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Adaptation and Some Quality Parameters of Cool Season Turfgrass Species in Samsun Conditions

Sedat Arslan[1,a], Zeki Acar[1,b], İlknur Ayan[1,c,*]

[1]*Department of Agronomy, Agricultural Faculty, Samsun Ondokuz Mayıs University, 55270 Samsun, Turkey*
[*]*Corresponding author*

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ABSTRACT

The aim of this study is to determine adaptation and quality parameters of some cool season turfgrass cultivars and species, In the scope of this study, leaf form, variation of leaf colour according to the seasons, tiller number, thinning ratio, weed ratio and general appearance of the species were determined. The experiment was established according to confounding design with four replications in Samsun Conditions at November, 2010. According to 1000 seed weight and characteristics of the plants seeding ratios were determined as pure and viable seed as follows; *Lolium perenne* 40 g m^{-2}, *Festuca rubra* var. *rubra* and *Festuca rubra* var. *commutata* 30 g m^{-2}, *Festuca arundinacea* 40 g m^{-2}, *Poa pratensis* 20 g m^{-2}, *Festuca rubra trichophylla* 30 g m^{-2}, *Agrostis stolonifera* and *Agrostis tenuis* 5 g m^{-2}, *Festuca ovina* 25 g m^{-2}. According to the results obtained from this study it was determined that species/cultivars have some superiority to each other because of their different morphological and physiological characteristics. When we consider weed competition, *Lolium perenne* and *Festuca arundinaceae* cultivars have to be added to the mixture in order to decrease weed competition. There was colour variation distinctively depending on the seasons for all species. But, compare to the others, cultivars of *Agrostis sp*. and *Poa pratensis* cultivars have the potential to keep leaf colour in different seasons. Leaf form and appearance of *Festuca rubra*, *Poa trivialis* and *Festuca ovina* are better than the others. In order to keep good conditions of turfgrass areas, especially after cutting in summer period, *Poa pratensis* and *Poa trivialis* should added in mixtures to get benefit their higher regenerating power.

[a] *sedat_1925@hotmail.com* *http://orcid.org/0000-0002-1407-9018*
[b] *zekiacar@omu.edu.tr* *http://orcid.org/0000-0002-0484-1961*
[c] *ilknuray@omu.edu.tr* *http://orcid.org/0000-0002-5097-9013*

Introduction

In the contrary of urbanization and industrialization, recreation area is decreasing day by day. In order to supply human shelter requirement concrete apartment buildings are increased, view of the cities changed and consequence of those issues life quality decreased while stress of humanity is rising. Human is trying to live in congested areas, started to create small green areas inside the cities (Avcioglu, 2014). The most important part of outdoor recreation areas is turfgrass. These areas are used commonly for improve architectural, scenery and aesthetic quality. Heat, watering and drought are the most important factors that restrict the growing of grasses during summer period (Jiang and Huang, 2001). Before choose the grasses, we have to know their usage aim, ecological conditions, sustainability, irrigation and appearance of them (Harivandi et al., 1984). Turfgrass has important functions on sports areas, in addition to around the houses. Turf grass species and cultivars selected for sports areas should be resist to pressing on. This trait is crucial for a turf grass, if it is used in sport areas (Yazgan et al., 1992). Before establish a sport or recreation area, turfgrass cultivars should be suitable to climatic conditions of the region. To know the adapted cultivars in the region is definitely necessary. Turfgrass plants, in addition to climatic adaptation, should satisfy expectations in terms of harmony of each other, persistence, appearance and aesthetic. Indicator of satisfaction is evaluated as turfgrass quality. Quality of turfgrass is divided two parts. The first one is individual quality of plants like as; colour, growing speed, growing structure, root growing, resistance to cutting depth and frequency, pressing on, drought, heat, disease and insects. The second one is general characteristics like as; harmony each other, uniformity, appearance, smoothness, density and hay yield (Beard, 1973; Altan, 1989; Uzun, 1989; Acikgoz, 1994; Avcioglu, 1997).

Cool season grass are suitable to North, East and Central part of Turkey, however warm season grass are more common in South and South-West regions. Province of Samsun is take place in Black Sea Region of Turkey. The area is very suitable for cool season grass due to its cool and rainy winter, mild and humid summer climatic conditions. Previous studies showed that turfgrass cultivars belongs to *Lolium perenne* L., *Poa pratensis* L., *Festuca sp*., *Agrostis sp*. are quite suitable to this region (Acar and Ayan, 2012; Avcioglu, 2014). The aim of this study is to determine adaptation and quality parameters of some cool season turfgrass cultivars and species, In the scope of this study, leaf form, variation of leaf colour according to the seasons, tiller number, thinning ratio, weed ratio and general appearance of the species were determined.

Material and Methods

The experiment was established according to confounding design with four replications in Samsun Conditions at November, 2010. Plot sizes were 2×1=2 m^2, plot number were 40×4=160 and total experiment area was 160×2=320 m^2. Species and cultivars used in this study are given Table 1.

According to 1000 seed weight and characteristics of the plants seeding ratios were determined as pure and viable seed consider to germination test as follows; *Lolium perene* 40 g m^{-2}, *Festuca rubra* var. *rubra* and *Festuca rubra* var. *commutata* 30 g m^{-2}, *Festuca arundinacea* 40 g m^{-2}, *Poa pratensis* 20 g m^{-2}, *Festuca rubra trichophylla* 30 g m^{-2}, *Agrostis stolonifera* and *Agrostis tenuis* 5 g m^{-2}, *Festuca ovina* 25 g m^{-2}. (Beard, 1973; Hope, 1978; Oral and Açıkgöz, 1999). The seeds scattered with hand on plots and compressed. Ten days earlier of seeding 4 kg da^{-1} (N-P-K:15-15-15) composite fertilizer, after full covering and each month from spring 10 g m^{-2} ammonium nitrate were applied (Avcıoğlu, 2014). Sprinkler irrigation was made from June to October when it is necessary. All observations and measurements were made in the second year (Anon., 2001).

Leaf form (1-9); width of the characteristics leaves of the plants were measured in spring as mm. 1= Highly coarse (> 4 mm), 3=Coarse (3-4 mm), 5=Medium (2-3mm), 7=Thin (1-2 mm), 9= Highly thin (< 1 mm).

Leaf colour (1-9); observations were made middle of the months of spring, summer, autumn and winter. 1= yellow, 3= light yellow-green, 5= green, 7= dark green, 9= highly dark green.

Tiller number (1-5); after second cutting in spring it is observed to investigate dense of tillers. 1= highly sparse, 3= medium, 5= highly dense.

Thinning ratio (1-9); it is observed the end of the second year as 1-9 scala. 1= highly sparsely, 3= sparsely, 5= medium, 7= dense, 9= highly dense.

Weed ratio (1-5); it is determined by considering weed number at the end of the second year (Anon., 2001). 1= high, 3= medium, 5= weed free.

General appearance (1-9); it is determined by considering uniformity, colour, form, vividness, weed ratio in four seasons. 1= very bad, 3= bad, 5= medium, 7= good, 9= very good.

The data obtained by this study were analysed by using SPSS program according to confounding design (Gülümser et al., 2013).

Table 1. Species and cultivars used in the study.

Species	Cultivars
Lolium perenne L. (LP)	Roadstar, Evening Shade, Pearlgreen, Topgun Caddieshack, Recitial
Festuca arundinacea Schreb. (FA)	Millenium, Jaguar, Tomahawk, Lucky, Apache
Festuca rubra L. subsp.commutate (Frc)	Intrugue, Cassanava, Raymond, Musica, Y-5
Festuca rubra L. subsp.rubra (Frr)	Gondolin, Elliot, Avolubon, Redskin, Bassonava, Franklin
Festuca rubra trchophyla (Frt)	Zamboni
Festuca ovina L. (Fo)	Auroa, Marco Polo, Nordic, Bornito, Ridu
Poa pratensis L. (Pp)	Brooklawn, Avoulance, 4season, Europa, Everest, Compact, Gerenimo
P0a trivialis L. (Pt)	Cypress, Starlite
Agrostis stolonifera L. (As)	Truline
Agrostis tenuis Sibth. (At)	Highland Bentgrass, Highlandbent

Results and Discussion

Leaf Form (1-9)

Leaf width of turfgrass plants is formed with the interactions of genetic and environmental conditions. For this reason, the highest and lowest leaf width of turfgrass plants should be determined and it should consider for selection process (Avcioglu, 2014). In terms of leaf form there were significant differences amongst the species. According to the result, coarse leaves were observed in *Festuca arundinacea* (3.3) and it is differentiated from the others (Table 2). The cultivars belong to *Festuca sp*. and *Poa trivialis* had thinner leaf form (Table 2 and Figure 1). These results are compatible to some previous findings, such as; leaf blades of *Festuca* plants twist on, thus their appearance is thin (Hubbard, 1992; Beard, 1973); *Festuca arundinacea* has the most coarse leaf form (Acikgoz and Basbug, 1993; Varoglu, 2010; Oztarhan, 2010). Because its leave sizes are bigger than the other species (Acar and Ayan, 2012).

Leaf Colour and Ranging of Leaf Colour Depending on the Seasons (1-9)

The colours of the species and colour variation depending on the seasons are given in Table 2 and Figure 2. The colour was altered significantly from season to season in all species. Colour alteration was limited in *Festuca rubra* and *Festuca ovina*, compare to the other species.

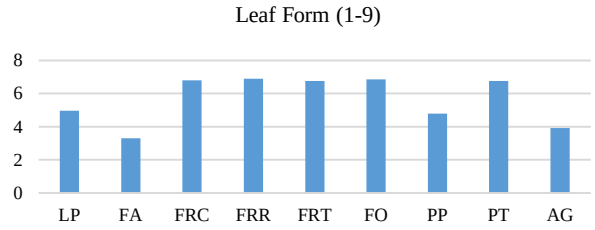

Figure 1. Leaf forms of the species

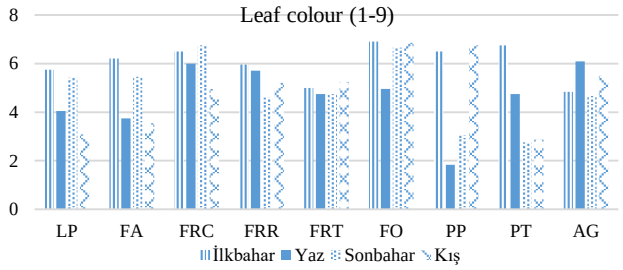

Figure 2. Seasonal leaf colours of the species

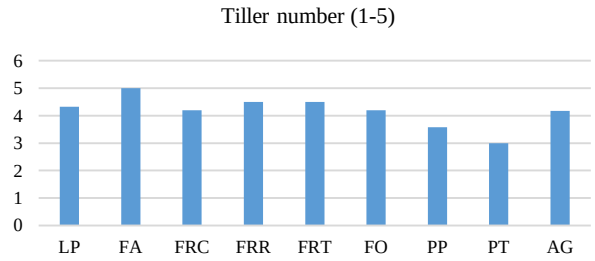

Figure 3. Tillers numbers of the species

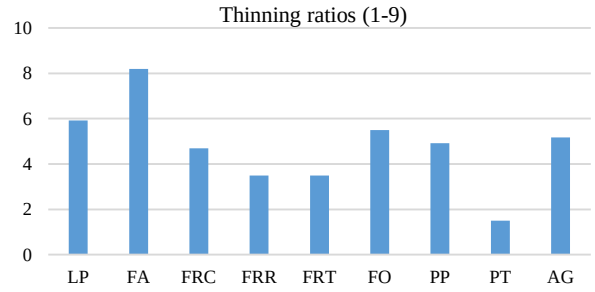

Figure 4. Thinning ratios of the species

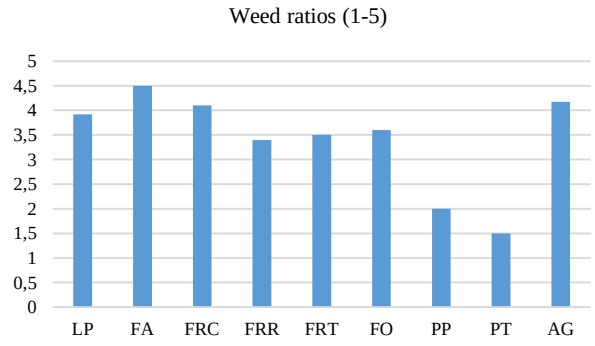

Figure 5. Weed ratios of the species

All of the species were generally good appearance and their colour was green or dark green in spring. In terms of colour, responses of *Festuca arundinacea* and *Lolium perenne* to changing seasons were similar. Only *Poa pratensis* has the darkest leaf colour in winter. The darkest leaf colour was determined at *Agrostis sp*. cultivars in summer. Though dark green leaf colour was lightening in summer for the whole plants, the most effected from high temperature were Avoulance, 4 season, Compact and Europa cultivars of *Poa pratensis*. Leaf colour of the species was getting recovery in autumn, except for *Poa trivialis*. Yellowish green leaf colour of *Poa pratensis* turned to dark green in winter. Leaf colour of *Festuca ovina* cultivars was stable throughout the year, except for summer. *Festuca rubra trichophylla* kept green leaf colour over the seasons. The response of the species and cultivars are different from climatic conditions. The results were compatible with previous findings (Varoglu, 2010; Öztarhan, 2010).

Tiller Number (1-5)

Tiller numbers of the cultivars were observed just after the second cut and the values of the species are given at Table 2 and Figure 3. Tillers of 11 different cultivars were very dense and their mark was 5. Especially tiller numbers of all *F.arundineacea* cultivars were high and their appearance was very frequent. Tiller number values of all perennial rygrass and other fescue cultivars were altered between 3.5 and 5.0. The least tiller number was observed on Compact cultivar of *Poa prastensis*. Tiller number results obtained from this study were harmonious to those declared by Bilgili and Açıkgöz (2005), Altan (1989), Varoğlu (2010) and Öztarhan (2010).

Thinning Ratio (1-9)

Thinning ratio of the plots was observed at the end of the vegetation period in the second year and was appreciated as using 1-9 scale. The results are given at Table 3 and Figure 4.

There were significant differences amongst the cultivars at the end of the second year, thinning ratio of cultivars were appreciated as follow: Cultivars of *F. arundinacea* were dense/highly dense, cultivars of perennial ryegrass were dense, cultivars of *Poa pratense, Agrostis* sp. and the other fescue were middle dense, but cultivars of *Poa trivialis* were very thin. While there was not observed any thinning from Millenium cultivar (9) of tall fescue, the lowest density was determined to Starlite and Cypress cultivars (1.5) of *Poa trivialis*. The effect of climatic conditions on cultivars are different, thus thinning ratio of the cultivars are ranged under hot and drought conditions. The results support to those results obtained from Avcıoğlu (1997), Varoğlu (2010) and Öztarhan (2010).

Weed Ratio (1-5)

Weed ratio of the plots were determined after the last cut in the second year as using 1-5 scale. The differences amongst the cultivars were found as highly significant in terms of weed ratio (Table 3 and Figure 5). The highest weed ratio was determined from cultivars of *Poa* sp. (1.5-2.5). Weeds had no chance to grow into Jaguar cultivar of *F. arundinacea* that its regeneration characteristic and tiller number were high. In fact weed ratio of all cultivars was acceptable, except for *Poa* cultivars and Redskin and Elliot cultivars of *F.rubra rubra*. In these species, the sparse is high, the gaps are filled by weeds. Consider the weed ratios, the results obtained from this study were parallel to the results declared by Varoğlu, (2010) and Öztarhan, (2010), except for red fescues. It is attributed that red fescues are adapted very well to our region, thus they increased tiller number and grow highly dense and supressed the weeds.

Table 2. Leaf form, colour and tiller numbers values of the species*

Species	Leaf Form (1-9)	Leaf Colour (1-9)				Tiller Number (1-5)
		Spring	Summer	Autumn	Winter	
LP	4.96^{b}	5.75^{ab}	4.04^{bc}	5.42^{b}	3.08^{c}	4.33^{ab}
FA	3.30^{c}	6.20^{a}	3.75^{c}	5.45^{b}	3.55^{c}	5.00^{a}
FRC	6.80^{a}	6.50^{a}	6.00^{a}	6.75^{a}	4.95^{b}	4.20^{ab}
FRR	6.90^{a}	5.95^{ab}	5.70^{ab}	4.6^{c}	5.2^{b}	4.50^{ab}
FRT	6.75^{a}	5.00^{b}	4.75^{a}-^{c}	4.75^{c}	5.25^{b}	4.50^{ab}
FO	6.85^{a}	6.90^{a}	4.95^{a}-^{c}	6.65^{a}	6.85^{a}	4.20^{ab}
PP	4.79^{b}	6.50^{a}	1.83^{d}	3.04^{d}	6.75^{a}	3.58^{b}
PT	6.75^{a}	6.75^{a}	4.75^{a}-^{c}	2.75^{d}	2.87^{c}	3.00^{c}
AG	3.92^{c}	4.83^{b}	6.08^{a}	4.67^{c}	5.50^{b}	4.17^{ab}

*There are no difference amongst the numbers indicate the same letters at 0.01 level in the same column

Table 3. Thinning ratio, weed ratio and general appearance values of the species*

Species	Thinning Ratio (1-5)	Weed Ratio (1-5)	General Appearance (1-5)
LP	5.92^{b}	3.92^{a}	6.58^{a}
FA	8.20^{a}	4.50^{a}	7.20^{a}
FRC	4.70^{c}	4.10^{a}	6.00^{a}
FRR	3.50^{e}	3.40^{ab}	6.00^{a}
FRT	3.50^{e}	3.50^{ab}	6.50^{a}
FO	5.50^{bc}	3.60^{a}	5.95^{a}
PP	4.92^{c}	2.00^{bc}	3.33^{b}
PT	1.50^{d}	1.50^{c}	3.00^{b}
AG	5.17^{bc}	4.17^{a}	7.67^{a}

*There are no difference amongst the numbers indicate the same letters at 0.01 level in the same column

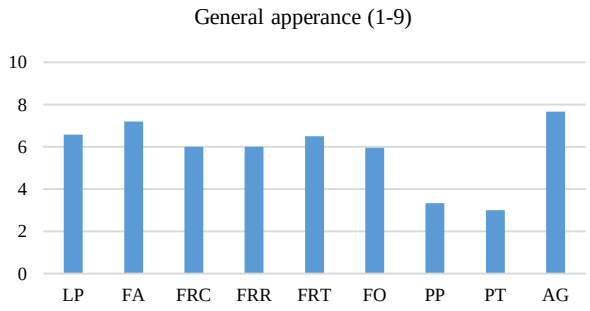

Figure 6. General appearance of the species

General Appearance (1-9)

General appearance of the plots was evaluated considering uniformity, colour, texture, vividness, weeds ratio, damage of the insects and disease in four seasons as using 1-9 scale (Table 3 and Figure 6). Jaguar cultivar of *F. arundinacea* and Highlandbent cultivar of *Agrostis tenius* were rewarded 8 points over 9 and their general appearance was the best. The worst general appearance was observed on *Poa* cultivars. Because, they were effected mostly from harsh conditions. In this case general appearance of *Poa* cultivars were evaluated as bad, and the others as good or very good. There a partial compatibility between this result and those declared by Alagöz and Turk (2017).

Conclusion

Species/cultivars have some superiority to each other because of their different morphological and physiological characteristics effect on plant growing. When we consider weed competition, *Lolium perenne* (Caddieshack Cv.) and *Festuca arundinacea* (Jaguar Cv.) have to be added to the mixture in order to decrease weed competition. There was colour variation distinctively depending on the seasons for all species. But, compare to the others, all the cultivars of *Agrostis sp*. and *Poa pratensis* have the potential to keep leaf colour in different seasons. Leaf form and appearance all of *Festuca rubra*, *Poa trivialis* and *Festuca ovina* cultivars are better than the others. In order to keep good conditions of turfgrass areas, especially after cutting in summer period, *Poa pratensis* and *Poa trivialis* cultivars should added in mixtures to get benefit their higher regenerating power.

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