Appendices

Appendix 1. The accessions of *Austrodanthonia* species used in the pot experiment (Chapter 4), where collected, and soil pH_{Ca}, Al and Mn values of the respective collection sites

Species	No. of accession	Accession ID	Where collected	pH_{Ca}	Al (mg/kg)	Mn (mg/kg)
A. caespitosa	3	182024	C	4.44	5.0	43.1
A. caespitosa		182089	S	4.50	1.2	11.2
A. caespitosa		182309	C	4.70	1.1	26.4
A. carphoides	4	182057	S	4.56	1.0	11.0
A. carphoides		182073	C	-	-	-
A. carphoides		182145	S	4.42	3.4	16.0
A. carphoides		182303	C	4.70	1.1	26.4
A. duttoniana	16	182039	C	4.61	1.6	32.6
A. duttoniana		182050	S	4.08	9.8	7.6
A. duttoniana		182053	S	4.13	8.2	17.4
A. duttoniana		182061	S	4.70	1.1	26.4
A. duttoniana		182064	S	4.70	1.1	26.4
A. duttoniana		182084	S	4.45	1.5	14.3
A. duttoniana		182106	C	4.61	1.6	32.6
A. duttoniana		182123	C	4.63	1.6	5.1
A. duttoniana		182131	S	3.96	8.5	10.1
A. duttoniana		182226	S	4.43	1.6	71.4
A. duttoniana		182239	S	4.24	4.4	10.2
A. duttoniana		182245	S	4.12	2.8	9.0
A. duttoniana		182287	C	4.53	1.8	12.1
A. duttoniana		182293	C	4.51	2.7	13.5
A. duttoniana		182300	C	4.08	14.6	5.3
A. duttoniana		182351	S	4.34	4.2	22.2
A. eriantha	18	182017	S	4.04	11.0	5.7
A. eriantha		182030	S	4.45	1.5	14.3
A. eriantha		182046	S	3.97	11.6	9.5
A. eriantha		182077	S	4.45	1.5	14.3
A. eriantha		182082	M	4.40	4.6	4.7
A. eriantha		182085	S	4.17	8.9	4.6
A. eriantha		182093	S	4.34	3.7	35.0
A. eriantha		182098	S	4.56	1.0	11.0
A. eriantha		182103	C	4.21	6.4	9.4
A. eriantha		182116	C	4.42	4.8	8.7

Species	No. of accession	Accession ID	Where collected	pH_{Ca}	Al (mg/kg)	Mn (mg/kg)
A. eriantha		182118	C	4.42	4.8	8.7
A. eriantha		182126	C	4.08	14.6	5.3
A. eriantha		182211	S	4.13	8.2	17.4
A. eriantha		182254	S	4.54	0.9	8.9
A. eriantha		182268	S	4.24	4.4	10.2
A. eriantha		182269	M	4.46	2.6	9.2
A. eriantha		182059a	S	4.45	1.5	14.3
A. eriantha		182059b	S	4.45	1.5	14.3
A. laevis	4	182170	C	4.88	0.4	12.2
A. laevis		182220	S	4.15	9.3	20.2
A. laevis		182253	S	4.03	15.9	23.3
A. laevis		182352	S	4.54	0.9	8.9
A. fulva	9	182202	M	4.33	5.6	13.5
A. fulva		182205	S	4.55	2.3	46.2
A fulva		182206	M	5.13	0.1	7.5
A. fulva		182219	S	4.18	7.5	6.6
A. fulva		182221	M	5.13	0.1	7.5
A. fulva		182255	S	4.42	2.4	13.2
A. fulva		182256	S	4.54	0.9	8.9
A. fulva		182407	M	5.13	0.0	9.3
A. fulva		182179a	S	4.37	3.9	13.9
A. bipartita	2	182395	M	5.64	0.1	1.2
A. bipartita		Bunderra*	Domesticated cultivar	-	-	-
A. monticola	1	182088	S	4.24	4.4	10.2
A. penicillata	11	182081	S	4.57	0.6	11.4
A. penicillata		182120	C	4.03	11.8	14.5
A. penicillata		182132	C	4.64	1.4	6.6
A. penicillata		182153	C	4.80	0.8	12.1
A. penicillata		182169	C	4.69	1.1	14.1
A. penicillata		182192	S	4.59	0.8	6.5
A. penicillata		182195	S	4.90	0.6	16.8
A. penicillata		182208	S	4.48	2.2	6.2
A. penicillata		182214	S	4.09	15.3	18.2
A. penicillata		182265	M	4.08	7.9	22.9
A. penicillata		182328	M	4.94	0.3	17.5
A. pilosa	36	182012	C	4.51	2.7	13.5
A. pilosa		182086	M	4.78	0.7	28.3
A. pilosa		182087	S	4.34	3.7	35.0

Species	No. of accession	Accession ID	Where collected	pH_{Ca}	Al (mg/kg)	Mn (mg/kg)
A. pilosa		182090	M	4.94	0.3	17.5
A. pilosa		182094	S	4.24	6.1	19.2
A. pilosa		182096	S	4.41	1.5	8.5
A. pilosa		182110	C	4.49	3.3	7.2
A. pilosa		182112	S	4.25	3.3	23.9
A. pilosa		182127	C	4.70	1.1	26.4
A. pilosa		182134	C	4.49	3.3	7.2
A. pilosa		182135	C	4.49	3.3	7.2
A. pilosa		182161	C	5.12	0.2	19.2
A. pilosa		182163	C	5.13	0.1	22.4
A. pilosa		182166	C	4.80	0.4	32.6
A. pilosa		182172	C	4.88	0.4	12.2
A. pilosa		182178	C	5.13	0.1	22.4
A. pilosa		182196	S	3.97	11.6	9.5
A. pilosa		182199	S	4.12	6.7	6.9
A. pilosa		182218	S	4.17	8.9	4.6
A. pilosa		182224	S	4.15	9.3	20.2
A. pilosa		182229	S	4.08	9.8	7.6
A. pilosa		182237	S	4.09	15.3	18.2
A. pilosa		182238	S	4.34	2.0	11.8
A. pilosa		182242	S	4.18	7.5	6.6
A. pilosa		182246	S	4.07	6.2	37.3
A. pilosa		182266	M	4.99	0.4	14.0
A. pilosa		182267	M	4.99	0.4	23.1
A. pilosa		182271	M	4.08	7.9	22.9
A. pilosa		182272	M	4.97	0.4	13.0
A. pilosa		182275	S	4.48	2.2	6.2
A. pilosa		182280	S	4.63	0.6	16.8
A. pilosa		182288	C	4.08	14.6	5.3
A. pilosa		182292	C	4.73	0.9	21.7
A. pilosa		182304	C	4.70	1.1	26.4
A. pilosa		182179b	C	4.80	0.4	32.6
A. pilosa		Unknown	S	-	-	-
A. procera	2	182401	M	4.75	0.4	10.5
A. procera		182403	S	-	-	-
A. racemosa	69	182000	C	4.95	0.5	13.5
A. racemosa		182007	C	4.59	2.9	11.4
A. racemosa		182056	S	4.56	1.0	11.0
A. racemosa		182095	M	5.16	0.2	16.4
A. racemosa		182099	S	4.18	7.5	6.6
A. racemosa		182102	M	4.48	0.8	9.0

A. racemosa		182108	C	4.60	3.6	7.7
Species	No. of accession	Accession ID	Where collected	pH_{Ca}	Al (mg/kg)	Mn (mg/kg)
A. racemosa		182114	S	4.25	5.1	12.3
A. racemosa		182119	C	4.56	1.7	12.4
A. racemosa		182128	C	5.06	0.3	23.1
A. racemosa		182136	C	4.83	0.3	13.3
A. racemosa		182140	C	4.61	1.6	32.6
A. racemosa		182142	C	4.69	0.8	17.9
A. racemosa		182144	S	4.25	5.1	12.3
A. racemosa		182146	C	4.60	3.6	7.7
A. racemosa		182147	S	3.96	8.5	10.1
A. racemosa		182148	C	4.64	1.4	6.6
A. racemosa		182149	S	3.96	8.5	10.1
A. racemosa		182152	C	4.69	0.8	17.9
A. racemosa		182156	C	4.44	5.0	43.1
A. racemosa		182157	C	4.69	1.1	14.1
A. racemosa		182158	C	4.64	1.4	6.6
A. racemosa		182160	S	4.25	5.1	12.3
A. racemosa		182165	C	4.69	1.1	14.1
A. racemosa		182167	C	4.69	1.1	14.1
A. racemosa		182171	C	4.86	0.7	11.2
A. racemosa		182174	C	4.95	0.5	13.5
A. racemosa		182180	C	4.59	2.9	11.4
A. racemosa		182184	C	4.51	2.7	13.5
A. racemosa		182188	C	4.03	11.8	14.5
A. racemosa		182189	C	4.03	11.8	14.5
A. racemosa		182190	M	4.40	4.6	4.7
A. racemosa		182191	M	4.40	4.6	4.7
A. racemosa		182198	S	4.37	3.9	13.9
A. racemosa		182201	M	4.48	0.8	9.0
A. racemosa		182204	S	4.24	4.4	10.2
A. racemosa		182209	M	4.48	2.0	10.9
A. racemosa		182210	S	4.34	2.0	11.8
A. racemosa		182215	M	4.90	0.3	11.9
A. racemosa		182225	S	4.39	1.6	35.8
A. racemosa		182230	S	5.12	0.3	15.9
A. racemosa		182231	S	4.28	2.4	92.2
A. racemosa		182233	S	4.63	0.6	16.8
A. racemosa		182234	S	4.15	9.3	20.2
A. racemosa		182235	S	4.12	2.8	9.0
A. racemosa		182248	S	4.57	0.6	11.4
A. racemosa		182251	S	4.39	1.6	35.8
A. racemosa		182252	S	4.57	0.6	11.4

Species	No. of accession	Accession ID	Where collected	pH_{Ca}	Al (mg/kg)	Mn (mg/kg)
A. racemosa		182258	S	4.23	4.0	19.4
A. racemosa		182259	M	4.99	0.4	23.1
A. racemosa		182261	M	4.97	0.4	13.0
A. racemosa		182262	M	4.48	0.8	9.0
A. racemosa		182264	M	4.08	7.9	22.9
A. racemosa		182274	M	4.97	0.4	13.0
A. racemosa		182276	S	4.37	3.9	13.9
A. racemosa		182282	M	4.33	5.6	13.5
A. racemosa		182283	M	4.46	2.6	9.2
A. racemosa		182291	C	4.53	1.8	12.1
A. racemosa		182294	C	4.53	1.8	12.1
A. racemosa		182295	C	5.07	0.3	11.8
A. racemosa		182296	C	5.07	0.3	11.8
A. racemosa		182297	C	5.05	0.2	6.0
A. racemosa		182299	C	5.05	0.2	6.0
A. racemosa		182301	C	5.05	0.2	6.0
A. racemosa		182302	C	5.07	0.3	11.8
A. racemosa		182334	C	4.86	0.7	11.2
A. racemosa		182361	C	5.54	0.1	1.8
A. racemosa		182396	M	4.75	0.4	10.5
A. racemosa		182413	S	4.51	0.8	13.2
A. richardsonii	3	182070	C	4.56	1.7	12.4
A. richardsonii		182122	C	4.56	1.7	12.4
A. richardsonii		Taranna*	Domesticated cultivar	-	-	-
A. setacea	6	182013	C	4.53	1.8	12.1
A. setacea		182031	S	4.13	8.2	17.4
A. setacea		182075	S	4.41	1.5	8.5
A. setacea		182113	S	4.42	3.4	16.0
A. setacea		182278	S	4.04	11.0	5.7
A. setacea		182349	S	4.39	1.6	35.8
A. tenuior	1	182429	M	4.40	4.6	4.7

C – Central Tablelands; M – Monaro Tablelands; S – Southern Tablelands
** Lodge (1993a, 1993b); Lodge and Schipp (1993); Lodge (1996)*
Source of data: Peter Dowling and Denys Garden (unpublished)
- indicates data not available

Appendix 2. Dry matter (DM) yield responses of different accessions of *Austrodanthonia* species to pH treatments (Chapter 4, Table 4.2). Values are means of two pH's (4.4 and 5.3). Values in parentheses have been back transformed

Species	Accession	DM (mg/plant)		*Species*	Accession	DM (mg/plant)	
A. duttoniana	182287	4.82	(123.88)	*A. pilosa*	Unknown	3.46	(31.87)
A. fulva	182179a	4.65	(104.79)	*A. racemosa*	182299	3.46	(31.81)
A. racemosa	182114	4.61	(99.88)	*A. racemosa*	182201	3.43	(30.72)
A. pilosa	182229	4.53	(93.07)	*A. racemosa*	182000	3.40	(29.97)
A. fulva	182205	4.31	(74.11)	*A. eriantha*	182030	3.38	(29.26)
A. racemosa	182210	4.28	(72.20)	*A. eriantha*	182116	3.37	(29.04)
A. duttoniana	182245	4.22	(67.83)	*A. penicillata*	182328	3.35	(28.26)
A. racemosa	182295	4.19	(65.84)	*A. eriantha*	182118	3.26	(25.99)
A. racemosa	182171	4.18	(65.35)	*A. eriantha*	182268	3.24	(25.50)
A. racemosa	182230	4.15	(63.17)	*A. eriantha*	182085	3.24	(25.46)
A. fulva	182407	4.08	(59.26)	*A. eriantha*	182103	3.24	(25.37)
A. eriantha	182059a	4.07	(58.19)	*A. fulva*	182221	3.17	(23.80)
A. racemosa	182152	4.03	(56.40)	*A. penicillata*	182208	3.09	(21.82)
A. racemosa	182190	4.02	(55.44)	*A. pilosa*	182199	3.06	(21.23)
A. racemosa	182235	3.98	(53.53)	*A. racemosa*	182128	3.00	(19.96)
A. duttoniana	182050	3.97	(53.10)	*A. pilosa*	182271	2.98	(19.63)
A. racemosa	182095	3.95	(51.88)	*A. fulva*	182206	2.97	(19.39)
A. racemosa	182184	3.94	(51.31)	*A. fulva*	182202	2.92	(18.37)
A. pilosa	182163	3.92	(50.50)	*A. racemosa*	182225	2.86	(17.33)
A. racemosa	182251	3.91	(49.78)	*A. pilosa*	182288	2.80	(16.34)
A. duttoniana	182061	3.90	(49.17)	*A. racemosa*	182140	2.73	(15.25)
A. penicillata	182153	3.86	(47.37)	*A. setacea*	182031	2.48	(11.84)
A. penicillata	182214	3.84	(46.28)	*A. carphoides*	182145	2.37	(10.65)
A. racemosa	182209	3.84	(46.22)	*A. bipartita*	182395	2.24	(9.34)
A. pilosa	182304	3.82	(45.64)	*A. duttoniana*	182239	2.24	(9.29)
A. racemosa	182165	3.82	(45.39)	*A. duttoniana*	182123	2.18	(8.77)
A. racemosa	182274	3.81	(44.85)	*A. eriantha*	182126	2.15	(8.50)
A. richardsonii	182070	3.79	(44.35)	*A. racemosa*	182108	2.13	(8.32)
A. pilosa	182090	3.75	(42.21)	*A. duttoniana*	182131	1.98	(7.16)
A. procera	182401	3.72	(41.34)	*A. carphoides*	182303	1.66	(5.15)
A. duttoniana	182084	3.62	(37.08)	*A. monticola*	182088	1.60	(4.83)
A. racemosa	182215	3.60	(36.54)	*A. pilosa*	182134	1.41	(4.01)
A. racemosa	182264	3.57	(35.41)	*A. racemosa*	182297	1.39	(3.90)
A. racemosa	182234	3.57	(35.30)	*A. racemosa*	182198	1.29	(3.52)
A. penicillata	182192	3.54	(34.37)	*A. pilosa*	182272	1.26	(3.41)

A. racemosa	182291	3.53	(33.87)	*A. racemosa*	182302	1.25	(3.40)
Species	Accession	DM (mg/plant)		*Species*	Accession	DM (mg/plant)	
A. racemosa	182156	1.19	(3.20)	*A. eriantha*	182093	0.52	(1.58)
A. pilosa	182135	1.14	(3.01)	*A. racemosa*	182258	0.51	(1.57)
A. racemosa	182276	1.09	(2.88)	*A. racemosa*	182301	0.51	(1.56)
A. carphoides	182057	1.02	(2.67)	*A. racemosa*	182147	0.49	(1.53)
A. eriantha	182211	0.98	(2.57)	*A. racemosa*	182119	0.48	(1.52)
A. eriantha	182082	0.95	(2.49)	*A. pilosa*	182166	0.45	(1.47)
A. caespitosa	182024	0.92	(2.40)	*A. fulva*	182255	0.45	(1.47)
A. duttoniana	182039	0.90	(2.36)	*A. racemosa*	182146	0.45	(1.47)
A. laevis	182352	0.85	(2.24)	*A. racemosa*	182157	0.44	(1.46)
A. setacea	182278	0.85	(2.23)	*A. racemosa*	182231	0.44	(1.45)
A. racemosa	182174	0.84	(2.22)	*A. duttoniana*	182064	0.36	(1.34)
A. racemosa	182262	0.83	(2.20)	*A. racemosa*	182144	0.35	(1.32)
A. racemosa	182102	0.82	(2.16)	*A. richardsonii*	182122	0.34	(1.31)
A. pilosa	182012	0.81	(2.14)	*A. duttoniana*	182293	0.30	(1.25)
A. racemosa	182282	0.80	(2.13)	*A. racemosa*	182188	0.26	(1.19)
A. pilosa	182266	0.80	(2.12)	*A. penicillata*	182081	0.25	(1.18)
A. racemosa	182294	0.79	(2.09)	*A. laevis*	182253	0.24	(1.17)
A. pilosa	182179b	0.78	(2.09)	*A. setacea*	182013	0.22	(1.15)
A. duttoniana	182300	0.75	(2.02)	*A. penicillata*	182169	0.22	(1.15)
A. pilosa	182238	0.75	(2.01)	*A. pilosa*	182161	0.21	(1.13)
A. carphoides	182073	0.74	(2.00)	*A. racemosa*	182396	0.14	(1.04)
A. racemosa	182204	0.74	(2.00)	*A. racemosa*	182099	0.12	(1.02)
A. racemosa	182259	0.71	(1.93)	*A. setacea*	182075	0.05	(0.95)
A. eriantha	182077	0.70	(1.92)	*A. caespitosa*	182089	0.02	(0.92)
A. racemosa	182334	0.70	(1.91)	*A. racemosa*	182191	-0.02	(0.88)
A. racemosa	182261	0.70	(1.91)	*A. racemosa*	182056	-0.11	(0.80)
A. duttoniana	182226	0.69	(1.90)	*A. racemosa*	182361	-0.11	(0.80)
A. penicillata	182120	0.69	(1.89)	*A. pilosa*	182110	-0.17	(0.74)
A. pilosa	182280	0.66	(1.83)	*A. pilosa*	182178	-0.17	(0.74)
A. racemosa	182142	0.66	(1.83)	*A. eriantha*	182269	-0.19	(0.73)
A. racemosa	182148	0.66	(1.83)	*A. caespitosa*	182309	-0.44	(0.55)
A. racemosa	182160	0.65	(1.82)	*A. pilosa*	182218	-0.45	(0.54)
A. racemosa	182158	0.64	(1.80)	*A. richardsonii*	Taranna	-0.48	(0.52)
A. duttoniana	182106	0.60	(1.73)	*A. bipartita*	Bunderra	-0.55	(0.48)
A. racemosa	182007	0.56	(1.66)	*A. fulva*	182219	-0.62	(0.44)
A. eriantha	182017	0.55	(1.63)	*A. laevis*	182170	-1.13	(0.22)
A. pilosa	182086	0.55	(1.63)	*A. eriantha*	182046	-1.17	(0.21)
A. duttoniana	182053	0.53	(1.61)	*A. pilosa*	182196	-1.50	(0.12)
A. penicillata	182195	0.53	(1.60)				

Standard error of the mean for accessions (natural log transformed value) = ± 1.61

Accessions with zero values are not shown in the table
Accessions are ranked on the basis of dry matter yield from the highest to the lowest

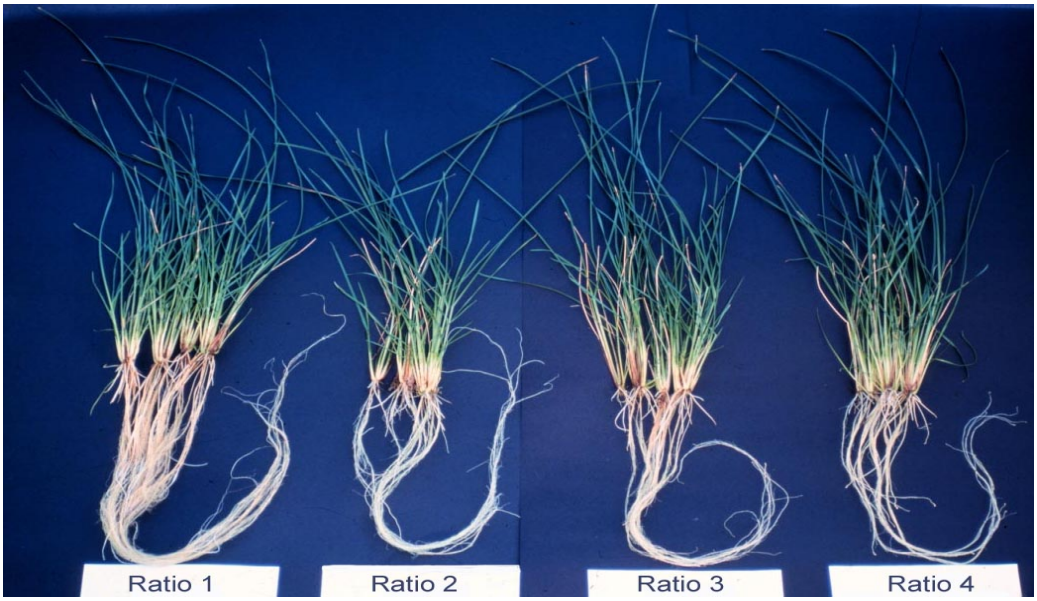
Appendix 3. Accessions of *Austrodanthonia* spp. selected for further investigation based on emergence at lower pH's (Chapter 4, Fig. 4.8)

Species	No. of accessions	Accessions ID	Where collected	Emergence			Survival		DM
				pH 3.9	pH 4.4	pH 5.3	pH 4.4	pH 5.3	mg/plant
A. carphoides	1	182145	S	0.23	0.82	0.86	0.72	0.51	10.65
A. duttoniana	7	182239	S	0.43	0.88	0.92	0.77	0.86	9.29
A. duttoniana		182245	S	0.27	0.86	0.92	0.84	0.86	67.83
A. duttoniana		182050	S	0.25	0.80	0.90	0.69	0.86	53.10
A. duttoniana		182131	S	0.18	0.89	0.94	0.90	0.65	7.16
A. duttoniana		182293	C	0.18	0.79	0.89	0.43	0.63	1.25
A. duttoniana		182300	C	0.26	0.89	0.90	0.45	0.85	2.02
A. duttoniana		182351	S	0.08	0.86	0.92	0.90	0.73	2.24
A. eriantha	1	182059b	S	0.29	0.64	0.78	0.21	0.25	58.19
A. fulva	6	182256	S	0.25	0.94	0.92	0.87	0.91	104.79
A. fulva		182179a	S	0.25	0.81	0.66	0.69	0.16	-
A. fulva		182205	S	0.17	0.94	0.92	0.93	0.92	74.11
A. fulva		182407	M	0.05	0.90	0.89	0.80	0.91	59.26
A. fulva		182221	M	0.04	0.88	0.85	0.72	0.84	23.80
A. fulva		182206	M	0.03	0.90	0.86	0.83	0.76	19.39
A. penicillata	7	182153	C	0.55	0.88	0.89	0.74	0.70	47.37
A. penicillata		182081	S	0.44	0.80	0.82	0.57	0.38	1.18
A. penicillata		182192	S	0.43	0.79	0.83	0.51	0.83	34.37
A. penicillata		182208	S	0.30	0.85	0.85	0.51	0.83	21.82
A. penicillata		182265	M	0.26	0.72	0.68	0.48	0.22	-
A. penicillata		182328	M	0.21	0.79	0.85	0.66	0.87	28.26
A. penicillata		182214	S	0.20	0.75	0.76	0.66	0.62	46.28
A. pilosa	13	182266	M	0.81	0.73	0.83	0.26	0.87	2.12
A. pilosa		182090	M	0.59	0.73	0.78	0.72	0.75	42.21
A. pilosa		182288	C	0.58	0.71	0.74	0.56	0.67	16.34
A. pilosa		182280	S	0.50	0.69	0.75	0.10	0.64	1.83
A. pilosa		182218	S	0.50	0.69	0.67	0.55	0.35	0.54
A. pilosa		182224	S	0.45	0.79	0.81	0.39	0.50	-
A. pilosa		182087	S	0.40	0.61	0.62	0.47	0.35	-
A. pilosa		182304	C	0.35	0.69	0.78	0.49	0.81	45.64
A. pilosa		182163	C	0.29	0.77	0.80	0.80	0.75	50.50
A. pilosa		182237	S	0.29	0.76	0.82	0.41	0.81	2.35
A. pilosa		182161	C	0.29	0.76	0.82	0.38	0.27	1.13
A. pilosa		182110	C	0.17	0.83	0.87	0.78	0.21	0.74
A. pilosa		Unknown	S	0.16	0.80	0.86	0.73	0.82	31.87
A. racemosa	13	182262	M	0.35	0.90	0.95	0.81	0.57	2.20
A. racemosa		182152	C	0.20	0.89	0.94	0.89	0.73	56.40
A. racemosa		182234	S	0.20	0.89	0.94	0.68	0.86	35.30
A. racemosa		182251	S	0.13	0.88	0.93	0.89	0.87	49.78

A. racemosa		182171	C	0.12	0.86	0.92	0.60	0.86	65.35
A. racemosa		182282	M	0.09	0.89	0.94	0.63	0.71	2.13

Species	No. of accessions	Accessions ID	Where Collected	Emergence			Survival		DM
				pH 3.9	pH 4.4	pH 5.3	PH 4.4	pH 5.3	mg/plant
A. racemosa		182299	C	0.07	0.87	0.93	0.88	0.65	31.81
A. racemosa		182007	C	0.07	0.87	0.93	0.51	0.85	1.66
A. racemosa		182108	C	0.07	0.87	0.93	0.83	0.93	8.32
A. racemosa		182095	M	0.04	0.88	0.94	0.90	0.93	51.88
A. racemosa		182000	C	0.04	0.88	0.94	0.59	0.79	29.97
A. racemosa		182146	C	0.04	0.88	0.94	0.87	0.42	1.47
A. racemosa		182157	C	0.03	0.86	0.92	0.59	0.79	1.46
A. setacea	1	182031	S	0.46	0.72	0.88	0.53	0.62	11.84

C – Central Tablelands; M – Monaro Tablelands; S – Southern Tablelands



Appendix 4. Growth response of *A. duttoniana* (182064) as affected by different NO_3^--N: NH_4^+-N ratios. Ratio 1 = 12:1; 2 = 11:2; 3 = 9:4; 4 = 7:6. (Experiment 5.1).

Appendix 5. Composition of nutrient solutions during experimental period (Experiment 5.1)

Element	Concentration	NO_3^--N:NH_4^+-N ratio*				Before final harvest**
		R1	R2	R3	R4	
NO_3-N	mg/L	47.0	46.0	44.0	40.0	38.0
NH_4-N	mg/L	1.3	1.2	2.5	3.6	2.3
P	mg/L	2.8	2.4	2.4	2.4	1.3
K	mg/L	49.0	46.0	46.0	46.0	43.0
Na	mg/L	30.0	29.0	30.0	29.0	30.0
Ca	mg/L	59.0	51.0	54.0	54.0	58.0
Mg	mg/L	17.0	15.0	15.0	15.0	18.0
Cl	mg/L	NA	NA	NA	NA	100.0
S	mg/L	11.0	14.0	23.0	28.0	23.0
Mn	mg/L	0.14	0.11	0.11	0.09	0.09
Fe	mg/L	0.50	0.27	0.23	0.19	0.63
Cu	mg/L	0.08	0.05	0.05	0.05	0.05
Zn	mg/L	0.08	0.07	0.06	0.07	0.08
B	mg/L	0.08	0.07	0.07	0.06	0.06
Al	mg/L	NA	NA	NA	NA	0.10

** After two-weeks of treatment initiation; **composite sample of four ratios was taken at eight weeks; NA = not analysed*

Appendix 6. Element concentrations in whole tops (dry weight basis) of *A. duttoniana* as affected by different N-ratios (Experiment 5.1)

Element	Concentration	NO_3^--N:NH_4^+-N ratio			
		R1	R2	R3	R4
NO_3-N	mg/kg	1500	1600	1000	920
NH_4-N	mg/kg	350	580	640	790
P	% w/w	0.53	0.66	0.58	0.59
K	% w/w	4.50	3.40	3.00	3.00
Na	% w/w	0.10	0.18	0.15	0.13
Ca	% w/w	0.36	0.45	0.35	0.30
Mg	% w/w	0.18	0.22	0.19	0.18
Cl	% w/w	1.30	1.30	1.30	1.30
S	% w/w	0.87	0.67	0.57	0.57
Mn	mg/kg	71	47	38	40
Fe	mg/kg	160	160	160	140
Cu	mg/kg	15	17	16	19
Zn	mg/kg	40	42	40	42
B	mg/kg	8	9	9	8

Appendix 7. A section of the hydroponic pH experiment with different *Austrodanthonia* accessions in the glasshouse (Experiment 5.2).

Appendix 8. Composition of nutrient solution at the time of final harvest (Experiment 5.2)

Elements	Concentration	pH				
		3.0	3.5	4.0	4.5	5.5
NH_4-N	mg/L	7.7	3.7	4.0	5.0	5.9
NO_3-N	mg/L	39.0	43.0	38.0	36.0	45.0
P	mg/L	2.4	2.2	1.9	2.0	2.3
K	mg/L	39.0	41.0	38.0	41.0	45.0
Na	mg/L	19.0	22.0	18.0	18.0	22.0
Ca	mg/L	51.0	55.0	52.0	58.0	51.0
Mg	mg/L	13.0	16.0	14.0	14.0	15.0
Cl	mg/L	15.5	13.8	14.1	13.6	10.6
S	mg/L	28.0	29.0	31.0	33.0	29.0
Mn	mg/L	0.04	0.05	0.04	0.04	0.09
Fe	mg/L	0.59	0.62	0.43	0.29	0.18
Cu	mg/L	0.04	0.04	0.04	0.04	0.04
Zn	mg/L	0.04	0.05	0.04	0.04	0.06
B	mg/L	0.03	0.05	0.05	0.05	0.05
F	mg/L	0.40	0.40	0.40	0.40	0.40
Al	mg/L	0.10	0.10	0.10	0.10	0.10

Appendix 9. Composition of nutrient solutions at the time of final harvest

Element concentrations are in mg/L (Experiment 5.3)

Elements	Sources of water									
	DW					TW				
	Al (µM)									
	0	50	100	200	250	0	50	100	200	250
NH_4-N	4.0	4.0	4.0	4.2	4.1	1.3	1.4	1.6	1.2	1.0
NO_3-N	45.0	52.0	51.0	54.0	55.0	73.0	68.0	70.0	73.0	72.0
P	1.1	0.9	1.8	2.3	2.3	1.4	1.5	1.2	1.9	2.9
K	27.0	34.0	40.0	45.0	46.0	60.0	55.0	52.0	60.0	65.0
Na	3.1	3.2	3.0	3.1	3.2	44.0	44.0	43.0	43.0	41.0
Ca	62.0	50.0	48.0	47.0	48.0	86.0	92.0	94.0	91.0	88.0
Mg	11.1	11.7	11.1	11.0	11.3	23.0	24.0	25.0	24.0	23.0
Cl	11.0	14.0	14.0	14.0	15.0	51.0	54.0	55.0	53.0	54.0
S	8.9	12.0	15.0	21.0	25.0	45.0	51.0	56.0	61.0	63.0
Mn	0.15	0.16	0.15	0.16	0.16	0.20	0.21	0.22	0.22	0.21
Fe	0.41	0.78	0.62	0.43	0.51	1.20	0.80	1.00	1.20	0.89
Cu	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03
Zn	0.05	0.09	0.06	0.14	0.08	0.09	0.10	0.10	0.09	0.10
B	0.07	0.07	0.07	0.07	0.06	0.11	0.12	0.12	0.11	0.11
Mo	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
F	0.10	0.10	0.10	0.10	0.10	1.10	1.30	1.30	1.20	1.70
Al	0.10	1.80	3.40	6.60	8.50	0.22	2.0	4.0	7.50	9.0

Appendix 10. Activity ({Al^{3+}}) and concentration ([Al^{3+}]) of free Al^{3+}, and percent of Al as free metal, and Al complexed with ligands in nutrient solutions (pH 4.0) made up from deionised water (DW) and tap water (TW) with different Al treatments - based on GEOCHEM (Experiment 5.3)

All Al concentrations are in µM

Treatment	{Al^{3+}}	Free [Al^{3+}]	Al as free metal (%)	Al complexed with (%)			
				SO_4	F	PO_4	EDTA
DW							
Al 50	11.54	24.29	48.47	18.43	10.31	21.04	0.08
Al 100	23.91	50.98	50.98	22.22	5.22	19.81	0.05
Al 200	46.89	102.30	51.29	27.99	2.63	16.34	0.04
Al 250	58.22	128.50	51.16	30.18	2.09	14.82	0.03
TW							
Al 50	1.01	2.23	4.45	1.83	91.51	2.03	0.02
Al 100	9.31	20.77	20.77	9.94	59.81	8.75	0.04
Al 200	30.32	69.17	34.67	19.90	32.38	11.90	0.03
Al 250	40.89	94.23	37.51	23.51	26.04	11.69	0.03

Appendix 11. Element concentrations (dry weight basis) in whole shoots of *A. duttoniana* grown hydroponically in deionised water (DW) and tap water (TW) over five levels of Al (Experiment 5.3)

Data are from composite samples of five plants

Elements	Sources of water									
	DW					TW				
	Al (µM)									
	0	50	100	200	250	0	50	100	200	250
NH_4-N*	100	110	130	120	120	150	160	130	120	140
NO_3-N*	800	810	860	570	610	880	780	900	850	750
N#	3.00	3.30	3.10	2.80	2.70	3.10	3.30	3.20	3.00	3.10
P#	0.45	0.42	0.35	0.30	0.29	0.40	0.44	0.46	0.44	0.35
K#	3.10	3.20	2.70	2.20	2.30	2.90	3.00	3.20	3.10	2.60
Na#	0.02	0.03	0.02	0.02	0.03	0.06	0.07	0.07	0.06	0.09
Ca#	0.21	0.17	0.18	0.17	0.18	0.17	0.19	0.20	0.17	0.17
Mg#	0.10	0.06	0.05	0.06	0.06	0.09	0.10	0.09	0.06	0.08
Cl#	0.64	0.62	0.66	0.60	0.67	0.82	0.93	0.92	0.86	0.90
F#	0.07	0.06	0.07	0.07	0.09	0.09	0.09	0.09	0.10	0.10
S#	0.28	0.29	0.25	0.22	0.22	0.32	0.33	0.37	0.29	0.27
Mn*	26	18	15	25	21	22	22	23	16	15
Fe*	83	83	83	71	79	64	53	55	52	46
Cu*	7.20	5.10	3.90	3.30	3.00	3.70	4.50	4.70	3.80	3.50
Zn*	40	24	19	26	21	22	21	23	17	17
B*	4.70	5.80	5.60	5.10	4.80	4.60	5.50	6.40	5.90	5.90
Mo*	5.50	4.10	2.70	2.10	2.10	2.50	4.20	4.80	3.10	2.40
Al*	7.50	27	52	87	142	8.20	18.20	29	40	72

** Concentration in mg/kg; # concentration (%)*

Appendix 12. Shoot and root growth of *Austrodanthonia* spp. as affected by different plant size at the time of harvesting. Upper numbering, species: 1 = *A. racemosa*, 2 =

A. penicillata, 3 = *A. pilosa*; lower numbering, plant-size: 1 = single, 2 = two, 3 = three tillers (Experiment 5.4).

Appendix 13. Composition of nutrient solution as affected by Mn treatments at the time of the final harvest of experiment 5.5 (element concentrations are in mg/L)

Elements	Mn treatments (µM)				
	Control (2.4)	100	500	1000	2000
P	0.20	0.15	0.22	0.34	0.49
K	33.0	22.0	24.0	21.0	15.0
Na	4.0	4.3	4.4	3.9	2.7
Ca	50.0	51.0	51.0	47.0	32.0
Mg	11.0	11.5	11.5	10.5	7.0
S	11.9	16.5	34.0	49.0	58.0
Mn	0.12	6.6	33.0	56.0	80.0
Fe	0.90	0.85	0.81	0.69	0.46
Cu	0.02	0.02	0.02	0.02	0.02
Zn	0.030	0.03	0.04	0.02	0.01
B	0.07	0.07	0.07	0.07	0.04
Mo	0.02	0.02	0.02	0.02	0.02
Al	0.10	0.10	0.10	0.10	0.10

Appendix 14. Activity ({Mn^{2+}}) and concentration ([Mn^{2+}]) of free Mn^{2+}, and percent of Mn as free metal, and Mn complexed with ligand in nutrient solutions (pH 4.0) with different Mn treatments - based on GEOCHEM (Experiment 5.5)

All Mn concentrations are in µM

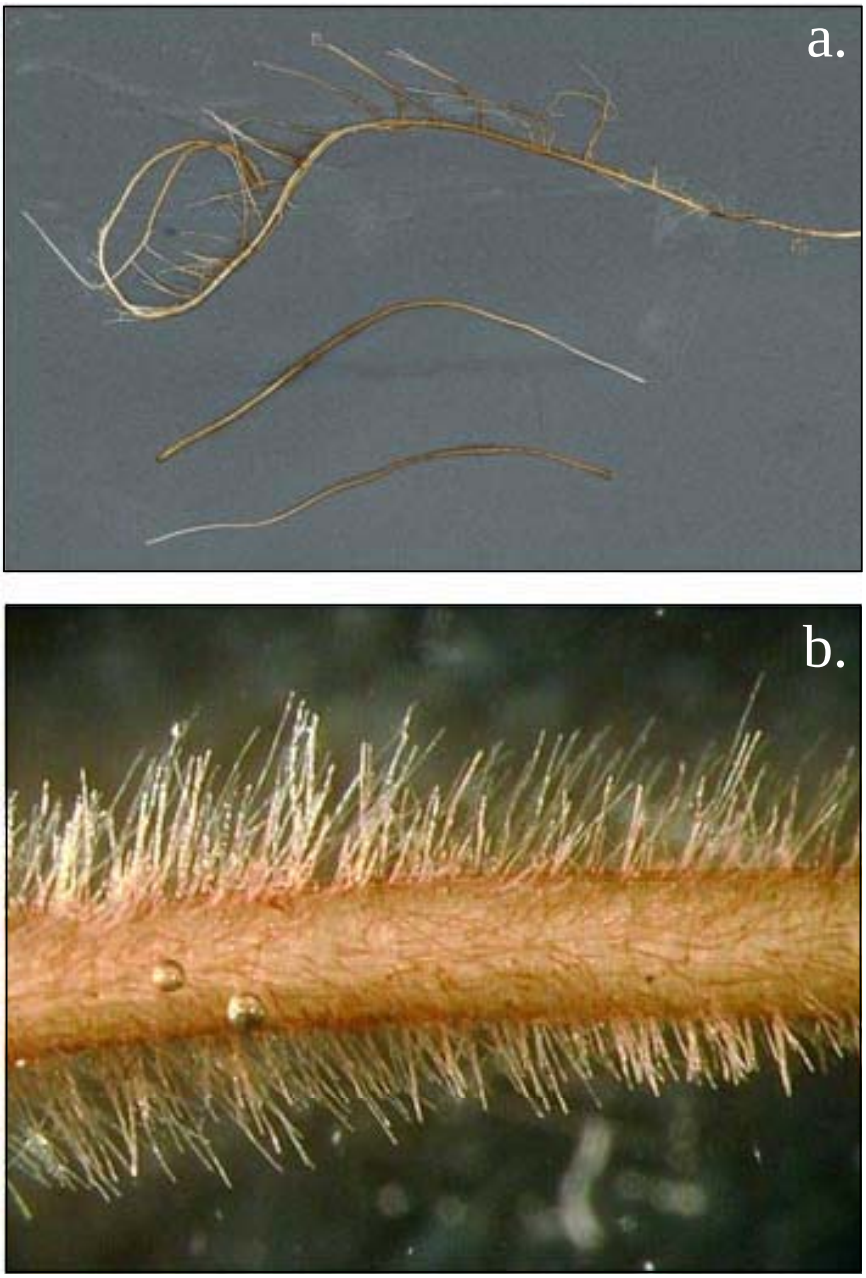
Treatment Mn (µM)	{Mn^{2+}}	Free [Mn^{2+}]	Mn as free metal (%)	Mn complexed with SO_4 (%)
Control (2.4)	1.71	2.36	98.02	1.96
100	69.96	97.25	97.25	2.73
500	329.10	472.00	94.39	5.60
1000	617.40	915.60	91.56	8.42
2000	1118.00	1752.00	87.38	12.60

Appendix 15. Element concentrations (dry weight basis) in shoots and roots of *Austrodanthonia* accessions grown hydroponically with five levels of Mn (Experiment 5.5)

Data are from composite samples of six plants

Element	Shoot					Root				
	Mn treatment (µM)									
	control	100	500	1000	2000	control	100	500	1000	2000
Accession 182064 (*A.duttoniana*)										
P#	0.60	0.54	0.63	0.52	0.59	0.49	0.41	0.46	0.34	0.41
K#	3.30	3.70	3.70	3.50	3.30	4.00	3.50	4.00	3.30	3.40
Na#	0.02	0.02	0.02	0.20	0.02	0.06	0.06	0.06	0.05	0.04
Ca#	0.30	0.27	0.32	0.25	0.20	0.32	0.26	0.28	0.28	0.19
Mg#	0.11	0.11	0.13	0.11	0.11	0.16	0.14	0.17	0.13	0.11
S#	0.38	0.38	0.53	0.45	0.49	0.42	0.40	0.46	0.39	0.43
Mn*	115	370	1130	1880	3200	810	2300	4900	9500	11200
Fe*	61	58	79	78	68	730	800	830	580	830
Cu*	9.70	9.80	14.20	12.10	10.70	15.60	19.10	20.00	19.20	18.10
Zn*	58	48	59	63	47	310	200	240	260	144
B*	8.50	8.00	8.30	7.20	9.90	2.00	2.00	2.00	2.00	2.00
Mo*	6.40	6.10	7.40	4.00	4.00	6.70	7.70	9.90	9.30	9.90
Al*	7	7	7	7	7	24	30	33	42	34
Accession 182293 (*A. duttoniana*)										
P#	0.52	0.42	0.46	0.42	0.42	0.61	0.44	0.46	0.44	0.40
K#	3.20	3.20	3.20	3.20	3.20	4.80	3.70	4.20	3.80	3.50
Na#	0.03	0.03	0.02	0.03	0.03	0.05	0.07	0.06	0.06	0.05
Ca#	0.34	0.33	0.33	0.27	0.20	0.34	0.26	0.22	0.22	0.19
Mg#	0.12	0.12	0.12	0.11	0.09	0.15	0.14	0.15	0.13	0.11
S#	0.34	0.31	0.39	0.36	0.40	0.34	0.30	0.35	0.36	0.39
Mn*	86	290	1130	1890	3000	490	2100	5100	10000	14000
Fe*	59	75	77	55	66	1250	950	1110	770	1000
Cu*	7.70	7.00	8.80	7.50	7.80	17.10	19.80	19.70	33.00	26.00
Zn*	39	40	41	35	31	310	151	210	162	131
B*	5.70	5.50	8.50	6.70	5.80	2.00	2.00	2.00	2.00	2.00
Mo*	4.20	3.00	3.30	2.40	2.00	7.30	6.70	8.80	7.70	8.90
Al*	7.00	7.30	7.00	7.00	7.00	27.00	23.00	34.00	45.00	39.00
Accession 182221 (*A. fulva*)										
P#	0.46	0.44	0.51	0.45	0.39	0.36	0.31	0.36	0.32	0.33
K#	3.50	3.70	3.40	3.30	3.00	4.80	3.90	5.20	4.60	4.50
Na#	0.02	0.02	0.02	0.02	0.01	0.09	0.08	0.08	0.07	0.05
Ca#	0.23	0.20	0.02	0.18	0.13	0.27	0.18	0.19	0.17	0.13
Mg#	0.11	0.10	0.11	0.09	0.08	0.22	0.18	0.23	0.21	0.17
S#	0.36	0.35	0.46	0.46	0.42	0.34	0.34	0.45	0.44	0.53
Mn*	67	230	850	1340	2100	440	1450	4600	10200	14300
Fe*	86	71	94	110	96	560	560	590	610	700
Cu*	12.20	12.50	16.70	19.70	17.30	13.40	19.40	28.00	42.00	51.00
Zn*	76	62	76	96	73	220	100	132	155	85
B*	4.50	3.50	4.70	4.10	4.10	2.00	2.00	2.00	2.00	2.00
Mo*	5.20	5.80	7.10	5.20	4.70	4.50	6.70	9.00	9.10	7.80
Al*	7.00	7.00	7.00	7.00	7.00	13.20	16.30	21.00	37.00	34.00

*[#] Concentration (%); * concentration in mg/kg*



Appendix 16. Roots of *A. fulva* (accession 182221) affected by Mn treatments (> 500 µM) in the nutrient solutions at pH 4.0 (Experiment 5.5). a, portion of root systems

grown in the solution; b, part of affected roots (~ 10x magnification using a Zeiss Stemi SV8 microscope, and photographed using an Agfa Photo 1680 digital camera).