

# **Evaluation under Grazing of Experimental Varieties of Tall Fescue with Different Levels of Summer Dormancy in Mixture with White Clover - Productivity and Composition**

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## **ABSTRACT**

In South America, tall fescue [*Lolium arundinaceum* (Schreb.) Darbysh.] is the perennial grass forage most used in the mild region. The favorable agronomic conditions, ample geographic distribution, resistance to grazing and tolerance to biotic and a biotic stress, led to – since 1996 – introductions, evaluations and breeding programs of the species. The existing ample genetic variability enabled the obtaining of materials, with different agronomic characteristics. The goal was to characterize the production of dry matter, dormant levels and complementation with white clover, of experimental varieties of Mediterranean fescues obtained in Argentina. The experiment was cultivated in March 2007 in the Experimental field of Gentos S.A. in Argentina. An experimental randomized block design with 4 repetitions was used. The data for the period March 2007-January 2009 was evaluated. Significant differences were detected in the seasonal and total dry matter production among the tested materials, as well as in the composition of the white clover (*Trifolium repens* L.). Ample differences were detected between materials in the summer dormancy, softness of leaf, animal preference and tiller density. The dormant level present in the different materials seems to affect the fescue's productivity. In addition, levels of growth of white clover are affected by the larger or minor grade of dormancy level and the plant structure. Mediterranean fescues have characteristics that show adaptation advantages that make them very valuable materials for use in new scenarios of cattle activity worldwide.

## **INTRODUCTION**

Tall fescue is the perennial grass most used in the mild region of South America (Bertín y Rosso, 1990; Maddaloni y Ferrari, 2001). It is characterized for its high potential and flexibility to varying soil conditions (Mazzanti et al., 1992). In Argentina, Tall Fescue is distributed in all the humid and sub humid Pampa Region, reaching the West of this region with rainfalls below 500 mm.

The materials that were most widespread in the national market corresponds to the North Europe type and have been used to perform genetic breeding in Argentina and Uruguay (Maddaloni y Ferrari, 2001). The Mediterranean materials were introduced for its evaluation by the end of the 1980s, proceeding mainly from Europe (France, Italy and Spain) (Bertín y Rosso, 1990), these materials did not have propagation in the South American market.

Currently, with the National Registry of Cultivars in Argentina (INASE, 2009) there exist 55 cultivars registered. Only 6 of those cultivars correspond to the Mediterranean type; and 3 of them are widely spread and cultivated in Argentina and Uruguay. The main advantages of the Mediterranean materials are: high and strong winter growth (Milne 2001); better persistence in extreme summer conditions (Malinowski et al., 2005); better legume compatibility (Scheneiter & Amándola, 2008); and greater health of leaf (Carrete, 2001).

In 1996, within the breeding program of the species, Gentos S.A. initiates the introduction and evaluation of the ecotype collections of Mediterranean tall Fescues. The wide genetic variability found in the species enabled developing and obtaining of materials, with different agronomic characteristics.

The main goal of this project was to evaluate and characterize the agronomic behavior of different Mediterranean fescue materials, obtained in the breeding program; determine the seasonal distribution of dry matter production; legume compatibility and determine the existence of different levels of summer dormancy.

## **MATERIALS AND METHODS**

The materials used correspond to six pre-commercial lines and three breeding lines developed in the tall fescue breeding program (Gentos S.A.). Commercial materials, continental and Mediterranean, were used as controls in the trial.

Plots were established at Pergamino, Buenos Aires (33° 55' S – 60° 22' W), on March 16, 2007. Plots were arranged in a complete randomized block design with 18 treatments replicated four times, each plots measuring 13.2 m<sup>2</sup> (2.2 m x 6 m).

Seeds were planted with small-plot planter in direct drilling, at row spacing of 0.19 m and seeding rate of 15 kg ha<sup>-1</sup> tall fescue and 3 kg ha<sup>-1</sup> “Goliath” white clover and 100 kg<sup>-1</sup> diamonium phosphate. The pasture mass was assessed pre-grassing by sheep, dry matter was measured by harvest of 0.25 m<sup>2</sup> quadrants. Samples were sorted for botanical composition. The number of live tillers was recorded in the second year of trial during December 2008.

Data were analyzed using ANOVA procedure, specified in InfoStat/P (Version 1.1- Universidad Nacional de Córdoba, Estadística y Diseño - F.C.A., 2002).

## RESULTS AND DISCUSSION

Total annual rainfall was 1196 mm in 2007 and 703 mm in 2008 compared with the long term average annual rainfall (1965-2007) of 1162 mm. Precipitations during 2007, were atypical; abundant during autumn but scarce during spring and summer. This tendency continued during 2008 from April to October rainfalls were very low.

The results shown in this trial test correspond to the period between March, 2007 to January, 2009. In this period 10 samples of forage production were taken and grouped in different growing seasons (Figure 1).

During the establishment period, differences in initial vigor were noticed between materials (Table 1). Some of them (Line 01 and Line M25) showed a lower initial vigor compared to Flecha. Other materials (Line 02 and Line 12) were similar to Flecha and there was a third group of materials that proved to be superior to Flecha and similar to the growth of continental type fescues. Initial vigor is one of the weakest characteristics of Mediterranean tall fescues since generally they have less initial vigor when compared with Continental fescues (Hill et al., 1985).

The materials of Mediterranean fescues showed differences in softness of leaf, animal preference and tiller numbers ( $P < 0.01$ ) (Table 1). Most of the pre-commercial materials of Mediterranean fescues had a greater tiller number than the continental tall fescues (Table 1). Total forage production of this trial differs from the measurements that are regularly carried out for the species in this type of assessment (Bertin and Rosso, 1990). This was due to very low rainfalls during autumn 2007 and during the entire 2008 (Table 2).

Significant differences ( $P < 0.01$ ) were found in the summer dormancy score, both in 2008 and in 2009 summer evaluations (Table 1). Most of the Mediterranean fescues tested presented summer dormancy, 2 of them (Line 01 and Line 02) were the ones that showed the greatest dormancy level. Other 3 materials (Line M27, Line M24 and Line M25) followed in the dormancy scale. Three lines were similar to Flecha (Line 09, Line 11 and Line 12).

The dormancy mechanisms is very important for the adaptation in areas where the stress summer period is very severe (Malinowski et al., 2005); but at the same time this characteristic can be relevant in areas where the stress summer conditions are not quite determinant. The cease or reduction in the growth during summer season may favor that components of mixtures demonstrate its potential for growth in this period.

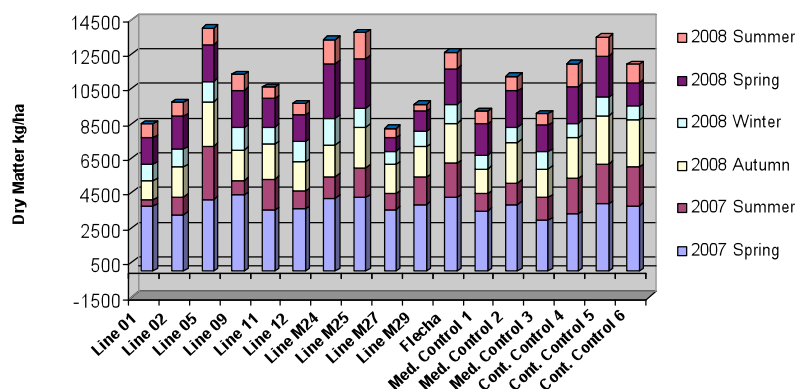
In the results of dry matter of the fescue material that showed higher summer dormancy, is the one that has the highest composition of legume in the mixture (58%) (Table 2). When comparing the distribution curves of different forage materials, it is observed that materials with higher summer dormancy complement very well with the growth of white clover in the mixture (Line 01, Line 02, Line 09, Line 12 and Line M24). Intermediate dormant materials have lower percentages of white clover in the composition of the pasture (Line 11, Line M25, Line M27 and Line M29). In the continental-type materials, the legume component never exceeds the production provided by the Fescue. (Figure. 2).

## CONCLUSIONS

Some of the evaluated pre-commercial materials showed a high dry matter winter growth, higher than the controls of Mediterranean fescues used in the trial. All Mediterranean materials showed summer dormancy; some of them have greater dormancy levels than the Mediterranean controls.

There is an association between the capacity of summer dormancy and legume compatibility, levels of growth of white clover are affected by the grade of dormancy level. Differences exist in the softness of leaf and in animal preference, which can reveal differences in the aspect of forage quality between these materials.

Mediterranean tall fescues, in addition to the advantage in forage production during the winter, have other characteristics that show adaptation advantages that make them very valuable materials for use in new scenarios of cattle activity worldwide.



**Figure 1.** Seasonal dry matter production in tall fescue (kg/ha).

**Table 1.** Characteristics of tall fescue materials.

	Initial vigor Scor (1-5) <sup>A</sup> 03/04/07	Number of tillers/m <sup>2</sup> 28/12/08	Summer dormancy <sup>B</sup> 14/02/08	Summer dormancy <sup>B</sup> 13/01/09	Soft leaf (1-5) <sup>C</sup> 15/09/08	Animal preference Score (1-5) <sup>D</sup>
Line 01	2,6	2.959	2,6	1,6	3,0	3,2
Line 02	3,8	2.862	2,8	1,9	3,5	3,4
Line 05	4,9	2.161	5,0	4,0	2,8	2,0
Line 09	4,8	3.419	2,75	1,9	2,0	2,5
Line 11	4,5	3.725	3,0	1,1	2,8	3,3
Line 12	3,9	3.045	2,5	1,0	3,5	3,5
Line M24	4,1	3.365	2,6	2,0	2,0	1,5
Line M25	3,1	4.166	2,5	2,2	2,5	1,5
Line M27	5,9	3.311	2,6	1,8	5,0	4,6
Line M29	5,3	3.131	2,6	1,5	4,0	4,1
Flecha	3,8	3.284	3,0	2,5	3,5	3,2
Mediterranean Control 1	4,8	2.696	2,9	1,1	2,0	2,8
Mediterranean Control 2	4,1	3.394	2,8	1,8	3,5	3,0
Mediterranean Control 3	4,4	2.591	2,9	1,6	3,5	3,0
Continental control 1	3,6	2.473	3,2	3,6	4,2	4,0
Continental control 2	4,5	2.454	5	4,1	4,5	4,0
Continental control 3	4,4	2.451	4,3	3,5	3,5	2,9
I.s.d. (P=0.01)	0.2	138.92	0.92	1.46	0.75	0.48

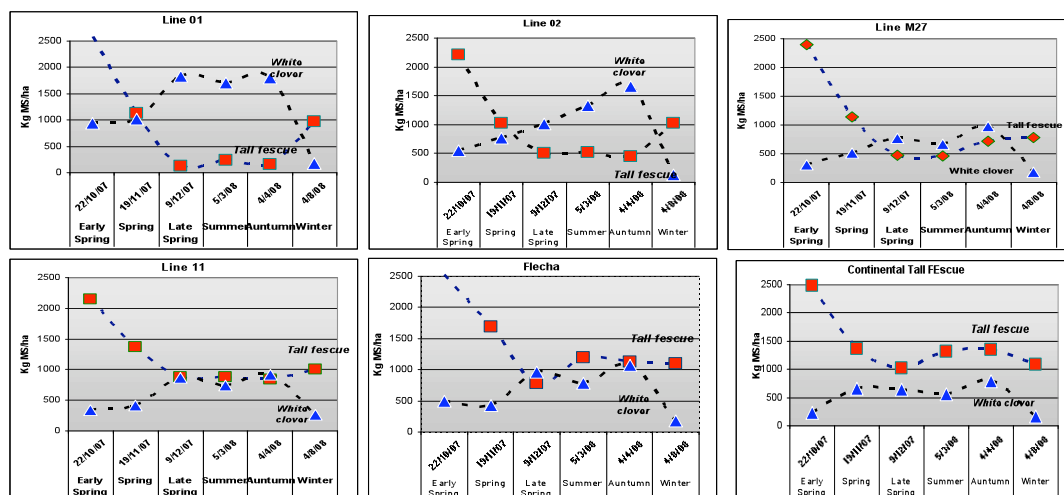
<sup>A</sup> Vigor scale 1 (Low), 5 (High) - <sup>B</sup> Summer dormancy 1 (Low growth), 5 (Good growth)

<sup>C</sup> Soft Leaf 1 (Tough) to 5 (Soft leaf) <sup>D</sup> Animal preference 1 (Few grazed), 5 (completely grazed).

**Table 2.** Tall fescue and white clover dry matter production

	Tall fescue Total dry matter kg/ha	White clover Total dry matter kg/ha	TOTAL Tall fescue + white clover	% White clover
Line 01	6.149	7.476	12.684	59
Line 02	7.002	5.444	11.182	49
Line 05	10.908	2.567	12335	21
Line 09	8.255	4.612	11.699	39
Line 11	8.293	3.547	9.401	38
Line 12	7.436	5.041	11.440	44
Line M24	8.814	4.599	12.092	38
Line M25	9.374	3.567	11.591	31

Continue Table 2				
	Tall fescue Total dry matter kg/ha	White clover Total dry matter kg/ha	TOTAL Tall fescue + white clover	% White clover
Line M27	6.913	3.402	9.372	36
Line M29	8.041	2.954	9.076	33
Flecha	9.613	3.928	12.338	32
Mediterranean Control 1	6.666	4.641	10.400	45
Mediterranean Control 2	8.282	4.289	10.978	39
Mediterranean Control 3	6.863	3.429	9.621	36
Continental control 1	8.507	4.276	11.510	37
Continental control 2	10.027	3.048	11.675	26
Continental control 3	9.495	3.382	11.240	30
I.s.d. (P=0.01)	1605.7	778.5	2096.3	



**Figure 2.** Seasonal dry matter production of tall fescue and white clover.  
Data from some materials (Line 01, 02, 11 M27, Flecha and continental material).

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