

Supplementary Materials: Is the Invasive Plant *Amaranthus spinosus* L. More Competitive than the Native Plant *A. tricolor* L. When Exposed to Acid Deposition with Different Sulfur–Ni–trogen Ratios?

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Electronic supplementary materials:

Table S1. Four-way ANOVA on the effects of planting pattern, plant species, acid deposition acidity, acid deposition type, and their interactions on the evaluated variances. $P \leq 0.05$ is presented in bold.

		Mean Square	F	P	η^2
Planting pattern	Plant height	0.3521	0.0712	0.7906	0.0013
	Ground diameter	0.4187	0.6874	0.4106	0.0121
	Leaf length	0.1182	0.1076	0.7441	0.0019
	Leaf width	2.0410	2.0814	0.1547	0.0358
	Green leaf area	129.1692	0.4196	0.5198	0.0074
	Leaf thickness	0.0008	0.3252	0.5708	0.0058
	Single-leaf wet weight	0.2632	4.8596	0.0316	0.0798
	Single-leaf dry weight	0.0018	5.2486	0.0257	0.0857
	Leaf water content	0.0426	0.2050	0.6525	0.0036
	Specific leaf area	31109.9047	4.3019	0.0427	0.0713
	Leaf chlorophyll content	88.4552	125.0276	<0.0001	0.6907
	Leaf nitrogen content	0.3143	28.1810	<0.0001	0.3348
	Plant aboveground wet weight	13.4670	1.0716	0.3050	0.0188
	Plant aboveground dry weight	0.0113	0.1679	0.6836	0.0030
	Plant aboveground water content	0.2289	0.6947	0.4081	0.0123
	Plant malondialdehyde content	0.0000	0.1571	0.6933	0.0028
	Plant proline content	1321.4778	3.3929	0.0708	0.0571
	Plant soluble sugar content	0.2133	0.9518	0.3335	0.0167
	Plant catalase activity	12.5671	2.1429	0.1488	0.0369
	Plant peroxidase activity	0.2490	0.0214	0.8842	0.0004
	Plant superoxide dismutase activity	6865.8836	5.1353	0.0273	0.0840
Plant species	Plant height	2535.5213	512.4477	<0.0001	0.9015
	Ground diameter	1.5920	2.6135	0.1116	0.0446
	Leaf length	113.1021	102.9752	<0.0001	0.6477
	Leaf width	331.8350	338.4062	<0.0001	0.8580
	Green leaf area	82985.4758	269.5912	<0.0001	0.8280
	Leaf thickness	0.0986	42.7523	<0.0001	0.4329
	Single-leaf wet weight	8.2268	151.8928	<0.0001	0.7306
	Single-leaf dry weight	0.0026	7.4836	0.0083	0.1179
	Leaf water content	249.8699	1203.2671	<0.0001	0.9555
	Specific leaf area	4726713.2955	653.6083	<0.0001	0.9211
	Leaf chlorophyll content	3895.8297	5506.5889	<0.0001	0.9899
	Leaf nitrogen content	18.5719	1665.0280	<0.0001	0.9675
	Plant aboveground wet weight	163.3333	12.9970	0.0007	0.1884
	Plant aboveground dry weight	0.2581	3.8232	0.0555	0.0639
	Plant aboveground water content	60.4264	183.3595	<0.0001	0.7660
	Plant malondialdehyde content	0.0002	33.0571	<0.0001	0.3712
	Plant proline content	1032.7440	2.6516	0.1091	0.0452
	Plant soluble sugar content	6.2784	28.0223	<0.0001	0.3335
	Plant catalase activity	551.6949	94.0753	<0.0001	0.6269

Acid deposition acidity	Plant peroxidase activity	109.4748	9.4047	0.0033	0.1438
	Plant superoxide dismutase activity	650.9429	0.4869	0.4882	0.0086
	Plant height	56.2978	11.3782	0.0014	0.1689
	Ground diameter	0.0394	0.0647	0.8001	0.0012
	Leaf length	8.2463	7.5080	0.0082	0.1182
	Leaf width	3.3440	3.4102	0.0701	0.0574
	Green leaf area	1643.6611	5.3397	0.0246	0.0871
	Leaf thickness	0.0001	0.0602	0.8071	0.0011
	Single-leaf wet weight	0.3444	6.3596	0.0145	0.1020
	Single-leaf dry weight	0.0014	4.1220	0.0471	0.0686
	Leaf water content	0.6498	3.1292	0.0823	0.0529
	Specific leaf area	2519.5378	0.3484	0.5574	0.0062
	Leaf chlorophyll content	28.0134	39.5957	<0.0001	0.4142
	Leaf nitrogen content	0.1613	14.4650	0.0004	0.2053
	Plant aboveground wet weight	33.6200	2.6753	0.1075	0.0456
	Plant aboveground dry weight	0.1600	2.3698	0.1293	0.0406
	Plant aboveground water content	0.0618	0.1875	0.6667	0.0033
	Plant malondialdehyde content	0.0000	3.6269	0.0620	0.0608
	Plant proline content	12511.6294	32.1240	<0.0001	0.3645
	Plant soluble sugar content	0.1760	0.7856	0.3792	0.0138
	Plant catalase activity	0.3090	0.0527	0.8193	0.0009
	Plant peroxidase activity	5.0315	0.4322	0.5136	0.0077
	Plant superoxide dismutase activity	354.7937	0.2654	0.6085	0.0047
	Plant height	291.1244	58.8384	<0.0001	0.6776
	Ground diameter	4.8021	7.8834	0.0010	0.2197
	Leaf length	5.3543	4.8749	0.0112	0.1483
	Leaf width	0.7119	0.7260	0.4883	0.0253
	Green leaf area	487.9416	1.5852	0.2140	0.0536
	Leaf thickness	0.0052	2.2478	0.1151	0.0743
	Single-leaf wet weight	0.2490	4.5974	0.0142	0.1410
	Single-leaf dry weight	0.0028	8.0544	0.0008	0.2234
	Leaf water content	0.8015	3.8597	0.0269	0.1211
	Specific leaf area	45876.9380	6.3438	0.0033	0.1847
Acid deposition type	Plant chlorophyll content	20.0649	28.3609	<0.0001	0.5032
	Leaf nitrogen content	0.1857	16.6466	<0.0001	0.3729
	Plant aboveground wet weight	146.4676	11.6549	0.0001	0.2939
	Plant aboveground dry weight	0.7588	11.2412	0.0001	0.2865
	Plant aboveground water content	0.1513	0.4591	0.6342	0.0161
	Plant malondialdehyde content	0.0000	4.6997	0.0130	0.1437
	Plant proline content	197609.7657	507.3700	<0.0001	0.9477
	Plant soluble sugar content	3.4151	15.2428	<0.0001	0.3525
	Plant catalase activity	16.3403	2.7864	0.0702	0.0905
	Plant peroxidase activity	184.6892	15.8662	<0.0001	0.3617
	Plant superoxide dismutase activity	287.8707	0.2153	0.8070	0.0076
	Plant height	24.4803	4.9477	0.0302	0.0812
	Ground diameter	0.3818	0.6267	0.4319	0.0111
	Leaf length	12.7401	11.5994	0.0012	0.1716
	Leaf width	0.0473	0.0483	0.8269	0.0009
Planting pattern Plant species	Green leaf area	244.3660	0.7939	0.3767	0.0140
	Leaf thickness	0.0022	0.9619	0.3309	0.0169
	Single-leaf wet weight	0.1904	3.5154	0.0660	0.0591
	Single-leaf dry weight	0.0014	4.0011	0.0503	0.0667
	Leaf water content	0.4967	2.3917	0.1276	0.0410
	Specific leaf area	26611.8983	3.6799	0.0602	0.0617
	Leaf chlorophyll content	47.3630	66.9456	<0.0001	0.5445
	Leaf nitrogen content	0.1694	15.1851	0.0003	0.2133
	Plant aboveground wet weight	24.4803	1.9480	0.1683	0.0336
	Plant aboveground dry weight	0.0036	0.0531	0.8186	0.0009
	Plant aboveground water content	1.6099	4.8851	0.0312	0.0802
	Plant malondialdehyde content	0.0000	0.3043	0.5834	0.0054

Planting pattern Acid deposition acidity	Plant proline content	25.3921	0.0652	0.7994	0.0012
	Plant soluble sugar content	0.0354	0.1580	0.6925	0.0028
	Plant catalase activity	2.4797	0.4228	0.5182	0.0075
	Plant peroxidase activity	3.2286	0.2774	0.6005	0.0049
	Plant superoxide dismutase activity	169.7771	0.1270	0.7229	0.0023
	Plant height	0.0484	0.0098	0.9216	0.0002
	Ground diameter	0.4729	0.7763	0.3820	0.0137
	Leaf length	0.0000	0.0000	0.9970	0.0000
	Leaf width	0.2094	0.2136	0.6458	0.0038
	Green leaf area	30.7423	0.0999	0.7532	0.0018
	Leaf thickness	0.0039	1.6786	0.2004	0.0291
	Single-leaf wet weight	0.0193	0.3571	0.5526	0.0063
	Single-leaf dry weight	0.0003	0.9965	0.3225	0.0175
	Leaf water content	0.0044	0.0210	0.8854	0.0004
	Specific leaf area	2758.0022	0.3814	0.5394	0.0068
	Leaf chlorophyll content	8.3183	11.7575	0.0011	0.1735
	Leaf nitrogen content	0.0551	4.9393	0.0303	0.0811
	Plant aboveground wet weight	3.2939	0.2621	0.6107	0.0047
	Plant aboveground dry weight	0.0127	0.1876	0.6666	0.0033
	Planting pattern Acid deposition type	Plant aboveground water content	0.0003	0.0008	0.9771
Plant malondialdehyde content		0.0000	0.7036	0.4051	0.0124
Plant proline content		21.1000	0.0542	0.8168	0.0010
Plant soluble sugar content		0.9655	4.3092	0.0425	0.0715
Plant catalase activity		1.3250	0.2259	0.6364	0.0040
Plant peroxidase activity		0.2335	0.0201	0.8879	0.0004
Plant superoxide dismutase activity		3102.7437	2.3207	0.1333	0.0398
Plant height		8.6591	1.7501	0.1831	0.0588
Ground diameter		0.1096	0.1799	0.8358	0.0064
Leaf length		2.8920	2.6330	0.0807	0.0860
Leaf width		0.5615	0.5727	0.5673	0.0200
Green leaf area		144.0742	0.4680	0.6287	0.0164
Leaf thickness		0.0026	1.1265	0.3314	0.0387
Single-leaf wet weight		0.0034	0.0623	0.9397	0.0022
Single-leaf dry weight		0.0001	0.3595	0.6996	0.0127
Leaf water content		0.0755	0.3635	0.6969	0.0128
Specific leaf area		5339.5672	0.7384	0.4825	0.0257
Leaf chlorophyll content		16.1004	22.7572	<0.0001	0.4484
Leaf nitrogen content		0.0479	4.2918	0.0184	0.1329
Plant species Acid deposition acidity		Plant aboveground wet weight	7.7560	0.6172	0.5431
	Plant aboveground dry weight	0.0753	1.1159	0.3348	0.0383
	Plant aboveground water content	0.2780	0.8436	0.4356	0.0292
	Plant malondialdehyde content	0.0000	1.2204	0.3028	0.0418
	Plant proline content	2.6669	0.0068	0.9932	0.0002
	Plant soluble sugar content	0.0237	0.1056	0.9000	0.0038
	Plant catalase activity	6.5677	1.1199	0.3335	0.0385
	Plant peroxidase activity	30.3181	2.6046	0.0829	0.0851
	Plant superoxide dismutase activity	1763.7118	1.3192	0.2755	0.0450
	Plant height	7.2835	1.4720	0.2301	0.0256
	Ground diameter	0.0449	0.0737	0.7870	0.0013
	Leaf length	0.0068	0.0062	0.9375	0.0001
	Leaf width	2.7417	2.7960	0.1001	0.0476
	Green leaf area	738.4711	2.3990	0.1270	0.0411
	Leaf thickness	0.0074	3.2264	0.0779	0.0545
	Single-leaf wet weight	0.0103	0.1897	0.6649	0.0034
	Single-leaf dry weight	0.0000	0.0928	0.7617	0.0017
	Leaf water content	0.0013	0.0060	0.9384	0.0001
	Specific leaf area	4749.4811	0.6568	0.4211	0.0116
	Leaf chlorophyll content	7.2796	10.2894	0.0022	0.1552
Leaf nitrogen content	0.0352	3.1545	0.0811	0.0533	
Plant aboveground wet weight	31.4689	2.5041	0.1192	0.0428	

	Plant aboveground dry weight	0.1753	2.5967	0.1127	0.0443
	Plant aboveground water content	0.0091	0.0278	0.8683	0.0005
	Plant malondialdehyde content	0.0000	0.9118	0.3438	0.0160
	Plant proline content	658.3085	1.6902	0.1989	0.0293
	Plant soluble sugar content	0.0312	0.1393	0.7104	0.0025
	Plant catalase activity	12.3891	2.1126	0.1517	0.0364
	Plant peroxidase activity	0.0047	0.0004	0.9840	0.0000
	Plant superoxide dismutase activity	1118.3384	0.8365	0.3643	0.0147
	Plant height	1.5593	0.3152	0.7310	0.0111
	Ground diameter	0.4488	0.7368	0.4832	0.0256
	Leaf length	0.1919	0.1747	0.8402	0.0062
	Leaf width	0.2104	0.2145	0.8076	0.0076
	Green leaf area	51.7955	0.1683	0.8456	0.0060
	Leaf thickness	0.0067	2.9261	0.0618	0.0946
	Single-leaf wet weight	0.0438	0.8094	0.4503	0.0281
	Single-leaf dry weight	0.0001	0.2860	0.7523	0.0101
	Leaf water content	0.1949	0.9385	0.3973	0.0324
Plant species	Specific leaf area	22171.3014	3.0658	0.0545	0.0987
Acid deposition type	Leaf chlorophyll content	18.7248	26.4667	<0.0001	0.4859
	Leaf nitrogen content	0.0747	6.6940	0.0025	0.1929
	Plant aboveground wet weight	4.8912	0.3892	0.6794	0.0137
	Plant aboveground dry weight	0.0152	0.2257	0.7987	0.0080
	Plant aboveground water content	0.0669	0.2031	0.8168	0.0072
	Plant malondialdehyde content	0.0000	3.2221	0.0474	0.1032
	Plant proline content	619.0106	1.5893	0.2131	0.0537
	Plant soluble sugar content	0.4275	1.9082	0.1579	0.0638
	Plant catalase activity	4.9406	0.8425	0.4360	0.0292
	Plant peroxidase activity	30.0744	2.5836	0.0845	0.0845
	Plant superoxide dismutase activity	300.5801	0.2248	0.7994	0.0080
	Plant height	4.2041	0.8497	0.4330	0.0295
	Ground diameter	0.6333	1.0396	0.3603	0.0358
	Leaf length	1.1140	1.0143	0.3692	0.0350
	Leaf width	2.1547	2.1973	0.1206	0.0728
	Green leaf area	588.6129	1.9122	0.1573	0.0639
	Leaf thickness	0.0012	0.5301	0.5915	0.0186
	Single-leaf wet weight	0.0574	1.0589	0.3537	0.0364
	Single-leaf dry weight	0.0002	0.6925	0.5045	0.0241
	Leaf water content	0.2401	1.1564	0.3220	0.0397
Acid deposition acid-ity	Specific leaf area	6359.4347	0.8794	0.4207	0.0305
	Leaf chlorophyll content	12.8981	18.2309	<0.0001	0.3943
Acid deposition type	Leaf nitrogen content	0.0809	7.2569	0.0016	0.2058
	Plant aboveground wet weight	12.9037	1.0268	0.3648	0.0354
	Plant aboveground dry weight	0.0339	0.5016	0.6083	0.0176
	Plant aboveground water content	0.1461	0.4432	0.6442	0.0156
	Plant malondialdehyde content	0.0000	0.4643	0.6310	0.0163
	Plant proline content	39994.4062	102.6870	<0.0001	0.7857
	Plant soluble sugar content	0.6065	2.7070	0.0755	0.0882
	Plant catalase activity	4.1720	0.7114	0.4953	0.0248
	Plant peroxidase activity	275.4643	23.6645	<0.0001	0.4580
	Plant superoxide dismutase activity	3913.1986	2.9269	0.0618	0.0946
	Plant height	1.4926	0.3017	0.5850	0.0054
	Ground diameter	0.2707	0.4444	0.5077	0.0079
	Leaf length	0.0035	0.0032	0.9554	0.0001
Planting pattern	Leaf width	0.2094	0.2136	0.6458	0.0038
Plant species	Green leaf area	24.3241	0.0790	0.7797	0.0014
Acid deposition acid-ity	Leaf thickness	0.0066	2.8502	0.0969	0.0484
	Single-leaf wet weight	0.0221	0.4071	0.5260	0.0072
	Single-leaf dry weight	0.0001	0.3465	0.5585	0.0061
	Leaf water content	0.0896	0.4315	0.5139	0.0076
	Specific leaf area	2969.0031	0.4106	0.5243	0.0073

	Leaf chlorophyll content	30.1037	42.5503	<0.0001	0.4318
	Leaf nitrogen content	0.1645	14.7493	0.0003	0.2085
	Plant aboveground wet weight	2.0672	0.1645	0.6866	0.0029
	Plant aboveground dry weight	0.0043	0.0641	0.8011	0.0011
	Plant aboveground water content	0.0252	0.0764	0.7833	0.0014
	Plant malondialdehyde content	0.0000	0.1565	0.6939	0.0028
	Plant proline content	106.0296	0.2722	0.6039	0.0048
	Plant soluble sugar content	0.1669	0.7448	0.3918	0.0131
	Plant catalase activity	0.1590	0.0271	0.8698	0.0005
	Plant peroxidase activity	23.4422	2.0139	0.1614	0.0347
	Plant superoxide dismutase activity	482.1801	0.3606	0.5506	0.0064
	Plant height	0.8496	0.1717	0.8427	0.0061
	Ground diameter	0.2747	0.4510	0.6393	0.0159
	Leaf length	0.6871	0.6256	0.5386	0.0219
	Leaf width	0.5268	0.5372	0.5873	0.0188
	Green leaf area	22.6665	0.0736	0.9291	0.0026
	Leaf thickness	0.0005	0.2295	0.7957	0.0081
	Single-leaf wet weight	0.0375	0.6927	0.5045	0.0241
	Single-leaf dry weight	0.0003	0.9621	0.3883	0.0332
	Leaf water content	0.0118	0.0570	0.9446	0.0020
Planting pattern	Specific leaf area	3290.3214	0.4550	0.6368	0.0160
Plant species	Leaf chlorophyll content	18.1549	25.6611	<0.0001	0.4782
Acid deposition type	Leaf nitrogen content	0.1279	11.4698	0.0001	0.2906
	Plant aboveground wet weight	6.1513	0.4895	0.6155	0.0172
	Plant aboveground dry weight	0.0280	0.4149	0.6624	0.0146
	Plant aboveground water content	0.0895	0.2717	0.7631	0.0096
	Plant malondialdehyde content	0.0000	2.4460	0.0958	0.0803
	Plant proline content	51.2973	0.1317	0.8769	0.0047
	Plant soluble sugar content	0.0016	0.0069	0.9931	0.0002
	Plant catalase activity	20.9372	3.5702	0.0347	0.1131
	Plant peroxidase activity	4.9651	0.4265	0.6549	0.0150
	Plant superoxide dismutase activity	2006.3249	1.5006	0.2318	0.0509
	Plant height	10.2402	2.0696	0.1358	0.0688
	Ground diameter	0.5934	0.9741	0.3838	0.0336
	Leaf length	0.0900	0.0820	0.9214	0.0029
	Leaf width	0.6357	0.6482	0.5268	0.0226
	Green leaf area	157.1063	0.5104	0.6030	0.0179
	Leaf thickness	0.0002	0.1017	0.9035	0.0036
	Single-leaf wet weight	0.0086	0.1589	0.8535	0.0056
	Single-leaf dry weight	0.0002	0.4936	0.6131	0.0173
	Leaf water content	0.1904	0.9167	0.4058	0.0317
Planting pattern	Specific leaf area	3832.8777	0.5300	0.5915	0.0186
Acid deposition acid-ity	Leaf chlorophyll content	17.3715	24.5538	<0.0001	0.4672
Acid deposition type	Leaf nitrogen content	0.0997	8.9395	0.0004	0.2420
	Plant aboveground wet weight	6.0976	0.4852	0.6181	0.0170
	Plant aboveground dry weight	0.0537	0.7954	0.4565	0.0276
	Plant aboveground water content	0.6751	2.0487	0.1385	0.0682
	Plant malondialdehyde content	0.0000	0.7317	0.4856	0.0255
	Plant proline content	371.0091	0.9526	0.3919	0.0329
	Plant soluble sugar content	0.4259	1.9011	0.1589	0.0636
	Plant catalase activity	3.2152	0.5483	0.5810	0.0192
	Plant peroxidase activity	11.7638	1.0106	0.3705	0.0348
	Plant superoxide dismutase activity	577.7917	0.4322	0.6513	0.0152
	Plant height	9.2270	1.8648	0.1644	0.0624
Plant species	Ground diameter	0.6209	1.0193	0.3674	0.0351
Acid deposition acid-ity	Leaf length	0.2743	0.2497	0.7799	0.0088
	Leaf width	0.3778	0.3853	0.6820	0.0136
Acid deposition type	Green leaf area	129.6897	0.4213	0.6582	0.0148
	Leaf thickness	0.0035	1.5002	0.2319	0.0509
	Single-leaf wet weight	0.0235	0.4346	0.6497	0.0153

	Single-leaf dry weight	0.0002	0.4377	0.6477	0.0154
	Leaf water content	0.1153	0.5551	0.5771	0.0194
	Specific leaf area	11950.2858	1.6525	0.2008	0.0557
	Leaf chlorophyll content	16.2788	23.0095	<0.0001	0.4511
	Leaf nitrogen content	0.0758	6.7977	0.0023	0.1954
	Plant aboveground wet weight	3.5635	0.2836	0.7542	0.0100
	Plant aboveground dry weight	0.0233	0.3448	0.7099	0.0122
	Plant aboveground water content	0.1195	0.3626	0.6975	0.0128
	Plant malondialdehyde content	0.0000	1.7875	0.1768	0.0600
	Plant proline content	983.3424	2.5248	0.0892	0.0827
	Plant soluble sugar content	0.1492	0.6659	0.5178	0.0232
	Plant catalase activity	9.5032	1.6205	0.2069	0.0547
	Plant peroxidase activity	92.3572	7.9342	0.0009	0.2208
	Plant superoxide dismutase activity	2393.3482	1.7901	0.1764	0.0601
	Plant height	2.1440	0.4333	0.6505	0.0152
	Ground diameter	0.1746	0.2867	0.7519	0.0101
	Leaf length	0.6342	0.5774	0.5646	0.0202
	Leaf width	0.8737	0.8910	0.4160	0.0308
	Green leaf area	259.1921	0.8420	0.4362	0.0292
	Leaf thickness	0.0004	0.1847	0.8318	0.0066
	Single-leaf wet weight	0.0082	0.1505	0.8606	0.0053
	Single-leaf dry weight	0.0001	0.3202	0.7274	0.0113
Planting pattern	Leaf water content	0.3491	1.6810	0.1955	0.0566
Plant species	Specific leaf area	5413.7473	0.7486	0.4777	0.0260
Acid deposition acid- ity	Leaf chlorophyll content	13.0476	18.4422	<0.0001	0.3971
	Leaf nitrogen content	0.0569	5.1027	0.0092	0.1541
Acid deposition type	Plant aboveground wet weight	3.1068	0.2472	0.7818	0.0088
	Plant aboveground dry weight	0.0384	0.5694	0.5691	0.0199
	Plant aboveground water content	0.3665	1.1122	0.3360	0.0382
	Plant malondialdehyde content	0.0000	0.5634	0.5725	0.0197
	Plant proline content	189.5349	0.4866	0.6173	0.0171
	Plant soluble sugar content	0.6467	2.8866	0.0641	0.0935
	Plant catalase activity	51.9710	8.8621	0.0005	0.2404
	Plant peroxidase activity	3.5540	0.3053	0.7381	0.0108
	Plant superoxide dismutase activity	5085.5952	3.8038	0.0283	0.1196