54ª. Reunião Anual da Sociedade Brasileira de Zootecnia
24 a 28 de Julho de 2017
Hotel Bourbon Cataratas – Foz do Iguaçu – Brasil
ISSN 1983-4357

Theme 4 | Genetics, genomics, animal breeding and reproduction

Adaptability and stability of alfalfa genotypes using fuzzy controller

Reinaldo de P. Ferreira[1], Iara G. dos Santos*[2], Vinícius Q. Carneiro[2], Cosme D. Cruz[2],
[1]Embrapa Pecuária Sudeste, São Carlos/São Paulo; [2]Federal University of Viçosa, Viçosa/
Minas Gerais, Brazil;
*Master student – iara.santos@ufv.br

Alfalfa is one of the main forages used on world dairy production. The development and recommendation of alfalfa cultivars requires studies about the interaction between genotypes and environments and adaptability and stability. Using analyses based on computational intelligence can be a good alternative to evaluate genotypes adaptability and stability, since it facilitates the decision-making process to solve simple and mainly complex problems. This study aimed to apply fuzzy controller to evaluate the behavior of alfalfa genotypes in different seasons of the year. A total of 76 alfalfa genotypes were evaluated for dry matter production, in the spring of 2015 and summer and fall of 2016 by Embrapa Pecuária Sudeste (São Carlos, São Paulo), resulting in three different environments. The experimental design constituted of randomized blocks with three replications. All statistical analyses were carried out using GENES and MATLAB. A fuzzy controller based on Eberhart and Russell method was used to evaluate the stability and adaptability of the genotypes. This controller uses the general mean (βo), coefficient of regression ($\beta 1$) and coefficient of determination (R^2) to automate the genotype recommendation in general or specific adaptability. In addition, it allows to define the threshold of the general mean of dry matter production and R^2 to be considered in the recommendation. Thus, three thresholds for R^2 (60, 70 and 80%) were defined, maintaining the threshold of the general mean of dry matter production equal to the general mean of the experiments. After detecting genotype x environment interaction, the adaptability and stability analysis using Eberhart and Russell method was carried out, and the obtained parameters were submitted to the fuzzy controller. Using the controller with threshold of 60% for R^2, 26 genotypes were classified as of general adaptability, three as of favorable adaptability, and the others were poorly adapted. At the threshold of 70%, the classification of favorable adaptability genotypes was not altered. However, 23 genotypes remained classified as of general adaptability. Finally, at the threshold of 80%, the number of genotypes classified as of general adaptability reduced to 18 and the classification of favorable adaptability was not changed. The stability and adaptability method using fuzzy controller allows a greater flexibility in genotypes classification. This fact can be proven by observing the genotypes classification within each threshold. Depending on the rigor applied in the analysis, it is possible to obtain other possibilities of recommending genotypes for different environments. In all situations, the genotype ProINTA Patricia presented greater pertinence for the class of poorly adapted genotypes, SIRIVER 2 for the general adaptability class and P 30 for the favorable adaptability class. From the pertinence values it is possible to identify the best genotype within each class, increasing the efficiency of genotype recommendation.

Keywords: alfalfa, adaptability and stability, fuzzy controller, computational intelligence