STOVER TRAITS AS INDICATORS FOR FORAGE APTITUDE IN ARGENTINE HYBRIDS OF MAIZE

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ABSTRACT

The use of maize as forage in Argentina has increased in recent years. Nowadays, the seed sold in the country as forage maize belongs to selected grain hybrids. The development of wholly forage materials means a complete change in the architecture of the plant. Our aims were 1) To propose classification criteria of maize genotypes 2) To characterize maize hybrids used as forage on the Argentine market, based on yield and quality forage traits. Numerical techniques allowed the classification of the hybrids. Stover digestibility and stover soluble carbohydrates, indicative of forage quality traits, presented the greatest variability. These results would seem to suggest the need to select the maize hybrids through all its components, separately.

KEYWORDS

Maize, forage traits, stover, numerical taxonomy, digestibility

INTRODUCTION

In Argentina the use of maize (*Zea mays* L) as forage is frequent in many cattle areas. The whole plant in the field is consumed or indeed broken down to be kept in silos. At present, the seed sold in the country as forage maize belongs to selected grain hybrids. The area in Argentina planted with maize for forage production is over 700,000 ha and has been proved to be increasing constantly.

The development of wholly forage materials means a complete change in the architecture of the plant. According to Gunn (1975) the best hybrids for grain yield will not necessarily be the most adequate for dry matter production.

The purpose of this research was to characterize Argentine hybrids utilized for forage, discriminating them according to aptitudes, from yield and quality forage traits and to propose classification criteria which will allow for the separation of ideotypes.

MATERIALS AND METHODS

The materials utilized were: Cargill Record 160 (R 160), Cargill Semiden 5 (SD 5), Funk's Tronador (TRON), Morgan 506 (M 506) and Pioneer 3452 (P 3452).

The statistical design was standard randomized complete blocks with 4 replications, for 3 years in 3 environments. The evaluated traits were: Plant height, in m (PH); ear dry matter yield, in kg ha^{-1} (EY); stover dry matter yield, in kg ha^{-1} (SY); ear dry matter protein content, in % (EPC); stover dry matter protein content, in % (SPC); ear dry matter soluble carbohydrates content, in % (ESC); stover dry matter soluble carbohydrates content, in % (SSC); ear "*in vitro*" dry matter digestibility, in % (ED); stover "*in vitro*" dry matter digestibility, in % (SD).

The total protein content was determined by Microkjeldahl (AOAC, 1960). The soluble carbohydrates content was evaluated by the methodology proposed by Dumphy and Hanway (1976). The technique of Gabrielsen (1986) was employed to determine -*in vitro*- dry matter digestibility.

The basic data matrix OTUS *per* variables was established by averaging the values of the replications of all the environments (years and locations). The Manhattan distance coefficient was utilized to make a similitude matrix. The grouping of the OTUS was carried out by the unweighted pair group method, UPGMA. Principal Components Analysis (PCA) was used. Eigenvectors made up the new principal components axes on to which the OTUS were plotted (Sneath and Sokal, 1973).

RESULTS AND DISCUSSION

Table 1 shows the basic matrix of data OTUS *per* variables. Figure 1 shows the phenogram obtained. R 160 is grouped with M 506, whereas SD 5 is grouped with TRON. All four make up a subgroup which divides itself from P 3452.

The PCA allowed the identification of the variables that explain most of the variation in the above mentioned grouping. The most important traits in the first component are SD (0.939) and SSC (0.921). In the second component the trait SPC had the highest value (0.792). Next in importance was SY with an even lower value (0.702). In the third component the most important variable was the EY, reaching a value of 0.962. The first three components accumulate 86.6 % of the total variation and these were used to group the hybrids into two dimensional graphics (Figures 2, 3 and 4). It is observed from figure 2 that the first component separates P 3452 from the rest of the hybrids, this being due to showing a greater SSC and a highest SD compared with the rest (Table 1). The second component groups R 160 and M 506, which are separated from P 3452, TRON and SD 5. R 160 and M 506 showed the greatest SPC values (Table 1). The third component places R 160 and M 506 at the opposite points of the scale, while the remaining are at intermediate values (Fig. 3),.being R 160 and SD 5 the hybrids with greater EY.

Our results showed that P 3452 was the hybrid with a greatest SD, SSC and SY. Moreover it is found inside the group which contains a lower SP and a medium value in EY. This allows P 3452 to be identified as the hybrid which closest resembles the forage ideotype.

The stover traits are those which showed a greater discriminatory value in the first two components, in the third component EY is the most important. It indicates no significant correlation between forage yield and grain production. Similarly, the vegetative trait PH and the ear traits ESC, EPC and ED did not have a significant weight in the characterization of the OTUS under scrutiny. In this manner given that the first component contains the highest variance between the OTUS (46.25 %) and that the trait weighing most in this are traits indicative of forage quality (SD and SSC), we may conclude that these are the variables that present greater variation for the population of hybrids studied.

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Table 1
Basic matrix of data.

	R160	SD5	TRON	M506	P3452
PH	= 2.406	2.512	2.331	2.338	2.237
EY	= 10010	9549	9254	8567	9462
SY	= 10770	11750	11120	11500	12700
EPC	= 6.787	7.168	6.682	6.974	7.254
SPC	= 4.935	4.791	4.809	5.043	4.838
SSC	= 12.87	12.51	12.33	13.24	16.85
ESC	= 27.36	26.34	24.64	26.87	27.23
SD	= 57.45	54.86	53.91	57.50	58.65
ED	= 78.12	83.00	81.30	80.39	78.50

References: See MATERIAL AND METHODS.

Figure 1
Phenogram of the hybrids.

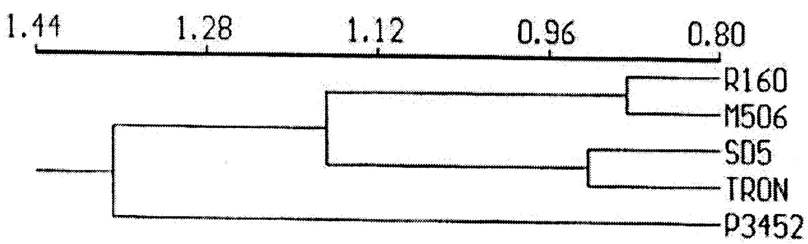

Figure 2
Biplot of the hybrids according to the first and second principal component axes.

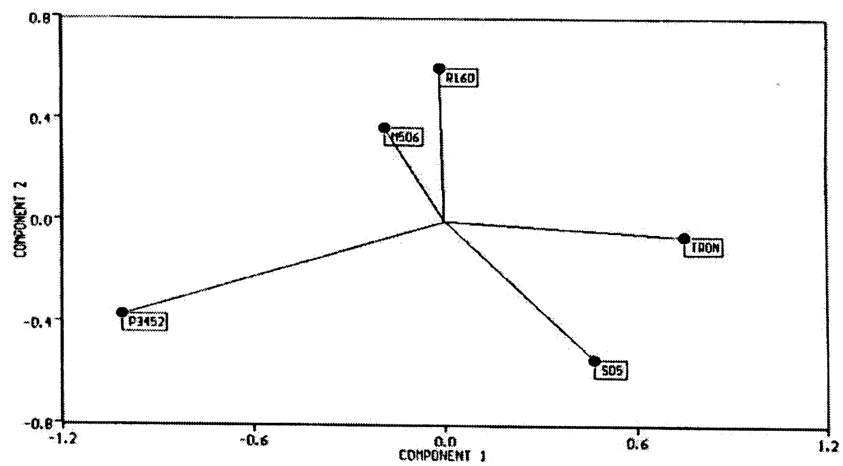

Figure 3
Biplot of the hybrids according to the first and third principal component axes.

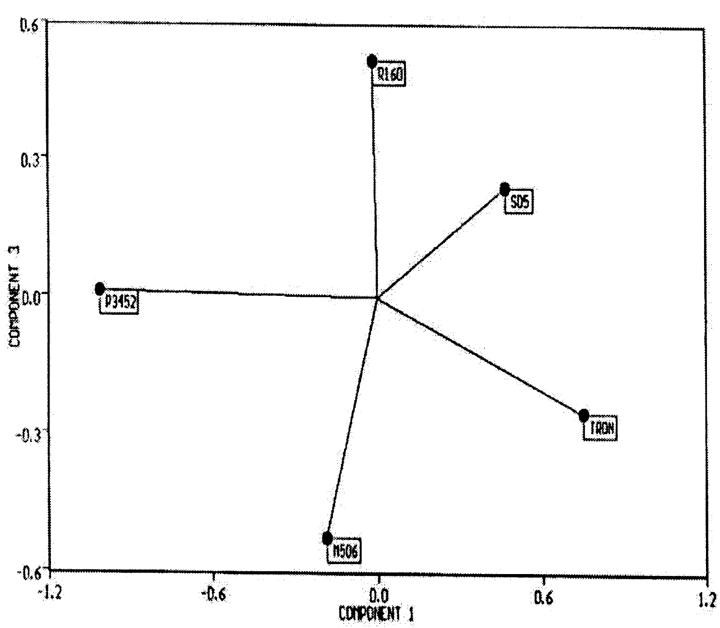

Figure 4
Biplot of the hybrids according to the second and third principal component axes.