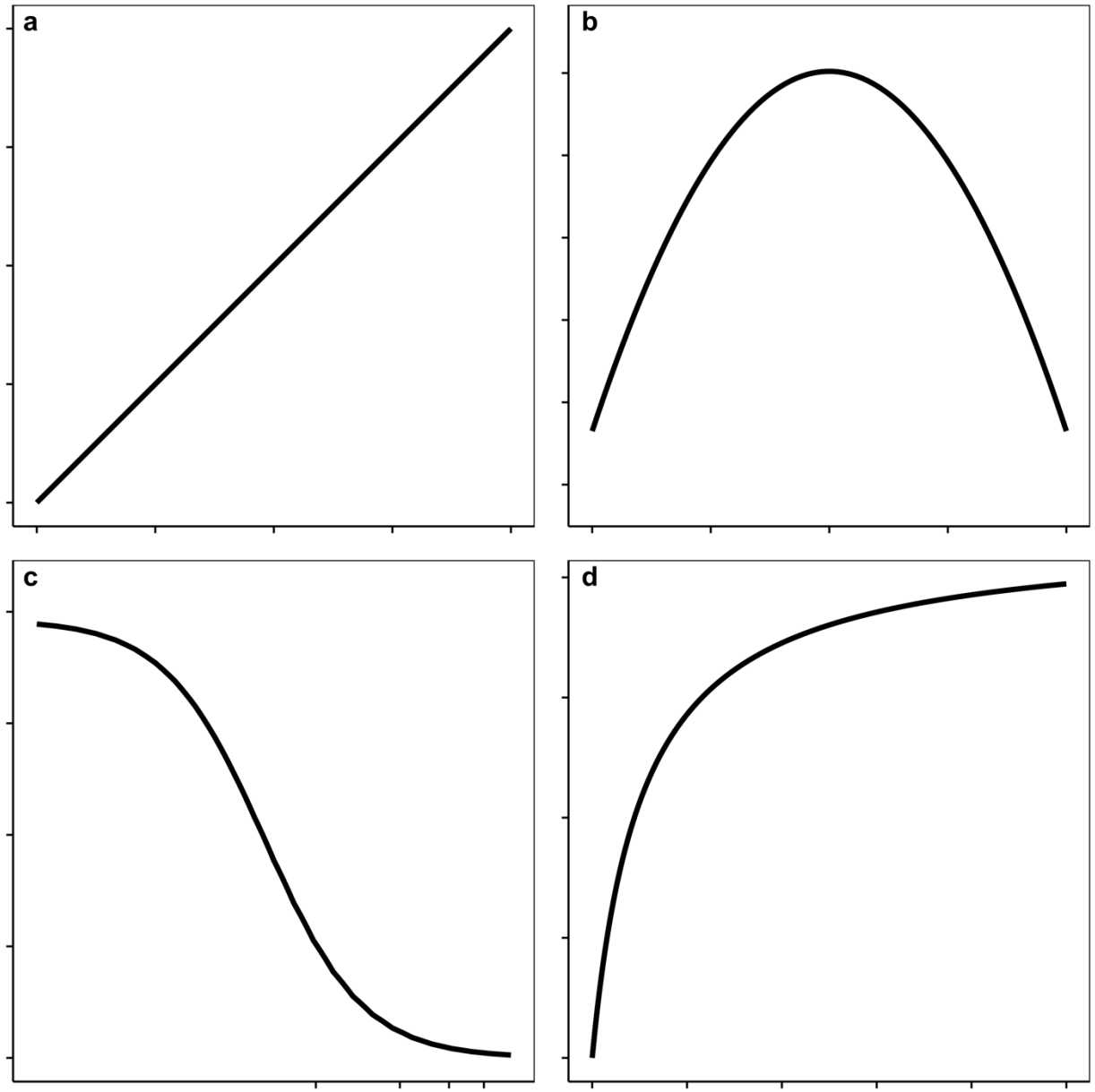


Figure 1. Common regression curves used to describe the data from crop-weed competition studies in additive design: a) linear; b) polynomial quadratic; c) sigmoid; d) rectangular hyperbola.

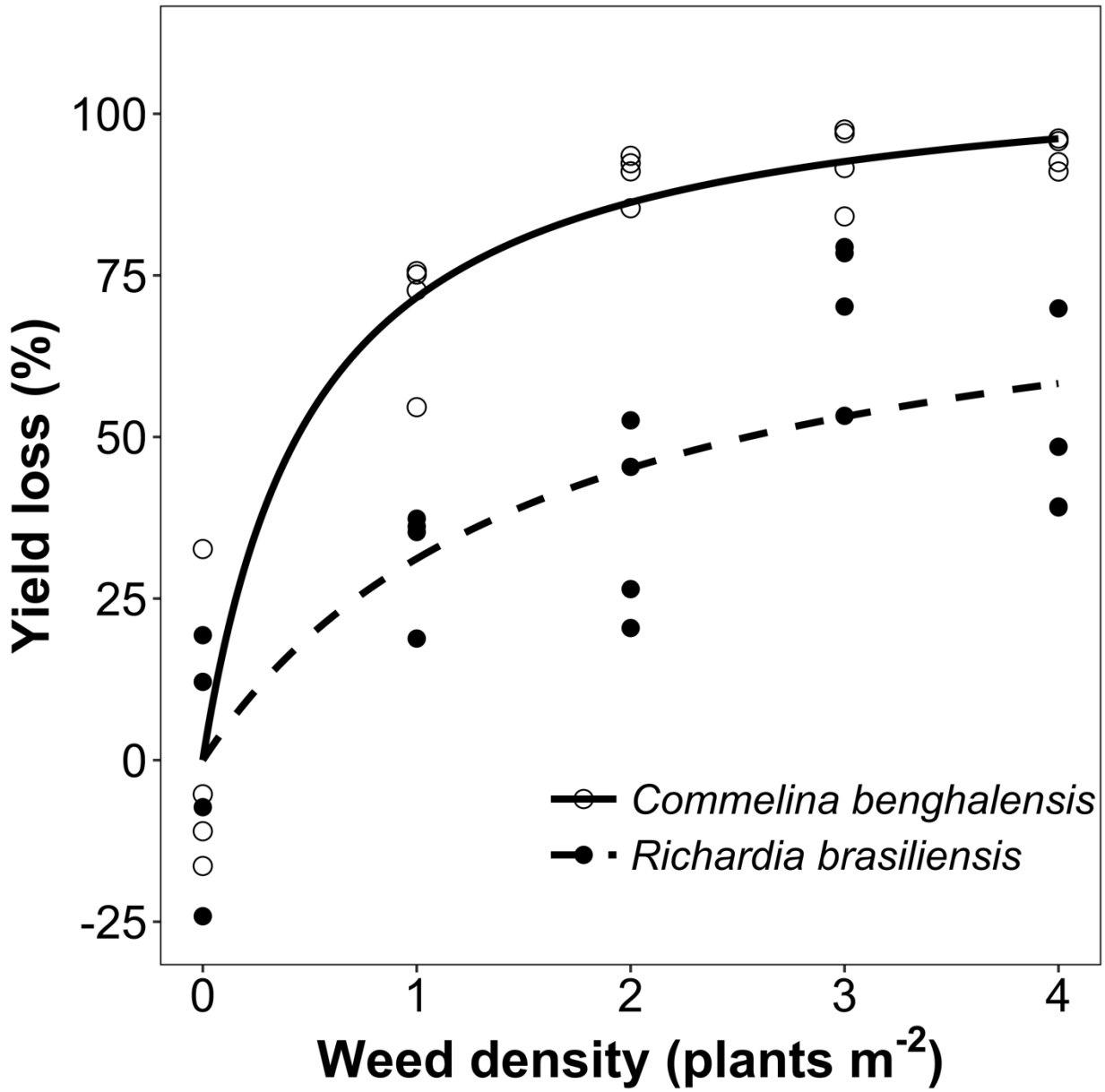


Figure 2. The relationship between corn yield loss (%) and weed density (plants $pot^{-1}$) described with a rectangular hyperbola model.

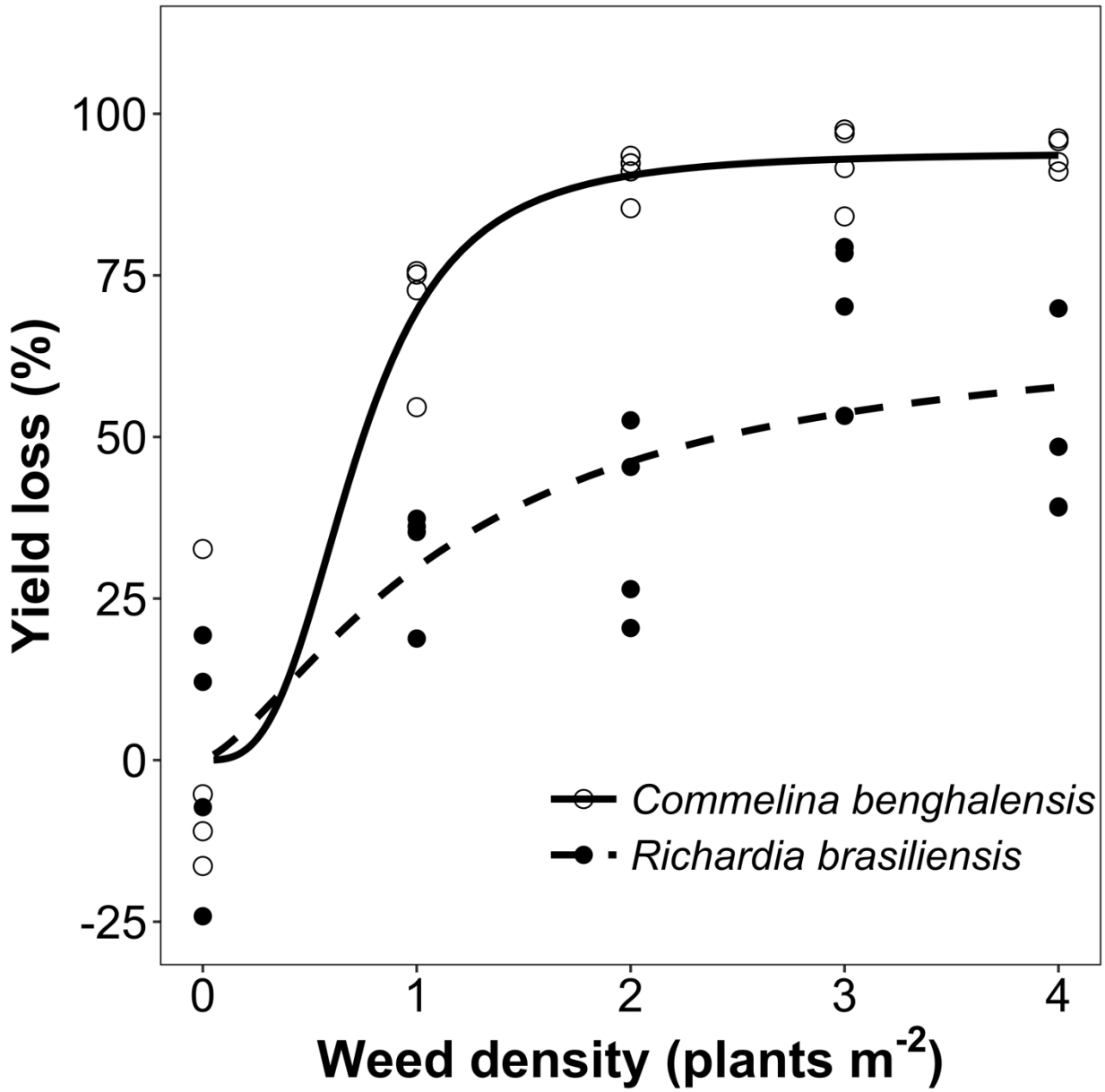


Figure 3. The relationship between corn yield loss (%) and weed density (plants $pot^{-1}$) described with a sigmoid model.

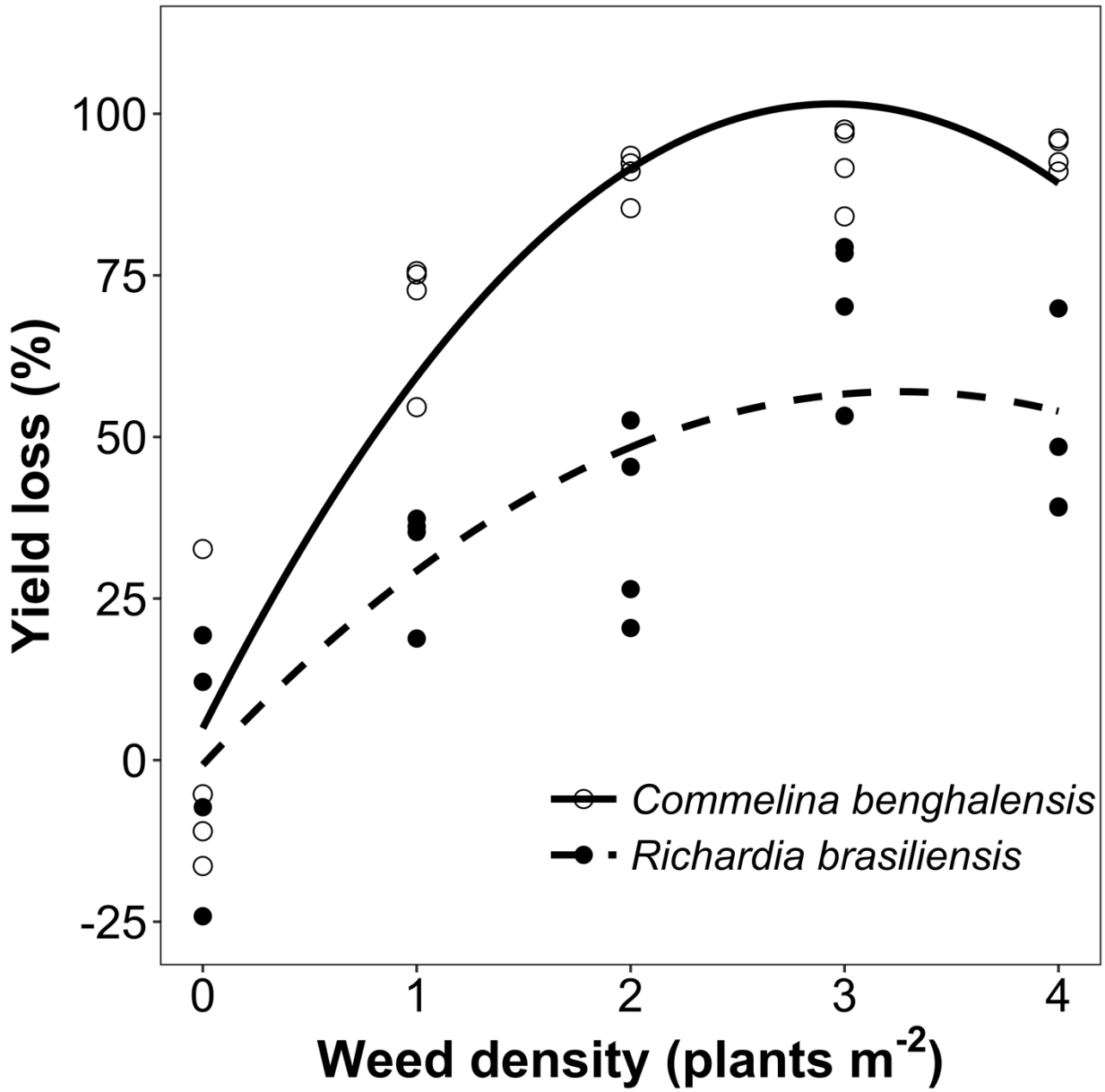


Figure 4. The relationship between corn yield loss (%) and weed density (plants $pot^{-1}$) described with a polynomial quadratic model.

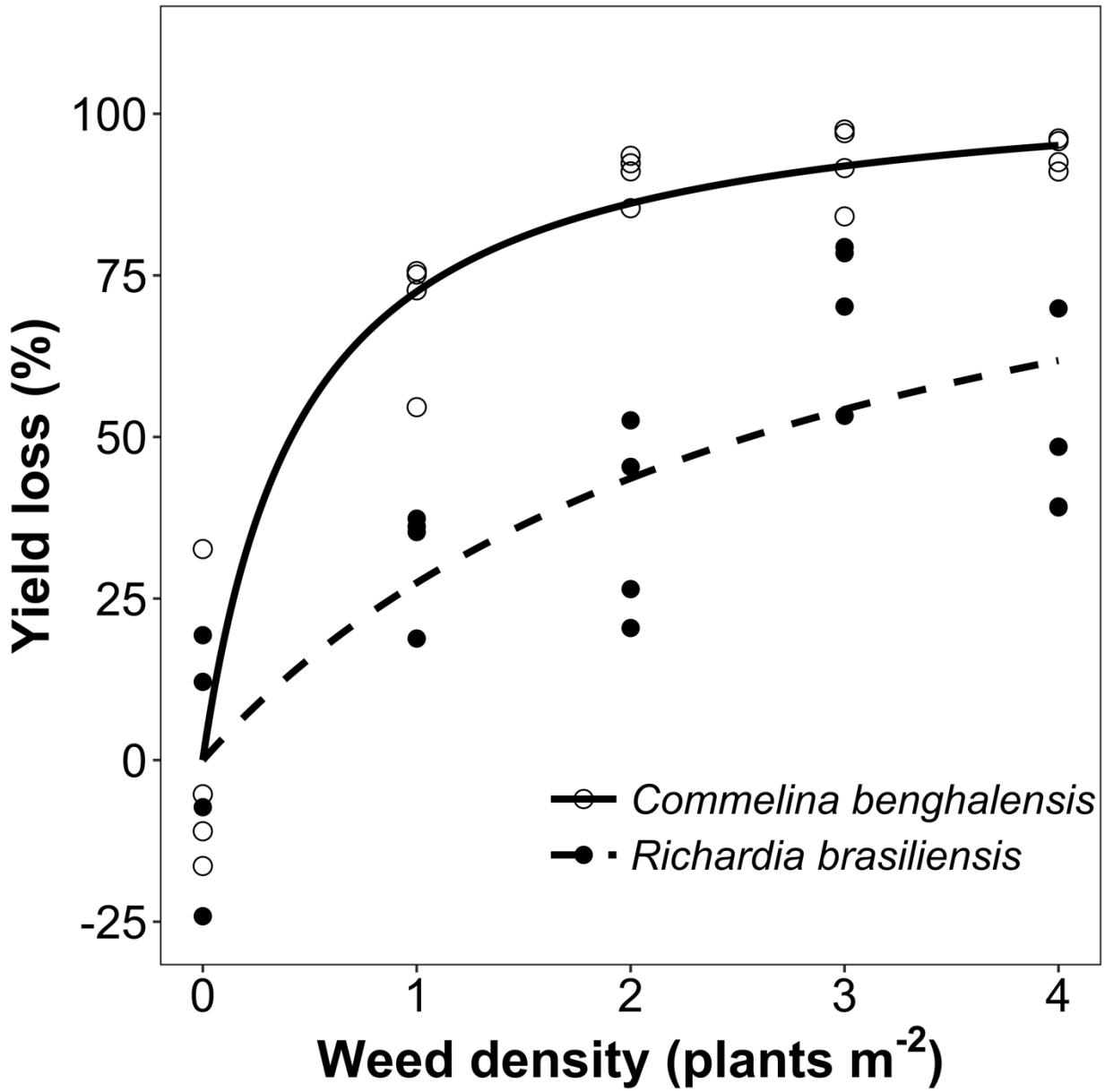


Figure 5. The relationship between corn yield loss (%) and weed density (plants $pot^{-1}$) described with a rectangular hyperbola model, using the model Red III.

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 | - |
| Sigmoid | *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 sigmoid).

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. Sigmoid 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. benghalensis*.

| Rectangular hyperbola model | Species | Model Selection† | | Goodness of fit§ | | |
|---|---|---|---|---|---|---|
| | | F-test | | AICc | RMSE | ME |
| | | F-value | P-value‡ | | | |
| Different *I* and *A* (Full) | *R. brasiliensis* | - | - | 332.2 | 13.3 | 0.92 |
| | *C. benghalensis* | | | | | 0.64 |
| Similar *I* and *A* (Red. I) | *R. brasiliensis* | 32.3 | *** | 368.2 | 22.2 | 0.84 |
| | *C. benghalensis* | | | | | |
| Similar *I* but different *A* (Red. II) | *R. brasiliensis* | 4.1 | ** | 333.9 | 14.0 | 0.94 |
| | *C. benghalensis* | | | | | 0.69 |
| Similar *A* but different *I* (Red. II) | *R. brasiliensis* | 0.7 | NS | 330.4 | 13.4 | 0.98 |
| | *C. benghalensis* | | | | | 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* | 106.1 | 10.3 | 10.3 | *** |
| | *C. benghalensis* | | | | |

†*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.