

Determination of Some Morphological and Agricultural Characters of Natural Orchardgrass Plants (*Dactylis glomerata* ssp. *glomerata* L.) Collected from Different Places of Ondokuz Mayıs University Campus Area, Turkey¶¶

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This study was conducted to determine some morphologic and agricultural traits of natural orchardgrass plant (*Dactylis glomerata* ssp. *glomerata*) which were collected from different places of Ondokuz Mayıs University Kurupelit Campus in 2002-2003 years. Average total number of tillers, plant height, number of nodes, peduncle length, stem thickness, lamina width, lamina length were 36.31-35.74, 71.36-67.20 cm, 4.60-4.91, 13.60-8.26 cm, 1.76-2.30 mm, 15.45-15.37 cm, respectively in orchardgrass plants (*Dactylis glomerata* ssp. *glomerata*) which were grown in different places in Ondokuz Mayıs University Kurupelit Campus in 2002-2003 years. Average leaf ratio was 43.49 % in 2002 and 67.77 % in 2003. Variation coefficient for hay yield was 51 % in 70 orchardgrass plants which were studied in all the places in 2002, whilst it was found as 37 % in 2003. Average hay yield per plant was 16.92 g in 2002, on the contrary, it was found as 26.04 g in 2003.

Key Words: *Dactylis glomerata*, Morphology, Agricultural traits.

INTRODUCTION

Nearly half of the fodder production is provided from range and pastures in Turkey. The botanical composition of these areas has been affected negatively by early grazing and overgrazing and consequently their yields have declined. It is essential to determine the suitable species and varieties in a certain region for improving ranges and pastures.

The most efficient short-term way to cover feed deficiency is to increase the planting cultivation and yields of forages for this aims. Orchardgrass (*Dactylis glomerata* ssp. *glomerata* L.), is clearly important plant for Black Sea region due to the fact that it is consumed as an appetite by animals. Also orchardgrass is resistant to drought, cold, tolerant to shadow, resistant to grazing, cutting and it is began to develop in earlier times of spring^{1,2}.

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Sagsoz *et al.*³, mentioned that there were differences in terms of all phenological, morphological and biological traits among to orchardgrass, collected from different regions of Erzurum. They also reported that the plants collected from Oltu to have been highest plant height, stem thickness, node numbers, leaf length and leaf width.

The plant height, leaf length and leaf width were determined for orchard grass as 60-100 cm, 10-34 and 3-9 mm, respectively, in a study conducted with the aim of determining some morphological and agronomic traits of plants collected from ranges in Minnesota and North Dakota⁴.

There were found some positive and significant relationships between hay yield and plant height, leaf length, leaf width and number of tillers in a study which aims at determining relationships between hay/seed yields and some morphological traits in wild orchardgrass (*Dactylis glomerata* L.) samples collected from 8 different locations in Erzurum district⁵.

In this study, some morphological and agronomic traits of orchardgrass (*Dactylis glomerata* ssp. *glomerata* L.) samples collected from 19 Mayıs University campus area were determined.

EXPERIMENTAL

Salt content is extremely low and pH is moderate acid or neutral in soils according to the physical and chemical analyses conducted in soil samples taken from 0-20 cm soil depth. Soil samples rich in potassium at all locations. The phosphorus contents were extremely low at samples from 4th location; low at 5th, 6th and 3rd locations; moderate at 1st and 2nd locations and high at 7th location. Organic material (OM) contents were low at samples taken from 2nd and 5th locations; moderate at 1st location and high at the other locations. While the 1st, 3rd and 7th locations had a clayed soil textures, the 2nd, 4th, 5th and 6th locations had clay loam soil textures. This means that orchardgrass is not selective in terms of soil requirements. All of the locations were poor in calcium content. Magnesium contents were at moderate level at 4th and 7th locations and were low at the other locations.

Long-term total precipitation during growth period of orchardgrass in Samsun was 381.4 mm. The total precipitation was 395 mm in 2002 and 242.4 mm in the past half of the 2003. Long-term mean temperature value was 14.33 °C between January and August during which this study was conducted. Long-term mean temperature value (14.33 °C) was lower than that in 2002 (14.88 °C) and higher than that in the first half of 2003 (10.8 °C).

The orchardgrass (*Dactylis glomerata* ssp. *glomerata* L.) samples grown naturally at 19 Mayıs University campus area were used in this study.

Orchardgrass samples were collected from the 7 different locations, in which orchardgrass plants were found intensively, during March and June in 2002 and 2003. General information regarding the locations from which

samples were taken was given in Table-1. Orchardgrass samples were monitored at regular intervals between March and June and morphological measurements were made according to Tosun⁶, Sagsoz *et al.*³ and Tukul and Hatipoglu⁷ and agronomic measurements⁸.

The results of this study were evaluated according to the Randomized Parcels Experimental Design⁹. The means were compared using Duncan multiple comparison test. Variance analysis and comparison tests were made using MSTAT-C pocket programme. Furthermore, measurements done¹⁰ for orchardgrass were compared by computing standard error, coefficient of variation (CV) and probability confidence values at 0.05 levels.

RESULTS AND DISCUSSION

Variation limits, confidence limits and coefficient of variation related to some morphological and agronomic traits were given in Table-2 and mean values in Tables 3 and 4. From the Table-2, it can be seen that there was a big variation in terms of investigated traits among the orchardgrass populations. This is an expectable case for orchardgrass which is an allogam. Also, this means that a selection procedure applied for traits bearing importance with respect to agricultural aspects can be successful⁷.

Total number of tillers: When all of the orchardgrass samples grown in different locations of Kurupelit campus were evaluated all together, coefficient of variation (CV) related to total number of tillers in 2002 and 2003 were found as 51 and 59 %, respectively (Table-2). Total number of tillers was found significantly different among locations in both years. The highest number of tillers (54.40) was determined in plants collected from 2nd location in 2002. The other locations were in same comparison group in terms of number of tillers. In 2003, the least number of tillers (15.60) was found for 3rd location and this trait was been similar among the other locations.

Number of tillers in orchardgrass is altered substantially by environmental factors, plant age and plant growth⁶. These researchers reported that average number of tillers in orchardgrass collected from natural flora varied from 30-50. Davies and Thomas¹¹, stated that tillering capacity is varied by the factors such as ambient temperature, lightening time, light quality, lightening of tillers found at the bottom and nutrient contents in soil. In present study, number of tillers in 2nd location in 2002 and in 1st location in 2003 was found higher than reported values.

Plant height: The CVs related to plant height were 19 % in 2002 and 18 % in 2003 (Table-2). These values are slightly higher than those reported by Tukul and Hatipoglu⁷ (9.05-13.69 %). This situation might be sourced from highly different altitude, north or south facing pastures and soil structure among the investigated areas. The differences among the

TABLE-1
GENERAL DESCRIPTION OF LOCATIONS FROM WHICH ORCHARDGRASS SAMPLES WERE COLLECTED IN THIS STUDY

Locations	Position	Soil depth (cm)	Altitude (m)	General description of land
1	Entrance of University	90-120	24	The samples were collected from a land with a 10% slope positioned in northwest direction. The land was covered with fruit shoots.
2	Between Theological Faculty and Waste Water Cleaning Unit.	0-30	147	The samples were collected from a slightly gravelled land with a low soil depth. The slope was 20-25%. The land was positioned in northwest direction and was covered with short bush vegetation.
3	The range behind the Educational Faculty.	0-30	180	The samples were collected from within-forest ranges found among oat trees in west direction..
4	Between TEK building and main road	30-60	188	The samples were collected from rarely afforested lands (5% slope) positioned in the direction of north-east. The samples were also collected from way sides.
5	The range which was found behind TEK building.	0-30	190	The samples were collected from the range which abandoned 26 years ago after plowing. The land was positioned in west region.
6	The secondary way between Agricultural Faculty and Educational Faculty.	30-60	191	The samples were collected from the land with low soil depth, slightly gravelled and positioned in southwest region.
7	Between Educational Faculty and dormitory	30-60	192	The samples were collected from open areas found among oat trees in direction of northwest.

TABLE-2
 VARIATION LIMITS, CONFIDENCE LIMITS AND COEFFICIENTS OF
 VARIATION RELATED TO SOME MORPHOLOGICAL AND
 AGRONOMIC TRAITS OF ORCHARDGRASS PLANTS RAISED IN
 DIFFERENT LOCATIONS OF KURUPELIT CAMPUS

Traits	n	Year	Variation limits (cm)	Confidence limits (cm)	CV (%)
Total number of tillers	70	2002	7.0-97	35.14 ± 4.29	51
	70	2003	7.0-121.0	35.74 ± 5.06	59
Plant height (cm)	70	2002	49.5-114.6	71.36 ± 3.26	19
	70	2003	45.5-95.5	67.21 ± 2.89	18
Number of nodes (adet)	70	2002	2-7	4.6 ± 0.22	19
	70	2003	3-7	4.91 ± 0.21	18
Peduncle length (cm)	70	2002	4.5-28.3	13.59 ± 0.94	28
	70	2003	1.0-16.35	8.03 ± 0.95	49
Stem thickness (mm)	70	2002	0.58-3.20	1.76 ± 0.13	32
	70	2003	1.41-3.25	2.29 ± 0.13	23
Lamina width (mm)	70	2002	3.25-14.7	5.97 ± 0.47	32
	70	2003	4.0-10.0	6.29 ± 0.32	21
Lamina length (cm)	70	2002	8.3-25.3	15.45 ± 1.05	26
	70	2003	6.5-27.0	15.37 ± 1.08	29
Leaf ratio (%)	70	2002	24.1-75.5	43.88 ± 3.45	33
	70	2003	50.16-79.80	67.77 ± 1.54	9
Hay/Plant (g)	70	2002	5.17-49.73	16.92 ± 2.07	51
	70	2003	8.49-48.23	26.04 ± 2.35	37

locations in terms of plant height were insignificant in 2002 and significant in 2003 (Table-3). Even though there were no statistical differences among the locations in 2002, the highest plant height value was determined for 1st location (80.69 cm) and this followed by 7th location (74.52 cm) and 4th location (73.15 cm). In 2003, the highest plant height values were found for 7th location (81.78 cm) and 1st location (71.72 cm). The other locations were in the same statistical group. Plant heights found in both years were in consistence with findings of Tukul and Hatipoglu⁷ and Sedivec *et al.*⁴, but higher than findings reported by Mika *et al.*¹².

Node number: CV related to node number on main stem of orchardgrass was found as 19 % in 2002 and 18 % in 2003 (Table-2). The node number were not significantly different among the locations in both years. The highest node number was determined in orchardgrass collected from 2nd location (5.30) in 2002 and 7th location (5.40) in 2003. These results are in consistence with findings of Tukul and Hatipoglu⁷.

Internode length: Among collected orchardgrass, CV related to internode length was 28 % in 2002 and 49 % in 2003. On the differences of CV between years, climatic events occurring each year were been much effective. In terms of internode length, it was determined that there was significant differences in 2002 and, must significant differences in 2003 among location. The highest internode length was determined in 1st locations both 2002 and 2003 as 17.20 and 12.23 cm, respectively. There was no statistical differences in 1st and 4th locations in 2002 and 1st, 2nd, 4th and 6th locations in 2003 (Table-3). Related to internode length of main stem, inter location differences may be due to different growing condition and genetic structure while intra location differences may be mainly genetic structures of orchardgrass. The present results are similar to work of Tukul and Hatipoglu⁷.

Stem thickness: CV related to main stem thickness was calculated as 32 % in 2002 and 23 % in 2003 for 70 orchardgrass samples collected from all the locations (Table-2). The differences among the locations in terms of main stem thicknesses were significant in 2002 but insignificant in 2003 (Table-3). The highest stem thickness values were found for 6th, 2nd, 5th, 7th and 1st locations and these followed by 3rd and 4th locations. The highest stem thickness values were obtained from 6th, 2nd, 5th, 7th and 1st locations and these followed by 3rd and 4th locations. The highest stem thickness was found in 2nd location, *albeit* there were no statistical differences among the locations. The mean stem thickness values for 70 samples were increased from 1.76 mm in 2002 to 2.30 mm in 2003. Stem thickness increased in all locations except for 5th location in 2003 (Table-3).

Lamina width: The CV of 32 % observed for all locations in terms of leaf width in 2002 decreased to 21 % in 2003 (Table-2) and differences among the locations were found significant in 2002 and significant in 2003. The least leaf width value was found for 2nd location in 2002 and for 5th location in 2003. The leaf width values found in present study are in agreement with findings of Sagsoz *et al.*³ and are superior to those reported by Mika *et al.*¹².

Lamina length: The CV related to lamina length in all orchardgrass plants was 26 % in 2002 and 29 % in 2003 (Table-2). These values are slightly higher than those reported by Tukul and Hatipoglu⁷. The differences among the locations in terms of lamina length were found statistically insignificant (Table-4). Even though there were no statistically significant differences among the locations in 2002, the highest lamina length found for 5th location (17.18 cm) and this followed by 6th location (16.88 cm) and 4th location (16.18 cm) in 2002. The highest lamina length value (18.45 cm) was found for 4th location in 2003. These findings are in consistence with findings of Tukul and Hatipoglu⁷, Sedivac *et al.*⁴ and Mika and Mousset¹³ but are slightly lower than those reported by Mika *et al.*¹².

TABLE-3
AVERAGES RELATED TO MORPHOLOGICAL TRAITS OF ORCHARDGRASS PLANTS RAISED IN
DIFFERENT LOCATIONS OF KURUPELIT CAMPUS

Locations	Traits									
	Total number of tillers**		Plant height (cm)**		Number of nodes (adet)		Internode length (cm)		Stem thickness (mm)**	
	2002	2003	2002	2003	2002	2003	2002*	2003**	2002	2003
1	33.50 b	51.50 a	80.69	71.72 ab	4.30	5.20	17.20 a	12.25 a	1.72 ab	2.39
2	54.40 a	41.50 a	64.91	63.20 b	5.30	4.70	11.33 b	9.64 ab	2.06 ab	2.49
3	26.70 b	15.60 b	68.68	69.03 b	5.00	5.30	13.69 b	7.08 b	1.53 b	2.07
4	29.10 b	35.30 ab	73.15	64.55 b	4.20	4.80	14.34 ab	8.47 ab	0.98 c	2.41
5	32.60 b	39.90 ab	66.58	58.70 b	4.40	4.50	13.10 b	6.79 b	2.05 ab	1.97
6	39.80 b	36.70 ab	71.00	61.46 b	4.50	4.50	12.07 b	8.40 ab	2.25 a	2.39
7	29.90 b	29.70 ab	74.52	81.78 a	4.50	5.40	13.46 b	5.19 b	1.73 ab	2.35
Average	36.31	35.74	71.36	67.20	4.60	4.91	13.60	8.26	1.76	2.30
CV (%)	46.74	54.27	18.74	15.19	18.82	17.54	27.07	46.43	24.02	23.05

There were no differences at *0.05 and **0.01 probability levels between averages with same superscripts.

TABLE-4
AVERAGES RELATED TO SOME MORPHOLOGICAL AND AGRONOMIC TRAITS OF ORCHARDGRASS
PLANTS RAISED IN DIFFERENT SPOTS OF KURUPELIT CAMPUS

Locations	Traits							
	Leaf width (mm)		Lamina length (cm)		Leaf ratio (%)**		Hay yield (g/plant)**	
	2002*	2003**	2002	2003	2002	2003	2002	2003
1	6.60 ab	6.60 ab	13.48	15.17	36.29 bc	71.26	12.74 b	33.83 a
2	6.15 ab	6.15 ab	15.01	17.23	58.89 a	66.86	14.07 b	30.33 ab
3	5.60 b	5.60 b	15.06	15.33	31.90 c	65.41	13.86 b	22.90 bc
4	6.55 ab	6.55 ab	16.18	18.45	40.94 bc	71.37	24.66 a	30.05 ab
5	5.20 b	5.20 b	17.18	14.95	47.47 ab	68.14	21.56 ab	28.92 ab
6	7.55 a	7.55 a	16.88	13.30	59.64 a	67.11	13.10 b	21.43 bc
7	6.42 ab	6.42 ab	14.34	13.18	32.03 c	64.23	18.46 ab	14.80 c
Average	6.30	6.30	15.45	15.37	43.49	67.77	16.92	26.04
CV (%)	30.37	18.78	28.72	28.23	22.46	9.20	46.34	31.00

There were no differences at *0.05 and **0.01 probability levels between averages with same superscripts.

Leaf ratio: The CVs for all locations were 33 % in 2002 and 9 % in 2003 (Table-2). The differences in CV values observed in two years (2002 and 2003) can be attributed to differences in responses of plant genotypes grown in different locations to the climatical factors. Increases in the leaf ratio in 2003 [even though total number of tillers were similar in both years (Table-3)] can be explained by the increases in node number (namely increases in leaf counts per stem) and in lamina width in 2003 (Tables 3 and 4). Differences among the locations were found significant in 2002 and insignificant in 2003 (Table-4). The highest leaf ratio values observed for 6th, 2nd and 5th locations and these are followed by 4th and 1st locations. In 2003, the highest leaf ratio values were found for 4th and 1st locations even though there were no statistical differences among the locations. The mean leaf ratio for 70 plants was found as 43.82 % in 2002 and 67.77 % in 2003 (Table-4). These results were in consistence with findings of Mika *et al.*^{12,13} but higher than findings of Voshchinin and Tomorjova¹⁴, Tukul and Hatipoglu⁷. Samsun is a province with a low sunshine time⁸ (1900-2300). As the leaf counts increased in regions with low sunshine time^{2,15} leaf ratio was found slightly higher in present study compared to the other studies.

Hay yield: The CVs related to hay yield per plant for 70 orchardgrass samples at all locations were 51% in 2002 and 37% in 2003 (Table-2). These values are in aggrement with values (37.66-53.81 %) reported by Tukul and Hatipoglu⁷. Hay yields were significantly different among the locations in both years (Table-4). The highest hay yields were found for 4th location (24.66 g), 5th location (21.56 g) and 7th location (18.46 g) in 2002 and for 1st location (33.83 g), 2nd location (30.33 g), 4th location (30.05 g) and 5th location (28.92 g) in 2003. Average hay yield per plant was 16.92 g in 2002 and 26.04 in 2003. Hay yield of orchardgrass varies with year and region from which samples were collected^{16,17}. Hay yields per plant determined in both years were higher than those reported by Templeton *et al.*¹⁸ and Tosun⁶ and were lower than those reported by Lucchin and Olivieri¹⁹ and Tukul and Hatipoglu⁷.

Conclusion

There is a wide range of variation among the orchardgrass plants raised in different regions of Kurupelit campus in terms of examined traits in this study. This case is of great importance with respect to genetic diversity. Genotypic features of plants should be determined by eliminating the effects of environmental factors, which might be succeeded by raising plants in similar environmental regions.

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