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Impact of Different Sowing Rates and Cutting Times on Quality Properties of Kentucky Bluegrass (*Poa pratensis* L. cv. Geronimo)*

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ABSTRACT: The current study was conducted to investigate the influence of different seed sowing rates 5, 10, 15, 20 and 25 g m^{-2} and five cutting times (T1:15 June, T2: 15 July, T3:15 August, T4: 15 September and T5:15 October 2013) on yield and the quality characteristics of Kentucky bluegrass (*Poa pratensis* L. cv. Geronimo). The experiment was carried out in a Completely Randomised Block Design with three replications. The experiment was conducted at the Agricultural Application and Research Centre of Iğdır University in 2013. The investigated characters were measured, the covering rate, green grass yield, the plant height, colour, leaf width and turfgrass quality in the trial. The results indicated that 5, 10, 15, 20 and 25 of seed density per m^{-2} produced covering rate 8.5, 22.7, 49.6, 51.8 and 57.0 (%); green grass yield 83.3, 218.7, 415.3, 457.3 and 514.0 g m^{-2}; plant height 7.9, 7.9, 8.4,8.6 and 8.3 cm; color 5.6, 5.6, 5.9, 5.9 and 6.0 (1-9 scala); leaf size 1.13, 1.19, 1.12, 1.14 and 1.14 mm; turf grass quality ranged from 1.19, 3.07, 4.93, 5.42 and 5.50 (1-9 scala). Under the environment conditions of Igdır, the highest green yield of grass, coverage ratio, colour and turfgrass quality were achieved by the application of 25 g seeds per m^{-2}. In respect of cutting times, the highest green yield and coverage rate were produced at T5 time, as well as the highest colour at T5, T1 and T2 times, respectively and turf grass quality was obtained at T5 and T4 times in the application of 25 g seeds per m^2 during the establishing year. Accordingly, it can be concluded that the rates of seed to be recommended in 25 g per square, when all the features examined are taken into account of *Poa* grown in landscape establishment under the Iğdır ecological conditions.

Keywords: Cutting time, *Poa pratensis* L., seed quantity, turfgrass quality

Farklı Tohum Oranları ve Biçim Zamanlarının Çayır salkım otunun (*Poa pratensis* L. Geronimo) Kalite Özellikleri Üzerine Etkileri

ÖZET: Bu çalışma, farklı tohum oranı (5, 10, 15, 20 ve 25 g m^{-2}) ve yıl içerisinde beş ayrı biçim zamanında (T1:15 Haziran, T2:15 Temmuz, T3:15 Ağustos, T4:15 Eylül ve T5:15 Ekim 2013) biçilen çayır salkım otu (*Poa pratensis* L. Cv. Geronimo)'nun verim ve kalite özelliklerini incelemek amacıyla yapılmıştır. Deneme, 2013 yılında, Iğdır Üniversitesi'nin Tasımsal Uygulama ve Araştırma Merkezinde, Şansa Bağlı Bloklar Deneme desenine göre üç tekrarlamalı olarak yürütülmüştür. Çalışmada, bitki boyu, yaş ot verimi, yaprak eni, kaplama oranı, renk ve kalite özellikleri incelenmiştir. Çayır salkım otu (*Poa pratensis* L. cv. Geronimo) çeşidinden m^{-2}'ye 5, 10, 15, 20 ve 25 g tohum sıralamasına göre, bitki boyu 7.9, 7.9, 8.4, 8.6 ve 8.3 cm, yaş ot verimi 83.3, 218.7, 415.3, 457.3 ve 514.0 g m^{-2}, yaprak eni (doku) 1.13, 1.19, 1.12, 1.14 ve 1.14 mm, kaplama oranı % 8.7, 22.7, 49.6, 51.8 ve 57.0, renk 5.6, 5.6, 5.9, 5.9 ve 6.0 (1-9 skala), çim kalitesi 1.19, 3.07, 4.93, 5.42 ve 5.50 (1-9 skala), arasında değişmiştir. Iğdır ekolojik koşullarında, m^{-2}'ye 25 g tohum ekilen uygulamalarda çayır salkım otundan en yüksek yaş ot verimi, kaplama oranı, çim rengi ve çim kalitesi elde edilmiştir. En yüksek yaş ot verimi ve kaplama oranı T5 zamanında biçilen çayır salkım otunda elde edilirken, en yüksek çim rengi sırasıyla T5, T1 ve T2 zamanlarında, çim kalitesi ise T5 ve T4 zamanlarında elde edilmiştir. Iğdır ekolojik koşullarında peyzaj alan tesisinde, çayır salkımotu Geronimo varyetesinin bütün özellikleri dikkate alındığında m^{-2},ye 25 g tohum kullanılmasının daha iyi olduğu sonucuna varılmıştır.

Anahtar Kelimeler: Biçim zamanı, çim kalitesi, *Poa pratensis* L., tohum miktarı.

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INTRODUCTION

Green fields consist of plants or plant groups covering surface of soil and creating a uniform view. For this purpose, short-height species,which are from *Poaceae* family, an essential one of landscaping components, cover surface of soil, possess content texture, are homogenous, and can be mown regularly, are used. Grass species to be used in the parks, gardens, play grounds, caravan sites, sports, and play areas should have a content and strong structure being resistant to stepping on and regenerating itself in a short time. In studies revealed, that it is crucial for seed to be cheap (Avcıoğlu and Gül, 1997; Acartürk, 2001; Kyoung, 2013). Dubel (2004) stated that Kentucky bluegrass which is a cool climate plant from Poaceae family is considerably resistant to winter since it has an intense root layer on 8 cm upper part of soil. Dürr et al., (2005) reported that in northern Canada, the number of shoots in *Poa pratensis* was 6440 m^{-2}, which was higher than meadow foxtail (number of shoots: 3040 m^{-2}) and *Poa pratensis* is an important plant as a green field plant in terms of both conservation of soil and covering soil. Çelebi et al., (2010) reported that *Poa pratensis* in multi mixtures gave good results between 10-20% under Van ecological conditions; Öztekin and Var (2006) suggested the Geronimo cultivar of *Poa pratensis* up to 30% for grass mixtures under Trabzon conditions ; Gül (2015) recommended Baron and Geronimo cultivars of the same plant for conditions of Diyarbakır; on the other hand, Varoğlu et al., (2015) recorded that Geronimo was the weakest one in terms of covering rate among cultivars of Kentucky bluegrass and likewise Kır et al., (2010) observed that numerous species develops well in Mediterranean climate zone but they did not recommend *Poa pratensis*; and Yılmaz and Avcıoğlu, (2002) found that seed yields and qualities of other cultivars from some gramineae, except for Poa species, to be used in landscape establishment under conditions of Tokat with a different ecology, were substantially high and they were worth to cultivate. Drought stress was reported to decrease turfgrass quality by reducing shoot development and chlorophyll content of the plant. Bizhani and Salehi (2014), who investigated *Poa pratensis* compared with *Cynodon dactylon* in terms of salinity tolerance, revealed that while visual quality of *Poa pratensis* started to reduce in 2.5 dS m^{-1}salt concentration, the quality of *Cynodon dactylon* remained the same in 5.0 dS m^{-1} salt concentration; wet and dry weights of surface and root parts, leaf area, photosynthesis rate, and total chlorophyll and starch rates decreased in both plants at increasing salinity rates. Akbari at al., (2011) determined that *Poa pratensis and Cynodon dactylon* species gave the optimum ratio respectively at *60% and 40%* for bare species and mixtures, single plantation of *Poa pratensis* yielded the highest seedling rate, root wet weight, and total wet weight. According to Geren and Yönter (2007) found that the different covering rates decreased the surface flow at the rate of 69% in *A. stolonifera*, 65% in *L. perenne*, 53% in *P. pratensis*, 44% in *F. rubra rubra*, and 25% in *F. arundinacea* on average as well as soil loss at the rate of 98, 96, 95, 94, and 92%, respectively. According to Qui et al., (2009) the maximum quality from cutting *Poa pratensis* was reported at 8 cm high and 7-day intervals. Żurek and Prończuk (2007) found that there was a significant correlation between seed yield and all characteristics of plant in 27 cultivars and lines of Kentucky bluegrass (*Poa pratensis* L.), while, there was no significant correlation between view, shoot density, leaf thinness, colour in turfgrass quality. Walker et al., (2007) found that *Poa pratensis* generally achieved the maximum green covering in all nitrogen programs under field conditions and *Poa pratensis* was superior in active development period even though it was lower than *Festuca arundinacea* in terms of turfgrass quality. Elçi (2005) stated that Kentucky bluegrass is widely used in parks, entertainment and playing fields and areas such as golf ranges. Ecological regions are required to be studied in term of both cultivar and seed ratio because of certain difficulties for establishing landscape lead due to the fact that its seeds are small and germinate lately (Açıkgöz, 1994; Avcıoğlu, 1997; Öztekin and Var, 2006). With keeping the above points in view, the aim of the present study was to reveal the effects of different seed rates of Kentucky bluegrass, which has never been studied under ecological conditions of Iğdır, on turfgrass quality and to reveal some plant characteristics.

MATERIAL AND METHOD

Plant Material, Growing Conditions and Materials

The trial was carried out in three replications with respect to randomized blocks experiment design in Research, Practice, and Experimental Fields of Iğdır University in 2013. Covering rate, plant height, green

grass yield, leaf width, colour, and turfgrass quality of Kentucky bluegrass (*Poa pratensis* L. cv. Geronimo) were examined in different seed rates (5, 10, 15, 20, and 25 g m^{-2}) and 5 different cutting times (T1: June 15, T2: July 15, T3: August 15, T4: September 15, and T5: October 15). Geronimo cultivar of *Poa pratensis* was used as plant material.

Each parcel was 2x1=2 m^2, 0.5 m was left between parcels and 1 m was left between blocks. Following the preparation of soil, seeds were dispersed by hand within 2x1m frame in early October, covered with soil and pressed with cylinder, then irrigated with small nozzles. Soil fertility and pH influence development and quality of grass plants. According to analysis results of soil samples taken from 30 cm depth in trial soil, mean lime ratewas 6.53, pH was 7.98, electrical conductivity was 1.8 dS m^{-1}, potassium was 0.3 t ha^{-1}, phosphorus was 0.008 t ha^{-1}, and organic matter (1.6%) was considerably low and soil had clay characteristics.

Table 1. Some climatic values belonging to experiment months in 2013*

Months	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Mean**
Min. Temp. °C	-15.8	-4.6	-6.0	3.7	9.6	11.6	15.8	14.6	7.6	0.5	-2.1	-20	1.24
Max.Temp. °C	9.6	15.7	22.1	29.7	30.2	36.2	36.0	33.9	36.4	28.8	20.2	8.8	25.6
Mean Temp. °C	-2.2	4.3	9.3	15.4	18.9	23.3	26.5	25.4	21.4	12.3	10.1	8.2	14.4
Total Rainfal, mm	19.6	15.2	14.8	34.6	58.9	38.3	10.6	8.3	9.9	15.4	13.1	30.3	22.4
Humudity, %	71.9	64.3	44.3	46.1	52.6	43.7	39.7	41.7	43.2	53.8	64.6	73.3	53.3

*:Anonim, 2013. Provincial Directorate of Meteorology-Iğdır

Experimental Site and the Experimental Setup

The soil was fertilized with 8 kg da^{-1} pure P_2O_5 before sowing and with 5 kg da^{-1} pure nitrogen after every cutting. Weeds growing partially were eliminated by hand. Table 1 shows temperature, precipitation, and humidity values of months when the trial was conducted. The highest temperature was above 30 °C from May to October, the highest mean temperature was 26.5 °C in July, and the minimum relative humidity was 39.7% in July. The lowest precipitation occurred in July, August, and September (Anonymous, 2013).

Data Collection, Measurement and Data Analysis

The first cutting height was about 8-10 cm, cuttings from 4-6 cm height were included into assessment for measurement and evaluation (Açıkgöz, 1994). Plant height was measured from 10 plants randomly were chosen from every parcel, green grass yields of every parcel were weighed just after cutting with lawn mower, covering rate was measured with the help of 50 x 50 cm quadrat (Avcıoğlu, 1983), and shade of colour was evaluated with respect to 1-9 scale, 1: yellow, 9 dark green. Data obtained from the of research were subjected to a variance analysis with SPSS packet program and Duncan's multiple comparison test was used for demonstrate differences between each other subjects (SPSS, 1991).

RESULTS AND DISCUSSION

Covering Rate (%)

The obtained results are presented in (Table 2) showed the effects of different seed rates on covering rate of Kentucky bluegrass in this study. Covering ratios of parcels planted using 5, 10, 15, 20, and 25 g seed at T1 time were 4.7, 16.7, 44.7, 44.0, and 52.3%, respectively, were increased gradually and the highest covering rate was obtained from the parcel planted with 25 g seeds. It was observed that there was no significant difference between parcels planted with 15 and 20 g seeds per m^2 in terms of covering rate (Table 2). The lowest covering rate (4.7%), was obtained from parcel planted with minimum quantity of seeds (5g). Covering rate of the same parcel increased over time, that is T2, T3, and T4 were produced 6.7, 10.3, 12.3% respectively, and relatively 8.7% for T5. Tthe highest covering rate (45.5%) occurred at T5 time, the lowest

covering rate was 32.5% at T1 time and covering rates at T1, T2, and T3 times (32.5, 33.5, and 35.5%) were very close to each other and were insignificant, and it was found the covering rate of the plant was very slow. Varoğlu et al., (2015) stated that Geronimo cultivar was the weakest one among *Poa pratensis* cultivars in terms of covering rate, which was compatible with the results of present study. Gül (2015) found that covering rates of *Poa pratensis* cultivars under conditions of Diyarbakır environment were between 91.9-95.0% which were higher than the results of the present study, and also the factor of years, seasons, and season-cultivar interaction were significant. Depending on different seed quantities as mean ofthe times, covering rate was increased.Mean covering rates of parcels in which 5, 10, 15, 20 and 25 g seed per m^2 were used in the experiment were 8.5%, 22.7%, 49.6%, 51.8%, and 57.0%, and it were observed a significant. While the lowest covering rate of the plant was obtained from parcel planted with 5 g m^{-2} seeds, the highest covering rate was obtained from the one planted with 25 g m^2 seeds. The results showed that there is no statistically significant difference between parcels planted with 10 and 15 g seeds per m^2 (Table 2).

Arslan and Çakmakçı (2004) emphasized that the first development of *Poa pratensis* L. cultivars which are sensitive to fungal diseases was substantially well and they had a good view, but got worse in terms of both view and bottom covering as from September. Russi et al., (2004) reported that *Poa pratensis* which is also used as a meadow plant is known to be adapted to cold climates and to spread via its short rhizomes. After reaching the fastest spread and covering rate using the minimum quantity of seeds, it is economically desired for plant to have slow development in terms of care, restore, and process in landscaping areas. Johnson et al., (2010) explained that turfgrass quality was negatively associated with the number of plants per unit area, however it was not continuously associated with other components of yield.

Table 2. The effects of different seed quantities on covering rate, % of Kentucky bluegrass

Seed rates (g m^{-2})	**T1**	**T2**	**T3**	**T4**	**T5**	**Means**
5	4.7 d	6.7 c	10.3 d	12.3 d	8.7 c	8.5 d
10	16.7 c	19.3 b	22.0 c	24.7 c	31.0 6	22.7 c
15	44.7 ab	46.0 a	44.0 b	53.0 b	60.3 a	49.6 b
20	44.0 b	46.0 a	48.0 ab	59.3 a	61.7 a	51.8 b
25	52.3 a	49.3 a	53.0 a	64.7 a	65.7 a	57.0 a
Mean Times	32.5 d	33.5 cd	35.5 c	42.8 b	45.5 a	

*: There were not significant differences in $p<0.05$ level among averages shown with same letter.

Green Grass Yield (g m^{-2})

The data belonging to dry or green herbage weight increased as an indicator of plant growth and development which is considered to be an important criterion. As in covering rate of Kentucky bluegrass, the lowest green grass yield at almost all times was obtained from the parcel in which the lowest amount of seed (5 g) was used per m^2, the highest green grass yield was obtained from the parcel with the highest amount of seed (25 g) per m^2. The range of times were compared, the highest green grass yield was obtained from T5 time with 422.0 g, which was followed by T4 with 378.0 g, T3 with 331.0 g, T2 with 312.0 g and T1 with 245.3 g (Table 3).

Parcels planted with 5, 10, 15, 20, and 25 g m^{-2} seeds on average were produced 83.3 g, 218.7, 415.3, 457.3 and 514.0 g green grass yield, respectively. For example the lowest green grass yield was obtained from the parcel with the lowest quantity of seeds; whereas, the highest green grass yield was obtained from the parcel with the highest quantity of seeds planted. It varies depending on species of plants and course of plants can also vary depending on different ecologies and care conditions. Green grass yield were varied between 312.96 and 361.89 g m^{-2} and it was found the maximum green grass yield from Geronimo cultivar in all seasons according to results of 3-year study on different cultivars of *Poa pratensis* (Gül, 2015).

Table 3. The effects of different seed quantities on green grass yield of Kentucky bluegrass

Seed rates (g m^{-2})	T1	T2	T3	T4	T5	Means
5	43.3 d	50.0 d	100.0 d	106.7 e	116.7 d	83.3 e
10	150.0 c	193.3 c	206.7 c	243.3 d	300.0 c	218.7 d
15	336.7 ab	423.3 b	413.3 b	246.6 c	476.7 b	415.3 c
20	313.3 b	423.4 b	446.7 ab	513.3 b	590.0 a	457.3 b
25	383.4 a	470.0 a	490.0 a	600.0 a	626.3 a	514.0 a
Mean Times	245.3 e	312.0 e	331.3 c	378.0 b	422.0 a	

*: There were not significant differences in p<0.05 level among averages shown with same letter.

Plant Height (cm)

Heights of plants in parcels planted with 5 g seed per m^2 at T1 time after plantation were found to be statistically lower compared to the plants in the parcel with 25 g/m^2 seeds. Although T2 and T3 times had partially similar, plant height at T5 time was not significant by reaching an almost stabilized condition without depending on increased seed rates. As the mean of seed quantities, plant heights were found to be different and significant as 7.8, 6.6, 8.0, 9.8, and 8.9 cm at T1, T2, T3, T4 and T5 times (Table 4). Even though plant height varied partially, it did not increase depending on time; this could be due tothe increase ofdensity in unit area forced plant to grow vertically because of competition after spreading and horizontal growth. It was recorded that the heights of plants in parcels planted with 15, 20, and 25 g seeds per unit were 8.4, 8.6, and 8.3 cm respectively and this was associated with the fact that there was no significant difference between them. According to Yazgan et al., (1992) reported that plant height of *Poa pratensis* "Geronimo" among 11 cultivars from 7 species was 6.55 cm which was lower than our findings, Tamkoç et al., (2007) determined that leaf length was between 9.0-11.6 cm and leaf width was 0.43-0.50 cm in genotypes of Kentucky bluegrass (*Poa pratensis* L.) they chose from natural meadow under conditions of Konya. *Poa pratensis* is considered as an important species in terms of worker and time wasting because the number of cuttings in unit time would be lesser than other species due to it is not a species growing much tall.

Table 4. The effects of different seed quantities on plant height of Kentucky bluegrass

Seed rates (g m^{-2})	T1	T2	T3	T4	T5	Means
5	6.7 d	5.8 b	7.3 c	10.2 ab	9.7	7.9 b
10	7.6 cd	6.3 ab	7.3 c	9.0 b	9.2	7.9 b
15	7.7 bc	7.1 a	8.7 a	10.5 a	8.7	8.4 a
20	8.6 ab	6.9 a	8.6 a	10.2 ab	8.6	8.6 a
25	9.0 a	7.2 a	8.0 b	6.2 b	8.7	8.3 a
Mean Times	7.8 c	6.6 d	8.0 c	1.8 a	8.1 b	

*: There were not significant differences in p<0.05 level among averages shown with same letter.

Grass Colour

Colour of plants depends on their genetic structure but sometimes it may partially change based on different conditions such as fertilization, irrigation, cutting, etc. There was no remarkable significant variation between plant colour when colour of Kentucky bluegrass was assessed in terms of both times and average of the times (Table 5). However, the plant colour were 6.2, 6.1 and 6.4 at T1, T2, and T5 times, respectively and it was observed to be higher than plant colour at T3 and T4 times (5.0 and 5.5). Jiang and Huang (2001) indicated that two critical factors limiting development of cool climate grass during summer season were high temperature and drought, colour values in Kentucky

bluegrass could change based on seasons; Oral and Açıkgöz (1999) reported that cool climate plants such as perennial ryegrass and Kentucky bluegrass did not lose their green colour unless mean temperature did not fall below 0 °C for a long time; Gül (2015) stated that *Poa pratensis* cultivars varied in terms of colour depending on years and seasons, Baron cultivar had the highest quality level and mean colour varied between 6.89-7.19, and remained the same in other seasons except for winter months.

Varoloğlu et al. (2015) found that mean colour value in cultivars of Kentucky bluegrass species was 6.8. This value was compatible with results of grass colour in the present study.

Table 5. The effects of different seed quantities on grass colour of Kentucky bluegrass

Seed rates (g m^{-2})	T1	T2	T3	T4	T5	Means
5	6.0	5.7	5.0	5.3	6.3	5.6
10	6.7	5.7	5.0	5.3	6.3	5.6
15	6.3	6.3	4.07	5.3	6.7	5.9
20	6.3	6.0	4.7	5.3	6.3	5.9
25	6.0	6.7	5.7	6.0	6.3	6.0
Mean Times	6.2 a	6.1 a	5.0 b	5.5 b	6.4 a	

*:There were not significant differences in $p<0.05$ level among averages shown with same letter.

Texture

The current research indicated that both seed sowing rate and times did not have a significant effect on leaf width (texture). Nonetheless, width of texture increased as times progressed. Depending on seed average, the highest leaf width occurred in T4 with 1.70 mm and T5 time with 1.66 mm (Table 6). This was followed in descending order by T3 with 1.21 mm and T2 with 0.63 mm, and the lowest leaf width was produced in T1 time. The obtained texture width (0.48-1.75 mm) was found to be lower than texture values (2.61-2.98 mm) of Gül (2015) studying on 4 different *Poa pratensis*. It was emphasized that texture could not change under normal care conditions and it was due to rather genetic. Tamkoç et al., (2007) determined that leaf width of Kentucky bluegrass (*Poa pratensis* L.) genotypes chosen from natural meadow under conditions of Konya were between 0.43-0.50 cm. On the contrary of intended use in meadow, it is considered that the narrower leaf blade of lawn plants is the more favourable it is (Kroon and Knops, 1991). Johnston et al., (1997) underlined that there might be differences between species and cultivars of Poa bluegrass in terms of colour, texture, plant density, vitality, resistance to disease, drought and frequent cutting.

Table 6. The effects of different seed quantities on texture (leaf width) of Kentucky bluegrass

Seed rates (g m^{-2})	T1	T2	T3	T4	T5	Means
5	0.48	0.62	1.20	1.74	1.60	1.13
10	0.49	0.62	1.34	1.75	1.70	1.19
15	0.51	0.57	1.21	1.71	1.61	1.12
20	0.55	0.57	1.27	1.65	1.68	1.14
25	0.46	0.77	1.07	1.65	1.72	1.14
Mean Times	0.50 d	0.63 c	1.21 b	1.70 a	1.66 a	

*:There were not significant differences in $p<0.05$ level among averages shown with same letter.

Turfgrass Quality

In a study examining the effect of seed quantities on turfgrass quality, turfgrass quality is resultant of other plant characteristics and varied depending on time are preented in (Table 7). Turfgrass quality also increased could be due to the increase of seed

quantitiesat T1 time. No significant difference was observed between seed rates of 15, 20, and 25 g m^{-2} at almost all times. However, the highest quality (4.9) occurredat T5 time.

The lowest quality (2.9) produced at T1 time when the plant was not exactly developed. As average of times, the lowest quality (1.19) was obtained from the parcel with 5 g m^{-2} seed while,the highest quality (5.42 and 5.50) was obtained from parcels with 20 and 25 g/m^{-2} respectively. It was found that turfgrassquality results in a range of 5.1-7.1 between different species of *Poa pratensis* L. by Johnston et al., (1997) were partially similar with results of the present study, but mean quality values (7.69-7.87) of Kentucky bluegrass in 3-year study by Gül (2015) were higher than results of the present study. Quality is a complex character with basic importance in assessment of grass plants (Russi et al., 2004). It was emphasized that colour might change depending on aesthetic, functional appearance, character of individual plants, uniformity, density, structure, growth characteristics and time. Popovici at al., (2008) emphasized that turfgrass quality could not be measured qualitatively in green fields and might change depending on seasonal and developmental periods of species and cultivars in different ecological regions.

Merewitz et al., (2010) highlighted that turfgrass quality of cool climate plants might decrease based on drought. In a study conducted by Żurak and Prończuk (2007) with poa pratensis cultivars and lines, it was emphasized that there was a significant correlation between turfgrass quality, leaf ratio, colour, texture of cultivars and lines and all plant characteristics, but no significant correlation between seed yield and turfgrass quality.

Table 7. The effects of different seed quantities on quality of Kentucky bluegrass

Seed rates (g m^{-2})	**T1**	**T2**	**T3**	**T4**	**T5**	**Means**
5	1.0 c	1.3 c	2.0 c	2.3 d	2.3 d	1.19 d
10	2.3 b	2.7 b	3.0 b	3.3 c	6.0 c	3.07 c
15	3.7 a	4.7 a	5.0 a	5.3 b	5.7 ab	4.93 b
20	4.0 a	4.3 a	5.3 a	6.0 a	5.7 ab	5.42 a
25	3.7 a	4.7 a	5.7 a	7.0 a	6.7 a	5.50 a
Mean Times	2.9 d	3.5 c	4.2 b	4.8 a	4.9 a	

*: There were not significant differences in $p<0.05$ level among averages shown with same letter.

CONCLUSION

The current research indicated that *Poa pratensis*is a plant that lasts long, resistant to cold, is short, dense, resistant to stepping on, responds fertilization quickly, the highest green grass yield, covering rate, turfgrass quality, and grass colour under ecological conditions of Iğdır were achieved from applications planted with 25 g seed per m^{-2}. As well as, the highest green grass yield and covering rate were obtained from Kentucky bluegrass cut at T5 time (in fall, 15 October 2013), the highest grass colour was obtained respectively at T5, T1, and T2 times corresponding cool temperatures, and turfgrass quality were obtained at T5 and T4 times.

It is critical to show due care to seeds of Kentucky bluegrass in establishment year using 25 g seeds per m^2 for single species plantation and to follow them in the next years because these seeds are very small. Under the ecological conditions of Iğdır, the optimum turfgrass quality will be obtained if 20-25 g seeds per m^{-2} are used as bare species for establishing landscape.

REFERENCES

Acartürk R, 2001. Park ve bahçe peyzajında süs bitkileri ve yer örtücüler, Ogem Vakfı, Ankara.

Açıkgöz E, 1994. Çim alanlar yapim ve bakim tekniği. Çevre Peyzaj Mimarlığı Yayınları:4., Bursa, 204 s.

Akbari M, Salehi H, Moteza K.K, 2011. Cool-warm season poa–cynodon seed mixtures and their turf growth and quality. Acta Agriculturae Scandinavica Section B Soil and Plant Science, 61: 559-564.

Anonim, 2013. Provincial Directorate of Meteorology-Iğdır.

Arslan M, Çakmakçı S, 2004. Farklı çim tür ve çeşitlerinin antalya ili sahil koşullarinda adaptasyon yeteneklerinin ve performanslarinin belirlenmesi. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 17 (1), 31-42

Avcıoğlu R, Gül, A. 1997. Bazı yesil alan bugdaygillerinin ege bölgesi sahil kuşağinda kullanima uygunlugu ve degisik çim yatagi üzerindeki performansinin arastirmasi. Ege Üniversitesi Arastırma Fonu Proje No: 94-ZRF-023, Bornova-6zmir.

Avcıoğlu R, 1983. *Ç*ayır-mer'a bitki topluluklarının incelenmesi. Ege Üniversitesi Ziraat Fak. Yayınları No: 466. Bornova, İzmir, 245s.

Avcıoğlu R, 1997. *Ç*im tekniği, yeşil alanlarin ekimi, dikimi ve bakimi. Ege Üniversitesi, Ziraat Fak., Bornova, İzmir, 271s.

Bizhani S, Salehi H, 2014. Physio-morphological and structural changes in common bermuda grass and Kentucy bluegrass during salt stress. Acta Physiologiae Plantarum, 36 (3): 777-786.

Çelebi Ş.Z, Andiç N, Yılmaz İ, 2010. Van bölgesinde tesis edilecek çim alanlari için uygun tohumluk miktarinin saptanmasi. YYÜ Tar Bil Derg (YYU J AGR SCI), 20 (1):16-25.

Dubel RL, 2004. Kentucy bluegrass (http://aggie-horticulture.tamu.edu./plantswers/turf/ publications/ 23 July 2004. Texas Cooperative Extension, Texas A and M University, College Station.

Dürr GH, Kunelius HT, Drapeau R, McRae KB, Fillmore S. A, 2005. Herbage yield and composition of Kentucky bluegrass (*Poa pratensis* L.) cultivars under two harvest systems. *Canadian Journal of Plant Science. Contribution no. 974, received 23 July 2004, Accepted 1 April 2005.*

Elçi Ş, 2005. Baklagil ve buğgaygil yembitkileri. Mart Matbaası, Ankara.

Geren H, Yönter G, 2007. Bazı serin iklim çim buğdaygillerinin laboratuvar koşullarinda su erozyonuna etkisi üzerinde araştirmalar. Ege Üniv. Ziraat Fak. Derg., 44 (2):1-15.

Gül İ, 2004. Diyarbakır koşullarinda bazi çayir salkim otu çeşitlerinin çim alan performanslarinin belirlenmesi. Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi Journal of Agricultural Faculty of Gaziosmanpaşa University http://ziraatdergi.gop.edu.tr/Araştırma Makalesi/Research Arcticle 32(2). 55-63.

Gül İ, 2015. A Research on Turfgrass performancess of some fescue specices in Diyarbakir conditions. Journal of Agricultural Faculty of Gaziosman paa University, 32 (1), 1-19.

Jiang YW, Huang B, 2001. Physiological responses to heat stress alone or in combination with drought: A comparison between tall fescue and perennial ryegrass. Hortscience 36(4): 682-686.

Johnson RC, Johnston WJ, Bertoli FB, Golob CT, 2010.Seed yield, development, and variation in diverse Poa pratensis. Crop Science, 50 (1) : 337-344.

Johnston WJ, Nelson MC, Johnson RC, Golob CT, 1997. Phenotypic evaluation of *Poa pratensis* L.: USDA/ARS Plant Introduction Germplasm Collection. Turfgrass Soc. Res. J. 8: 305 – 311.

Kır B, Avcıoğlu R, Demiroğlu G, Simic A, 2010. Performances of some cool season turfgrass species in mediterranean environment: I. *Lolium perenne* L., *Festuca arundinacea* Schreb., *Poa pratensis* L., and *Agrostis tenuis* Sibth.Turkish Journal of Field Crops, 15(2): 174-179.

Kroon H.D, Knops J, 1991. Habitat exploration through morphological plasticity in two chalk grassland perennials, Herbage Abst., 61 (8):

Kyoung N, 2013. Comparison of color quality, winter color, and spring grown under tree different soil-systmes. Kor. J. Hort. Sci. Techol. 31 (3) : 259268.

Merewitz E, Meyer W, Bonos S, Huang B.R, 2010. Drought stress responses and recovery of Texas × Kentucky hybrids and Kentucky bluegrass genotypes in temperate climate conditions. Agronomy Journal, 102 (1) : 258-268.

Oral N, Açıkgöz E, 1999. Bursa bölgesinde tesis edilecek çim alanlar için tohum karışımları, ekim oranları ve azotlu gübre uygulaması üzerinde araştırmalar. Türkiye 3. Tarla Bitkileri Kongresi, Cilt III: 155-159, 15-18 Kasım, Adana.

Öztekin B, Var M, 2006. Trabzon koşullarınd bazı çim tohumu karışımların ve taşıyıcı tabakalarının, çimlenme hızına etkisinin belirlenmesi. İstanbul Üniv. Orman Fak.Seri A, 56 (2), İstanbul.

Popovici CL, Vintu V, Samuil C, 2008. evaluation of different varieties of perennial turfgrasses used in pure culture or in mixtures. Lucrări Ştiinţifice, Universitatea de Stiinte Agricole Şi Medicină Veterinară "Ion Ionescu de la Brad" Iaşi, Seria Agronomie, 51 (3) : 112-115.

Qiu Zheng Qiang; Liu JiangLing; Li ShuXin; Cao YuHong; Ma YuShou, 2009. Preliminary study on the lawns and turf quality of *Poa pratensis* cv. Qinghai. Pratacultural Science, 26 (1): 119-122.

Russi L, Annicchiarico P, Martinello P, Tomasoni C, Piano E, Versonesi F, 2004. Turf quality of cool season grasses at low inputs: reliability across years, seasons and sites of evaluation. Acta Horticulturae, 661 : 387-392.

SPSS Inc., 1991. Statistical Package For The Social Sciences (SPSS/PC+). Chicago, IL.

Tamkoç A, Özköse A, Avcı M A 2007. Yaşlı doğal bir çayırdan seçilen *Poa pratensis* genotiplerinin bazı bitkisel özellikleri. Türkiye VII. Tarla Bitkileri Kongresi 25-27 Haziran (Poster Bildiri). S: 305-308. Erzurum.

Varoğlu H, Avcıoğlu R, Değirmenci R, 2015. Kamışsı Yumak (*Festuca arundinaceae*), Çayır Salkım Otu (*Poa pratensis*), Kırmızı Yumak (*Festuca rubra*) ve İngiliz Çimi (*Lolium perenne*) Çeşitlerinin Çim Alan Özellikleri. Tarla Bitkileri Merkez Araştırma Enstitü Dergisi, 54 (2) 85-95.

Walker K.S, Bigelow C.A, Smith D.R, Van Scoyoc G.E. and Reicher Z.J, 2007. Aboveground responses of cool-season lawnspecies to nitrogen rates and application timings, Crop Sci 47:1225-1236.

Yazgan E, Ekiz H, Karadeniz N, Kendir H 1992. Ankara koşullarinda yeşil saha tesisinde kullanılabilecek önemli çim türlerinin belirlenmesinde bazi morfolojik ve fenolojik karakterler üzerinde bir araştırma, Ankara Üniversitesi Ziraat Fakültesi Yayınları, 1277, Ankara, 38s.

Yılmaz M, Avcığlu R, 2002. Yeşil alan tesisinde kullanilacak bazi buğdaygillerin tokat koşullainda bazi agronomik özellikler ve tohum verimlerinin belirlenmesi. GOÜ. Ziraat Fakültesi Dergisi, 19 (1), 87-95.

Żurek G and Prończuk S, 2007. Plant breeding and acclimatization institute, independent laboratory of grasses and legumes, Radzików, 05-870 Błonie, Poland. Proceedıngs of the XXVIITH Eucarpia Symposium on Improvement of Fodder Crops and Amenıty Grasses. August 19-23, Copenhagen, Denmark.