

**EVALUATION AND UTILIZATION OF A TALL FESCUE GERMPLASM
COLLECTION AT PERGAMINO INTA, ARGENTINA**

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Abstract

One hundred and fifty four accessions of tall fescue (*Festuca arundinacea* Schreb.) representing different types grown around the world were evaluated at Pergamino Inta Experimental Station. A multivariate analysis was carried out to evaluate individual and group variations. Three principal components (PCs) explained 70 % of the variation. Cluster analysis (Ward method) allowed the identification of 7 groups of populations. Plants from the most promising populations were selected in order to form a new breeding gene pool. The main objective of this study is to develop a new cultivar with improved winter herbage yield. Selected genotypes were mostly of Mediterranean origin.

Keywords: Tall fescue, genetic resources, evaluation, utilization

Introduction

Tall fescue is a euroasiatic grass, broadly used for pastures in humid and sub humid Pampas in Argentina. This species grows well during cool winter, survives warm summers, and tolerates soil with poor drainage or low pH.

Although plant introductions have been an important source of germplasm for cultivar development, published data on the agronomic potential of foreign tall fescue in Argentina are rare.

At Pergamino Experimental Station many accessions of tall fescue were introduced in recent years, mainly from USDA collections. This collection represents different tall fescue types that are grown around the world. We can divide them into two main types according to their growth patterns. One is adapted to the north of Europe, and the other to Mediterranean environments.

The evaluation, characterization and screening of genetic resources are considered priorities in working collections associated with breeding as such information is crucial in choosing material for incorporation into breeding schemes (Tyler et al, 1987).

The objectives of this work were: a.) The evaluation of a tall fescue germplasm collection of different origin;

b.) to select materials to be used in the breeding programs with the aim to improve winter growth.

Materials and Methods

A collection of 154 accessions of tall fescue was evaluated. The germplasm origin was: Spain, France, Afghanistan, United Kingdom, China, Sweden, Portugal, Holland, Israel,

Japan, Algeria, Italy, Poland, Pakistan, Turkey, Russia, Switzerland, Tunisia, U.S.A., Iran, Germany, Yugoslavia and Australia.

Sowing was done in greenhouse and twenty plants of each accession were planted in the field in the autumn of 1996. Distance between plants was 20 cm, and between rows 45 cm. Plots were fertilized with nitrogen each autumn and spring.

Attributes scored or measured were: spring and winter vigor (1= low, 5= high); growth habit (1= prostrate, 9= erect); number of tillers (spring); panicles/plant; seed per panicle; persistence (1= Less than 30%, 2= 30-70%; 3= higher than 70%); susceptibility to stem rust (*Puccinia graminis* Pers.) in field conditions (1= susceptible, 4= tolerant); days to flowering since September 1.

Simple correlation analysis was carried out and significance was determined at the 5% level. Clustering of accessions was performed using an agglomerative hierarchical clustering procedure with squared Euclidean distance using the statistical analysis system (SAS, 1988). Values for each of the respective attributes were standardized to have a mean of zero and a variance of one, removing scaling effects.

Results and Discussion

Among all the materials evaluated, only five accessions originally from China, Turkey, Holland and Spain did not persist on the second year.

According to the correlation matrix eleven pairs of attributes correlated at 5 % significance level.

Earliness was associated with number of panicle/plant ($r: -0.70$), higher seed yield ($r: 0.47$), spring ($r: -0.61$) and winter ($r: 0.40$) vigor and stem rust (0.33). Stem rust was related also to spring vigor ($r: -0.57$). This disease affects the performance of many cultivars grown in Argentina.

Spring vigor was associated to the number of tillers per plant ($r: 0.41$), and panicle per plant ($r: 0.47$). Persistence related to winter vigor ($r: 0.47$), seed per panicle ($r: 0.38$) and panicle per plant ($r: 0.34$)

Multivariate analysis. The first three principal components (PCs) gave eigenvalues greater than 1.0 and all together explained 70 % of the accumulated variation (Table 1). Veronesi and Falcinelli (1988) explained 77 % of total variation in 48 introductions with four principal components. The first principal component included 37 % of the total variation and was associated mainly with panicles per plant, and days to flowering. Days to flowering were also the main characteristic that differentiated tall fescue in Alabama (van Santen and Collins, 1991), and in Italy (Veronesi and Falcinelli, 1988). The second principal component explained 22 % of the variation and was associated with spring vigor and rust tolerance. The third component was related to growth habit.

Cluster analysis. The cluster analysis identified seven groups. The principal characteristics associated with each cluster were those variables related to seed production, winter and spring vigor, and rust tolerance, as shown in Table 2. Accessions in cluster 3 showed some agronomic characteristic considered important for commercial cultivar. Most of them were originated in the Mediterranean region. This type of material has a growing pattern with a peak of production during autumn and winter, but it was generally considered less adapted to the north and central area of Argentina. As considered by Frame (1972) one of the main uses

for this type of material is for crossing with local material to improve winter forage production.

Utilization. Eighty-four plants from 45 populations were selected. Populations were selected according to rust tolerance, winter vigor, days to flowering, panicle production and persistence. All populations were endophyte (*Neotyphodium coenophialum*) free. Selected genotypes were mostly of Mediterranean origin. Progenies are being evaluated for seasonal herbage yield, seed production and digestibility in order to form a new gene pool. First results showed an important increase in winter growth, overyielding the check variety. This winter production was not associated with earliness to flowering as it usually occurs in types found in the north of Europe. This new gene pool selected is an important step regarding breeding for winter production in Argentina.

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Table 1 - Eigenvalue, percent of the variability explained by each component (PC) and accumulated variability.

Principal component (PC)	Eigenvalue	% Variability	Accumulated variability
PC 1	3,31	0,37	0,37
PC 2	1,95	0,21	0,58
PC 3	1,06	0,12	0,70

Table 2 - Clustering pattern of different accessions along with their geographical origin and distinctive characteristics.

Cluster	Number of accessions	Origin	Principal characteristics
1	13	Spain(3), Switzerland(2), Iran(2), Italy(2), Morocco(2), Russia(1), Turkey(1)	Late to flowering, tolerant to stem rust, low seed production, low spring and winter vigor, low persistence, low tillering capacity.
2	26	Russia(5), Poland(4), Italy(3), Germany(2), Australia(2), Yugoslavia(2), Holland(1), Sweden(1), Pakistan(1), Iran(1), Tunisia(1), Japan(1), Spain(1), Turkey(1)	Low winter vigor, low seed production, late to flowering, susceptible to stem rust.
3	29	Israel(8), Morocco(5), Algeria(4), Australia(3), Spain(3), Tunisia(2), United Kingdom(1), Portugal(1), Switzerland(1), Poland(1)	Tolerant to stem rust, high winter vigor, high seed yield, high persistence.
4	38	France(11), Yugoslavia(4), United Kingdom(3), Spain(2), Germany(2), Sweden(2), USA(2), Japan(2), Holland(2), Algeria(2), Tunisia(2), China(1), Russia(1), Portugal(1), Afghanistan(1)	Early to flowering, susceptible to stem rust, low winter vigor, high tillering capacity, intermediate seed yield.
5	27	France(12), Spain(5), USA(2), Holland(2), Germany(2), Australia(1), Japan(1), Russia(1)	Low winter vigor, susceptible to stem rust, early to flowering, low persistence.
6	8	Spain(3), Turkey(1), Japan(1), Switzerland(1), Iran(1), Afghanistan(1)	High tillering capacity, intermediate earliness, low seed production, tolerant to stem rust.
7	13	France(4), Morocco(2), Spain(1), Australia(1), United Kingdom(1), Pakistan(1), Tunisia(1), Japan(1), Portugal(1)	Intermediate winter vigor, erect growth habit, early to flowering.