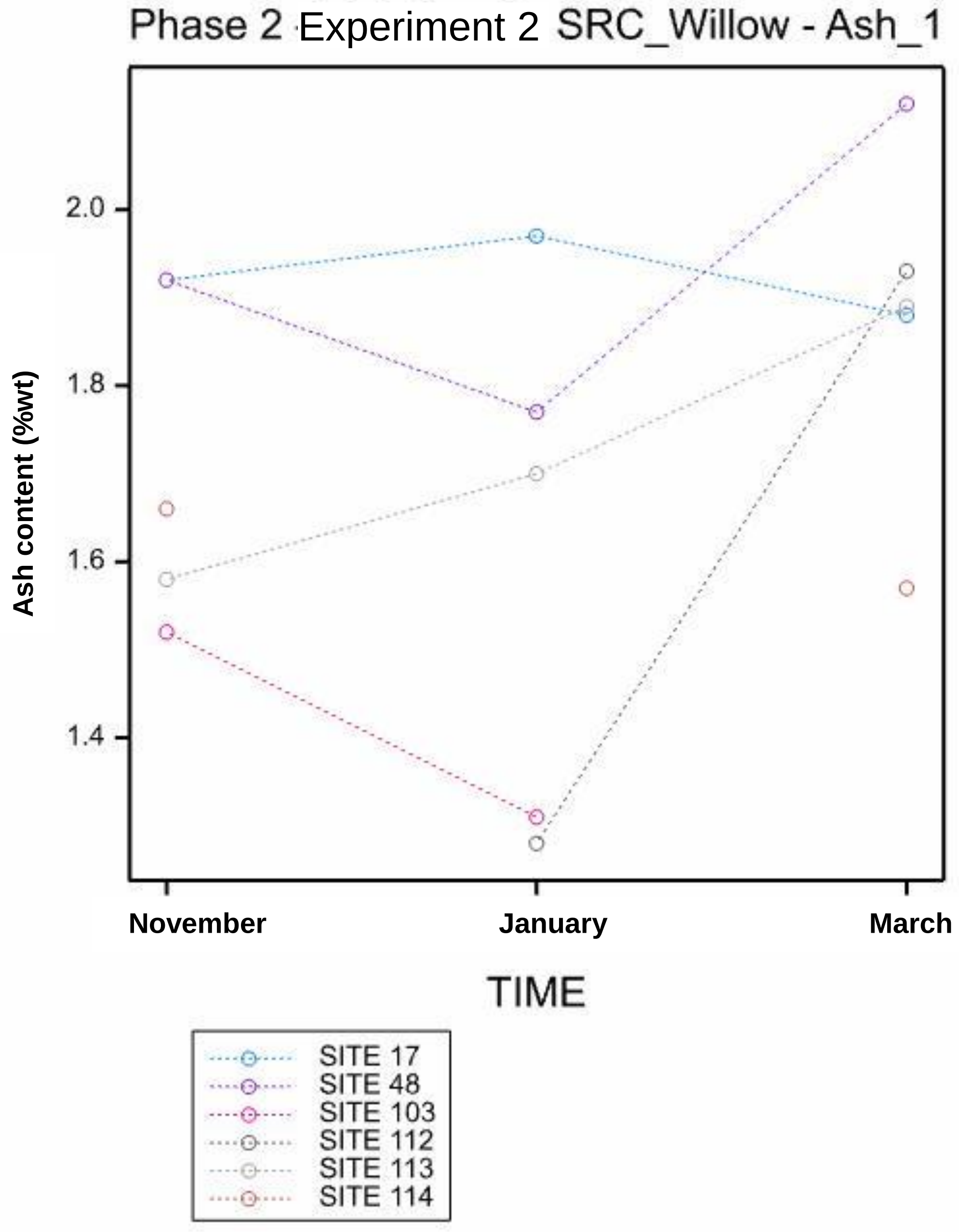
Table 2 List of variables and bases for analysis

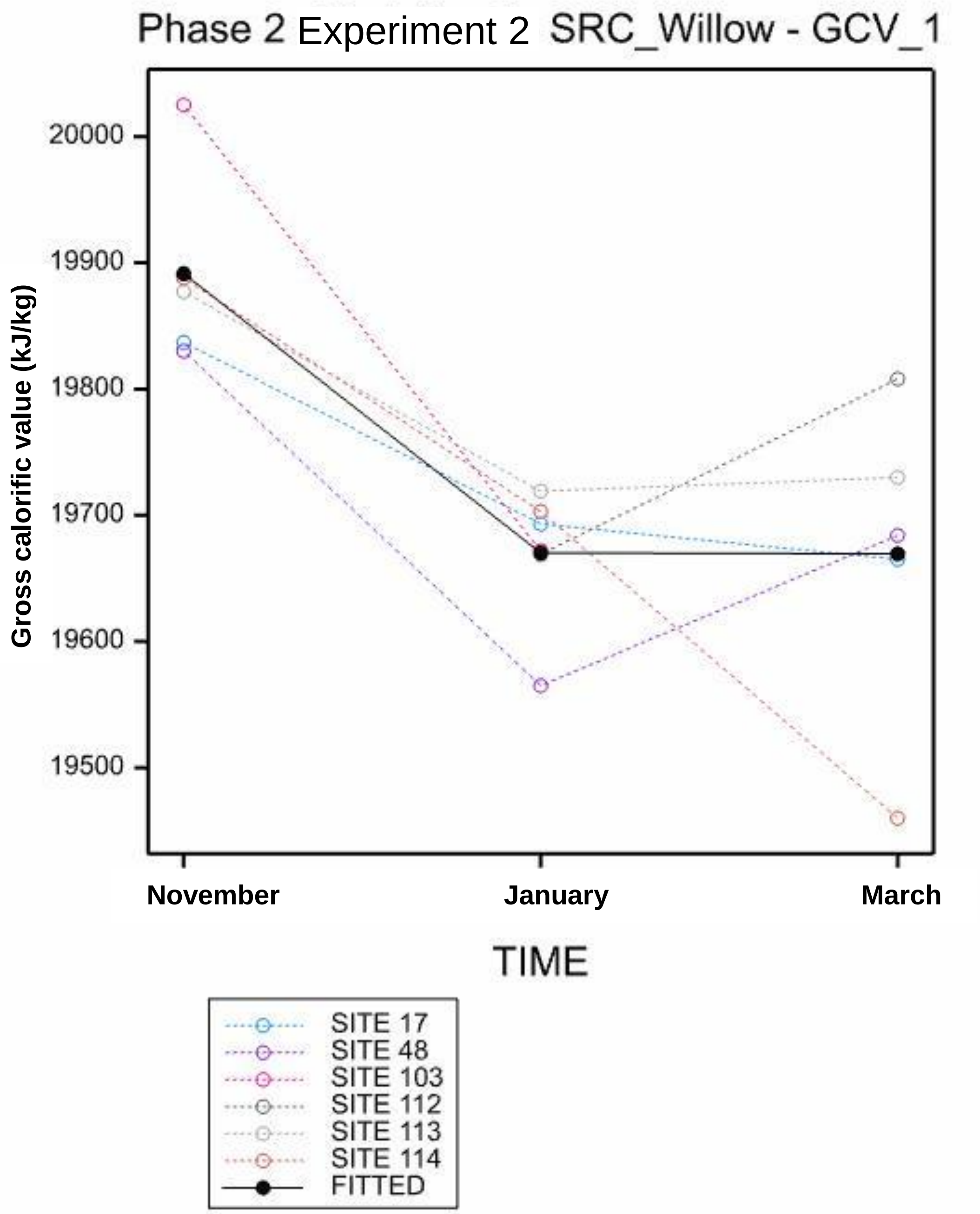
Variable	Basis of analysis
Moisture	As received
Net calorific value	As received
Ash content	Dry fuel
Volatile matter	Dry, ash free
Gross calorific value: GCV_1	Dry fuel
Gross calorific value: GCV_2	Dry, ash free
Carbon: C	Dry fuel
Carbon: C_1	Dry, ash free
Hydrogen: H_1	Dry fuel
Hydrogen: H_2	Dry, ash free
Nitrogen: N	Dry fuel
Nitrogen: N_1	Dry, ash free
Sulphur_1	Dry fuel
Sulphur_2	Dry, ash free
Chlorine_1	Dry fuel
Chlorine_2	Dry, ash free
Barium	Dry fuel
Beryllium	Dry fuel
Chromium	Dry fuel
Cobalt	Dry fuel
Copper	Dry fuel
Molybdenum	Dry fuel
Nickel	Dry fuel
Vanadium	Dry fuel
Zinc	Dry fuel
Antimony	Dry fuel
Arsenic	Dry fuel
Mercury	Dry fuel
Fluorine	Dry fuel
Bromine	Dry fuel
Selenium	Dry fuel
Cadmium	Dry fuel
Lead	Dry fuel
Aluminium	Dry fuel
Calcium	Dry fuel
Iron	Dry fuel
Potassium	Dry fuel
Magnesium	Dry fuel
Manganese	Dry fuel
Sodium	Dry fuel
Phosphorous	Dry fuel
Silicon	Dry fuel
Titanium	Dry fuel
Al_2O_3	Normalized ash
BaO	Normalized ash
$CaCO_3$	Normalized ash
Fe_2O_3	Normalized ash
K_2O	Normalized ash
MgO	Normalized ash
Mn_3O_4	Normalized ash
Na_2O	Normalized ash
P_2O_5	Normalized ash
SiO_2	Normalized ash
TiO_2	Normalized ash
Alkali index	



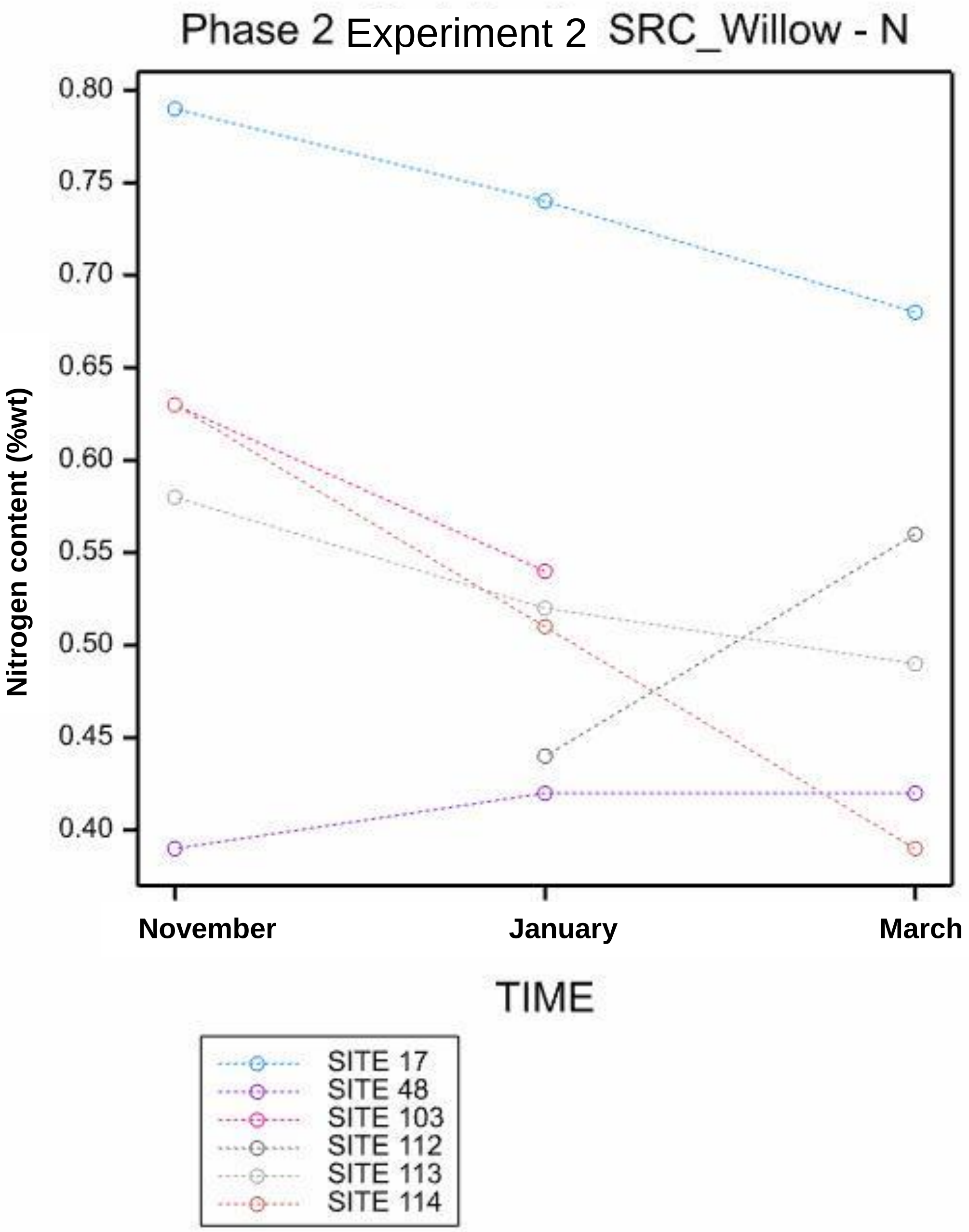
Phase 2 Experiment 2 SRC_Willow - Moisture
Moisture content (%wt)
58
57
56
55
54
53
52
51
50
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

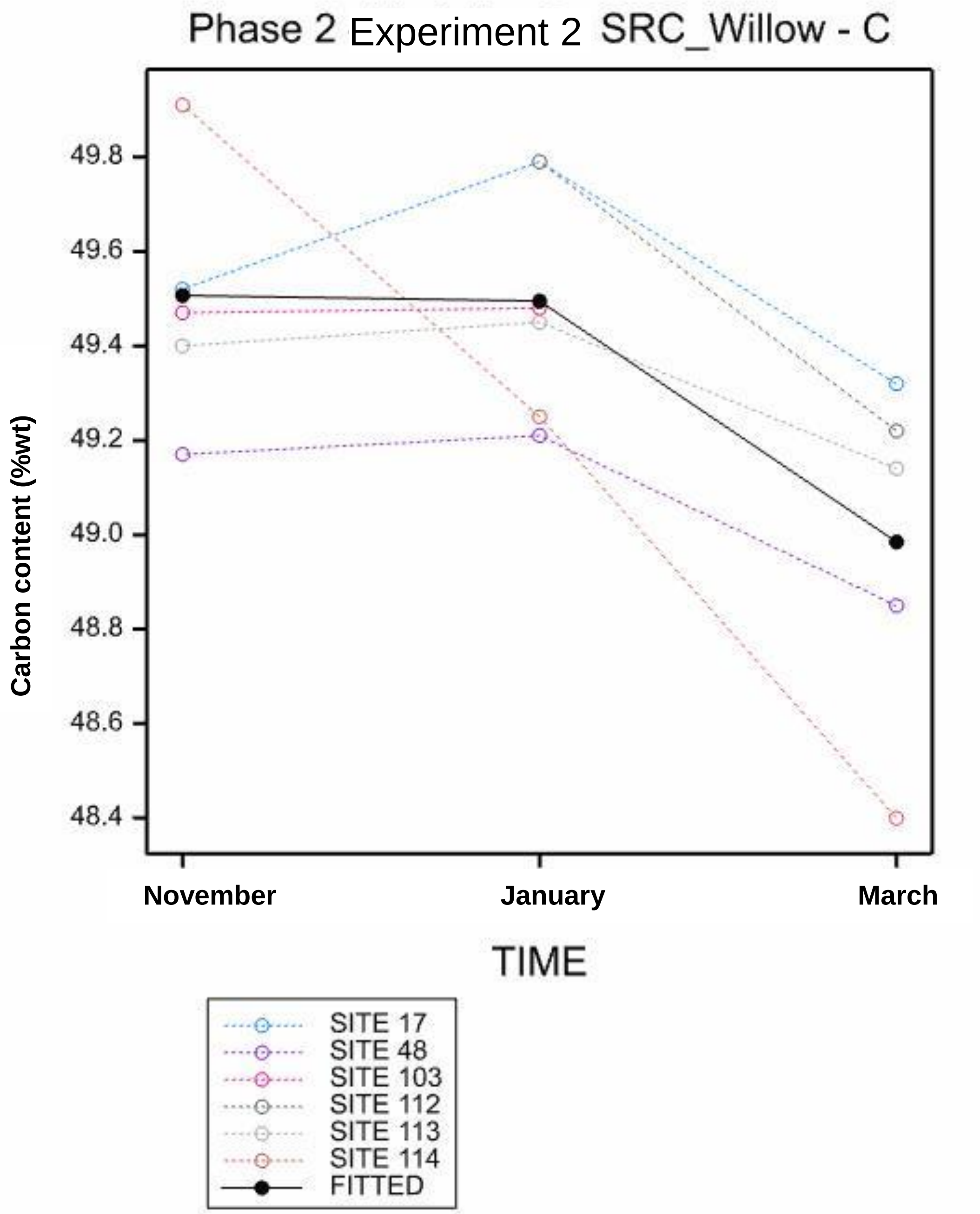

Phase 2 Experiment 2 SRC_Willow - Net_CV
Net calorific value (kJ/kg)
7800
7600
7400
7200
7000
6800
6600
6400
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

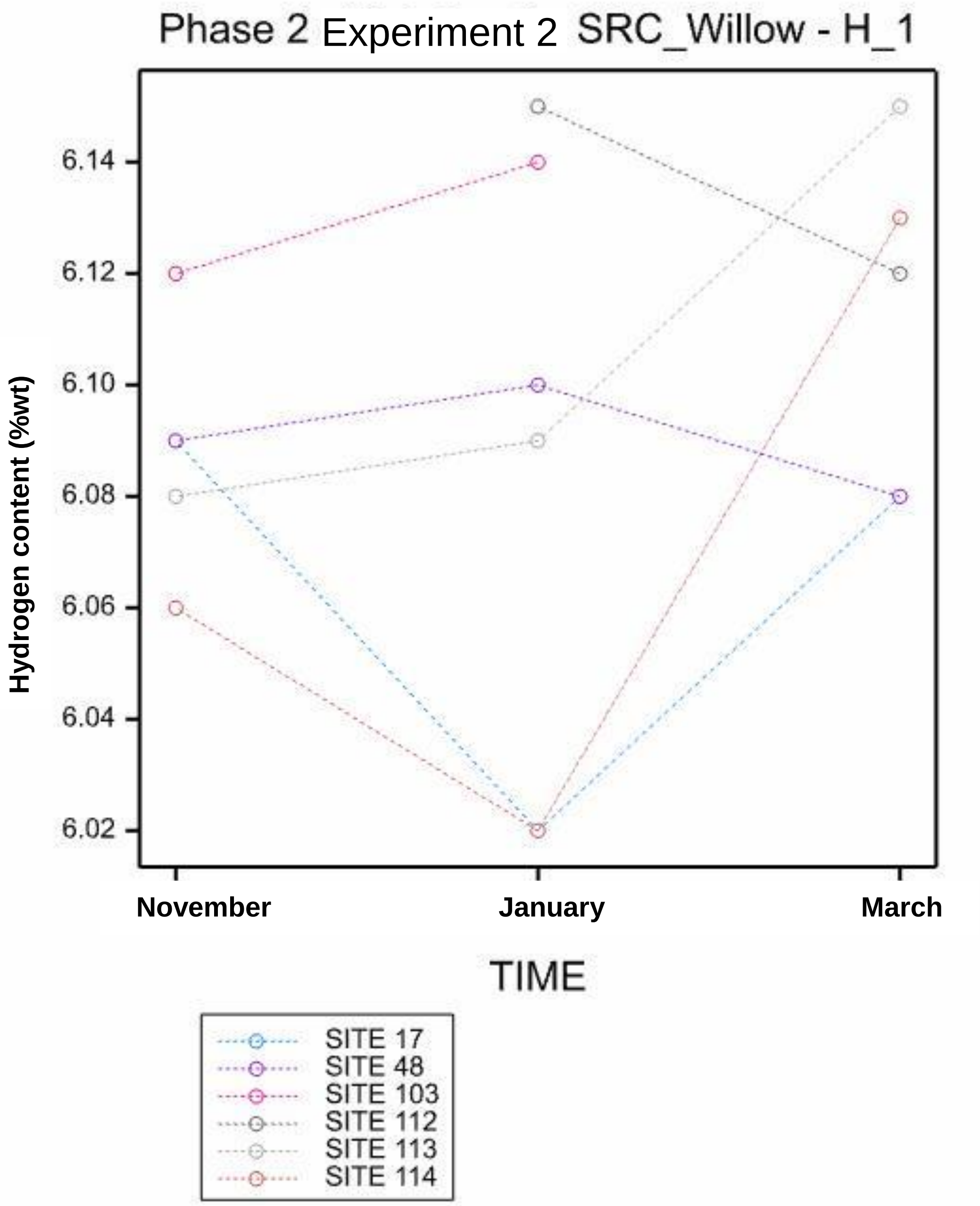

Phase 2 Experiment 2 SRC_Willow - Ash_1
Ash content (%wt)
2.0
1.8
1.6
1.4
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

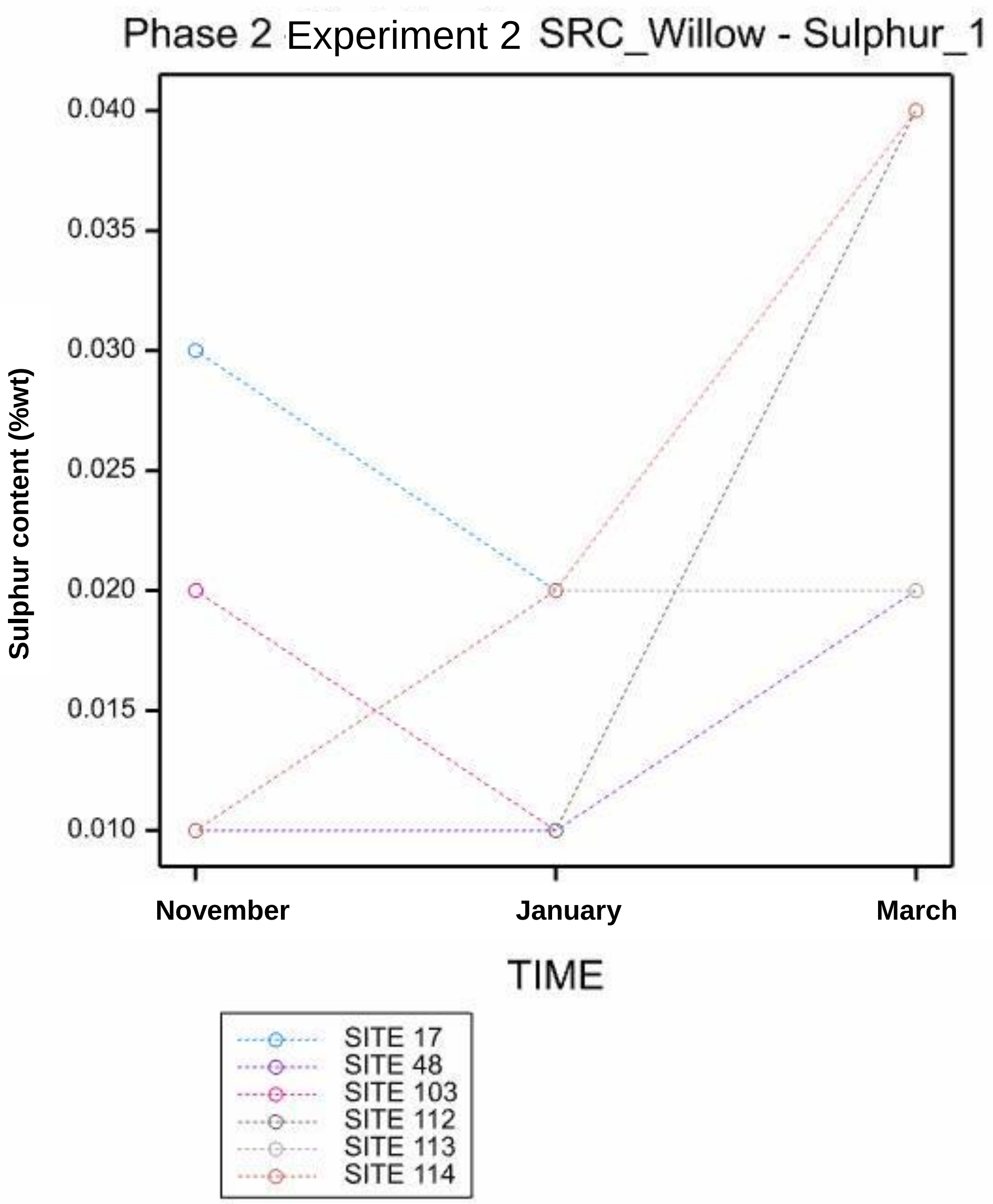


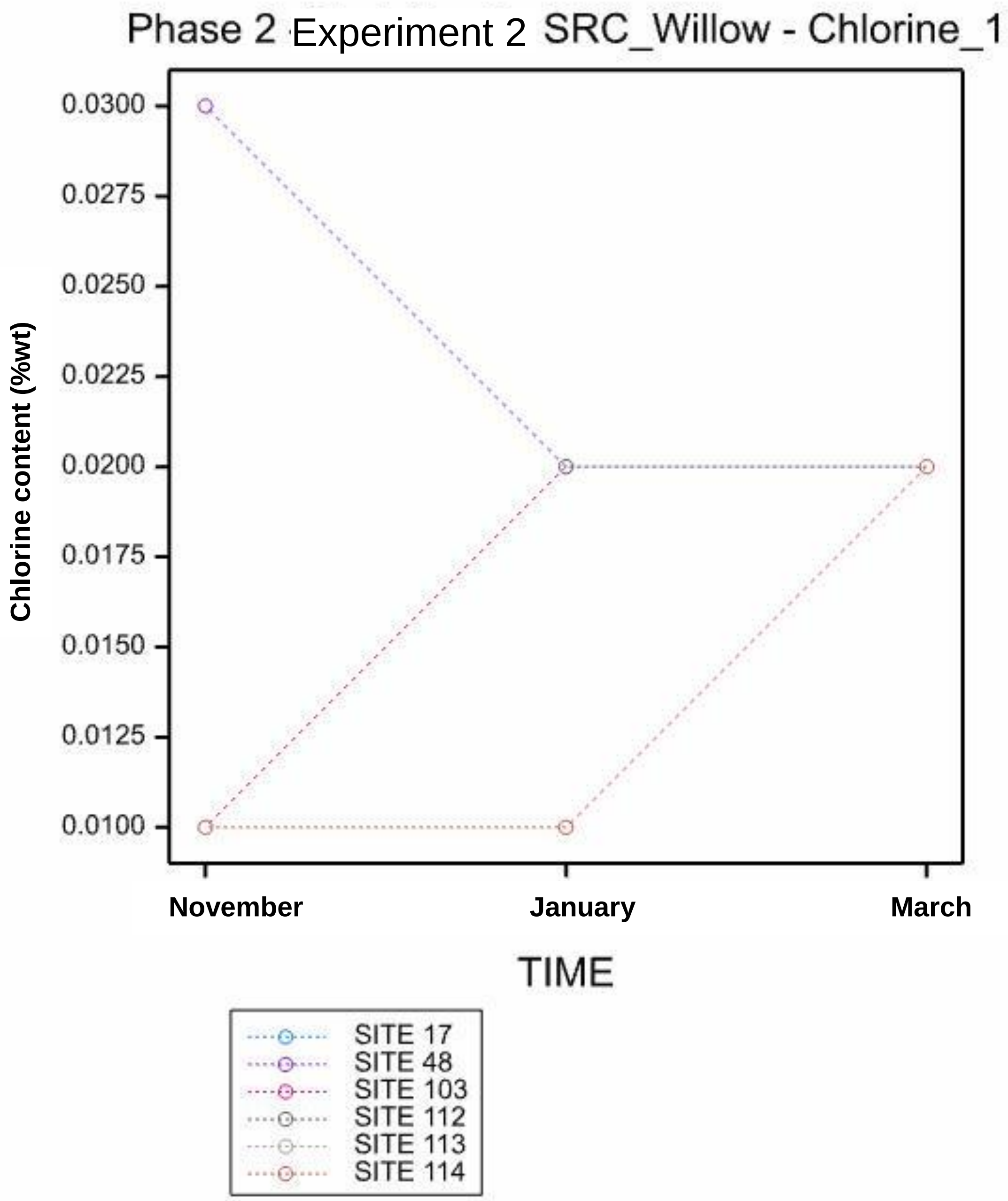
Phase 2 Experiment 2 SRC_Willow - GCV_1
Gross calorific value (kJ/kg)
20000
19900
19800
19700
19600
19500
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED


Phase 2 Experiment 2 SRC_Willow - N
Nitrogen content (%wt)
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

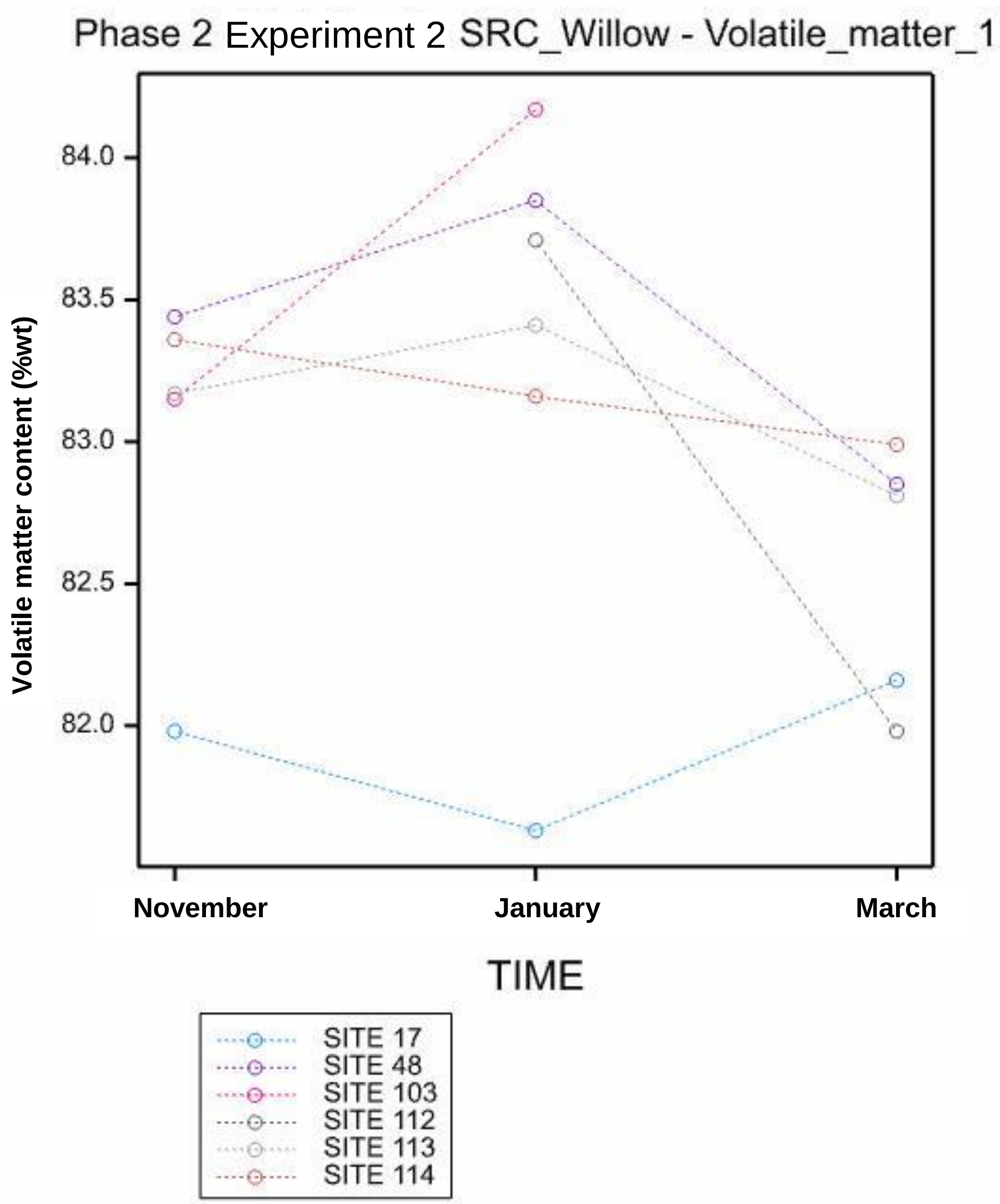

Phase 2 Experiment 2 SRC_Willow - C
Carbon content (%wt)
49.8
49.6
49.4
49.2
49.0
48.8
48.6
48.4
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED

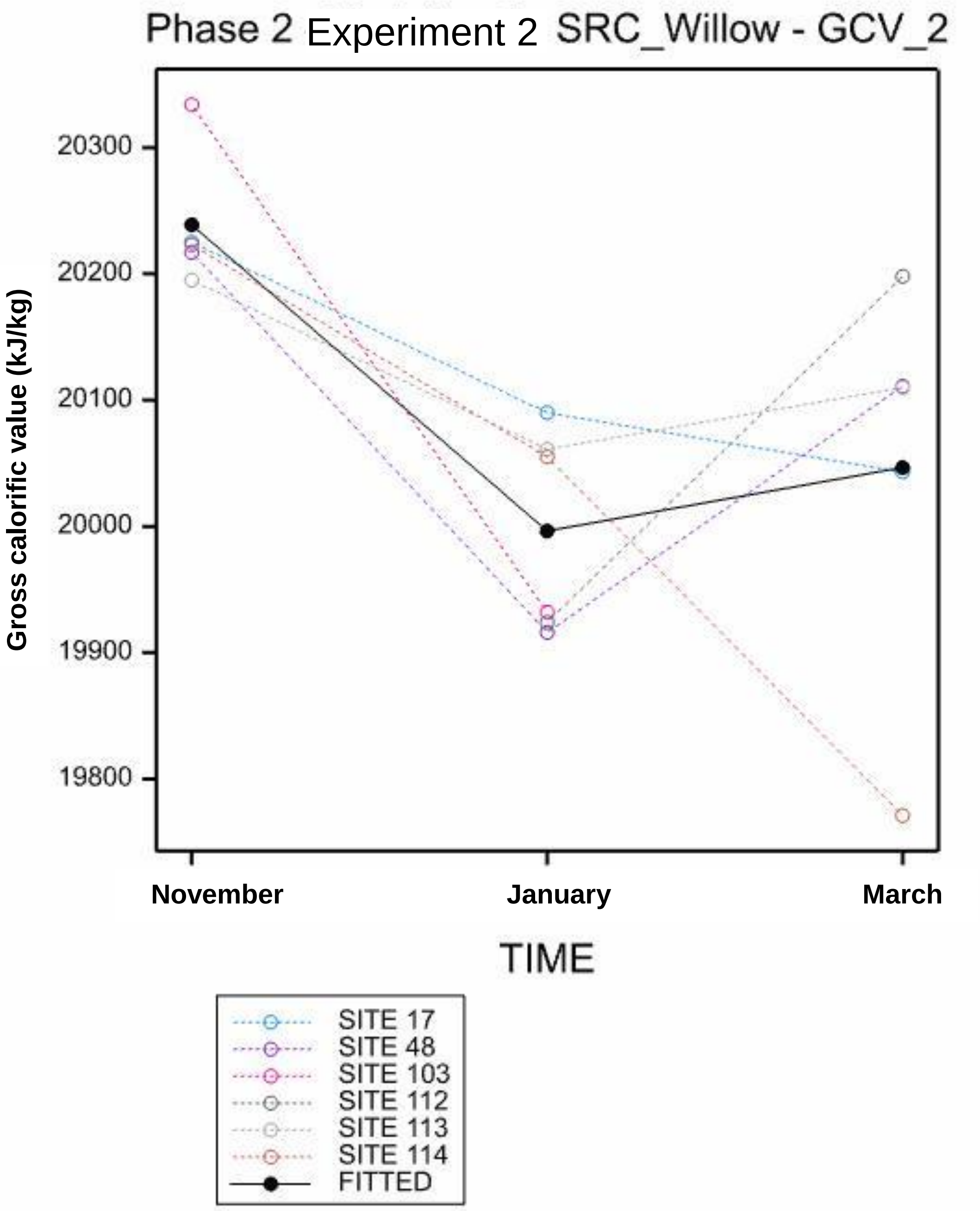

Phase 2 Experiment 2 SRC_Willow - H_1
Hydrogen content (%wt)
6.14
6.12
6.10
6.08
6.06
6.04
6.02
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114


Phase 2 Experiment 2 SRC_Willow - Sulphur_1
Sulphur content (%wt)
0.040
0.035
0.030
0.025
0.020
0.015
0.010
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

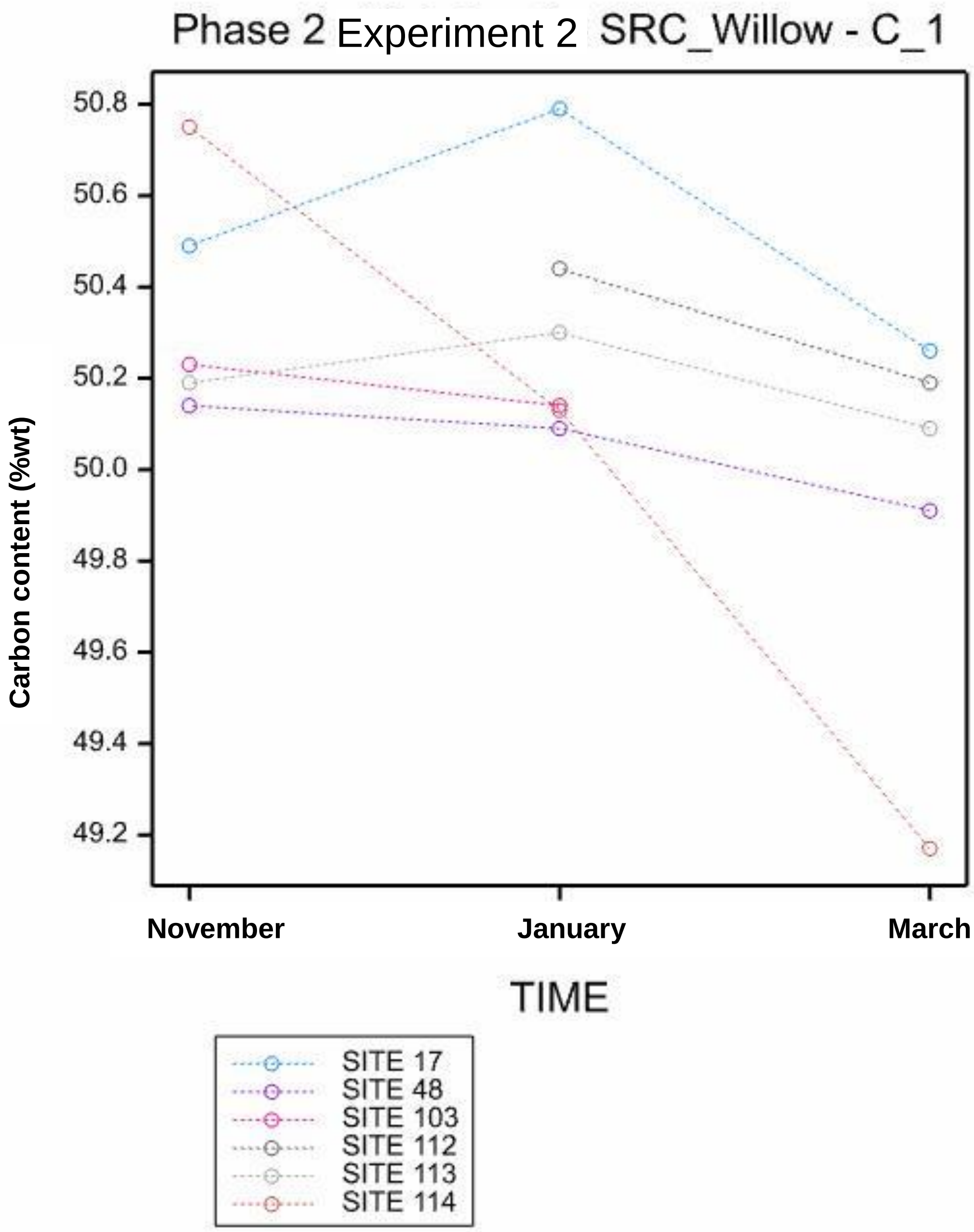


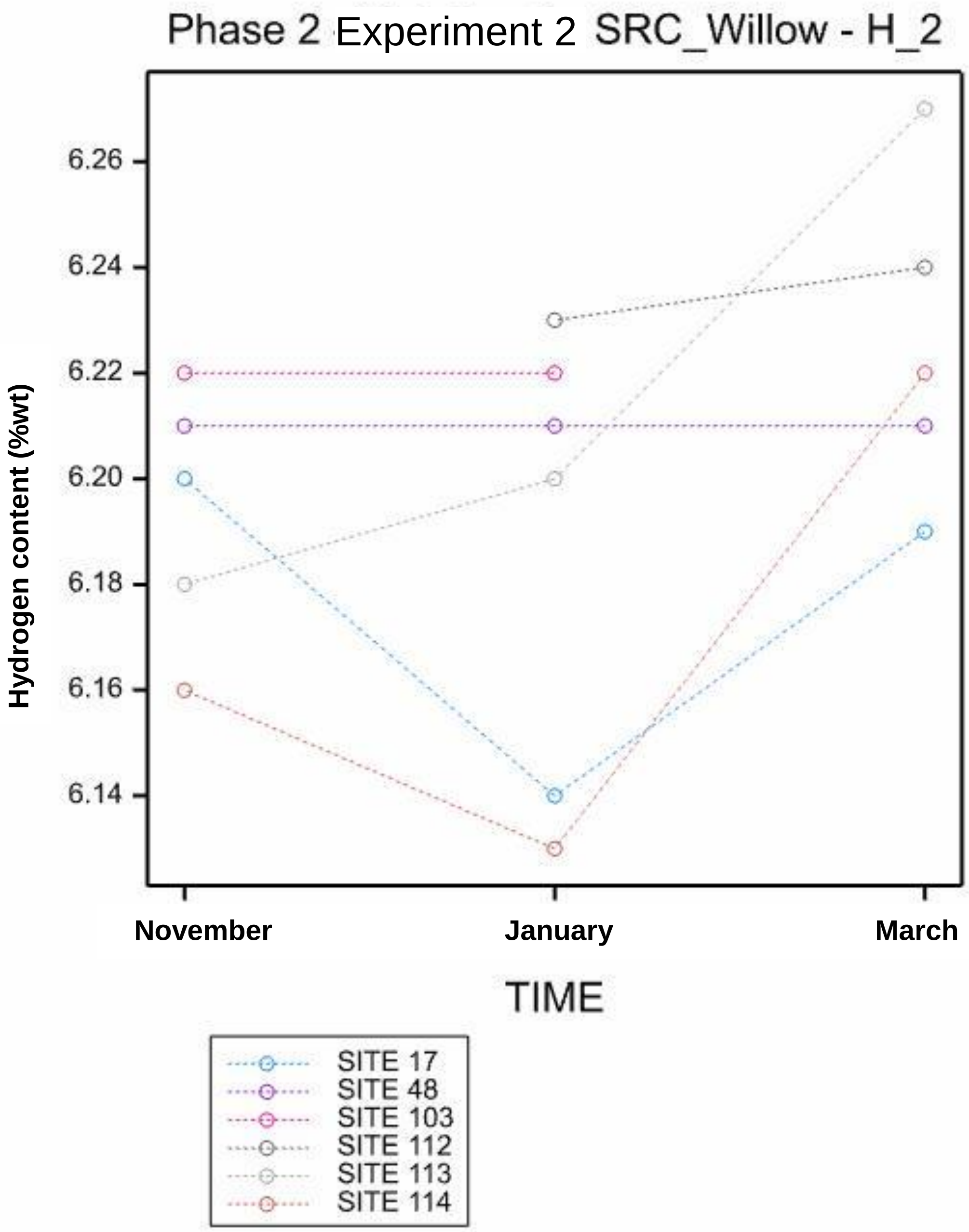
Phase 2 Experiment 2 SRC_Willow - Chlorine_1
Chlorine content (%wt)
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

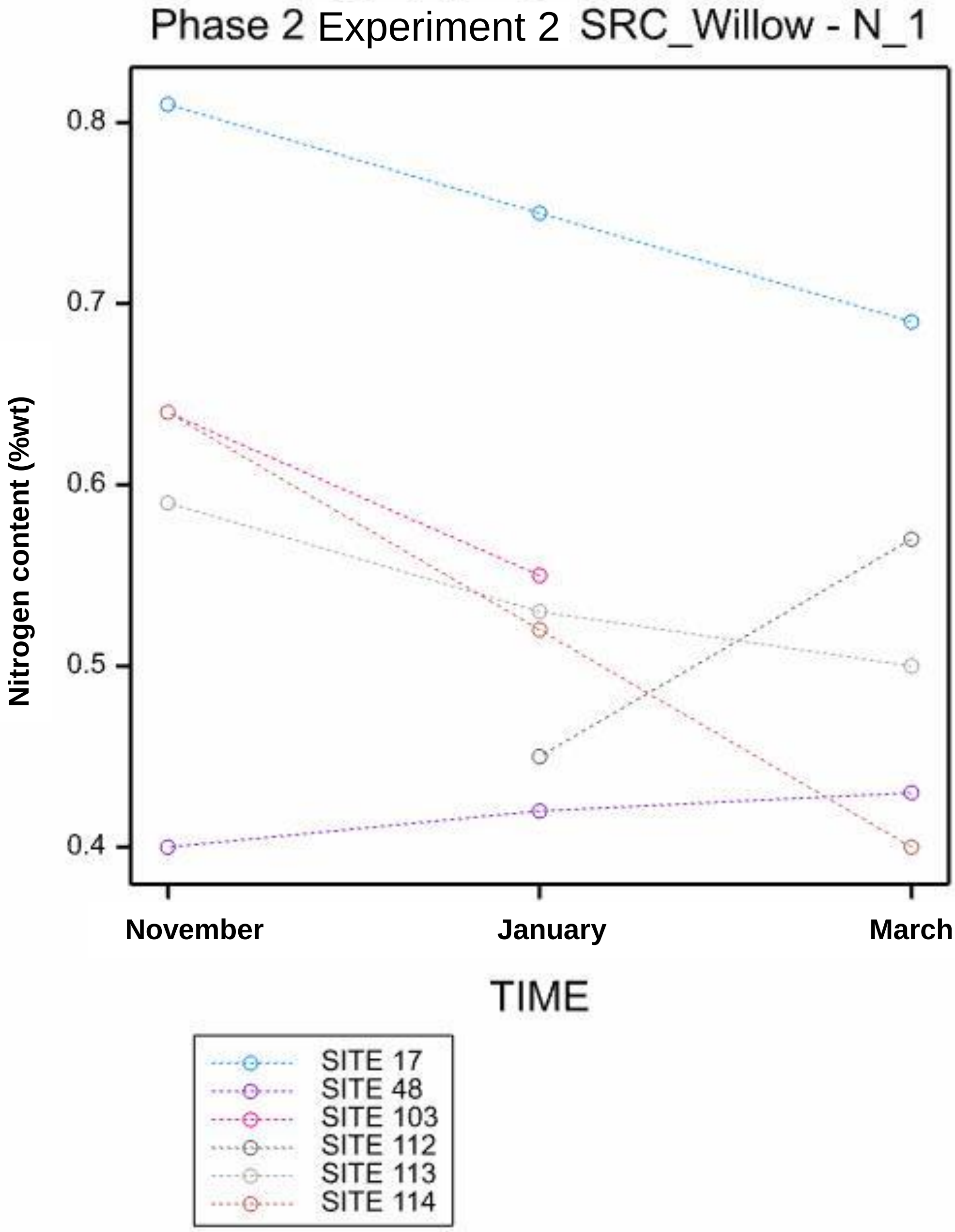

Phase 2 Experiment 2 SRC_Willow - Volatile_matter_1
84.0
83.5
83.0
82.5
82.0
Volatile matter content (%wt)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

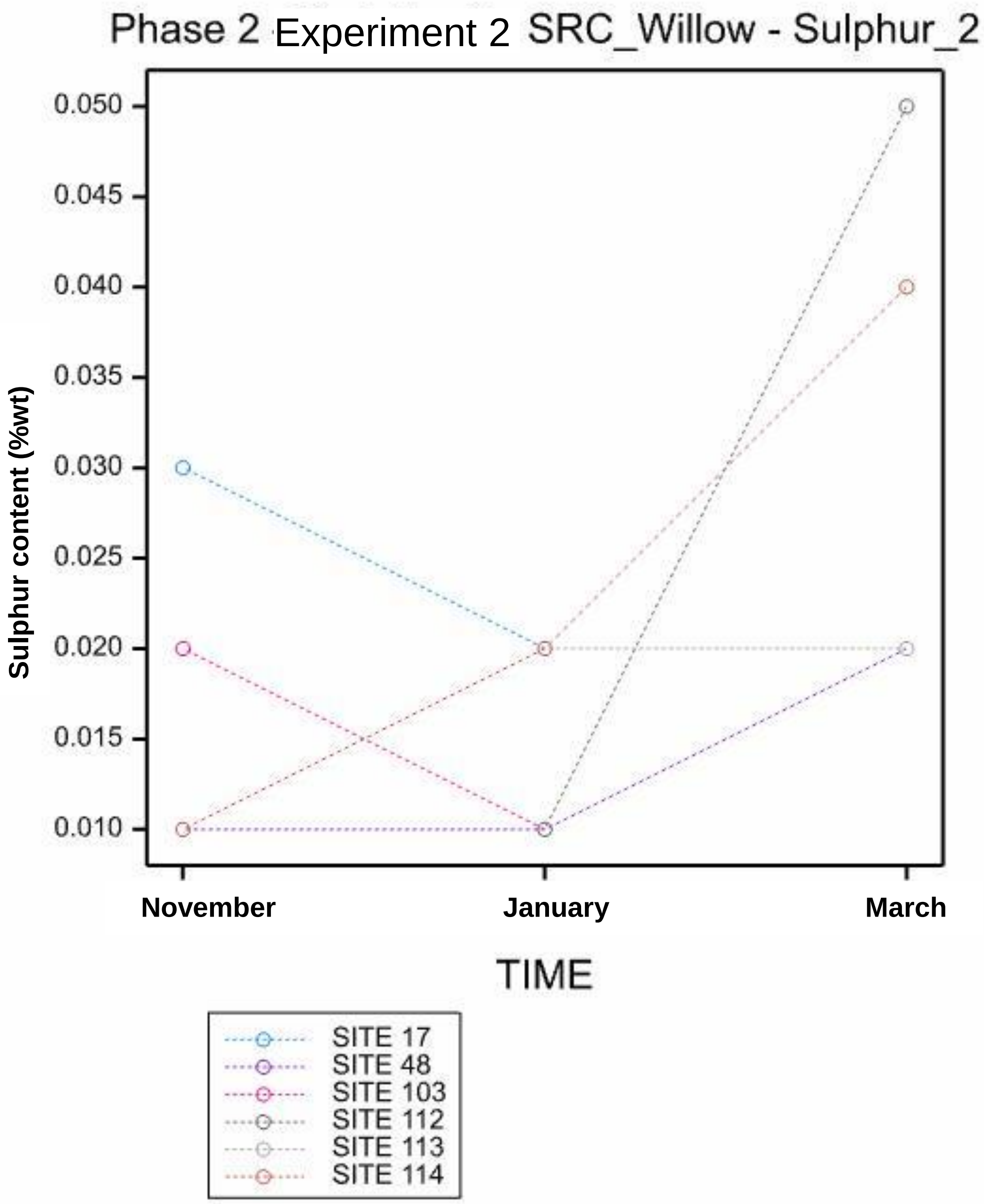


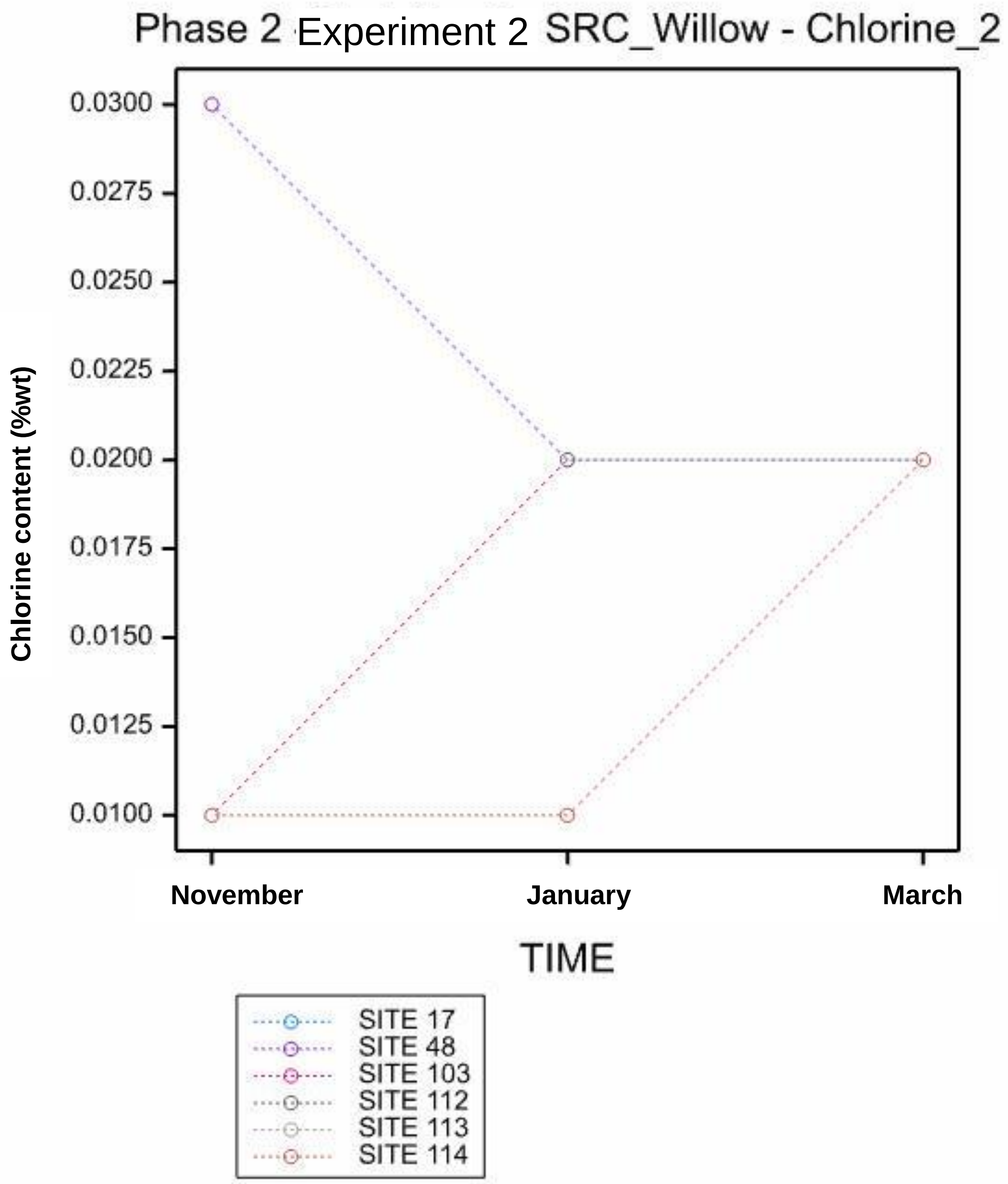
Phase 2 Experiment 2 SRC_Willow - GCV_2
Gross calorific value (kJ/kg)
20300
20200
20100
20000
19900
19800
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED


Phase 2 Experiment 2 SRC_Willow - C_1
Carbon content (%wt)
50.8
50.6
50.4
50.2
50.0
49.8
49.6
49.4
49.2
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

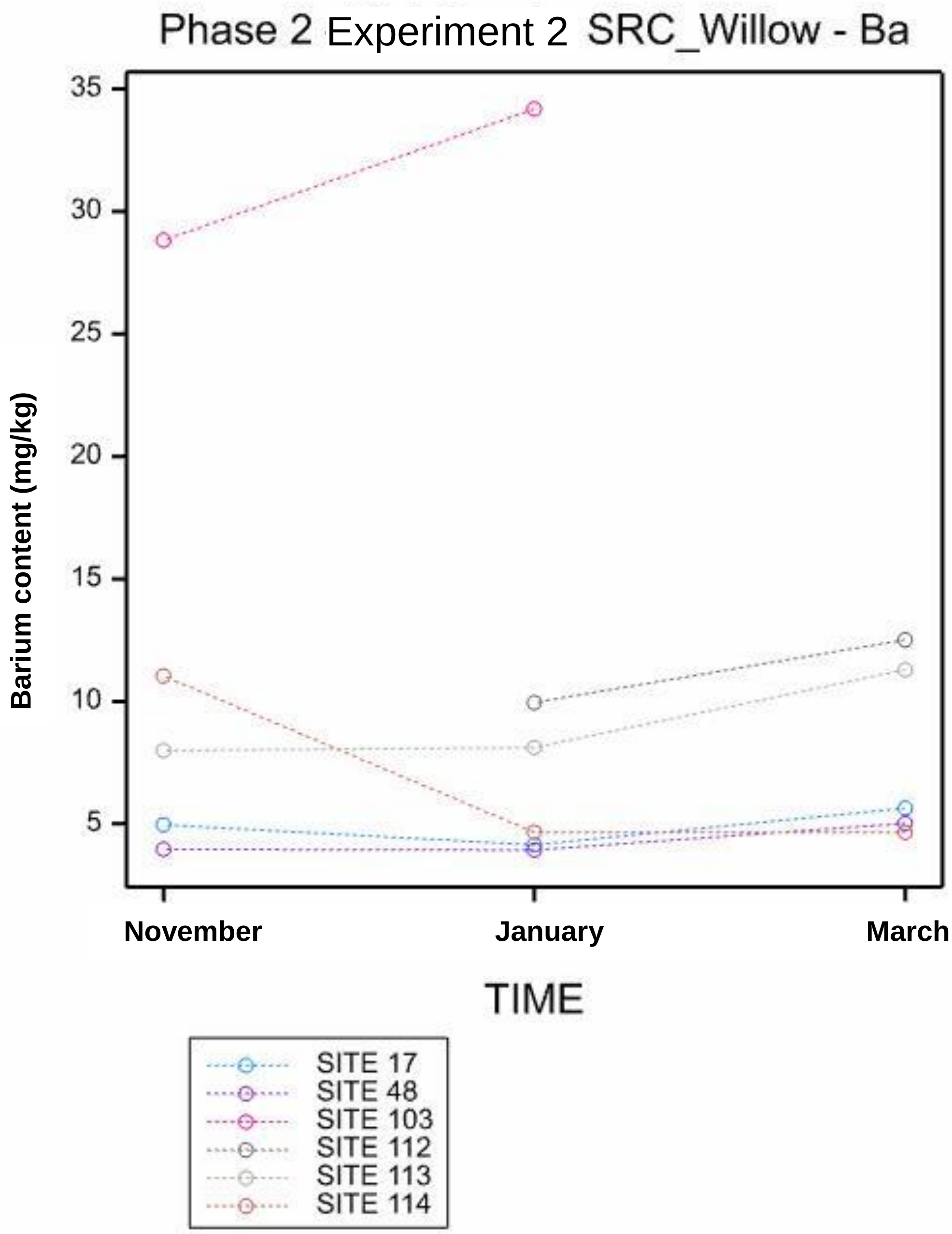

Phase 2 Experiment 2 SRC_Willow - H_2
Hydrogen content (%wt)
6.26
6.24
6.22
6.20
6.18
6.16
6.14
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

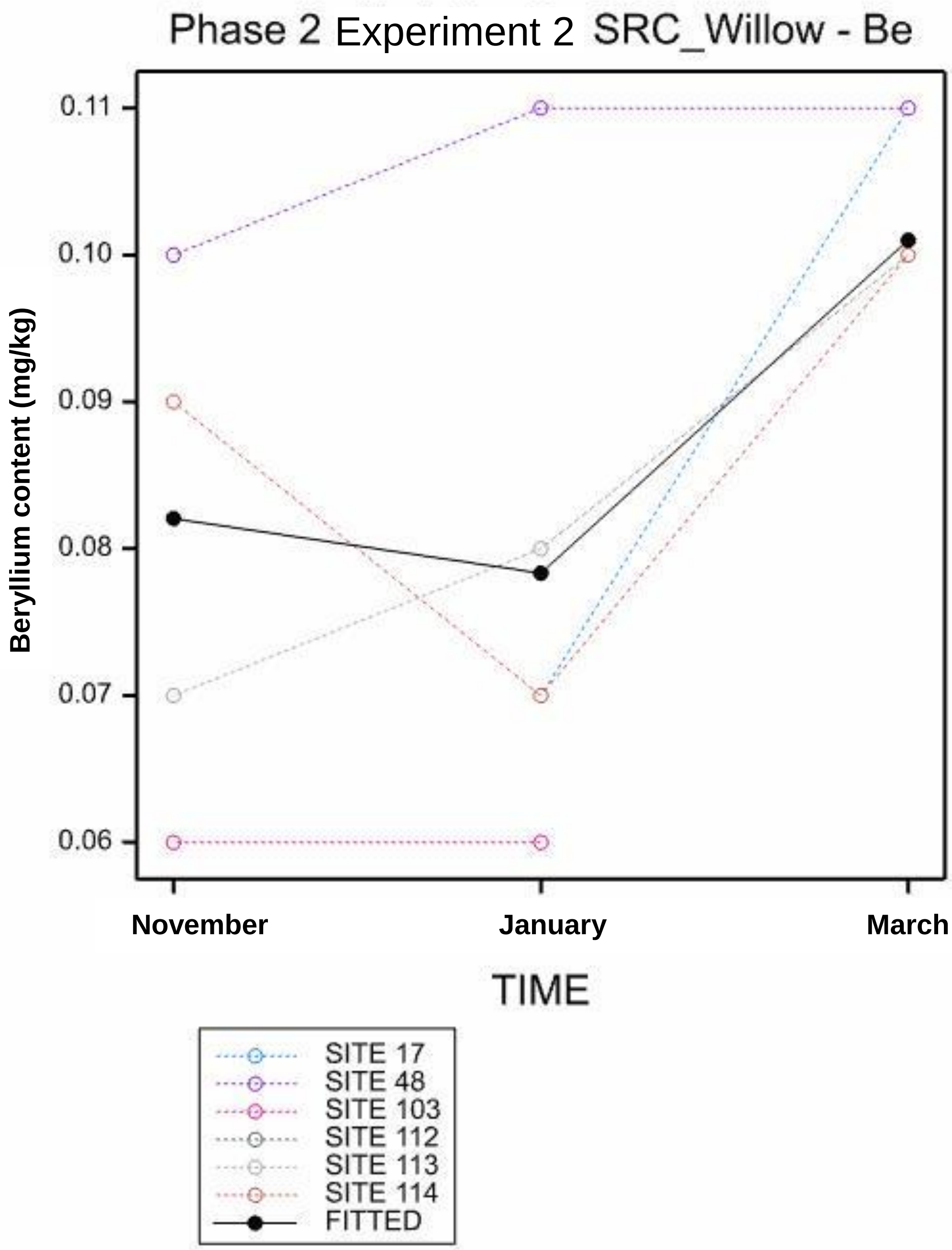

Phase 2 Experiment 2 SRC_Willow - N_1
Nitrogen content (%wt)
0.8
0.7
0.6
0.5
0.4
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

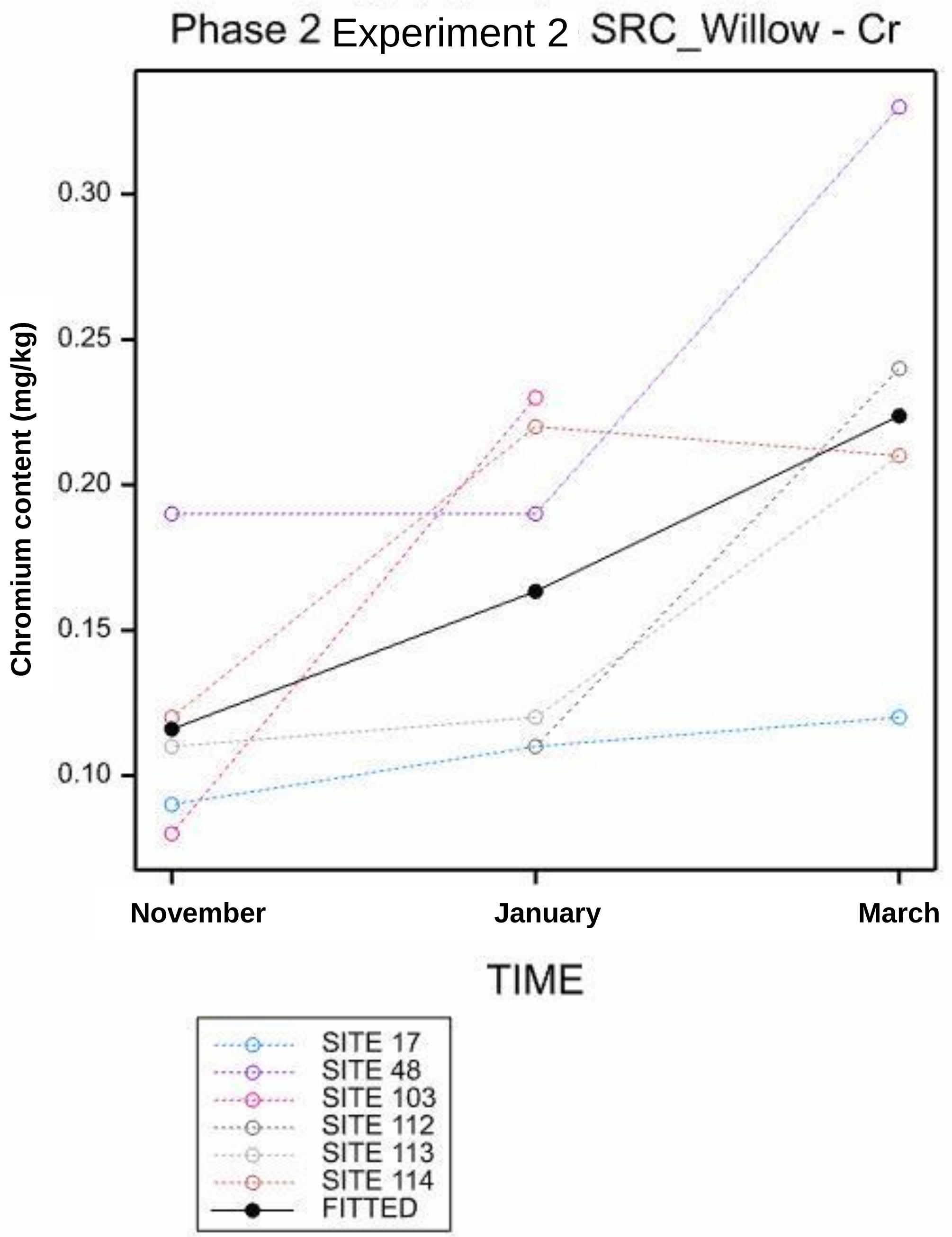

Phase 2 Experiment 2 SRC_Willow - Sulphur_2
Sulphur content (%wt)
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

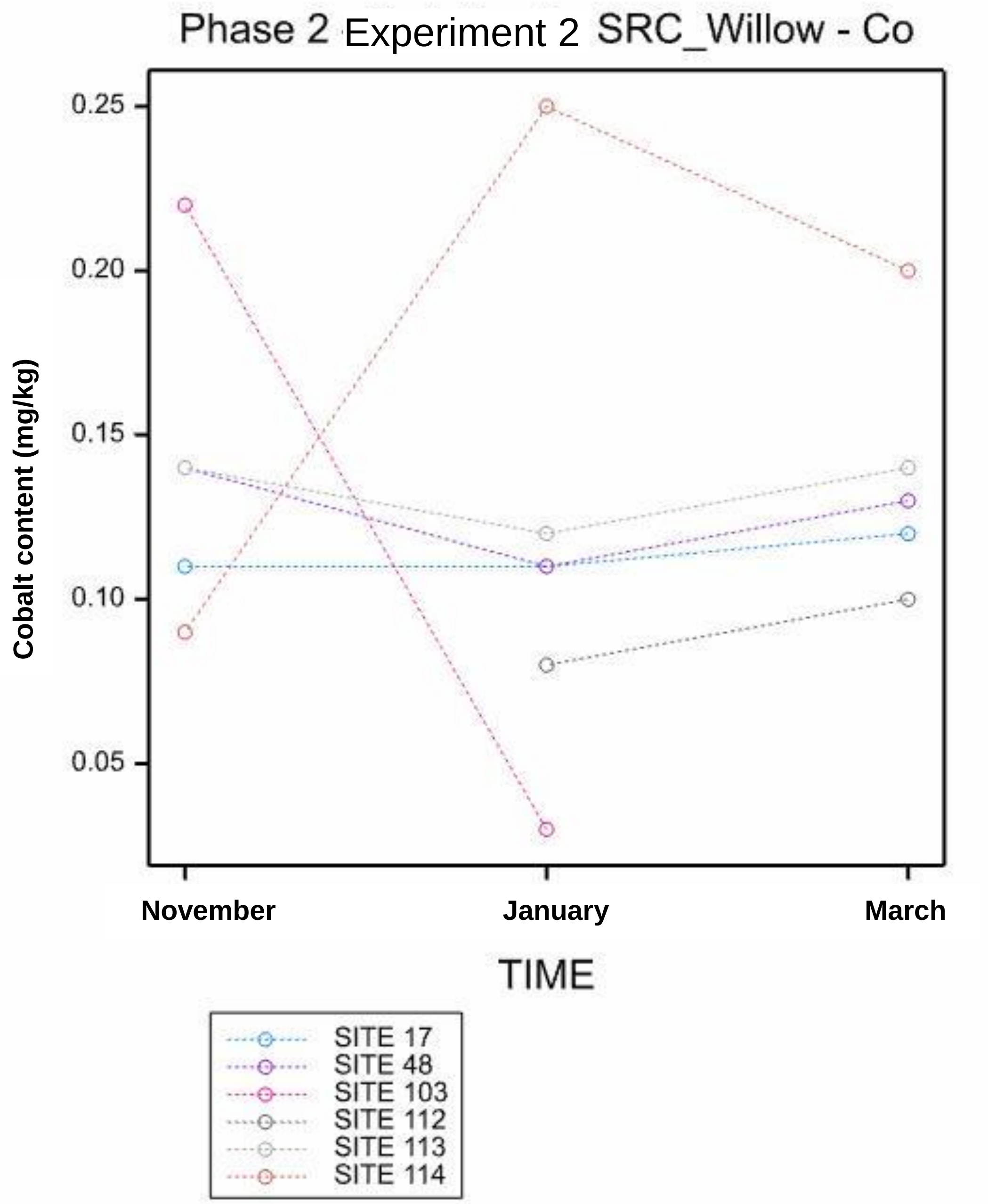


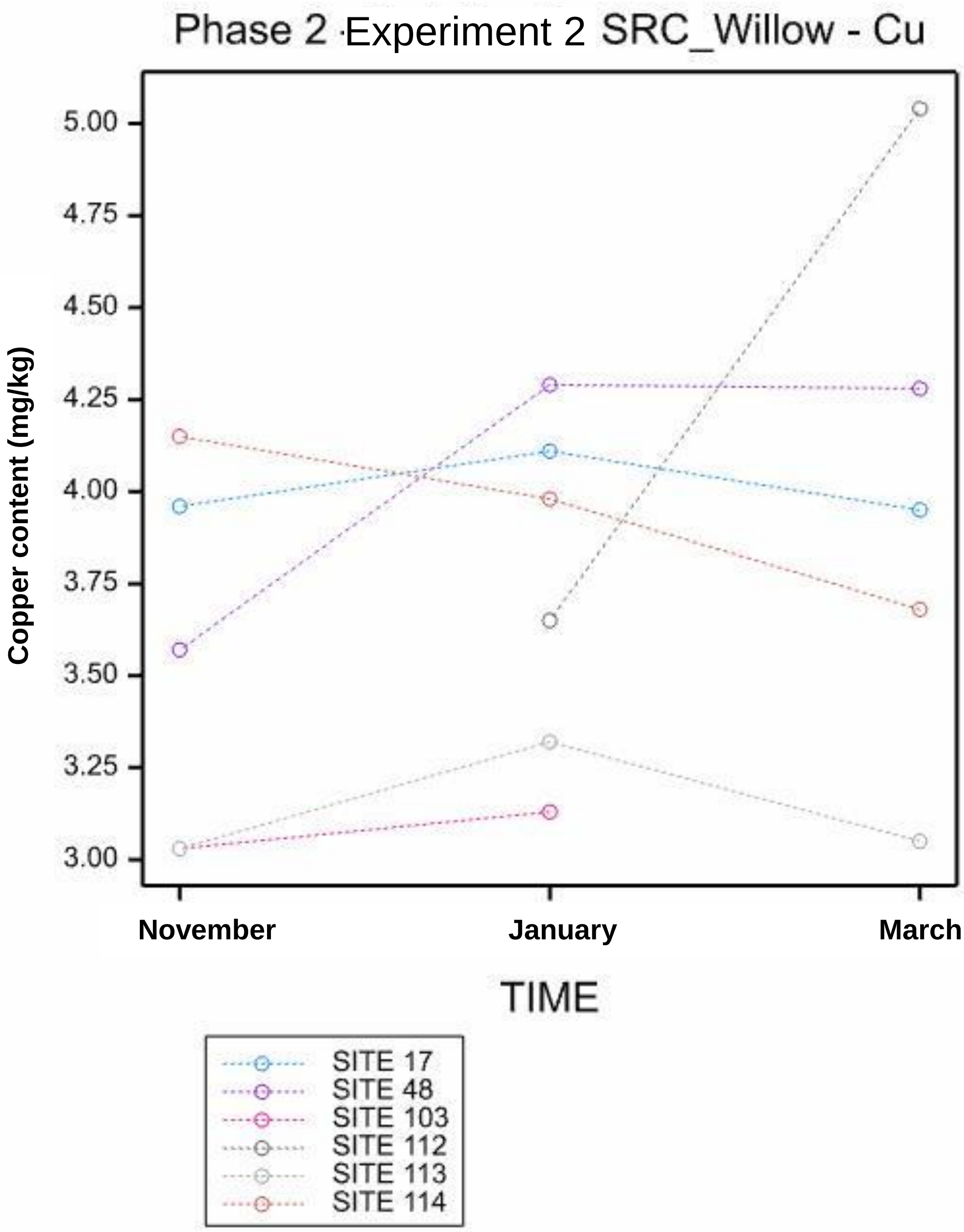
Phase 2 Experiment 2 SRC_Willow - Chlorine_2
Chlorine content (%wt)
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

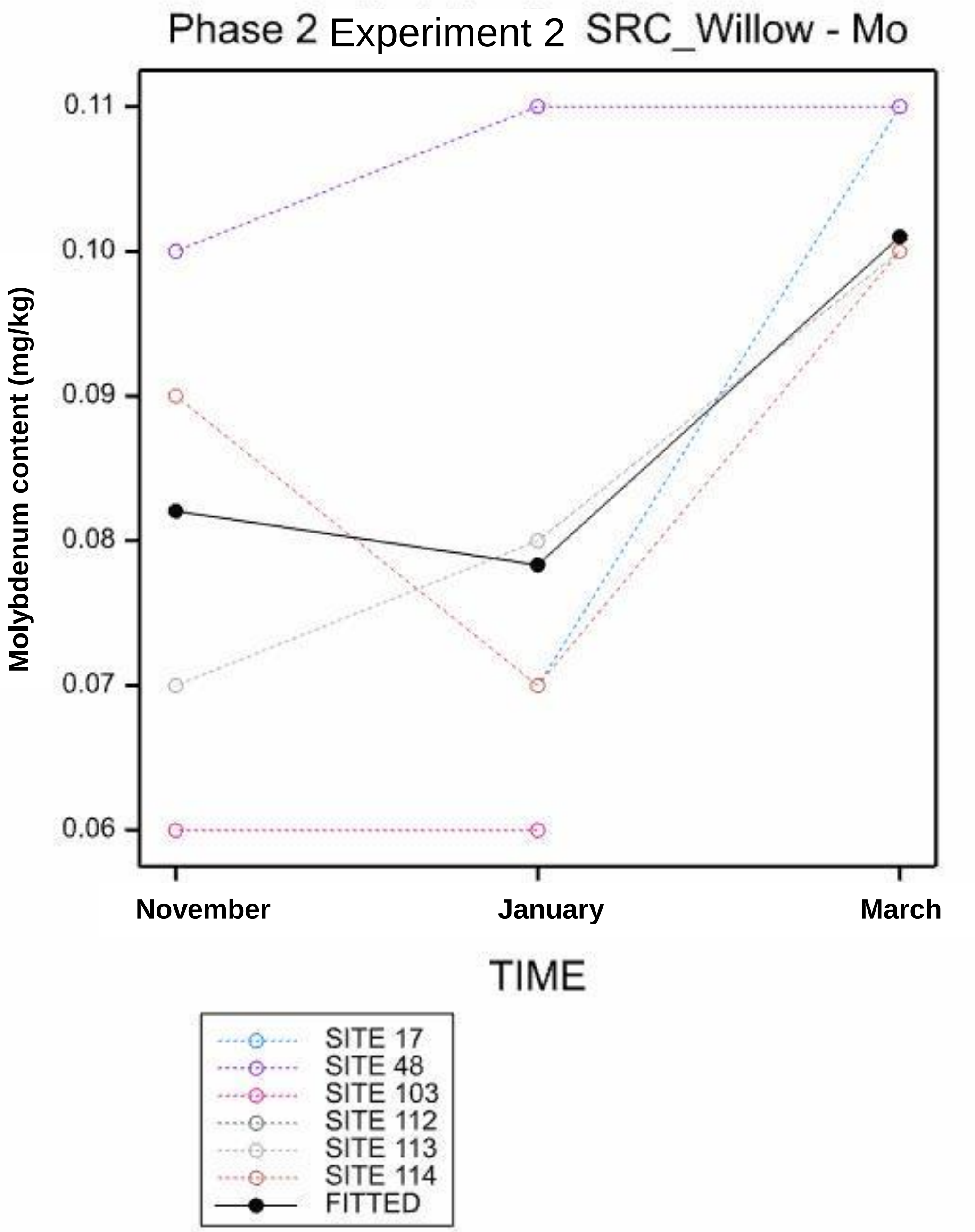

Phase 2 Experiment 2 SRC_Willow - Ba
Barium content (mg/kg)
35
30
25
20
15
10
5
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

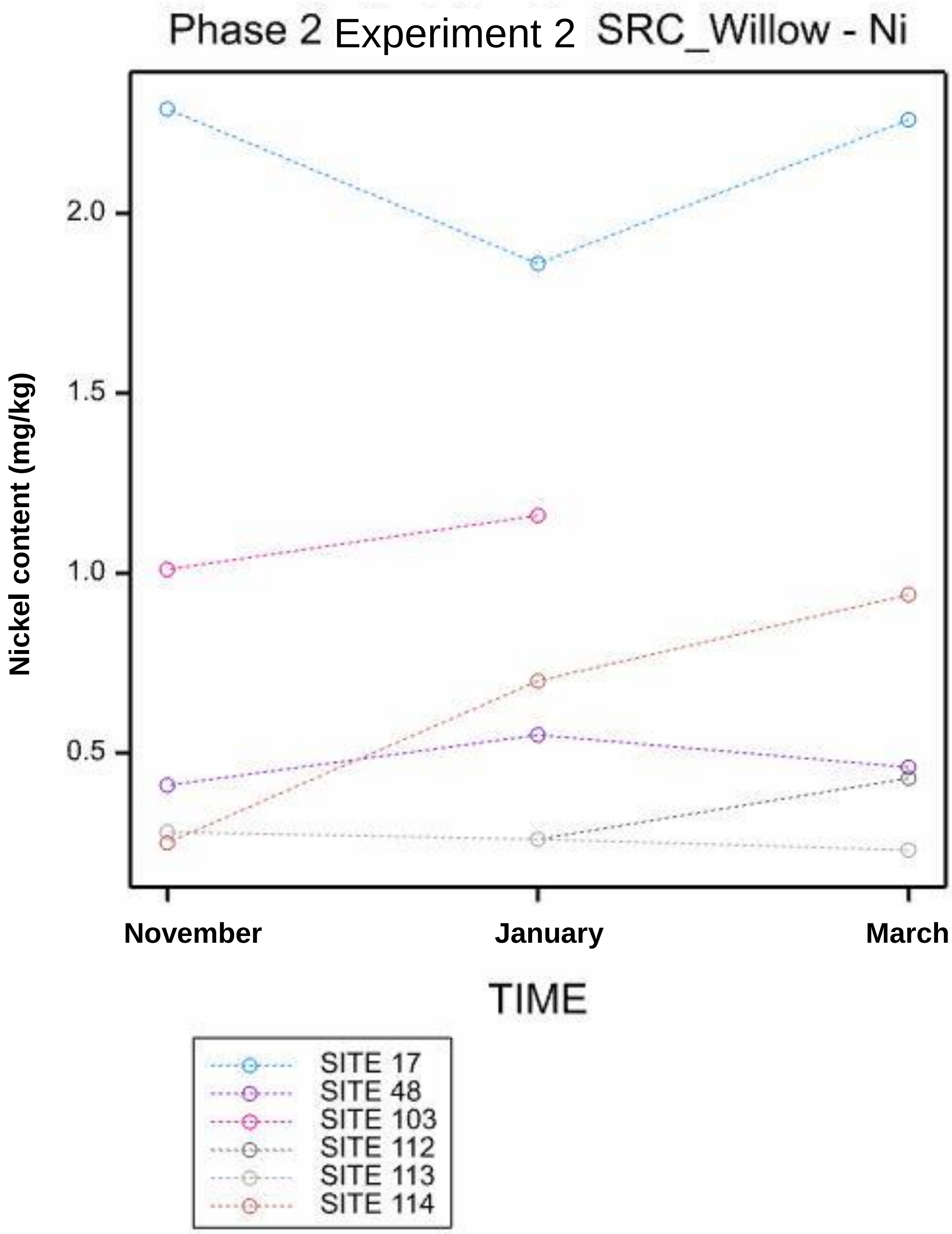

Phase 2 Experiment 2 SRC_Willow - Be
Beryllium content (mg/kg)
0.11
0.10
0.09
0.08
0.07
0.06
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED

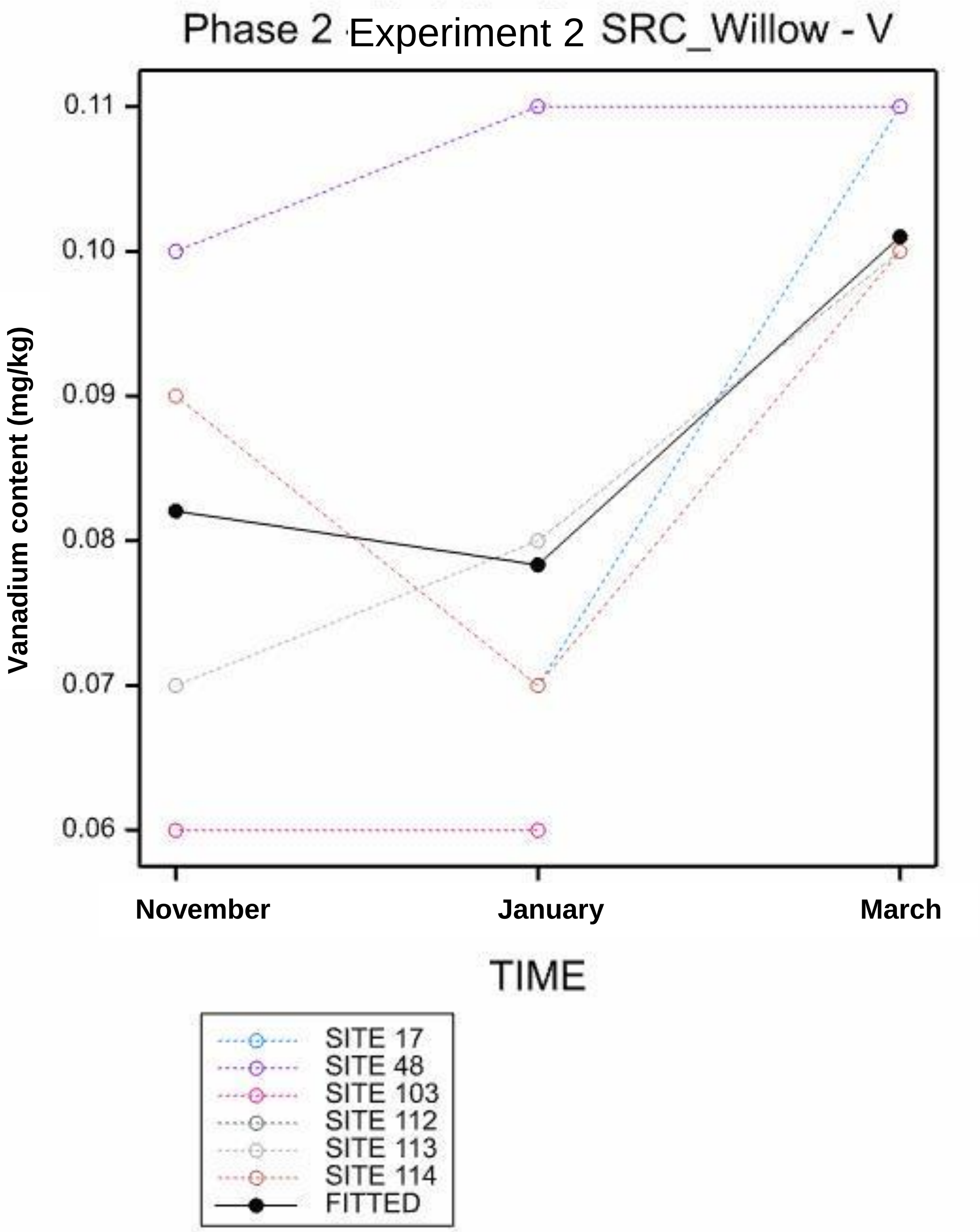

Phase 2 Experiment 2 SRC_Willow - Cr
Chromium content (mg/kg)
0.30
0.25
0.20
0.15
0.10
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED

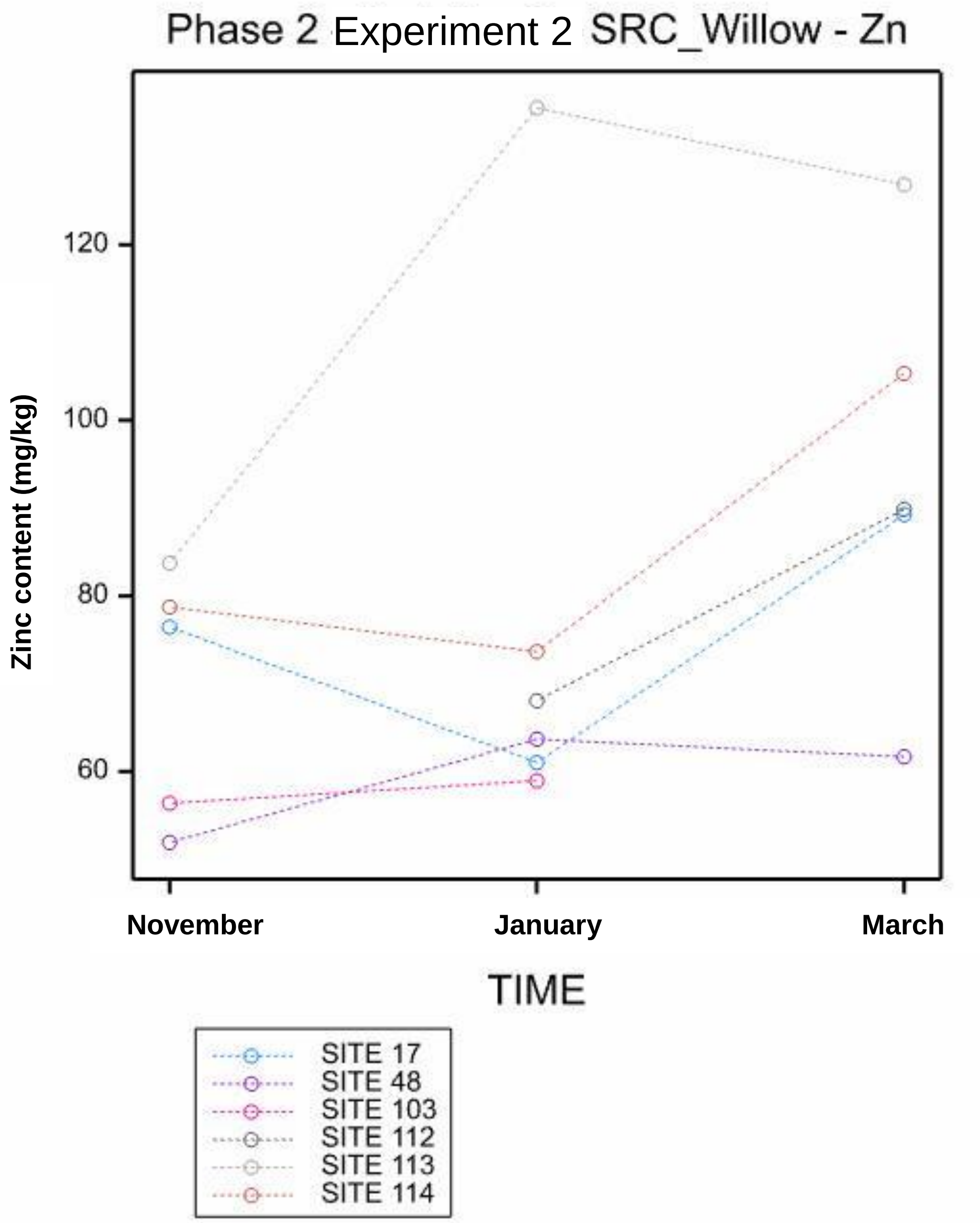

Phase 2 Experiment 2 SRC_Willow - Co
Cobalt content (mg/kg)
0.25
0.20
0.15
0.10
0.05
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

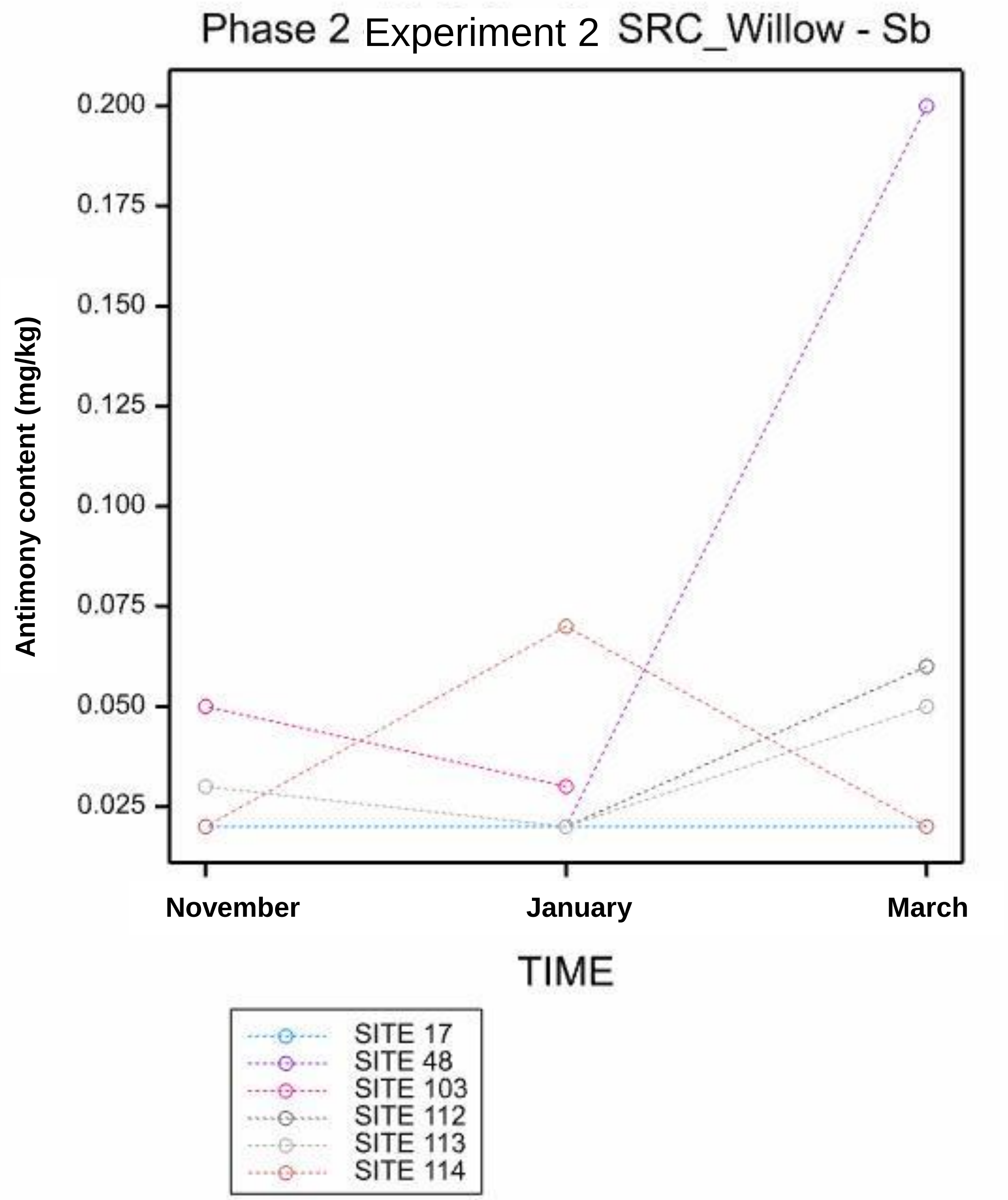

Phase 2 Experiment 2 SRC_Willow - Cu
Copper content (mg/kg)
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114


Phase 2 Experiment 2 SRC_Willow - Mo
Molybdenum content (mg/kg)
0.11
0.10
0.09
0.08
0.07
0.06
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED

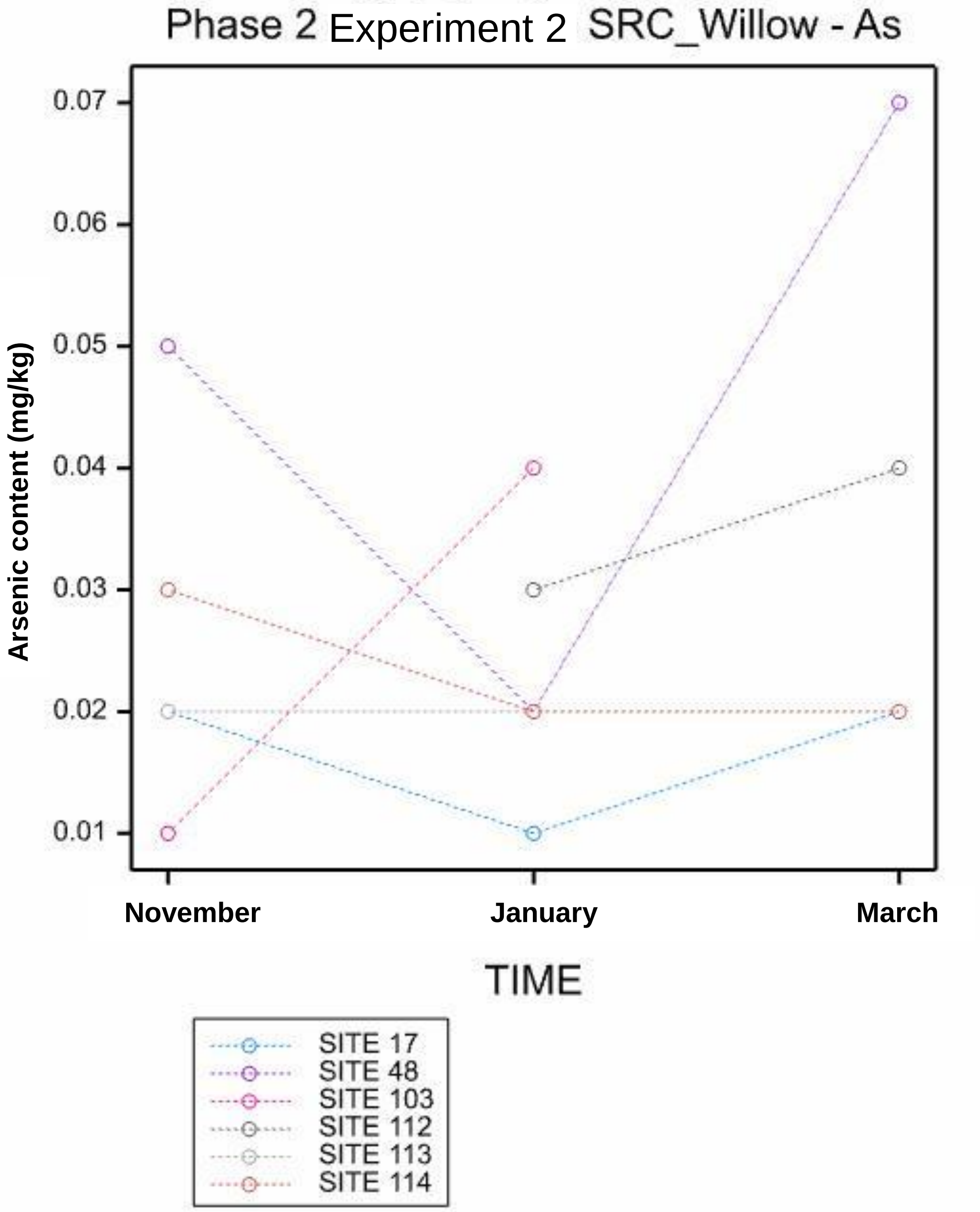

Phase 2 Experiment 2 SRC_Willow - Ni
Nickel content (mg/kg)
2.0
1.5
1.0
0.5
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

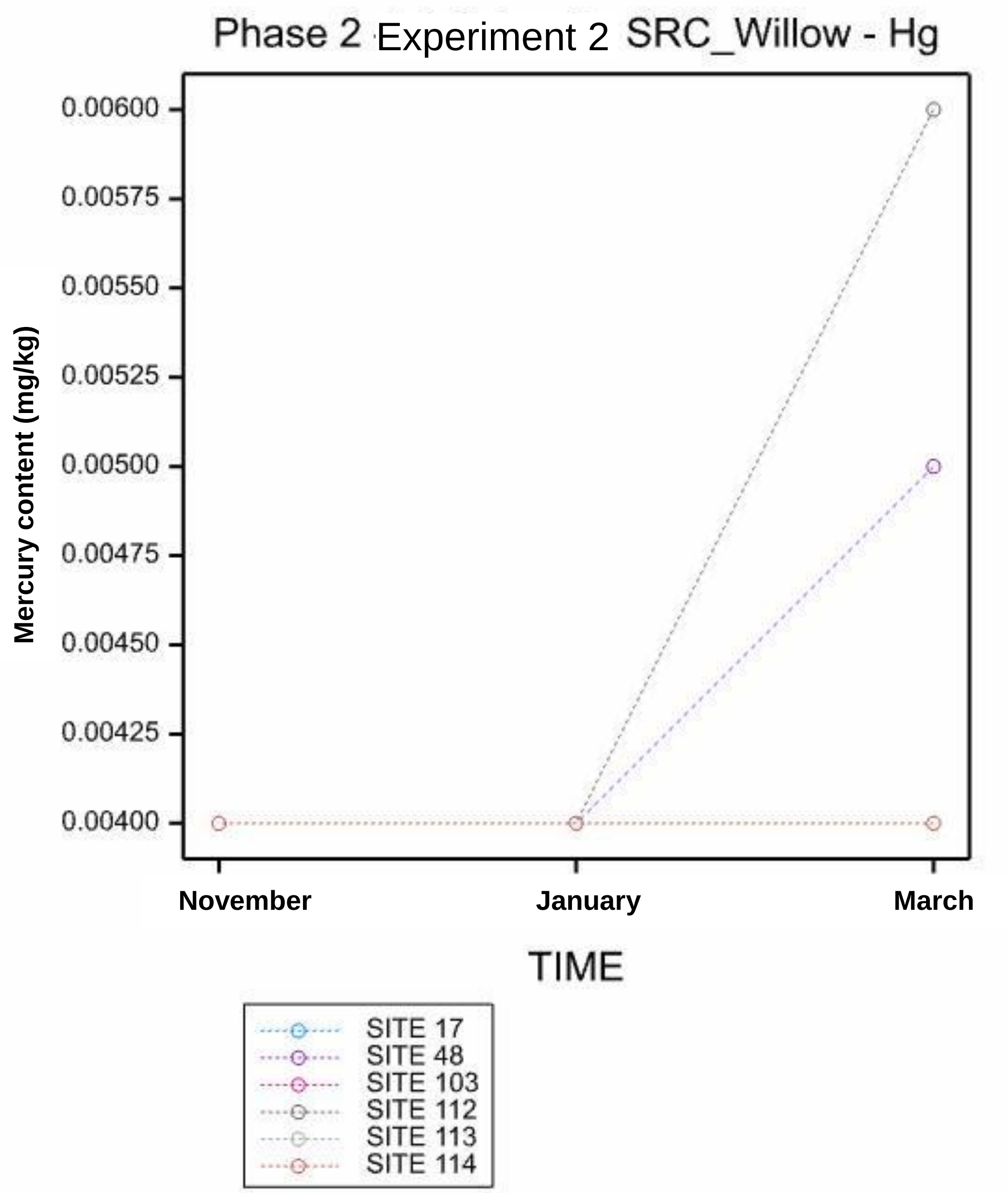

Phase 2 Experiment 2 SRC_Willow - V
Vanadium content (mg/kg)
0.11
0.10
0.09
0.08
0.07
0.06
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED


Phase 2 Experiment 2 SRC_Willow - Zn
Zinc content (mg/kg)
120
100
80
60
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

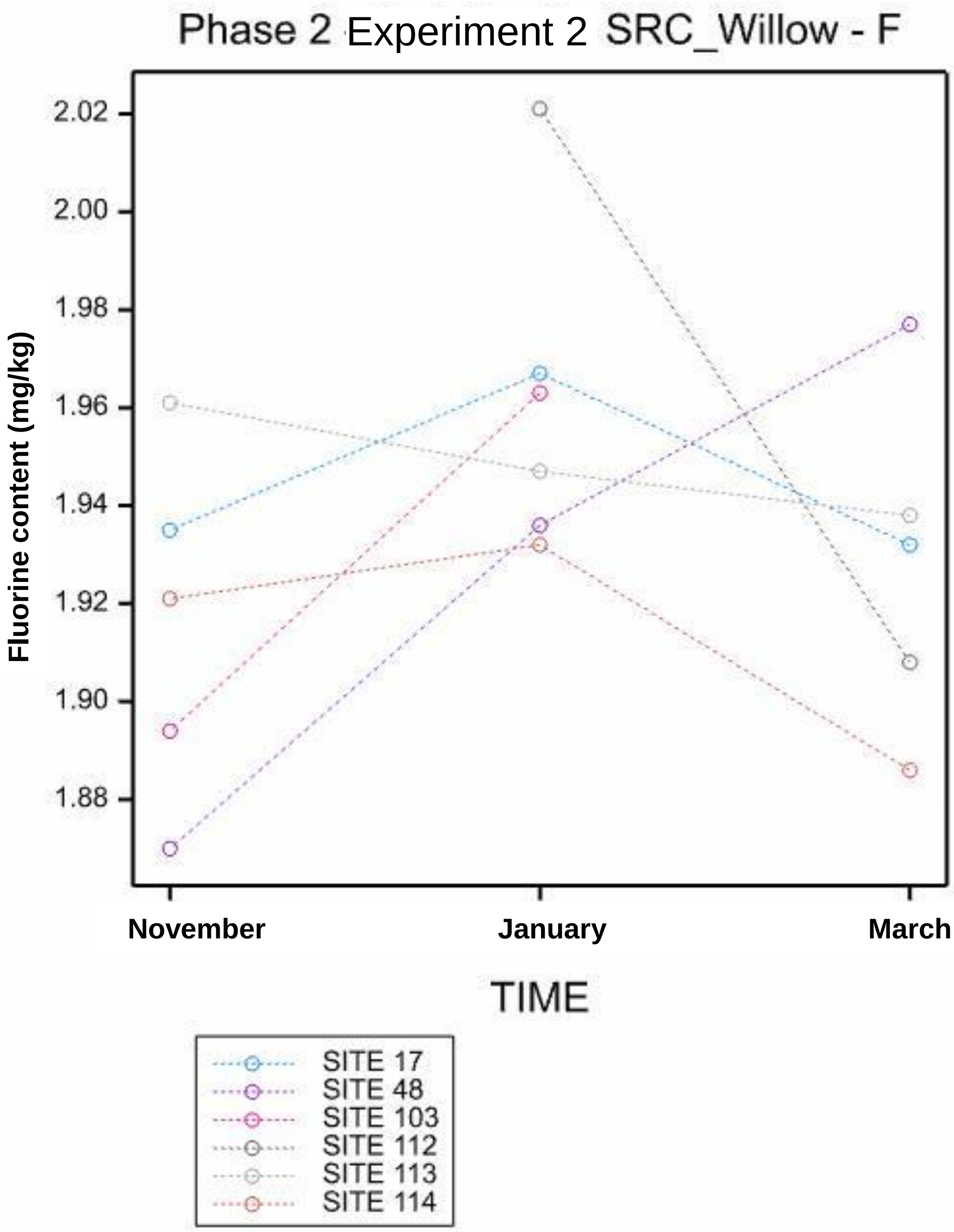


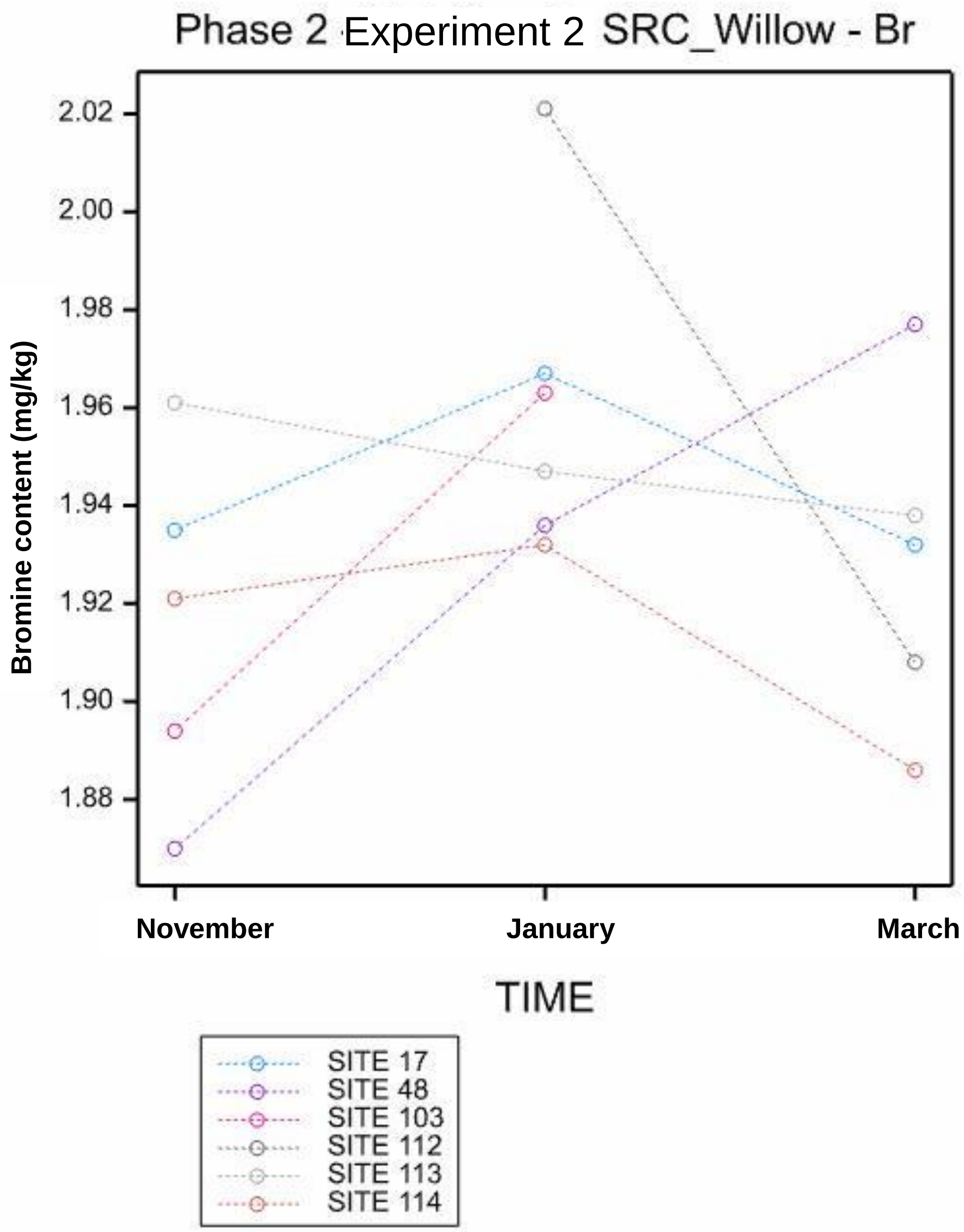
Phase 2 Experiment 2 SRC_Willow - Sb
Antimony content (mg/kg)
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114


Phase 2 Experiment 2 SRC_Willow - As
Arsenic content (mg/kg)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

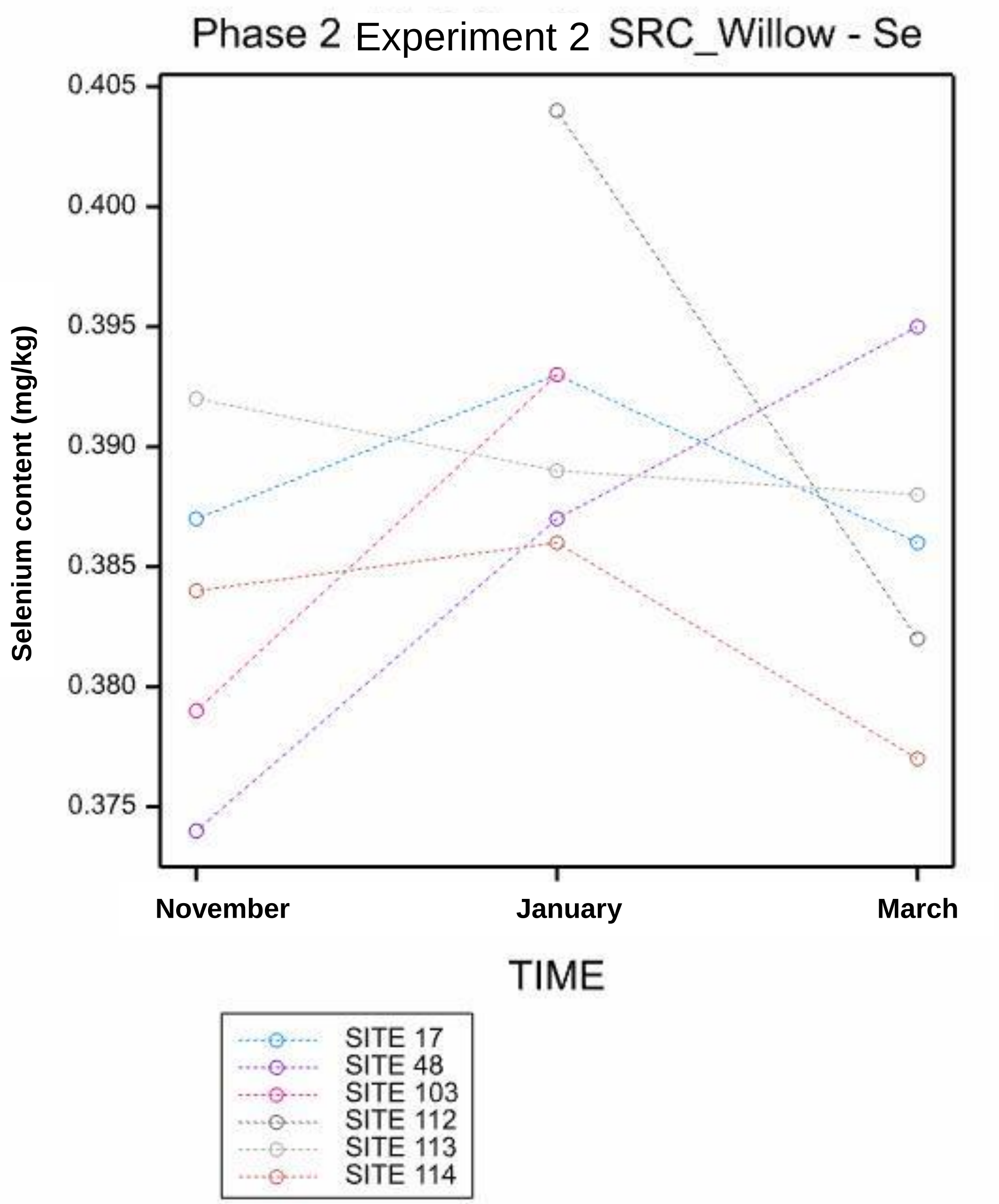


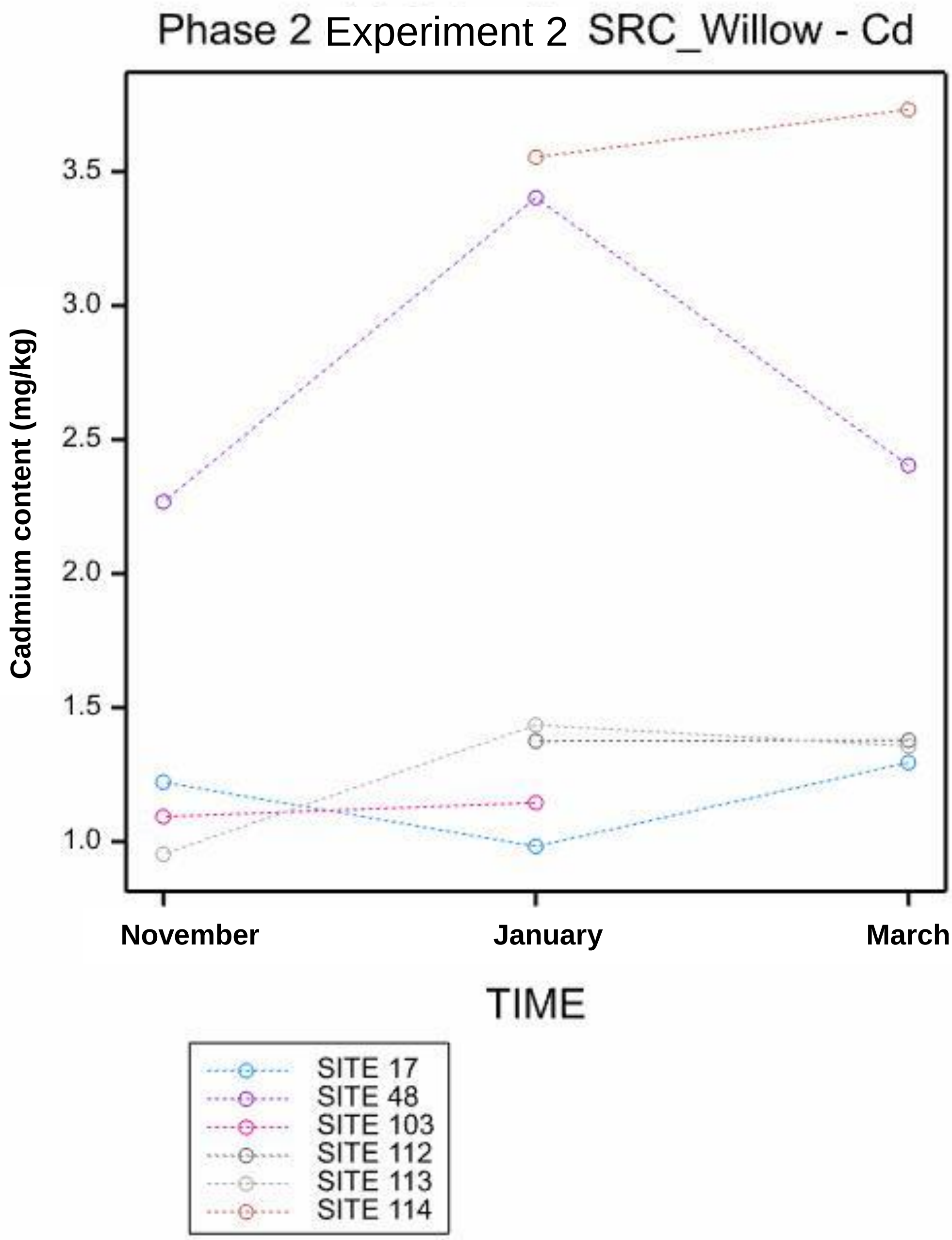
Phase 2 Experiment 2 SRC_Willow - Hg
Mercury content (mg/kg)
0.00600
0.00575
0.00550
0.00525
0.00500
0.00475
0.00450
0.00425
0.00400
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114


Phase 2 Experiment 2 SRC_Willow - F
Fluorine content (mg/kg)
2.02
2.00
1.98
1.96
1.94
1.92
1.90
1.88
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

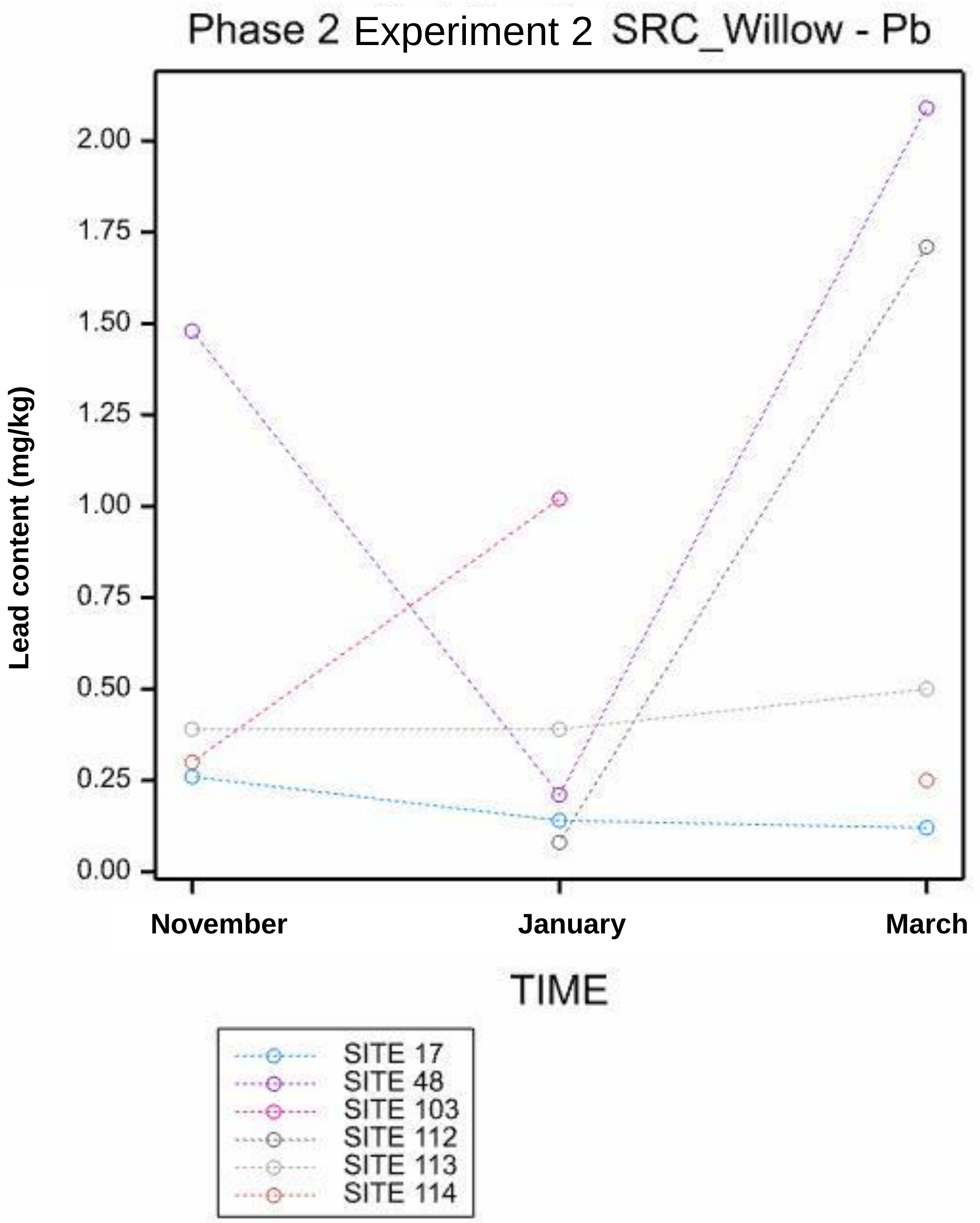


Phase 2 Experiment 2 SRC_Willow - Br
Bromine content (mg/kg)
2.02
2.00
1.98
1.96
1.94
1.92
1.90
1.88
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

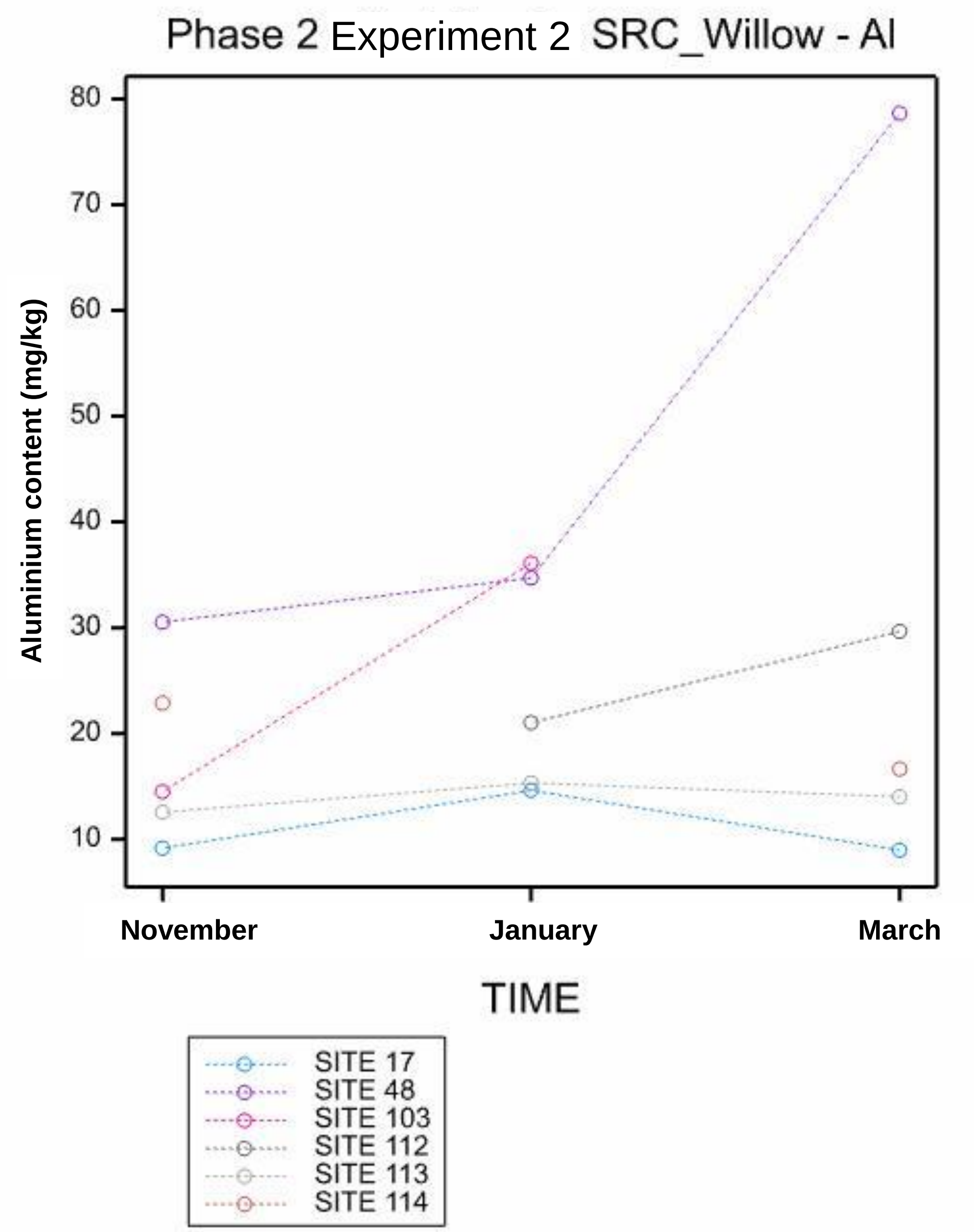

Phase 2 Experiment 2 SRC_Willow - Se
Selenium content (mg/kg)
0.405
0.400
0.395
0.390
0.385
0.380
0.375
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

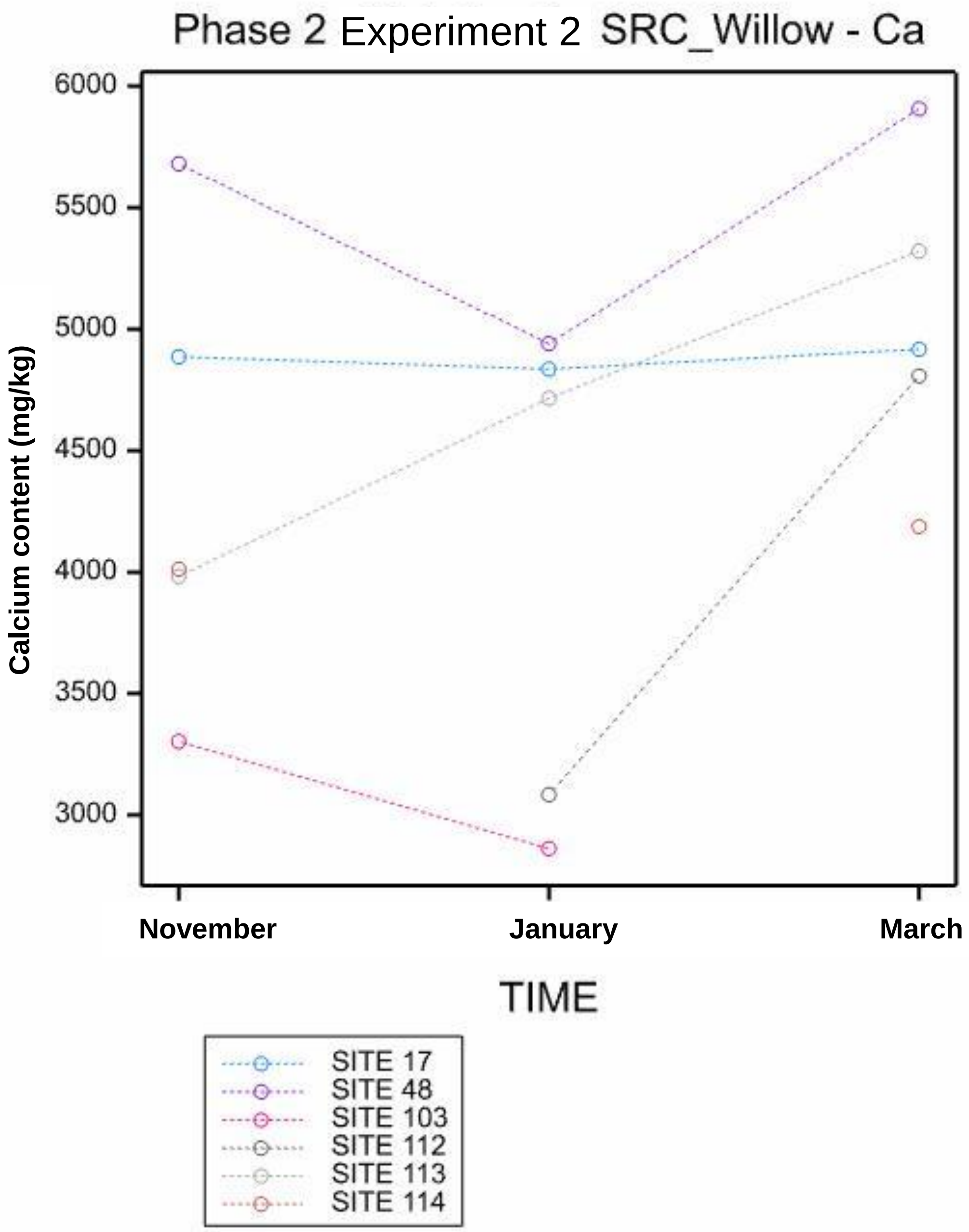


Phase 2 Experiment 2 SRC_Willow - Cd
Cadmium content (mg/kg)
3.5
3.0
2.5
2.0
1.5
1.0
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

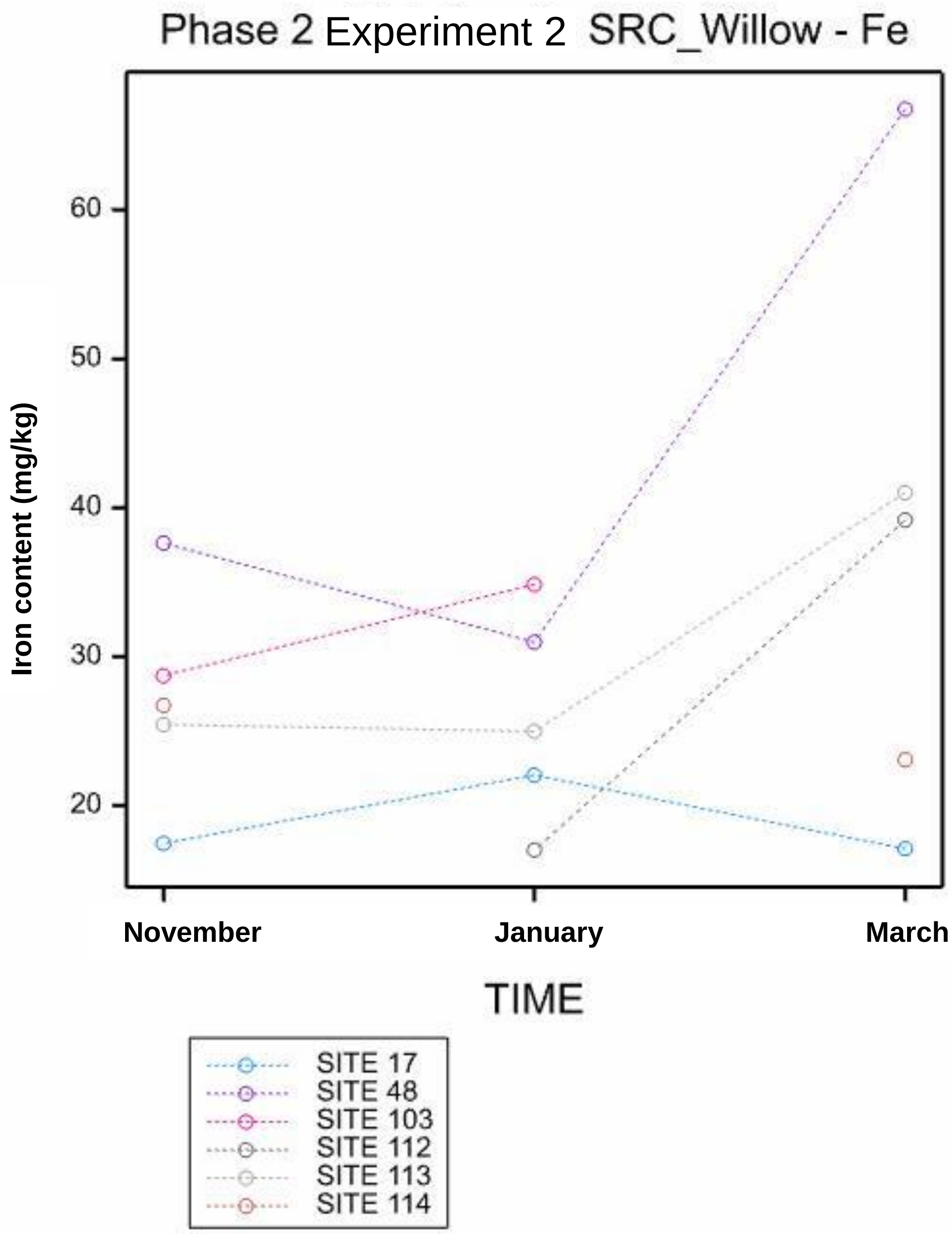


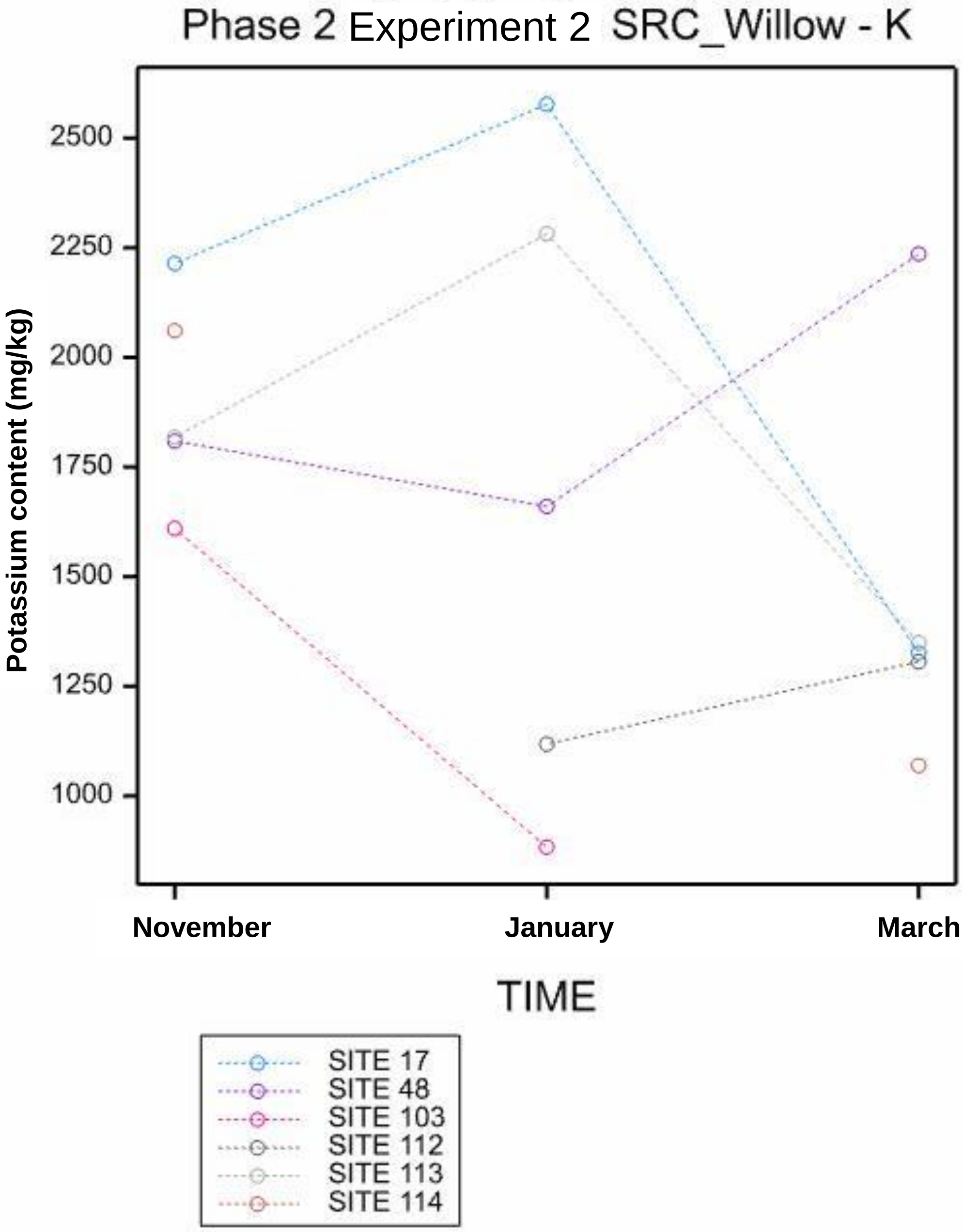
Phase 2 Experiment 2 SRC_Willow - Pb
Lead content (mg/kg)
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114


Phase 2 Experiment 2 SRC_Willow - Al
Aluminium content (mg/kg)
80
70
60
50
40
30
20
10
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

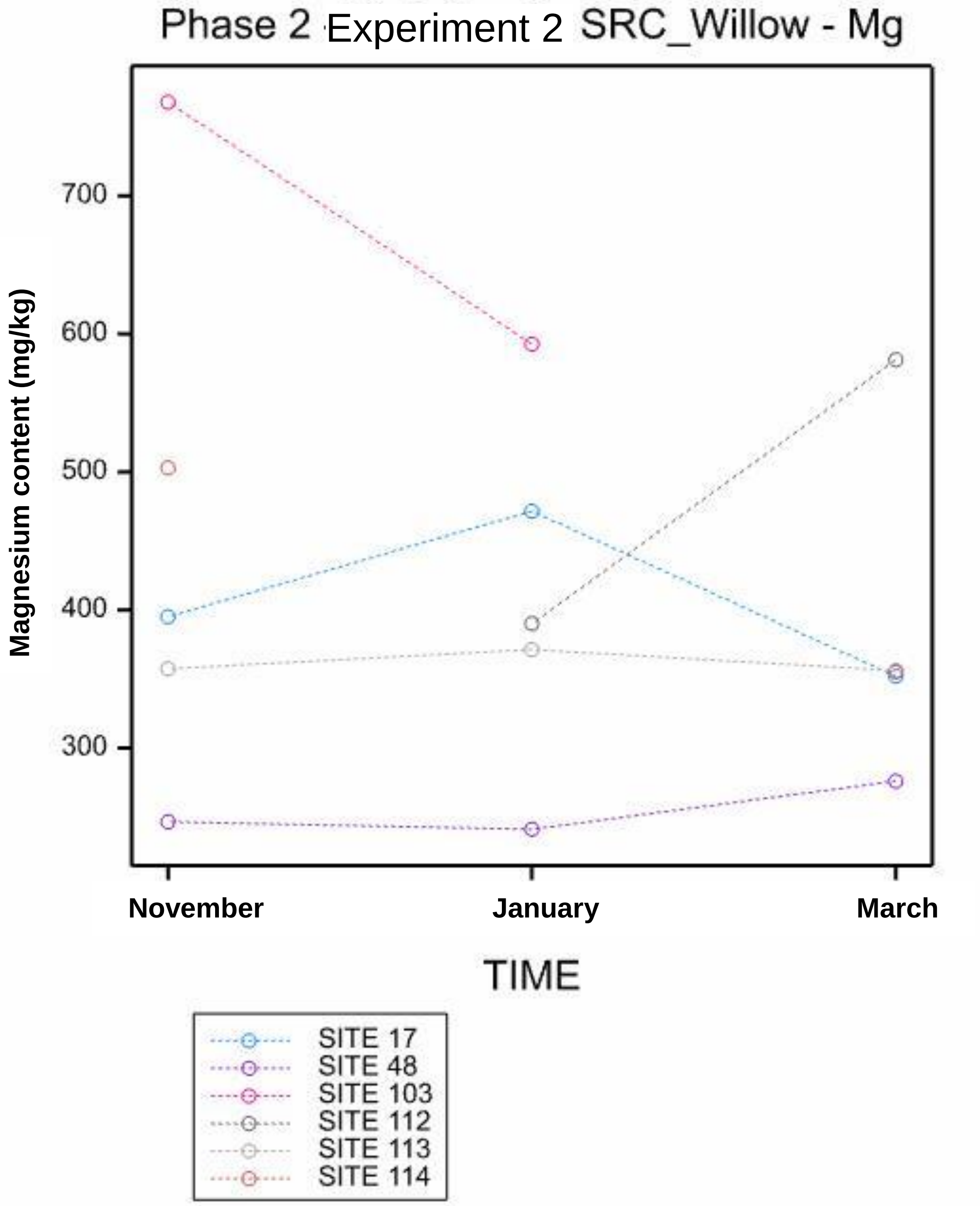


Phase 2 Experiment 2 SRC_Willow - Ca
Calcium content (mg/kg)
6000
5500
5000
4500
4000
3500
3000
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

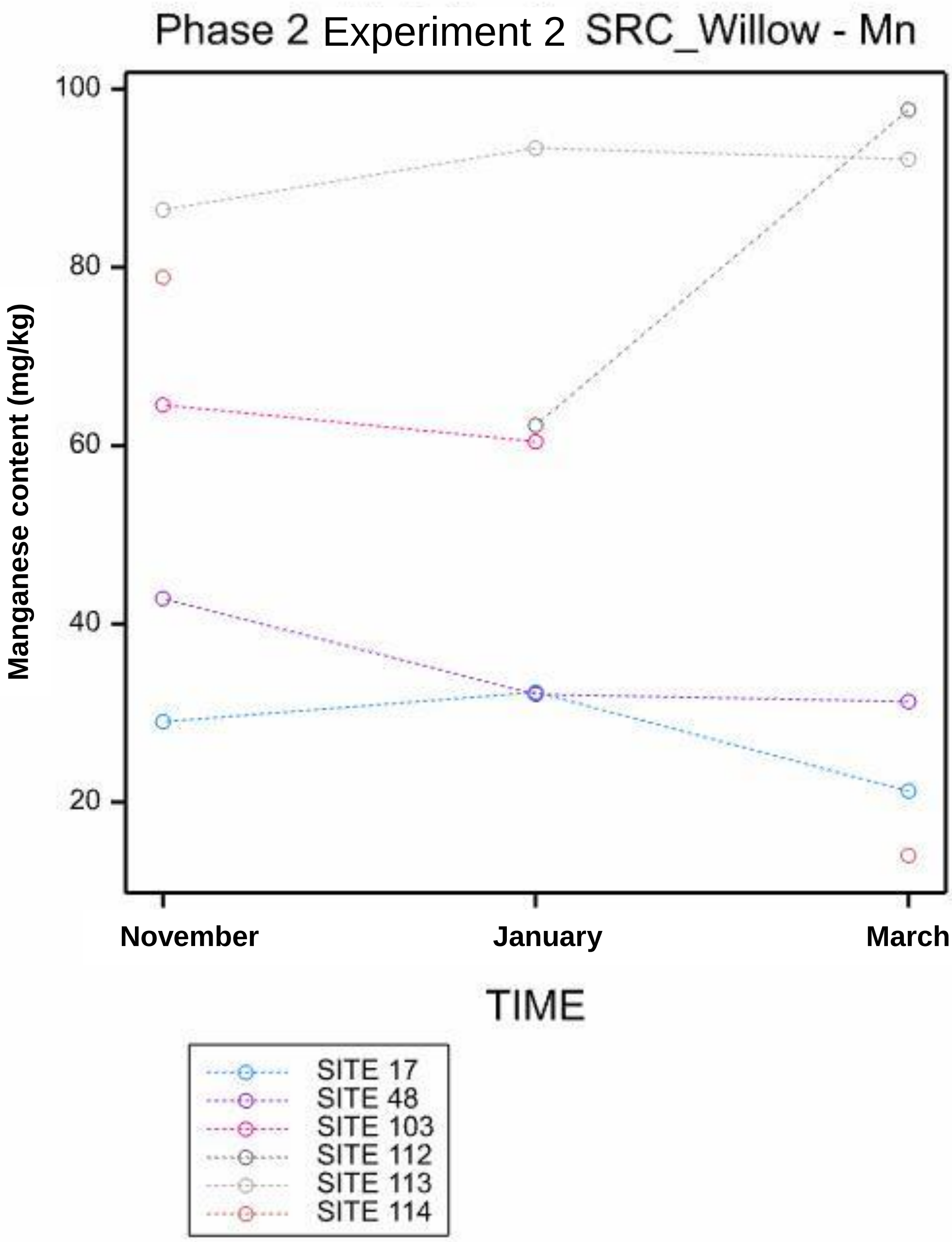

Phase 2 Experiment 2 SRC_Willow - Fe
Iron content (mg/kg)
60
50
40
30
20
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

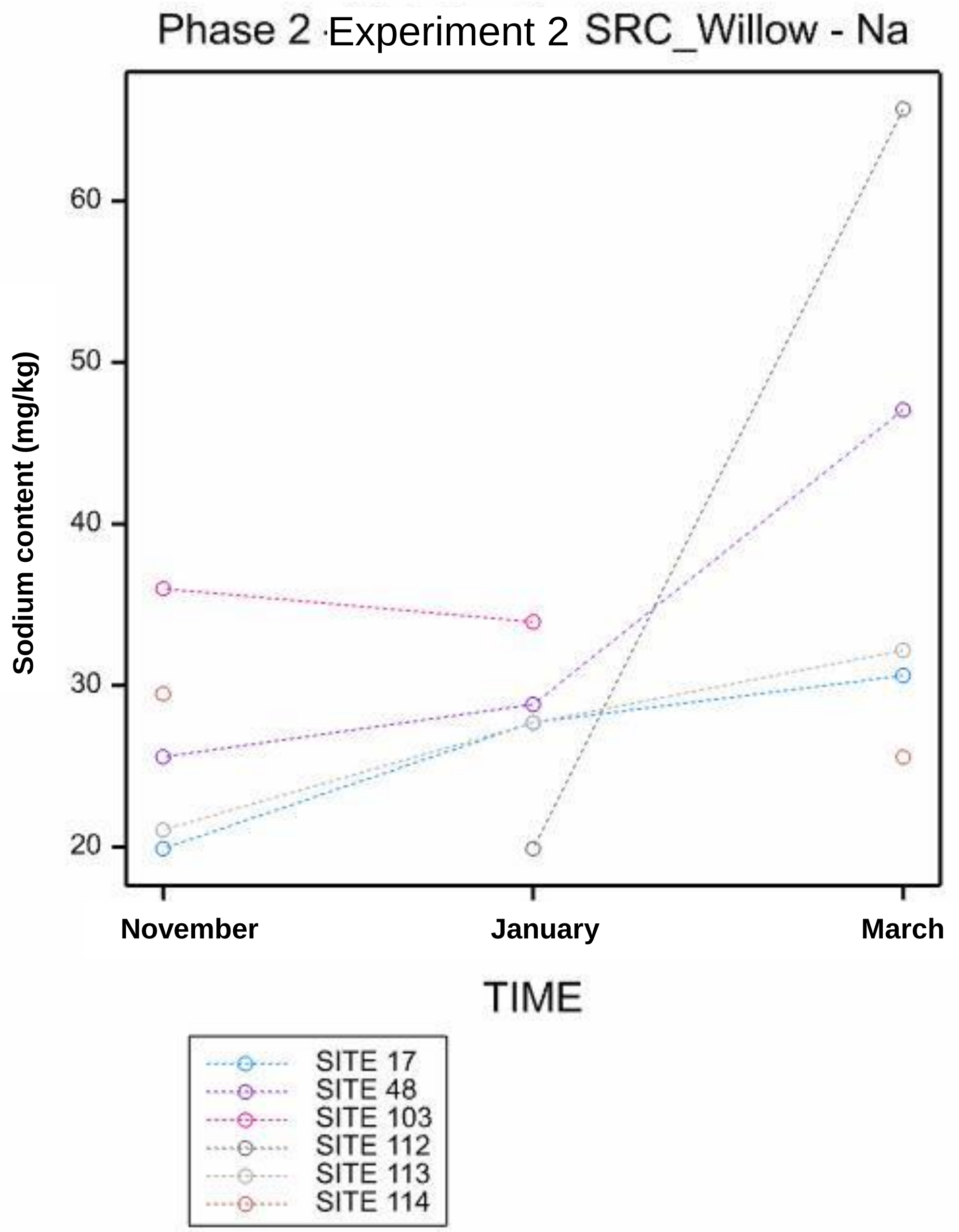


Phase 2 Experiment 2 SRC_Willow - K
Potassium content (mg/kg)
2500
2250
2000
1750
1500
1250
1000
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

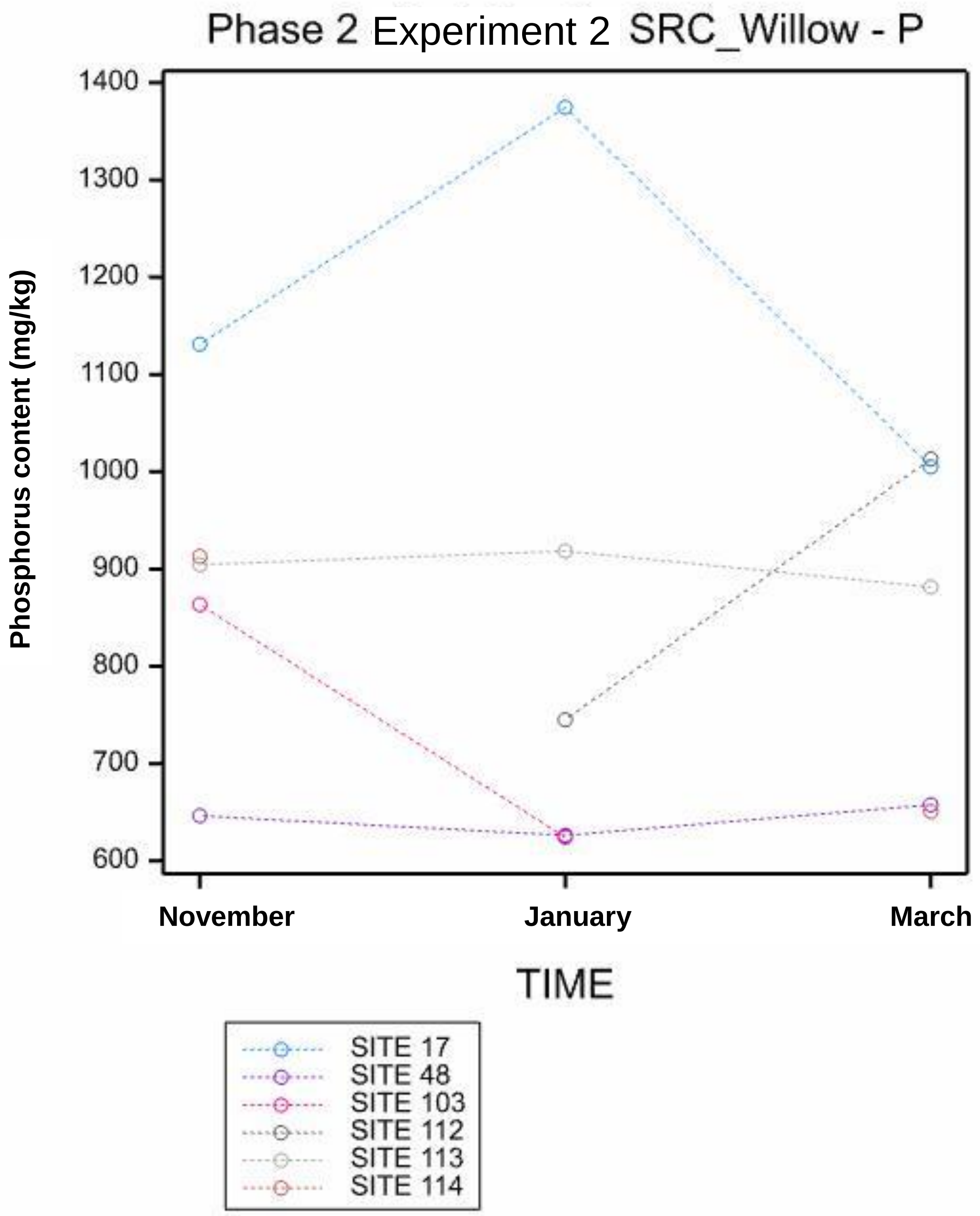


Phase 2 Experiment 2 SRC_Willow - Mg
Magnesium content (mg/kg)
700
600
500
400
300
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

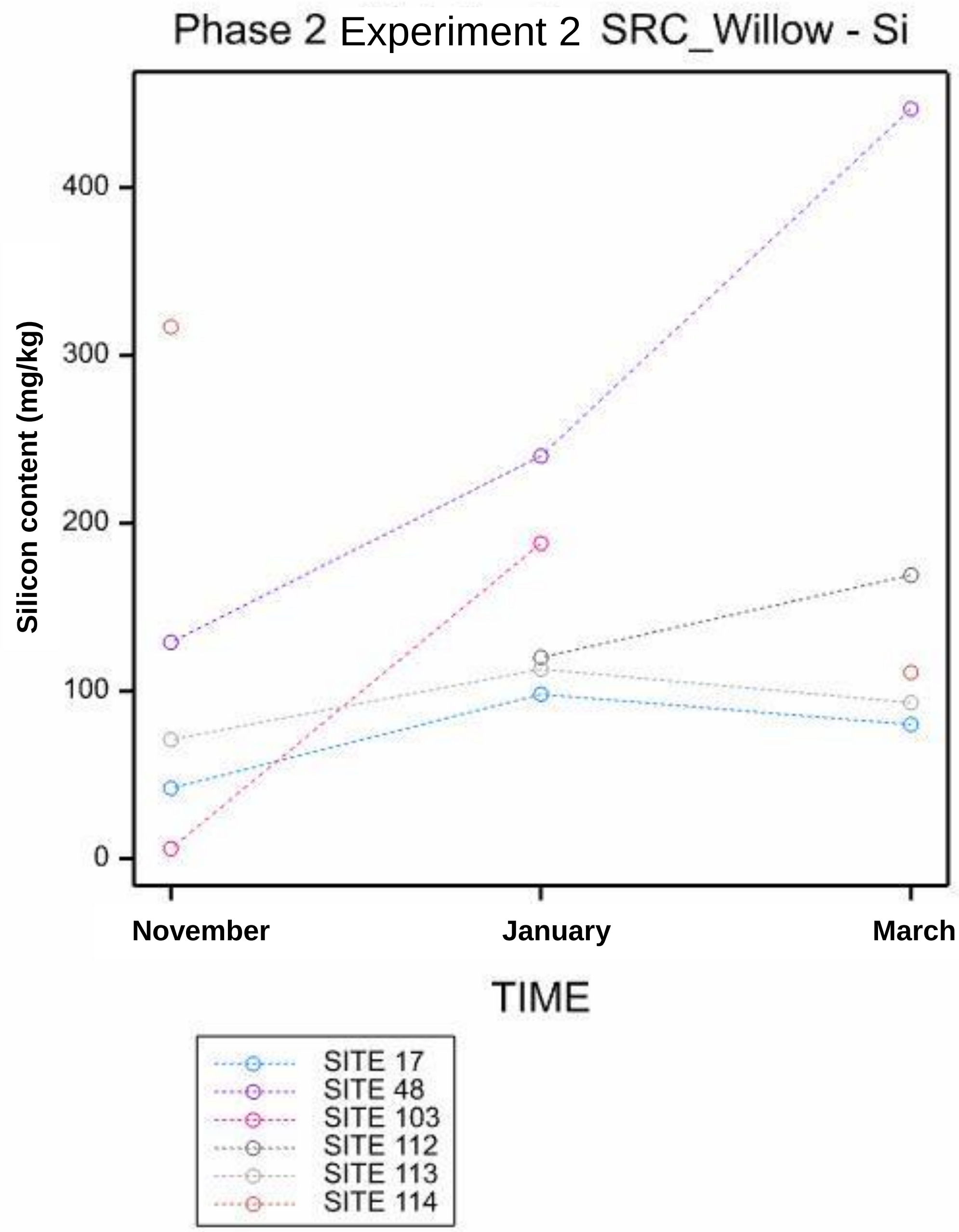

Phase 2 Experiment 2 SRC_Willow - Mn
100
80
60
40
20
Manganese content (mg/kg)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

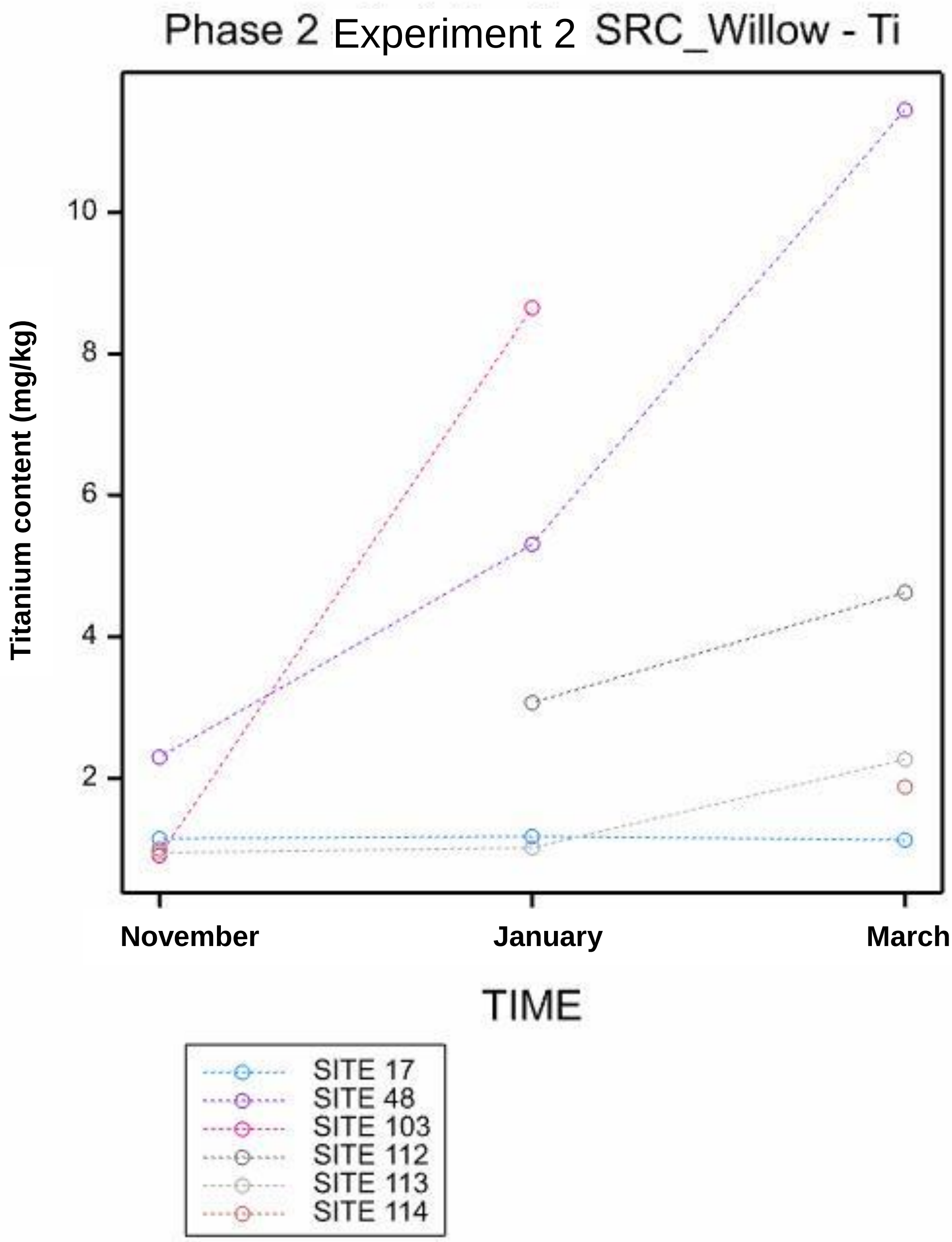


Phase 2 Experiment 2 SRC_Willow - Na
Sodium content (mg/kg)
60
50
40
30
20
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

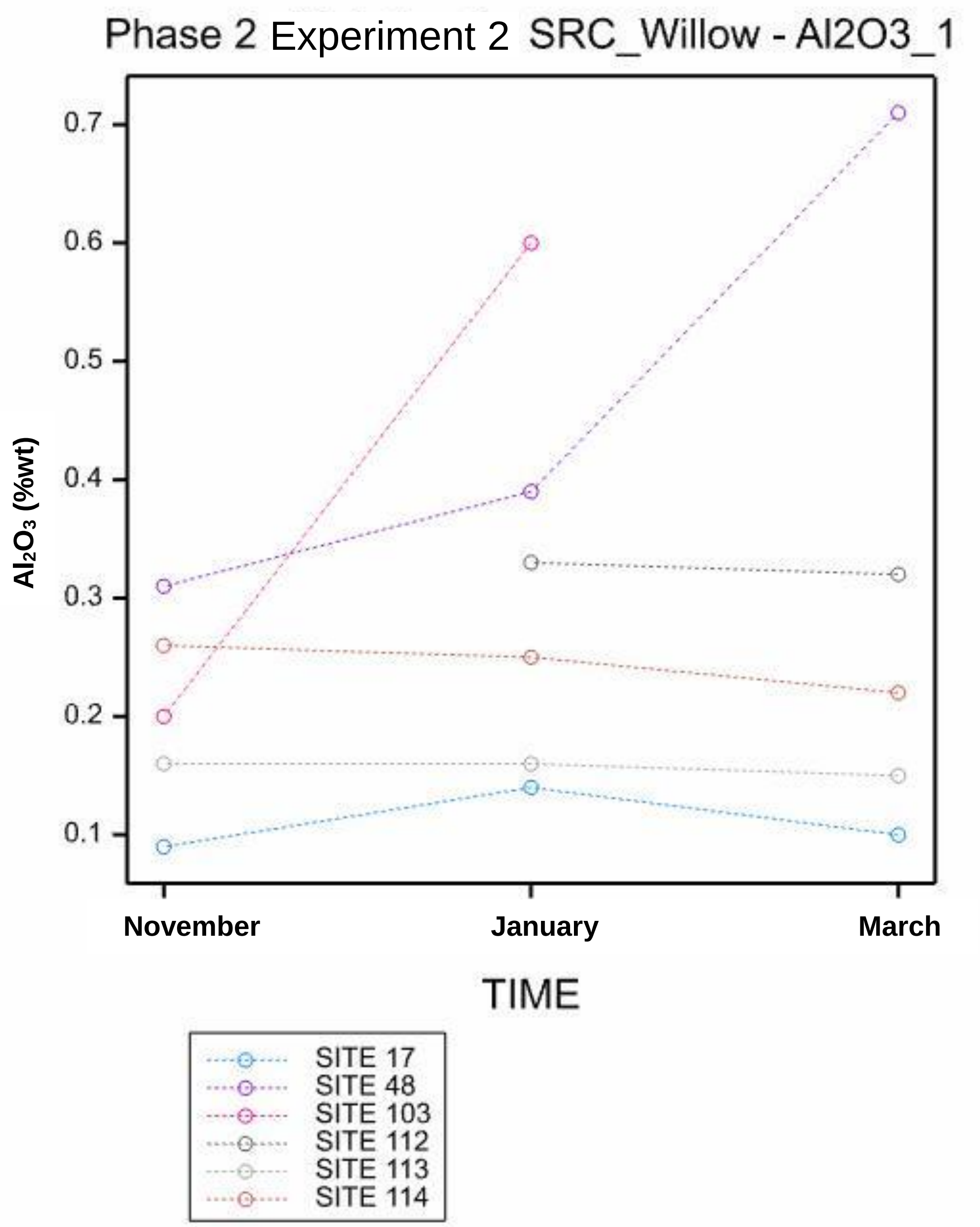


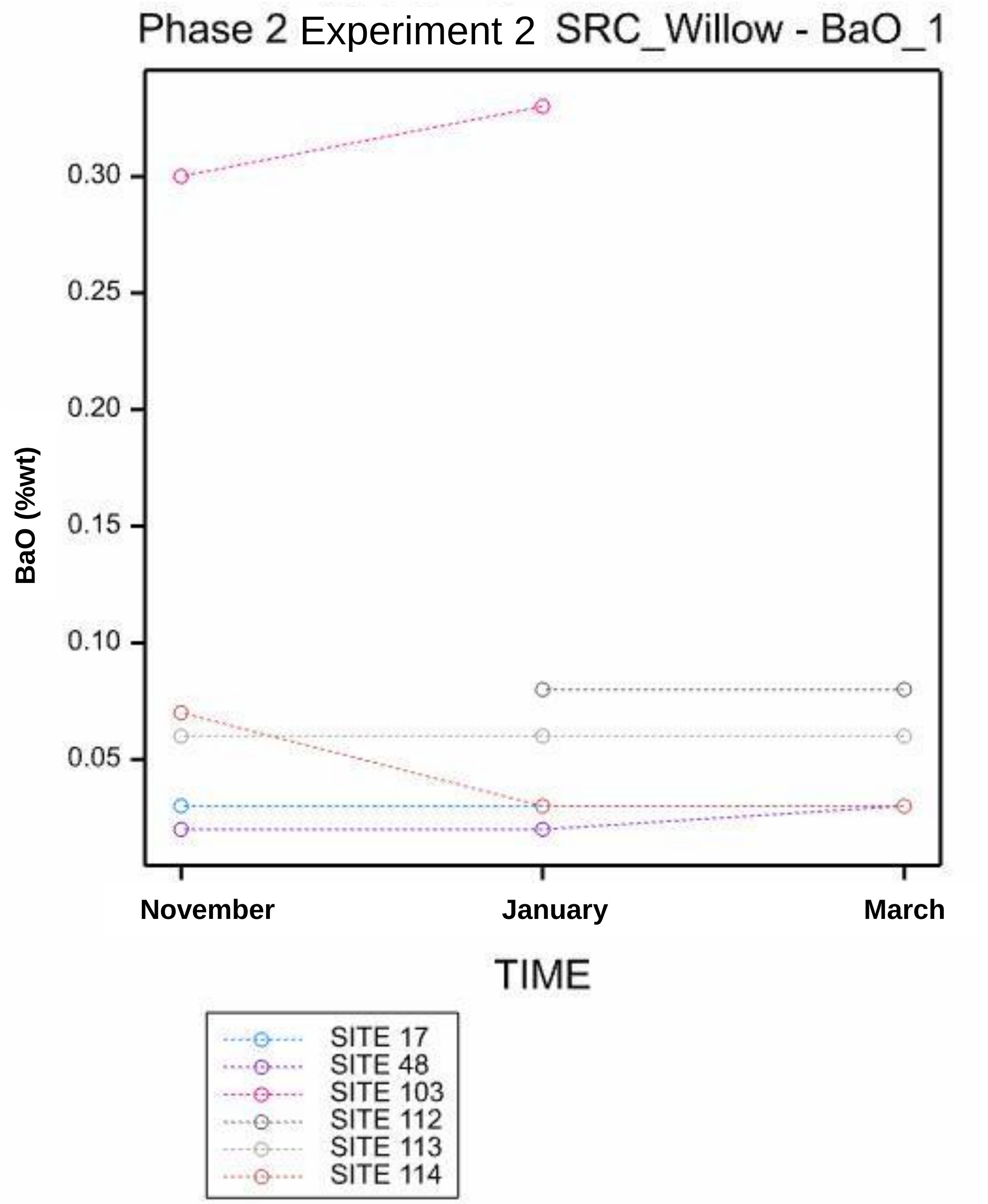
Phase 2 Experiment 2 SRC_Willow - P
Phosphorus content (mg/kg)
1400
1300
1200
1100
1000
900
800
700
600
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

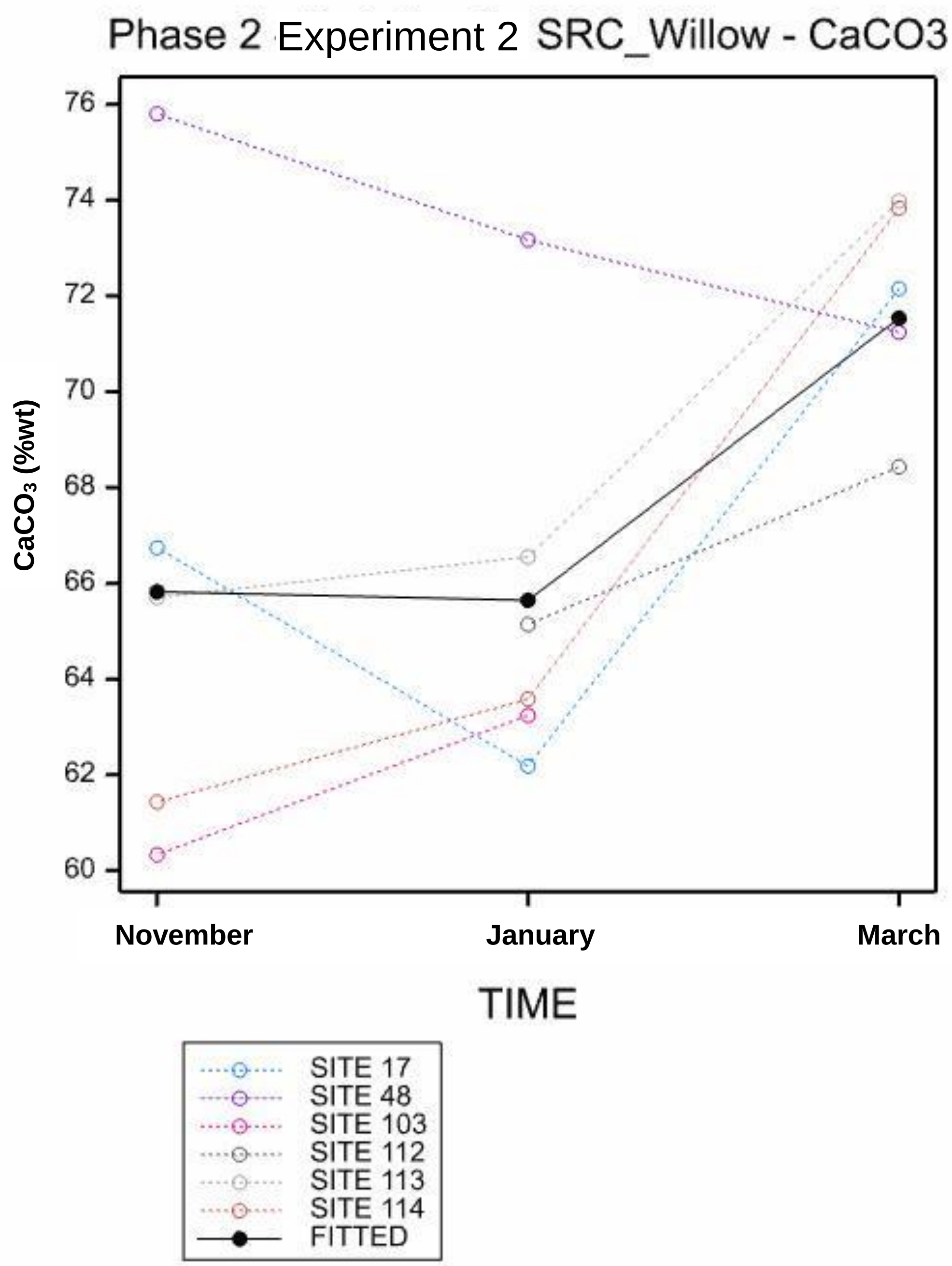

Phase 2 Experiment 2 SRC_Willow - Si
Silicon content (mg/kg)
400
300
200
100
0
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

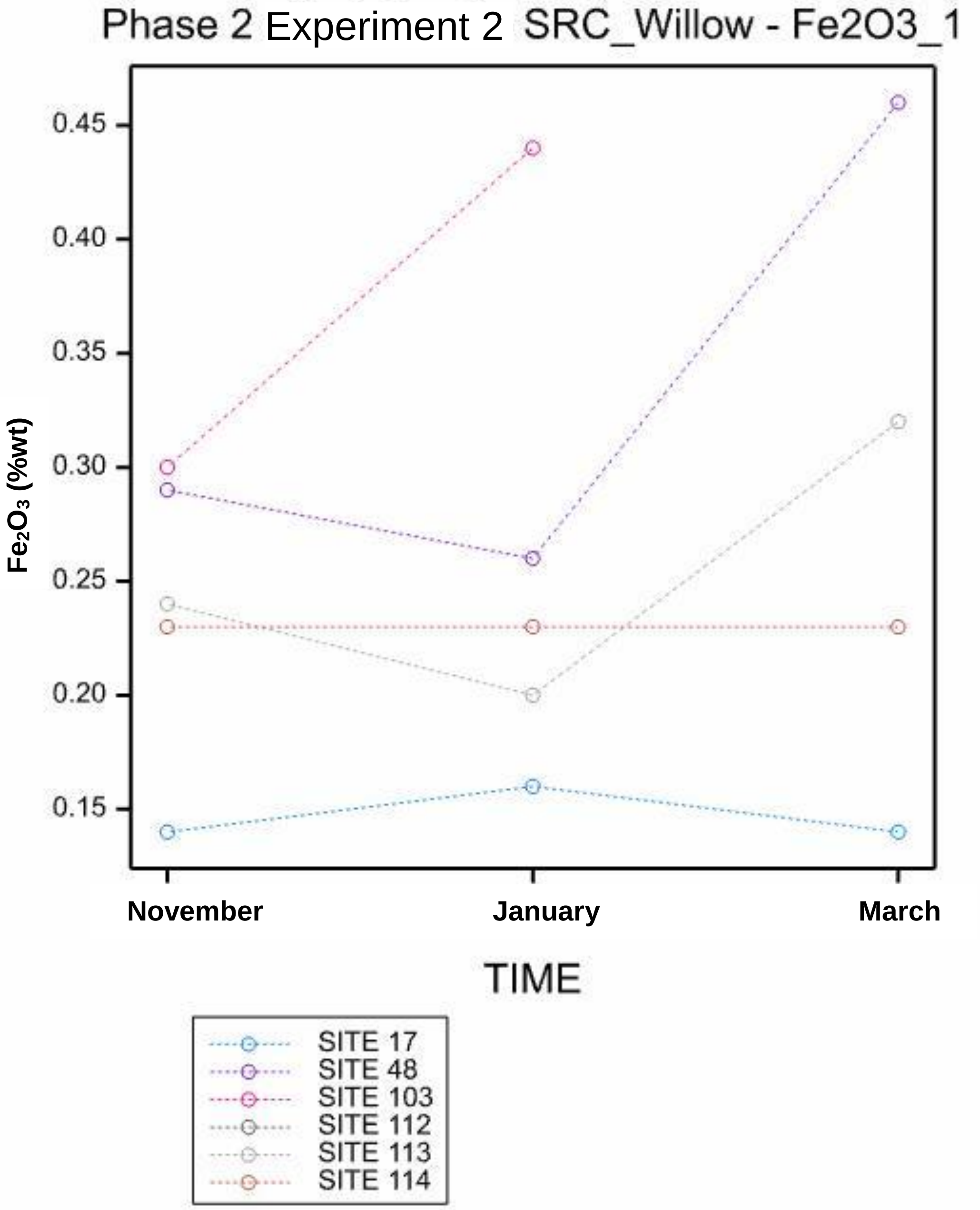


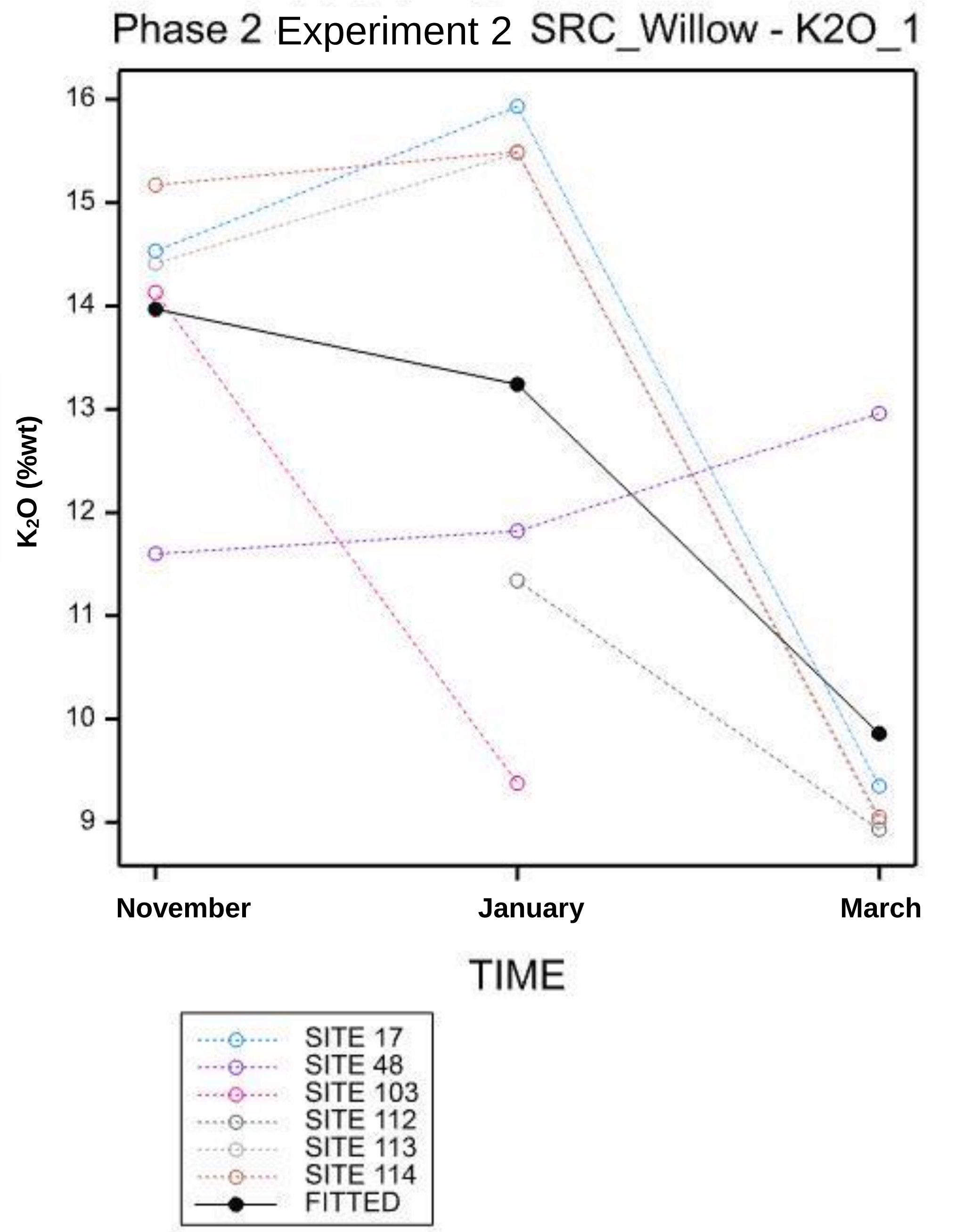
Phase 2 Experiment 2 SRC_Willow - Ti
Titanium content (mg/kg)
10
8
6
4
2
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

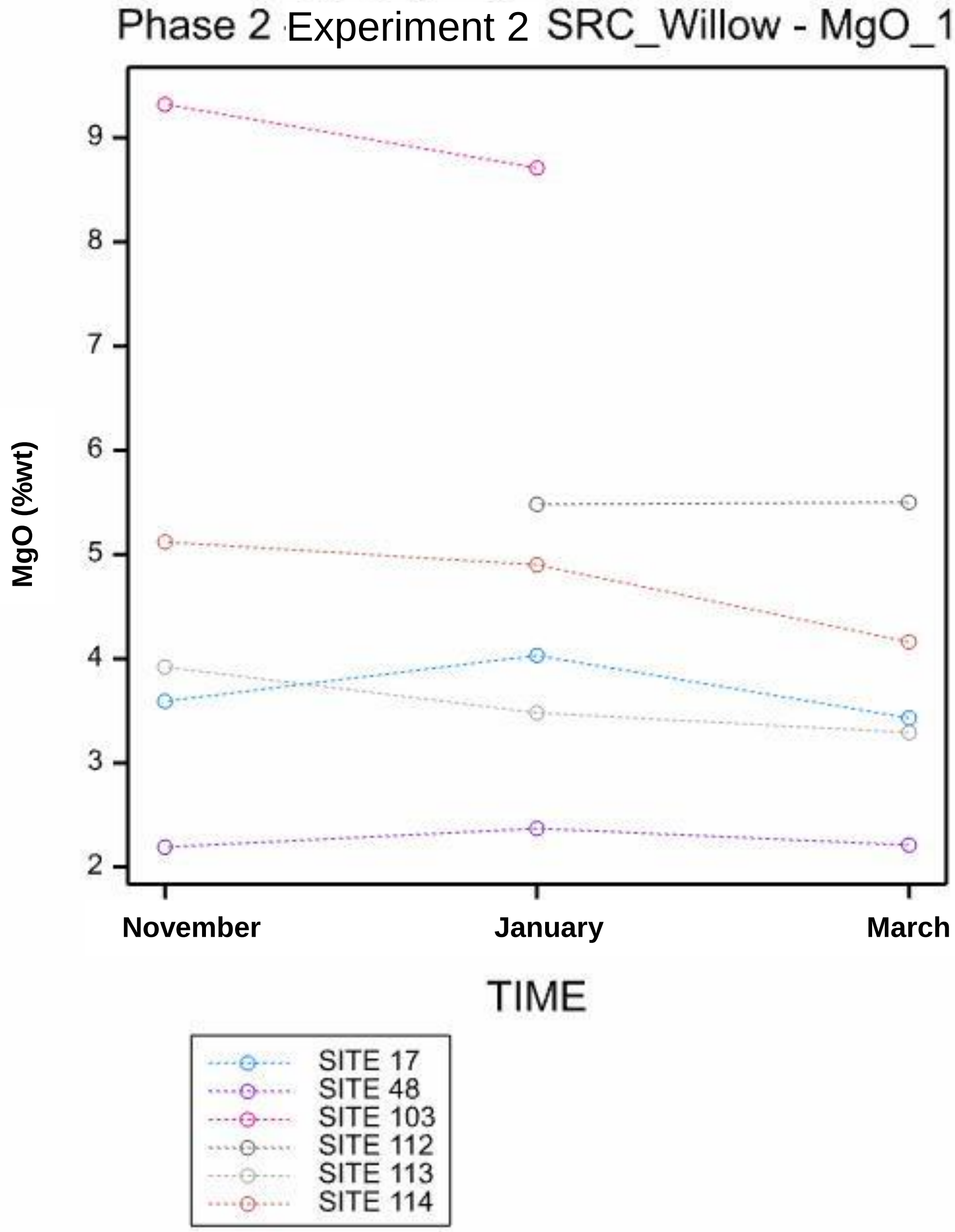

Phase 2 Experiment 2 SRC_Willow - Al2O3_1
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Al2O3 (%wt)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

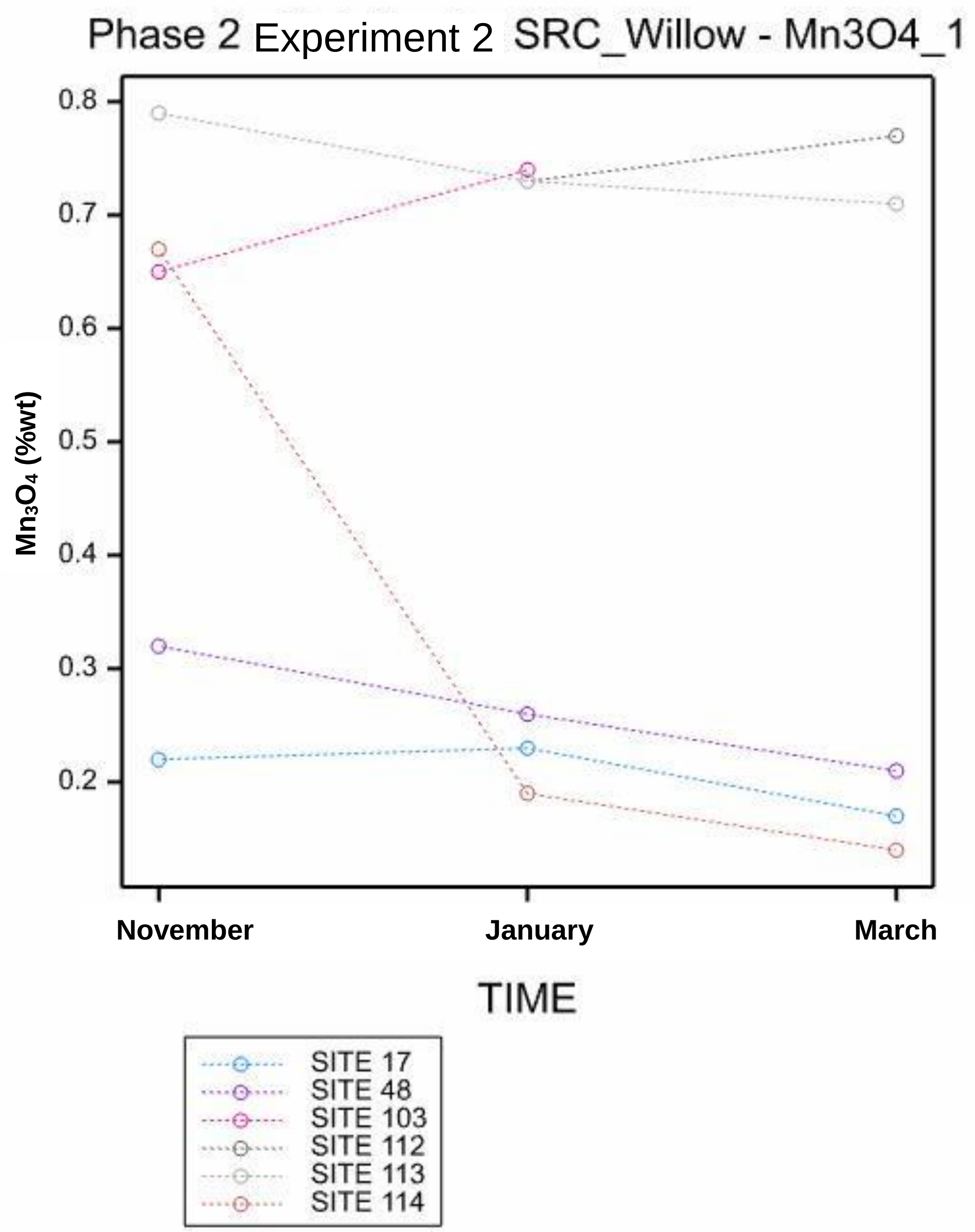

Phase 2 Experiment 2 SRC_Willow - BaO_1
BaO (%wt)
0.30
0.25
0.20
0.15
0.10
0.05
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114


Phase 2 Experiment 2 SRC_Willow - CaCO3
76
74
72
70
68
66
64
62
60
CaCO3 (%wt)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED

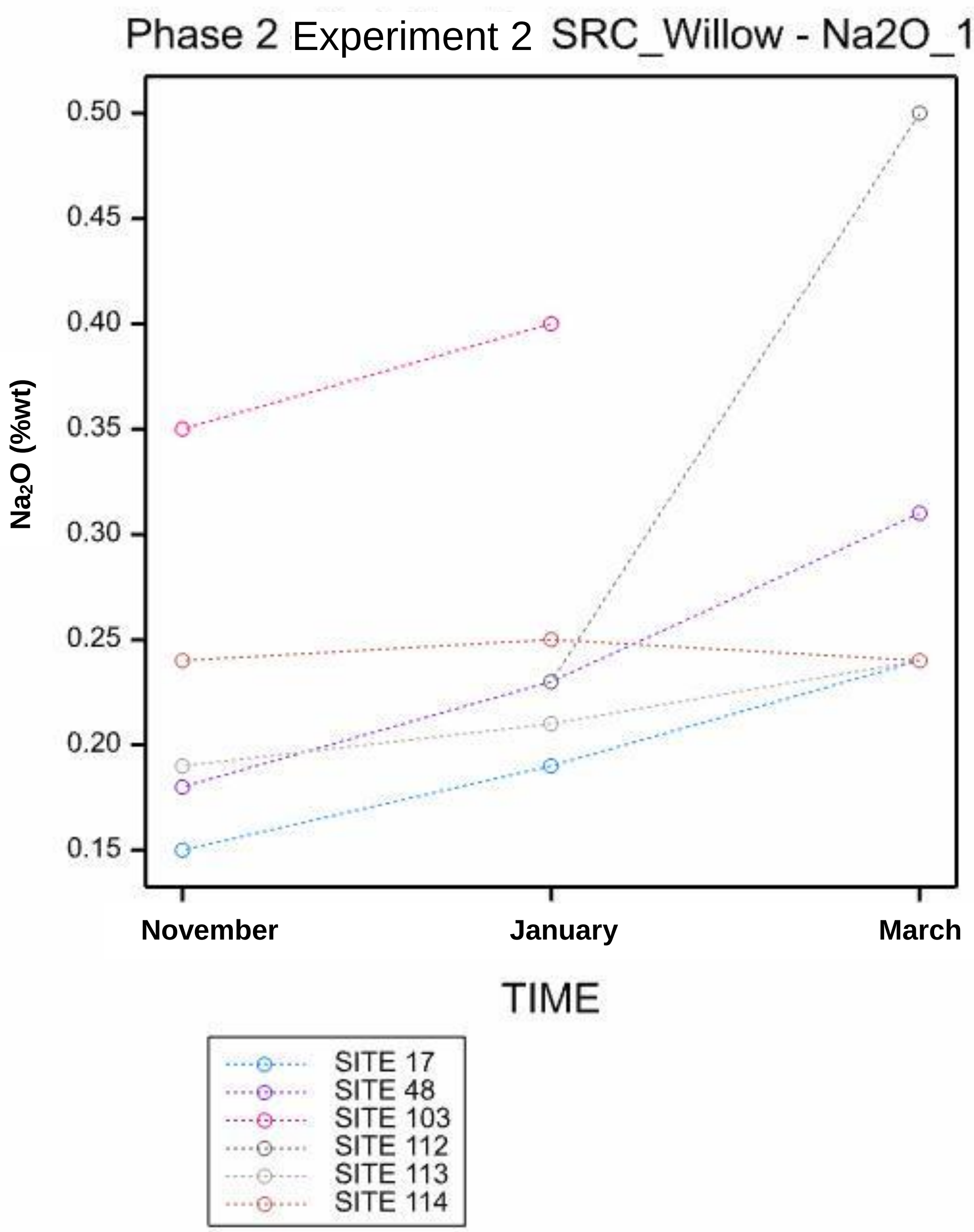

Phase 2 Experiment 2 SRC_Willow - Fe2O3_1
0.45
0.40
0.35
0.30
0.25
0.20
0.15
Fe2O3 (%wt)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

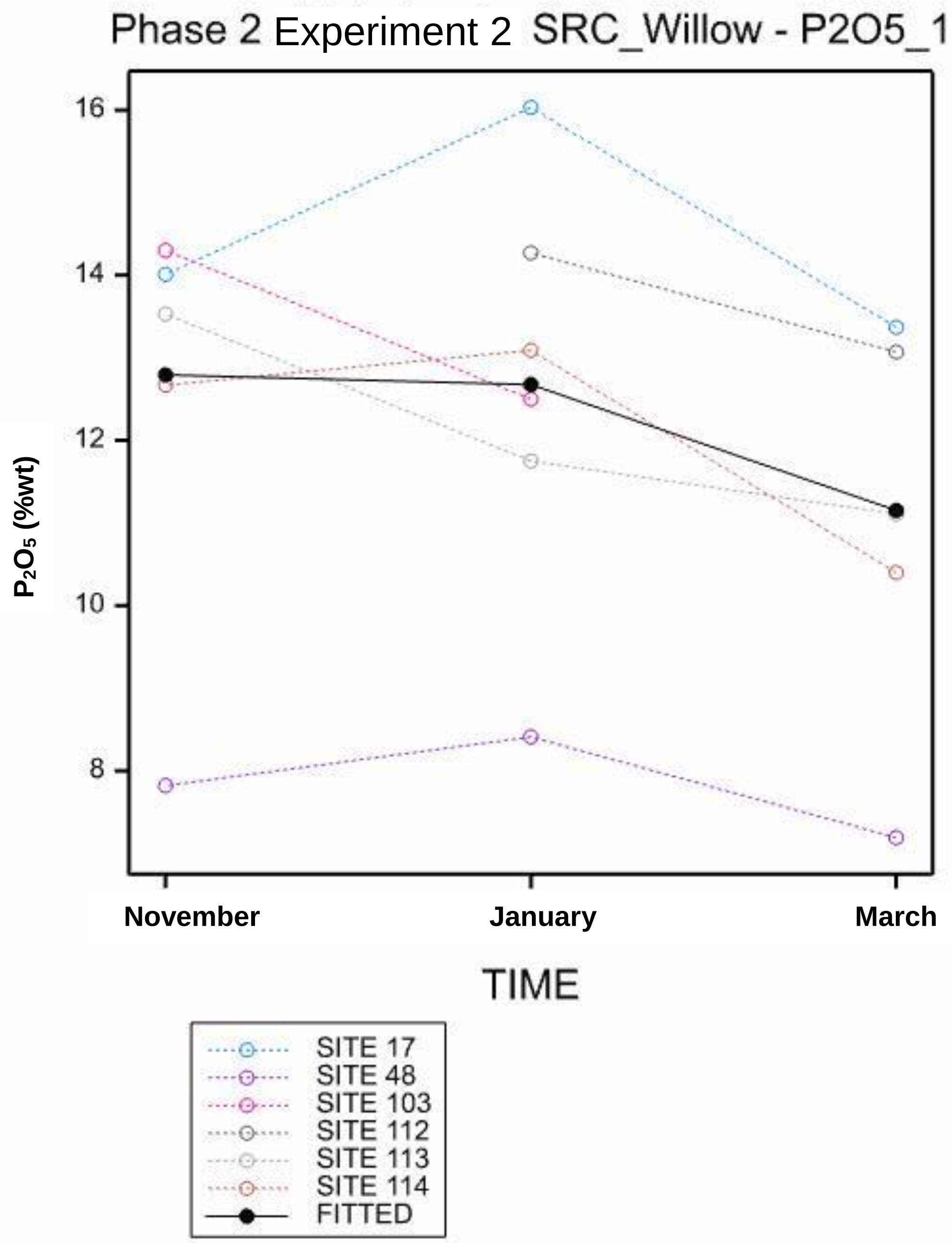

Phase 2 Experiment 2 SRC_Willow - K2O_1
16
15
14
13
12
11
10
9
K2O (%wt)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED


Phase 2 Experiment 2 SRC_Willow - MgO_1
MgO (%wt)
9
8
7
6
5
4
3
2
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

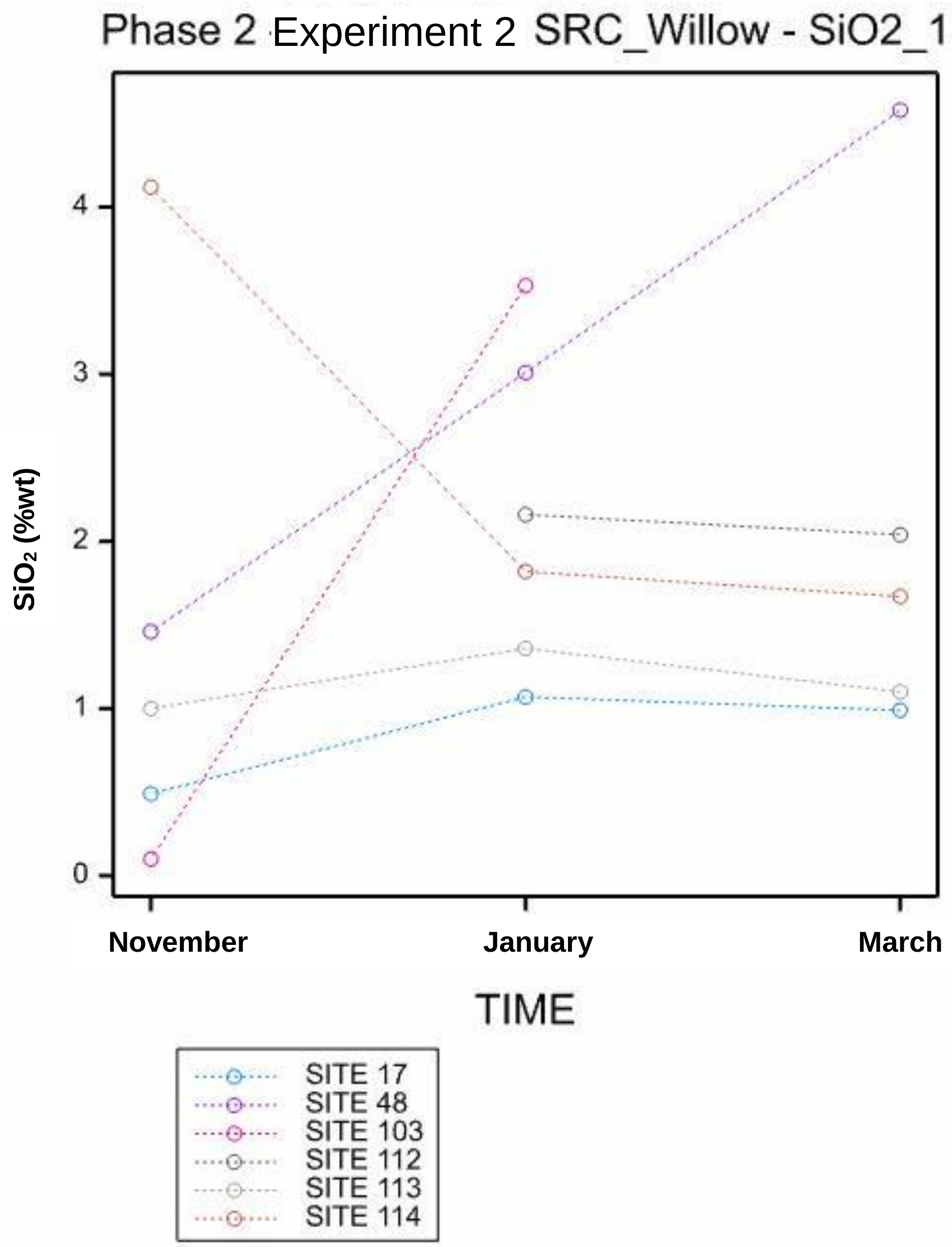


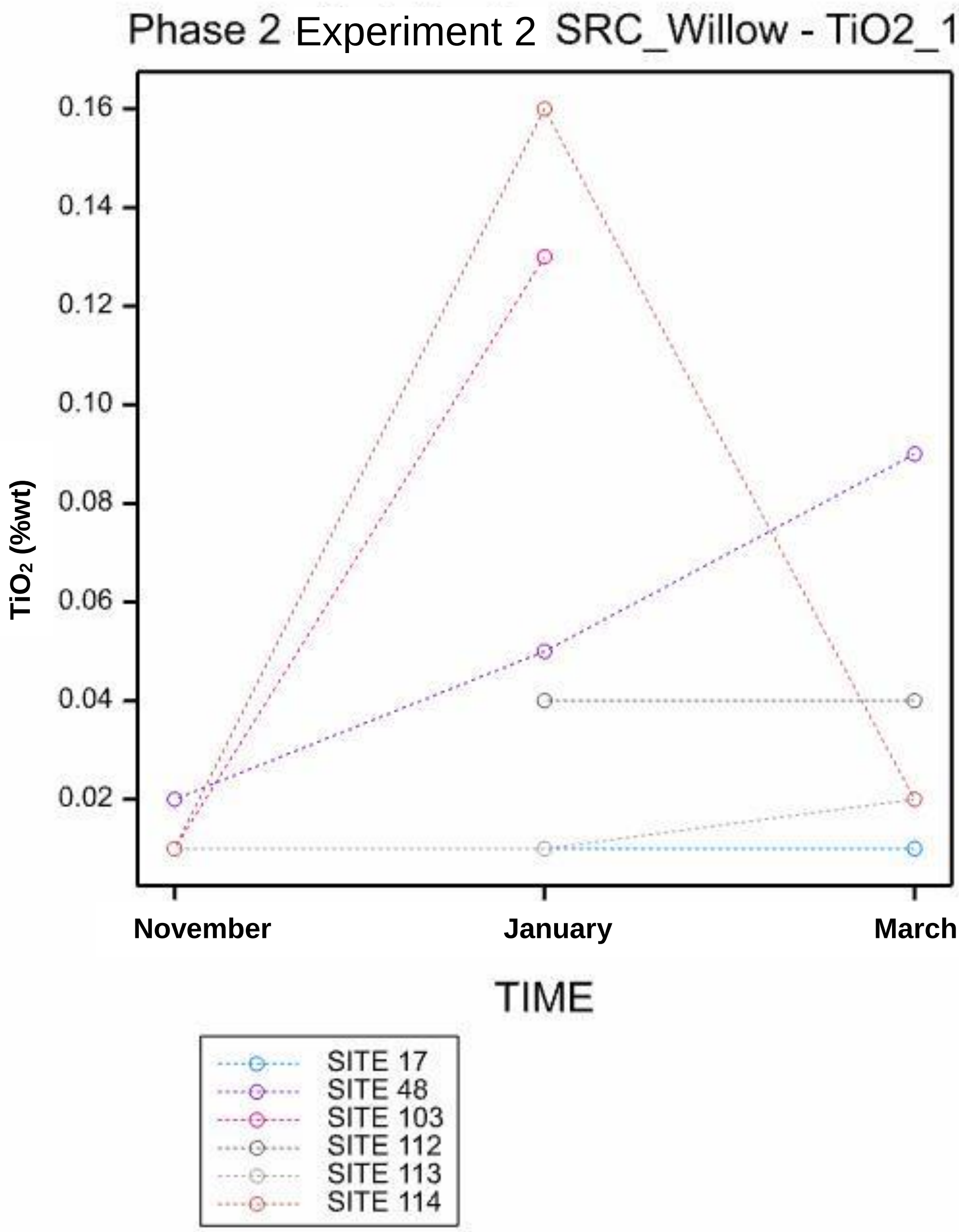
Phase 2 Experiment 2 SRC_Willow - Mn3O4_1
0.8
0.7
0.6
0.5
0.4
0.3
0.2
Mn3O4 (%wt)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

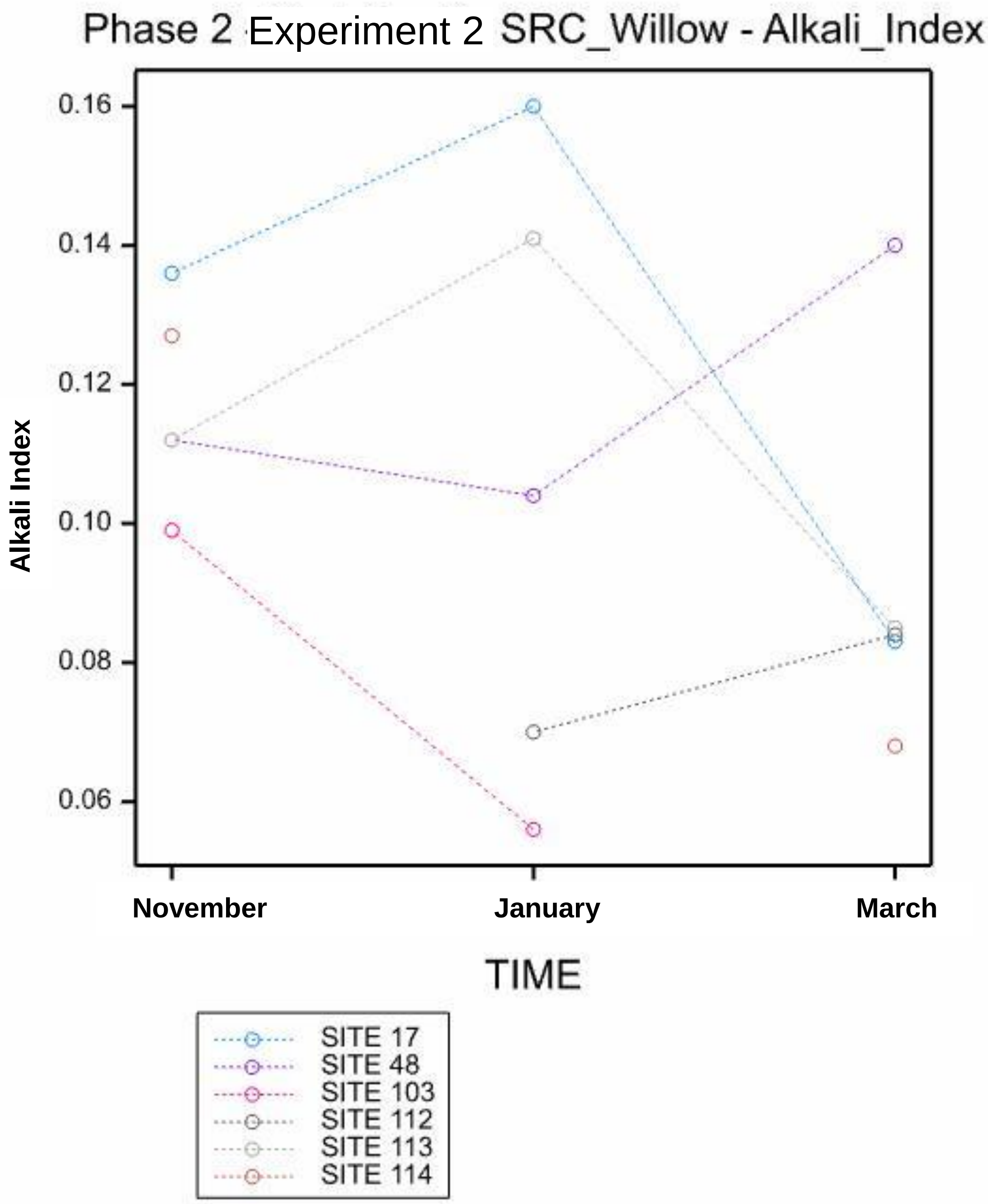

Phase 2 Experiment 2 SRC_Willow - Na2O_1
Na2O (%wt)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114



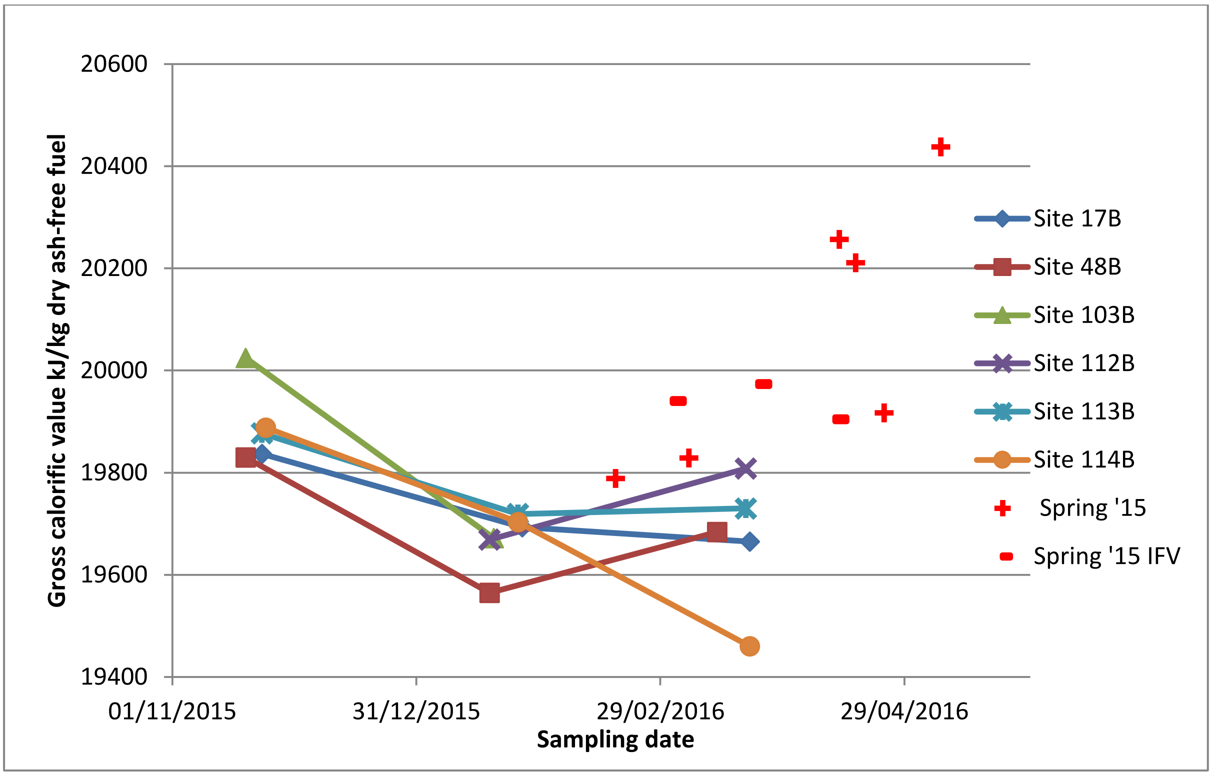
Phase 2 Experiment 2 SRC_Willow - P2O5_1
16
14
12
10
8
P2O5 (%wt)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114
FITTED

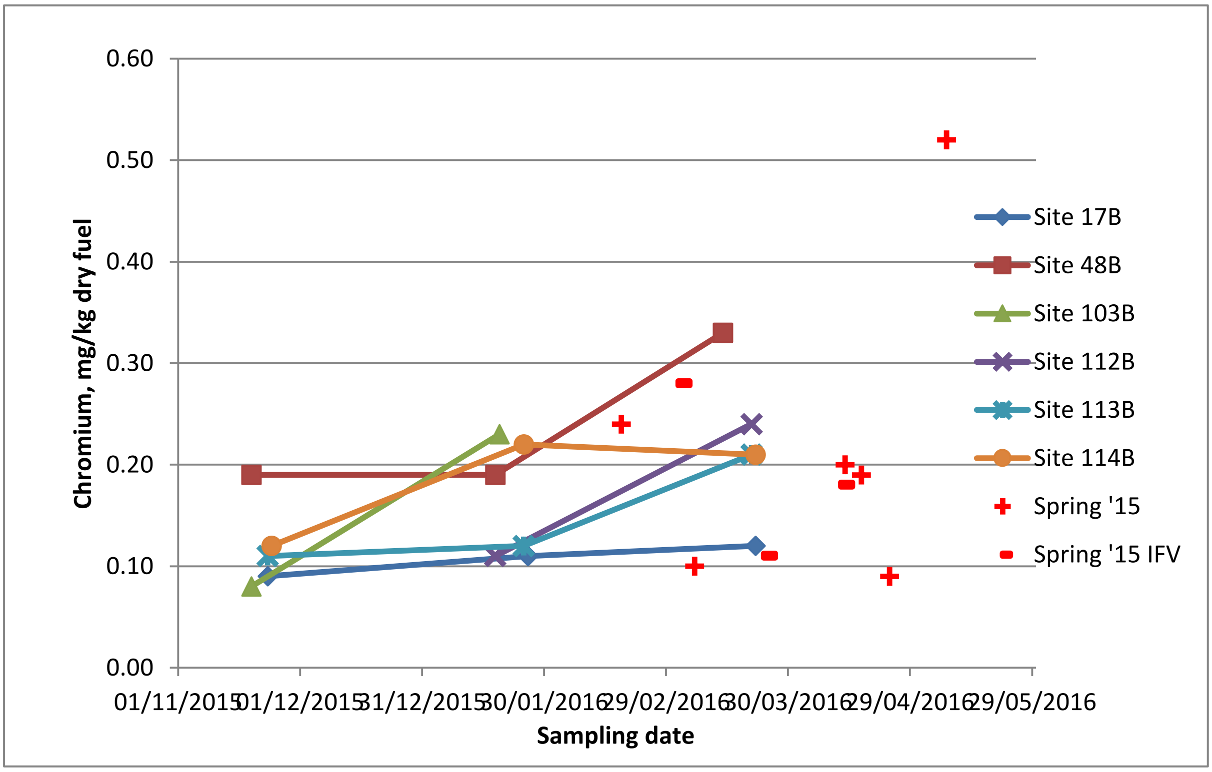

Phase 2 Experiment 2 SRC_Willow - SiO2_1
SiO2 (%wt)
0
1
2
3
4
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

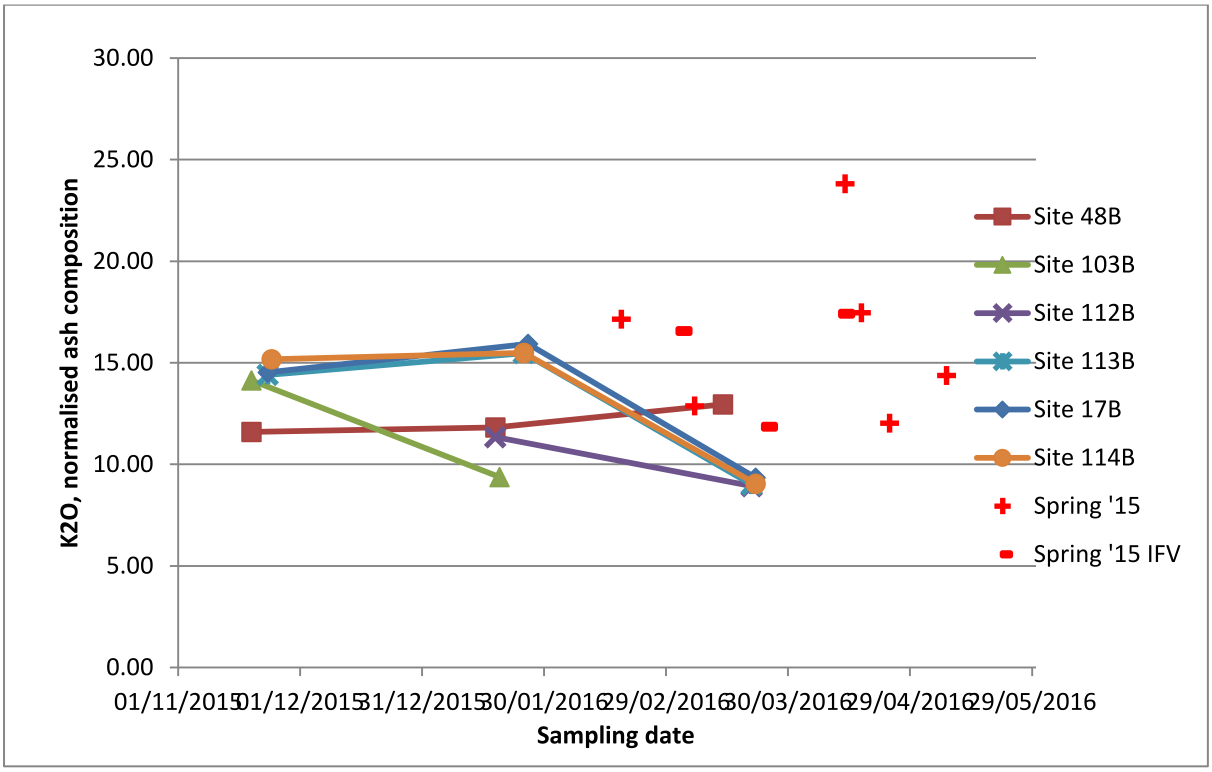

Phase 2 Experiment 2 SRC_Willow - TiO2_1
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
TiO2 (%wt)
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

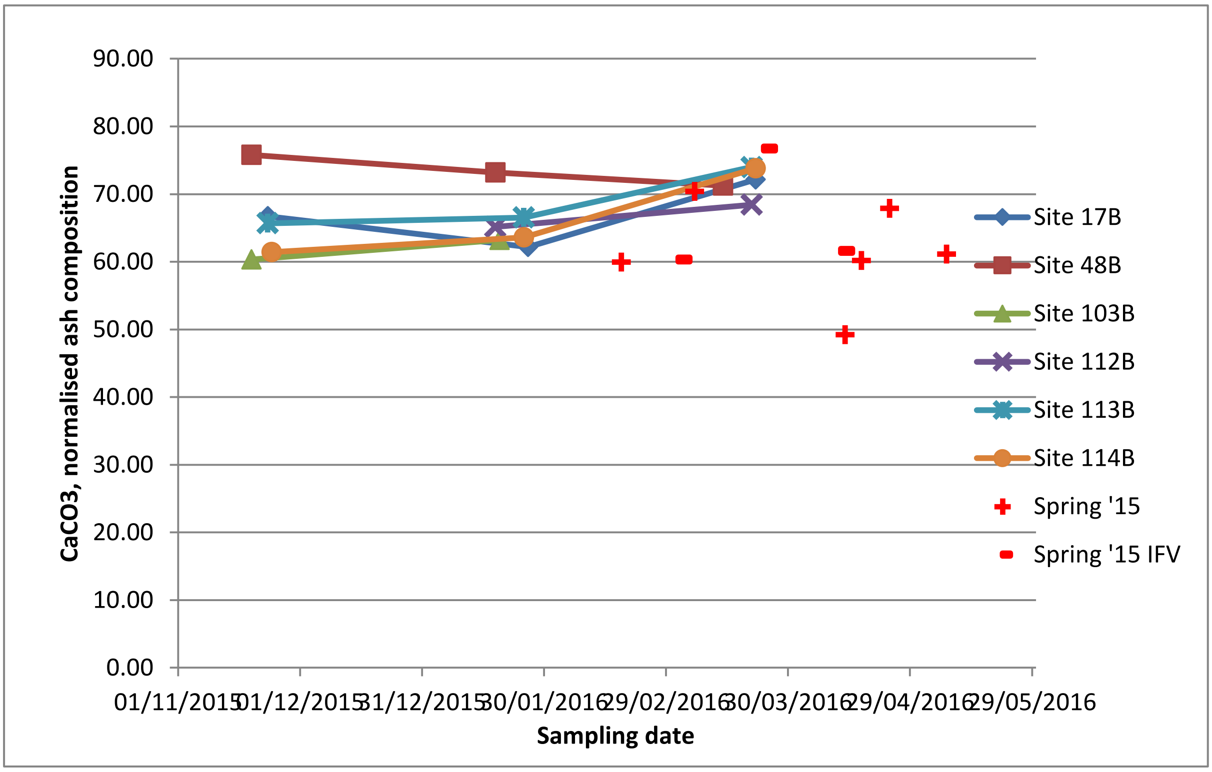

Phase 2 Experiment 2 SRC_Willow - Alkali_Index
Alkali Index
0.16
0.14
0.12
0.10
0.08
0.06
November
January
March
TIME
SITE 17
SITE 48
SITE 103
SITE 112
SITE 113
SITE 114

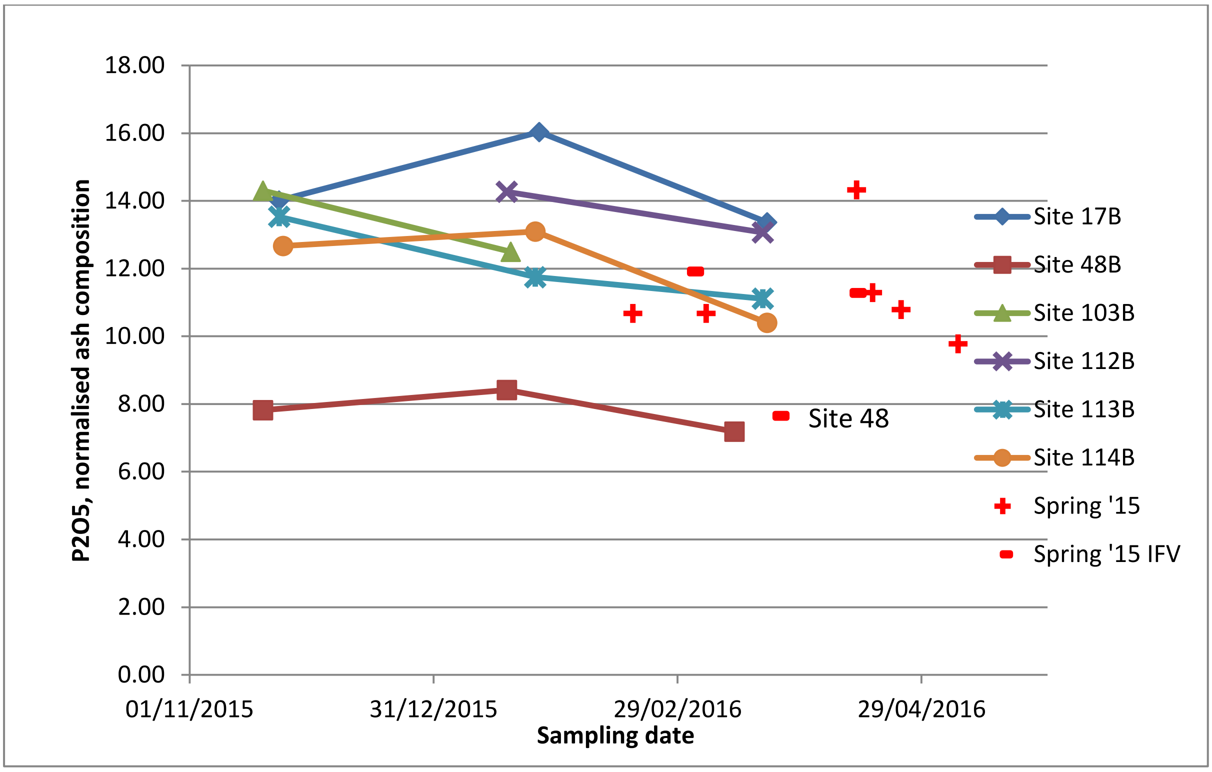
5. Graphs of comparable willow SRC feedstock characteristics in Spring 2015 and 2016. Note that data points from 2015 are overlaid on the equivalent day of 2016 .






30.00
25.00
20.00
15.00
10.00
5.00
0.00
K2O, normalised ash composition
01/11/2015
01/12/2015
31/12/2015
30/01/2016
29/02/2016
30/03/2016
29/04/2016
29/05/2016
Sampling date
Site 48B
Site 103B
Site 112B
Site 113B
Site 17B
Site 114B
Spring '15
Spring '15 IFV


90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
CaCO3, normalised ash composition
01/11/2015
01/12/2015
31/12/2015
30/01/2016
29/02/2016
30/03/2016
29/04/2016
29/05/2016
Sampling date
Site 17B
Site 48B
Site 103B
Site 112B
Site 113B
Site 114B
Spring '15
Spring '15 IFV



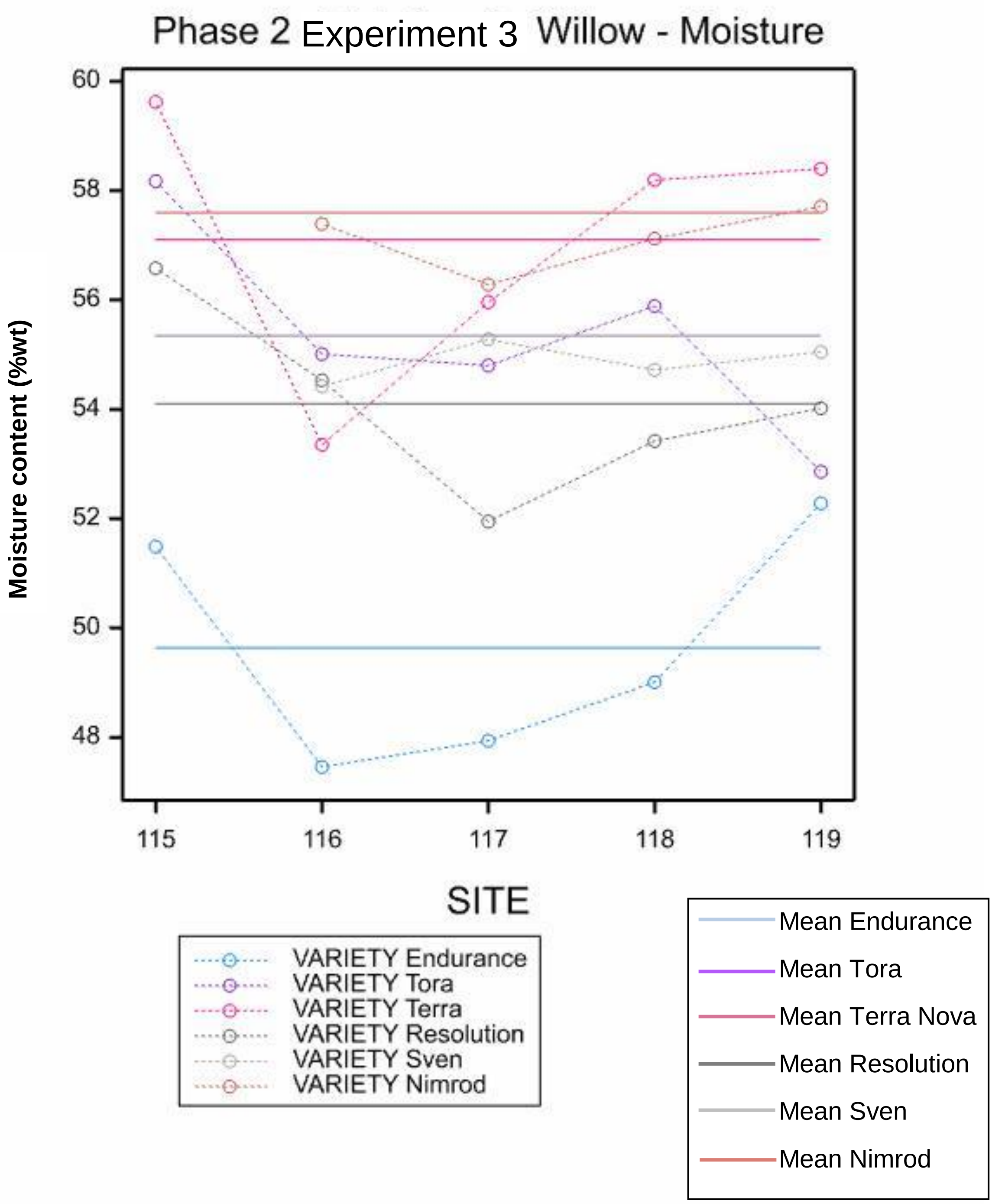
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
P2O5, normalised ash composition
01/11/2015
31/12/2015
29/02/2016
29/04/2016
Sampling date
Site 48
Site 17B
Site 48B
Site 103B
Site 112B
Site 113B
Site 114B
Spring '15
Spring '15 IFV

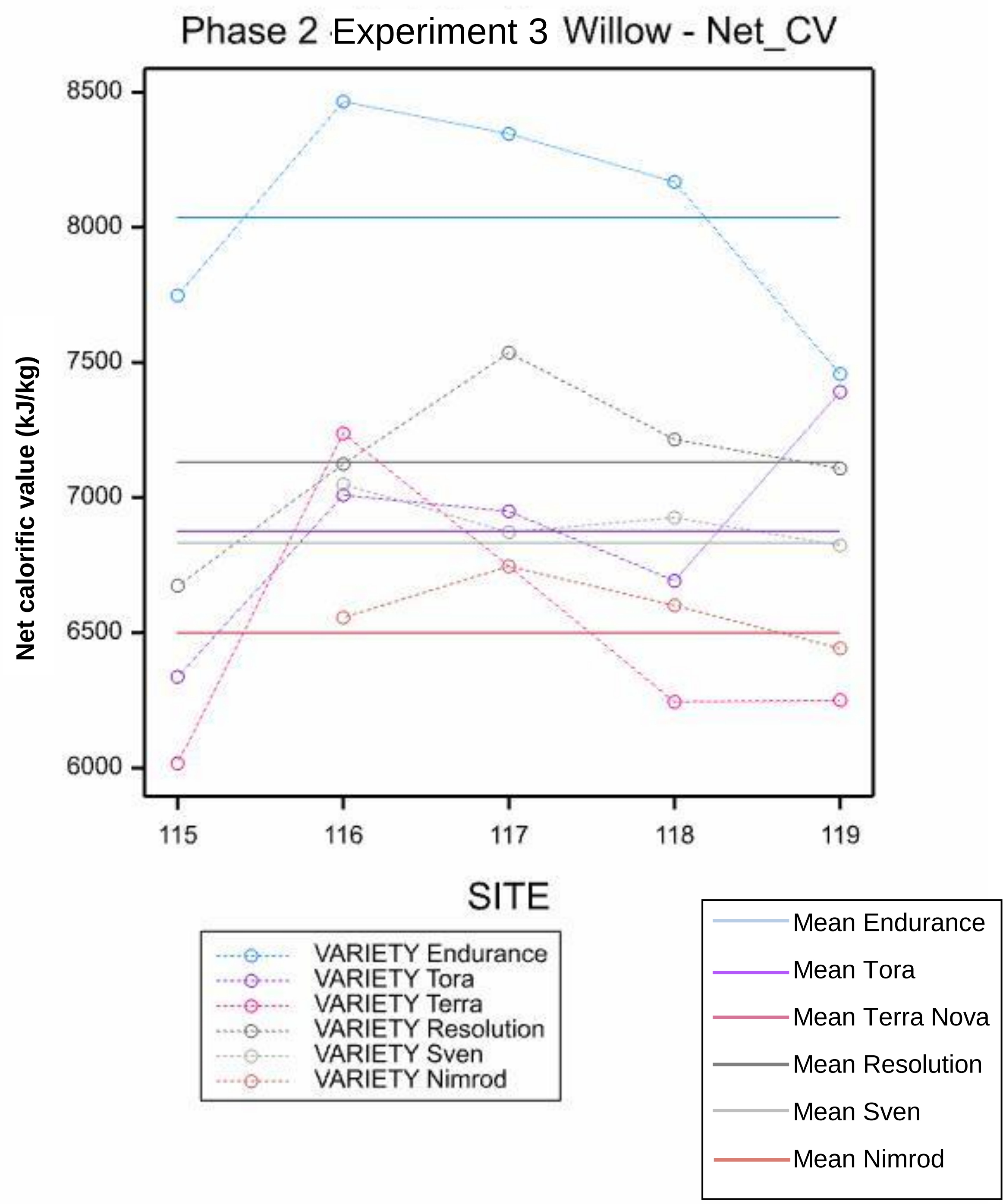
6. Graphs of all willow SRC feedstock characteristics for six varieties (Endurance, Nimrod, Resolution, Sven, Terra Nova, and Tora) at four-five sites (Aberystwyth, Brook Hall, Long Ashton, Loughall, and Rothamsted)

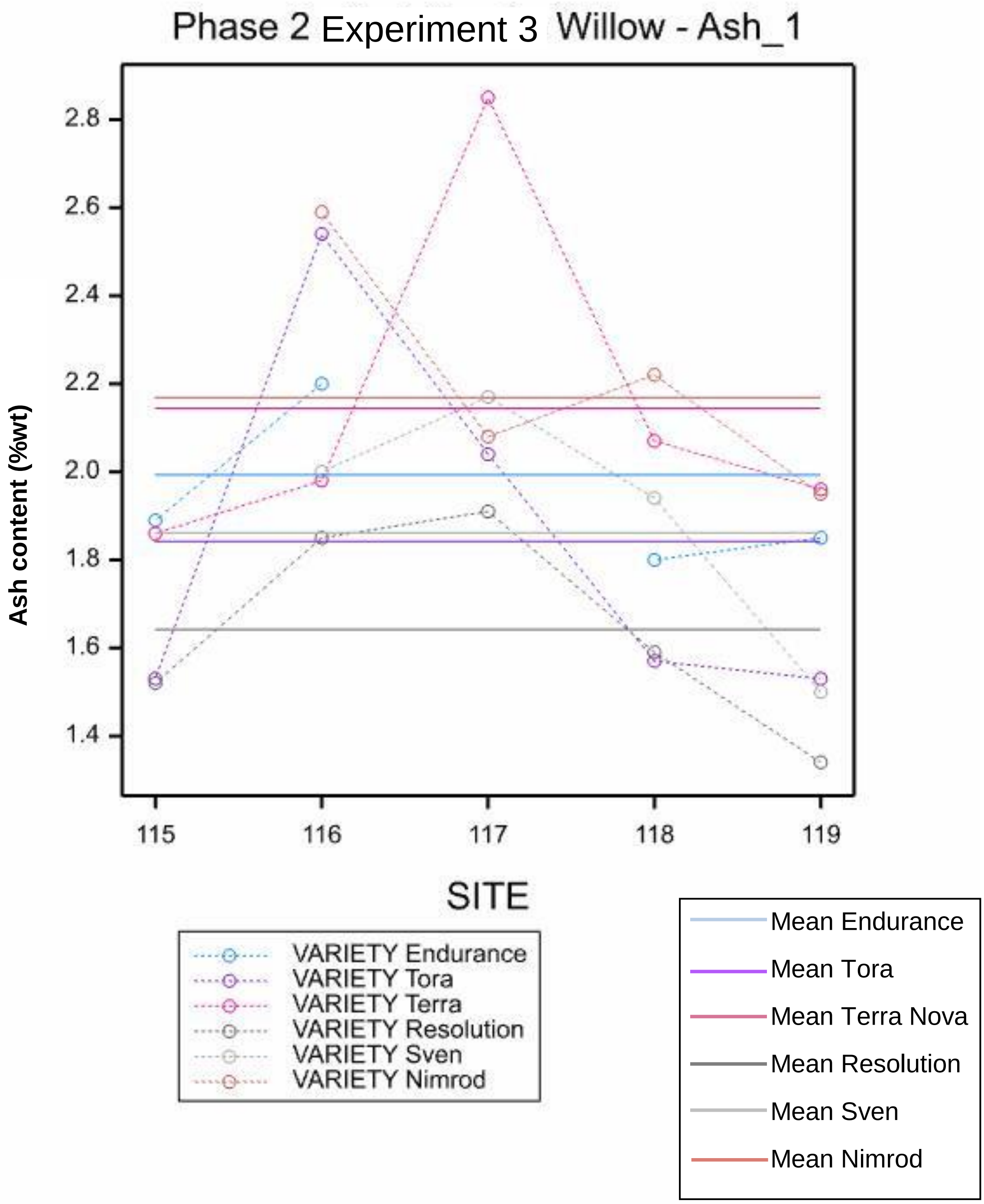
Table 3 List of variables and bases for analysis

Variable	Basis of analysis
Moisture	As received
Net calorific value	As received
Ash content	Dry fuel
Volatile matter	Dry, ash free
Gross calorific value: GCV_1	Dry fuel
Gross calorific value: GCV_2	Dry, ash free
Carbon: C	Dry fuel
Carbon: C_1	Dry, ash free
Hydrogen: H_1	Dry fuel
Hydrogen: H_2	Dry, ash free
Nitrogen: N	Dry fuel
Nitrogen: N_1	Dry, ash free
Sulphur_1	Dry fuel
Sulphur_2	Dry, ash free
Chlorine_1	Dry fuel
Chlorine_2	Dry, ash free
Barium	Dry fuel
Beryllium	Dry fuel
Chromium	Dry fuel
Cobalt	Dry fuel
Copper	Dry fuel
Molybdenum	Dry fuel
Nickel	Dry fuel
Vanadium	Dry fuel
Zinc	Dry fuel
Antimony	Dry fuel
Arsenic	Dry fuel
Mercury	Dry fuel
Fluorine	Dry fuel
Bromine	Dry fuel
Selenium	Dry fuel
Cadmium	Dry fuel
Lead	Dry fuel
Aluminium	Dry fuel
Calcium	Dry fuel
Iron	Dry fuel
Potassium	Dry fuel
Magnesium	Dry fuel
Manganese	Dry fuel
Sodium	Dry fuel
Phosphorous	Dry fuel
Silicon	Dry fuel
Titanium	Dry fuel
Al_2O_3	Normalized ash
BaO	Normalized ash
$CaCO_3$	Normalized ash
Fe_2O_3	Normalized ash
K_2O	Normalized ash
MgO	Normalized ash
Mn_3O_4	Normalized ash
Na_2O	Normalized ash
P_2O_5	Normalized ash

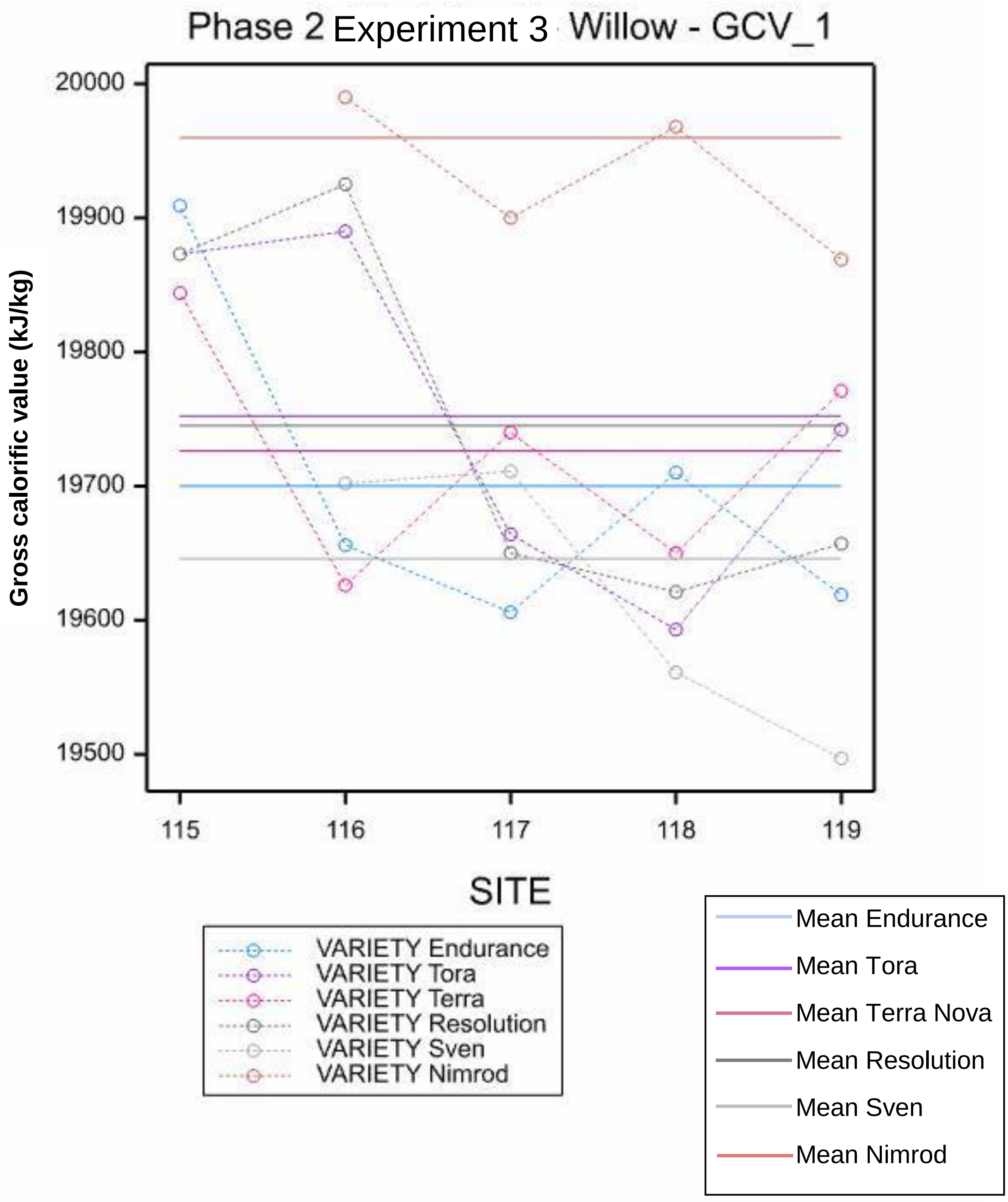
SiO_2 TiO_2 Alkali index	Normalized ash Normalized ash

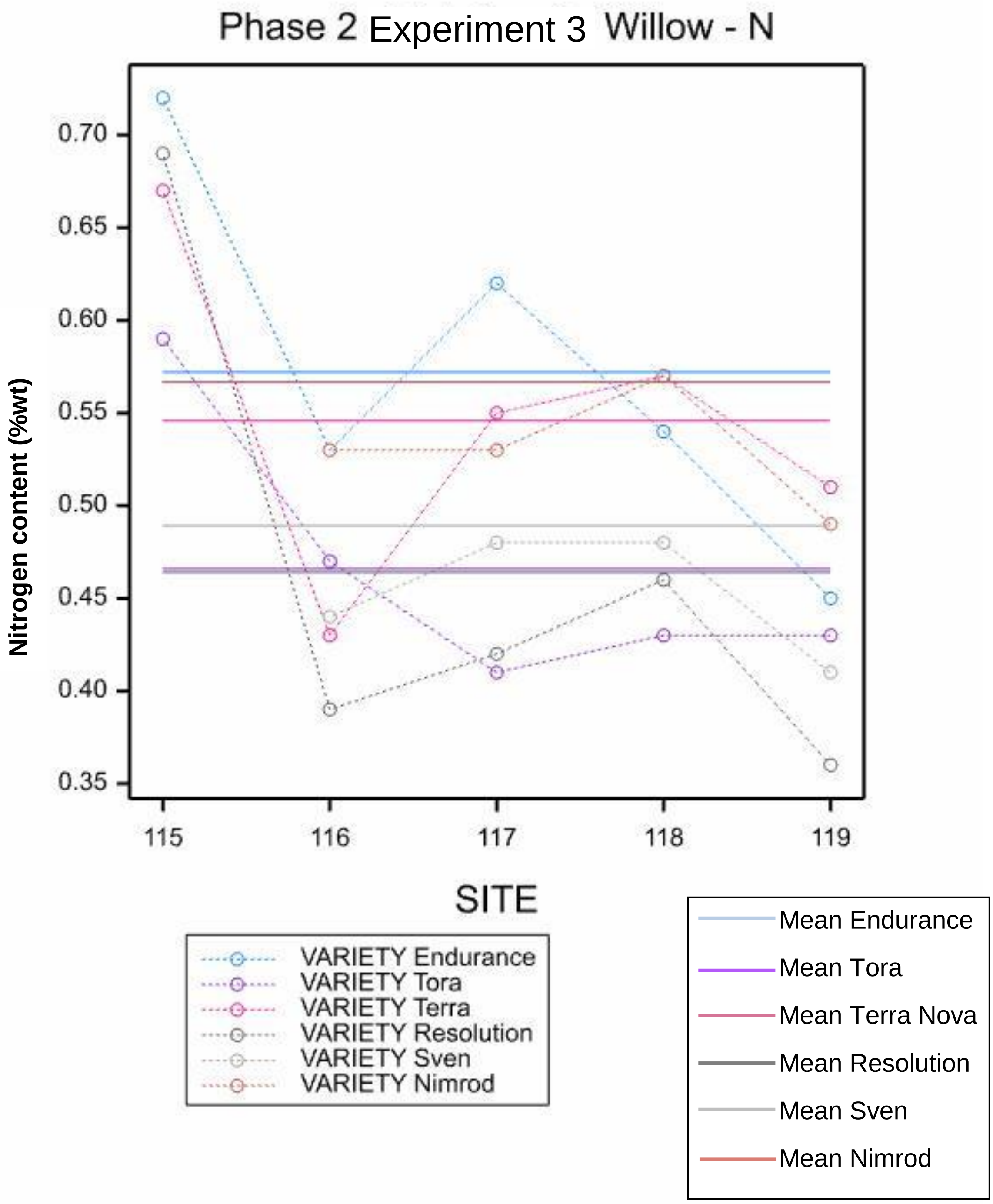

Phase 2 Experiment 3 Willow - Moisture
Moisture content (%wt)
60
58
56
54
52
50
48
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

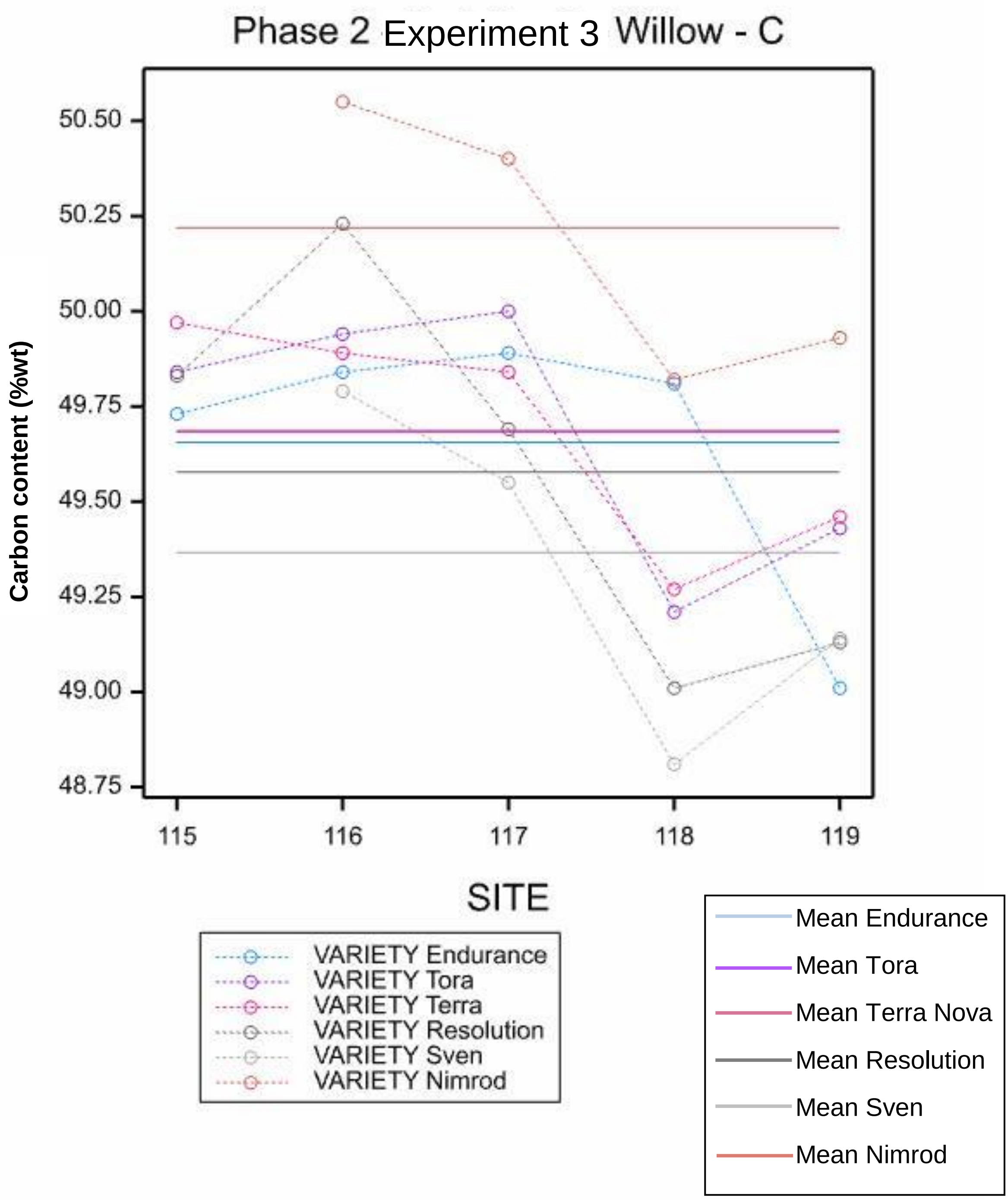

Phase 2 Experiment 3 Willow - Net_CV
Net calorific value (kJ/kg)
8500
8000
7500
7000
6500
6000
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

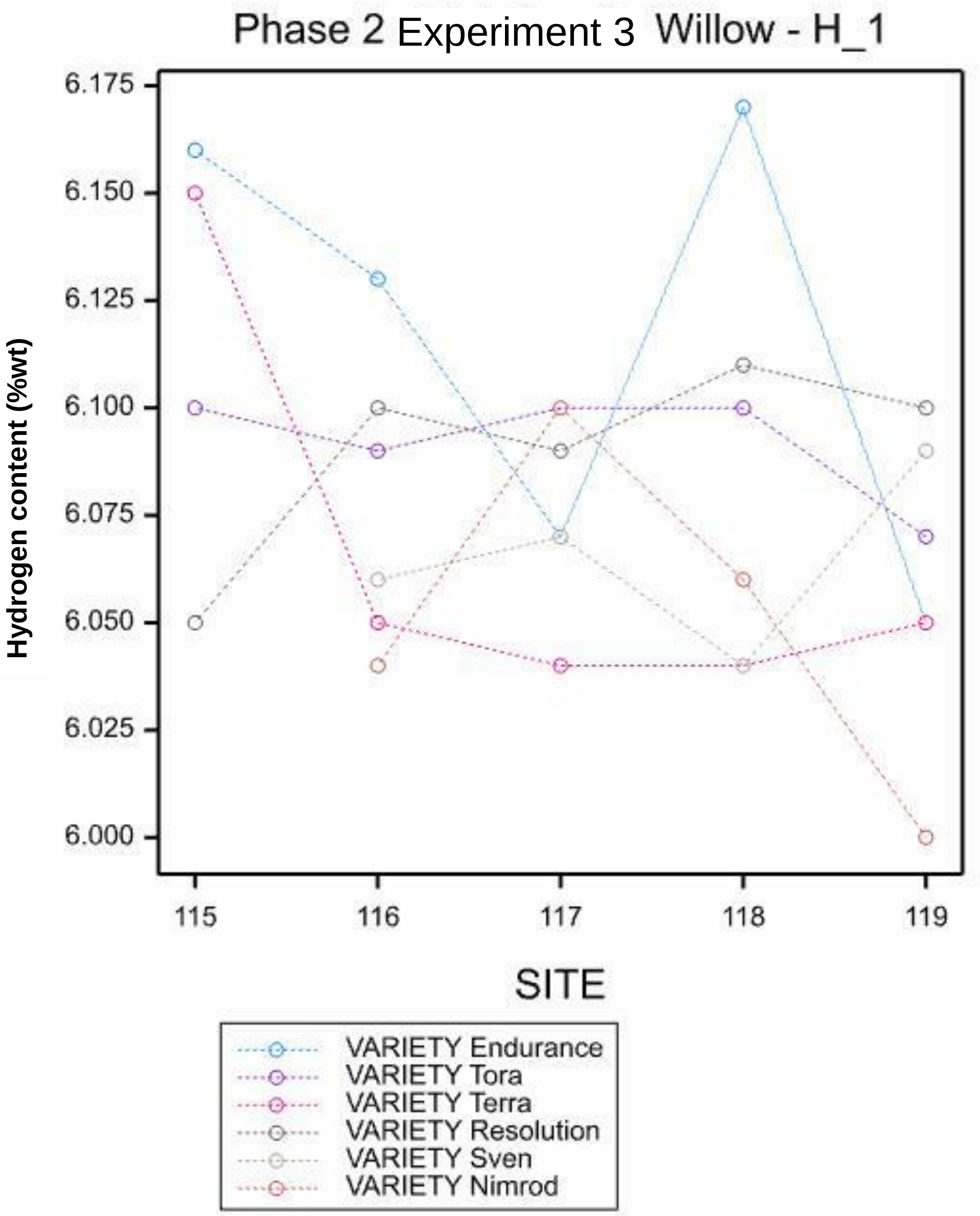


Phase 2 Experiment 3 Willow - Ash_1
Ash content (%wt)
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

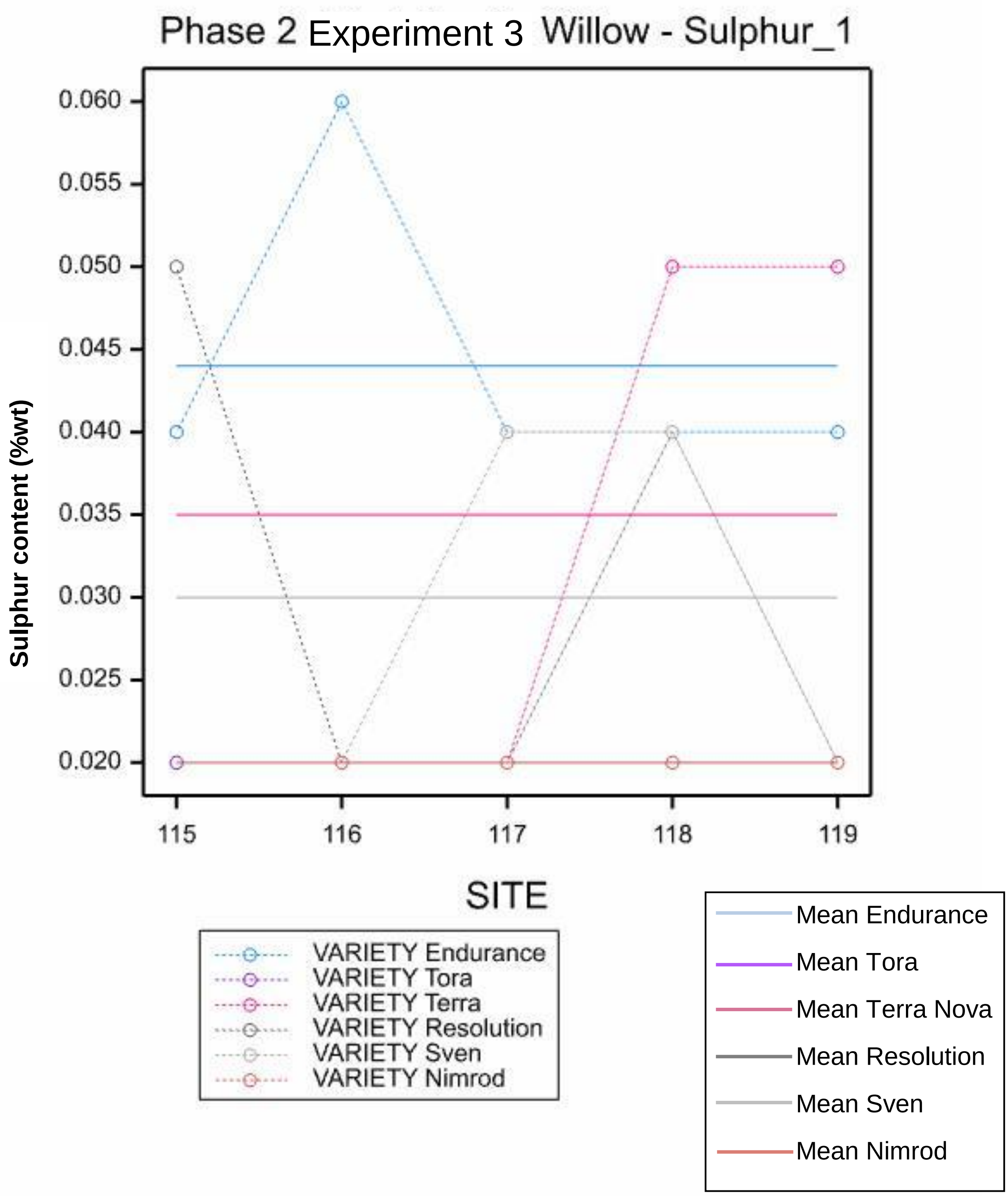

Phase 2 Experiment 3 Willow - GCV_1
Gross calorific value (kJ/kg)
20000
19900
19800
19700
19600
19500
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

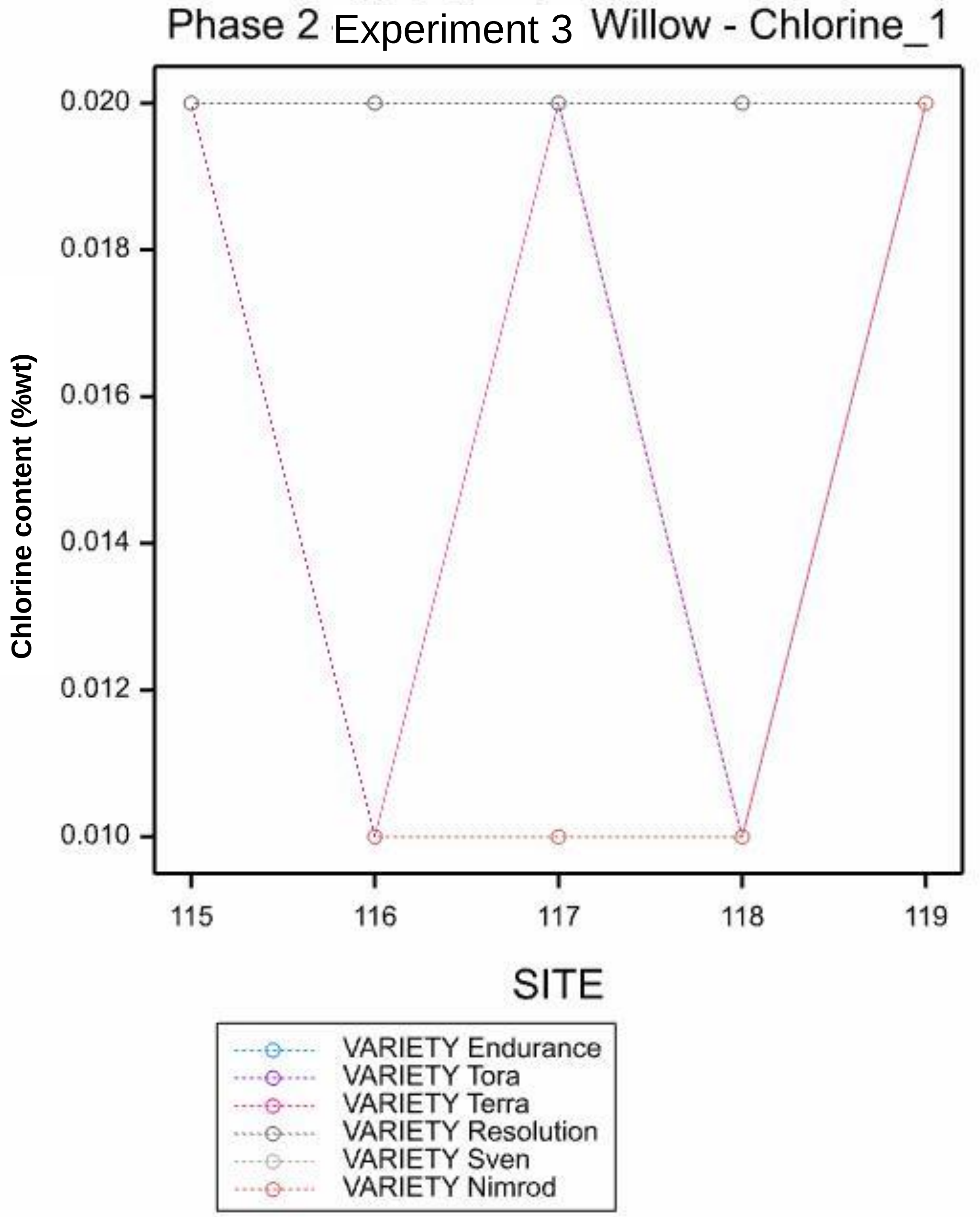

Phase 2 Experiment 3 Willow - N
Nitrogen content (%wt)
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

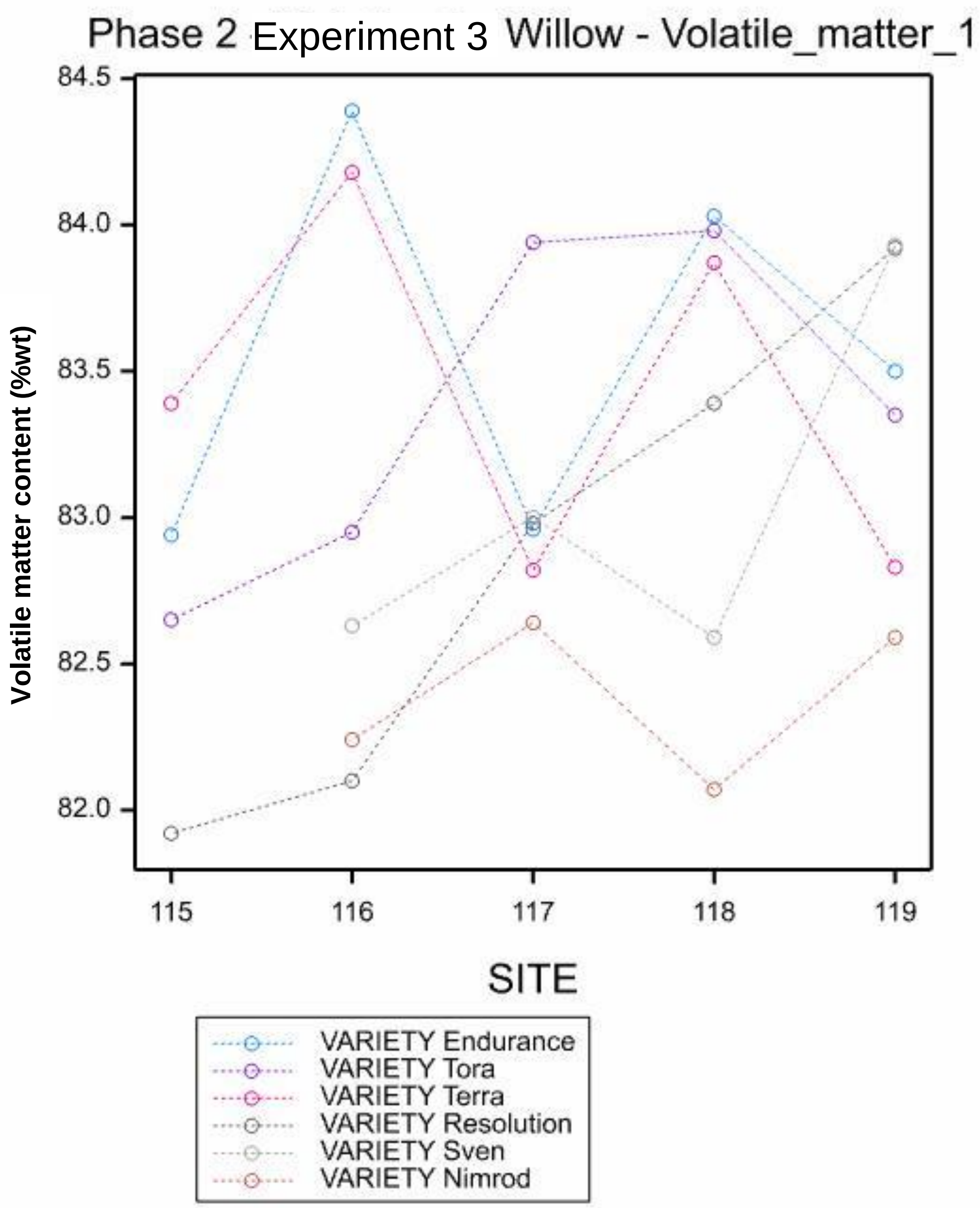

Phase 2 Experiment 3 Willow - C
Carbon content (%wt)
50.50
50.25
50.00
49.75
49.50
49.25
49.00
48.75
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod



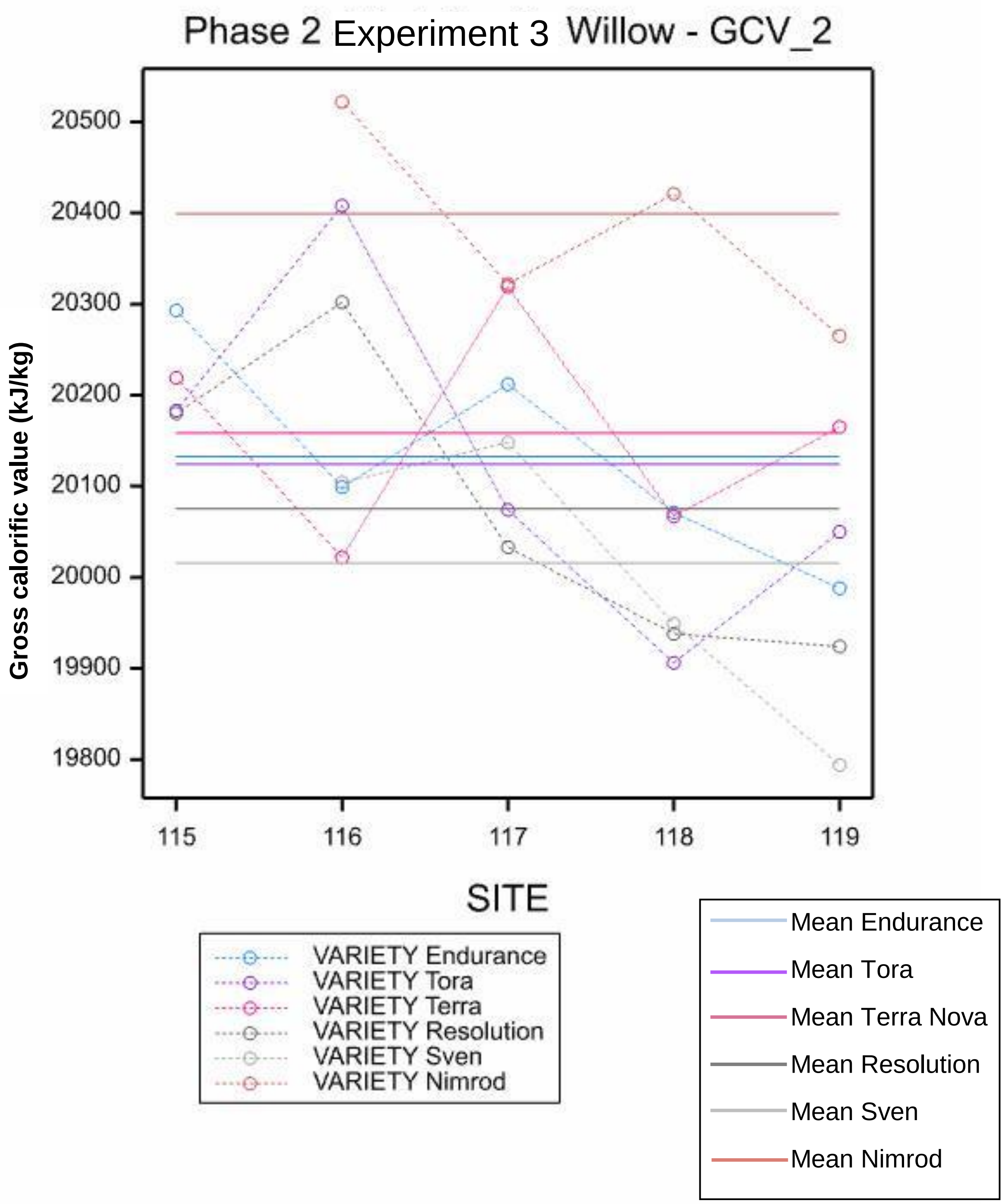
Phase 2 Experiment 3 Willow - H_1
6.175
6.150
6.125
6.100
6.075
6.050
6.025
6.000
Hydrogen content (%wt)
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

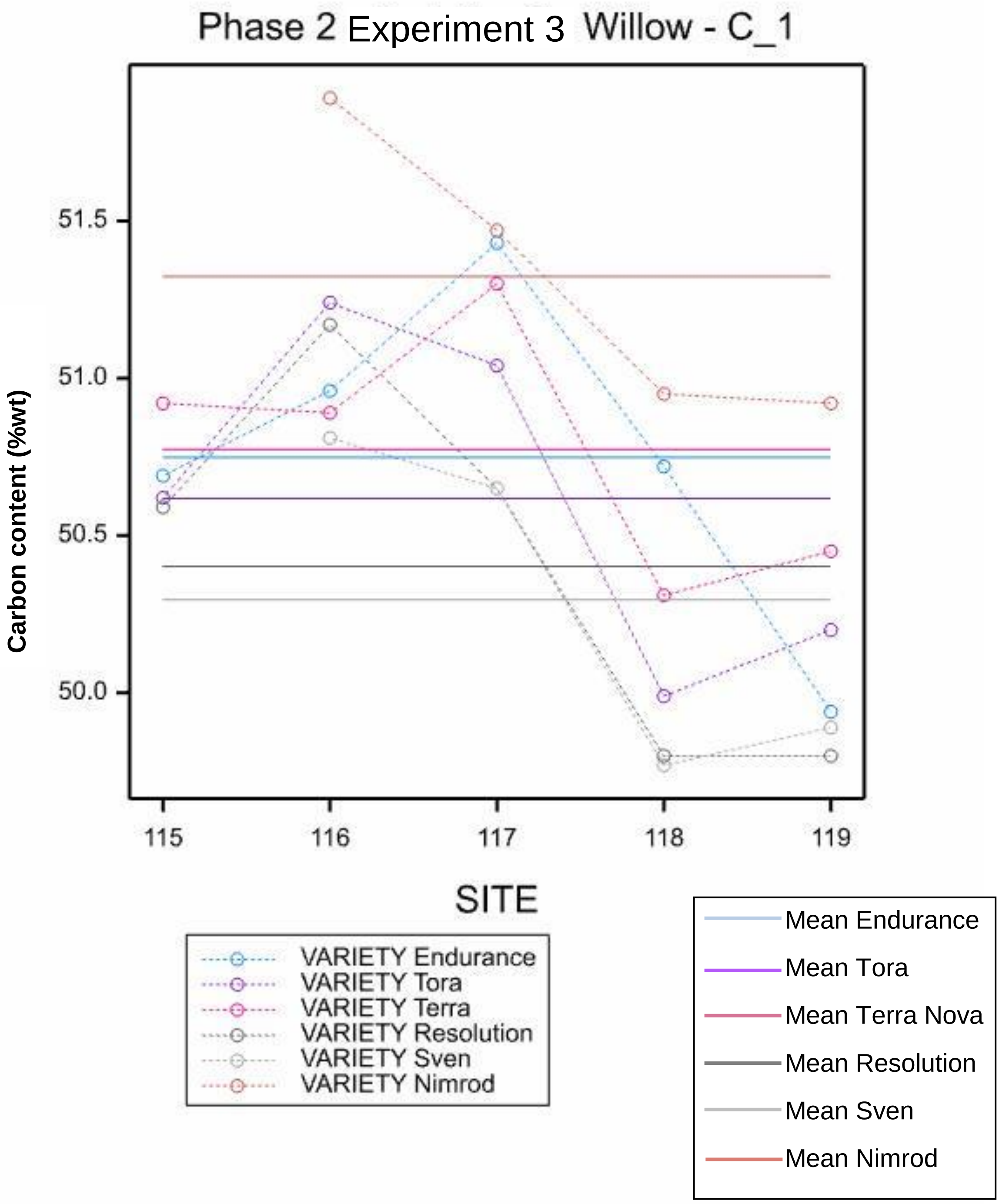

Phase 2 Experiment 3 Willow - Sulphur_1
Sulphur content (%wt)
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod


Phase 2 Experiment 3 Willow - Chlorine_1
Chlorine content (%wt)
0.020
0.018
0.016
0.014
0.012
0.010
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

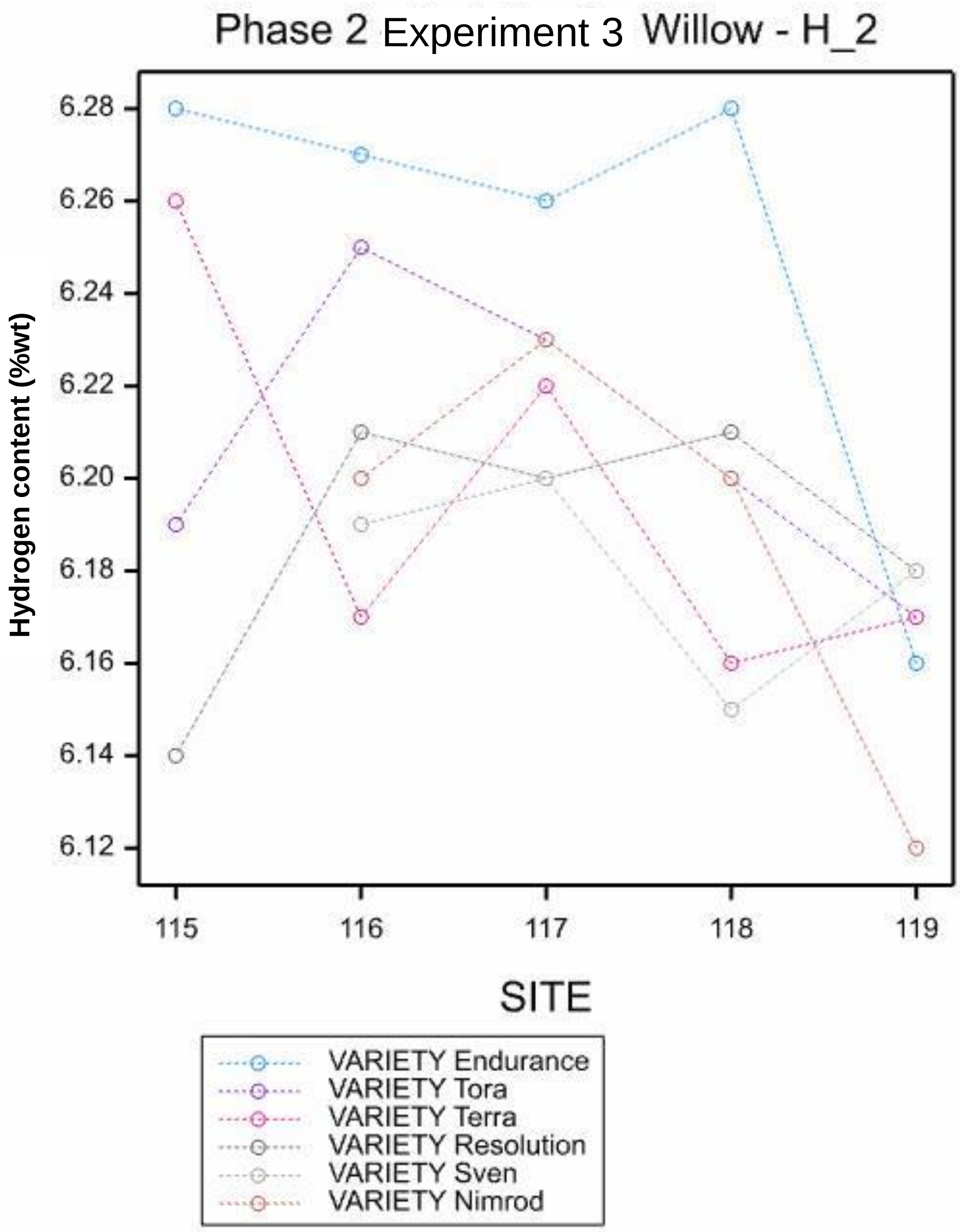


Phase 2 Experiment 3 Willow - Volatile_matter_1
Volatile matter content (%wt)
84.5
84.0
83.5
83.0
82.5
82.0
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

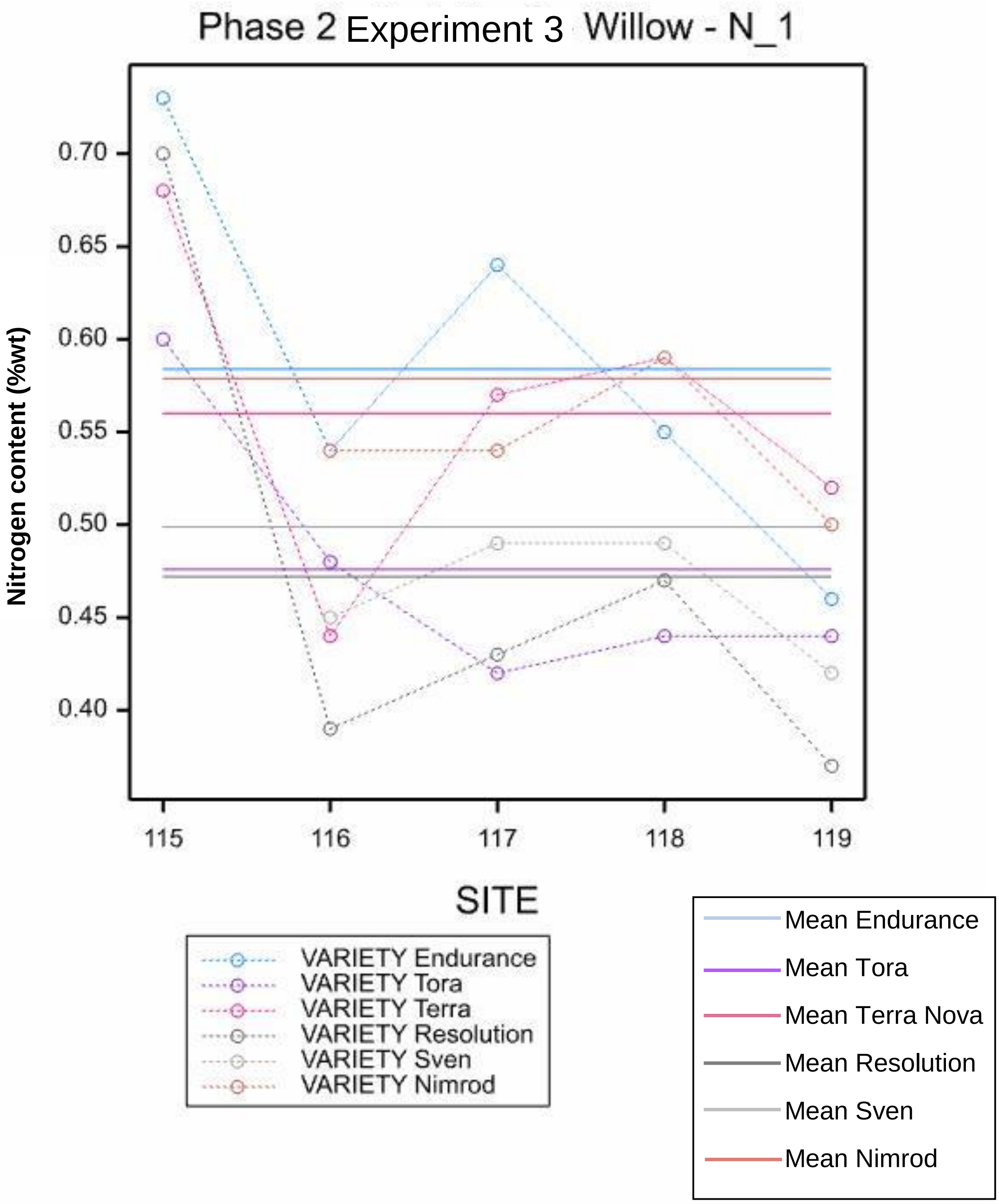

Phase 2 Experiment 3 Willow - GCV_2
Gross calorific value (kJ/kg)
20500
20400
20300
20200
20100
20000
19900
19800
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod



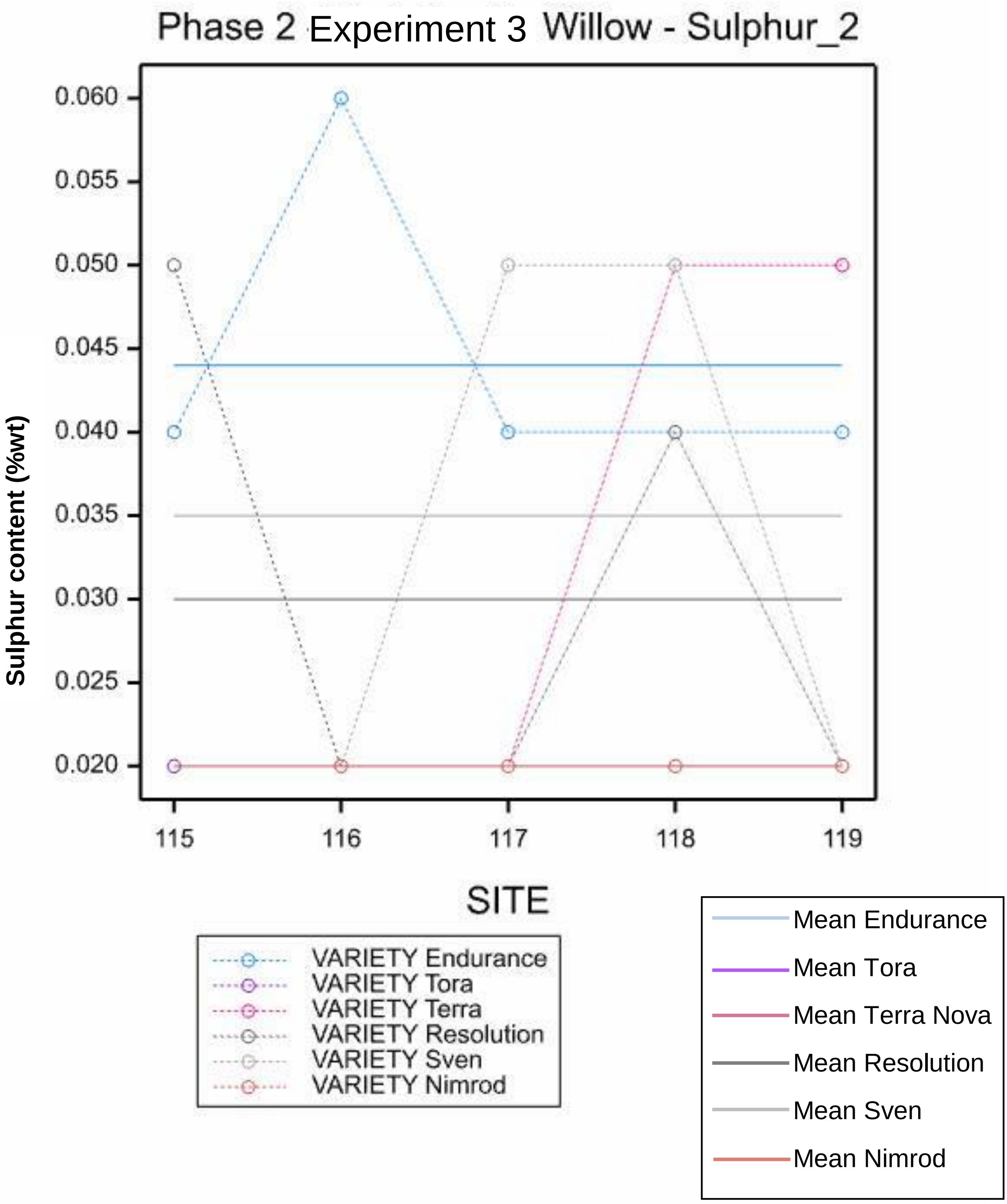
Phase 2 Experiment 3 Willow - C_1
Carbon content (%wt)
51.5
51.0
50.5
50.0
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

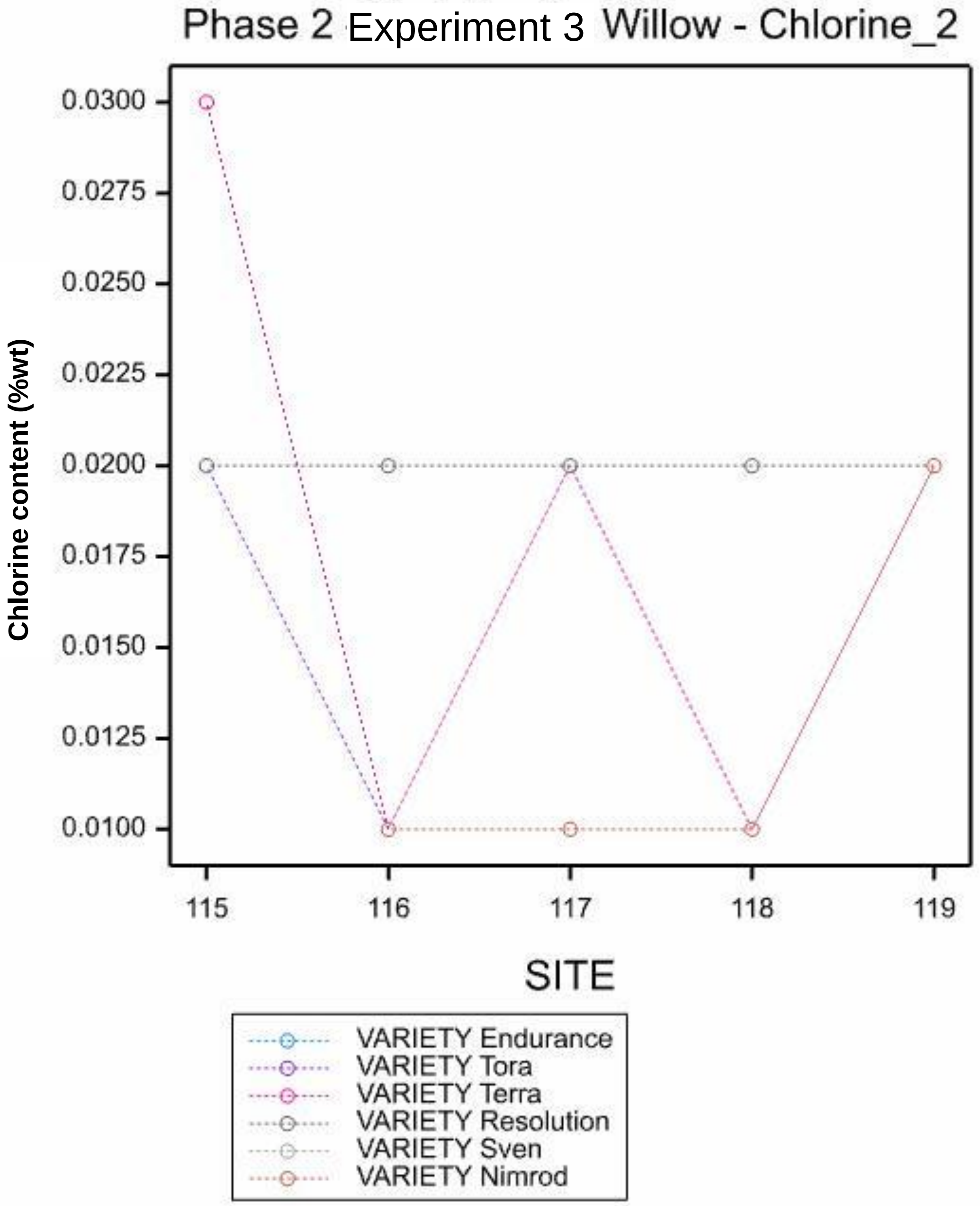


Phase 2 Experiment 3 Willow - H_2
Hydrogen content (%wt)
6.28
6.26
6.24
6.22
6.20
6.18
6.16
6.14
6.12
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

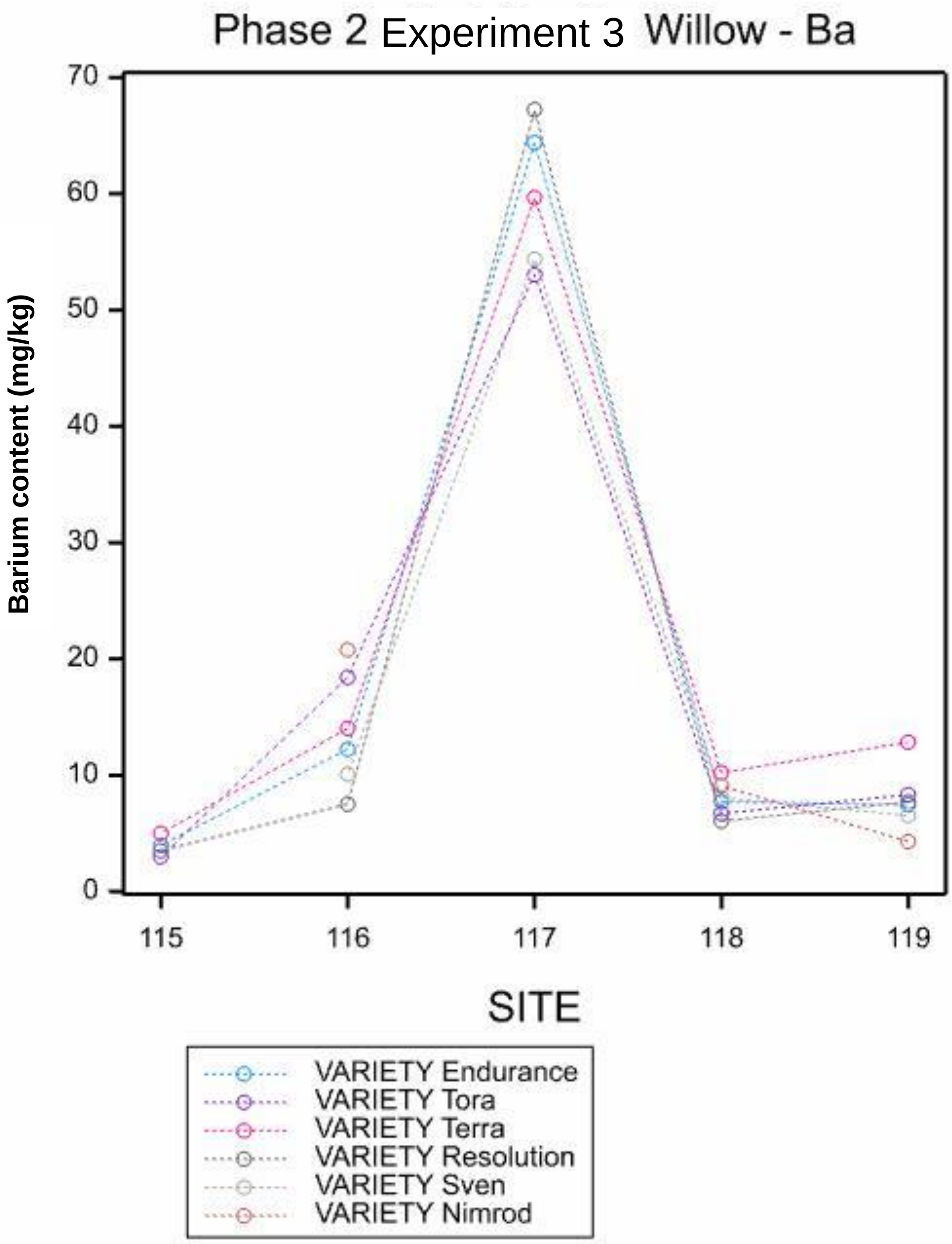


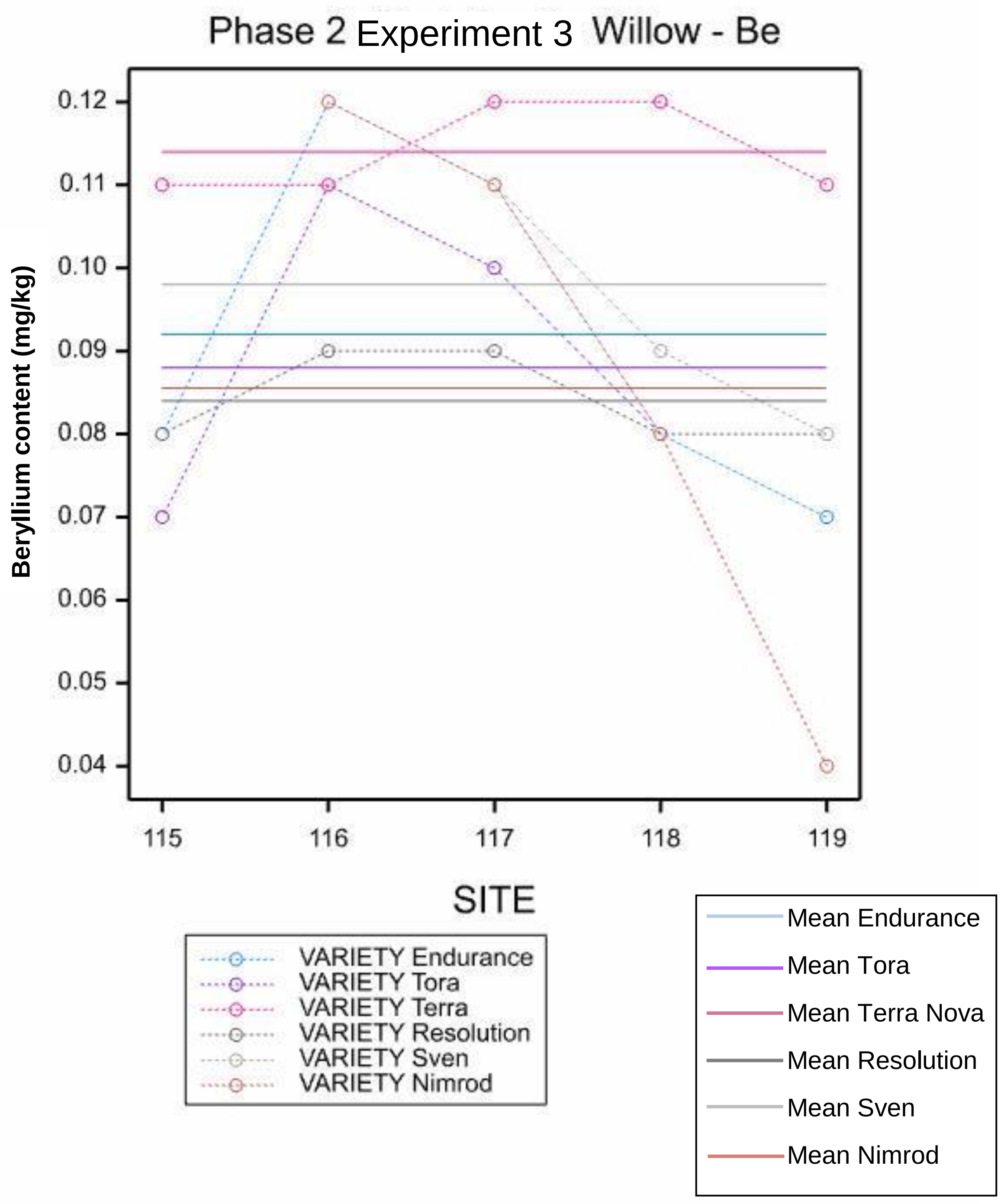
Phase 2 Experiment 3 Willow - N_1
Nitrogen content (%wt)
0.70
0.65
0.60
0.55
0.50
0.45
0.40
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

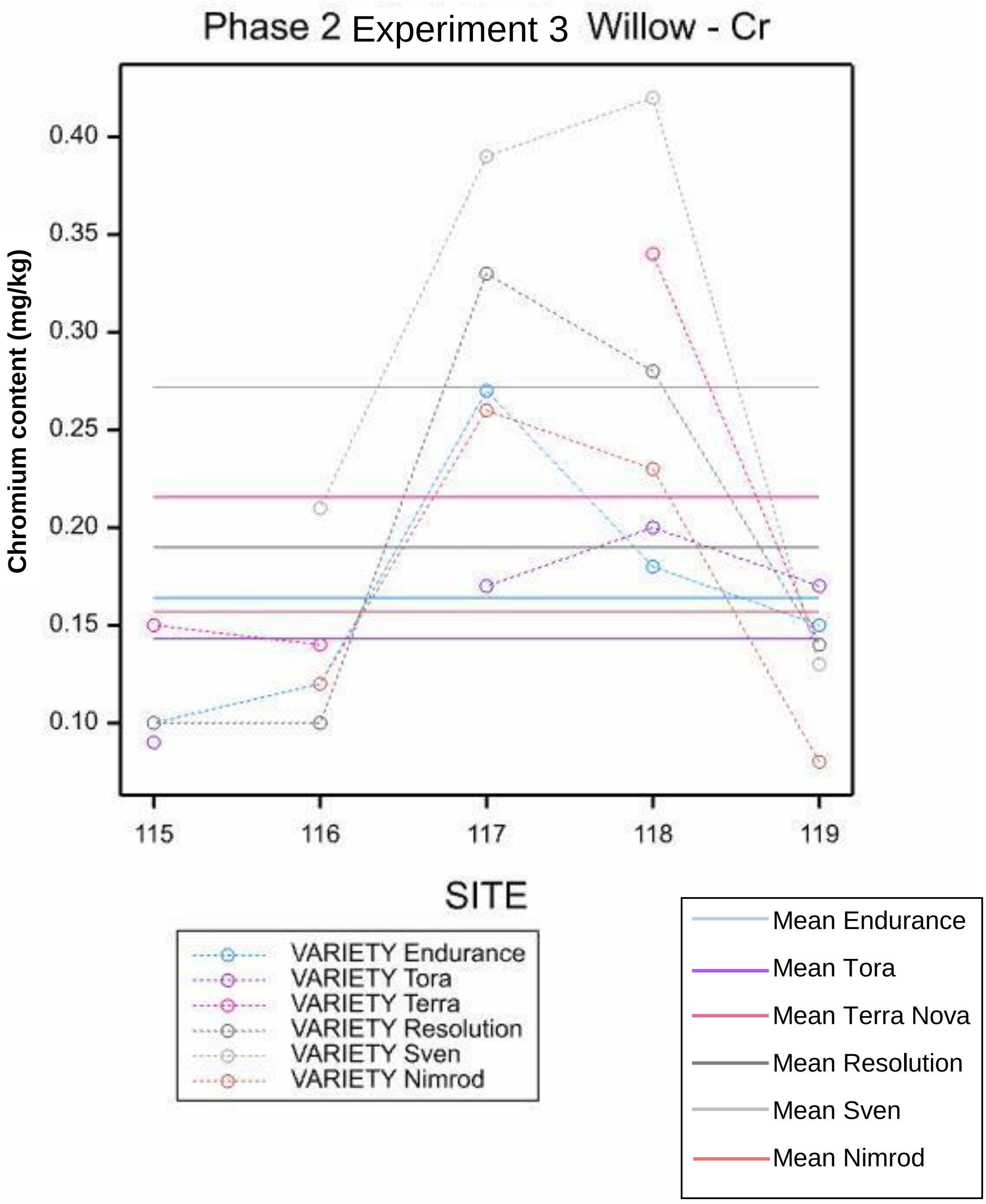

Phase 2 Experiment 3 Willow - Sulphur_2
Sulphur content (%wt)
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

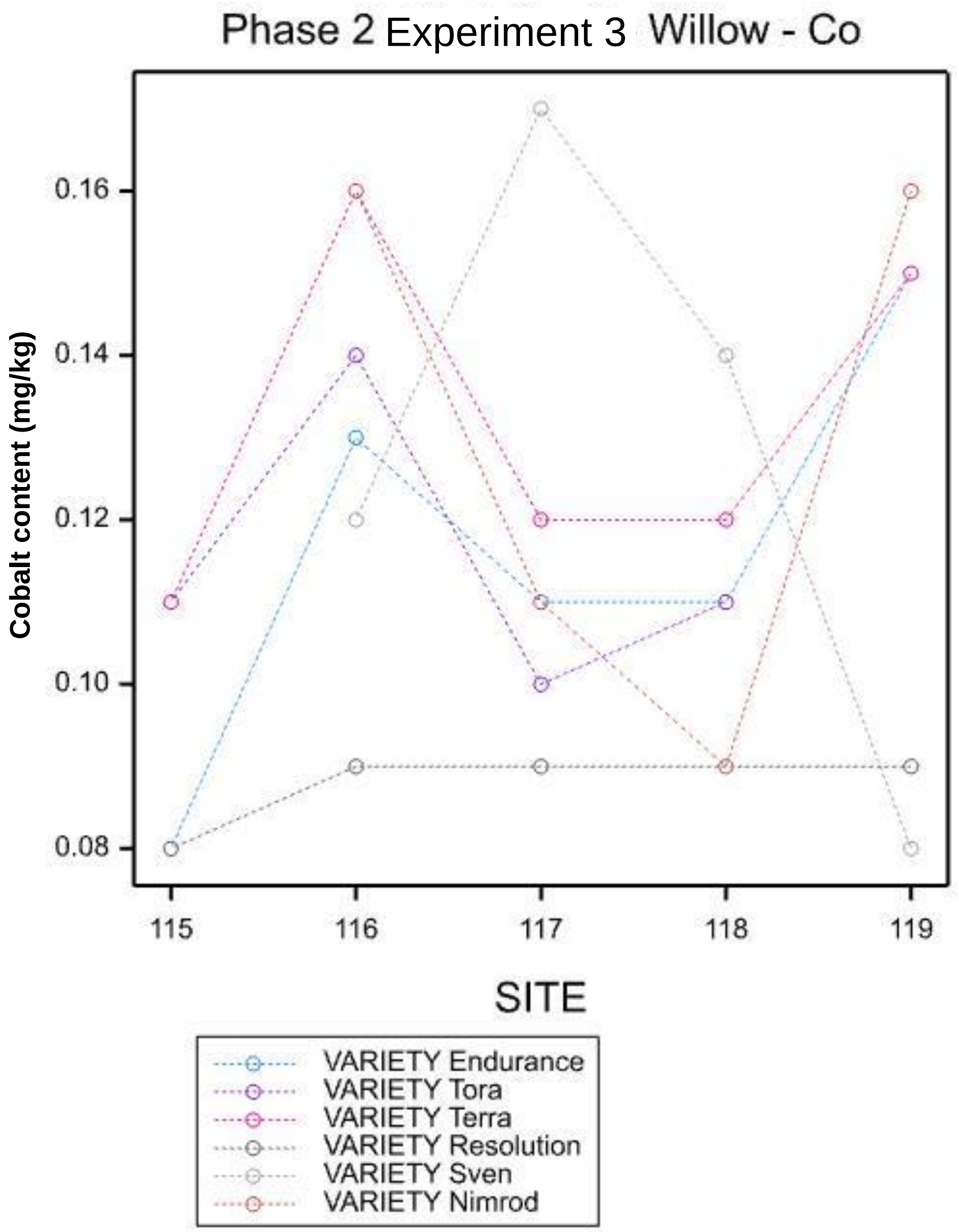


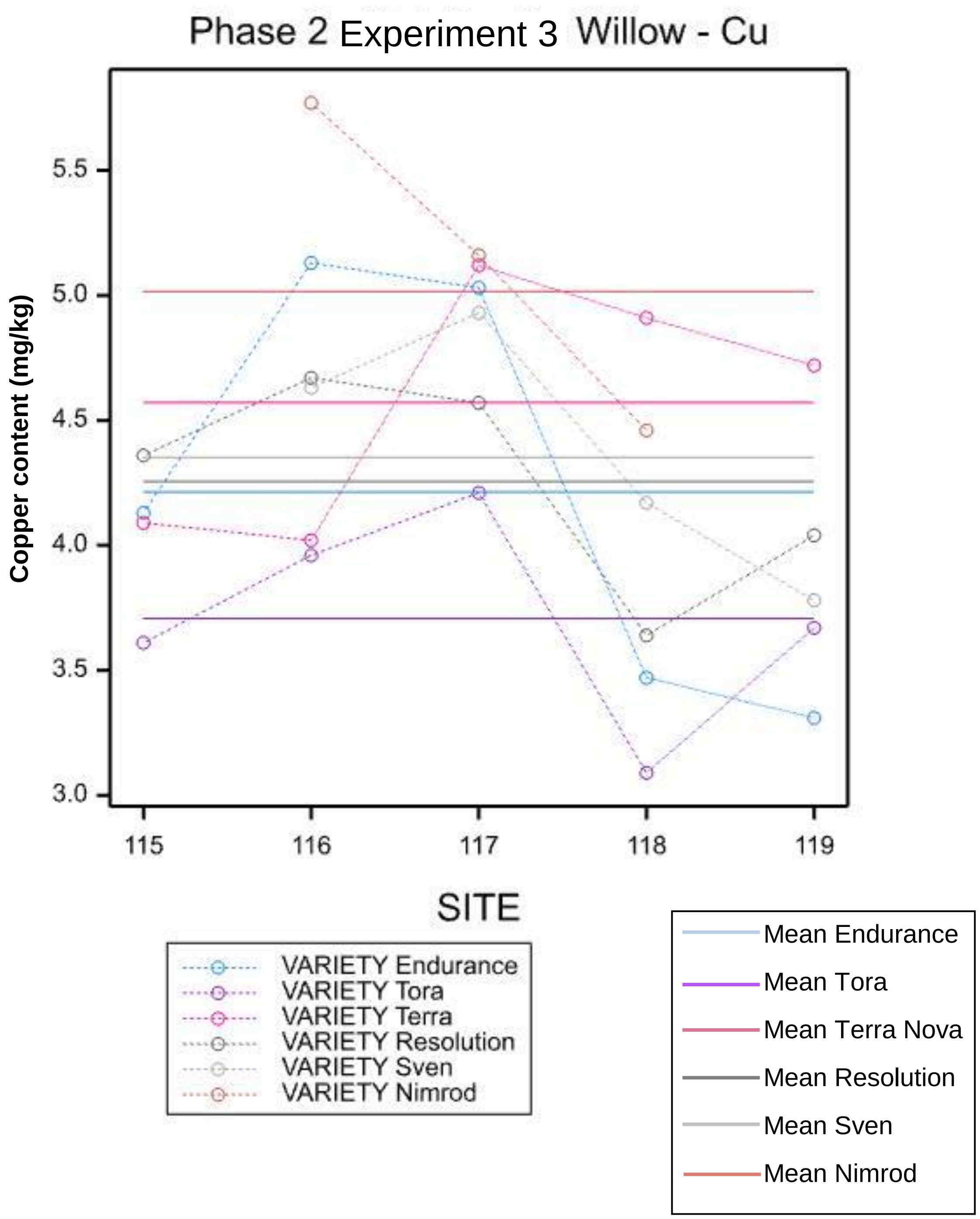
Phase 2 Experiment 3 Willow - Chlorine_2
Chlorine content (%wt)
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

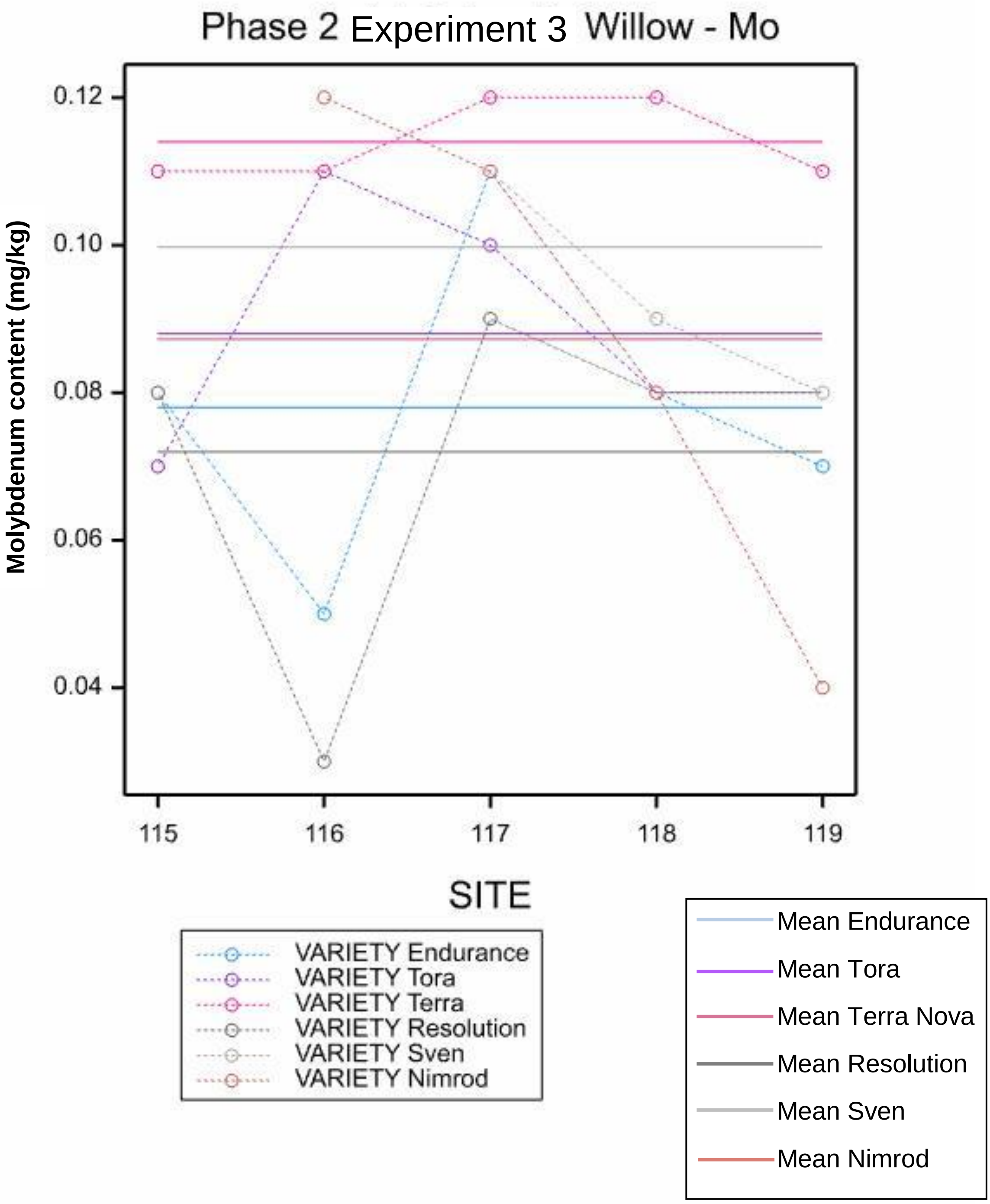

Phase 2 Experiment 3 Willow - Ba
Barium content (mg/kg)
70
60
50
40
30
20
10
0
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

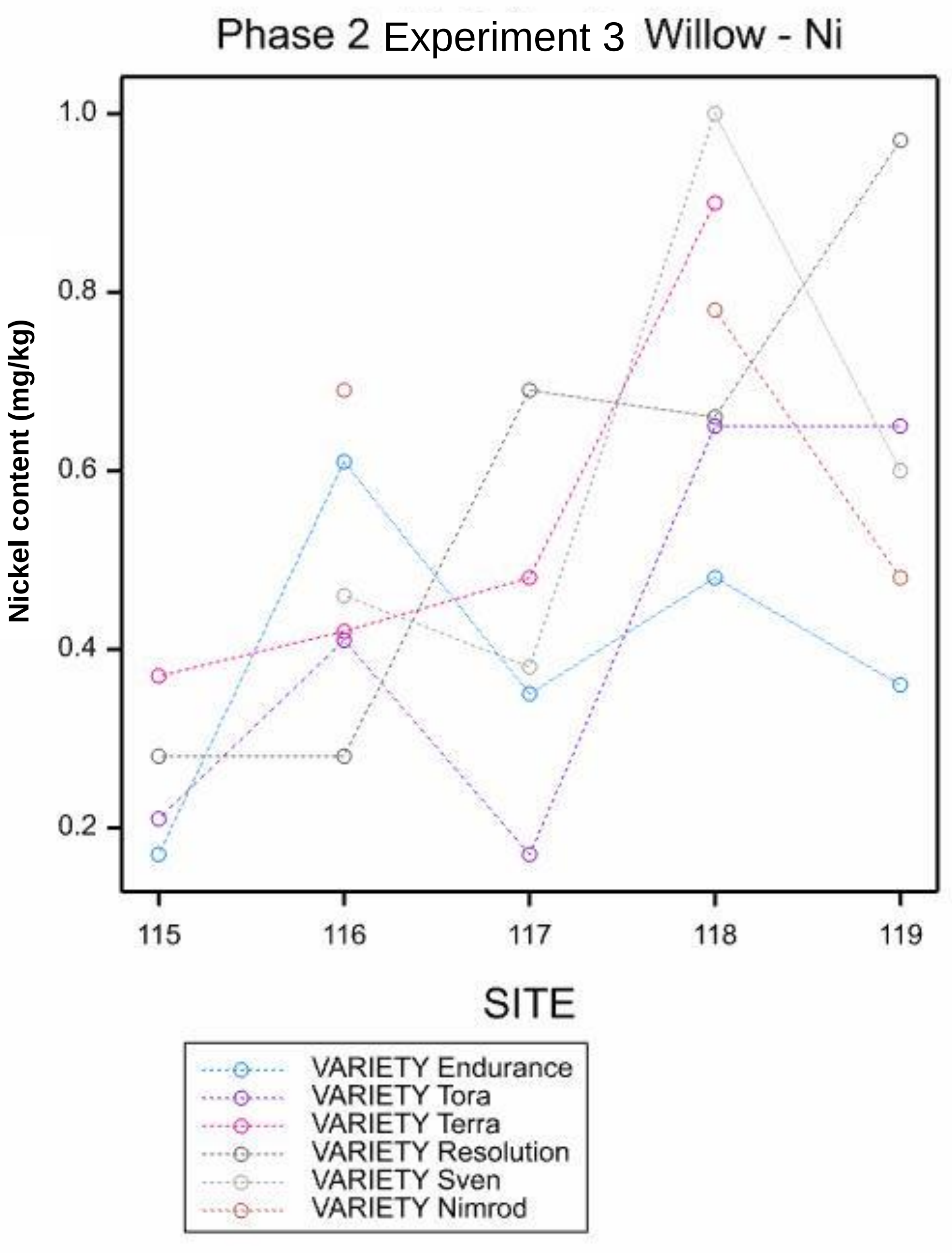

Phase 2 Experiment 3 Willow - Be
Beryllium content (mg/kg)
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod


Phase 2 Experiment 3 Willow - Cr
Chromium content (mg/kg)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

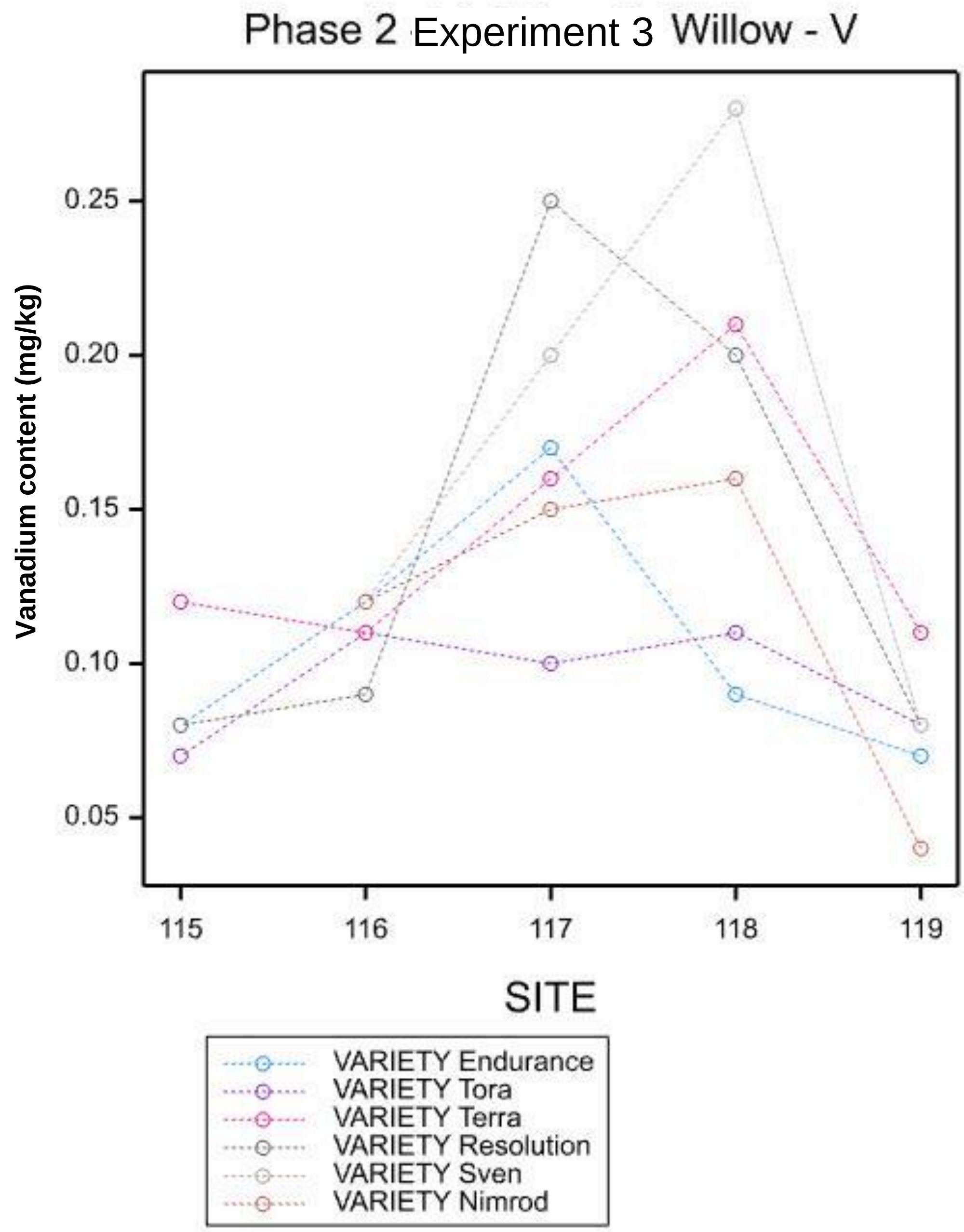

Phase 2 Experiment 3 Willow - Co
Cobalt content (mg/kg)
0.16
0.14
0.12
0.10
0.08
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

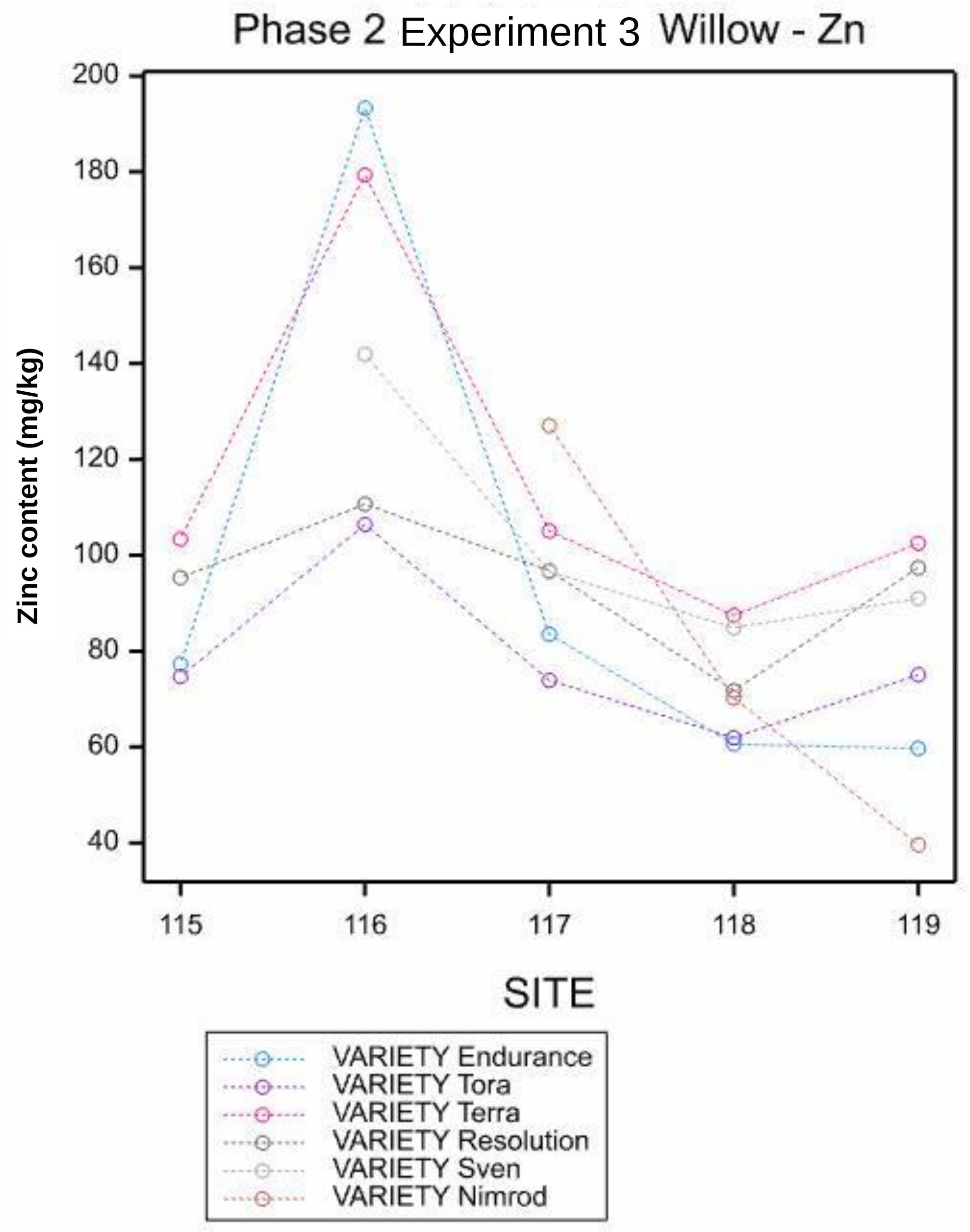

Phase 2 Experiment 3 Willow - Cu
Copper content (mg/kg)
5.5
5.0
4.5
4.0
3.5
3.0
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

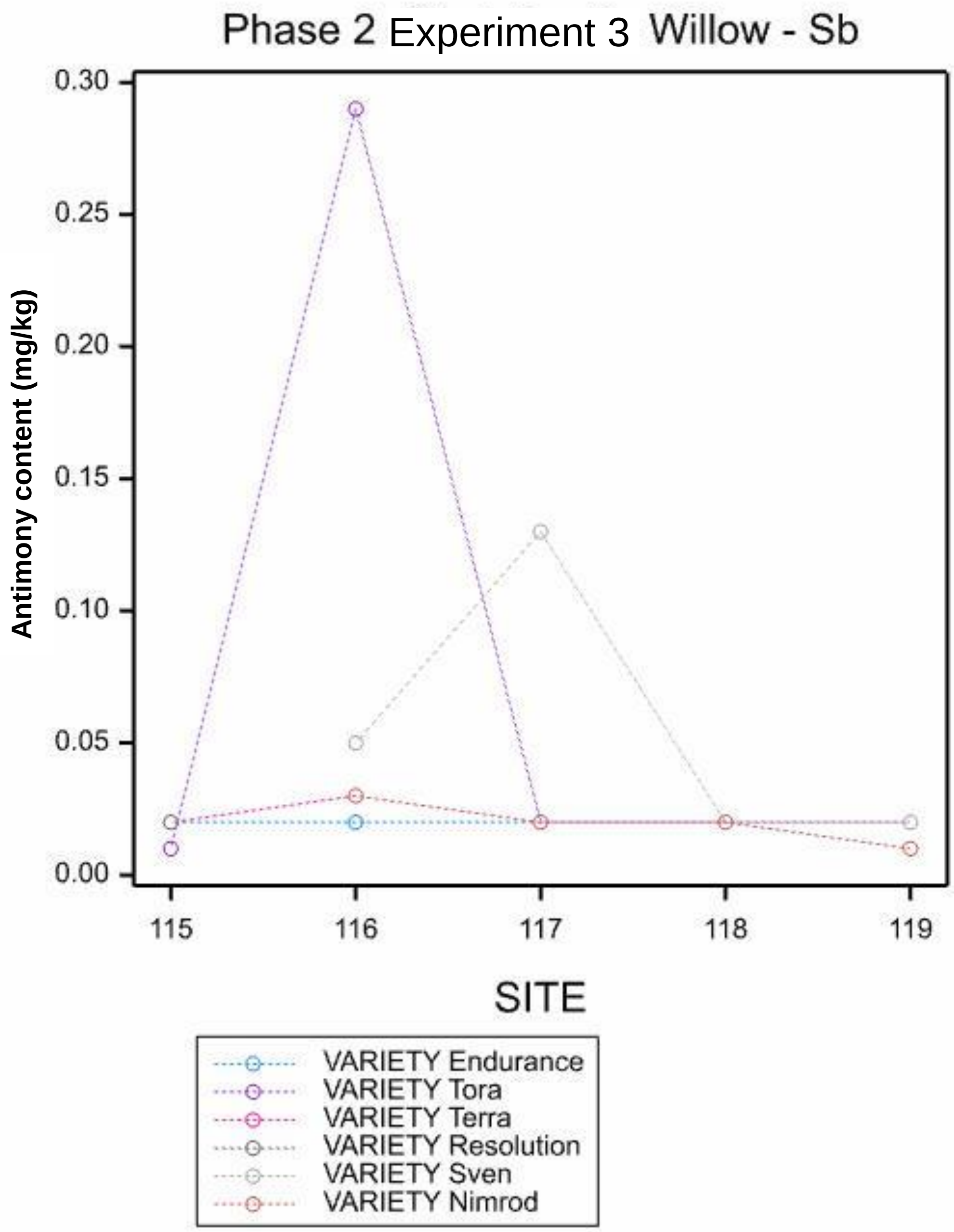

Phase 2 Experiment 3 Willow - Mo
Molybdenum content (mg/kg)
0.12
0.10
0.08
0.06
0.04
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod



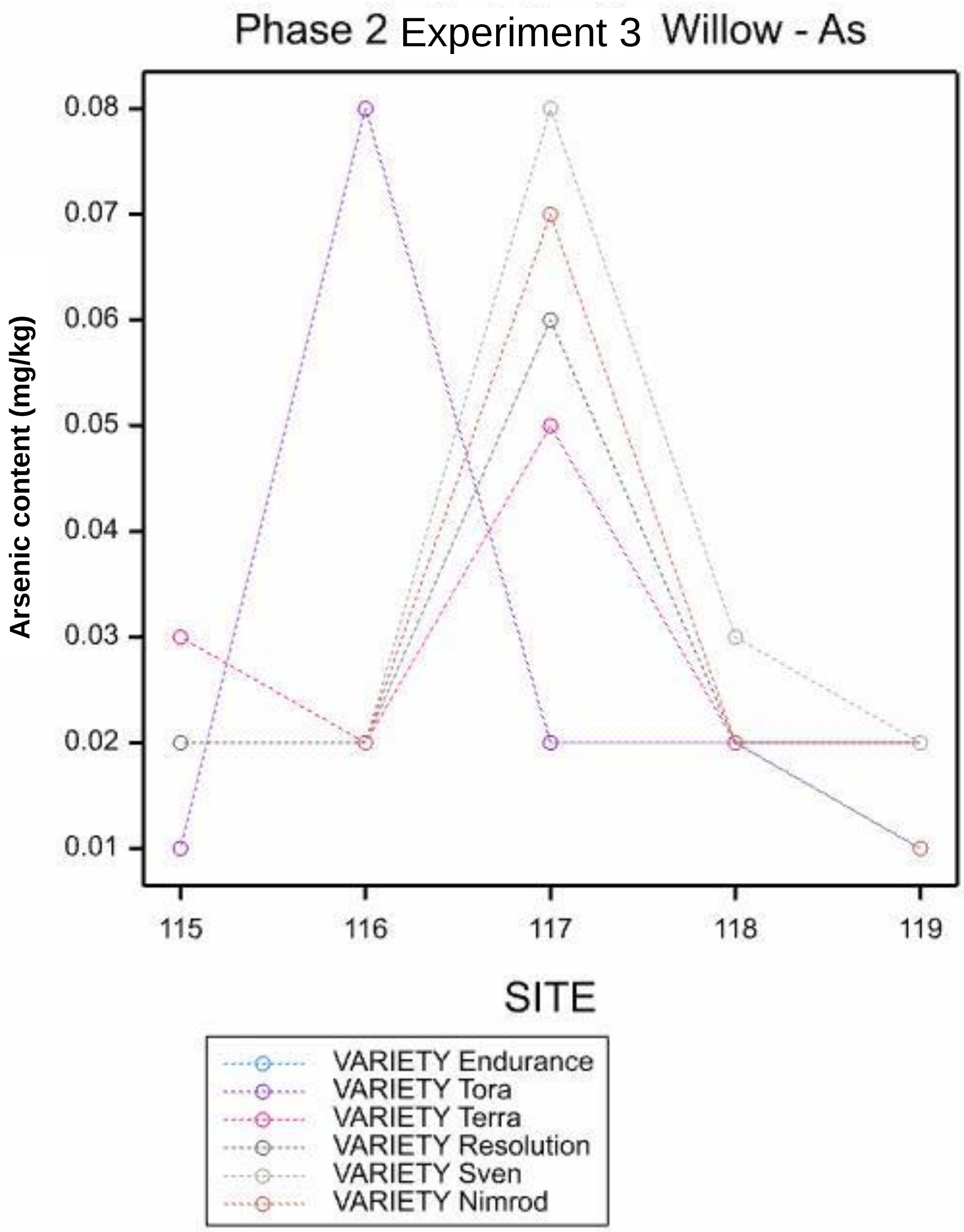
Phase 2 Experiment 3 Willow - Ni
Nickel content (mg/kg)
1.0
0.8
0.6
0.4
0.2
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod


Phase 2 Experiment 3 Willow - V
Vanadium content (mg/kg)
0.25
0.20
0.15
0.10
0.05
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

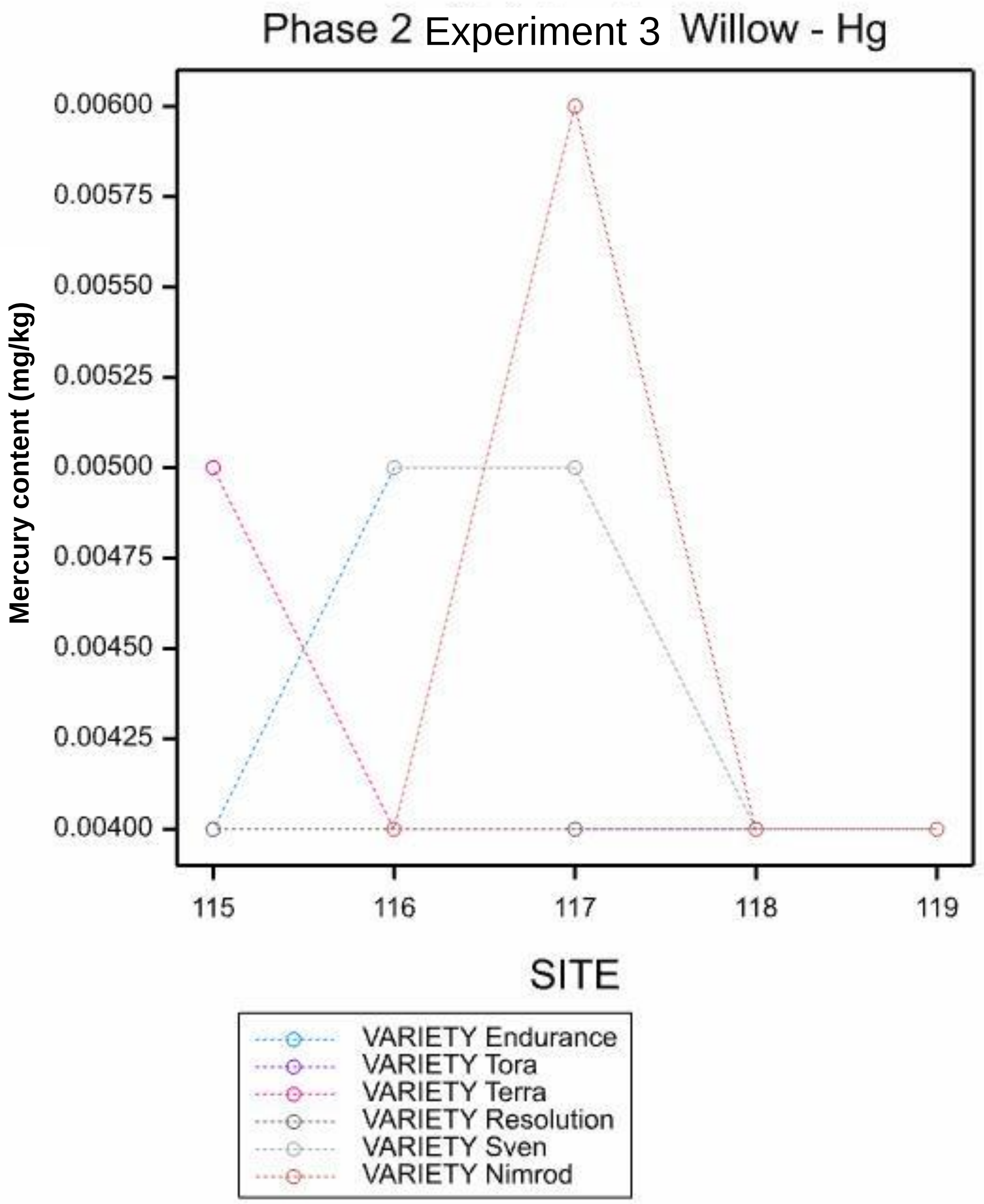

Phase 2 Experiment 3 Willow - Zn
Zinc content (mg/kg)
200
180
160
140
120
100
80
60
40
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod



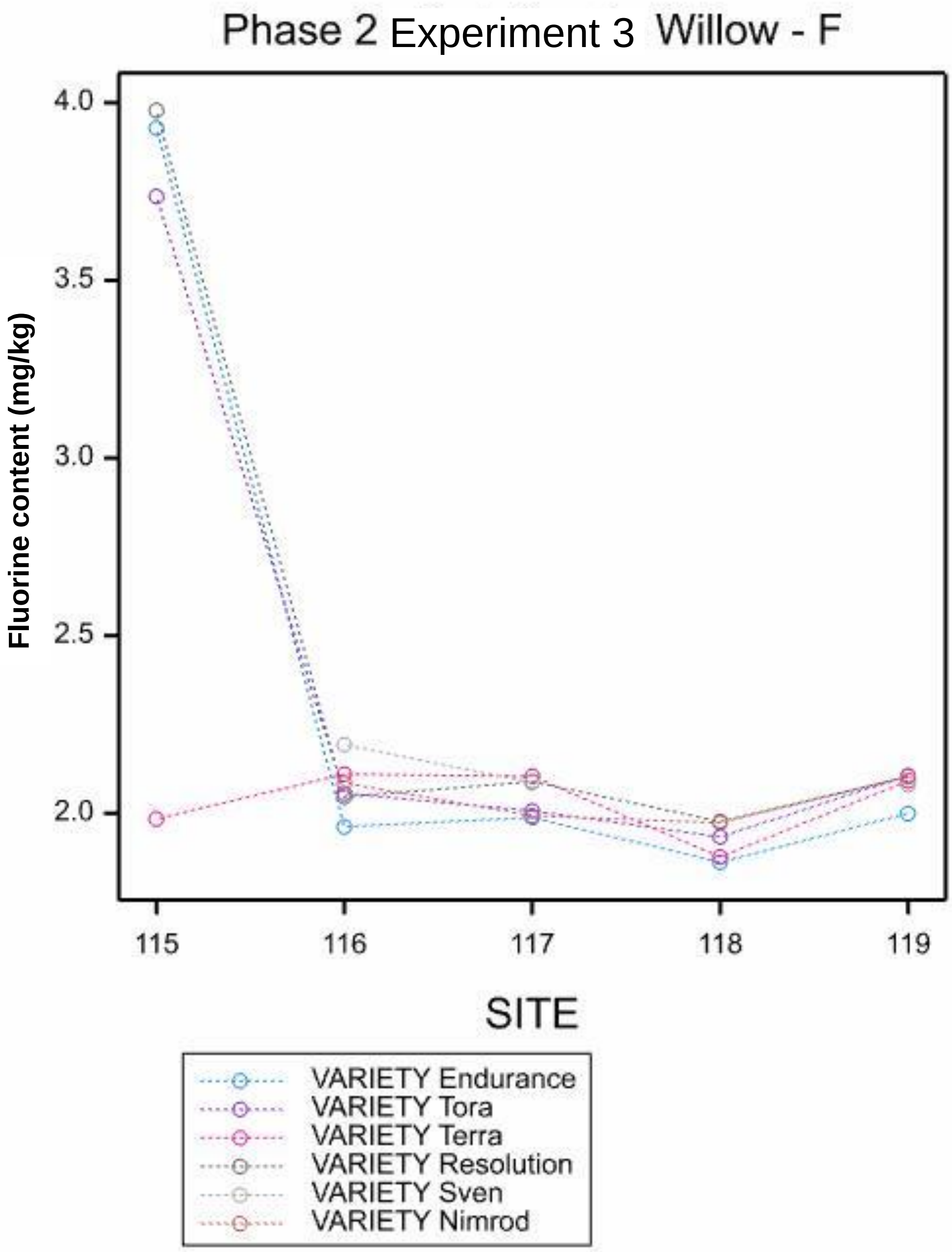
Phase 2 Experiment 3 Willow - Sb
Antimony content (mg/kg)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

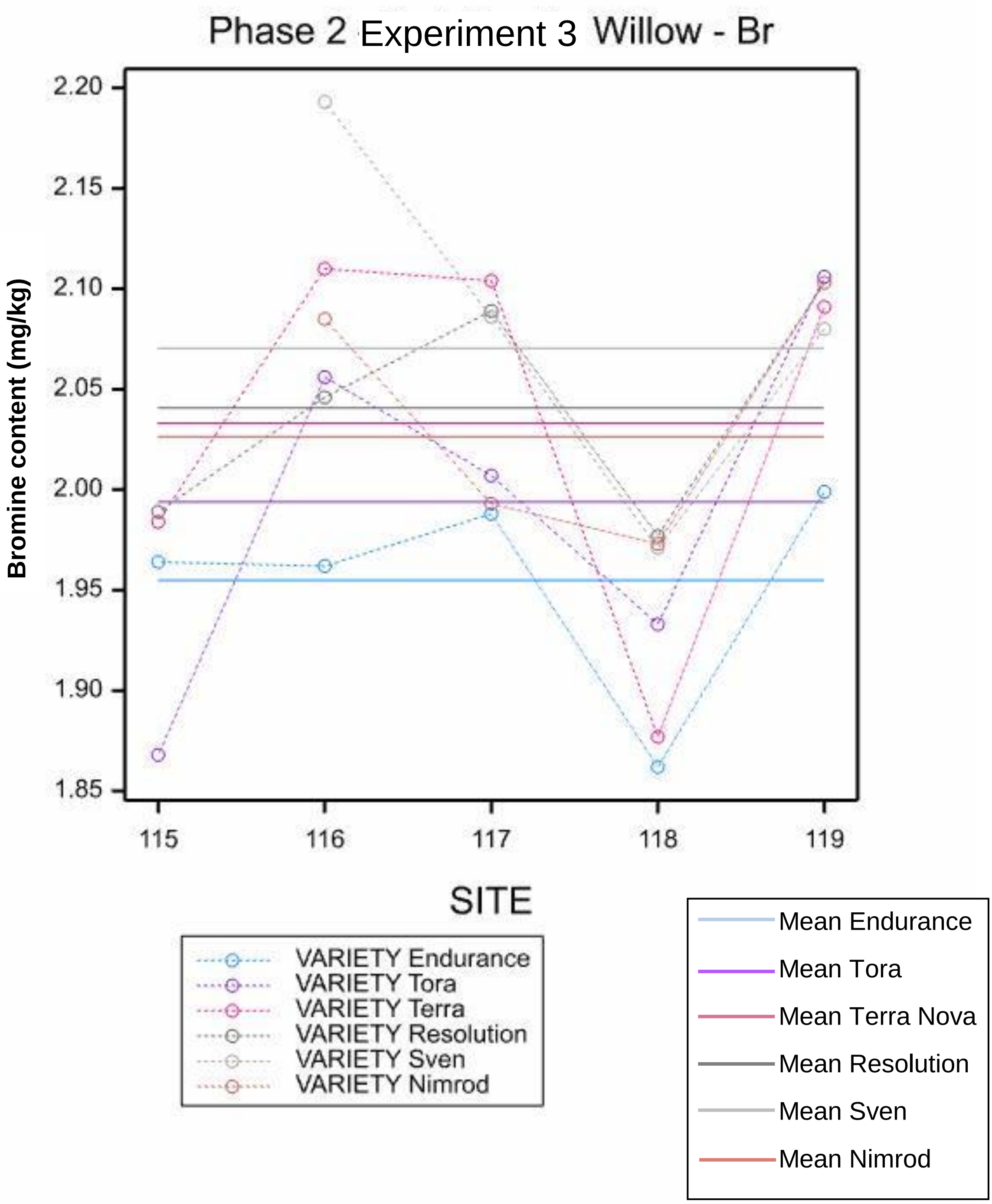


Phase 2 Experiment 3 Willow - As
Arsenic content (mg/kg)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

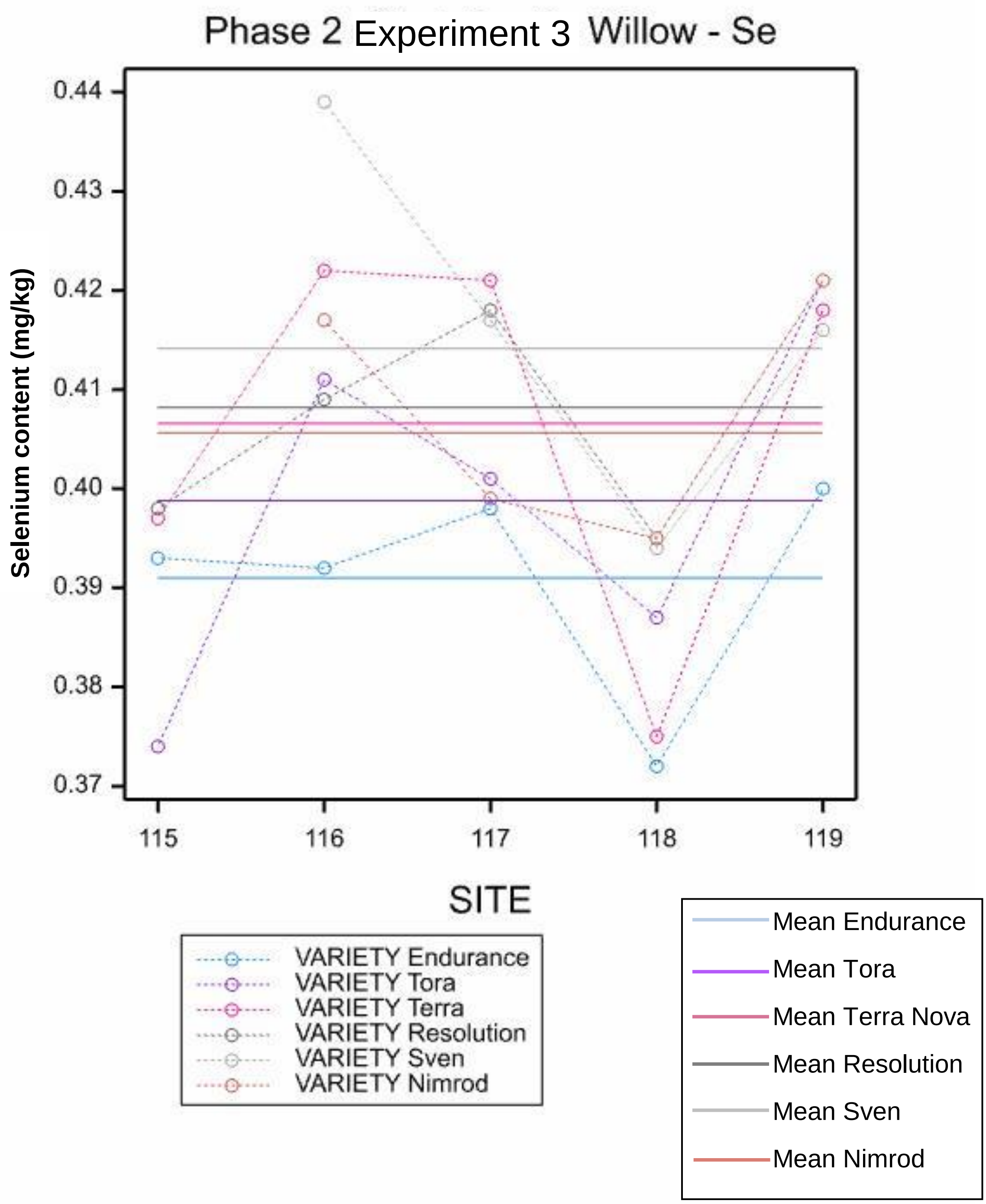


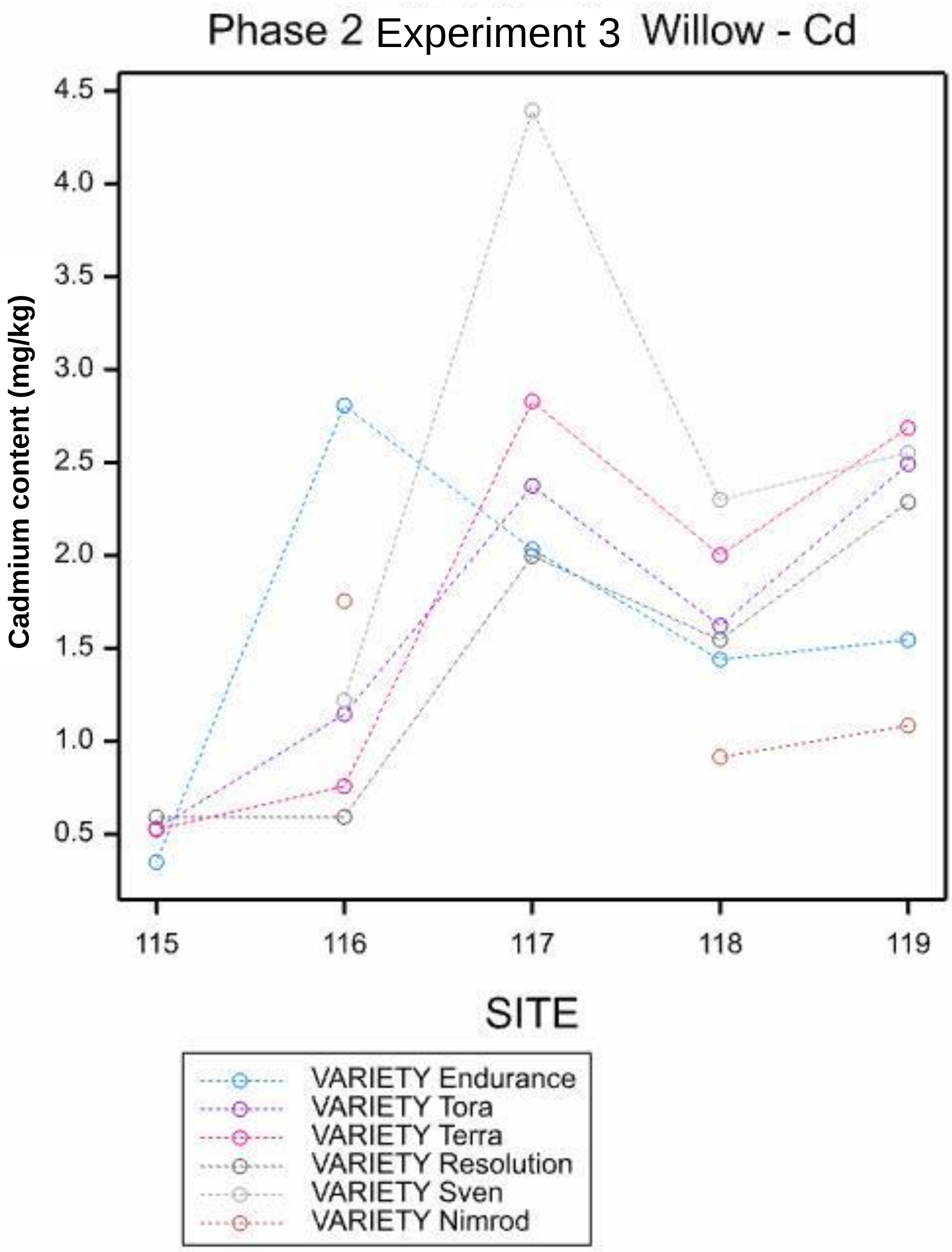
Phase 2 Experiment 3 Willow - Hg
Mercury content (mg/kg)
0.00600
0.00575
0.00550
0.00525
0.00500
0.00475
0.00450
0.00425
0.00400
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

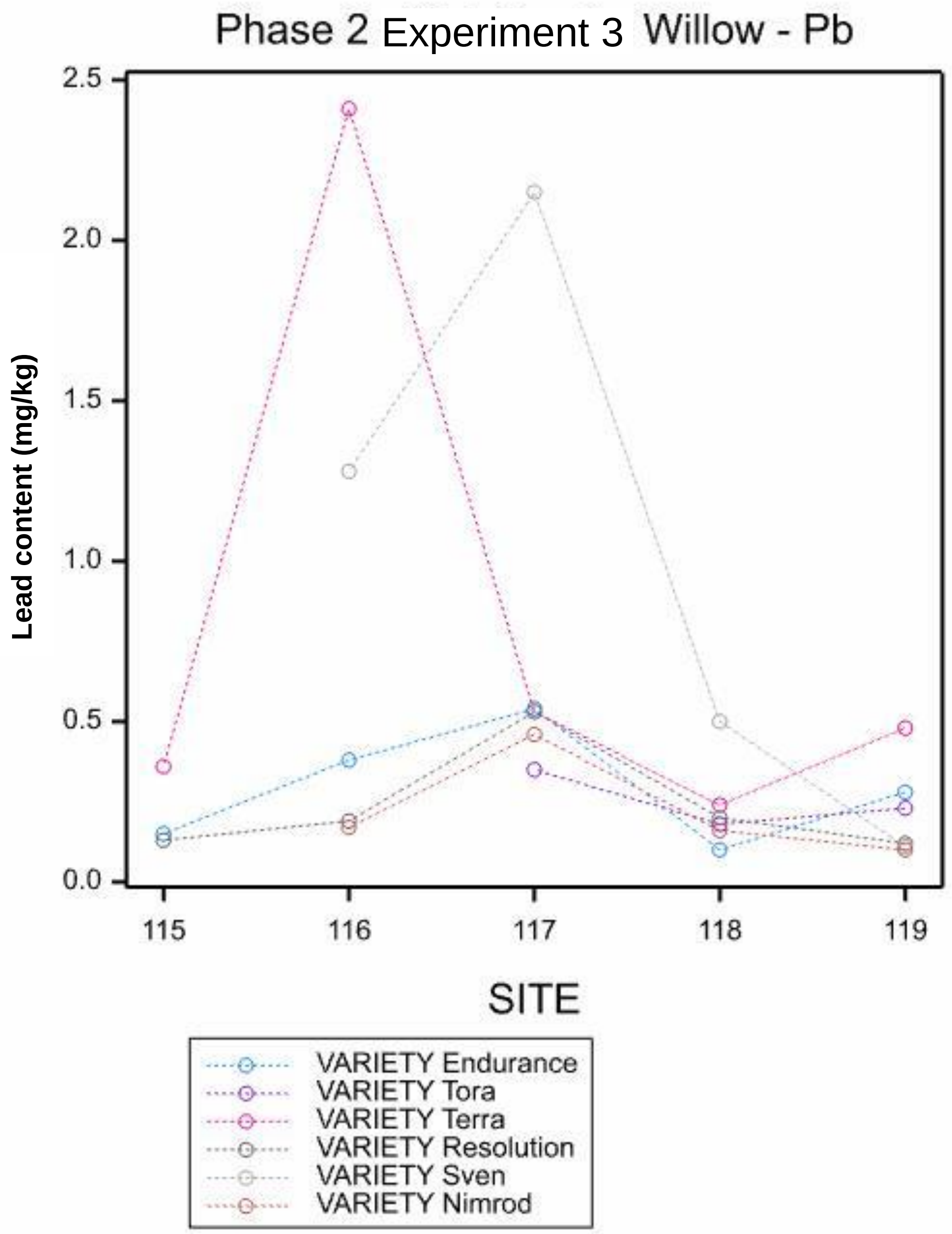

Phase 2 Experiment 3 Willow - F
Fluorine content (mg/kg)
4.0
3.5
3.0
2.5
2.0
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

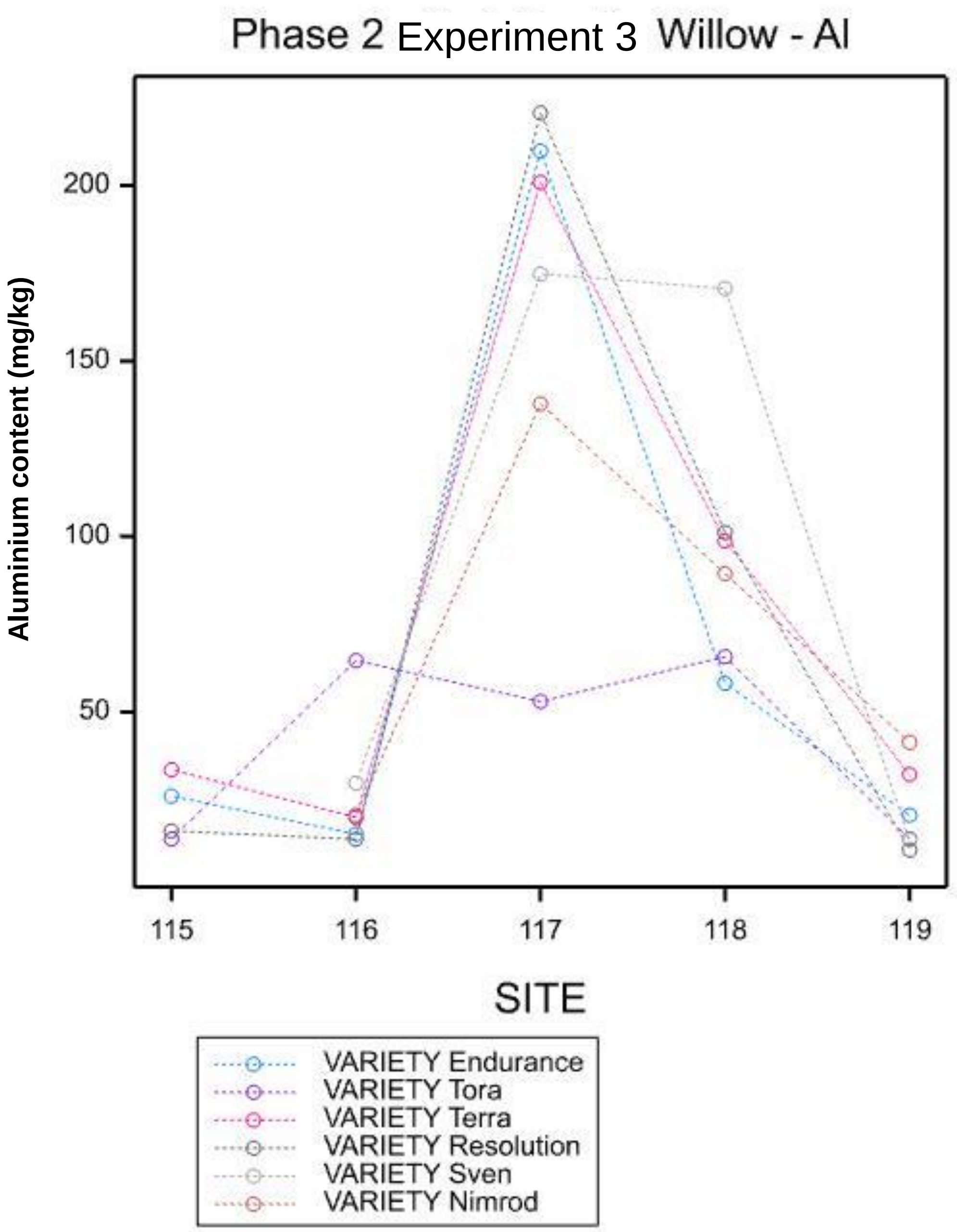


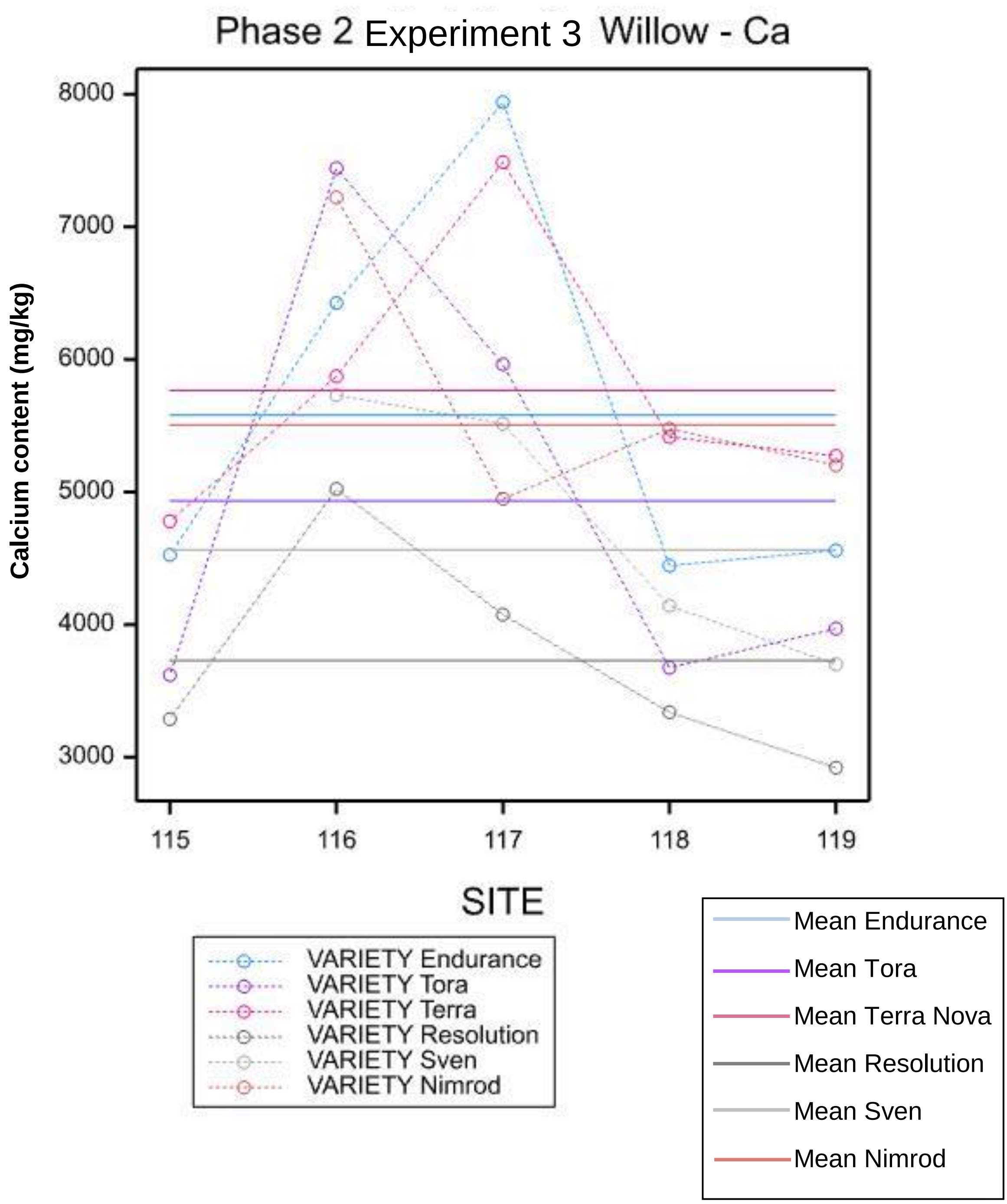
Phase 2 Experiment 3 Willow - Br
Bromine content (mg/kg)
2.20
2.15
2.10
2.05
2.00
1.95
1.90
1.85
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

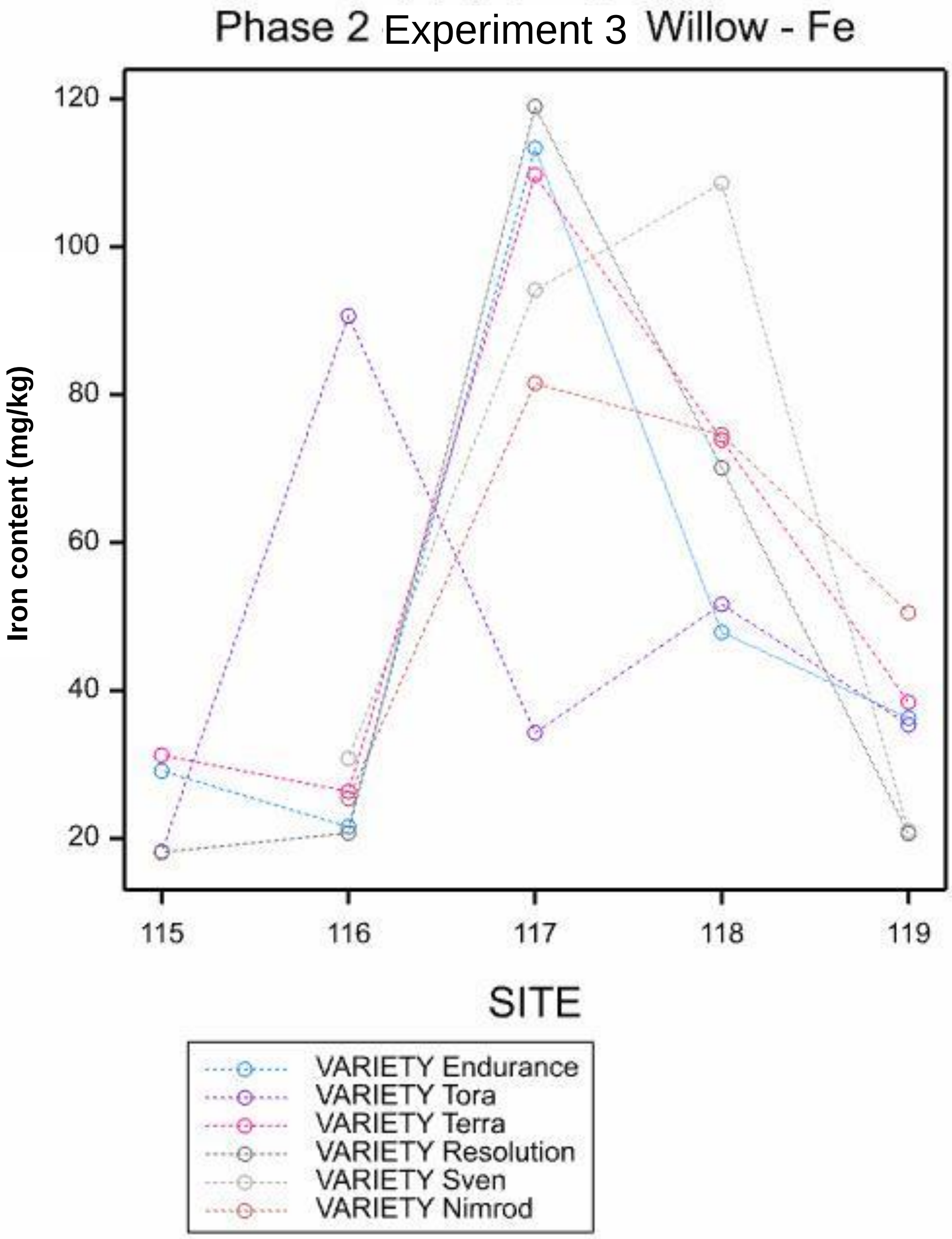

Phase 2 Experiment 3 Willow - Se
Selenium content (mg/kg)
0.44
0.43
0.42
0.41
0.40
0.39
0.38
0.37
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

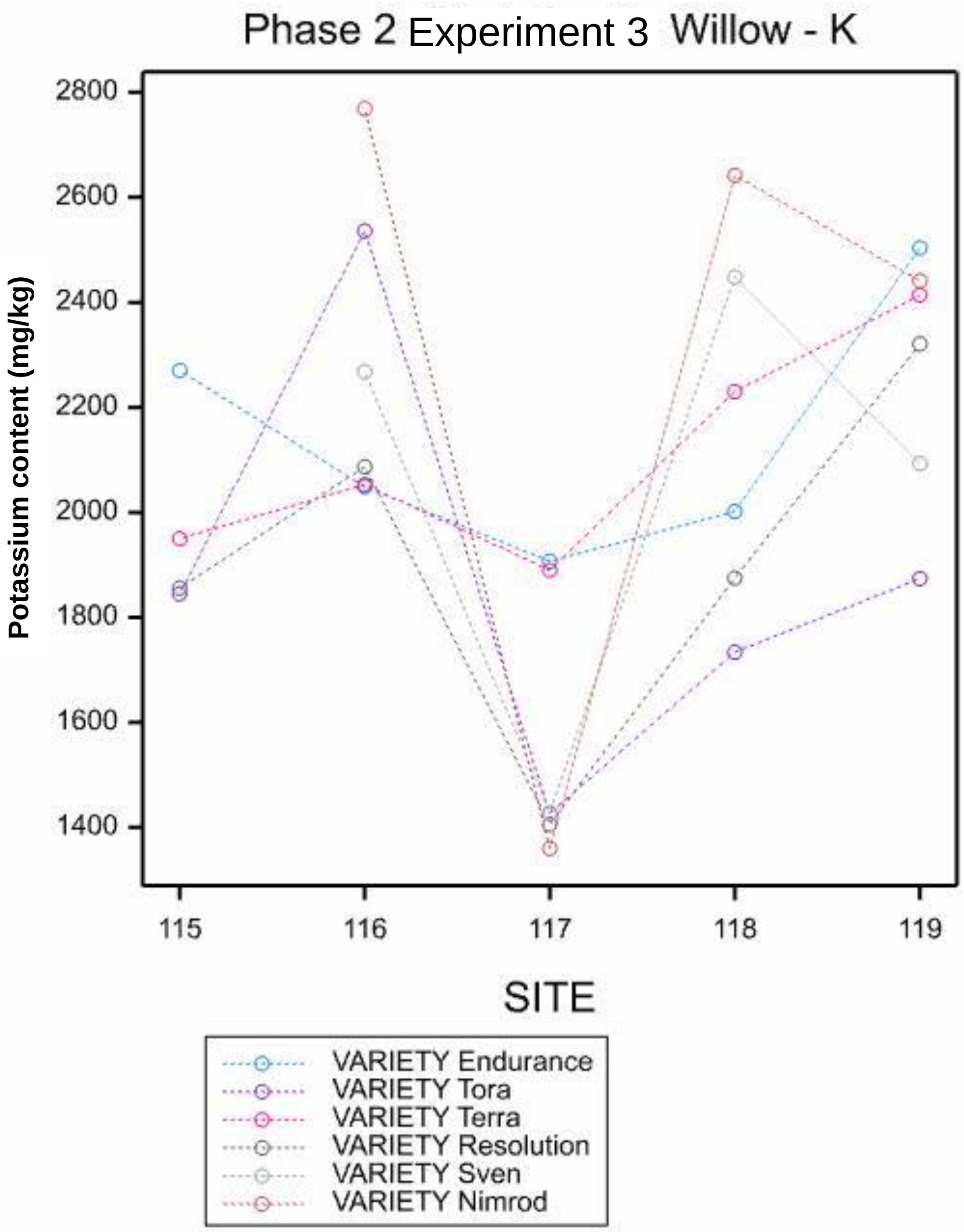

Phase 2 Experiment 3 Willow - Cd
Cadmium content (mg/kg)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

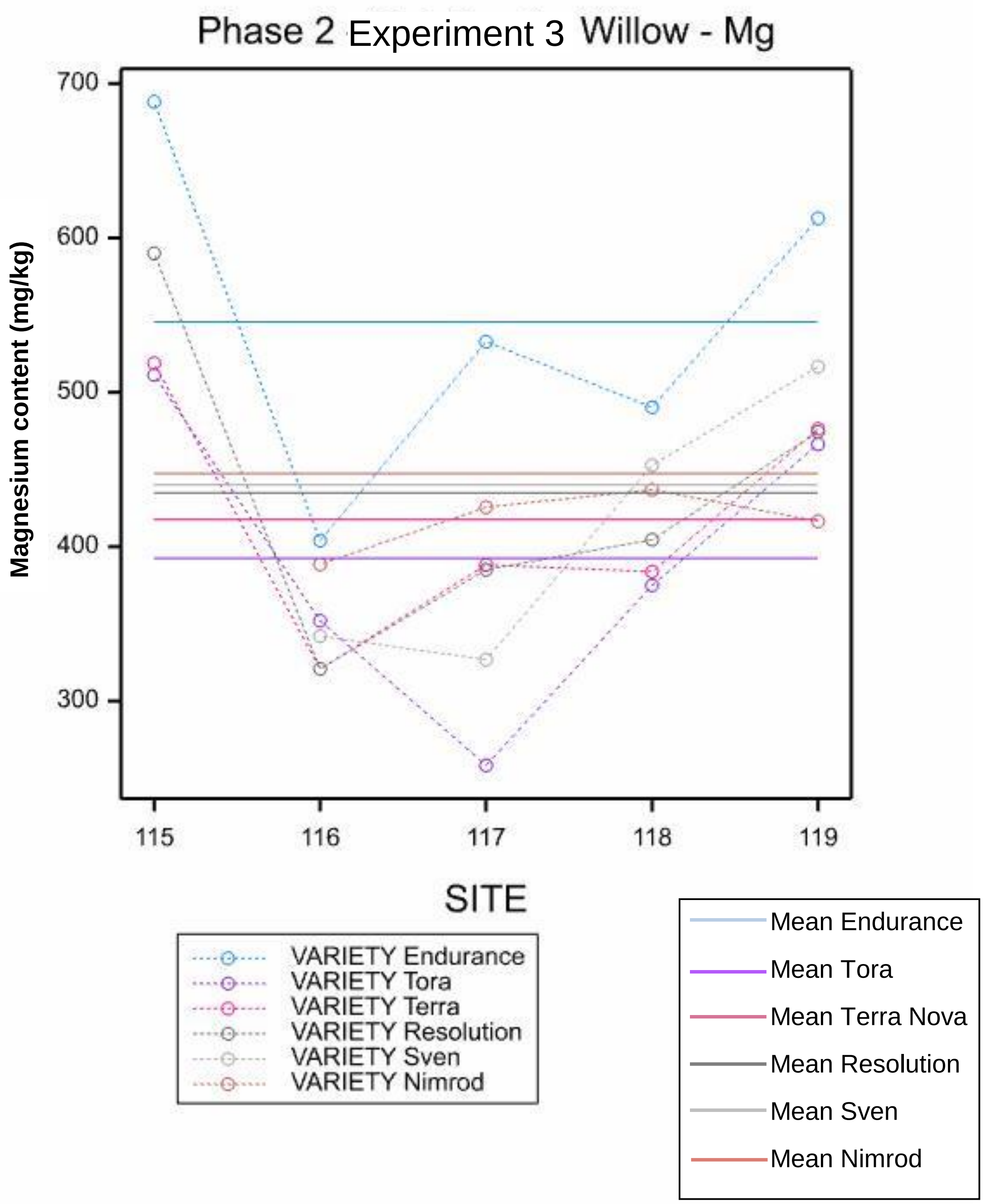

Phase 2 Experiment 3 Willow - Pb
Lead content (mg/kg)
2.5
2.0
1.5
1.0
0.5
0.0
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod


Phase 2 Experiment 3 Willow - Al
Aluminium content (mg/kg)
200
150
100
50
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

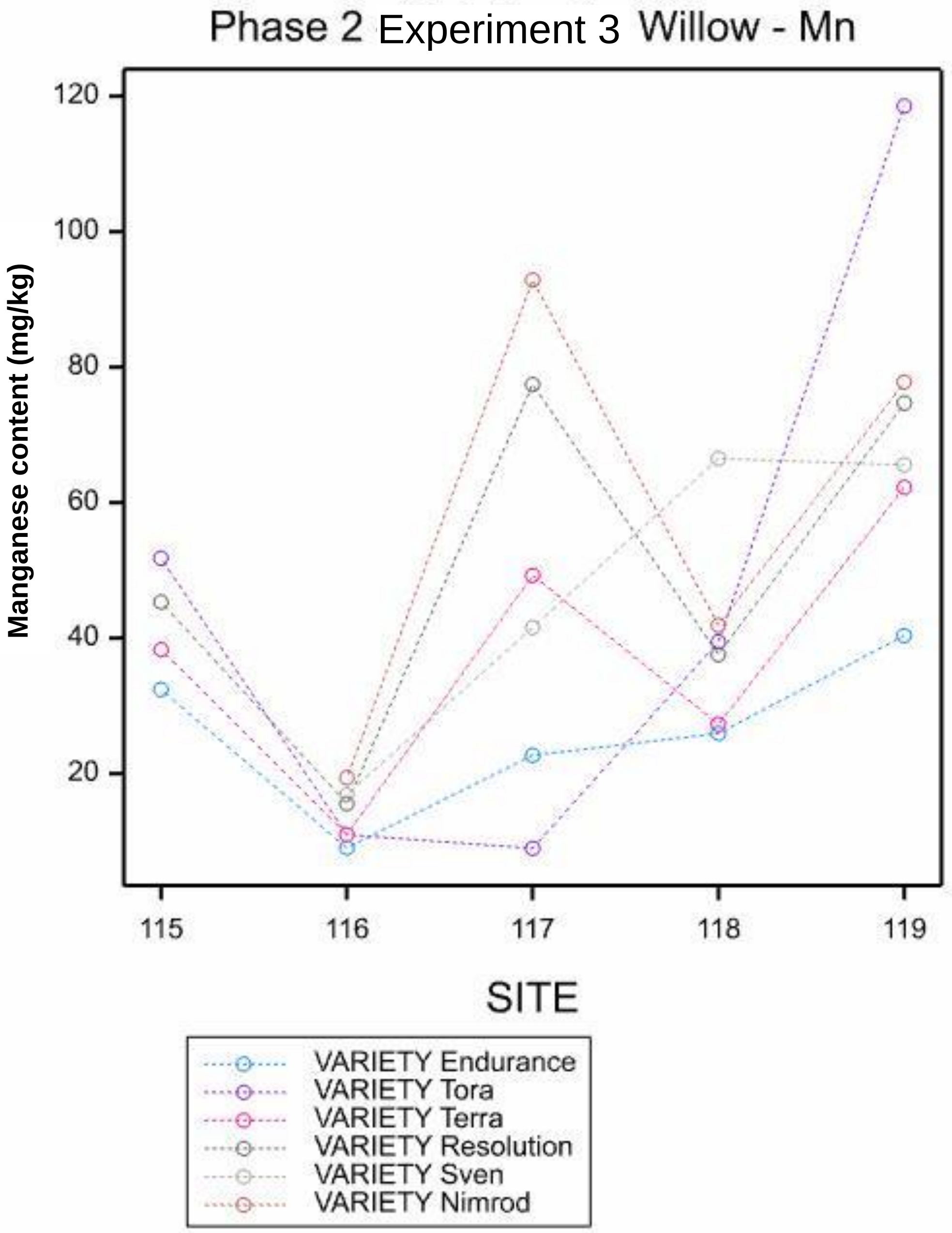

Phase 2 Experiment 3 Willow - Ca
Calcium content (mg/kg)
8000
7000
6000
5000
4000
3000
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

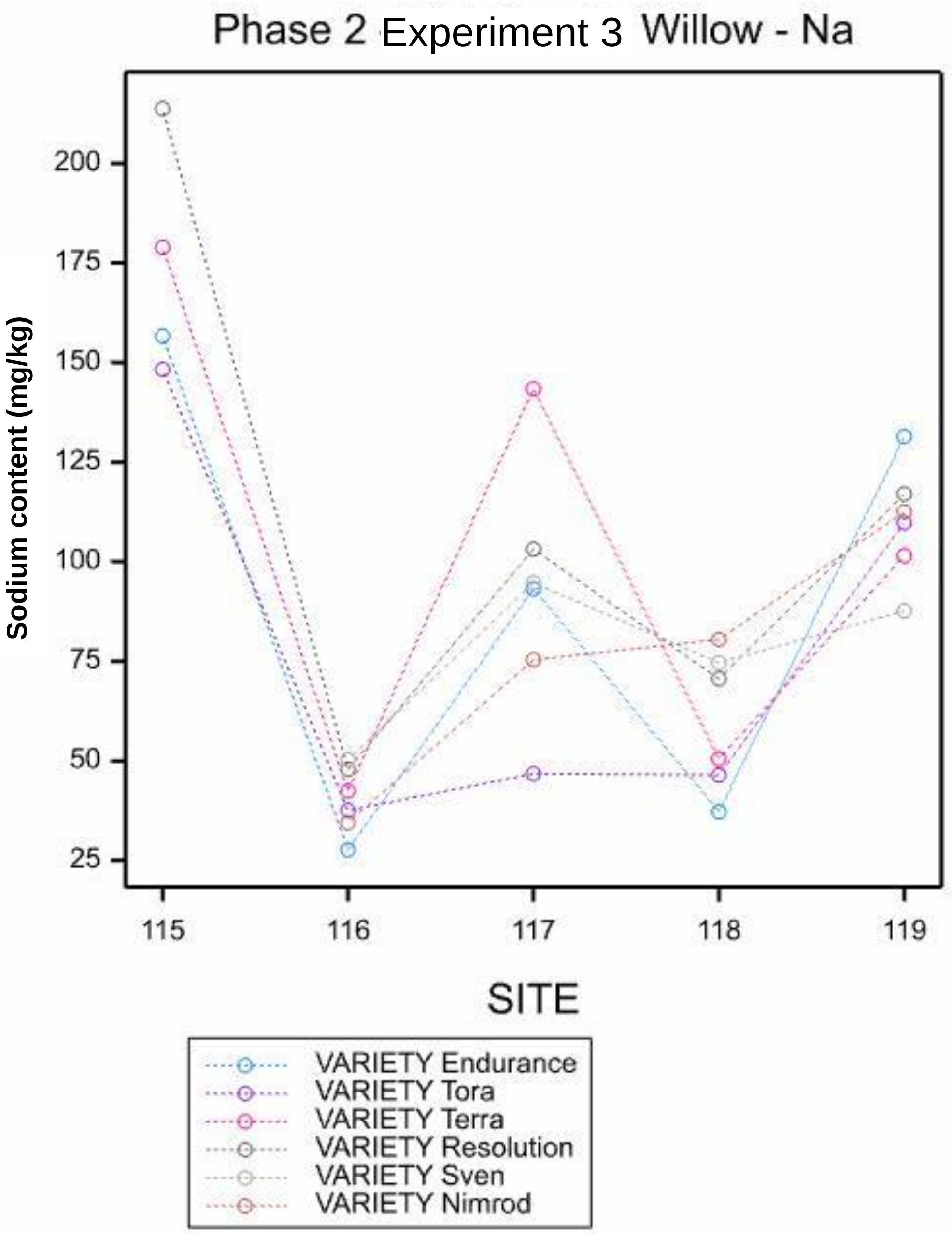

Phase 2 Experiment 3 Willow - Fe
Iron content (mg/kg)
120
100
80
60
40
20
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

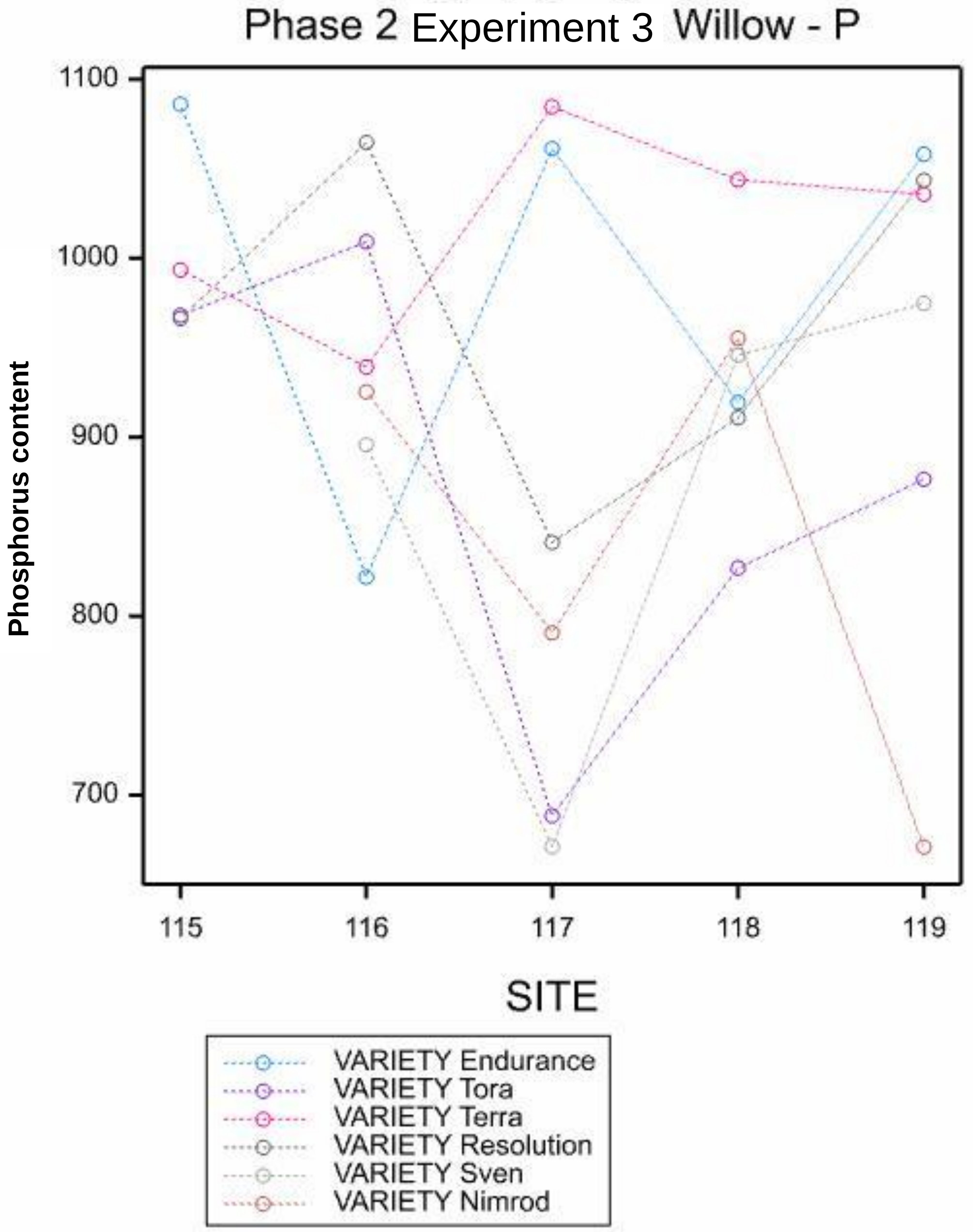

Phase 2 Experiment 3 Willow - K
Potassium content (mg/kg)
2800
2600
2400
2200
2000
1800
1600
1400
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

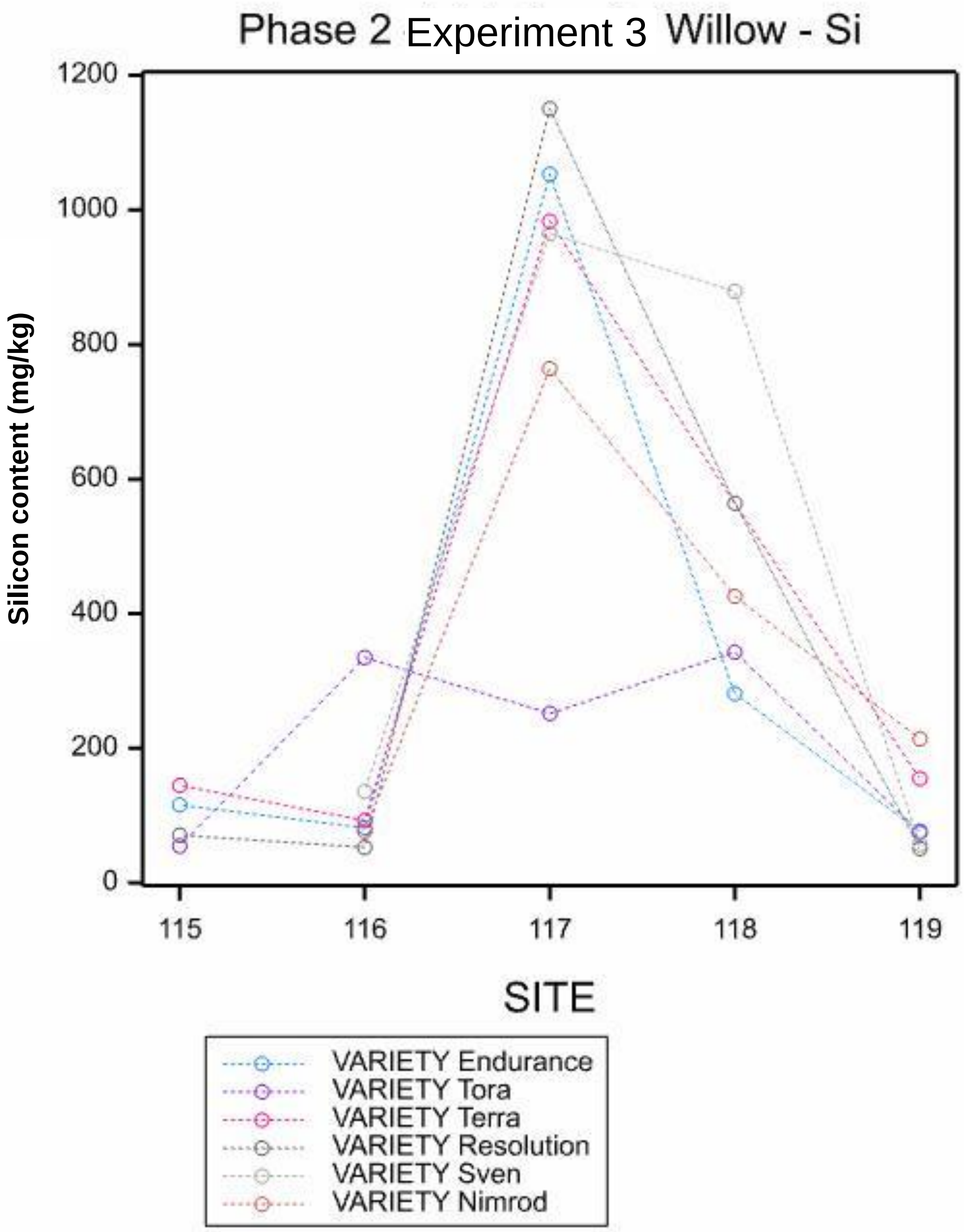


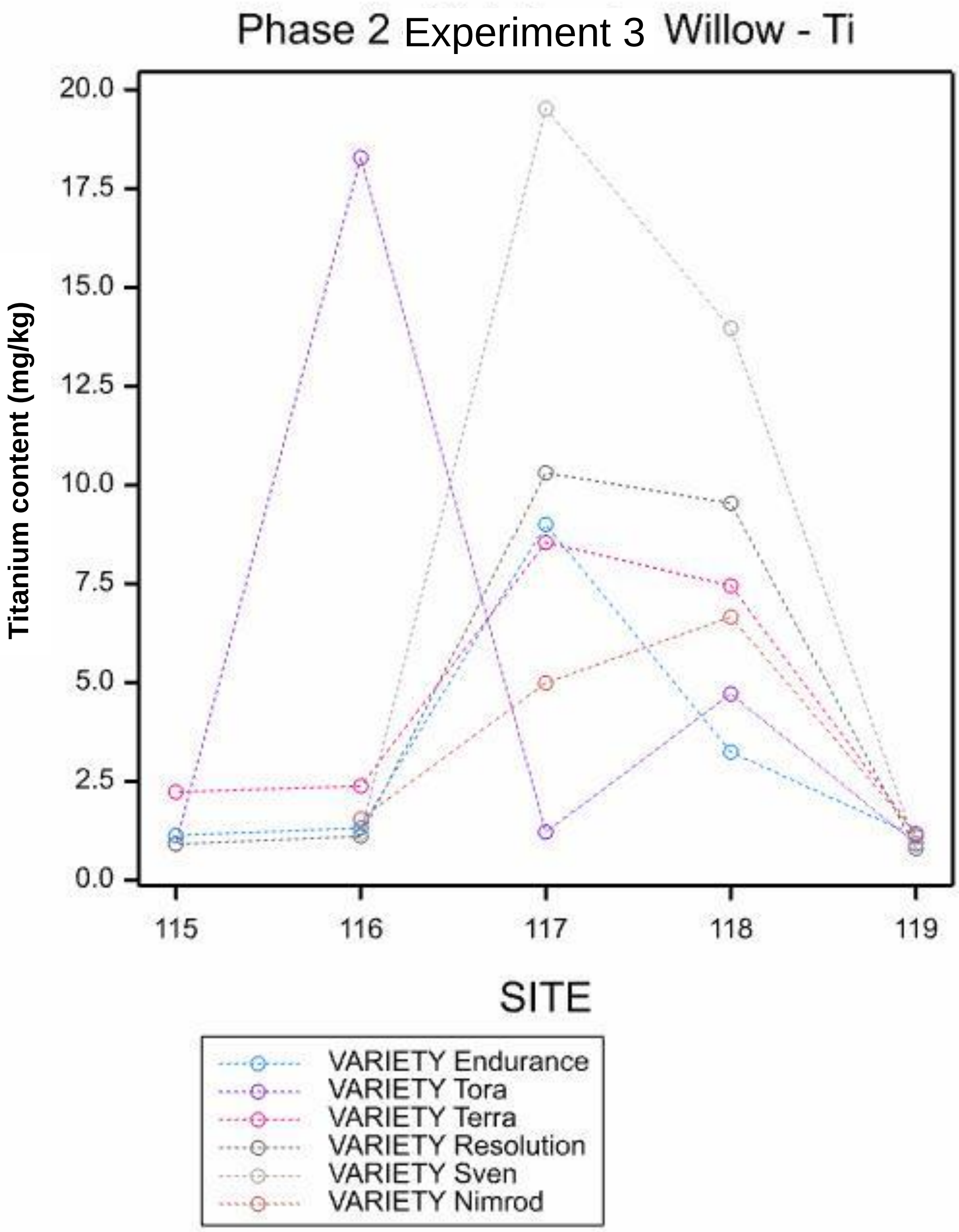
Phase 2 Experiment 3 Willow - Mg
Magnesium content (mg/kg)
700
600
500
400
300
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod


Phase 2 Experiment 3 Willow - Mn
Manganese content (mg/kg)
120
100
80
60
40
20
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

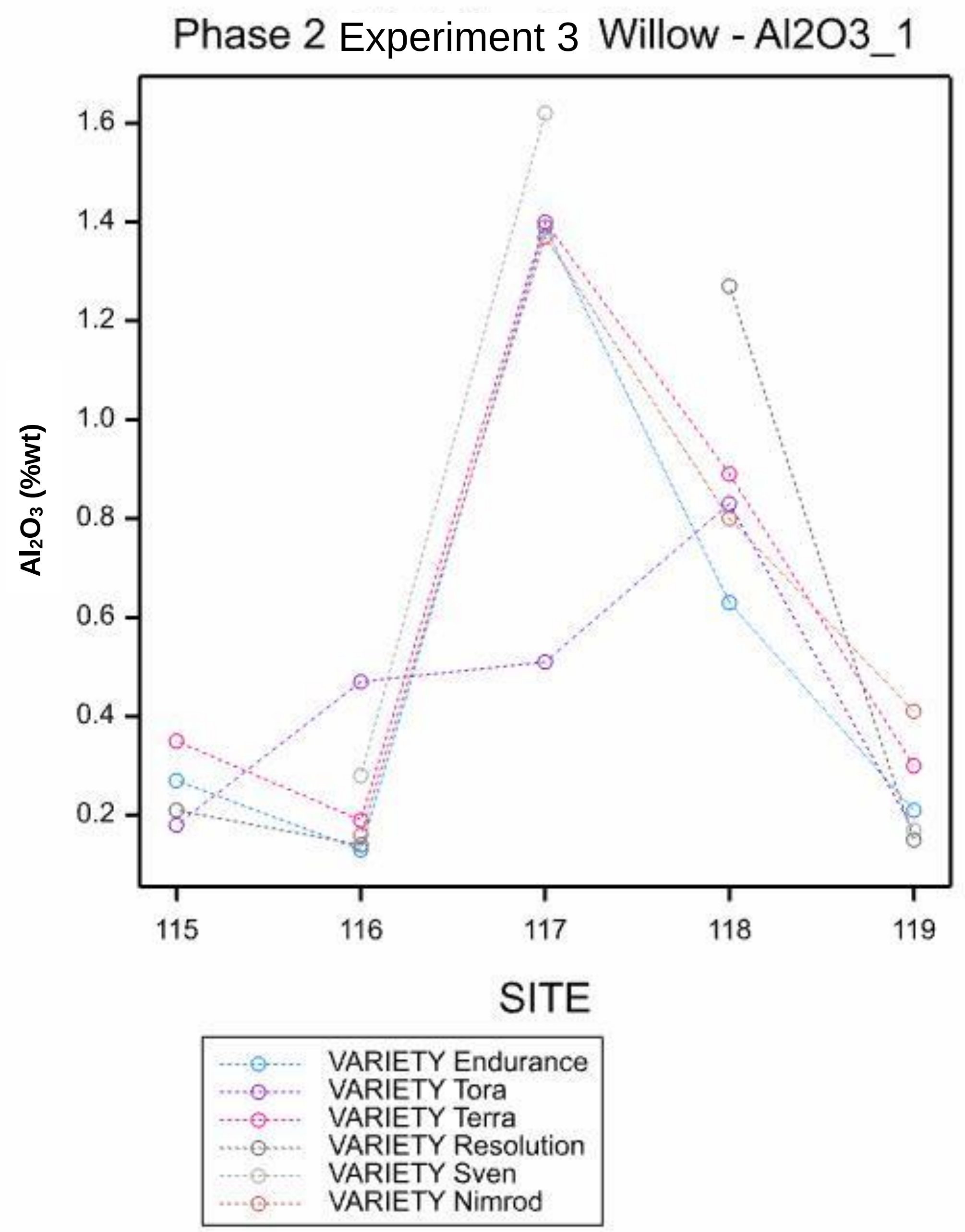

Phase 2 Experiment 3 Willow - Na
Sodium content (mg/kg)
200
175
150
125
100
75
50
25
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod


Phase 2 Experiment 3 Willow - P
1100
1000
900
800
700
Phosphorus content
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

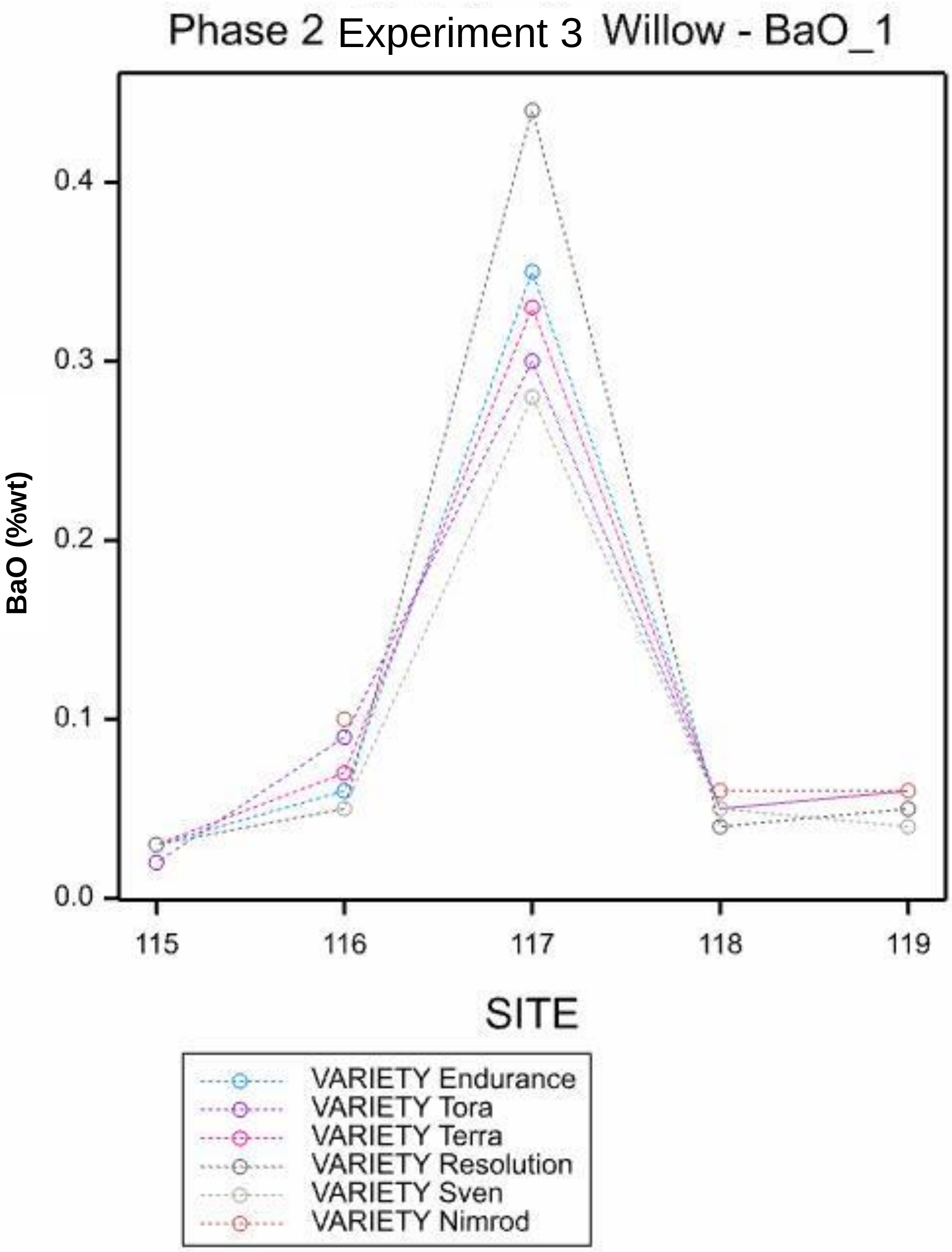

Phase 2 Experiment 3 Willow - Si
Silicon content (mg/kg)
1200
1000
800
600
400
200
0
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

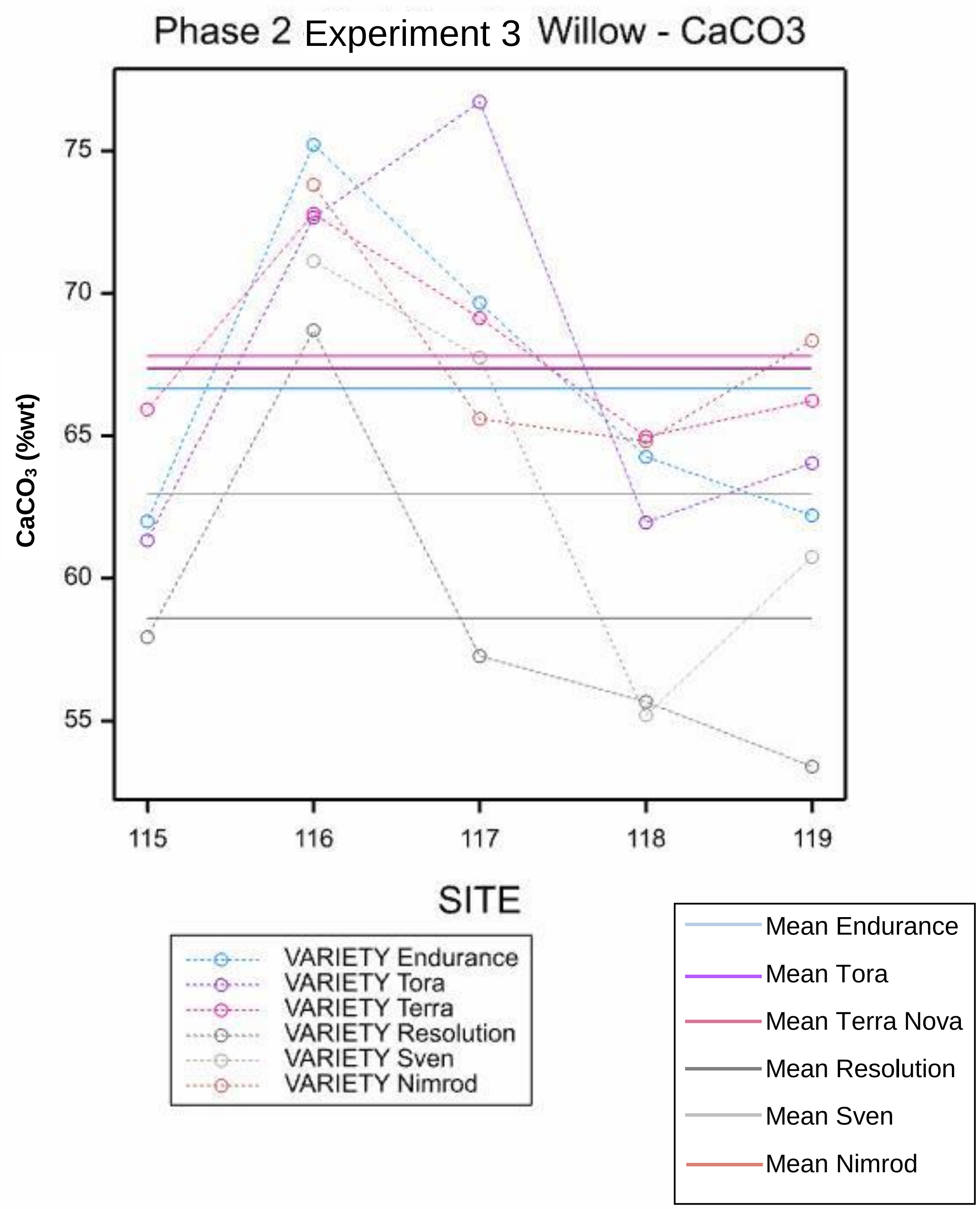


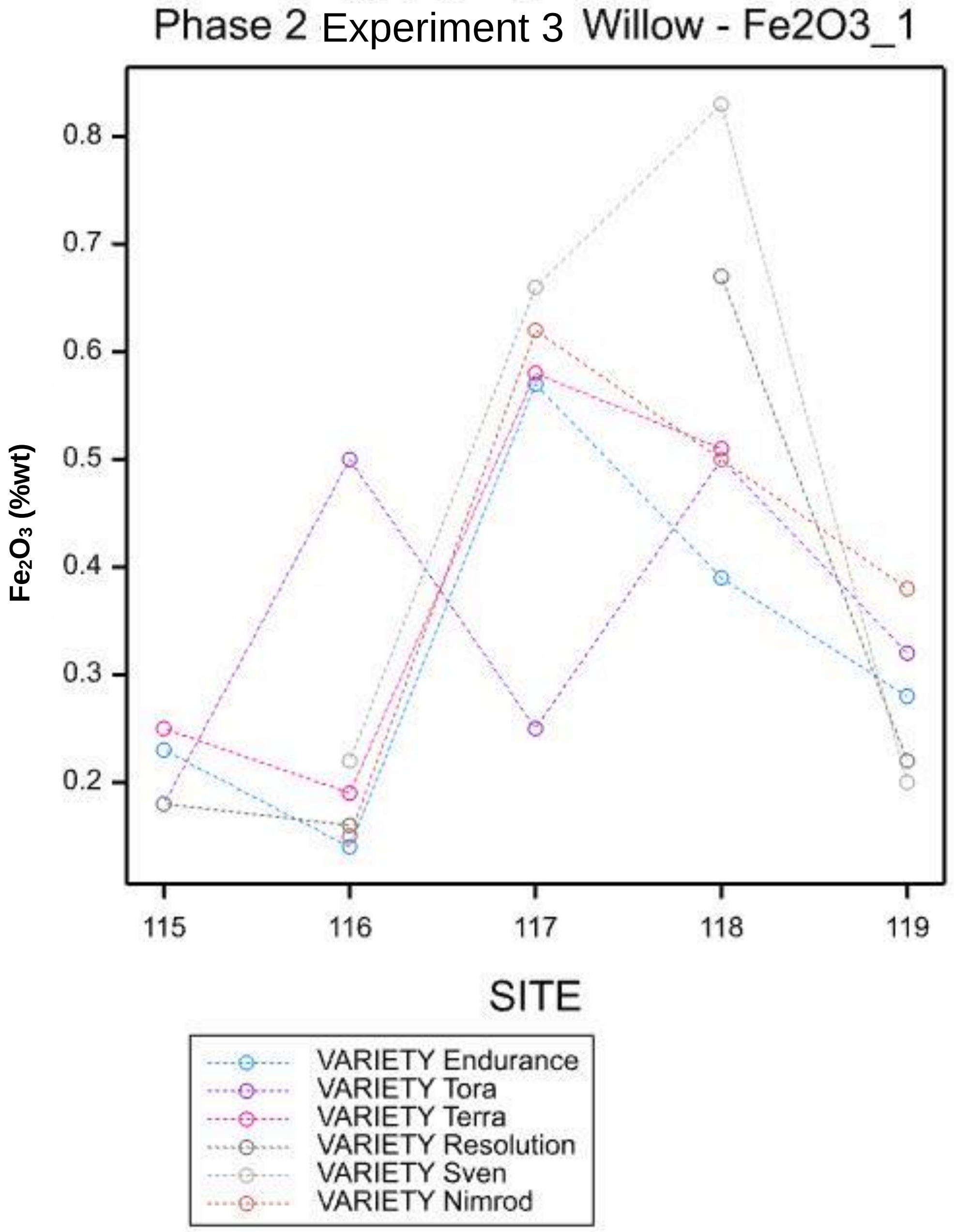
Phase 2 Experiment 3 Willow - Ti
Titanium content (mg/kg)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod



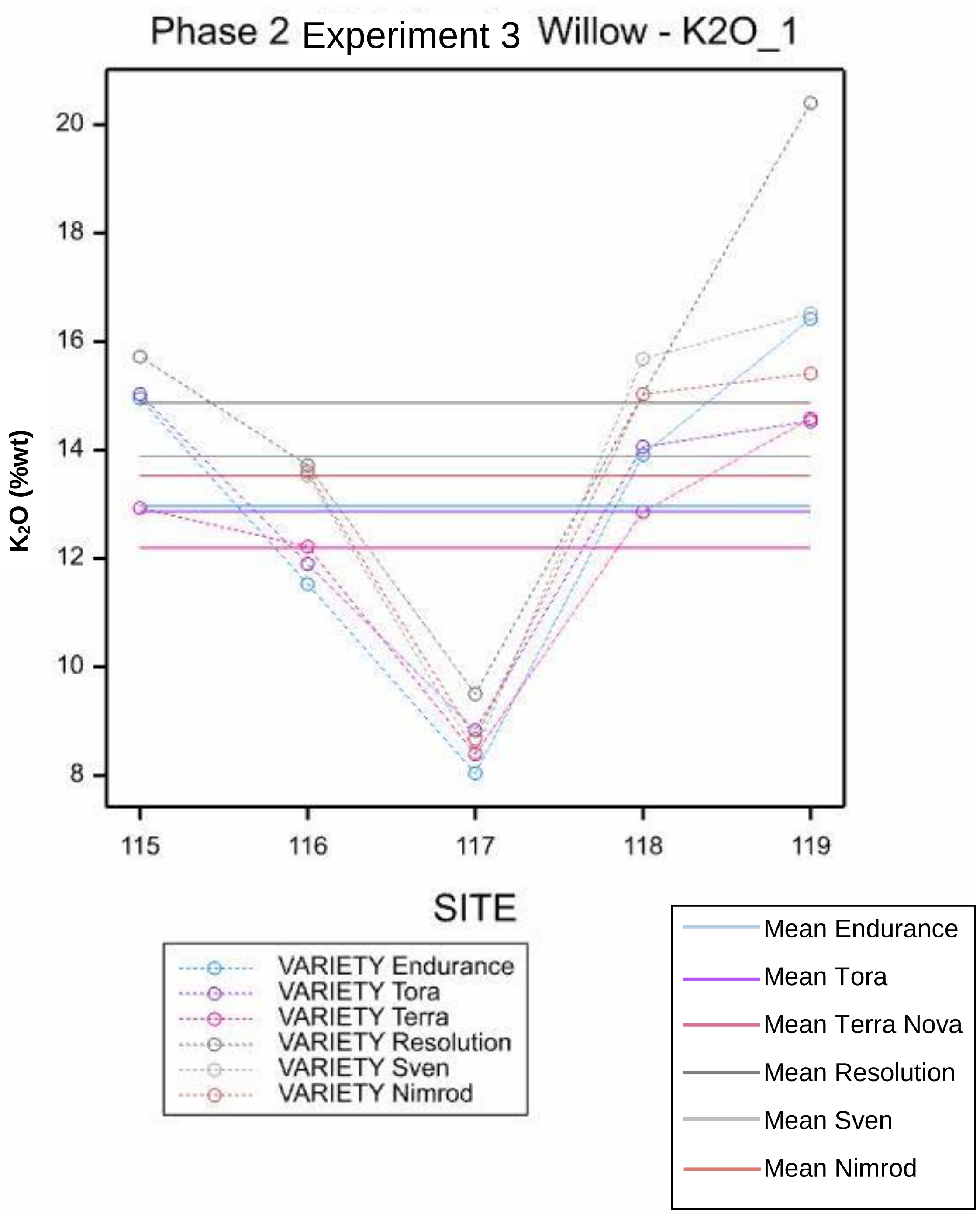
Phase 2 Experiment 3 Willow - Al2O3_1
Al2O3 (%wt)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod


Phase 2 Experiment 3 Willow - BaO_1
BaO (%wt)
0.0
0.1
0.2
0.3
0.4
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

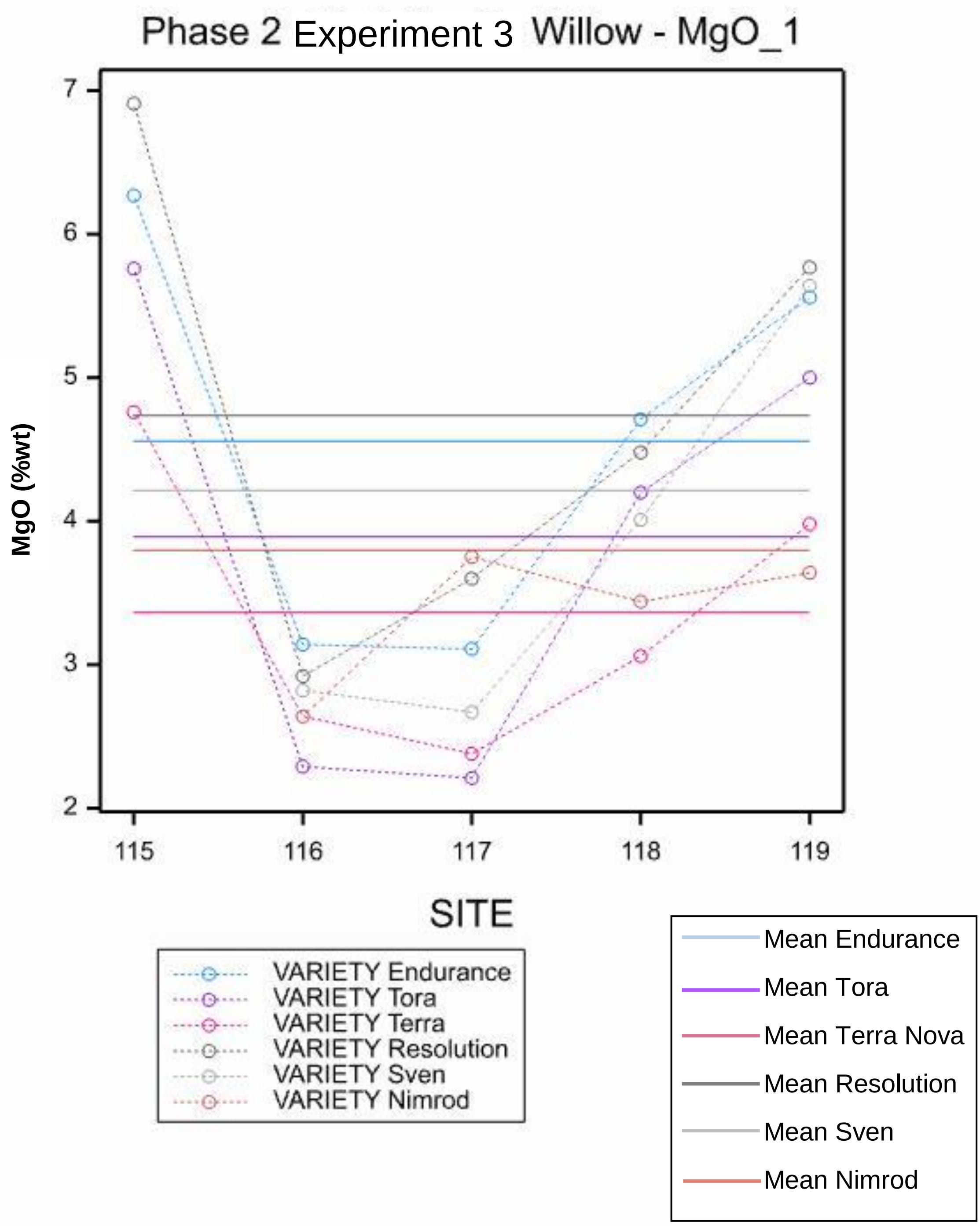

Phase 2 Experiment 3 Willow - CaCO3
CaCO₃ (%wt)
75
70
65
60
55
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

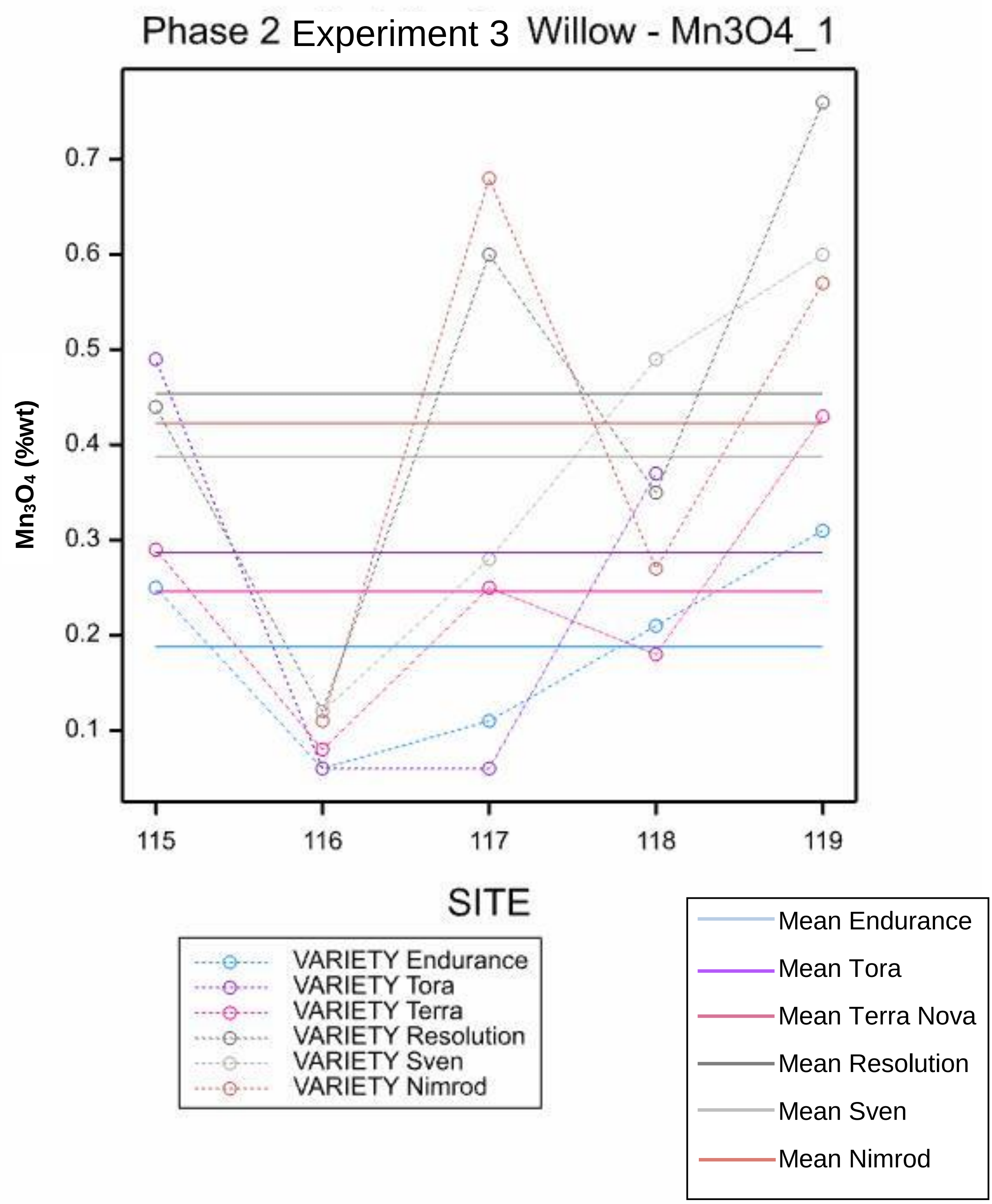


Phase 2 Experiment 3 Willow - Fe2O3_1
0.8
0.7
0.6
0.5
0.4
0.3
0.2
Fe_2O_3 (%wt)
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

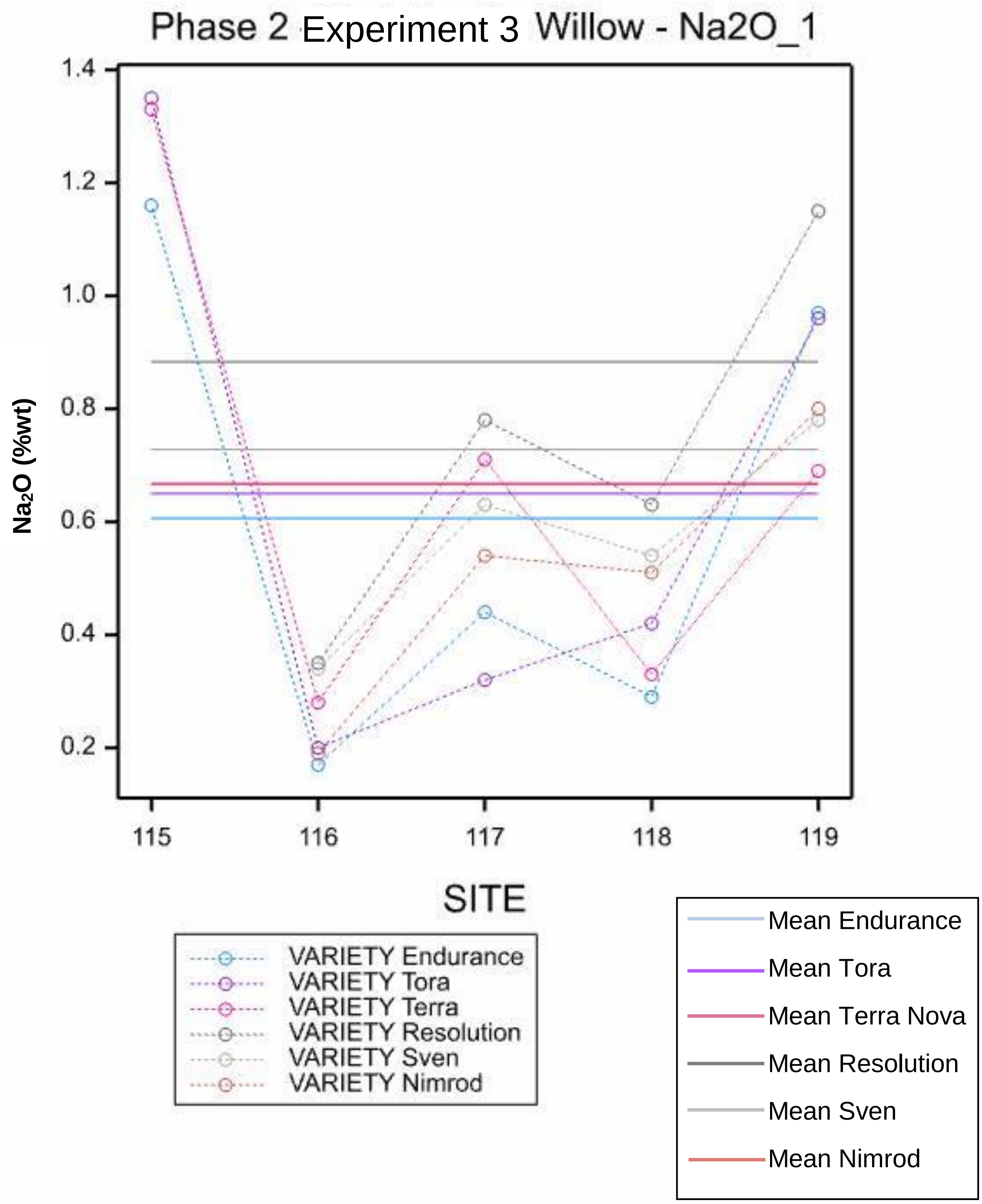


Phase 2 Experiment 3 Willow - K2O_1
K2O (%wt)
20
18
16
14
12
10
8
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

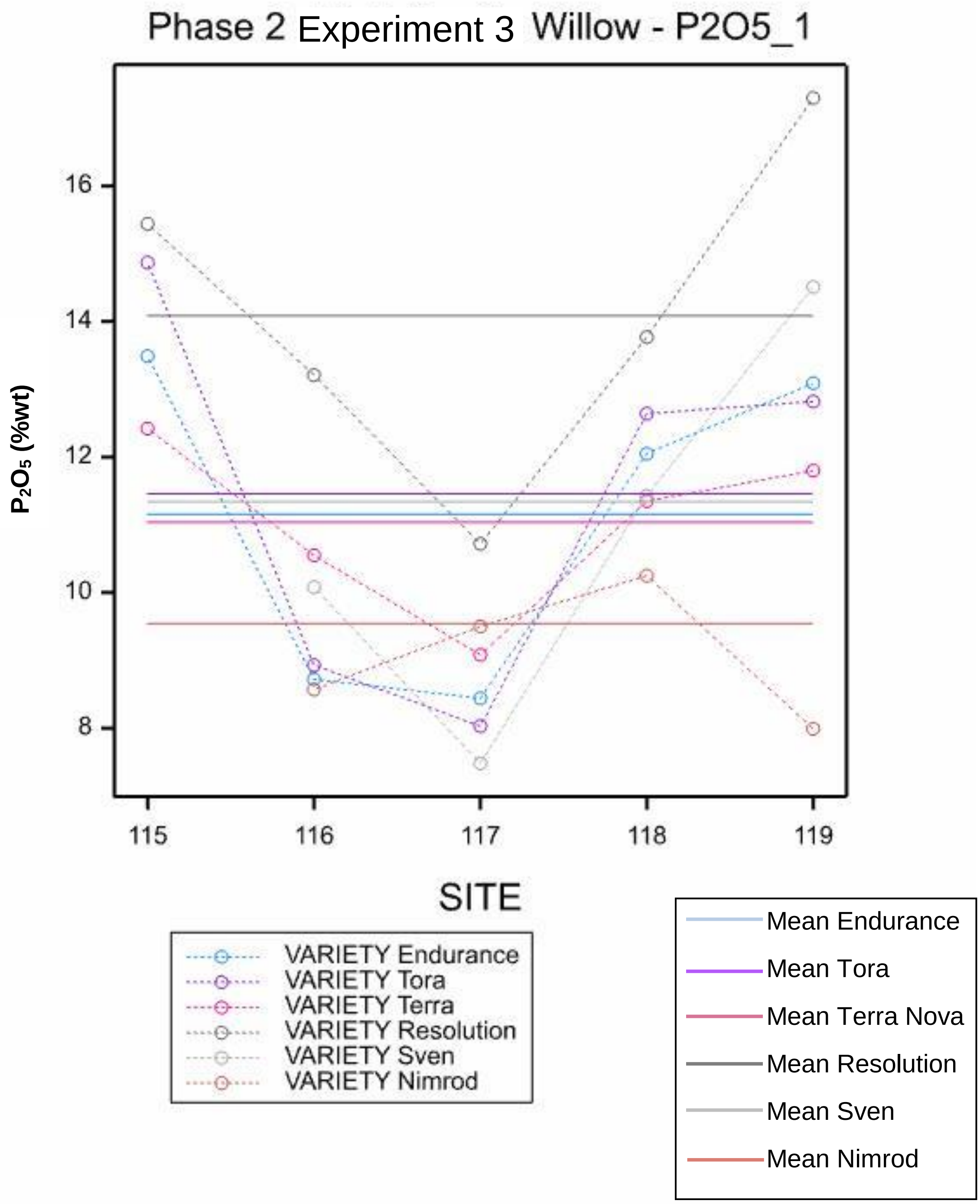

Phase 2 Experiment 3 Willow - MgO_1
MgO (%wt)
7
6
5
4
3
2
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod



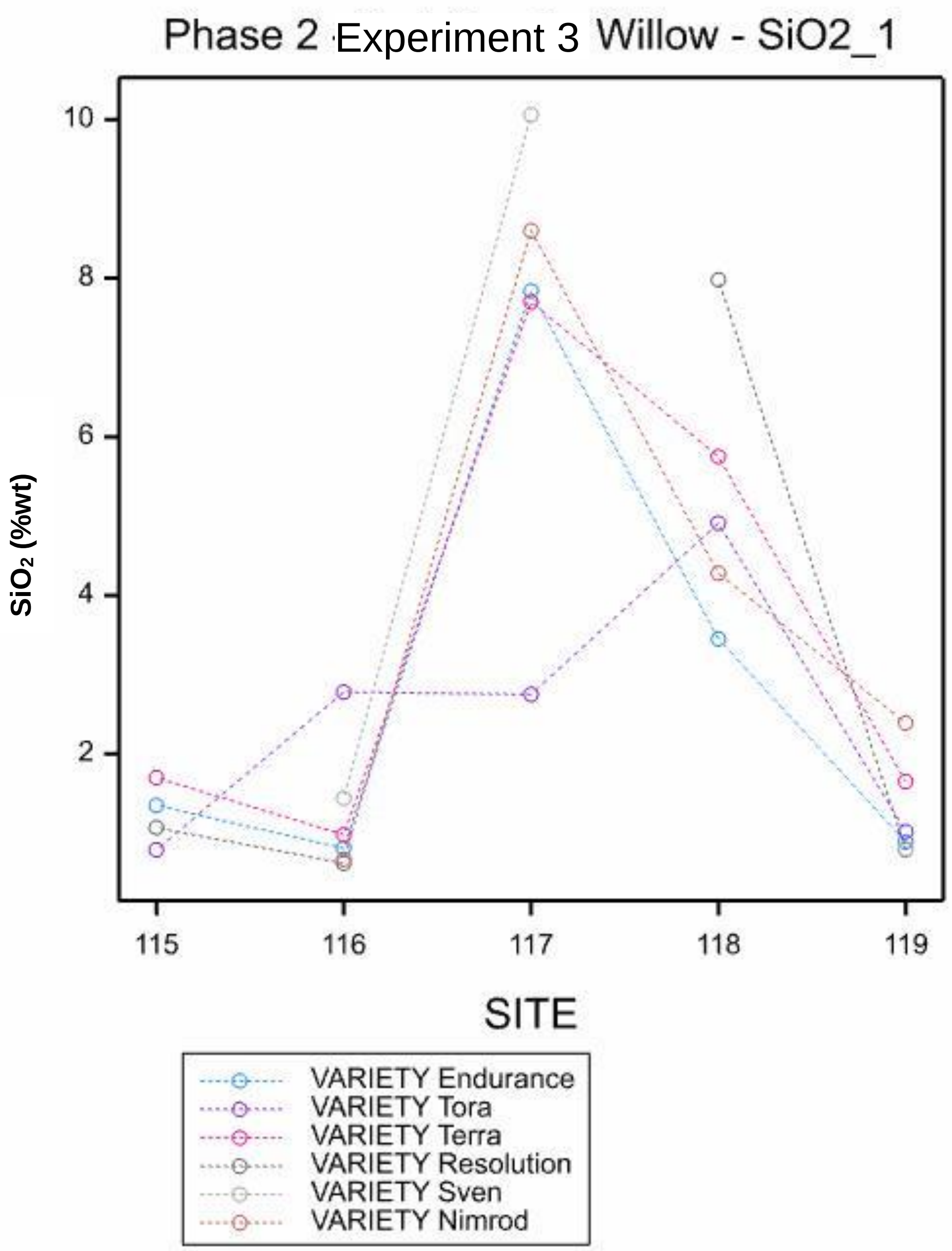
Phase 2 Experiment 3 Willow - Mn3O4_1
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Mn3O4 (%wt)
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod

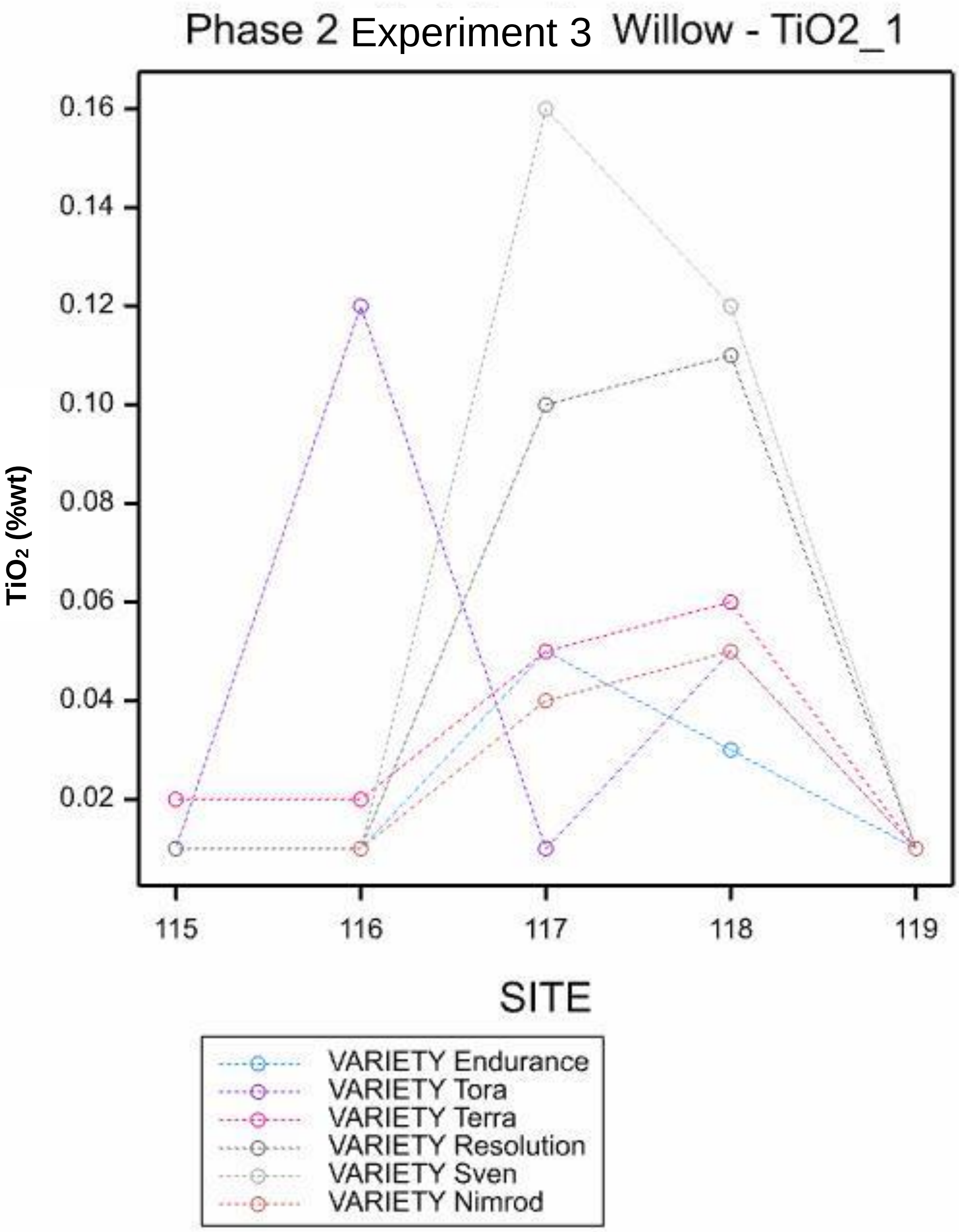


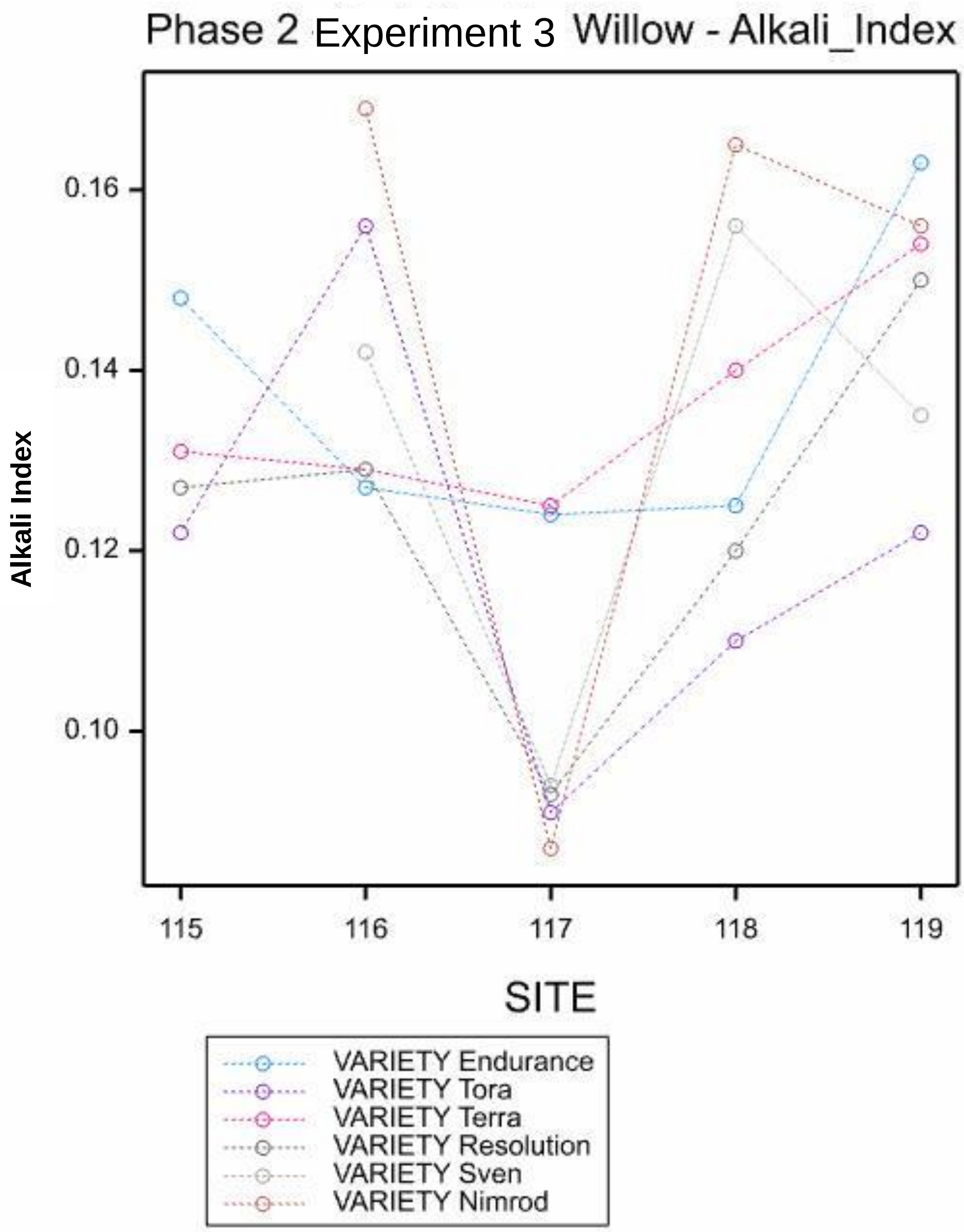
Phase 2 Experiment 3 Willow - Na2O_1
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Na₂O (%wt)
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod



Phase 2 Experiment 3 Willow - P2O5_1
16
14
12
10
8
P2O5 (%wt)
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod
Mean Endurance
Mean Tora
Mean Terra Nova
Mean Resolution
Mean Sven
Mean Nimrod


Phase 2 Experiment 3 Willow - SiO2_1
10
8
6
4
2
SiO₂ (%wt)
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod


Phase 2 Experiment 3 Willow - TiO2_1
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
TiO₂ (%wt)
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod


Phase 2 Experiment 3 Willow - Alkali_Index
Alkali Index
0.16
0.14
0.12
0.10
115
116
117
118
119
SITE
VARIETY Endurance
VARIETY Tora
VARIETY Terra
VARIETY Resolution
VARIETY Sven
VARIETY Nimrod

7. Statistical analysis of willow SRC varietal rankings by feedstock characteristic

Table 4 List of variables and bases for analysis

Variable	Basis of analysis
Moisture	As received
Net calorific value	As received
Ash content	Dry fuel
Volatile matter	Dry, ash free
Gross calorific value: GCV_1	Dry fuel
Gross calorific value: GCV_2	Dry, ash free
Carbon: C	Dry fuel
Carbon: C_1	Dry, ash free
Hydrogen: H_1	Dry fuel
Hydrogen: H_2	Dry, ash free
Nitrogen: N	Dry fuel
Nitrogen: N_1	Dry, ash free
Sulphur_1	Dry fuel
Sulphur_2	Dry, ash free
Chlorine_1	Dry fuel
Chlorine_2	Dry, ash free
Barium	Dry fuel
Beryllium	Dry fuel
Chromium	Dry fuel
Cobalt	Dry fuel
Copper	Dry fuel
Molybdenum	Dry fuel
Nickel	Dry fuel
Vanadium	Dry fuel
Zinc	Dry fuel
Antimony	Dry fuel
Arsenic	Dry fuel
Mercury	Dry fuel
Fluorine	Dry fuel
Bromine	Dry fuel
Selenium	Dry fuel
Cadmium	Dry fuel
Lead	Dry fuel
Aluminium	Dry fuel
Calcium	Dry fuel
Iron	Dry fuel
Potassium	Dry fuel
Magnesium	Dry fuel
Manganese	Dry fuel
Sodium	Dry fuel
Phosphorous	Dry fuel
Silicon	Dry fuel
Titanium	Dry fuel
Al_2O_3	Normalized ash
BaO	Normalized ash
$CaCO_3$	Normalized ash
Fe_2O_3	Normalized ash
K_2O	Normalized ash
MgO	Normalized ash
Mn_3O_4	Normalized ash
Na_2O	Normalized ash
P_2O_5	Normalized ash
SiO_2	Normalized ash
TiO_2	Normalized ash
Alkali index	

Moisture (ar)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	51.49	47.46	47.94	49.01	52.28
Tora	58.17	55.01	54.80	55.89	52.86
Terra	59.62	53.35	55.96	58.19	58.40
Resolution	56.58	54.53	51.95	53.42	54.02
Sven	*	54.42	55.28	54.72	55.05
Nimrod	*	57.39	56.28	57.12	57.71

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	47.46	47.94	49.01	52.28
Tora	55.01	54.80	55.89	52.86
Terra	53.35	55.96	58.19	58.40
Resolution	54.53	51.95	53.42	54.02
Sven	54.42	55.28	54.72	55.05
Nimrod	57.39	56.28	57.12	57.71

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	1.000	1.000	1.000
Tora	5.000	3.000	4.000	2.000
Terra	2.000	5.000	6.000	6.000
Resolution	4.000	2.000	2.000	3.000
Sven	3.000	4.000	3.000	4.000
Nimrod	6.000	6.000	5.000	5.000

Net calorific value (ar)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	7748.00	8465.00	8346.00	8168.00	7457.00
Tora	6337.00	7009.00	6949.00	6692.00	7391.00
Terra	6017.00	7238.00	6746.00	6244.00	6250.00
Resolution	6674.00	7124.00	7536.00	7215.00	7108.00
Sven	*	7049.00	6872.00	6926.00	6823.00
Nimrod	*	6556.00	6746.00	6601.00	6442.00

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	8465.00	8346.00	8168.00	7457.00
Tora	7009.00	6949.00	6692.00	7391.00
Terra	7238.00	6746.00	6244.00	6250.00
Resolution	7124.00	7536.00	7215.00	7108.00
Sven	7049.00	6872.00	6926.00	6823.00
Nimrod	6556.00	6746.00	6601.00	6442.00

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	6.000	6.000	6.000	6.000
Tora	2.000	4.000	3.000	5.000
Terra	5.000	1.500	1.000	1.000
Resolution	4.000	5.000	5.000	4.000
Sven	3.000	3.000	4.000	3.000
Nimrod	1.000	1.500	2.000	2.000

Ash content (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	1.89	2.20	*	1.80	1.85
Tora	1.53	2.54	2.04	1.57	1.53
Terra	1.86	1.98	2.85	2.07	1.96
Resolution	1.52	1.85	1.91	1.59	1.34
Sven	*	2.00	2.17	1.94	1.50
Nimrod	*	2.59	2.08	2.22	1.95

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	2.20	1.80	1.85
Tora	2.54	1.57	1.53
Terra	1.98	2.07	1.96
Resolution	1.85	1.59	1.34
Sven	2.00	1.94	1.50
Nimrod	2.59	2.22	1.95

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	4.000	3.000	4.000
Tora	5.000	1.000	3.000
Terra	2.000	5.000	6.000
Resolution	1.000	2.000	1.000
Sven	3.000	4.000	2.000
Nimrod	6.000	6.000	5.000

Volatile matter (DAF)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	82.94	84.39	82.96	84.03	83.50
Tora	82.65	82.95	83.94	83.98	83.35
Terra	83.39	84.18	82.82	83.87	82.83
Resolution	81.92	82.10	82.98	83.39	83.92
Sven	*	82.63	83.00	82.59	83.93
Nimrod	*	82.24	82.64	82.07	82.59

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	84.39	82.96	84.03	83.50
Tora	82.95	83.94	83.98	83.35
Terra	84.18	82.82	83.87	82.83
Resolution	82.10	82.98	83.39	83.92
Sven	82.63	83.00	82.59	83.93
Nimrod	82.24	82.64	82.07	82.59

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	6.000	3.000	6.000	4.000
Tora	4.000	6.000	5.000	3.000
Terra	5.000	2.000	4.000	2.000
Resolution	1.000	4.000	3.000	5.000
Sven	3.000	5.000	2.000	6.000
Nimrod	2.000	1.000	1.000	1.000

Gross calorific value (DAF)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	20293.00	20099.00	20212.00	20071.00	19988.00
Tora	20183.00	20408.00	20074.00	19906.00	20050.00
Terra	20219.00	20022.00	20319.00	20067.00	20165.00
Resolution	20180.00	20302.00	20033.00	19938.00	19924.00
Sven	*	20104.00	20148.00	19949.00	19794.00
Nimrod	*	20522.00	20322.00	20421.00	20265.00

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	20099.00	20212.00	20071.00	19988.00
Tora	20408.00	20074.00	19906.00	20050.00
Terra	20022.00	20319.00	20067.00	20165.00
Resolution	20302.00	20033.00	19938.00	19924.00
Sven	20104.00	20148.00	19949.00	19794.00
Nimrod	20522.00	20322.00	20421.00	20265.00

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	2.000	4.000	5.000	3.000
Tora	5.000	2.000	1.000	4.000
Terra	1.000	5.000	4.000	5.000
Resolution	4.000	1.000	2.000	2.000
Sven	3.000	3.000	3.000	1.000
Nimrod	6.000	6.000	6.000	6.000

Carbon (DAF)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	50.69	50.96	51.43	50.72	49.94
Tora	50.62	51.24	51.04	49.99	50.20
Terra	50.92	50.89	51.30	50.31	50.45
Resolution	50.59	51.17	50.65	49.80	49.80
Sven	*	50.81	50.65	49.77	49.89
Nimrod	*	51.89	51.47	50.95	50.92

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	50.96	51.43	50.72	49.94
Tora	51.24	51.04	49.99	50.20
Terra	50.89	51.30	50.31	50.45
Resolution	51.17	50.65	49.80	49.80
Sven	50.81	50.65	49.77	49.89
Nimrod	51.89	51.47	50.95	50.92

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	3.000	5.000	5.000	3.000
Tora	5.000	3.000	3.000	4.000
Terra	2.000	4.000	4.000	5.000
Resolution	4.000	1.500	2.000	1.000
Sven	1.000	1.500	1.000	2.000
Nimrod	6.000	6.000	6.000	6.000

Hydrogen (DAF)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	6.28	6.27	6.26	6.28	6.16
Tora	6.19	6.25	6.23	6.20	6.17
Terra	6.26	6.17	6.22	6.16	6.17
Resolution	6.14	6.21	6.20	6.21	6.18
Sven	*	6.19	6.20	6.15	6.18
Nimrod	*	6.20	6.23	6.20	6.12

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	6.27	6.26	6.28	6.16
Tora	6.25	6.23	6.20	6.17
Terra	6.17	6.22	6.16	6.17
Resolution	6.21	6.20	6.21	6.18
Sven	6.19	6.20	6.15	6.18
Nimrod	6.20	6.23	6.20	6.12

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	6.000	6.000	6.000	2.000
Tora	5.000	4.500	3.500	3.500
Terra	1.000	3.000	2.000	3.500
Resolution	4.000	1.500	5.000	5.500
Sven	2.000	1.500	1.000	5.500
Nimrod	3.000	4.500	3.500	1.000

Nitrogen (DAF)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.73	0.54	0.64	0.55	0.46
Tora	0.60	0.48	0.42	0.44	0.44
Terra	0.68	0.44	0.57	0.59	0.52
Resolution	0.70	0.39	0.43	0.47	0.37
Sven	*	0.45	0.49	0.49	0.42
Nimrod	*	0.54	0.54	0.59	0.50

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.54	0.64	0.55	0.46
Tora	0.48	0.42	0.44	0.44
Terra	0.44	0.57	0.59	0.52
Resolution	0.39	0.43	0.47	0.37
Sven	0.45	0.49	0.49	0.42
Nimrod	0.54	0.54	0.59	0.50

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	5.500	6.000	4.000	4.000
Tora	4.000	1.000	1.000	3.000
Terra	2.000	5.000	5.500	6.000
Resolution	1.000	2.000	2.000	1.000
Sven	3.000	3.000	3.000	2.000
Nimrod	5.500	4.000	5.500	5.000

Sulphur (DAF)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.04	0.06	0.04	0.04	0.04
Tora	0.02	0.02	0.02	0.02	0.02
Terra	*	0.02	0.02	0.05	0.05
Resolution	0.05	0.02	0.02	0.04	0.02
Sven	*	0.02	0.05	0.05	0.02
Nimrod	*	0.02	0.02	0.02	0.02

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.06	0.04	0.04	0.04
Tora	0.02	0.02	0.02	0.02
Terra	0.02	0.02	0.05	0.05
Resolution	0.02	0.02	0.04	0.02
Sven	0.02	0.05	0.05	0.02
Nimrod	0.02	0.02	0.02	0.02

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	6.000	5.000	3.500	5.000
Tora	3.000	2.500	1.500	2.500
Terra	3.000	2.500	5.500	6.000
Resolution	3.000	2.500	3.500	2.500
Sven	3.000	6.000	5.500	2.500
Nimrod	3.000	2.500	1.500	2.500

Chlorine (DAF)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.02	0.02	0.02	0.01	0.02
Tora	0.02	0.01	0.02	0.01	0.02
Terra	0.03	0.01	0.02	0.01	0.02
Resolution	0.02	0.02	0.02	0.02	0.02
Sven	*	0.01	*	0.01	0.02
Nimrod	*	0.01	0.01	0.01	0.02

Analysed Data (All Varieties x Sites With Complete Data)

	116	118	119
Endurance	0.02	0.01	0.02
Tora	0.01	0.01	0.02
Terra	0.01	0.01	0.02
Resolution	0.02	0.02	0.02
Sven	0.01	0.01	0.02
Nimrod	0.01	0.01	0.02

Analysed Data Ranks (1=Lowest to 6=Highest)

	116	118	119
Endurance	5.500	3.000	3.500
Tora	2.500	3.000	3.500
Terra	2.500	3.000	3.500
Resolution	5.500	6.000	3.500
Sven	2.500	3.000	3.500
Nimrod	2.500	3.000	3.500

Barium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	3.99	12.25	64.39	7.73	7.46
Tora	3.00	18.43	53.04	6.72	8.33
Terra	5.02	14.04	59.67	10.23	12.86
Resolution	3.52	7.53	67.23	6.06	7.72
Sven	*	10.10	54.38	8.09	6.54
Nimrod	*	20.79	*	9.10	4.31

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	12.25	7.73	7.46
Tora	18.43	6.72	8.33
Terra	14.04	10.23	12.86
Resolution	7.53	6.06	7.72
Sven	10.10	8.09	6.54
Nimrod	20.79	9.10	4.31

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	3.000	3.000	3.000
Tora	5.000	2.000	5.000
Terra	4.000	6.000	6.000
Resolution	1.000	1.000	4.000
Sven	2.000	4.000	2.000
Nimrod	6.000	5.000	1.000

Beryllium (d)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	0.08	0.12	0.11	0.08	0.07
Tora	0.07	0.11	0.10	0.08	0.08
Terra	0.11	0.11	0.12	0.12	0.11
Resolution	0.08	0.09	0.09	0.08	0.08
Sven	*	0.12	0.11	0.09	0.08
Nimrod	*	0.12	0.11	0.08	0.04

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.12	0.11	0.08	0.07
Tora	0.11	0.10	0.08	0.08
Terra	0.11	0.12	0.12	0.11
Resolution	0.09	0.09	0.08	0.08
Sven	0.12	0.11	0.09	0.08
Nimrod	0.12	0.11	0.08	0.04

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	5.000	4.000	2.500	2.000
Tora	2.500	2.000	2.500	4.000
Terra	2.500	6.000	6.000	6.000
Resolution	1.000	1.000	2.500	4.000
Sven	5.000	4.000	5.000	4.000
Nimrod	5.000	4.000	2.500	1.000

Chromium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.10	0.12	0.27	0.18	0.15
Tora	0.09	*	0.17	0.20	0.17
Terra	0.15	0.14	*	0.34	0.14
Resolution	0.10	0.10	0.33	0.28	0.14
Sven	*	0.21	0.39	0.42	0.13
Nimrod	*	0.12	0.26	0.23	0.08

No Data Analysed

Cobalt (d)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	0.08	0.13	0.11	0.11	0.15
Tora	0.11	0.14	0.10	0.11	*
Terra	0.11	0.16	0.12	0.12	0.15
Resolution	0.08	0.09	0.09	0.09	0.09
Sven	*	0.12	0.17	0.14	0.08
Nimrod	*	0.16	0.11	0.09	0.16

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.13	0.11	0.11
Tora	0.14	0.10	0.11
Terra	0.16	0.12	0.12
Resolution	0.09	0.09	0.09
Sven	0.12	0.17	0.14
Nimrod	0.16	0.11	0.09

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	3.000	3.500	3.500
Tora	4.000	2.000	3.500
Terra	5.500	5.000	5.000
Resolution	1.000	1.000	1.500
Sven	2.000	6.000	6.000
Nimrod	5.500	3.500	1.500

Copper (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	4.13	5.13	5.03	3.47	3.31
Tora	3.61	3.96	4.21	3.09	3.67
Terra	4.09	4.02	5.12	4.91	4.72
Resolution	4.36	4.67	4.57	3.64	4.04
Sven	*	4.63	4.93	4.17	3.78
Nimrod	*	5.77	5.16	4.46	*

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	5.13	5.03	3.47
Tora	3.96	4.21	3.09
Terra	4.02	5.12	4.91
Resolution	4.67	4.57	3.64
Sven	4.63	4.93	4.17
Nimrod	5.77	5.16	4.46

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	5.000	4.000	2.000
Tora	1.000	1.000	1.000
Terra	2.000	5.000	6.000
Resolution	4.000	2.000	3.000
Sven	3.000	3.000	4.000
Nimrod	6.000	6.000	5.000

Molybdenum (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.08	0.05	0.11	0.08	0.07
Tora	0.07	0.11	0.10	0.08	0.08
Terra	0.11	0.11	0.12	0.12	0.11
Resolution	0.08	0.03	0.09	0.08	0.08
Sven	*	0.12	0.11	0.09	0.08
Nimrod	*	0.12	0.11	0.08	0.04

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.05	0.11	0.08	0.07
Tora	0.11	0.10	0.08	0.08
Terra	0.11	0.12	0.12	0.11
Resolution	0.03	0.09	0.08	0.08
Sven	0.12	0.11	0.09	0.08
Nimrod	0.12	0.11	0.08	0.04

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	2.000	4.000	2.500	2.000
Tora	3.500	2.000	2.500	4.000
Terra	3.500	6.000	6.000	6.000
Resolution	1.000	1.000	2.500	4.000
Sven	5.500	4.000	5.000	4.000
Nimrod	5.500	4.000	2.500	1.000

Nickel (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.17	0.61	0.35	0.48	0.36
Tora	0.21	0.41	0.17	0.65	0.65
Terra	0.37	0.42	0.48	0.90	*
Resolution	0.28	0.28	0.69	0.66	0.97
Sven	*	0.46	0.38	1.00	0.60
Nimrod	*	0.69	*	0.78	0.48

No Data Analysed (All Varieties Have Less Than Three Sites Complete Data)

Vanadium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.08	0.12	0.17	0.09	0.07
Tora	0.07	0.11	0.10	0.11	0.08
Terra	0.12	0.11	0.16	0.21	0.11
Resolution	0.08	0.09	0.25	0.20	0.08
Sven	*	0.12	0.20	0.28	0.08
Nimrod	*	0.12	0.15	0.16	0.04

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.12	0.17	0.09	0.07
Tora	0.11	0.10	0.11	0.08
Terra	0.11	0.16	0.21	0.11
Resolution	0.09	0.25	0.20	0.08
Sven	0.12	0.20	0.28	0.08
Nimrod	0.12	0.15	0.16	0.04

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	5.000	4.000	1.000	2.000
Tora	2.500	1.000	2.000	4.000
Terra	2.500	3.000	5.000	6.000
Resolution	1.000	6.000	4.000	4.000
Sven	5.000	5.000	6.000	4.000
Nimrod	5.000	2.000	3.000	1.000

Zinc (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	77.33	193.30	83.52	60.59	59.74
Tora	74.72	106.42	73.91	61.95	75.07
Terra	103.39	179.33	105.07	87.50	102.50
Resolution	95.35	110.69	96.75	71.77	97.42
Sven	*	141.91	96.54	84.89	90.97
Nimrod	*	*	127.06	70.27	39.59

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	83.52	60.59	59.74
Tora	73.91	61.95	75.07
Terra	105.07	87.50	102.50
Resolution	96.75	71.77	97.42
Sven	96.54	84.89	90.97
Nimrod	127.06	70.27	39.59

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	2.000	1.000	2.000
Tora	1.000	2.000	3.000
Terra	5.000	6.000	6.000
Resolution	4.000	4.000	5.000
Sven	3.000	5.000	4.000
Nimrod	6.000	3.000	1.000

Antimony (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.02	0.02	0.02	0.02	0.01
Tora	0.01	0.29	0.02	0.02	0.02
Terra	0.02	0.03	0.02	0.02	0.02
Resolution	0.02	*	0.02	0.02	0.02
Sven	*	0.05	0.13	0.02	0.02
Nimrod	*	0.03	0.02	0.02	0.01

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.02	0.02	0.01
Tora	0.02	0.02	0.02
Terra	0.02	0.02	0.02
Resolution	0.02	0.02	0.02
Sven	0.13	0.02	0.02
Nimrod	0.02	0.02	0.01

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	3.000	3.500	1.500
Tora	3.000	3.500	4.500
Terra	3.000	3.500	4.500
Resolution	3.000	3.500	4.500
Sven	6.000	3.500	4.500
Nimrod	3.000	3.500	1.500

Arsenic (d)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	0.02	0.02	0.06	0.02	0.01
Tora	0.01	0.08	0.02	0.02	0.02
Terra	0.03	0.02	0.05	0.02	0.02
Resolution	0.02	0.02	0.06	0.02	0.02
Sven	*	0.02	0.08	0.03	0.02
Nimrod	*	0.02	0.07	0.02	0.01

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.02	0.06	0.02	0.01
Tora	0.08	0.02	0.02	0.02
Terra	0.02	0.05	0.02	0.02
Resolution	0.02	0.06	0.02	0.02
Sven	0.02	0.08	0.03	0.02
Nimrod	0.02	0.07	0.02	0.01

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	3.000	3.500	3.000	1.500
Tora	6.000	1.000	3.000	4.500
Terra	3.000	2.000	3.000	4.500
Resolution	3.000	3.500	3.000	4.500
Sven	3.000	6.000	6.000	4.500
Nimrod	3.000	5.000	3.000	1.500

Mercury (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.00	0.01	0.01	0.00	0.00
Tora	0.00	*	0.00	0.00	0.00
Terra	0.01	0.00	0.00	0.00	0.00
Resolution	0.00	0.00	0.00	0.00	0.00
Sven	*	0.01	0.01	0.00	0.00
Nimrod	*	0.00	0.01	0.00	0.00

Analysed Data (All Varieties x Sites With Complete Data)

	117	118	119
Endurance	0.01	0.00	0.00
Tora	0.00	0.00	0.00
Terra	0.00	0.00	0.00
Resolution	0.00	0.00	0.00
Sven	0.01	0.00	0.00
Nimrod	0.01	0.00	0.00

Analysed Data Ranks (1=Lowest to 6=Highest)

	117	118	119
Endurance	4.500	3.500	3.500
Tora	2.000	3.500	3.500
Terra	2.000	3.500	3.500
Resolution	2.000	3.500	3.500
Sven	4.500	3.500	3.500
Nimrod	6.000	3.500	3.500

Fluorine (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	3.93	1.96	1.99	1.86	2.00
Tora	3.74	2.06	2.01	1.93	2.11
Terra	1.98	2.11	2.10	1.88	2.09
Resolution	3.98	2.05	2.09	1.98	2.10
Sven	*	2.19	2.09	*	2.08
Nimrod	*	2.08	1.99	1.97	2.10

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	1.96	1.99	2.00
Tora	2.06	2.01	2.11
Terra	2.11	2.10	2.09
Resolution	2.05	2.09	2.10
Sven	2.19	2.09	2.08
Nimrod	2.08	1.99	2.10

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	1.000	1.000
Tora	3.000	3.000	6.000
Terra	5.000	6.000	3.000
Resolution	2.000	5.000	4.500
Sven	6.000	4.000	2.000
Nimrod	4.000	2.000	4.500

Bromine (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	1.96	1.96	1.99	1.86	2.00
Tora	1.87	2.06	2.01	1.93	2.11
Terra	1.98	2.11	2.10	1.88	2.09
Resolution	1.99	2.05	2.09	1.98	2.10
Sven	*	2.19	2.09	1.97	2.08
Nimrod	*	2.08	1.99	1.97	2.10

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	1.96	1.99	1.86	2.00
Tora	2.06	2.01	1.93	2.11
Terra	2.11	2.10	1.88	2.09
Resolution	2.05	2.09	1.98	2.10
Sven	2.19	2.09	1.97	2.08
Nimrod	2.08	1.99	1.97	2.10

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	1.000	1.000	1.000
Tora	3.000	3.000	3.000	6.000
Terra	5.000	6.000	2.000	3.000
Resolution	2.000	5.000	6.000	4.500
Sven	6.000	4.000	4.000	2.000
Nimrod	4.000	2.000	5.000	4.500

Selenium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.39	0.39	0.40	0.37	0.40
Tora	0.37	0.41	0.40	0.39	0.42
Terra	0.40	0.42	0.42	0.38	0.42
Resolution	0.40	0.41	0.42	0.40	0.42
Sven	*	0.44	0.42	0.39	0.42
Nimrod	*	0.42	0.40	0.40	0.42

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.39	0.40	0.37	0.40
Tora	0.41	0.40	0.39	0.42
Terra	0.42	0.42	0.38	0.42
Resolution	0.41	0.42	0.40	0.42
Sven	0.44	0.42	0.39	0.42
Nimrod	0.42	0.40	0.40	0.42

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	1.000	1.000	1.000
Tora	3.000	3.000	3.000	5.000
Terra	5.000	6.000	2.000	3.000
Resolution	2.000	5.000	5.500	5.000
Sven	6.000	4.000	4.000	2.000
Nimrod	4.000	2.000	5.500	5.000

Cadmium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.35	2.81	2.03	1.44	1.54
Tora	0.53	1.15	2.37	1.62	2.49
Terra	0.52	0.76	2.83	2.00	2.69
Resolution	0.59	0.59	2.00	1.55	2.29
Sven	*	1.22	4.39	2.30	2.55
Nimrod	*	1.75	*	0.91	1.08

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	2.81	1.44	1.54
Tora	1.15	1.62	2.49
Terra	0.76	2.00	2.69
Resolution	0.59	1.55	2.29
Sven	1.22	2.30	2.55
Nimrod	1.75	0.91	1.08

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	6.000	2.000	2.000
Tora	3.000	4.000	4.000
Terra	2.000	5.000	6.000
Resolution	1.000	3.000	3.000
Sven	4.000	6.000	5.000
Nimrod	5.000	1.000	1.000

Lead (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.15	0.38	0.54	0.10	0.28
Tora	0.13	*	0.35	0.18	0.23
Terra	0.36	2.41	0.53	0.24	0.48
Resolution	0.13	0.19	0.53	0.20	0.12
Sven	*	1.28	2.15	0.50	0.11
Nimrod	*	0.17	0.46	0.16	0.10

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.54	0.10	0.28
Tora	0.35	0.18	0.23
Terra	0.53	0.24	0.48
Resolution	0.53	0.20	0.12
Sven	2.15	0.50	0.11
Nimrod	0.46	0.16	0.10

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	5.000	1.000	5.000
Tora	1.000	3.000	4.000
Terra	3.500	5.000	6.000
Resolution	3.500	4.000	3.000
Sven	6.000	6.000	2.000
Nimrod	2.000	2.000	1.000

Aluminium (d)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	26.04	15.16	209.88	58.19	20.59
Tora	13.79	64.62	52.98	65.74	13.79
Terra	33.52	19.94	200.90	98.74	32.20
Resolution	16.11	13.73	220.68	101.12	10.65
Sven	*	29.68	174.82	170.68	13.52
Nimrod	*	20.59	137.80	89.42	41.34

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	15.16	209.88	58.19	20.59
Tora	64.62	52.98	65.74	13.79
Terra	19.94	200.90	98.74	32.20
Resolution	13.73	220.68	101.12	10.65
Sven	29.68	174.82	170.68	13.52
Nimrod	20.59	137.80	89.42	41.34

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	2.000	5.000	1.000	4.000
Tora	6.000	1.000	2.000	3.000
Terra	3.000	4.000	4.000	5.000
Resolution	1.000	6.000	5.000	1.000
Sven	5.000	3.000	6.000	2.000
Nimrod	4.000	2.000	3.000	6.000

Calcium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	4525.00	6425.00	7939.00	4444.00	4559.00
Tora	3618.00	7441.00	5962.00	3674.00	3969.00
Terra	4779.00	5873.00	7487.00	5414.00	5271.00
Resolution	3287.00	5022.00	4075.00	3338.00	2920.00
Sven	*	5730.00	5514.00	4142.00	3699.00
Nimrod	*	7221.00	4947.00	5476.00	5202.00

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	6425.00	7939.00	4444.00	4559.00
Tora	7441.00	5962.00	3674.00	3969.00
Terra	5873.00	7487.00	5414.00	5271.00
Resolution	5022.00	4075.00	3338.00	2920.00
Sven	5730.00	5514.00	4142.00	3699.00
Nimrod	7221.00	4947.00	5476.00	5202.00

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	4.000	6.000	4.000	4.000
Tora	6.000	4.000	2.000	3.000
Terra	3.000	5.000	5.000	6.000
Resolution	1.000	1.000	1.000	1.000
Sven	2.000	3.000	3.000	2.000
Nimrod	5.000	2.000	6.000	5.000

Iron (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	29.11	21.56	113.40	47.88	36.26
Tora	18.21	90.68	34.27	51.65	35.34
Terra	31.25	26.33	109.73	73.90	38.42
Resolution	18.09	20.72	118.99	70.12	20.64
Sven	*	30.80	94.18	108.64	21.00
Nimrod	*	25.38	81.54	74.59	50.51

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	21.56	113.40	47.88	36.26
Tora	90.68	34.27	51.65	35.34
Terra	26.33	109.73	73.90	38.42
Resolution	20.72	118.99	70.12	20.64
Sven	30.80	94.18	108.64	21.00
Nimrod	25.38	81.54	74.59	50.51

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	2.000	5.000	1.000	4.000
Tora	6.000	1.000	2.000	3.000
Terra	4.000	4.000	4.000	5.000
Resolution	1.000	6.000	3.000	1.000
Sven	5.000	3.000	6.000	2.000
Nimrod	3.000	2.000	5.000	6.000

Potassium (d)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	2270.00	2049.00	1907.00	2002.00	2504.00
Tora	1845.00	2536.00	1427.00	1734.00	1874.00
Terra	1950.00	2053.00	1890.00	2230.00	2414.00
Resolution	1856.00	2087.00	1406.00	1875.00	2321.00
Sven	*	2268.00	1428.00	2448.00	2093.00
Nimrod	*	2769.00	1360.00	2642.00	2441.00

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	2049.00	1907.00	2002.00	2504.00
Tora	2536.00	1427.00	1734.00	1874.00
Terra	2053.00	1890.00	2230.00	2414.00
Resolution	2087.00	1406.00	1875.00	2321.00
Sven	2268.00	1428.00	2448.00	2093.00
Nimrod	2769.00	1360.00	2642.00	2441.00

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	6.000	3.000	6.000
Tora	5.000	3.000	1.000	1.000
Terra	2.000	5.000	4.000	4.000
Resolution	3.000	2.000	2.000	3.000
Sven	4.000	4.000	5.000	2.000
Nimrod	6.000	1.000	6.000	5.000

Magnesium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	688.30	403.90	532.80	490.30	612.70
Tora	511.30	352.00	258.30	374.90	466.30
Terra	518.90	320.80	388.20	383.80	476.30
Resolution	590.10	320.80	385.10	404.50	474.40
Sven	*	342.00	326.80	452.80	516.60
Nimrod	*	388.50	425.60	436.90	416.50

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	403.90	532.80	490.30	612.70
Tora	352.00	258.30	374.90	466.30
Terra	320.80	388.20	383.80	476.30
Resolution	320.80	385.10	404.50	474.40
Sven	342.00	326.80	452.80	516.60
Nimrod	388.50	425.60	436.90	416.50

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	6.000	6.000	6.000	6.000
Tora	4.000	1.000	1.000	2.000
Terra	1.500	4.000	2.000	4.000
Resolution	1.500	3.000	3.000	3.000
Sven	3.000	2.000	5.000	5.000
Nimrod	5.000	5.000	4.000	1.000

Manganese (d)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	32.39	9.03	22.68	25.92	40.36
Tora	51.78	10.97	8.96	39.45	118.53
Terra	38.30	10.98	49.25	27.27	62.23
Resolution	45.31	15.58	77.42	37.55	74.68
Sven	*	16.85	41.56	66.49	65.56
Nimrod	*	19.39	92.85	41.88	77.78

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	9.03	22.68	25.92	40.36
Tora	10.97	8.96	39.45	118.53
Terra	10.98	49.25	27.27	62.23
Resolution	15.58	77.42	37.55	74.68
Sven	16.85	41.56	66.49	65.56
Nimrod	19.39	92.85	41.88	77.78

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	2.000	1.000	1.000
Tora	2.000	1.000	4.000	6.000
Terra	3.000	4.000	2.000	2.000
Resolution	4.000	5.000	3.000	4.000
Sven	5.000	3.000	6.000	3.000
Nimrod	6.000	6.000	5.000	5.000

Sodium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	156.64	27.68	93.24	37.30	131.42
Tora	148.32	37.59	46.80	46.47	109.82
Terra	178.93	42.49	143.41	50.55	101.53
Resolution	213.71	47.92	103.18	70.60	117.01
Sven	*	50.32	94.74	74.65	87.69
Nimrod	*	34.50	75.42	80.50	112.55

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	27.68	93.24	37.30	131.42
Tora	37.59	46.80	46.47	109.82
Terra	42.49	143.41	50.55	101.53
Resolution	47.92	103.18	70.60	117.01
Sven	50.32	94.74	74.65	87.69
Nimrod	34.50	75.42	80.50	112.55

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	3.000	1.000	6.000
Tora	3.000	1.000	2.000	3.000
Terra	4.000	6.000	3.000	2.000
Resolution	5.000	5.000	4.000	5.000
Sven	6.000	4.000	5.000	1.000
Nimrod	2.000	2.000	6.000	4.000

Phosphorous (d)

Observed Data (All Varieties x All Sites)

Site Variety	115	116	117	118	119
Endurance	1086.10	821.80	1061.30	919.50	1058.20
Tora	968.10	1009.20	688.50	826.90	876.50
Terra	993.50	939.20	1084.70	1043.80	1035.70
Resolution	966.40	1064.70	841.20	910.90	1043.60
Sven	*	895.80	671.20	945.80	974.80
Nimrod	*	925.40	790.70	955.30	671.00

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	821.80	1061.30	919.50	1058.20
Tora	1009.20	688.50	826.90	876.50
Terra	939.20	1084.70	1043.80	1035.70
Resolution	1064.70	841.20	910.90	1043.60
Sven	895.80	671.20	945.80	974.80
Nimrod	925.40	790.70	955.30	671.00

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	5.000	3.000	6.000
Tora	5.000	2.000	1.000	2.000
Terra	4.000	6.000	6.000	4.000
Resolution	6.000	4.000	2.000	5.000
Sven	2.000	1.000	4.000	3.000
Nimrod	3.000	3.000	5.000	1.000

Silicon (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	116.00	82.00	1053.00	281.00	77.00
Tora	55.00	335.00	252.00	343.00	75.00
Terra	145.00	93.00	983.00	564.00	155.00
Resolution	71.00	53.00	1150.00	564.00	51.00
Sven	*	136.00	965.00	879.00	57.00
Nimrod	*	77.00	764.00	426.00	214.00

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	82.00	1053.00	281.00	77.00
Tora	335.00	252.00	343.00	75.00
Terra	93.00	983.00	564.00	155.00
Resolution	53.00	1150.00	564.00	51.00
Sven	136.00	965.00	879.00	57.00
Nimrod	77.00	764.00	426.00	214.00

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	3.000	5.000	1.000	4.000
Tora	6.000	1.000	2.000	3.000
Terra	4.000	4.000	4.500	5.000
Resolution	1.000	6.000	4.500	1.000
Sven	5.000	3.000	6.000	2.000
Nimrod	2.000	2.000	3.000	6.000

Titanium (d)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	1.13	1.32	9.00	3.24	1.11
Tora	0.92	18.29	1.22	4.71	0.92
Terra	2.23	2.38	8.55	7.45	1.18
Resolution	0.91	1.11	10.31	9.54	0.80
Sven	*	1.20	19.53	13.97	0.90
Nimrod	*	1.55	4.99	6.66	1.17

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	1.32	9.00	3.24	1.11
Tora	18.29	1.22	4.71	0.92
Terra	2.38	8.55	7.45	1.18
Resolution	1.11	10.31	9.54	0.80
Sven	1.20	19.53	13.97	0.90
Nimrod	1.55	4.99	6.66	1.17

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	3.000	4.000	1.000	4.000
Tora	6.000	1.000	2.000	3.000
Terra	5.000	3.000	4.000	6.000
Resolution	1.000	5.000	5.000	1.000
Sven	2.000	6.000	6.000	2.000
Nimrod	4.000	2.000	3.000	5.000

Al_2O_3 (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.27	0.13	1.39	0.63	0.21
Tora	0.18	0.47	0.51	0.83	0.17
Terra	0.35	0.19	1.40	0.89	0.30
Resolution	0.21	0.14	*	1.27	0.15
Sven	*	0.28	1.62	*	0.17
Nimrod	*	0.16	1.37	0.80	0.41

No Data Analysed (All Varieties Have Less Than Three Sites Complete Data)

BaO (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.03	0.06	0.35	0.05	0.06
Tora	0.02	0.09	0.30	0.05	0.06
Terra	0.03	0.07	0.33	0.05	0.06
Resolution	0.03	0.05	0.44	0.04	0.05
Sven	*	0.05	0.28	0.05	0.04
Nimrod	*	0.10	*	0.06	0.06

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.06	0.05	0.06
Tora	0.09	0.05	0.06
Terra	0.07	0.05	0.06
Resolution	0.05	0.04	0.05
Sven	0.05	0.05	0.04
Nimrod	0.10	0.06	0.06

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	3.000	3.500	4.500
Tora	5.000	3.500	4.500
Terra	4.000	3.500	4.500
Resolution	1.500	1.000	2.000
Sven	1.500	3.500	1.000
Nimrod	6.000	6.000	4.500

CaCO3 (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	62.00	75.21	69.66	64.26	62.21
Tora	61.33	72.66	76.71	61.96	64.04
Terra	65.93	72.79	69.13	64.97	66.23
Resolution	57.94	68.70	57.27	55.67	53.40
Sven	*	71.13	67.74	55.20	60.75
Nimrod	*	73.81	65.59	64.81	68.34

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	75.21	69.66	64.26	62.21
Tora	72.66	76.71	61.96	64.04
Terra	72.79	69.13	64.97	66.23
Resolution	68.70	57.27	55.67	53.40
Sven	71.13	67.74	55.20	60.75
Nimrod	73.81	65.59	64.81	68.34

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	6.000	5.000	4.000	3.000
Tora	3.000	6.000	3.000	4.000
Terra	4.000	4.000	6.000	5.000
Resolution	1.000	1.000	2.000	1.000
Sven	2.000	3.000	1.000	2.000
Nimrod	5.000	2.000	5.000	6.000

Fe_2O_3 (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.23	0.14	0.57	0.39	0.28
Tora	0.18	0.50	0.25	0.50	0.32
Terra	0.25	0.19	0.58	0.51	*
Resolution	0.18	0.16	*	0.67	0.22
Sven	*	0.22	0.66	0.83	0.20
Nimrod	*	0.15	0.62	0.50	0.38

No Data Analysed

K2O (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	14.95	11.53	8.04	13.91	16.42
Tora	15.03	11.90	8.83	14.06	14.53
Terra	12.93	12.22	8.39	12.86	14.58
Resolution	15.72	13.72	9.50	15.03	20.40
Sven	*	13.53	8.43	15.68	16.52
Nimrod	*	13.60	8.67	15.03	15.41

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	11.53	8.04	13.91	16.42
Tora	11.90	8.83	14.06	14.53
Terra	12.22	8.39	12.86	14.58
Resolution	13.72	9.50	15.03	20.40
Sven	13.53	8.43	15.68	16.52
Nimrod	13.60	8.67	15.03	15.41

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	1.000	2.000	4.000
Tora	2.000	5.000	3.000	1.000
Terra	3.000	2.000	1.000	2.000
Resolution	6.000	6.000	4.500	6.000
Sven	4.000	3.000	6.000	5.000
Nimrod	5.000	4.000	4.500	3.000

MgO (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	6.27	3.14	3.11	4.71	5.56
Tora	5.76	2.29	2.21	4.20	5.00
Terra	4.76	2.64	2.38	3.06	3.98
Resolution	6.91	2.92	3.60	4.48	5.77
Sven	*	2.82	2.67	4.01	5.64
Nimrod	*	2.64	3.75	3.44	3.64

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	3.14	3.11	4.71	5.56
Tora	2.29	2.21	4.20	5.00
Terra	2.64	2.38	3.06	3.98
Resolution	2.92	3.60	4.48	5.77
Sven	2.82	2.67	4.01	5.64
Nimrod	2.64	3.75	3.44	3.64

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	6.000	4.000	6.000	4.000
Tora	1.000	1.000	4.000	3.000
Terra	2.500	2.000	1.000	2.000
Resolution	5.000	5.000	5.000	6.000
Sven	4.000	3.000	3.000	5.000
Nimrod	2.500	6.000	2.000	1.000

Mn3O4 (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.25	0.06	0.11	0.21	0.31
Tora	0.49	0.06	0.06	0.37	*
Terra	0.29	0.08	0.25	0.18	0.43
Resolution	0.44	0.12	0.60	0.35	0.76
Sven	*	0.12	0.28	0.49	0.60
Nimrod	*	0.11	0.68	0.27	0.57

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.06	0.11	0.21
Tora	0.06	0.06	0.37
Terra	0.08	0.25	0.18
Resolution	0.12	0.60	0.35
Sven	0.12	0.28	0.49
Nimrod	0.11	0.68	0.27

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.500	2.000	2.000
Tora	1.500	1.000	5.000
Terra	3.000	3.000	1.000
Resolution	5.500	5.000	4.000
Sven	5.500	4.000	6.000
Nimrod	4.000	6.000	3.000

Na2O (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	1.16	0.17	0.44	0.29	0.97
Tora	1.35	0.20	0.32	0.42	0.96
Terra	1.33	0.28	0.71	0.33	0.69
Resolution	*	0.35	0.78	0.63	1.15
Sven	*	0.34	0.63	0.54	0.78
Nimrod	*	0.19	0.54	0.51	0.80

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.17	0.44	0.29	0.97
Tora	0.20	0.32	0.42	0.96
Terra	0.28	0.71	0.33	0.69
Resolution	0.35	0.78	0.63	1.15
Sven	0.34	0.63	0.54	0.78
Nimrod	0.19	0.54	0.51	0.80

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	2.000	1.000	5.000
Tora	3.000	1.000	3.000	4.000
Terra	4.000	5.000	2.000	1.000
Resolution	6.000	6.000	6.000	6.000
Sven	5.000	4.000	5.000	2.000
Nimrod	2.000	3.000	4.000	3.000

P2O5 (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	13.49	8.72	8.44	12.05	13.09
Tora	14.87	8.93	8.03	12.64	12.82
Terra	12.42	10.55	9.08	11.35	11.80
Resolution	15.44	13.21	10.72	13.77	17.30
Sven	*	10.08	7.48	11.43	14.51
Nimrod	*	8.57	9.50	10.25	7.99

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	8.72	8.44	12.05	13.09
Tora	8.93	8.03	12.64	12.82
Terra	10.55	9.08	11.35	11.80
Resolution	13.21	10.72	13.77	17.30
Sven	10.08	7.48	11.43	14.51
Nimrod	8.57	9.50	10.25	7.99

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	2.000	3.000	4.000	4.000
Tora	3.000	2.000	5.000	3.000
Terra	5.000	4.000	2.000	2.000
Resolution	6.000	6.000	6.000	6.000
Sven	4.000	1.000	3.000	5.000
Nimrod	1.000	5.000	1.000	1.000

SiO2 (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	1.35	0.81	7.84	3.45	0.89
Tora	0.79	2.78	2.75	4.91	1.02
Terra	1.70	0.98	7.70	5.75	1.65
Resolution	1.07	0.62	*	7.98	0.79
Sven	*	1.44	10.06	*	0.80
Nimrod	*	0.67	8.60	4.28	2.39

No Data Analysed (All Varieties Have Less Than Three Sites Complete Data)

TiO2 (na)

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.01	0.01	0.05	0.03	0.01
Tora	0.01	0.12	0.01	0.05	0.01
Terra	0.02	0.02	0.05	0.06	0.01
Resolution	0.01	0.01	0.10	0.11	0.01
Sven	*	0.01	0.16	0.12	0.01
Nimrod	*	0.01	0.04	0.05	0.01

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.01	0.05	0.03	0.01
Tora	0.12	0.01	0.05	0.01
Terra	0.02	0.05	0.06	0.01
Resolution	0.01	0.10	0.11	0.01
Sven	0.01	0.16	0.12	0.01
Nimrod	0.01	0.04	0.05	0.01

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	2.500	3.500	1.000	3.500
Tora	6.000	1.000	2.500	3.500
Terra	5.000	3.500	4.000	3.500
Resolution	2.500	5.000	5.000	3.500
Sven	2.500	6.000	6.000	3.500
Nimrod	2.500	2.000	2.500	3.500

Alkali index

Observed Data (All Varieties x All Sites)

Site / Variety	115	116	117	118	119
Endurance	0.15	0.13	0.12	0.12	0.16
Tora	0.12	0.16	0.09	0.11	0.12
Terra	0.13	0.13	0.12	0.14	0.15
Resolution	0.13	0.13	0.09	0.12	0.15
Sven	*	0.14	0.09	0.16	0.14
Nimrod	*	0.17	0.09	0.17	0.16

Analysed Data (All Varieties x Sites With Complete Data)

Endurance	0.13	0.12	0.12	0.16
Tora	0.16	0.09	0.11	0.12
Terra	0.13	0.12	0.14	0.15
Resolution	0.13	0.09	0.12	0.15
Sven	0.14	0.09	0.16	0.14
Nimrod	0.17	0.09	0.17	0.16

Analysed Data Ranks (1=Lowest to 6=Highest)

Endurance	1.000	5.000	3.000	6.000
Tora	5.000	2.000	1.000	1.000
Terra	2.500	6.000	4.000	4.000
Resolution	2.500	3.000	2.000	3.000
Sven	4.000	4.000	5.000	2.000
Nimrod	6.000	1.000	6.000	5.000

8. Questionnaire on *Miscanthus* storage

<u>*Miscanthus* Bale Storage Questionnaire</u>

Information collected by:

Date questionnaire completed:

Key:

Priority questions	**Stored Outside**	**Stored Inside**

Questions	Answers	Further comment
1. Storage area/location choice		
1.1: What would be a typical storage location for your bales • internal and fully enclosed covered building (4 sides + roof) • covered but only with a roof and up to 3 sides • externally stored and covered using only a sheet • externally stored with no sheet • use a contractor – inside or outside stored		NB – If covered or external storage go to Q1.7:
1.2: If storing inside do you leave any breathing or ventilation areas around the sides of the stack		
1.3: If stored inside does the building have any fitted ventilation systems (windows, slates, other)		
1.4: If storing bales inside is the building specifically for bale storage or does it have other uses/requirements – if so what else is stored alongside the bales		

1.5: Do the bales have to leave the store by a certain time of year, if so and the buyer is not ready for them what happens		
1.6: If storing inside do you dry your bales with air systems, piping ducts etc.		
1.7: If bales are to be stored outside, how is the best location determined – for ongoing transport loading or weather conditions, both or other factor		
1.8: Is the position of the outside bale storage area sheltered by other buildings, or trees – if sheltered how close is the shelter in meters		
1.9: Why do you store your bales the way you have chosen		
1.10: What is the typical design configuration of the stack – is it decided firstly by height – how is stack design decided based on total bale numbers		

1.11: Contact between bales and ground – are the bales placed directly on the ground surface, or on bearers of any kind; or on sheeting, other bale types – in order to minimise bottom/top layer deterioration and or aid with drying		
1.12: If stored directly on ground surface what is the typical ground surface		
1.13: Do you have any storage obligations under your supply contract		
1.14: Do you use more than one type of storage system, if so do you notice any significant differences in the stored material – if so what are the percentages of inside versus outside storage and what are the reasons for this		
Any other comments		

Questions	Answers	Further comment
2.Logistics, handling and storage management aspects		
2.1: What equipment is required/do you use, to stack and handle bales – if not you your contractor		
2.2: On average what length of time are bales stored for before leaving farm		
2.3: Is all of your crop stored, or does some leave the farm immediately after harvest		
2.4: What would a typical stack size be for your crop, and what % of your farm is planted to *Miscanthus*		
2.5: What would be the maximum height of a bale stack outside and covered only with a sheet		
2.6: How much storage space is required on average each year for your crop, and how do you calculate if you will have sufficient storage area before harvesting		

2.7: What is the typical capacity or speed of loading in and out of store as tonnes/hr		
2.8: When bales are put on to collection lorry for leaving the farm or contractor storage site are they usually covered or sheeted for transport		
2.9: What measurements if any are taken, or monitored of bales going in/out of store and during storage		
2.10: How quickly are bales collected from the field after baling		
2.11: Are the bales ever rearranged during the period of storage, if so is there any systematic rearrangement, e,g, side bales moved to middle		

2.12: In an ideal world how would you like to store your bales – what are the limitations/triggers for doing so		
2.13: Do you harvest and bale your crop or do you hire a contractor		
2.14: Is all your material destined for energy end use, if not what other market do you supply and how do the storage requirements differ		
2.15: How do you know how many bales you have produced and what the total weight of production is going in to store		
2.16: Do you need to declare your produced tonnage to the buyer upon material entering store or when leaving store		
2.17: What bale type do you use, is this predetermined by your contract/contractor .		

2.18: What are the typical dimensions of your produced bales and typical weight		
2.19: Do your bales vary in density year on year, field by field, if so what is thought to be the reason for this		

Questions	Answers	Further comment
3.Sheeting operation and management (External storage relevant only)		
3.1: If using sheets how do you fix or manage the sheet from blowing away		
3.2: Are the sheets used water proof and breathable, do they need to be a certain colour (for planning, heat reflecting)		
3.3: Typically how big are the sheets, what do they cost and how many seasons do you expect them to last		
3.4: Do you sheet the entire stack, or the top and side of the stack which suffers the prevailing wind/weather, or the top layer only		
3.5: If you use sheets only for storage, what is the material type and size of a sheet used		

3.6: Do the bales deteriorate under the sheet, from condensation and moulds		
3.7: How often do sheets need to be checked for tears and ropes coming lose		
3.8: If using a contractors site for storage do they sheet your bales, or is contractor storage typically internal		
3.9: Do you sheet your own bale stacks or does the harvesting contractor – who is responsible for H&S		
3.10: Who supplies you with the sheets, are they your capital investment or supplied by buyer		
Any other comments		

Questions	Answers	Further comment
4.Expected storage losses		
4.1: Do you see more storage losses occur in wet years		
4.2: What are your typical expected losses from bales stored outside: covered by a sheet only		
4.3: What are your typical expected losses from bales stored outside under a roof only structure with 0 – 3 sides		
4.4: What are your typical expected losses from bales stored inside		
4.5: For outside sheet covered storage are the bottom and top layer of bales automatically discarded or are they sometimes ok		

4.6: Do you use any other type of bale (wheat straw, or similar) to reduce losses of *Miscanthus* bales in certain places on the stack – or as a buffer		
4.7: If using a contractor for storing your bales, who is responsible for the storage losses		
4.8: If you use a contractor for storage who do you use, do they store inside, and what made you choose them		
4.9: What would be a typical storage cost on farm, if you use a contractor what do they typically charge, and what does the cost include		
Any other comments		

Questions	Answers	Further comment
5.Health & Safety aspects		
5.1: Are there any H&S risks associated with fixing or applying cover sheets		
5.2: Are pests like mice or rats a problem to bale stacks		
5.3: Do you use any warning signs around bale stacks, if so what are the typical ones used		
5.4: What are the risks of theft or damage, do you use any cctv type or similar monitoring equipment		
5.5: What are the risks from fire, do you have to notify the local fire brigade if the bale stack is above a certain size		

5.6: What precautions can you/do you or your contractor put in place to minimize risk from fire and self-heating of stack		
5.7: What might cause a bale stack to collapse, how can this be avoided, how typical is it for this to happen		
5.8: What would be the typical Personal Safety Equipment (PSE) used when visiting/handling stored *Miscanthus* bales		
5.9: What are the perceived dust risks from handling, storing bales, do you use face masks when moving bales – especially if stored inside		
5.10: Are there any typical injuries which can occur from storing, handling, monitoring bales of *Miscanthus*		
Any other comments		

Thanks for your time

9. Experimental protocol on *Miscanthus* storage

***Miscanthus* Storage Sampling Protocol** v1.0 MW15216

Site criteria

Species	*Miscanthus* bales from one location (192 bales[1])
Age	[< 1 year] from baling at harvest
Location	Lower Marsh Farm, Kingston St. Mary, Taunton, Somerset TA2 8AB (Owner on site: Richard Goddard. *Miscanthus* Manager: Mike Cooper)

Storage type *Stacks 48 bales each[2] (4 wide, 4 high, 3 deep)*

1. Outside uncovered
2. Outside covered by sheet
3. Outside covered by a roof but no sides
4. Inside storage.

Treatment *Stacks 24 bales each[3](2 wide, 4 high, 3 deep)*

A. Unmoved

B. Moved monthly.

See **Annex A** for layout of stacks.

Method Summary

Each storage type will comprise a treatment A immediately adjacent to treatment B, forming one stack.

Treatments A will be placed into storage and not moved again until the stack is dismantled after 6 months. Samples will be taken at the start and end of the process.

Treatments B will be placed into storage and dismantled each month for sampling, so there will be six sampling occasions for each storage type, each collecting a bulked sample as indicated in the **Table 1** (32 in total):

Table 1. Bulk samples and identifiers

Stack	March	April	May	June	July	August
1A	1A Mar					1A Aug
1B	1B Mar	1B Apr	1B May	1B Jun	1B Jul	1B Aug
2A	2A Mar					2A Aug
2B	2B Mar	2B Apr	2B May	2B Jun	2B Jul	2B Aug
3A	3A Mar					3A Aug

[1] 192 bales is c. 100 fresh tonnes
[2] 48 bales is c. 25 fresh tonnes
[3] 48 bales is c. 25 fresh tonnes

3B	3B Mar	3B Apr	3B May	3B Jun	3B Jul	3B Aug
4A	4A Mar					4A Aug
4B	4B Mar	4B Apr	4B May	4B Jun	4B Jul	4B Aug

For each stack, each sampling occasion will produce a single bulk sample of *Miscanthus*, representing sub-samples drawn from throughout the stack. Some 25% of sub samples will be taken from within the stack, and the remaining 75% from the external faces of the stack[4] **(See Annex A).**

Each sub sample will be taken using a coring tool driven into the bale either vertically from the top of the relevant bale, or horizontally from the side (See Annex A).

Cores will be taken from predetermined points within the stack to c. 50 cm depth. On each occasion cores should be taken from a selection of the predetermined points reasonably *distributed within the 'Internal' and 'External' core positions available*. Each sampling occasion will use a proportion of the sampling locations such that as the trial progresses from month to month a proportion of sampling locations are 'used up'. A record of the location of sub-sample core locations should be kept on a copy of the diagrams in Annex A e.g. by circling the locations used on the occasion.

On completion of each sample core, the opening of the hole should be plugged using a quantity of the material removed.

[4] Allowing for a 50cm external layer, c. 25% of the stack is 'internal' volume and 75% is the external 50 cm layer

Figure 1: Corer, showing aluminium collection canister with inner, spiral assist and star cutting tip

Office work

Make and pack a copy of **Annex A** on which to mark the location of sample cores taken, with date and bulk sample identifier.

Liaise with the site owner or other contact to ensure that a suitable handling machine (e.g. JCB Loader with bale grab) and competent operator will be available on site to dismantle and re-assemble stacks as required.

Ensure appropriate Risk Assessment is in place and ensure that PPE and a suitable First Aid Kit are available on site.

Pack the fully charged coring tool and spare batteries as required[5], one or more clean plastic buckets (for collecting sub samples), clean spade and a large clean plastic sheet (on which to mix the sub-samples to extract a single bulk sample).

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[5] The coring device is fitted to a rechargeable electric hand held drill. The assembly is drilled into the bale and *Miscanthus* material is collected in the tool's sample container which, when full, is emptied into a bucket.

Pack sufficient plastic sample bags or containers and felt-pen markers etc.

Field work

On the first and last sampling occasion, for each Storage Type (1 to 4), each **Treatment A stack** will have [6] 'External' sample cores taken from the predetermined points on the 'outside' of the stack as shown in Annex A, reasonably distributed over the top and four sides of the stack i.e. [1] per face and [2] from the top. Similarly [2] 'Internal' samples will be taken from locations on the four 'internal bales'. These will be bulked into 1 sample.

On every sampling occasion, for each Storage Type (1 to 4), each **Treatment B stack** will have [6] 'External' sample cores taken from the predetermined points on the 'outside' of the stack as shown in Annex A, reasonably distributed over the top and four sides of the stack i.e. [1] per face and [2] from the top. Similarly [2] 'Internal' samples will be taken from locations on the four 'internal bales'. These will be bulked into 1 sample.

- Ensure there are sufficient robust sealable sample bags or containers for each Storage Type (1 to 4). At least 1 will be required for each bulked sample (8 in March and August, and 4 in April, May, June and July)
- The sample bags or containers should be labelled with the Storage Type (1 to 4), Treatment (A or B) and the Month as per Table 1.
- If more than 1 bag / container is used for a sample type, write 1 of X, i.e. 1 of 2… etc. for however many are used.

Stack dismantling and sampling

- Ensure that correct PPE is worn as per the Risk Assessment i.e. Helmet, overalls, Hi-viz waistcoat, gloves, safety boots, face mask and goggles.
- Liaise with the site machine operator such that the stack is dismantled a layer at a time and placed on a convenient level location that is as free from mud and water as practicable (to minimise bale contamination).
- Sampling staff must agree the method and safety precautions with the operator as per the Risk Assessment and remain out-with the machine risk zone whilst it is operating.
- Select the first coring position for the layer from the diagram in Annex A.
- Operate the coring tool to 50 cm depth to extract a core of *Miscanthus* material. Empty the material into a bucket but use a small proportion to plug the surface of the hole (thus reducing its subsequent ventilation impact). Mark the sampling position on a copy of Annex A.
- *Note that when using the coring tool it should be positioned at least 50 cm from any corner of any bale. For the 'Internal' bales, when coring from one side of a bale that has already been cored from the other side, aim to stagger the core so that two 50 cm holes do not meet in the middle.*
- Select, move to and complete the next sub-sampling position and so on until the sub-sampling of the stack is completed. This may require the next layer of bales to be removed by the machine.
- Once all sub samples have been taken, take up a safe position whilst the machine operator re-assembles the stack.

Sub-sample Bulking

- Spread the large plastic sheet in a suitable level, dry location. Empty the subsamples from the bucket/s into a pile at the centre of the sheet. Mix the pile with a clean spade, flatten and divide into quarters.
- Take an equal portion from each quarter in turn (repeating as necessary) and place in the bulk sample bag / container for the Storage Type / Treatment. Ensure that the bag / container is properly sealed and labelled. A total of [3] Kg is required for each bulk sample, which will be approximately [20] litres[6]

Records

- Visually assess and record recent weather conditions i.e. snow or frost present, recent heavy rain etc. and record on site assessment sheet. *Also record any other information that is evident about the state of the stack (e.g. 'North face very wet from driving rain' or 'roofing material loose at east end' etc.).*
- Take air temperature at 1.5m height with a vertex at front of each stack and record on site assessment sheet.
- Take a photo of the faces of each stack from each side and a single photo of the whole stack.
- Retain the above records and pass to the Uniper contact as agreed with them.

<u>Delivery to Uniper Laboratory</u>

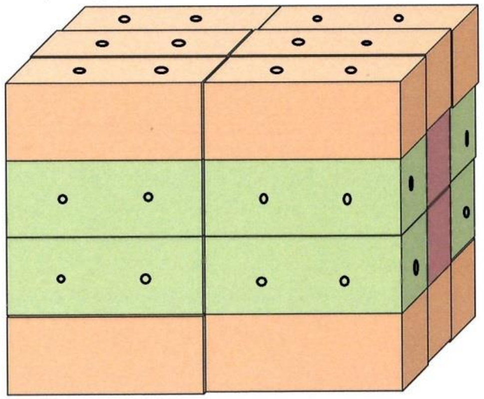
Samples will be dispatched for next day, before noon, delivery on the day of chipping to: Uniper Technologies Ltd, Technology Centre, Ratcliffe-on-Soar, Nottingham, NG11 0EE. or delivered straight to the lab

V2 MWSC9316

Annex A

[6] Bulk density c. 7 litres / kg

Location of sampling points in stack



'(Start) Complete Stack

Layer 1 — Layer 1 sample points 12 External vertical cores from above

Layer 2 — Layers 2 & 3 Left side as per right side and Back as per front i.e. 24 External horizontal cores

Layer 3 — Middle 4 bales (in red) - 2 horizontal cores from each side i.e. 4 cores each = 16 Internal cores locations in total

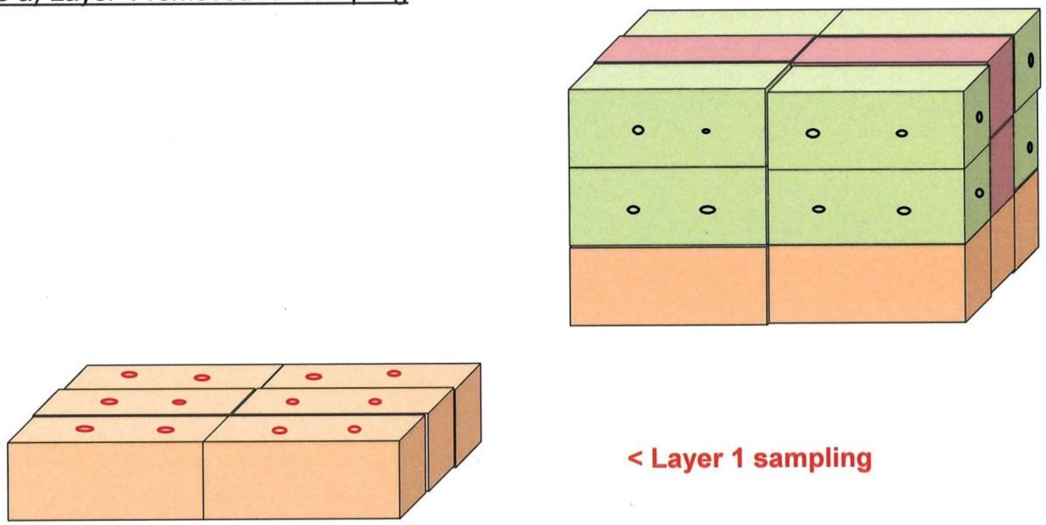
Layer 4 — Layer 4 sample points as per Layer 1 i.e. 12 Internal vertical cores from above

ALL CORES 50 CM DEPTH

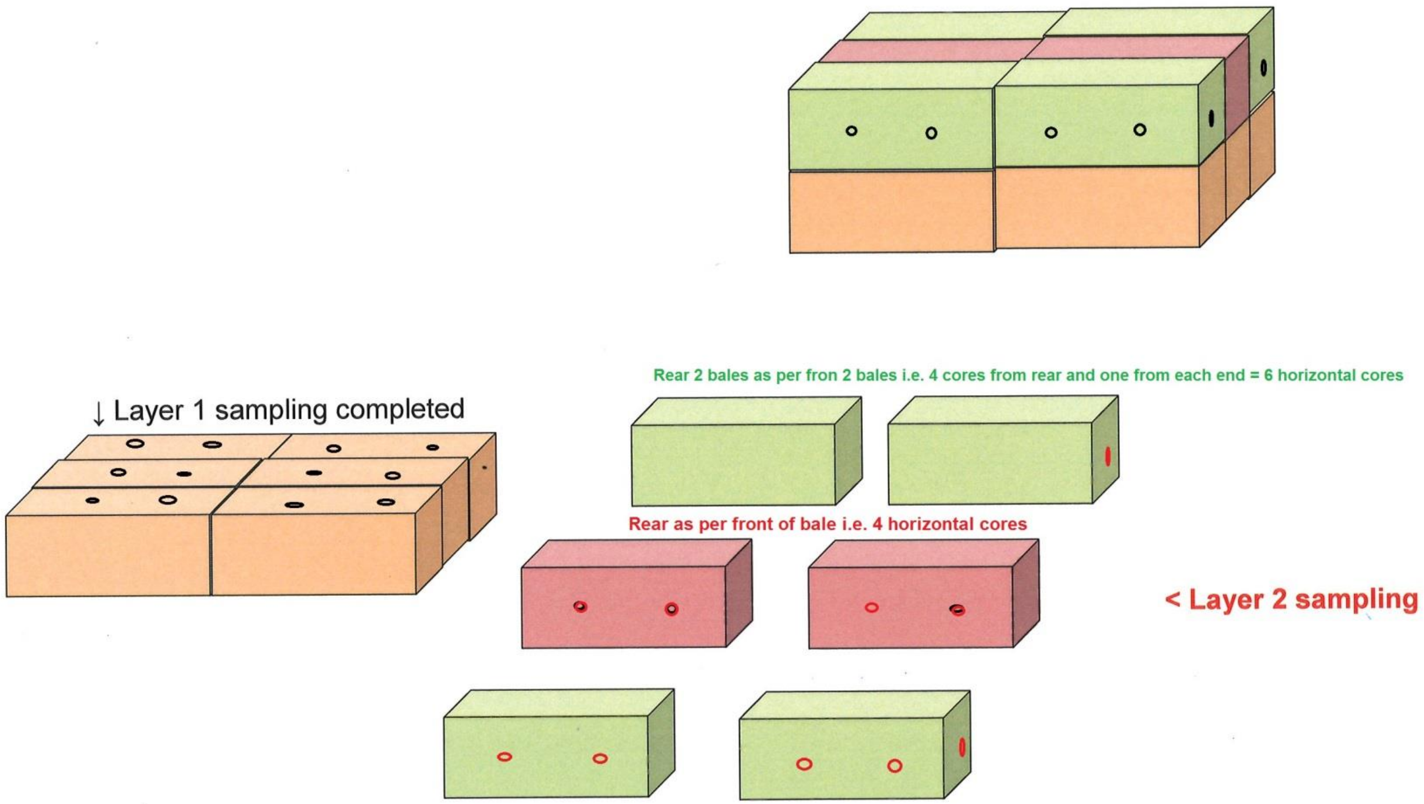
TOTAL: 36 - EXTERNAL CORE LOCATIONS AVAILABLE
28 - INTERNAL CORE LOCATIONS AVAILABLE

Sampling Process, by dismantling stack in stages:

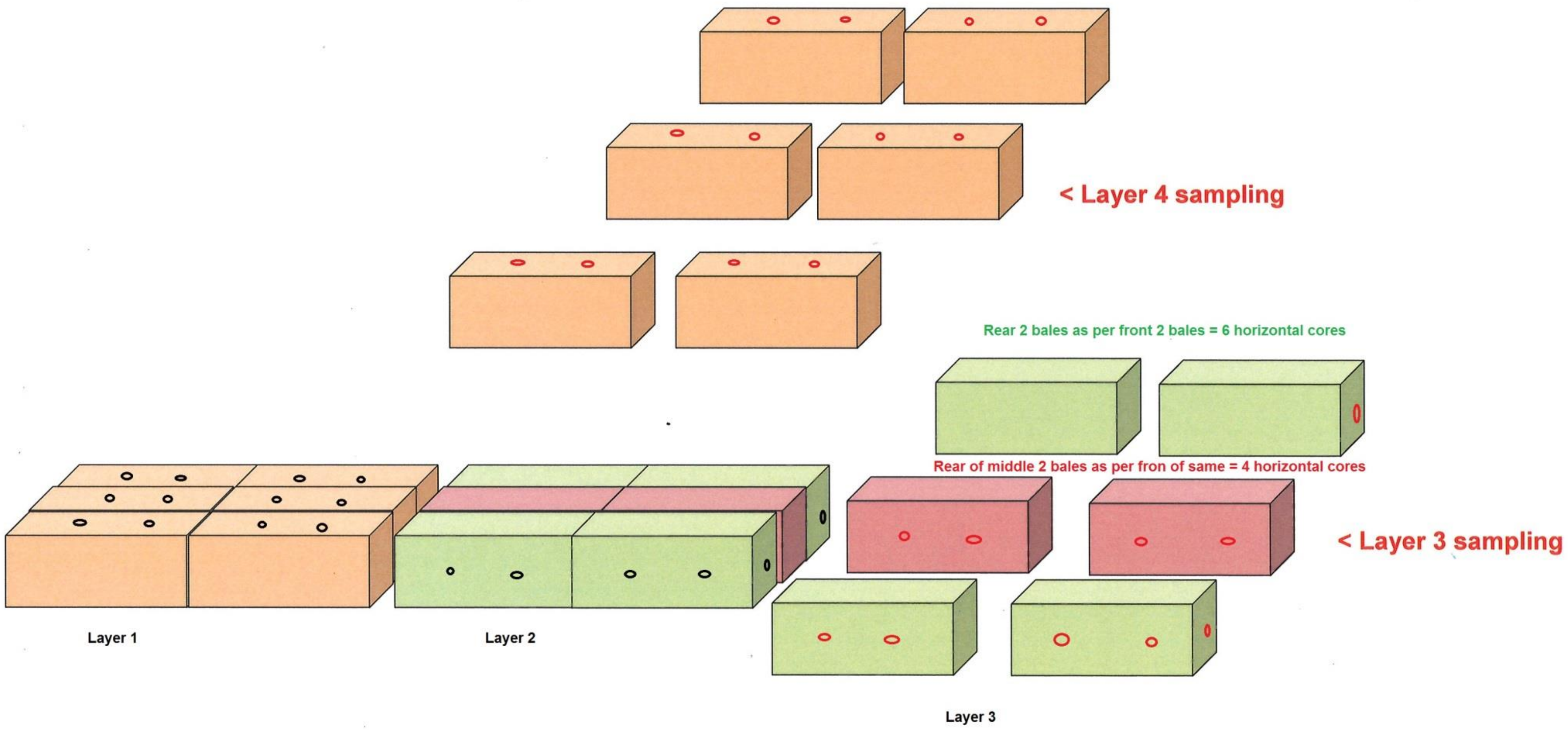
(Stage a) Layer 1 removed for sampling



(Stage b) Layer 2 removed for sampling



(Stage c) Layer 3 removed for sampling, also exposing Layer 4



10. Summary of questionnaire responses on *Miscanthus* storage

Questionnaire response summary 26.04.2016:

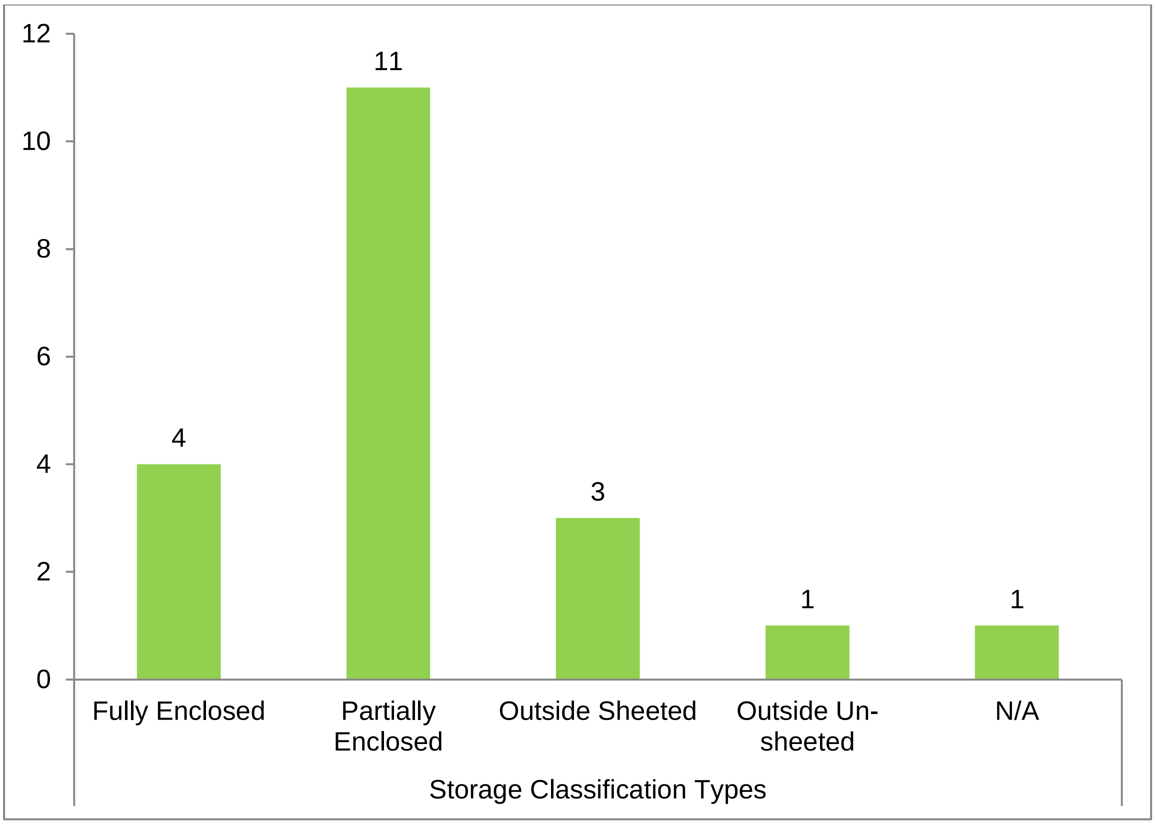
The majority (15) of the 20 surveyed growers store their bales in either a fully enclosed barn, or a partially enclosed shed (3 sides and a roof), with three growers storing outside under sheets, and only one grower interviewed storing outside with no sheeting. One other grower not having any storage as bales leave the farm straight away - see Figure 2.

The main reasoning behind which storage system is used by each grower, is largely only linked to what storage is available on their farm. Only one grower uses external contractors to store their bales, and only one grower has built dedicated storage.

Very few of the fully enclosed sheds have dedicated ventilation systems, with many growers stating it is not a necessary requirement for *Miscanthus* bales. No dedicated drying systems are currently being used, with open sides or gale-breakers (slated wooden boarding) which allow airflow being perfectly satisfactory.

The majority of indoor-stored (fully enclosed and partially enclosed) bales are stacked directly on the ground, with shed floors being typically concrete or consisting of loose stone, so not jeopardising the moisture content of the bales. Outside-stored bales are also often stored directly on the ground, however sometimes bales are stored on a sheet, pallet, or something similar to keep the bales off the ground. Interestingly, no grower uses any other type of straw bale as a buffer along the bottom or top of an outdoor stack, and no grower stated they discard the bottom layer, even when stacked directly on the ground.

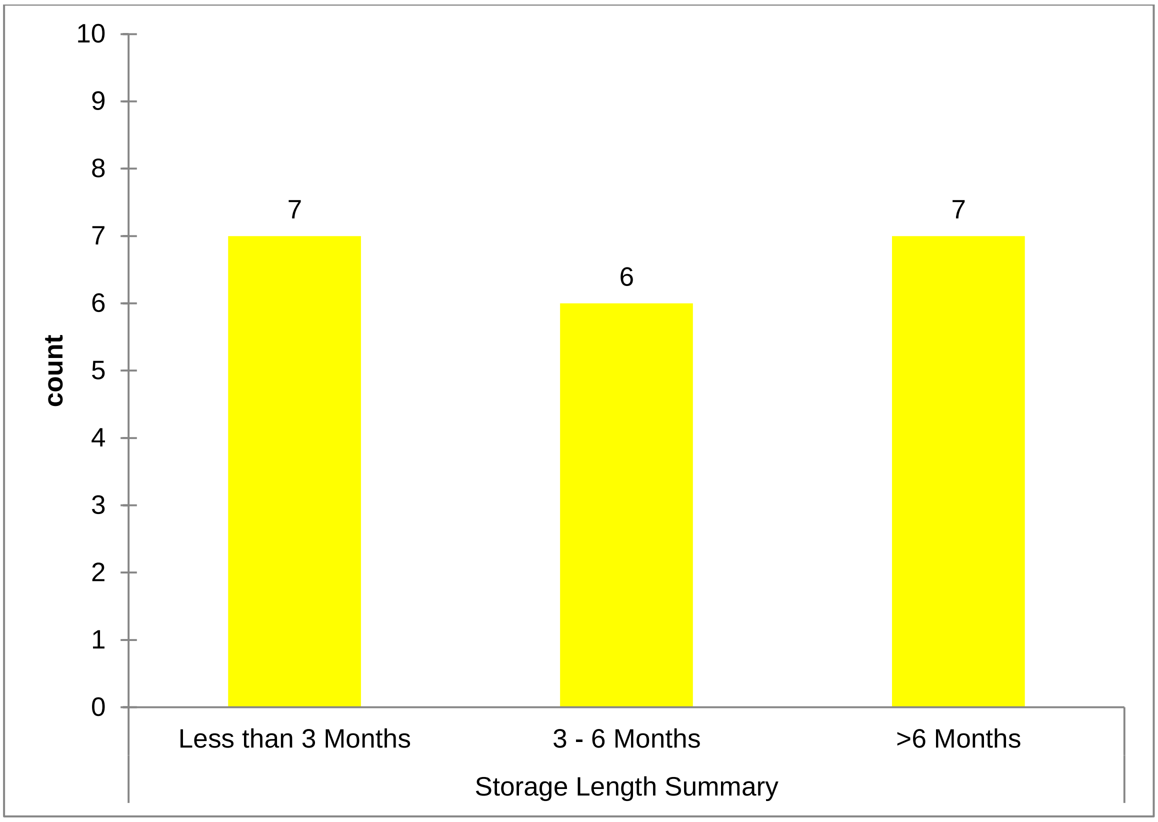
Figure 2: Different storage types by grower



Nearly all growers typically use only one storage method every year, the same method, with only a few growers using a mixture of two methods each year, because of the number of bales they produce. Nearly all growers use a tele-handler to handle their bales, with many using a 2 or 3 bale grab, and a few using single bale spikes or tines.

Of the growers surveyed, the time bales remained on-farm varied between growers and also year on year, see Figure 3. Some growers commented on having had bales collected in previous years less than 3 months after the harvest operation, then the following year they were asked to store for the best part of a year. It seems the total storage periods are evenly spread and managed across the growers. Terravesta commented that they try and rotate the collection rota for their growers, in order to make storage delays fair for all growers, changing the rota year on year. However they do have a few exceptions were bales must be collected immediately, due to a high risk of criminal damage at some locations, whilst other sites can easily hold their bales for >6 months and are happy to do so.

Figure 3: Storage length summary by grower



Many growers are pleased with their current storage situation, but several would ideally like a purpose-built, ‘Dutch’ barn style shed for their bales , however it was frequently commented that the value of the *Miscanthus* bales doesn’t warrant a shed all of its own.

Most growers don’t find their bales vary in quality or weight year on year, or field to field, with only a few saying any variance in bale weights was more likely due to the baler operator/contractor trying to make more money, than any variation in the actual crop performance.

Best locations for outside-stored bales are mainly determined by the growers based on accessibility aspects for Lorries to be loaded. Of the growers storing bales outside, not all stacks are sheeted, but of the ones that are sheeted the top is always sheeted. The sides of stacks suffering prevailing winds are often intended to be done, but limits on sheet availability and ongoing maintenance requirements often make it less routine to sheet the sides. Growers who sheet their bales stated that the sheeting operation itself is a serious area of Health and Safety concern, and must for example never be attempted on a windy day, or without the correct and well maintained equipment.

Several growers expect some storage losses from damp or mould affecting the odd bale whilst in storage, whilst other growers are confident that *Miscanthus* if baled when dry stores perfectly well. More storage losses are expected in wetter harvest years, and in also during wetter summers especially if stored outside, but typically growers only expect losses to be no greater than a few bales each year. Similarly, growers with indoor-stored bales generally only expect to lose one or two bales, and this is typically through bursting bales as an accident when being handled, rather than through water damage or similar deteriorations whilst in storage. Handling losses will also occur for outside stored bales, so in general losses are greater than inside stored.

Only a few growers think their bale stacks are more of a fire risk than their normal cereal straw stacks, with most growers not feeling the need to specifically forewarn the fire brigade. Needing to minimise the risk of fire and self-heating does not appear to be a major concern for growers; as long as the *Miscanthus* was baled at the right moisture content the perceived risk within store would be low, and some growers felt their risk is minimised by having secure, remote locations.

All growers stated their only cause of a collapsed stack is due to poor stacking in the first place, with bales never being moved unless of bales breaking, stacks collapsing, or storage space required for other uses. Only a few growers feel the need for any particular PPE requirements when handling or visiting *Miscanthus* bales, with a few growers stating that they wear what they normally wear for regular farm tasks; such as steel-toe capped safety boots and overalls. The Miscanthus canes can be sharp, and leave splinters and cause scratches and light cuts so gloves are the most common PPE considered.

Dust when handling and moving *Miscanthus* bales is not perceived to be any more of a risk than other bales to the majority of growers. With only a few growers commenting that M*iscanthus* bales can be a dust risk, and in particular noting how fine the dust can be. However, very few growers confirmed they regularly wear any PPE relating to dust risks from the *Miscanthus* bales when moving them.