Individual female aboveground mass and fecundity

Individual female aboveground mass and fecundity were affected by rotation, crop species, and corn weed management (Table 1). Crop identity was more influential on female aboveground mass and fecundity than corn weed management regime, but the effect of crop identity differed between corn weed management regimes (Table 2A and 2B). Differences in relative female size and fecundity across rotation by herbicide treatments were attributed to the relative size and fecundity differences when the waterhemp populations grew in different crops' presence.

Individual female aboveground mass was comparable in most pairwise comparison of the same crop species in different rotations, except S2 versus S3 (p-value = 0.0076) and S3 versus S4 (p-value = 0.0268) that followed corn under conventional weed management and C2 versus C3 (p-value = 0.0064) under low weed management. Averaged over rotations, individual female aboveground mass was 3.5- to 133.6-fold different across each pair of comparison (p-values < 0.05), except for corn under low weed management versus the succeeding oat (p-value = 0.9616).

Individual fecundity was comparable in most pairwise comparison of the same crop species in different rotations, except S2 versus S3 (p-value = 0.001) and S3 versus S4 (p-value = 0.0046) that followed corn under conventional weed management and C2 versus C3 under low weed management (p-value = 0.0032), and O3 versus O4 that followed corn under low weed management (p-value = 0.0321). Averaged over rotations, individual fecundity was comparable between corn under low herbicide and oat in the same system (p-value = 0.4904) but was 6.3- to 6857.1-fold different in other pairs of comparison (p-values ≤ 0.0001).

Table 1: Crop and rotation system effects on individual female aboveground mass and fecundity.

	Female individual aboveground mass				Individual fecundity			
	Conventional herbicide corn weed management		Low herbicide corn weed management		Conventional herbicide corn weed management		Low herbicide corn weed management	
Contrast	ratio	p.value	ratio	p.value	ratio	p.value	ratio	p.value
(A) - Crop phase effects								
C2 vs C3	2.62	0.1335	4.29	0.0064	3.95	0.0820	7.29	0.0032
C2 vs C4	2.12	0.3402	2.27	0.1613	3.00	0.2367	2.55	0.2288
C3 vs C4	0.81	0.9302	0.53	0.4070	0.76	0.9240	0.35	0.2253
S2 vs S3	0.18	0.0076	0.33	0.2005	0.07	0.0010	0.47	0.6323
S2 vs S4	0.70	0.7885	0.76	0.9068	0.60	0.7451	1.19	0.9782
S3 vs S4	3.81	0.0268	2.27	0.3553	8.45	0.0045	2.51	0.4525
O3 vs O4	0.93	0.8695	0.39	0.0457	0.62	0.4363	0.27	0.0321
(B) - Crop species effects								
soybean vs corn	8.64	<.0001	35.10	<.0001	17.51	<.0001	96.74	<.0001
soybean vs oat	36.55	<.0001	30.29	<.0001	110.44	<.0001	55.97	<.0001
soybean vs alfalfa	128.16	<.0001	133.62	<.0001	5423.32	<.0001	6857.12	<.0001
corn vs oat	4.23	0.0001	0.86	0.9616	6.31	0.0001	0.58	0.4904
corn vs alfalfa	14.83	<.0001	3.81	0.0099	309.73	<.0001	70.88	<.0001
oat vs alfalfa	3.51	0.0324	4.41	0.0062	49.11	<.0001	122.51	<.0001

Note: C2: corn in the 2-year rotation, C3: corn in the 3-year rotation, C4: corn in the 4-year rotation, S2: soybean in the 2-year rotation, S3: soybean in the 3-year rotation; S4: soybean in the 4-year rotation, O3: oat in the 3-year rotation, O4: oat in the 4-year rotation, and A4: alfalfa in the 4-year rotation

Effects of weed management regimes and rotations on female aboveground mass and fecundity relationship

Since the treatment effects were statistically significant for both female aboveground mass and fecundity (Table 2), we proceeded with finding the slopes and intercepts for each linear regression of fecundity against biomass. Different slopes were specified by including interaction terms between the covariate and treatment factors. A regression slope for each treatment was necessary. That the training and testing sets' data points were well mingled indicated that the established equations were robust (Figure 1). The equations in Table 3 could predict waterhemp fecundity parsimoniously from dried aboveground mass using the relevant context of crop and crop management. The presented means and SEs for the estimated intercepts and slopes were established from the whole data set.

Table 2: ANOVAs for effect of crop identity, corn weed management, and female aboveground mass on individual female aboveground mass (A), fecundity (B), and fecundity with aboveground mass covariate (C). Each combination of crop identity and corn weed management affected female aboveground mass and fecundity differently.

Source of variation	df1	df2	F.value	p.value
(A) - Individual female aboveground mass. MSE = 2.02				
Crop ID	8	46.56	48.83	<.0001
Corn weed management	1	158.23	13.57	0.0003
Crop ID x Corn weed management	8	73.81	2.36	0.0255
(B) - Individual fecundity. MSE = 3.43				
Crop ID	8	41.61	72.13	<.0001
Corn weed management	1	146.13	14.64	0.0002
Crop ID x Corn weed management	8	63.87	2.98	0.0067
(C) - Individual fecundity with individual aboveground mass covariate. MSE = 1.01				
Crop ID	8	67.84	16.53	<.0001
Corn weed management	1	312.01	2.92	0.0886
Biomass	1	349.08	483.09	<.0001
Crop ID x Corn weed management	8	151.00	1.66	0.1136
Crop ID x Biomass	8	300.15	2.99	0.0031
Corn weed management x Biomass	1	349.20	2.84	0.0931
Crop ID x Corn weed management x Biomass	8	333.06	2.49	0.0122

Note: C2: corn in the 2-year rotation, C3: corn in the 3-year rotation, C4: corn in the 4-year rotation, S2: soybean in the 2-year rotation, S3: soybean in the 3-year rotation; S4: soybean in the 4-year rotation, O3: oat in the 3-year rotation, O4: oat in the 4-year rotation, and A4: alfalfa in the 4-year rotation

Table 3: Means and SEs for estimated linear regression of waterhemp fecundity (ln(seeds + 1)) versus biomass (ln(gram + 0.005)) indices intercepts and slopes, accompanied by the R^2 values of each equations.

Effect		Intercept		Slope		R^2
Crop ID	Corn weed management	Estimate	Std.error	Estimate	Std.error	
C2	conv	6.07	0.18	1.24	0.08	0.89
C2	low	5.88	0.22	1.22	0.11	0.78
S2	conv	6.30	0.31	1.14	0.11	0.89
S2	low	7.07	0.22	0.97	0.07	0.96
C3	conv	5.86	0.25	1.26	0.14	0.83
C3	low	5.11	0.35	0.66	0.21	0.33
S3	conv	7.25	0.44	0.96	0.09	0.84
S3	low	4.89	0.82	1.47	0.20	0.78
O3	conv	5.73	0.24	1.29	0.22	0.60
O3	low	5.64	0.21	0.60	0.18	0.29
C4	conv	5.90	0.60	1.26	0.29	0.60
C4	low	6.04	0.16	1.41	0.10	0.90
S4	conv	7.57	0.41	0.75	0.12	0.67
S4	low	7.33	0.56	0.74	0.19	0.58
O4	conv	6.05	0.18	1.01	0.16	0.66
O4	low	6.29	0.14	0.92	0.13	0.70
A4	conv	3.06	0.67	0.80	0.35	0.21
A4	low	1.97	0.43	0.50	0.20	0.23

Note: C2: corn in the 2-year rotation, C3: corn in the 3-year rotation, C4: corn in the 4-year rotation, S2: soybean in the 2-year rotation, S3: soybean in the 3-year rotation; S4: soybean in the 4-year rotation, O3: oat in the 3-year rotation, O4: oat in the 4-year rotation, and A4: alfalfa in the 4-year rotation

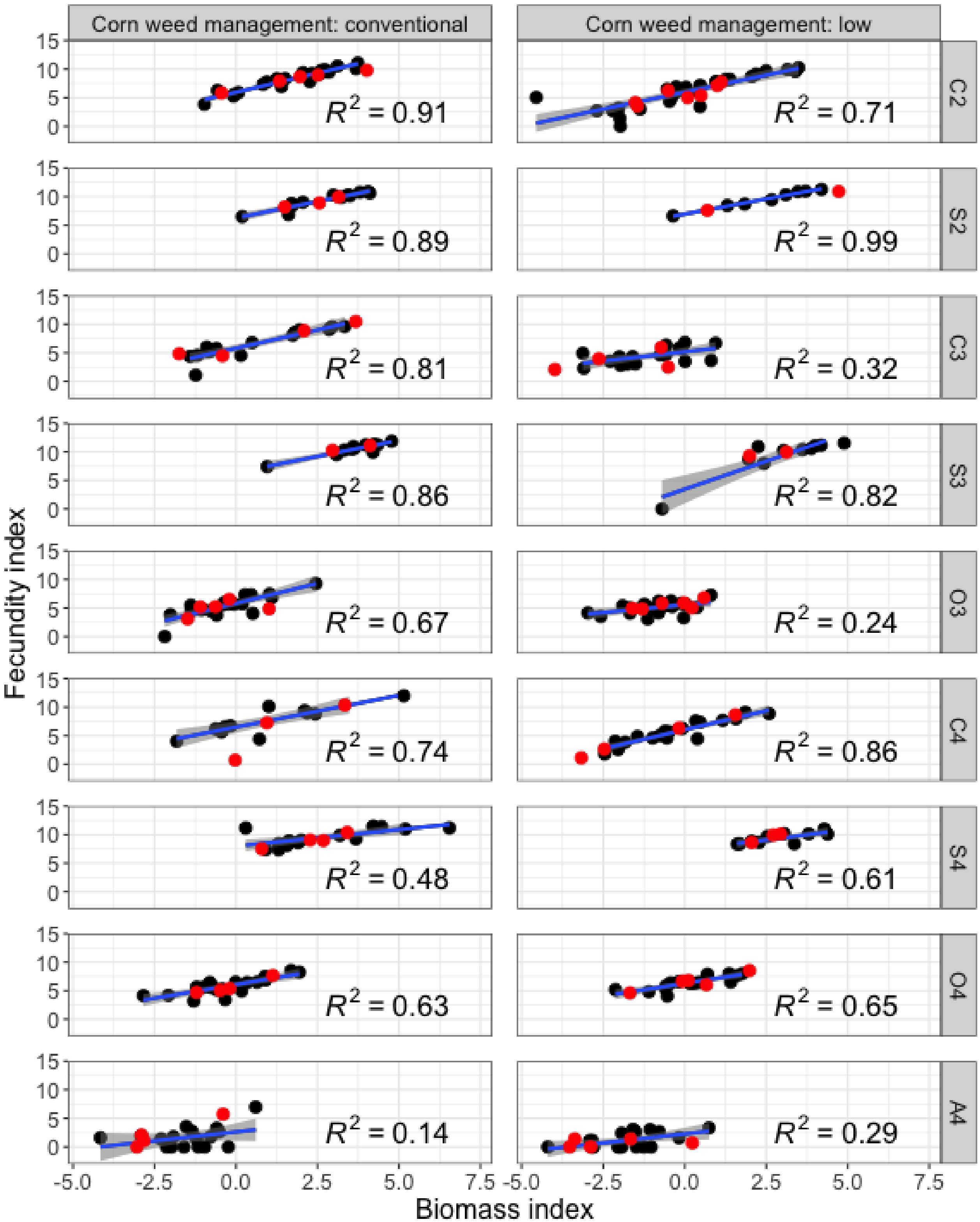

Figure 1: The black and red dots are values from training and testing sets, respectively. Each regression line was plotted for one crop identity by herbicide treatment using the training set. Biomass index = ln(gram biomass + 0.005) and Fecundity index = ln(seeds + 1)