

**Mechanochemically engineered ammonium magnesium-sulfate double salts synthesized from ammonium carbonate for improved nitrogen-use efficiency**

Mohamed Ammar,<sup>1,‡</sup> Julia Farias,<sup>2,3‡</sup> Emmanuel Aransiola,<sup>1</sup> Matthew Conley,<sup>4</sup> Kerry A. Hamilton,<sup>2,3</sup> Clinton Williams,<sup>4</sup> and Jonas Baltrusaitis<sup>1,\*</sup>

<sup>1</sup>Department of Chemical and Biomolecular Engineering, Lehigh University, 124 E. Morton St., Bethlehem, PA 18015, United States of America

<sup>2</sup>The Biodesign Institute Center for Environmental Health Engineering, Arizona State University, Tempe, AZ 85281, United States of America

<sup>3</sup>School of Sustainable Engineering and the Built Environment, Arizona State University, Tempe, AZ 85281, United States of America

<sup>4</sup>Agricultural Research Service, U.S. Department of Agriculture, Maricopa, AZ 85138, United States of America

Tables S1-S3. Fresh plant weight (g plant<sup>-1</sup>), ACI, chlorophyll (mg g<sup>-1</sup> FW), Nitrate (mg Kg<sup>-1</sup> soil) and Total Nitrogen (mg Kg<sup>-1</sup> soil).

Table S1. Fresh weight (g plant<sup>-1</sup>)

Soil	NN	AC	UR	MgS
A	0.0476	0.0798	0.0852	0.0904
A	0.1019	0.0878	0.0739	0.0712
A	0.067	0.027	0.0938	0.1065
A	0.048	0.1036	0.0804	0.0835
A	0.0892	0.1299	0.1078	0.1124
A	0.0911	0.081	0.0792	0.112
A	0.0532	0.1128	0.0817	0.0973
A	0.0698	0.0984	0.075	0.0982
B	0.1442	0.158	0.1196	0.1245
B	0.1079	0.0494	0.116	0.2
B	0.1095	0.1298	0.0964	0.1223
B	0.1095	0.1551	0.1422	0.138
B	0.1147	0.0864	0.1404	0.1612
B	0.0998	0.157	0.168	0.178
B	0.0828	0.1243	0.1067	0.0547
B	0.097	0.1406	0.1139	0.1165
C	0.1151	0.2439	0.2394	0.3
C	0.0867	0.2332	0.4045	0.345
C	0.0961	0.147	0.3322	0.2874
C	0.1774	0.1028	0.1579	0.4478
C	0.1255	0.0694	0.2903	0.1798
C	0.086	0.2139	0.1097	0.3566
C	0.1074	0.1631	0.2168	0.3087
C	0.1074	0.1721	0.3304	0.2438

Table S2. ACI

Soil	NN	AC	UR	MgS
A	40.38	42.33	27.45	36.68
A	41.64	39.66	39.31	38.02
A	30.62	38.80	38.64	39.02
A	39.01	44.86	36.91	40.67
A	39.21	40.56	41.22	36.28
A	41.24	38.57	34.41	40.56
A	33.51	41.03	28.55	38.06
A	32.92	37.78	38.71	39.67
B	48.57	47.04	51.82	47.71
B	53.07	39.08	42.44	44.64
B	44.23	38.14	48.35	44.11
B	45.24	43.25	51.28	47.31
B	43.47	49.40	48.21	47.77
B	53.13	41.81	55.21	50.84
B	51.99	48.79	41.52	46.15
B	50.84	45.86	51.87	47.40
C	50.25	32.70	39.45	34.71
C	47.90	43.14	33.16	42.40
C	52.51	43.61	30.15	33.62
C	39.92	37.86	35.89	33.29
C	45.81	43.90	34.35	34.25
C	52.98	45.78	39.19	40.62
C	44.15	34.33	31.41	31.71
C	46.62	35.67	34.87	37.43

Table S3.

Chlorophyll (mg g <sup>-1</sup> FW)				
Soil	NN	AC	UR	MgS
A	6.466765	4.188871	6.315276	8.544354
A	7.303531	4.870701	5.736916	6.564397
A	6.885148	4.529786	6.026096	7.5543755
B	4.018812	4.559235	4.374053	3.824345
B	1.790531	5.736916	4.335319	4.330278
B	2.9046715	5.1480755	4.354686	4.0773115
C	3.946385	3.848753	8.428152	8.978657
C	3.90261	5.980996	8.111645	9.315328
C	3.9244975	4.9148745	8.2698985	9.1469925
Nitrate (mg Kg <sup>-1</sup> soil)				
Soil	NN	AC	UR	MgS
A	14.0	15.0	73	39.0
A	14.0	15.0	71.0	38.0
A	17.0	14.0	65.0	58.0
B	4.9	19.0	25	33.0
B	1.7	21.0	25.0	17.0
B	1.4	21.0	21.0	31.0
C	1.1	2.7	7.0	6.3
C	1.1	2.7	21.0	4.9
C	0.8	2.0	12.2	6.3
Total Nitrogen (mg Kg <sup>-1</sup> soil)				
soil	NN	AC	UR	MgS
A	180	260	210	420
A	250	260	250	490
A	240	248	360	300
B	310	590	580	650
B	360	400	500	420
B	310	490	600	526
C	250	230	410	628
C	100	180	560	730
C	110	160	460	620