

Trait-based responses of annual crops to elevated CO2 and water limitation

Appendix 2: Additional results

Summarized response data

Photosynthetic yield

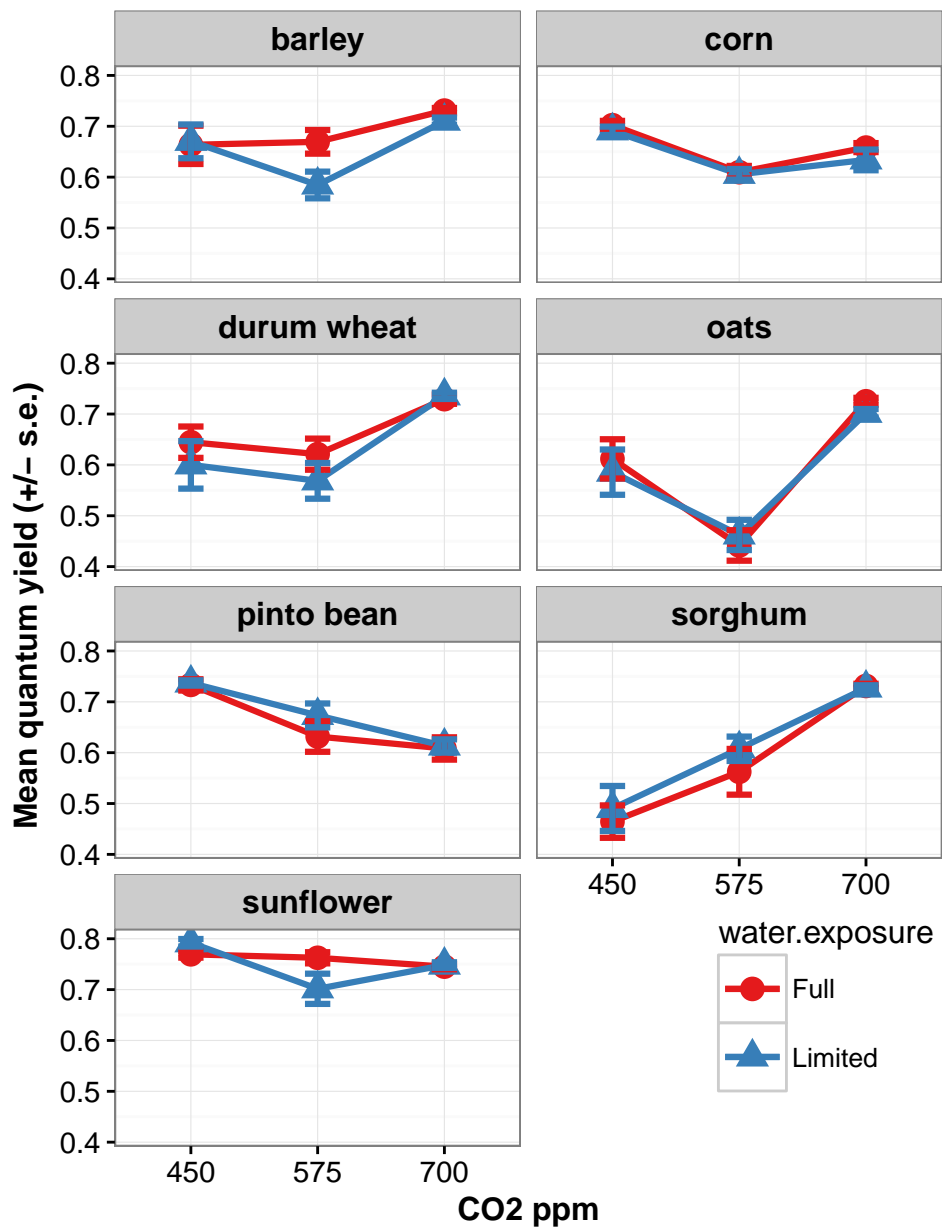


Figure 1: Quantum Photosynthetic Yield of PSII.

Chlorophyll flourescence ratio

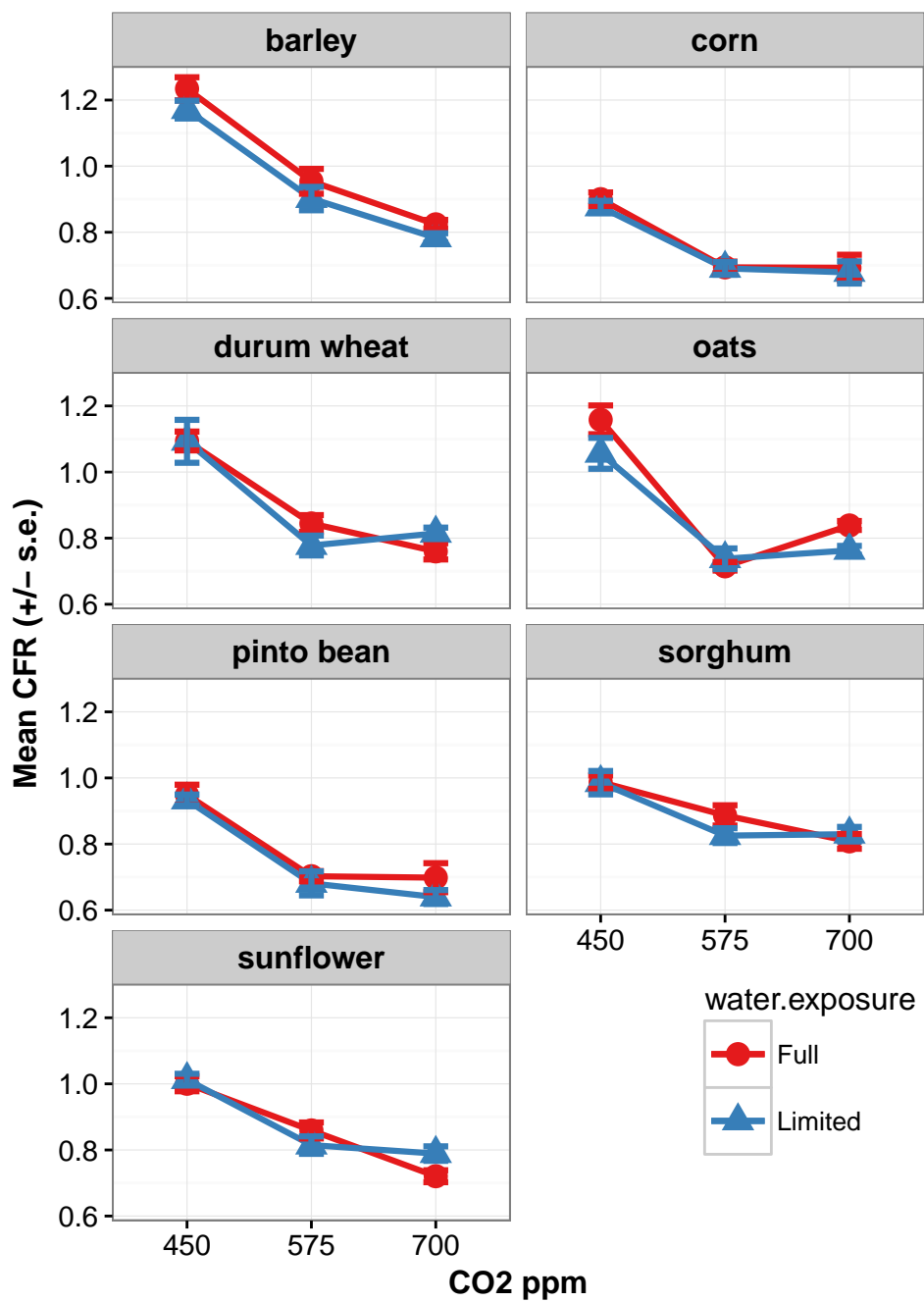


Figure 2: Chlorophyll flourescence ratio, CFR, a measure of chlorophyll content.

Leaf area

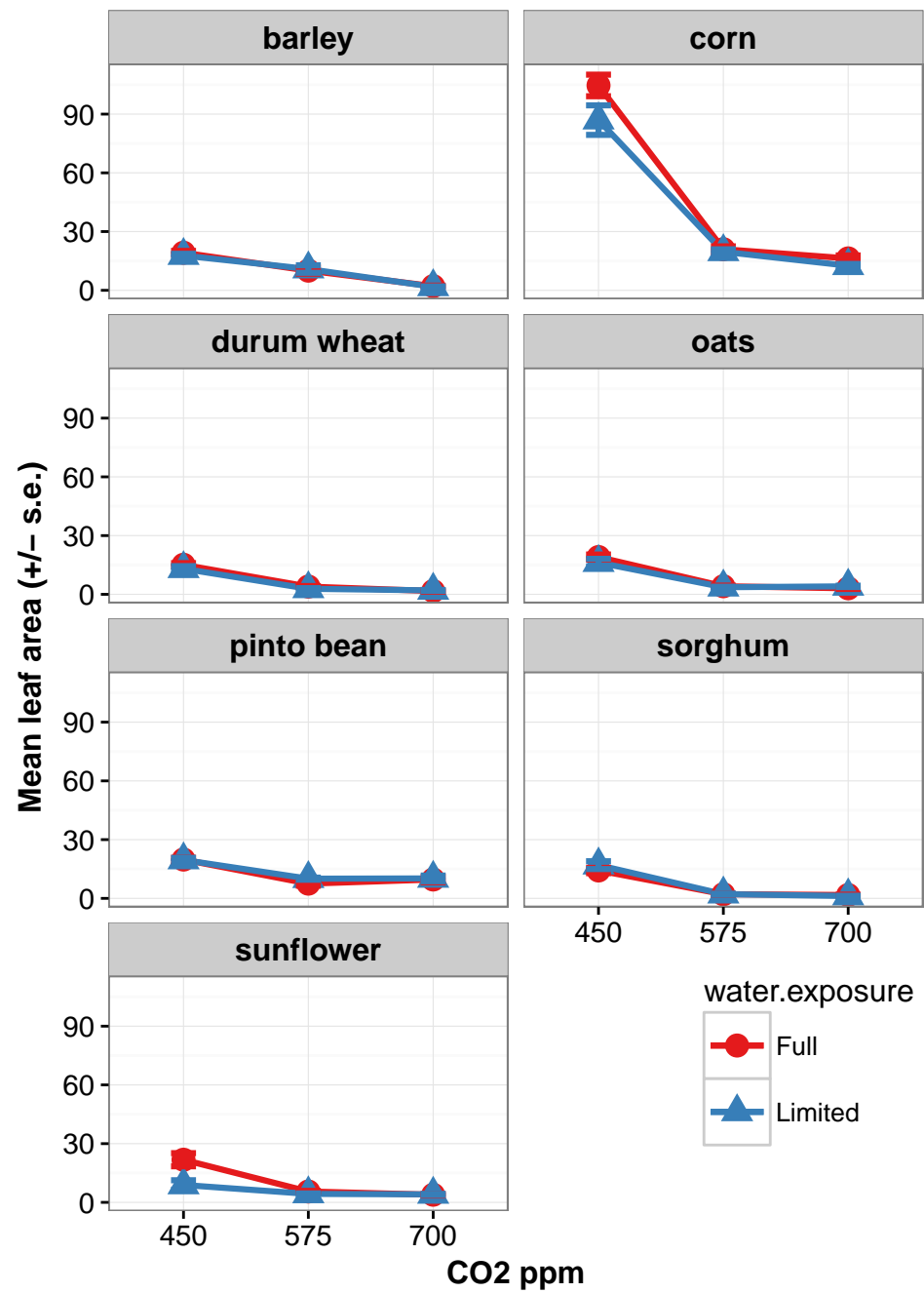


Figure 3: Leaf area.

Root:shoot ratio

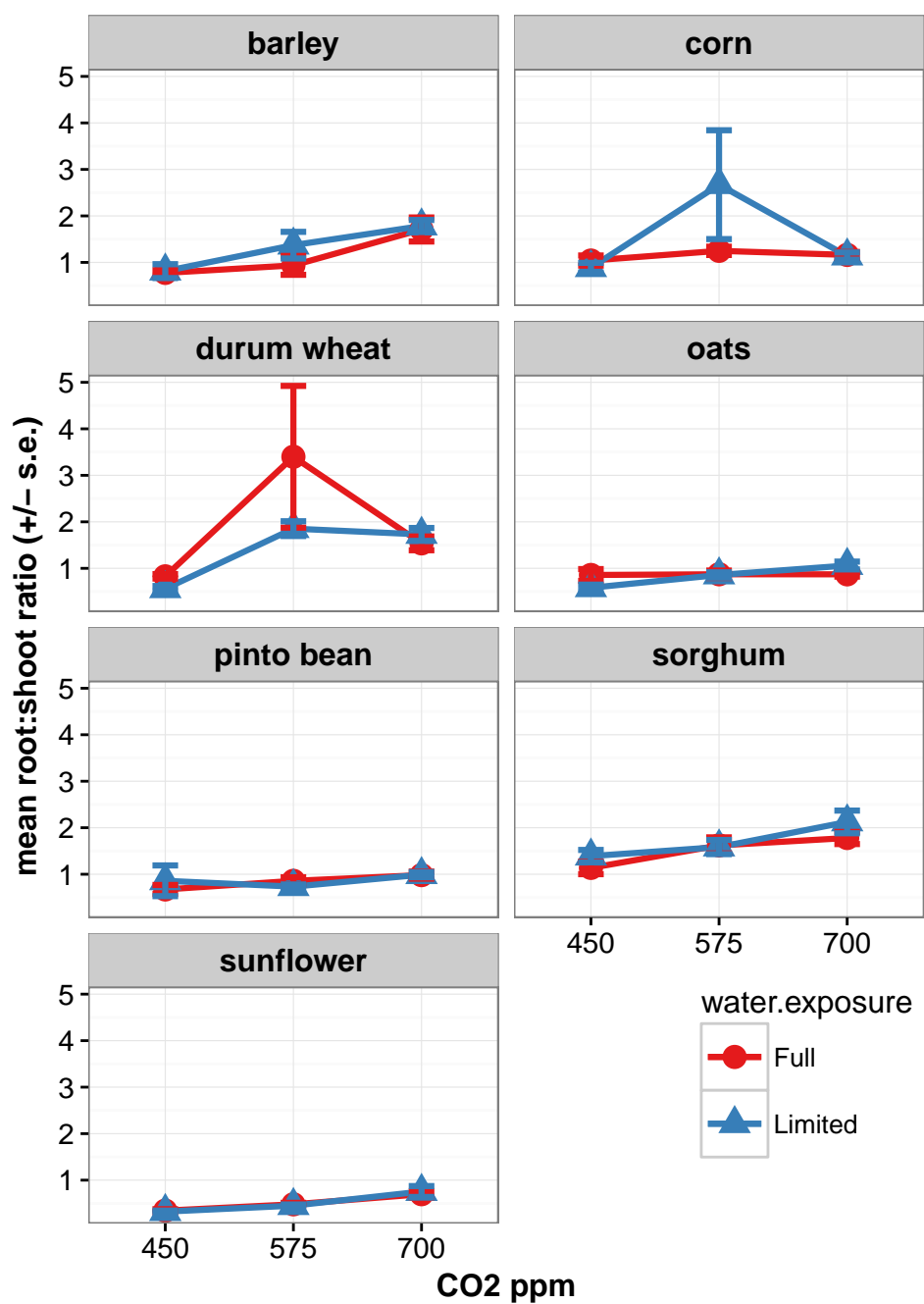


Figure 4: Root:shoot ratio

Interaction plots

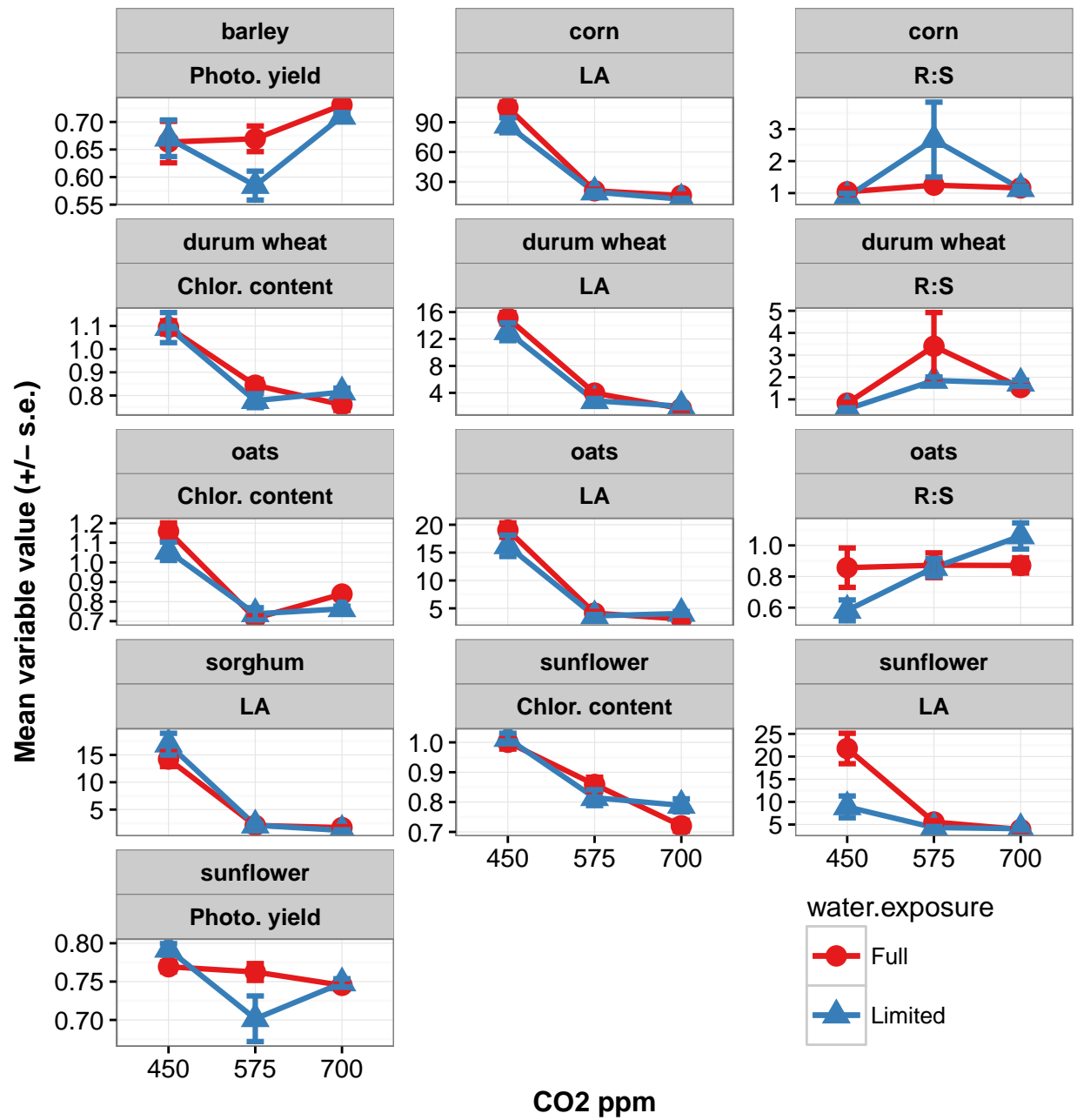


Figure 5: Interaction plots for combinations of species and response variables for which AICc-based model selection identified interaction terms as top-ranked or competitive.

Full model selection results

species	response	Modnames	K	AICc	Delta_AICc	ModelLik	AICcWt	LL	Cum.Wt
barley	os1	m.CO2	4.00	-120.67	0.00	1.00	0.43	64.74	0.43
barley	os1	m.add	5.00	-120.40	0.27	0.87	0.38	65.81	0.81
barley	os1	m.int	7.00	-118.40	2.27	0.32	0.14	67.39	0.95
barley	os1	m.null	2.00	-115.52	5.15	0.08	0.03	59.88	0.98
barley	os1	m.H2O	3.00	-114.45	6.22	0.04	0.02	60.46	1.00
barley	cfr	m.add	5.00	-113.23	0.00	1.00	0.77	62.23	0.77
barley	cfr	m.CO2	4.00	-110.20	3.03	0.22	0.17	59.50	0.94
barley	cfr	m.int	7.00	-108.25	4.97	0.08	0.06	62.32	1.00
barley	cfr	m.null	2.00	-24.11	89.12	0.00	0.00	14.17	1.00
barley	cfr	m.H2O	3.00	-23.03	90.20	0.00	0.00	14.75	1.00
barley	LA	m.CO2	4.00	274.05	0.00	1.00	0.65	-132.63	0.65
barley	LA	m.add	5.00	275.49	1.44	0.49	0.32	-132.14	0.97
barley	LA	m.int	7.00	280.12	6.07	0.05	0.03	-131.89	1.00
barley	LA	m.null	2.00	377.04	102.98	0.00	0.00	-186.40	1.00
barley	LA	m.H2O	3.00	379.19	105.14	0.00	0.00	-186.36	1.00
barley	root.shoot	m.CO2	4.00	93.09	0.00	1.00	0.54	-42.18	0.54
barley	root.shoot	m.add	5.00	93.83	0.73	0.69	0.37	-41.36	0.91
barley	root.shoot	m.int	7.00	96.71	3.62	0.16	0.09	-40.28	1.00
barley	root.shoot	m.null	2.00	113.75	20.66	0.00	0.00	-54.77	1.00
barley	root.shoot	m.H2O	3.00	114.84	21.75	0.00	0.00	-54.21	1.00
corn	os1	m.CO2	4.00	-214.79	0.00	1.00	0.54	111.77	0.54
corn	os1	m.add	5.00	-214.29	0.50	0.78	0.42	112.72	0.95
corn	os1	m.int	7.00	-209.89	4.89	0.09	0.05	113.07	1.00
corn	os1	m.null	2.00	-177.14	37.64	0.00	0.00	90.68	1.00
corn	os1	m.H2O	3.00	-176.04	38.75	0.00	0.00	91.24	1.00
corn	cfr	m.CO2	4.00	-104.76	0.00	1.00	0.73	56.89	0.73
corn	cfr	m.add	5.00	-102.66	2.10	0.35	0.26	57.12	0.98
corn	cfr	m.int	7.00	-97.30	7.46	0.02	0.02	57.21	1.00
corn	cfr	m.null	2.00	-58.22	46.54	0.00	0.00	31.26	1.00
corn	cfr	m.H2O	3.00	-56.38	48.38	0.00	0.00	31.49	1.00
corn	LA	m.add	5.00	405.65	0.00	1.00	0.65	-197.26	0.65
corn	LA	m.int	7.00	407.43	1.78	0.41	0.27	-195.62	0.91
corn	LA	m.CO2	4.00	409.65	4.00	0.14	0.09	-200.45	1.00
corn	LA	m.null	2.00	564.87	159.22	0.00	0.00	-280.33	1.00
corn	LA	m.H2O	3.00	566.60	160.95	0.00	0.00	-280.08	1.00
corn	root.shoot	m.int	7.00	101.31	0.00	1.00	0.97	-42.56	0.97
corn	root.shoot	m.CO2	4.00	108.84	7.53	0.02	0.02	-50.05	0.99
corn	root.shoot	m.add	5.00	110.81	9.50	0.01	0.01	-49.84	1.00

corn	root.shoot	m.H2O	3.00	123.10	21.79	0.00	0.00	-58.33	1.00
corn	root.shoot	m.null	2.00	125.86	24.55	0.00	0.00	-60.82	1.00
durum wheat	os1	m.CO2	4.00	-105.49	0.00	1.00	0.59	57.15	0.59
durum wheat	os1	m.add	5.00	-104.57	0.92	0.63	0.37	57.90	0.95
durum wheat	os1	m.int	7.00	-100.41	5.08	0.08	0.05	58.40	1.00
durum wheat	os1	m.null	2.00	-90.32	15.17	0.00	0.00	47.28	1.00
durum wheat	os1	m.H2O	3.00	-89.21	16.28	0.00	0.00	47.84	1.00
durum wheat	cfr	m.CO2	4.00	-100.47	0.00	1.00	0.62	54.60	0.62
durum wheat	cfr	m.add	5.00	-98.10	2.37	0.31	0.19	54.61	0.81
durum wheat	cfr	m.int	7.00	-98.09	2.37	0.31	0.19	57.15	1.00
durum wheat	cfr	m.null	2.00	-42.34	58.13	0.00	0.00	23.27	1.00
durum wheat	cfr	m.H2O	3.00	-40.18	60.28	0.00	0.00	23.31	1.00
durum wheat	LA	m.CO2	4.00	234.32	0.00	1.00	0.52	-112.80	0.52
durum wheat	LA	m.int	7.00	235.33	1.01	0.60	0.32	-109.59	0.84
durum wheat	LA	m.add	5.00	236.70	2.38	0.30	0.16	-112.79	1.00
durum wheat	LA	m.null	2.00	346.14	111.82	0.00	0.00	-170.97	1.00
durum wheat	LA	m.H2O	3.00	347.95	113.63	0.00	0.00	-170.76	1.00
durum wheat	root.shoot	m.int	7.00	120.49	0.00	1.00	0.76	-52.17	0.76
durum wheat	root.shoot	m.add	5.00	123.44	2.95	0.23	0.17	-56.16	0.94
durum wheat	root.shoot	m.CO2	4.00	125.49	5.00	0.08	0.06	-58.38	1.00
durum wheat	root.shoot	m.H2O	3.00	167.98	47.49	0.00	0.00	-80.78	1.00
durum wheat	root.shoot	m.null	2.00	169.26	48.77	0.00	0.00	-82.52	1.00
oats	os1	m.CO2	4.00	-111.75	0.00	1.00	0.73	60.25	0.73
oats	os1	m.add	5.00	-109.51	2.25	0.32	0.24	60.32	0.97
oats	os1	m.int	7.00	-105.33	6.42	0.04	0.03	60.76	1.00
oats	os1	m.null	2.00	-66.03	45.73	0.00	0.00	35.12	1.00
oats	os1	m.H2O	3.00	-63.97	47.78	0.00	0.00	35.20	1.00
oats	cfr	m.int	7.00	-112.71	0.00	1.00	0.54	64.45	0.54
oats	cfr	m.add	5.00	-111.32	1.39	0.50	0.27	61.23	0.80
oats	cfr	m.CO2	4.00	-110.68	2.02	0.36	0.20	59.71	1.00
oats	cfr	m.null	2.00	-30.11	82.60	0.00	0.00	17.16	1.00
oats	cfr	m.H2O	3.00	-29.37	83.34	0.00	0.00	17.90	1.00
oats	LA	m.CO2	4.00	249.93	0.00	1.00	0.44	-120.60	0.44
oats	LA	m.int	7.00	250.16	0.23	0.89	0.39	-117.00	0.83
oats	LA	m.add	5.00	251.79	1.86	0.40	0.17	-120.34	1.00
oats	LA	m.null	2.00	371.72	121.79	0.00	0.00	-183.75	1.00
oats	LA	m.H2O	3.00	373.72	123.79	0.00	0.00	-183.65	1.00
oats	root.shoot	m.int	7.00	10.53	0.00	1.00	0.74	2.81	0.74
oats	root.shoot	m.CO2	4.00	13.80	3.28	0.19	0.14	-2.54	0.88
oats	root.shoot	m.add	5.00	14.62	4.10	0.13	0.09	-1.76	0.97
oats	root.shoot	m.null	2.00	17.81	7.28	0.03	0.02	-6.80	0.99

oats	root.shoot	m.H2O	3.00	19.81	9.29	0.01	0.01	-6.69	1.00
pinto bean	os1	m.CO2	4.00	-164.49	0.00	1.00	0.62	86.61	0.62
pinto bean	os1	m.add	5.00	-163.21	1.28	0.53	0.33	87.17	0.94
pinto bean	os1	m.int	7.00	-159.67	4.82	0.09	0.06	87.93	1.00
pinto bean	os1	m.null	2.00	-133.31	31.18	0.00	0.00	68.76	1.00
pinto bean	os1	m.H2O	3.00	-131.63	32.86	0.00	0.00	69.03	1.00
pinto bean	cfr	m.CO2	4.00	-105.16	0.00	1.00	0.48	56.95	0.48
pinto bean	cfr	m.add	5.00	-105.11	0.05	0.98	0.47	58.12	0.95
pinto bean	cfr	m.int	7.00	-100.76	4.39	0.11	0.05	58.48	1.00
pinto bean	cfr	m.null	2.00	-51.99	53.17	0.00	0.00	28.10	1.00
pinto bean	cfr	m.H2O	3.00	-50.53	54.62	0.00	0.00	28.48	1.00
pinto bean	LA	m.CO2	4.00	342.48	0.00	1.00	0.50	-166.87	0.50
pinto bean	LA	m.add	5.00	342.73	0.25	0.88	0.44	-165.80	0.94
pinto bean	LA	m.int	7.00	346.57	4.09	0.13	0.06	-165.18	1.00
pinto bean	LA	m.null	2.00	381.22	38.74	0.00	0.00	-188.50	1.00
pinto bean	LA	m.H2O	3.00	383.21	40.74	0.00	0.00	-188.39	1.00
pinto bean	root.shoot	m.null	2.00	44.64	0.00	1.00	0.38	-20.21	0.38
pinto bean	root.shoot	m.CO2	4.00	44.81	0.17	0.92	0.35	-18.04	0.73
pinto bean	root.shoot	m.H2O	3.00	46.79	2.15	0.34	0.13	-20.18	0.86
pinto bean	root.shoot	m.add	5.00	47.07	2.43	0.30	0.11	-17.98	0.97
pinto bean	root.shoot	m.int	7.00	49.68	5.04	0.08	0.03	-16.76	1.00
sorghum	os1	m.CO2	4.00	-110.23	0.00	1.00	0.66	59.51	0.66
sorghum	os1	m.add	5.00	-108.70	1.53	0.47	0.31	59.95	0.97
sorghum	os1	m.int	7.00	-104.22	6.01	0.05	0.03	60.27	1.00
sorghum	os1	m.null	2.00	-65.07	45.16	0.00	0.00	34.65	1.00
sorghum	os1	m.H2O	3.00	-62.98	47.24	0.00	0.00	34.72	1.00
sorghum	cfr	m.CO2	4.00	-120.14	0.00	1.00	0.68	64.47	0.68
sorghum	cfr	m.add	5.00	-117.99	2.15	0.34	0.23	64.61	0.92
sorghum	cfr	m.int	7.00	-115.93	4.21	0.12	0.08	66.16	1.00
sorghum	cfr	m.null	2.00	-87.97	32.17	0.00	0.00	46.10	1.00
sorghum	cfr	m.H2O	3.00	-86.04	34.10	0.00	0.00	46.26	1.00
sorghum	LA	m.add	5.00	196.78	0.00	1.00	0.49	-92.80	0.49
sorghum	LA	m.CO2	4.00	197.71	0.92	0.63	0.31	-94.47	0.79
sorghum	LA	m.int	7.00	198.47	1.69	0.43	0.21	-91.09	1.00
sorghum	LA	m.null	2.00	334.20	137.42	0.00	0.00	-164.99	1.00
sorghum	LA	m.H2O	3.00	336.40	139.62	0.00	0.00	-164.98	1.00
sorghum	root.shoot	m.CO2	4.00	99.19	0.00	1.00	0.52	-45.23	0.52
sorghum	root.shoot	m.add	5.00	99.63	0.44	0.80	0.41	-44.26	0.93
sorghum	root.shoot	m.int	7.00	103.38	4.19	0.12	0.06	-43.61	0.99
sorghum	root.shoot	m.null	2.00	109.27	10.08	0.01	0.00	-52.53	1.00
sorghum	root.shoot	m.H2O	3.00	110.05	10.86	0.00	0.00	-51.81	1.00

sunflower	os1	m.int	7.00	-184.09	0.00	1.00	0.64	100.24	0.64
sunflower	os1	m.CO2	4.00	-181.55	2.54	0.28	0.18	95.17	0.82
sunflower	os1	m.add	5.00	-180.60	3.49	0.18	0.11	95.91	0.93
sunflower	os1	m.null	2.00	-178.45	5.64	0.06	0.04	91.34	0.97
sunflower	os1	m.H2O	3.00	-178.23	5.85	0.05	0.03	92.35	1.00
sunflower	cfr	m.int	7.00	-124.32	0.00	1.00	0.48	70.35	0.48
sunflower	cfr	m.CO2	4.00	-123.76	0.56	0.76	0.36	66.28	0.84
sunflower	cfr	m.add	5.00	-122.09	2.23	0.33	0.16	66.66	1.00
sunflower	cfr	m.null	2.00	-72.15	52.17	0.00	0.00	38.19	1.00
sunflower	cfr	m.H2O	3.00	-70.14	54.18	0.00	0.00	38.31	1.00
sunflower	LA	m.int	7.00	264.28	0.00	1.00	1.00	-123.97	1.00
sunflower	LA	m.CO2	4.00	275.93	11.65	0.00	0.00	-133.57	1.00
sunflower	LA	m.add	5.00	276.90	12.62	0.00	0.00	-132.85	1.00
sunflower	LA	m.H2O	3.00	330.37	66.09	0.00	0.00	-161.96	1.00
sunflower	LA	m.null	2.00	340.31	76.03	0.00	0.00	-168.04	1.00
sunflower	root.shoot	m.CO2	4.00	-67.54	0.00	1.00	0.73	38.14	0.73
sunflower	root.shoot	m.add	5.00	-65.36	2.18	0.34	0.24	38.24	0.97
sunflower	root.shoot	m.int	7.00	-61.08	6.47	0.04	0.03	38.62	1.00
sunflower	root.shoot	m.null	2.00	-19.39	48.15	0.00	0.00	11.80	1.00
sunflower	root.shoot	m.H2O	3.00	-17.18	50.37	0.00	0.00	11.80	1.00

Table 1: Results of AICc-based model selection

Confidence intervals

species	response	term	estimate	ciL	ciU
barley	Photosynthetic yield	575 ppm	-0.17	-0.39	0.05
barley	Photosynthetic yield	700 ppm	0.21	-0.00	0.43
barley	Photosynthetic yield	Water- limited	-0.13	-0.31	0.05
barley	Chlorophyll content	575 ppm	-0.27	-0.41	-0.14
barley	Chlorophyll content	700 ppm	-0.40	-0.52	-0.28
barley	Chlorophyll content	Water- limited	-0.05	-0.14	0.05
barley	Leaf area	575 ppm	-8.09	-16.45	0.27
barley	Leaf area	700 ppm	-16.52	-23.70	-9.34
barley	Leaf area	Water- limited	-0.32	-1.86	1.21
barley	Root:Shoot	575 ppm	0.35	0.01	0.68
barley	Root:Shoot	700 ppm	0.95	0.49	1.41
barley	Root:Shoot	Water- limited	0.16	-0.14	0.45
durum wheat	Photosynthetic yield	575 ppm	-0.14	-0.38	0.10
durum wheat	Photosynthetic yield	700 ppm	0.46	0.21	0.71
durum wheat	Photosynthetic yield	Water- limited	-0.13	-0.33	0.07
durum wheat	Chlorophyll content	575 ppm	-0.28	-0.39	-0.17
durum wheat	Chlorophyll content	700 ppm	-0.31	-0.42	-0.20
durum wheat	Chlorophyll content	Water- limited	-0.00	-0.08	0.08
durum wheat	Leaf area	575 ppm	-10.69	-16.32	-5.06
durum wheat	Leaf area	700 ppm	-12.24	-17.76	-6.72
durum wheat	Leaf area	Water- limited	-0.02	-1.27	1.23
durum wheat	Root:Shoot	575 ppm	1.88	1.07	2.69
durum wheat	Root:Shoot	700 ppm	0.97	0.42	1.51
durum wheat	Root:Shoot	Water- limited	-0.28	-0.66	0.10
oats	Photosynthetic yield	575 ppm	-0.60	-0.84	-0.37
oats	Photosynthetic yield	700 ppm	0.47	0.23	0.70
oats	Photosynthetic yield	Water- limited	-0.04	-0.23	0.16
oats	Chlorophyll content	575 ppm	-0.38	-0.50	-0.26
oats	Chlorophyll content	700 ppm	-0.31	-0.43	-0.18
oats	Chlorophyll content	Water- limited	-0.04	-0.13	0.05
oats	Leaf area	575 ppm	-13.74	-19.91	-7.56
oats	Leaf area	700 ppm	-14.06	-20.21	-7.90
oats	Leaf area	Water- limited	0.26	-1.53	2.04
oats	Root:Shoot	575 ppm	0.15	-0.01	0.31
oats	Root:Shoot	700 ppm	0.26	0.08	0.43
oats	Root:Shoot	Water- limited	-0.08	-0.22	0.06
sunflower	Photosynthetic yield	575 ppm	-0.22	-0.37	-0.06
sunflower	Photosynthetic yield	700 ppm	-0.16	-0.32	-0.01
sunflower	Photosynthetic yield	Water- limited	-0.08	-0.20	0.04
sunflower	Chlorophyll content	575 ppm	-0.17	-0.26	-0.08
sunflower	Chlorophyll content	700 ppm	-0.25	-0.34	-0.16
sunflower	Chlorophyll content	Water- limited	0.02	-0.05	0.08
sunflower	Leaf area	575 ppm	-11.89	-18.29	-5.49
sunflower	Leaf area	700 ppm	-12.79	-19.13	-6.46
sunflower	Leaf area	Water- limited	-0.73	-2.76	1.30
sunflower	Root:Shoot	575 ppm	0.13	0.03	0.24
sunflower	Root:Shoot	700 ppm	0.39	0.25	0.54
sunflower	Root:Shoot	Water- limited	-0.01	-0.11	0.08
pinto bean	Photosynthetic yield	575 ppm	-0.37	-0.53	-0.20
pinto bean	Photosynthetic yield	700 ppm	-0.56	-0.72	-0.40
pinto bean	Photosynthetic yield	Water- limited	0.07	-0.06	0.20
pinto bean	Chlorophyll content	575 ppm	-0.25	-0.35	-0.15
pinto bean	Chlorophyll content	700 ppm	-0.27	-0.37	-0.17

pinto bean	Chlorophyll content	Water- limited	-0.04	-0.11	0.04
pinto bean	Leaf area	575 ppm	-10.96	-15.72	-6.20
pinto bean	Leaf area	700 ppm	-9.81	-14.65	-4.96
pinto bean	Leaf area	Water- limited	1.46	-1.31	4.24
pinto bean	Root:Shoot	575 ppm	0.03	-0.17	0.24
pinto bean	Root:Shoot	700 ppm	0.22	-0.01	0.45
pinto bean	Root:Shoot	Water- limited	0.03	-0.15	0.21
corn	Photosynthetic yield	575 ppm	-0.39	-0.49	-0.29
corn	Photosynthetic yield	700 ppm	-0.22	-0.32	-0.12
corn	Photosynthetic yield	Water- limited	-0.06	-0.14	0.02
corn	Chlorophyll content	575 ppm	-0.20	-0.28	-0.11
corn	Chlorophyll content	700 ppm	-0.20	-0.29	-0.12
corn	Chlorophyll content	Water- limited	-0.01	-0.08	0.06
corn	Leaf area	575 ppm	-75.13	-110.76	-39.50
corn	Leaf area	700 ppm	-81.19	-116.44	-45.93
corn	Leaf area	Water- limited	-3.13	-11.81	5.55
corn	Root:Shoot	575 ppm	0.98	0.45	1.52
corn	Root:Shoot	700 ppm	0.18	-0.19	0.56
corn	Root:Shoot	Water- limited	0.10	-0.24	0.45
sorghum	Photosynthetic yield	575 ppm	0.44	0.21	0.67
sorghum	Photosynthetic yield	700 ppm	1.04	0.81	1.27
sorghum	Photosynthetic yield	Water- limited	0.09	-0.10	0.28
sorghum	Chlorophyll content	575 ppm	-0.13	-0.20	-0.06
sorghum	Chlorophyll content	700 ppm	-0.17	-0.23	-0.10
sorghum	Chlorophyll content	Water- limited	-0.01	-0.07	0.04
sorghum	Leaf area	575 ppm	-13.45	-20.67	-6.23
sorghum	Leaf area	700 ppm	-14.19	-21.36	-7.01
sorghum	Leaf area	Water- limited	-0.35	-1.48	0.78
sorghum	Root:Shoot	575 ppm	0.35	0.01	0.69
sorghum	Root:Shoot	700 ppm	0.69	0.30	1.07
sorghum	Root:Shoot	Water- limited	0.19	-0.11	0.48

Table 2: Beta coefficient estimates and confidence intervals for all responses, all models.