

# The Effects of Varying Nutrient Availability on Females and Hermaphrodites of the Gynodioecious *Geranium maculatum*

Katharine Putney,<sup>1\*</sup> Mavis Wolf,<sup>2</sup> Chase Mason,<sup>3</sup> and Shu-Mei Chang<sup>2\*</sup>

<sup>1</sup>Department of Biology, Wofford College, 429 N. Church St., Spartanburg, SC 29303

<sup>2</sup>Department of Plant Biology, University of Georgia, 120 Carlton St., Athens, GA 30602

<sup>3</sup>Department of Biology, University of Central Florida, 4110 Libra Dr., Orlando, FL 32816

**Supplement Table 1. Modified Hoagland's recipes (A) and the resulting moles of each element (B) used for N and P manipulation treatments. Each of these nitrogen and phosphorus treatments was either used as made (1X), or diluted to 0.5X or 0.1X of the original solution. Focal nutrient manipulations are highlighted with brackets.**

**(A) Modified Hoagland's recipes**

	Nitrogen treatments			Control (mL/L)	Phosphorus treatments (mL/L) (mL/L)		
	0.4 N	2 N	16 N	8 N ; 1 P	4 P	0.5 P	0.01 P
<b>KNO<sub>3</sub></b>	[0.35]	[1]	[6]	3	3	3	3
<b>Ca(NO<sub>3</sub>)<sub>2</sub>×4H<sub>2</sub>O</b>	[0]	[0.375]	[4]	2	2	2	2
<b>K<sub>2</sub>SO<sub>4</sub></b>	[11.3]	[10]	[0]	6	[0]	[7]	[8]
<b>KH<sub>2</sub>PO<sub>4</sub></b>	2	2	2	2	[8]	[1]	[0.02]
<b>MgSO<sub>4</sub>×7H<sub>2</sub>O</b>	1	0	1	1	1	1	1
<b>CaSO<sub>4</sub>×2H<sub>2</sub>O</b>	[400]	[1]	[0]	200	200	200	200
<b>NH<sub>4</sub>Cl</b>	[0.05]	[363]	[2]	1	1	1	1
<b>KCl</b>	0.5	0.5	0.5	0.5	0.5	0.5	0.5
<b>H<sub>3</sub>BO<sub>3</sub></b>							
<b>MnSO<sub>4</sub>×H<sub>2</sub>O</b>							
<b>ZnSO<sub>4</sub>×7H<sub>2</sub>O</b>							
<b>CuSO<sub>4</sub>×5H<sub>2</sub>O</b>							
<b>MoO<sub>3</sub></b>							
<b>FeEDTA</b>							

**(B) Element moles in mmol/L**

	0.4 N	2 N	16 N	8 N ; 1 P	4 P	0.5 P	0.01 P
<b>N</b>	[0.4]	[2]	[16]	8	8	8	8
<b>NO<sub>3</sub><sup>-</sup></b>	[0.35]	[1.75]	[14]	7	7	7	7
<b>NH<sub>4</sub><sup>+</sup></b>	[0.05]	[0.25]	[2]	1	1	1	1
<b>K</b>	7	7	7	7	7	7	7.01
<b>Ca</b>	4	4.005	4	4	4	4	4
<b>P</b>	1	1	1	1	[4]	[0.5]	[0.01]
<b>S</b>	7.325	6.63	0.5	4	2.5	4.25	4.5
<b>Mg</b>	0.5	0.5	0.5	0.5	0.5	0.5	0.5
<b>Cl</b>	0.025	0.025	0.025	0.025	0.025	0.025	0.025
<b>B</b>	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
<b>Mn</b>	0.001	0.001	0.001	0.001	0.001	0.001	0.001
<b>Zn</b>	0.001	0.001	0.001	0.001	0.001	0.001	0.001
<b>Cu</b>	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
<b>Mo</b>	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
<b>Fe</b>	0.025	0.025	0.025	0.025	0.025	0.025	0.025

\*email address: [putneykh@wofford.edu](mailto:putneykh@wofford.edu) or [smchang@uga.edu](mailto:smchang@uga.edu)

Supplement Table 2a. F-values, degrees of freedom, and p-values for the effects of the dilution, nitrogen, and phosphorus treatments, as well as their interactions with plant sex on biomass and other growth measurements. All models were run using a Gaussian error distribution. The “All data” dataset refers to analysis using all plants used in the study, for which it is most appropriate to interpret the effects of Sex, Dilution, and Sex×Dilution. The “N man” data set refers to the plants for which nitrogen concentration was manipulated (as well as dilution). This represents a subset of the “all data” dataset, and only the effects of the nitrogen manipulation (“N/P”) and Sex×N/P are appropriate to interpret from this analysis. The equivalent is true for the “P man” data set, which refers to the plants for which phosphorus concentration was manipulated. Asterisks indicate *p*-values that were significant after Benjamini-Hochberg test, and that are appropriate to interpret given the above explanation. “in. rh. mass” refers to “initial rhizome mass” which was used as a covariate in all analyses.

Data set	Dependent variable	Independent variables of interest						in. rh. mass
		Sex	N/P	Dilution	N/P×dil	Sex×dil	sex×N/P	
all data	total dry mass estimate	F=4.31	1.51	4.85	2.40	1.96	1.93	411.70
		d.f=1, 138	6, 138	2, 138	12, 138	2, 138	6, 138	1, 138
		<b>p=0.04</b>	<b>0.18</b>	<b>&lt;0.01*</b>	<b>0.01</b>	<b>0.15</b>	<b>0.08</b>	<b>&lt;0.001</b>
N man.	total dry mass estimate	7.34	1.83	0.11	1.22	3.83	0.92	230.31
		1, 79	3, 79	2, 79	6, 79	2, 79	3, 79	1, 79
		<b>0.01</b>	<b>0.15</b>	<b>0.89</b>	<b>0.30</b>	<b>0.03</b>	<b>0.43</b>	<b>&lt;0.001</b>
P man.	total dry mass estimate	0.05	0.20	8.76	2.06	1.15	2.13	175.07
		1, 75	3, 75	2, 75	6, 75	2, 75	3, 75	1, 75
		<b>0.83</b>	<b>0.89</b>	<b>&lt;0.001</b>	<b>0.07</b>	<b>0.32</b>	<b>0.10</b>	<b>&lt;0.001</b>
all data	AG dry mass	1.11	2.57	8.21	1.57	0.73	2.11	19.48
		1, 109	6, 109	2, 109	12, 109	2, 109	6, 109	1, 109
		<b>0.29</b>	<b>0.02</b>	<b>&lt;0.001*</b>	<b>0.11</b>	<b>0.48</b>	<b>0.06</b>	<b>&lt;0.001</b>
N man.	AG dry mass	0.13	5.42	3.36	1.01	1.34	1.50	4.29
		1, 62	3, 62	2, 62	6, 62	2, 62	3, 62	1, 62
		<b>0.72</b>	<b>&lt;0.01*</b>	<b>0.04</b>	<b>0.43</b>	<b>0.04</b>	<b>0.27</b>	<b>0.22</b>
P man.	AG dry mass	3.65	0.09	7.96	0.95	0.17	1.32	13.23
		1, 60	3, 60	2, 60	6, 60	2, 60	3, 60	1, 60
		<b>0.06</b>	<b>0.96</b>	<b>&lt;0.001</b>	<b>0.47</b>	<b>0.83</b>	<b>0.85</b>	<b>0.28</b>
all data	Belowground fresh mass	7.41	0.83	2.55	2.27	1.80	1.57	512.09
		1, 138	6, 138	2, 138	12, 138	2, 138	6, 138	1, 138
		<b>0.01</b>	<b>0.55</b>	<b>0.08</b>	<b>0.01</b>	<b>0.17</b>	<b>0.16</b>	<b>&lt;0.001</b>
N man.	Belowground fresh mass	8.68	0.67	0.08	1.14	3.66	0.51	295.02
		1, 79	3, 79	2, 79	6, 79	2, 79	3, 79	1, 79
		<b>0.00</b>	<b>0.57</b>	<b>0.92</b>	<b>0.35</b>	<b>0.03</b>	<b>0.68</b>	<b>&lt;0.001</b>
P man.	Belowground fresh mass	0.89	0.49	6.42	2.29	1.00	2.67	232.16
		1, 75	3, 75	2, 75	6, 75	2, 75	3, 75	1, 75
		<b>0.35</b>	<b>0.35</b>	<b>&lt;0.01</b>	<b>0.04</b>	<b>0.37</b>	<b>0.05</b>	<b>&lt;0.001</b>

Supplement Table 2a. continued

Data set	Dependent variable	Independent variables of interest						in. rh. mass
		Sex	N/P	Dilution	N/P×dil	Sex×dil	sex×N/P	
all data	Highest recorded flower count (sq rt trans)	0.77	1.87	1.96	1.56	1.14	1.61	8.94
		1, 138	6, 138	2, 138	12, 138	2, 138	6, 138	1, 138
		<b>0.38</b>	<b>0.09</b>	<b>0.14</b>	<b>0.11</b>	<b>0.32</b>	<b>0.15</b>	<b>0.00</b>
N man.	Highest recorded flower count (sq rt trans)	0.93	3.17	1.13	2.08	0.66	0.48	7.21
		1, 79	3, 79	2, 79	6, 79	2, 79	3, 79	1, 79
		<b>0.34</b>	<b>0.03*</b>	<b>0.33</b>	<b>0.06</b>	<b>0.52</b>	<b>0.70</b>	<b>0.01</b>
P man.	Highest recorded flower count (sq rt trans)	4.56	0.93	2.80	1.57	1.07	1.28	3.21
		1, 75	3, 75	2, 75	6, 75	2, 75	3, 75	1, 75
		<b>0.04</b>	<b>0.43</b>	<b>0.07</b>	<b>0.17</b>	<b>0.35</b>	<b>0.29</b>	<b>0.08</b>
all data	Highest recorded leaf count (sq rt transformed)	0.45	0.27	0.42	1.24	0.84	0.87	0.14
		1, 138	6, 138	2, 138	12, 138	2, 138	6, 138	1, 138
		<b>0.50</b>	<b>0.95</b>	<b>0.66</b>	<b>0.26</b>	<b>0.43</b>	<b>0.52</b>	<b>0.71</b>
N man.	Highest recorded leaf count (sq rt transformed)	0.00	0.49	0.66	1.17	0.86	1.25	0.04
		1, 79	3, 79	2, 79	6, 79	2, 79	3, 79	1, 79
		<b>0.95</b>	<b>0.69</b>	<b>0.52</b>	<b>0.33</b>	<b>0.43</b>	<b>0.30</b>	<b>0.85</b>
P man.	Highest recorded leaf count (sq rt transformed)	0.75	0.10	0.02	1.10	0.08	0.47	0.08
		1, 75	3, 75	2, 75	6, 75	2, 75	3, 75	1, 75
		<b>0.39</b>	<b>0.96</b>	<b>0.98</b>	<b>0.37</b>	<b>0.92</b>	<b>0.70</b>	<b>0.77</b>

Supplement Table 2b. F-values, degrees of freedom, and p-values for the effects of the dilution, nitrogen, and phosphorus treatments, as well as their interactions with plant sex on biomass, allocation, and leaf quality measurements. All models were run using a Gaussian error distribution. The “All data” dataset refers to analysis using all plants used in the study, for which it is most appropriate to interpret the effects of Sex, Dilution, and Sex×Dilution. The “N man” data set refers to the plants for which nitrogen concentration was manipulated (as well as dilution). This represents a subset of the “all data” dataset, and only the effects of the nitrogen manipulation (“N/P”) and Sex×N/P are appropriate to interpret from this analysis. The equivalent is true for the “P man” data set, which refers to the plants for which phosphorus concentration was manipulated. Asterisks indicate p-values that were significant after Benjamini-Hochberg test. “in. rh. mass” refers to “initial rhizome mass” which was used as a covariate in all analyses.

Data set	Dependent variable	Independent variables of interest						in. rh. mass
		Sex	N/P	Dilution	N/P×dil	Sex×dil	sex×N/P	
all data	BG:total dry mass	F=0.85	2.37	3.84	0.82	1.94	1.20	6.48
		d.f.=1, 138	6, 138	2, 138	12, 138	2, 138	6, 138	1, 138
		<b>p=0.36</b>	<b>0.03</b>	<b>0.02*</b>	<b>0.63</b>	<b>0.15</b>	<b>0.31</b>	<b>0.01</b>
N man.	BG:total dry mass	0.22	4.63	2.59	0.66	1.01	0.34	5.57
		1, 79	3, 79	2, 79	6, 79	2, 79	3, 79	1, 79
		<b>0.64</b>	<b>&lt;0.01*</b>	<b>0.08</b>	<b>0.69</b>	<b>0.37</b>	<b>0.80</b>	<b>0.02</b>
P man.	BG:total dry mass	0.91	0.95	3.65	1.06	2.02	1.59	4.17
		1, 75	3, 75	2, 75	6, 75	2, 75	3, 75	1, 75
		<b>0.34</b>	<b>0.42</b>	<b>0.03</b>	<b>0.39</b>	<b>0.04</b>	<b>0.14</b>	<b>0.20</b>
all data	infl:total dry mass (arcsin sq rt transformed)	0.28	1.47	5.68	1.00	0.33	2.06	1.53
		1, 138	6, 138	2, 138	12, 138	2, 138	6, 138	1, 138
		<b>0.60</b>	<b>0.19</b>	<b>&lt;0.01*</b>	<b>0.45</b>	<b>0.72</b>	<b>0.06</b>	<b>0.22</b>
N man.	infl:total dry mass (arcsin sq rt transformed)	0.83	2.44	3.81	1.24	0.48	2.22	0.92
		1, 79	3, 79	2, 79	6, 79	2, 79	3, 79	1, 79
		<b>0.36</b>	<b>0.07</b>	<b>0.03</b>	<b>0.29</b>	<b>0.62</b>	<b>0.09</b>	<b>0.34</b>
P man.	infl:total dry mass (arcsin sq rt transformed)	1.55	1.22	4.75	1.24	0.54	1.27	1.80
		1, 75	3, 75	2, 75	6, 75	2, 75	3, 75	1, 75
		<b>0.22</b>	<b>0.31</b>	<b>0.01</b>	<b>0.29</b>	<b>0.18</b>	<b>0.58</b>	<b>0.29</b>
all data	inflorescence dry mass	3.83	1.34	4.37	1.01	0.27	1.66	15.46
		1, 105	6, 105	2, 105	12, 105	2, 105	6, 105	1, 105
		<b>0.05</b>	<b>0.24</b>	<b>0.02*</b>	<b>0.45</b>	<b>0.00</b>	<b>0.76</b>	<b>0.14</b>
N man.	inflorescence dry mass	0.14	3.34	3.24	1.52	0.44	2.24	6.31
		1, 58	3, 58	2, 58	6, 58	2, 58	3, 58	1, 58
		<b>0.71</b>	<b>0.03*</b>	<b>0.05</b>	<b>0.19</b>	<b>0.65</b>	<b>0.09</b>	<b>0.01</b>
P man.	inflorescence dry mass	7.33	0.19	4.00	0.75	1.29	0.41	14.08
		1, 59	3, 59	2, 59	6, 59	2, 59	3, 59	1, 59
		<b>0.01</b>	<b>0.91</b>	<b>0.02</b>	<b>0.61</b>	<b>0.00</b>	<b>0.28</b>	<b>0.75</b>

Supplement Table 2b. continued

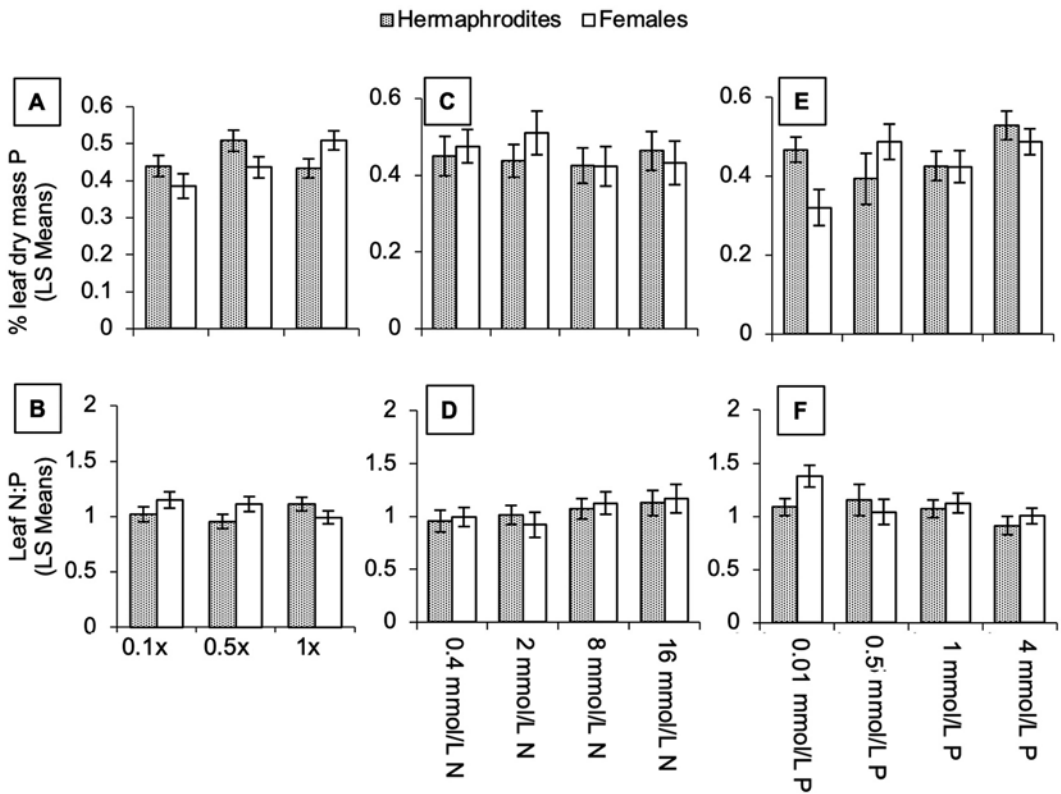
Data set	Dependent variable	Independent variables of interest						in. rh. mass
		Sex	N/P	Dilution	N/P×dil	Sex×dil	sex×N/P	
all data	leaf area	0.09	1.03	1.13	1.63	0.20	0.57	2.05
		1, 74	6, 74	2, 74	12, 74	2, 74	6, 74	1, 74
		<b>0.76</b>	<b>0.41</b>	<b>0.33</b>	<b>0.10</b>	<b>0.82</b>	<b>0.75</b>	<b>0.16</b>
N man.	leaf area	0.62	1.87	0.12	1.58	1.94	1.10	0.49
		1, 41	3, 41	2, 41	6, 41	2, 41	3, 41	1, 41
		<b>0.44</b>	<b>0.15</b>	<b>0.89</b>	<b>0.18</b>	<b>0.49</b>	<b>0.16</b>	<b>0.36</b>
P man.	leaf area	0.01	0.36	3.84	1.15	1.10	0.18	1.12
		1, 36	3, 36	2, 36	6, 36	2, 36	3, 36	1, 36
		<b>0.93</b>	<b>0.78</b>	<b>0.03</b>	<b>0.36</b>	<b>0.34</b>	<b>0.91</b>	<b>0.30</b>
all data	leaf dry matter content	0.46	1.49	0.25	0.87	0.47	0.56	1.25
		1, 76	6, 76	2, 76	12, 76	2, 76	6, 76	1, 76
		<b>0.50</b>	<b>0.19</b>	<b>0.78</b>	<b>0.58</b>	<b>0.27</b>	<b>0.63</b>	<b>0.76</b>
N man.	leaf dry matter content	1.01	1.71	0.34	1.05	0.49	0.34	0.42
		1, 41	3, 41	2, 41	6, 41	2, 41	3, 41	1, 41
		<b>0.32</b>	<b>0.18</b>	<b>0.72</b>	<b>0.41</b>	<b>0.61</b>	<b>0.80</b>	<b>0.52</b>
P man.	leaf dry matter content	0.58	0.83	0.75	0.55	0.26	0.54	3.78
		1, 39	3, 39	2, 39	6, 39	2, 39	3, 39	1, 39
		<b>0.45</b>	<b>0.48</b>	<b>0.48</b>	<b>0.77</b>	<b>0.78</b>	<b>0.66</b>	<b>0.06</b>

Supplement Table 2c. F-values, degrees of freedom, and p-values for the effects of the dilution, nitrogen, and phosphorus treatments, as well as their interactions with plant sex on leaf quality measurements. All models were run using a Gaussian error distribution. The “All data” dataset refers to analysis using all plants used in the study, for which it is most appropriate to interpret the effects of Sex, Dilution, and Sex×Dilution. The “N man” data set refers to the plants for which nitrogen concentration was manipulated (as well as dilution). This represents a subset of the “all data” dataset, and only the effects of the nitrogen manipulation (“N/P”) and Sex×N/P are appropriate to interpret from this analysis. The equivalent is true for the “P man” data set, which refers to the plants for which phosphorus concentration was manipulated. Asterisks indicate *p*-values that were significant after Benjamini-Hochberg test. “in. rh. mass” refers to “initial rhizome mass” which was used as a covariate in all analyses.

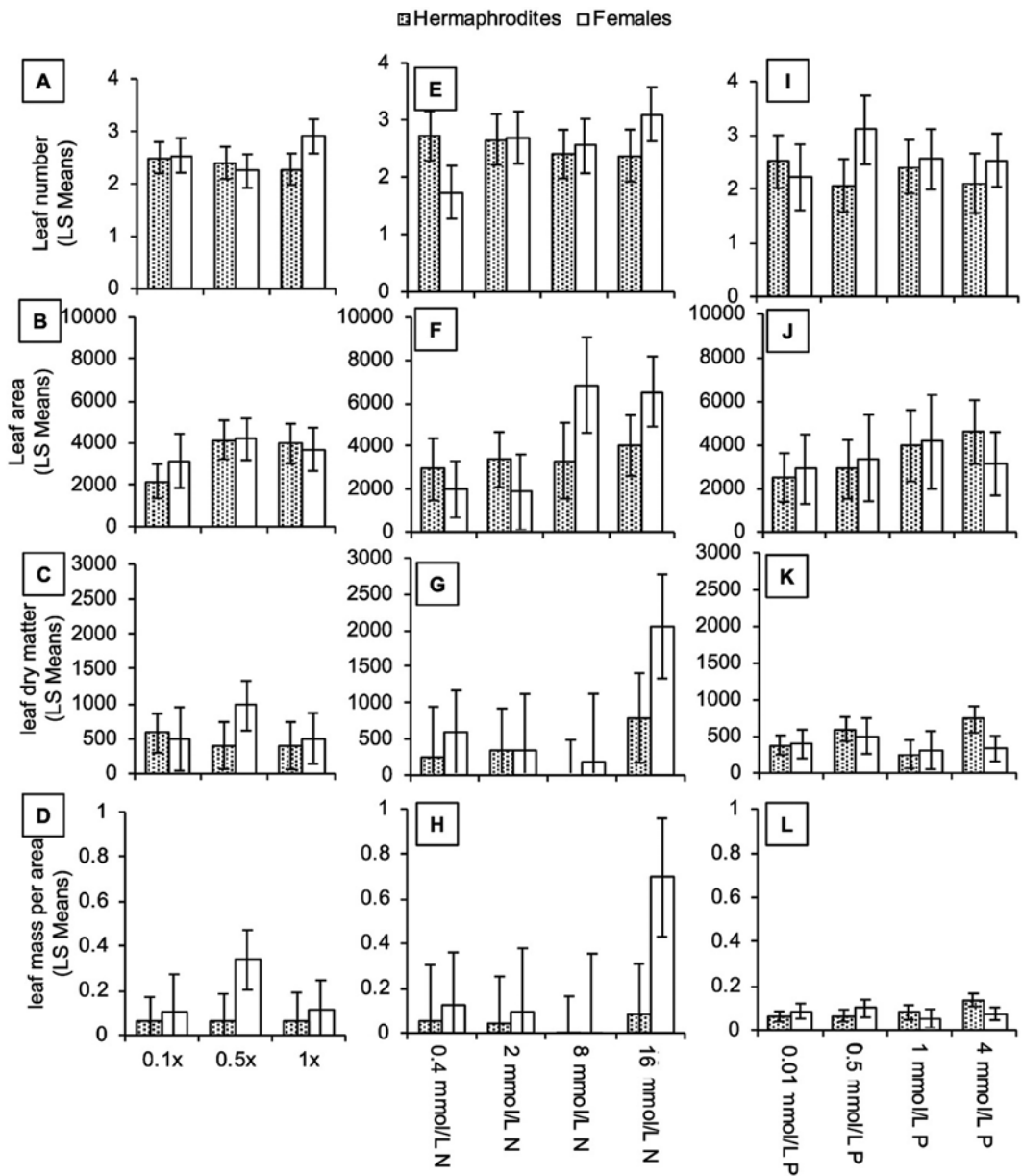
Data set	Dependent variable	Independent variables of interest						in. rh. mass
		Sex	N/P	Dilution	N/P×dil	Sex×dil	sex×N/P	
all data	LMA	F=1.21	0.97	0.51	0.67	0.56	0.74	0.65
		d.f.=1, 69	6, 69	2, 69	12, 69	2, 69	6, 69	1, 69
		<b>p=0.275</b>	<b>0.45</b>	<b>0.61</b>	<b>0.77</b>	<b>0.57</b>	<b>0.62</b>	<b>0.42</b>
N man.	LMA	1.30	1.14	0.24	0.87	0.66	0.60	0.33
		1, 38	3, 38	2, 38	6, 38	2, 38	3, 38	1, 38
		<b>0.26</b>	<b>0.35</b>	<b>0.78</b>	<b>0.52</b>	<b>0.52</b>	<b>0.62</b>	<b>0.57</b>
P man.	LMA	0.14	0.65	0.17	0.43	0.08	1.06	2.20
		1, 34	3, 34	2, 34	6, 34	2, 34	3, 34	1, 34
		<b>0.71</b>	<b>0.59</b>	<b>0.84</b>	<b>0.85</b>	<b>0.15</b>	<b>0.93</b>	<b>0.38</b>
all data	% leaf N	0.00	3.40	5.07	1.74	0.60	0.90	0.01
		1, 64	6, 64	2, 64	12, 64	2, 64	6, 64	1, 64
		<b>0.98</b>	<b>0.01</b>	<b>&lt;0.01*</b>	<b>0.08</b>	<b>0.55</b>	<b>0.50</b>	<b>0.93</b>
N man.	% leaf N	1.33	4.84	1.23	0.65	0.93	0.15	0.05
		1, 37	3, 37	2, 37	6, 37	2, 37	3, 37	1, 37
		<b>0.26</b>	<b>&lt;0.01*</b>	<b>0.30</b>	<b>0.69</b>	<b>0.40</b>	<b>0.93</b>	<b>0.83</b>
P man.	% leaf N	0.72	1.98	7.05	1.76	0.08	2.15	0.07
		1, 31	3, 31	2, 31	6, 31	2, 31	3, 31	1, 31
		<b>0.40</b>	<b>0.14</b>	<b>&lt;0.001</b>	<b>0.14</b>	<b>0.93</b>	<b>0.11</b>	<b>0.80</b>
all data	% leaf P	0.32	1.29	1.17	1.02	1.13	1.23	1.75
		1, 39	6, 39	2, 39	12, 39	2, 39	6, 39	1, 39
		<b>0.57</b>	<b>0.28</b>	<b>0.32</b>	<b>0.45</b>	<b>0.33</b>	<b>0.31</b>	<b>0.19</b>
N man.	% leaf P	0.21	0.58	2.78	0.61	0.48	0.62	3.22
		1, 21	3, 21	2, 21	6, 21	2, 21	3, 21	1, 21
		<b>0.65</b>	<b>0.64</b>	<b>0.08</b>	<b>0.72</b>	<b>0.63</b>	<b>0.61</b>	<b>0.09</b>
P man.	% leaf P	0.05	1.78	0.65	0.81	0.31	1.82	0.16
		1, 20	3, 20	2, 20	6, 20	2, 20	3, 20	1, 20
		<b>0.83</b>	<b>0.18</b>	<b>0.53</b>	<b>0.58</b>	<b>0.69</b>	<b>0.88</b>	<b>0.18</b>

Supplement Table 2c. continued

Data set	Dependent variable	Independent variables of interest						in. rh. mass
		Sex	N/P	Dilution	N/P×dil	Sex×dil	sex×N/P	
all data	Leaf N:P ratio <b>0.09</b>	3.14	1.16	0.09	1.31	0.77	0.98	2.21
		1, 36	6, 36	2, 36	11, 36	2, 36	5, 36	1, 36
		<b>0.35</b>	<b>0.91</b>	<b>0.26</b>	<b>0.15</b>	<b>0.47</b>	<b>0.44</b>	
N man.	Leaf N:P ratio	1.26	0.87	0.50	0.74	0.75	0.60	2.03
		1, 19	3, 19	2, 19	6, 19	2, 19	3, 19	1, 19
		<b>0.28</b>	<b>0.47</b>	<b>0.61</b>	<b>0.62</b>	<b>0.49</b>	<b>0.62</b>	<b>0.17</b>
P man.	Leaf N:P ratio	2.01	1.38	0.55	0.72	0.30	1.21	0.92
		1, 19	3, 19	2, 19	5, 19	2, 19	2, 19	1, 19
		<b>0.17</b>	<b>0.28</b>	<b>0.58</b>	<b>0.61</b>	<b>0.35</b>	<b>0.74</b>	<b>0.32</b>
all data	SPAD	2.49	1.49	0.22	1.58	0.29	2.37	0.00
		1, 80	6, 80	2, 80	12, 80	2, 80	6, 80	1, 80
		<b>0.12</b>	<b>0.19</b>	<b>0.81</b>	<b>0.12</b>	<b>0.75</b>	<b>0.04</b>	<b>0.97</b>
N man.	SPAD	4.75	4.08	0.98	3.36	1.73	5.81	0.08
		1, 46	3, 46	2, 46	6, 46	2, 46	3, 46	1, 46
		<b>0.03</b>	<b>0.01*</b>	<b>0.38</b>	<b>0.01</b>	<b>0.19</b>	<b>&lt;0.01*</b>	<b>0.78</b>
P man.	SPAD	1.74	0.97	0.89	0.33	0.69	1.12	0.28
		1, 39	3, 39	2, 39	6, 39	2, 39	3, 39	1, 39
		<b>0.19</b>	<b>0.42</b>	<b>0.42</b>	<b>0.91</b>	<b>0.51</b>	<b>0.35</b>	<b>0.60</b>



**Supplement Figure 1.** Least squares means of the % leaf dry mass P (**A**, **C**, **E**), and leaf N:P ratio (**B**, **D**, **F**) of the two sexes across the three dilution treatments (**A** and **B**), the four nitrogen treatments (**C** and **D**), and the four phosphorus treatments (**E** and **F**). Pairs of bars with different letters within a trait are significantly different from each other. Pairs of means with asterisks above are those in which females and hermaphrodites are significantly different from post-hoc comparisons of means.



**Supplement Figure 2.** Least squares means of the highest recorded leaf number at one time (A, E, I), total green leaf adaxial area ( $\text{mm}^2$ ; B, F, J), leaf dry matter content ( $\text{mg/g}$ ; C, G, K), and leaf mass per area ( $\text{mg/mm}^2$ ; D, H, L) of the two sexes across the three dilution treatments (A, B, C, D), the four nitrogen treatments (E, F, G, H), and the four phosphorus treatments (I, J, K, L). Pairs of bars with different letters within a trait are significantly different from each other. Pairs of means with asterisks above are those in which females and hermaphrodites are significantly different from post-hoc comparisons of means.