Software PPBB_MX: potential productivity modelling of Brachiaria brizantha (cultivars Marandu and Xaraés)

E.R. Detomini and D. Dourado Neto
Agricultural Department - University of São Paulo, Piracicaba, SP. Mail Box 09 CEP 13418-900, Brazil, Email: detomini@esalq.usp.br

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Introduction Recent improvements in computer capacity and technology allow models to be built to simulate the attributes of many agricultural processes and systems. Although *Brachiaria brizantha* is the most cultivated tropical grass species in Brazil, there is no single tool to predict its production under optimal conditions. The objective of this paper is to present PPBB_MX software to calibrate and simulate (using a stochastical procedure) the shoot and total biomass potential productivity (output variables) of *Brachiaria brizantha* as a function of the following input variables: local latitude, season (from cutting date – Julian day), length of regrowth (time, days) and climate attributes (global solar radiation and air temperature).

Material and methods From use of an iterative method and field experimental data, obtained with high nitrogen supply and optimal water conditions (Detomini, 2004), a Visual Basic for Windows software was built – the PPBB_MX (Dourado Neto *et al*., 2004). This was developed from physiological principles according to a model concept based on the energy relations between the plant and the atmosphere (Heemst, 1986). Throughout the regrowth period roots and shoots were sampled. Fifteen equations were needed to predict simulated shoot dry matter values (kg/ha). These related to solar declination, day length, available photosynthetic active radiation flux density, degree-days, relative plant growth, leaf area index, canopy extinction coefficient, fraction of light interception by canopy, CO_2 assimilation, gross photosynthesis rate, accumulated gross photosynthesis, respiration rate, total biomass accumulation, root partitioning and shoot biomass accumulation.

Results An iterative method was used to create the procedures F1 (calibration function) and F2 (calibration factor). These were used to find, respectively, optimal values for CO_2 assimilation and root partitioning (both from general empirical equations) to calibrate the model against the field data, and then to simulate total biomass (including roots, kg/ha) and shoot biomass (Fspa) (kg/ha). From historical data for air temperature and radiation, which give a distribution of probabilities, the program generates 1000 randomised numbers for each climatic attribute for each day following the cutting date. Finally, a probabilistic distribution is generated providing 1000 possible values of FSpa. The histogram in Figure 1, for example, resulted from a simulation considering a regrowth of 66 d following a cutting date of 22 Nov. in Piracicaba-Brazil (latitude: 22.73). This location has a good set of historical data for atmospheric attributes. In this case, the normal distribution suggested some value between 16156 and 17458 kg/ha**,** as the probable magnitude of synthesised shoot biomass.

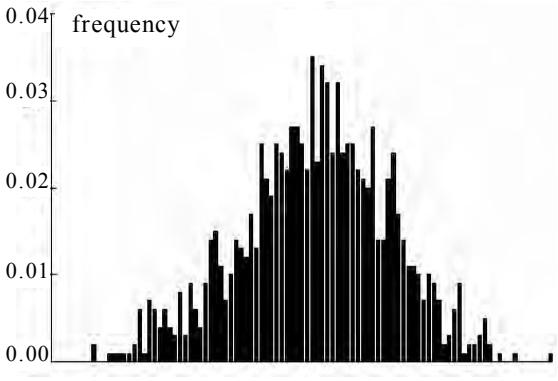

Figure 1 Simulation of potential shoot biomass production of *B. brizantha* cultivar Marandu - 1000 values

Conclusions From a stochastical procedure, the software PPBB_MX simulates satisfactorily the shoot and total potential biomass productivity (output variable) of *Brachiaria brizantha* (cultivars Marandu and Xaraés) as a function of the input variables season (from cutting date – Julian day), time of regrowth (days), climate attributes (daily means of global solar radiation and air temperature) and the local latitude.

References

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