Fitting nonlinear models to describe *Brachiaria brizantha* seed germination

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Abbreviated abstract: The accumulated percentage of germination of *Brachiaria brizantha* seeds has a behavior characterized by a sigmoidal model. Therefore, the aim of this study was to evaluate the goodness of fit of the Logistic and Gompertz nonlinear models, in the description of *Brachiaria brizantha* seed germination using the dormancy breaking method (H_2SO_4) and temperature of 20-35ºC. The Gompertz model was presented as the best to describe the germination process over time.

Related publications:

– OLIVEIRA, C.M.G et al. duração do teste de germinação de *Brachiaria brizantha* cv. Marandu (Hochst. ex A. Rich.) Stapf. **Revista Brasileira de Sementes**, vol. 30, nº 3, p.030-038, 2008

– SEBER, G. A. F.; WILD, C. J. Nonlinear regression. New Jersey: J. Wiley,1989. 752 p

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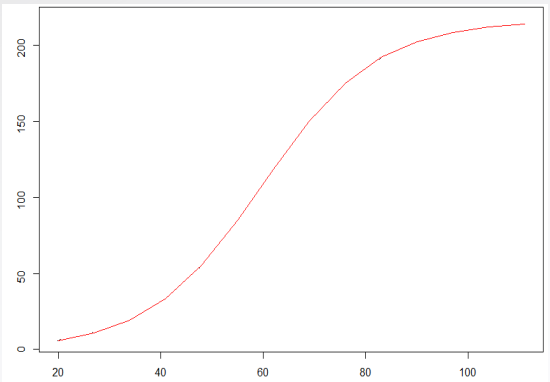
Problem

➢ *Brachiaria Brizantha* stands out as the most planted forage species in Brazil, being used by researchers in the field of technology and seed production.

➢ Seed germination, as well as other biological phenomena, generally has a sigmoidal behavior described by nonlinear models. Therefore, the aim of this study was to evaluate the goodness of fit of the Logistic and Gompertz nonlinear models, in the description of *Brachiaria brizantha* seed germination using the dormancy breaking method (H_2SO_4) and temperature of 20-35ºC.

Brachiaria Brizantha plant



Sigmoid Function Graph

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Methods

➢ The data analyzed to fit the models were extracted from Oliveira et al. (2008).

➢ A non-linear adjustment was performed with the germination percentage results, in which the estimates of the function parameters (α, β and κ) were determined. The non-linear regression models used were: Logistic (1) and Gompertz (2)

$$Y_i = \frac{\alpha}{1 + e^{K(\beta - x_i)}} + \varepsilon_i \quad (1)$$

$$Y_i = \alpha e^{-e^{k(\beta - x_i)}} + \varepsilon_i \quad (2)$$

➢ For residual analysis, the Shapiro-Wilk, Breuch-Pagan and Durbin-Watson tests were used.

➢The models were adjusted by the MMQ using the Gauss-Newton algorithm through the R software.
➢The goodness of fit of the model --> R^2, RSD and AIC.

Results and Conclusions

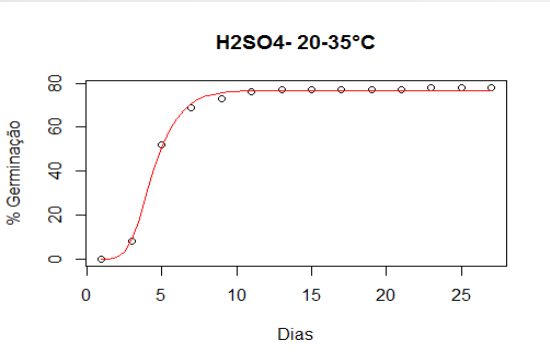
Table 1 - P-values of the Shapiro-Wilk (SW), Breusch-Pagan (BP) and Durbin-Watson (DW) tests and evaluators of goodness of fit, coefficient of determination (R2), residual standard deviation (RSD) and Akaike information criterion (AIC) for the dormancy breaking method (H2SO4) and temperature of 20-35ºC.

Models	SW	BP	DW	R^2	RSD	AIC
Logistic	0,008*	0,333	0,056	0, 994	2,056	64,540
Gompertz	0,113	0,279	0,069	0, 998	1,271	51,068

Table 2 - Estimates of the parameters of the Gompertz model

	Parameters		
Model	**α**	**β**	**κ**
Gompertz	76,873	3,938	0,817

Figure 1 - Adjustment of the Gompertz model to the data



Conclusion: The germination percentage of B.brizantha seeds described by the non-linear Gompertz model presents a good fit and adequate biological interpretation of the parameters.