Figure 1. Common regression curves used to describe the data from crop-weed competition studies in additive design: a) linear; b) polynomial quadratic; c) sigmoid; d) rectangular hyperbola.
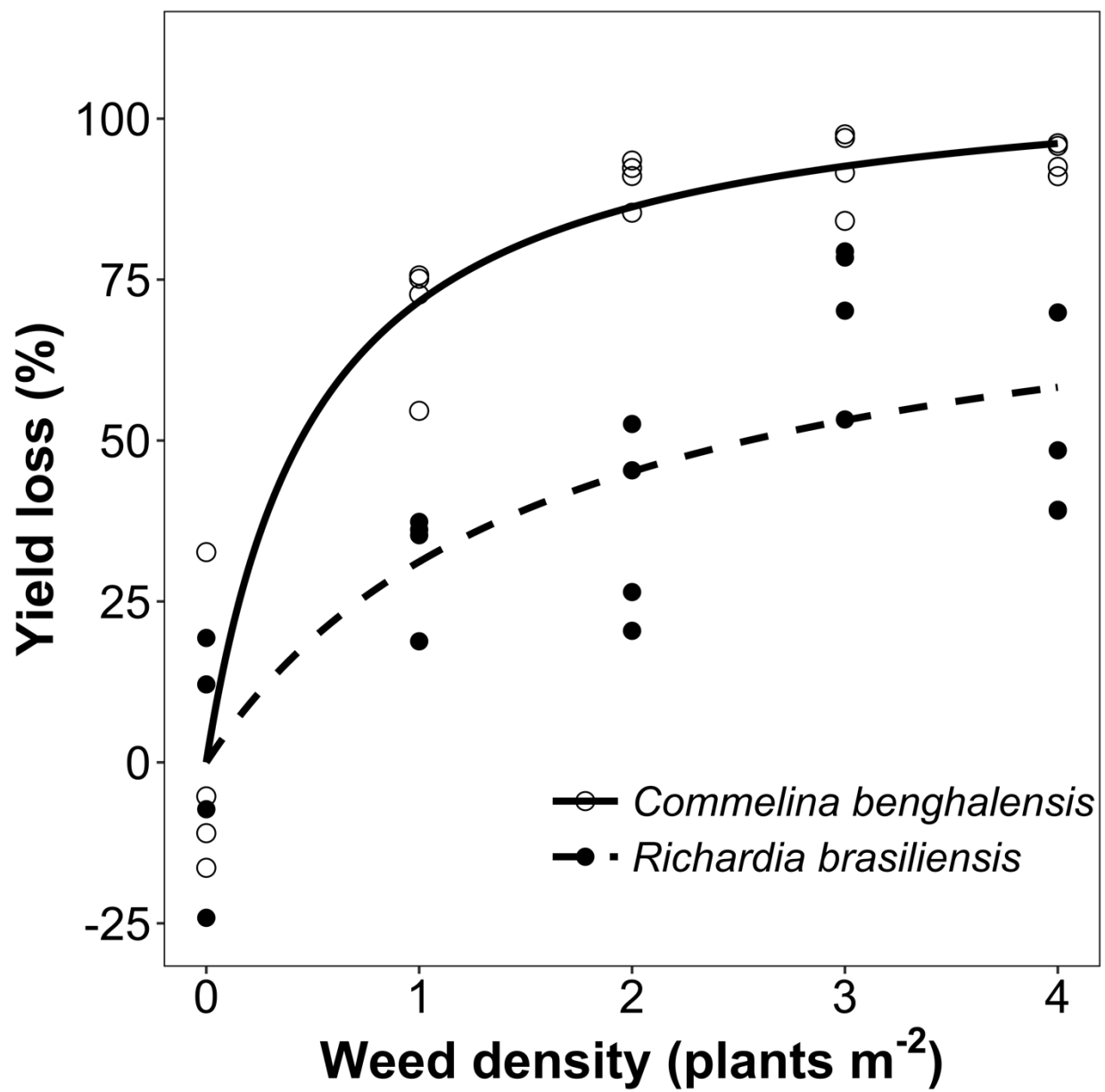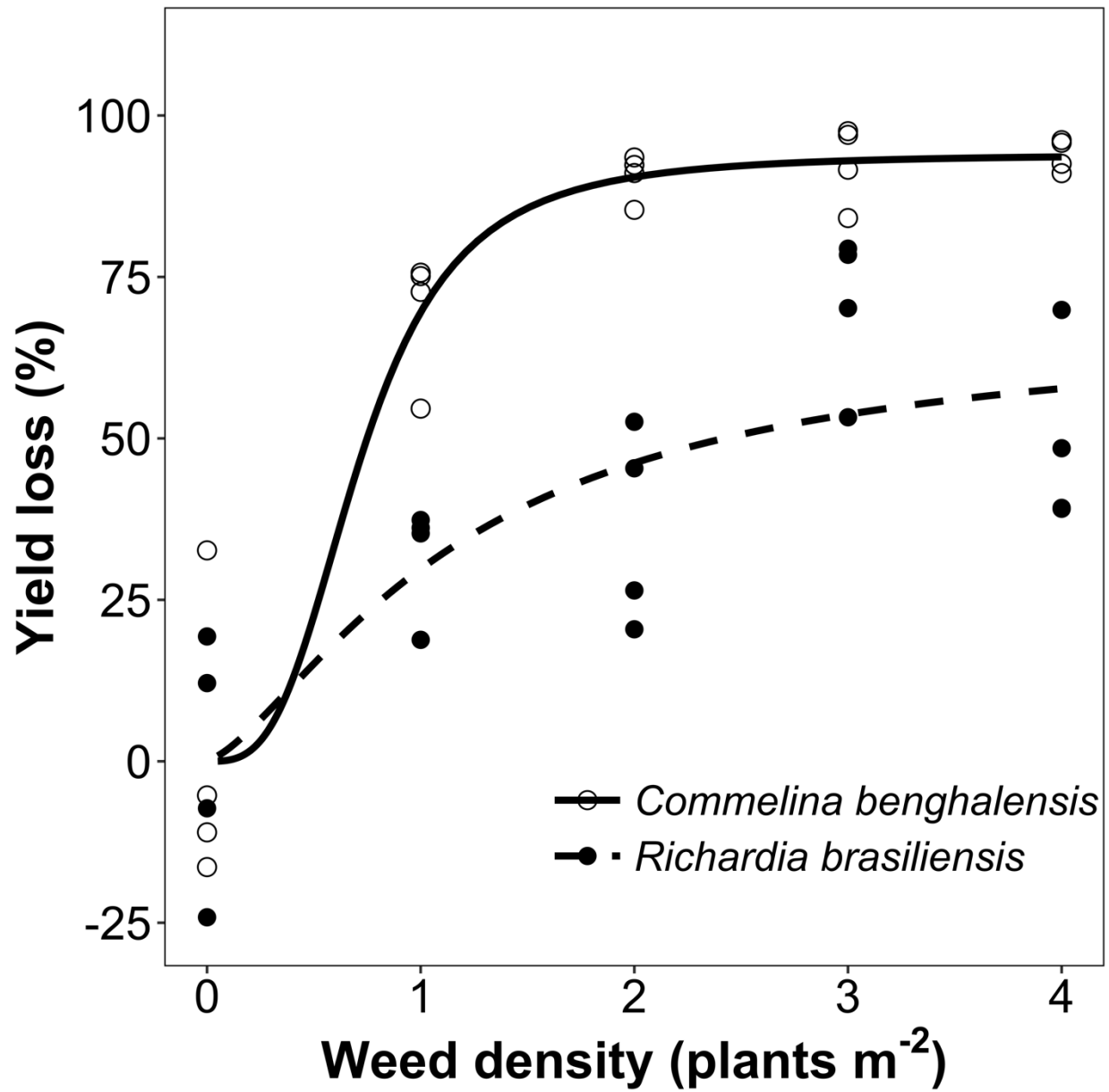
Figure 2. The relationship between corn yield loss (%) and weed density (plants pot^{-1}) described with a rectangular hyperbola model.

1

2   Figure 3. The relationship between corn yield loss (%) and weed density (plants pot[-1]) described
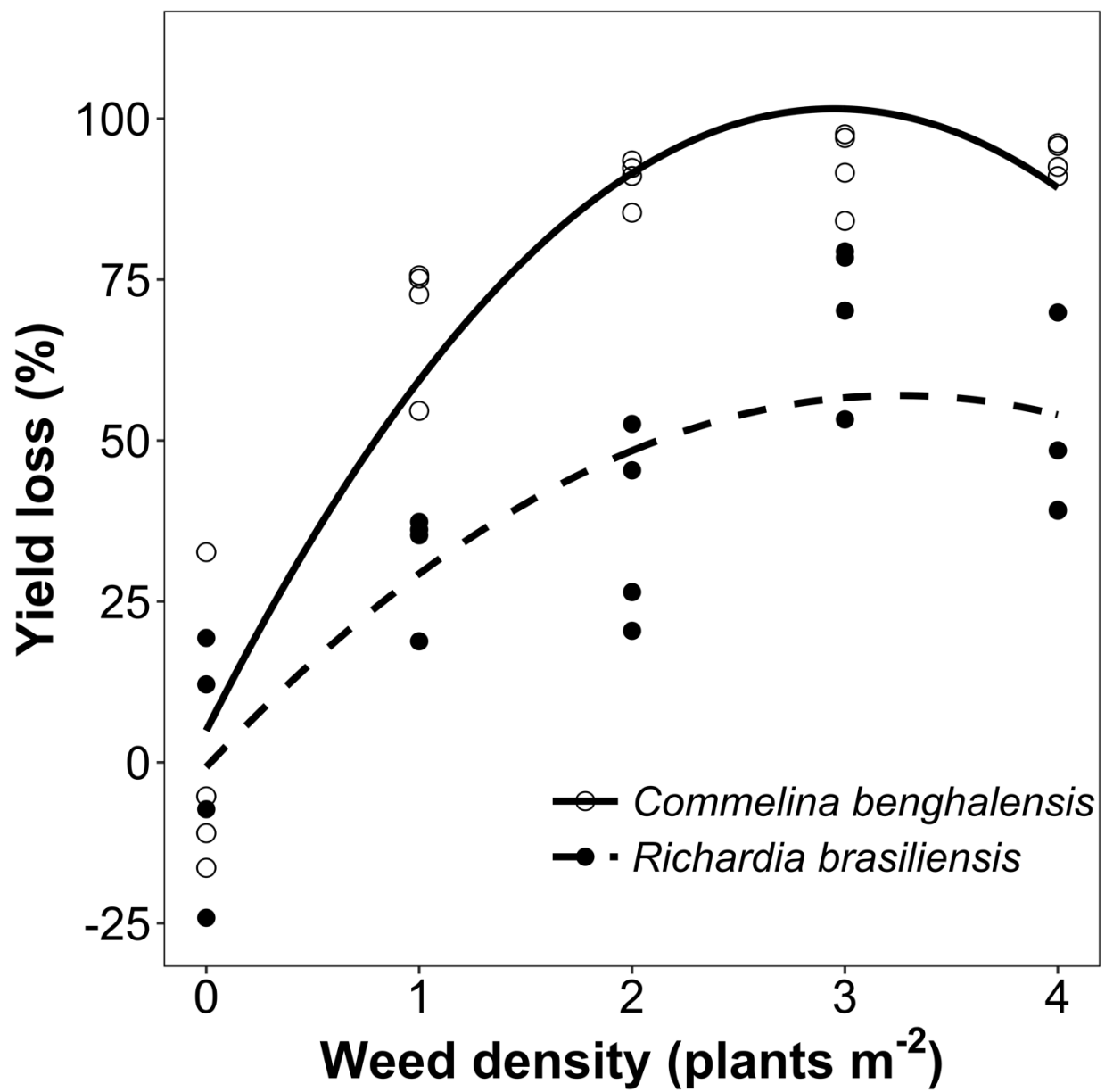
3   with a logistic model.

Figure 4. The relationship between corn yield loss (%) and weed density (plants pot[-1]) described with a polynomial quadratic model.
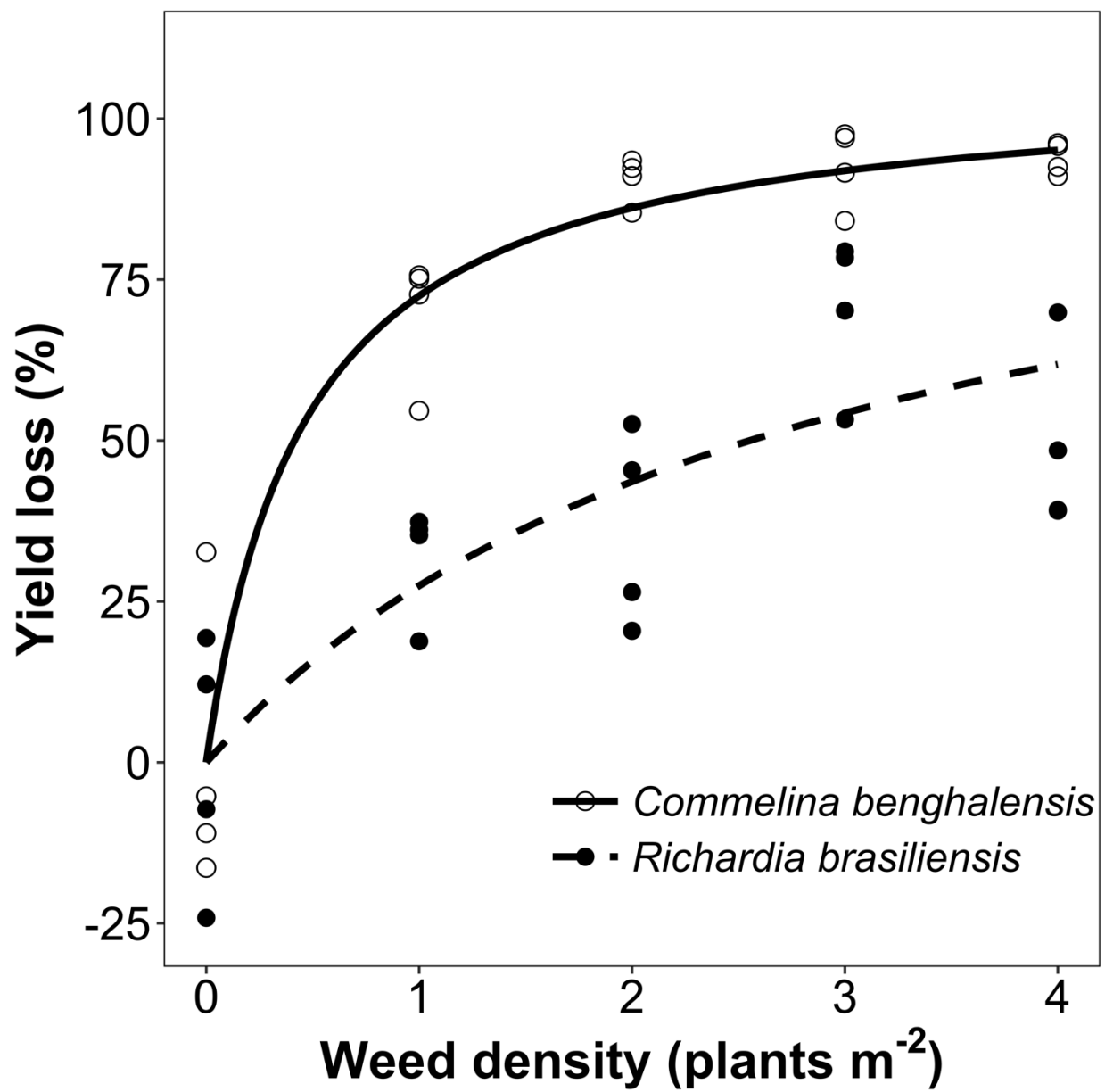
Figure 5. The relationship between corn yield loss (%) and weed density (plants pot^{-1}) described with a rectangular hyperbola model.

Table 1. Corn yield loss (%) model comparison among rectangular hyperbola, logistic, and polynomial quadratic models.

Model	Species	Model Selection[†]	Goodness of Fit[‡]		
		AICc	RMSE	ME	R^2
Rectangular hyperbola	*C. benghalensis*	332.2	12.6	0.92	-
	R. brasiliensis			0.64	-
Logistic	*C. benghalensis*	337.6	13.2	0.85	-
	R. brasiliensis			0.58	-
Polynomial quadratic	*C. benghalensis*	343.1	19.4	0.90	0.89
	R. brasiliensis			0.71	0.71

[†]Alkeike's information criterion (AIC).

[‡]Root mean square error (RMSE), model efficiency (ME), and R-squared (R^2). R^2 is not appropriate for nonlinear models (rectangular hyperbola and logistic).

Table 2. Rectangular hyperbola (Cousens model) parameters estimates, standard error, t-value

and P-value of corn yield loss (%) caused by competition of *R. brasiliensis* and *C. benghalensis*.

Parameters[†]	Species	Estimate	Standard Error	t-value	P-value[‡]
		——— % ———			
I	*R. brasiliensis*	50.3	22.6	2.2	**
	C. benghalensis	210.2	88.6	2.4	**
A	*R. brasiliensis*	82.1	23.1	3.6	*
	C. benghalensis	108.6	11.1	9.7	*

[†]*I*: represents corn yield loss (%) per unit weed density as density approaches 0; *A*: represents corn yield loss (%) as

density approaches ∞ (or maximum expected yield loss).

[‡]** P<0.05; *** P-value<0.01

Table 3. Logistic (four parameters logistic model) parameters estimate, standard error, t-value and P-value of corn yield loss (%) caused by competition of *R. brasiliensis* and *C. benghalensis*.

Parameters[†]	Species	Estimate	Standard Error	t-value	*P*-value[‡]
		— % —			
b	*R. brasiliensis*	-1.5	1.4	-1.1	NS
	C. benghalensis	-3.2	5.1	-0.6	NS
c	*R. brasiliensis*	0.2	7.4	0.0	NS
	C. benghalensis	-5.3	7.4	0.0	NS
d	*R. brasiliensis*	67.2	26.9	2.5	**
	C. benghalensis	93.4	8.4	11.1	***
e	*R. brasiliensis*	1.2	0.7	1.6	NS
	C. benghalensis	0.7	0.3	2.1	**

[†]*b*: slope; *c*: lower limit (weed competition at low densities); d: upper limit (maximum expected corn yield loss, %);

e: inflection point (weed density which corn yield loss is 50% relative to *d*.

[‡]** $P<0.05$ and *** P-value<0.01. NS, no significance difference.

Table 4. Polynomial quadratic parameters estimate, standard error, t-value and P-value of corn

yield loss (%) caused by competition of *R. brasiliensis* and *C. benghalensis*.

Parameters[†]	Species	Estimate	Standard Error	t-value	P-value[‡]
		——— % ———			
α	*R. brasiliensis*	-0.7	7.7	-0.1	NS
	C. benghalensis	4.9	6.1	0.8	NS
a	*R. brasiliensis*	35.5	9.1	3.8	***
	C. benghalensis	65.5	7.3	9.0	***
b	*R. brasiliensis*	-5.4	2.2	-2.5	**
	C. benghalensis	-11.1	1.7	-6.4	***

[†]α: intercept at Y-value when density equals zero; a is the slope of the equation; b is the quadratic term of the

equation.

[‡]** $P < 0.05$ and *** P-value < 0.01. NS, no significance difference.

Table 5. Nested model selection criteria and goodness of fit of Cousens model parameters I and A of maize biomass reduction (%) with *R. brasiliensis* and *C. benghalensi*s.

Cousens Models	Species	Model Selection[†]		Goodness of fit[§]		
		F-test		AICc	RSME	ME
		F-value	*P*-value[‡]			
Different I and A (Full)	*R. brasiliensis* *C. benghalensis*	-	-	332.2	13.3	0.92 0.64
Similar I and A (Red. I)	*R. brasiliensis* *C. benghalensis*	32.3	***	368.2	22.2	0.84
Similar I but different A (Red. II)	*R. brasiliensis* *C. benghalensis*	4.1	**	333.9	14.0	0.97 0.69
Similar A but different I (Red. III)	*R. brasiliensis* *C. benghalensis*	0.7	NS	330.4	13.4	0.98 0.95

[†]F-test model selection; if P-value<0.05: significantly different models; if P-value>0.05: non-significantly different models. Alkeike's Information Criterion (AIC);

[‡]** P<0.05 and *** P-value<0.01. NS, no significance difference.

[§]Root mean square error (RMSE) and model efficiency (ME).

Table 6. Rectangular hyperbola (Cousens model) parameters estimates, standard error, t-value and P-value of corn yield loss (%) caused by competition of *R. brasiliensis* and *C. benghalensis*.

Parameters[1]	Species	Estimate	Standard Error	t-value	P-value[‡]
		——— % ———			
I	*R. brasiliensis*	37.0	6.2	5.9	***
	C. benghalensis	228.3	100.2	2.3	**
A	*R. brasiliensis* *C. benghalensis*	106.1	10.3	10.3	***

[†]*I*: represents corn yield loss (%) per unit weed density as density approaches 0; *A*: represents corn yield loss (%) as density approaches ∞ (or maximum expected yield loss).

[‡]** P<0.05 and *** P-value<0.01.